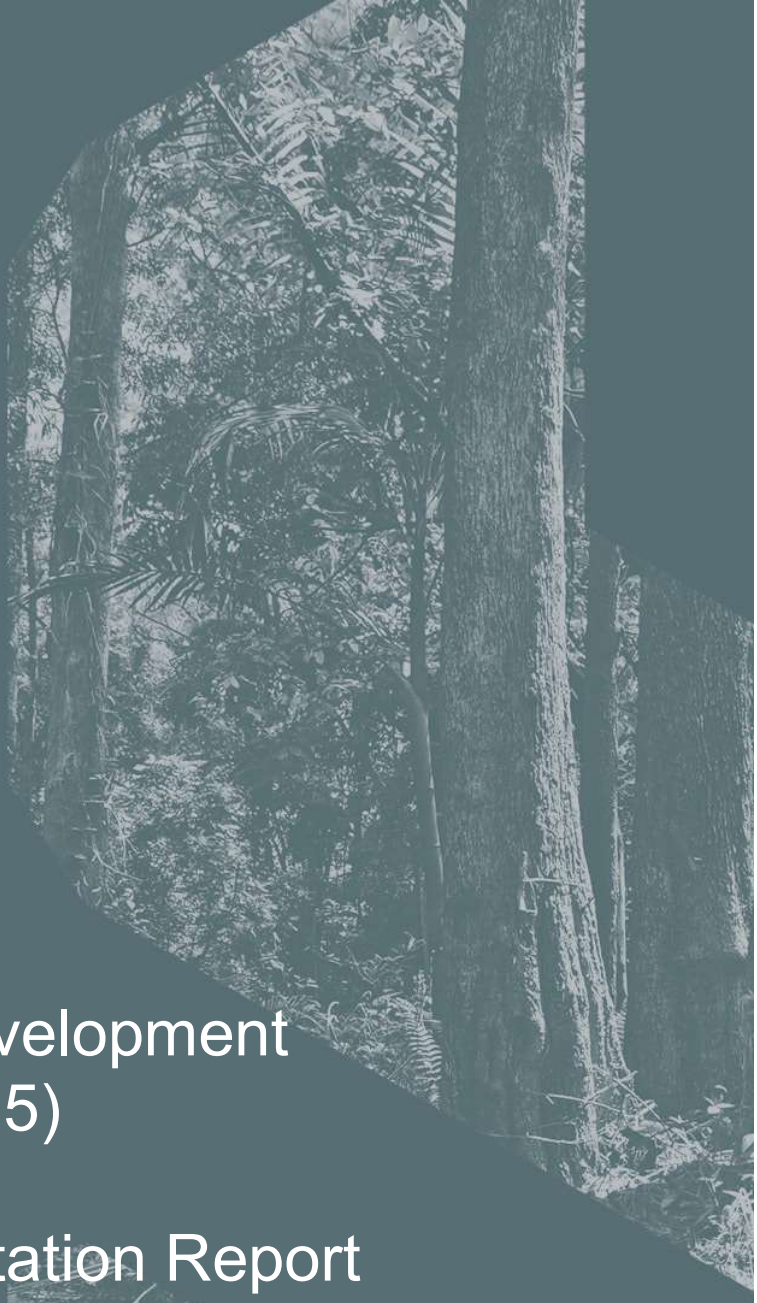

Ripley Residential Development EPBC Act (2024/09865)

Preliminary Documentation Report (PART B – Referral Material)

HB QLD Pty Ltd

17 February 2026

Saunders Havill

PATHWAYS TO SUCCESS

Residential Development Project

Application Number: **02375** Commencement Date: **26/04/2024** Status: **Locked**

1. About the project

1.1 Project details

1.1.1 Project title *

Residential Development Project

1.1.2 Project industry type *

Residential Development

1.1.3 Project industry sub-type

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1.1.4 Estimated start date *

01/01/2025

1.1.4 Estimated end date *

31/12/2027

1.2 Proposed Action details

1.2.1 Provide an overview of the proposed action, including all proposed activities. *

HBD QLD Pty Ltd (‘the Proponent’) is proposing a residential development including 125 residential allotments, pedestrian links, internal roads, and detention/drainage areas on freehold land located at 187 – 197 Binnies Road, Ripley, Queensland described as Lot 335 on RP814578. The proposed action sits adjacent to several other current and future residential developments in the Ripley Valley Priority Development Area (RVPDA) to cater for the increasing housing demands in South-East Queensland (SEQ). The referral area is zoned for ‘Urban Living’ under the RVPDA. The referral area, which is the same as the proposed disturbance footprint, is a vacant 7.52-hectare (ha) patch of vegetation situated between roads and existing/future developments.

The referral area is located within the north-western portion of the Ripley Valley PDA, approximately 6 kilometres (km) south-east of Ipswich Town Centre, 1.2km north of the Centenary Highway and 1km south of the Cunningham Highway. The site is bound by Binnies Road to the south, Daleys Road to the west, Tempo Drive to the east, and residential developments under construction to the north. The broader landscape is shifting from large lot residential land uses to smaller lot residential development.

Activities necessary to deliver this project include vegetation clearing, construction of residential dwellings and associated roads, pathways, and infrastructure including for stormwater and drainage, and ongoing standard maintenance of the associate roads, pathways, and infrastructure. Clearing of vegetation involves a total of 7.52 ha that has been assessed on-ground as:

1. Eucalypt woodland indicative of RE12.9-10.2 (7.18 ha)
2. Highly disturbed area (0.20 ha)
3. Constructed dam (0.14 ha)

The project will involve direct impacts including vegetation clearing which will be across the whole 7.52 ha referral area. For further information on project related impacts refer to Att 1 MNES report, section 6, pp52-54

Site context, the referral area, and the proposed development layout are shown on *Att 1 MNES Report, Figure 1, 2,* and *3* respectively.

1.2.2 Is the project action part of a staged development or related to other actions or proposals in the region?

No

1.2.6 What Commonwealth or state legislation, planning frameworks or policy documents are relevant to the proposed action, and how are they relevant? *

The proposed action is being referred under the *Environmental Protection and Biodiversity Conservation Act 1999* for potential impacts to Matters of National Environmental Significance. Refer to *Att 1 MNES Report pp. 52 – 54.*

Att 1 MNES Report pp. 12-13 provides the details of the relevant legislation that applies to the referral area which at the State level includes the Queensland *Planning Regulation 2017*, *Vegetation Management Act 1999*, and *Nature Conservation Act 1992*. At the Local level, the referral area is located within the Ipswich City Council Local Government Area (LGA) and Ripley Valley Priority Development Area (RVPDA).

Under Queensland *Planning Regulation 2017* (PR) legislation, the referral area is predominantly mapped with core Koala Habitat Area (KHA) outside of a Koala Priority Area (KPA).

Under the *Vegetation Management Act 1999*, the referral area is predominantly mapped as Category B (remnant), with some Category C (high-value regrowth) in the south-eastern portion, and a small area of Category X (non-remnant) vegetation in the south-western and south-eastern corners. Vegetation mapping shows the Category B (remnant) vegetation is mapped as Least Concern RE12.9-10.2, and Category C (high-value regrowth) vegetation is mapped as composite Of Concern RE 12.9-10.2/12.9-10.7/12.9-10.16, as shown

in *Att 1 MNES Report, Figure 4*. Pre-clear mapping shows the entire referral area, including the Category X (non-remnant) vegetation is also mapped as composite Of Concern RE 12.9-10.2/12.9-10.7/12.9-10.16. Category X (non-remnant) vegetation is exempt to clear.

The development proposal occurs within the former Ripley Valley Urban Development Area (UDA), declared under the Urban Land Development Authority Act 2007 (ULDA Act). This legislation supersedes the requirements of Local Government planning provisions (in this case, the Ipswich City Council Planning Scheme) and selective other state legislation (e.g., Vegetation Management Act 1999, and others). Development applications referred to EDQ for assessment against the Ripley Valley UDA Development Scheme will be assessed by ICC against EDQ's Implementation Guidelines

Under the *Nature Conservation Act 1992* (NCA) Protected Plants Flora Trigger Survey Map, the referral area is predominantly mapped as 'High Risk'. Prior to clearing, a flora survey and associated report will be completed in accordance with the Flora Survey Guidelines – Protected Plants provided by the Department of Environment, Science, and Innovation.

The Proponent is advised to ensure that any development obligations pursuant to the provisions of the *Aboriginal Cultural Heritage Act 2003* and the *Planning Act 2016* are complied with in respect to the proposed development. Applicants, developers and landowners have a duty of care under the legislation where items of cultural heritage significance are located, even if those items have not been previously recorded in a database.

1.2.7 Describe any public consultation that has been, is being or will be undertaken regarding the project area, including with Indigenous stakeholders. Attach any completed consultation documentations, if relevant. *

The proponent has commenced a Cultural and Heritage Management Plan with local Indigenous group, Yuggera Ugarapul People (YUP). They have also undertaken Council and Authority due diligence consultation, as well as consultation with owners of the adjoining land.

1.3.1 Identity: Referring party

Privacy Notice:

Personal information means information or an opinion about an identified individual, or an individual who is reasonably identifiable.

By completing and submitting this form, you consent to the collection of all personal information contained in this form. If you are providing the personal information of other individuals in this form, please ensure you have their consent before doing so.

The Department of Climate Change, Energy, the Environment and Water (the department) collects your personal information (as defined by the Privacy Act 1988) through this platform for the purposes of enabling the department to consider your submission and contact you in relation to your submission. If you fail to provide some or all of the personal information requested on this platform (name and email address), the department will be unable to contact you to seek further information (if required) and subsequently may impact the consideration given to your submission.

Personal information may be disclosed to other Australian government agencies, persons or organisations where necessary for the above purposes, provided the disclosure is consistent with relevant laws, in particular the Privacy Act 1988 (Privacy Act). Your personal information will be used and stored in accordance with the Australian Privacy Principles.

See our Privacy Policy to learn more about accessing or correcting personal information or making a complaint.

Alternatively, email us at privacy@awe.gov.au.

☑ **Confirm that you have read and understand this Privacy Notice ***

1.3.1.1 Is Referring party an organisation or business? *

Yes

Referring party organisation details

ABN/ACN	24144972949
Organisation name	Saunders Havill Group Pty Ltd
Organisation address	4006 QLD

Referring party details

Name	Liam Brzezinski
Job title	Senior Ecologist
Phone	0431173273
Email	liambrzezinski@saundershavill.com
Address	9 Thompson Street, Bowen Hills, 4006 QLD

1.3.2 Identity: Person proposing to take the action

1.3.2.1 Are the Person proposing to take the action details the same as the Referring party details? *

No

1.3.2.2 Is Person proposing to take the action an organisation or business? *

Yes

Person proposing to take the action organisation details

ABN/ACN	26638077415
Organisation name	HB QLD PTY LTD
Organisation address	Qld 4218

Person proposing to take the action details

Name	Peter Johnson
Job title	National Development Director
Phone	0400661594
Email	pj@hbland.com.au
Address	Suite 323, Oracle South, Level 3, 17 Elizabeth Avenue, Broadbeach, QLD, 4218

1.3.2.14 Are you proposing the action as part of a Joint Venture? *

No

1.3.2.15 Are you proposing the action as part of a Trust? *

No

1.3.2.17 Describe the Person proposing the action's history of responsible environmental management including details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against the Person proposing to take the action. *

HB QLD Pty Ltd has a history of delivering projects with a satisfactory record of responsible environmental management. HB QLD Pty Ltd delivers land estates in both SEQ and Victoria to a high standard. HB QLD Pty Ltd has received and delivered on two EPBC approvals and offsets on sites in both Ripley Valley and Collingwood Park QLD. HBD QLD Pty Ltd does not have any present proceedings under Commonwealth, State or territory law for the protection of the environment or the conservation and sustainable use of natural resources.

1.3.2.18 If the person proposing to take the action is a corporation, provide details of the corporation's environmental policy and planning framework

HB QLD Pty Ltd do not currently have an Environmental Policy. However, HB QLD Pty Ltd are committed to delivering projects that comply with legislative and regulatory requirements as a minimum. HB QLD Pty Ltd endeavour to continually improve on environmentally responsible actions through cooperation with their suppliers and contractors. This project specifically includes a significant biodiversity assessment report which outlines site specific management plans under local legislation.

1.3.3 Identity: Proposed designated proponent

1.3.3.1 Are the Proposed designated proponent details the same as the Person proposing to take the action? *

Yes

Proposed designated proponent organisation details

ABN/ACN	26638077415
Organisation name	HB QLD PTY LTD
Organisation address	Qld 4218

Proposed designated proponent details

Name	Peter Johnson
Job title	National Development Director
Phone	0400661594
Email	pj@hbland.com.au
Address	Suite 323, Oracle South, Level 3, 17 Elizabeth Avenue, Broadbeach, QLD, 4218

1.3.4 Identity: Summary of allocation

Confirmed Referring party's identity

The Referring party is the person preparing the information in this referral.

ABN/ACN	24144972949
Organisation name	Saunders Havill Group Pty Ltd
Organisation address	4006 QLD
Representative's name	Liam Brzezinski
Representative's job title	Senior Ecologist
Phone	0431173273
Email	liambrzezinski@saundershavill.com
Address	9 Thompson Street, Bowen Hills, 4006 QLD

Confirmed Person proposing to take the action's identity

The Person proposing to take the action is the individual, business, government agency or trustee that will be responsible for the proposed action.

ABN/ACN	26638077415
Organisation name	HB QLD PTY LTD
Organisation address	Qld 4218
Representative's name	Peter Johnson
Representative's job title	National Development Director
Phone	0400661594
Email	pj@hbland.com.au
Address	Suite 323, Oracle South, Level 3, 17 Elizabeth Avenue, Broadbeach, QLD, 4218

Confirmed Proposed designated proponent's identity

The Person proposing to take the action is the individual or organisation proposed to be responsible for meeting the requirements of the EPBC Act during the assessment process, if the Minister decides that this project is a controlled action.

Same as Person proposing to take the action information.

1.4 Payment details: Payment exemption and fee waiver

1.4.1 Do you qualify for an exemption from fees under EPBC Regulation 5.23 (1) (a)? *

No

1.4.3 Have you applied for or been granted a waiver for full or partial fees under Regulation 5.21A? *

No

1.4.5 Are you going to apply for a waiver of full or partial fees under EPBC Regulation 5.21A?

No

1.4.7 Has the department issued you with a credit note? *

No

1.4.9 Would you like to add a purchase order number to your invoice? *

No

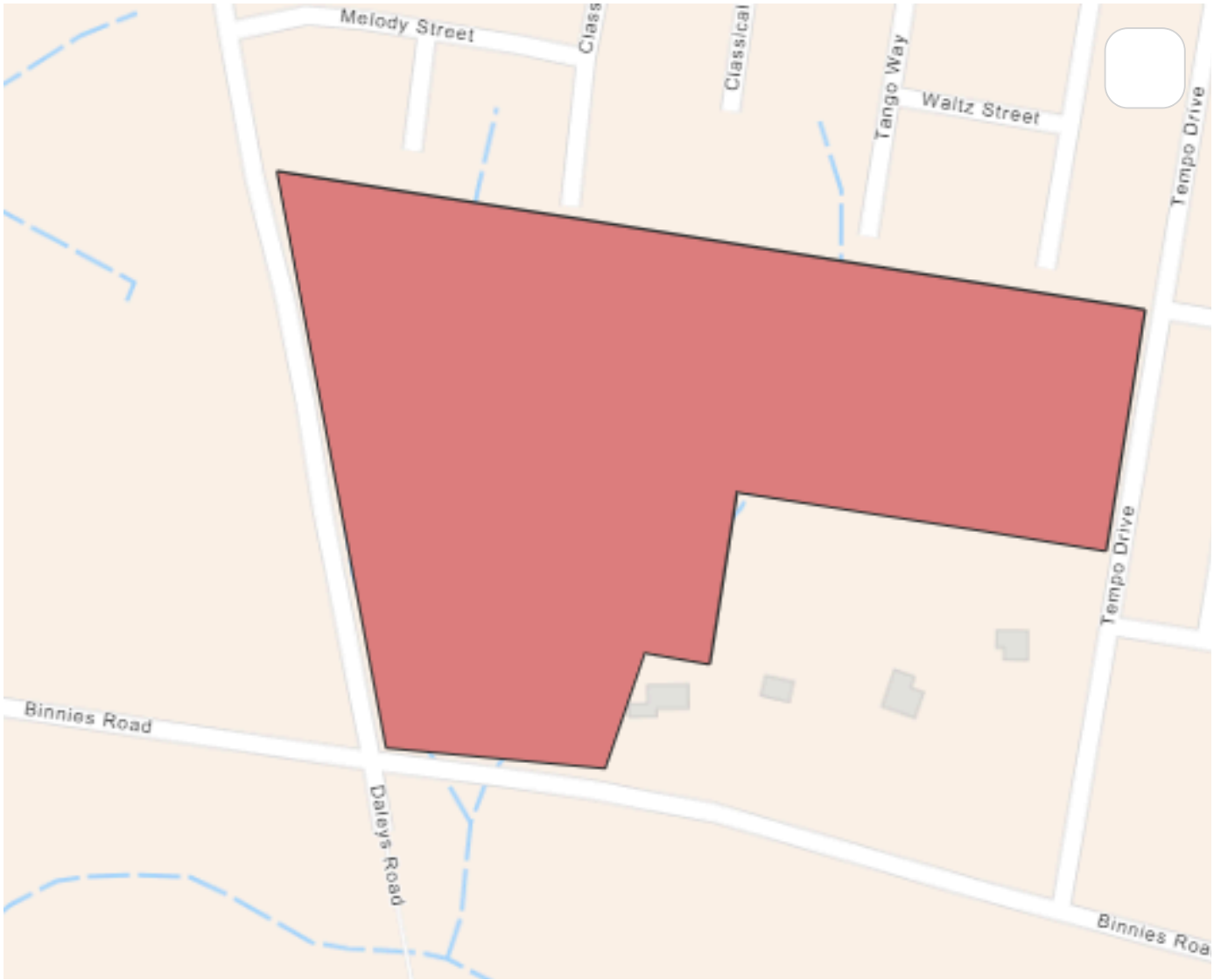
1.4 Payment details: Payment allocation

1.4.11 Who would you like to allocate as the entity responsible for payment? *

Person proposing to take the action

2. Location

2.1 Project footprint



Project Area: 7.54 Ha **Disturbance Footprint:** 7.54 Ha

2.2 Footprint details

2.2.1 What is the address of the proposed action? *

187 – 197 Binnies Road, Ripley, Queensland, 4306 described as Lot 335 on RP814578.

2.2.2 Where is the primary jurisdiction of the proposed action? *

Queensland

2.2.3 Is there a secondary jurisdiction for this proposed action? *

No

2.2.5 What is the tenure of the action area relevant to the project area? *

The property is freehold.

3. Existing environment

3.1 Physical description

3.1.1 Describe the current condition of the project area's environment.

The referral area is located at Binnies Road, Ripley, Queensland described as Lot 335 on RP814578. The referral area is located within the north-western portion of the Ripley Valley Priority Development Area (RVPDA), approximately 6 kilometres (km) south-east of Ipswich Town Centre, 1.2km north of the Centenary Highway and 1km south of the Cunningham Highway. The referral area, and surrounding landscape, is zoned for 'Urban Living' under the RVPDA. Ripley Valley PDA zoning is shown on *Att 1 MNES Report, Plan 4*.

The referral area is bound by Binnies Road to the south, Daleys Road to the west, current and future residential developments to the north and east. Land adjoining the referral area to the south-east remains for now as large lot residential. Land adjoining the referral area to the west and south is currently vacant bushland, mapped as Category B (remnant) and Category C (high-value regrowth) vegetation, but is covered by development approvals and applications, like much of the surrounding area. Only the land south-west of the site, not directly adjoining, contains bushland and is not currently covered by a development approval or application.

The referral area is located in a landscape that has been subject to extensive historical and contemporary modification. Historically, the surrounding area was used for rural land uses with major roads and high-density developments occurring from 1982. Following the designation of the RVPDA in 2010, a significant amount of development has occurred within the immediate vicinity of the referral area. The broader landscape is shifting from large lot residential land uses to smaller lot residential development, with the planning intent of the region highlighted by the significant number of approved developments over surrounding land holdings which are also zoned as 'urban living'. *Att 1 MNES Report, Plan 2 and 3* show the historical aerial imagery and current development approvals and applications in the surrounding landscape.

The referral area is on a gentle south facing slope at 50m AHD in the southern portion of the site and 60m AHD in the northern portion of the site. The referral area itself is mapped as composite land zone 9-10 as defined by the *Land zones of Queensland*. Land Zone 9-10 includes undulating country on sedimentary rocks. The referral area is mapped as having Sodosol soils under the Australian Soil Classification which are generally found in poorly drained sites with low agricultural potential and have low to moderate chemical fertility.

Vegetation across the majority of the referral area is mapped as Category B (remnant) RE12.9-10.2, with Category C (high-value regrowth) composite RE12.9-10.2/12.9-10.7/12.9-10.16 mapped along the south-east of the site. Field surveys identified vegetation across the referral area to be consistent with eucalypt woodland with indicator species of RE12.9-10.2 throughout. A constructed dam and associated areas of high disturbance were observed in the south. Full details of field survey findings are presented within *Att 1 MNES Report, Section 5, pp 35 – 51*.

Field surveys confirmed that the referral area contains relatively intact eucalypt woodland dominated by *Corymbia citriodora* (Spotted Gum) with *Eucalyptus crebra* (Narrow-leaved Ironbark) and *E. tereticornis* (Forest Red Gum). The sub-canopy is sparse, but typically dominated by native species. Despite constituting remnant vegetation, field surveys identified that the majority of vegetation displays evidence of disturbance from historical land-uses and thus does not resemble old growth forest. Only forty-four (44) trees on site had Diameter at Breast Height (DBH) greater than 500 mm, and only nine (9) trees were recorded as containing hollows, seven (7) of which were dead/stag trees. This is a relatively low number of hollow-bearing trees, and so the potential habitat for hollow-dependent native fauna on site is minimal. Further, aggressive, highly competitive invasive avifauna such as *Manorina melanocephala* (Noisy Minor) were observed, reducing the potential for opportunistic foraging of less aggressive native species.

Additionally, this remnant vegetation is intersected by two eroded drainage features originating from culverts to the north of the site and extending to the southern boundary where they merge into a low-lying area with standing water and *Typha orientalis* (Broad-leaved Cumbungi) present.

The south of the referral area (totalling 0.2 ha) displayed significant disturbance and is dominated by weeds and regrowth. Category X (non-remnant) mapped vegetation is located adjacent to the neighbouring lot where maintained lawn, overgrown exotic grass species and regrowth is present. A dam is located in the south-eastern corner of the property. This feature boarders the adjacent residential property and displayed evidence of disturbance.

Although the majority of the referral area contains remnant vegetation, the suitability of the referral area as potential long-term habitat for threatened species is severely limited due to the current and intended future land uses and lack of connectivity. The referral area is not particularly large, only 7.52 ha, which greatly limits the resources available to native species that might attempt to rely solely on the referral area for habitat. However, the referral area also lacks viable movement opportunity for fauna as a result of current and future developments, roads and highly modified land-uses. To the north and east development is on-going and partially complete with all vegetation removed. To the west of the referral area is Daleys Road which runs along the entire western boundary. This road is approximately 35m in width and provides a significant barrier to fauna movement. To the south of the referral area is Binnies Road which has not been fully constructed and therefore retains marginal connectivity. However, this road is anticipated to be upgraded and has received catalyst funding from the Queensland Government. Additionally, only a 110 m section of the referral area boundary adjoins Binnies Road with the majority of the southern boundary adjacent to three rural residential properties which have been recently cleared of all vegetation. This significantly limits fauna movement potential in a southern direction.

Therefore, in spite of the relatively intact vegetation within the referral area, the quality of potential habitat is low for native species other than those that are highly mobile and do not require old-growth forests or hollows. Further, the ample availability of large areas of potential habitat within White Rock Conservation Park, less than 8 km east, or Flinders-Goolman Conservation Estate to the south, is far more likely to be utilised than the comparatively low-value/poorly connected habitat within the referral area.

3.1.2 Describe any existing or proposed uses for the project area.

The referral area is a vacant 7.52-hectare patch of vegetation situated between roads and existing/future developments. The proposed land has historically been a part of rural land uses, though has been relatively well vegetated since 1968, as shown in the historical aerial imagery provided in *Att 1 MNES Report*, *Plan 2*.

The proposed use of the referral area is for residential development, as aligns with the 'Urban Living' zoning under the Ripley Valley Priority Development Area.

3.1.3 Describe any outstanding natural features and/or any other important or unique values that applies to the project area.

The referral area does not contain any outstanding natural features or unique values. The closest conservation areas are all at least 8 km from the project area and separated by major roads or existing or approved future urban development. The predominant RE 12.9-10.2 is least concern. Field surveys of the referral area did not observe any unique or important habitat, nor any threatened species.

A site context figure and MNES context analysis plan are provided as *Att 1 – MNES Report, Figure 1 and Plan 3*, respectively.

3.1.4 Describe the gradient (or depth range if action is to be taken in a marine area) relevant to the project area.

The referral area is on a gentle south facing slope at 50m AHD in the southern portion of the site and 60m AHD in the northern portion of the site. The referral area itself is mapped as composite land zone 9-10 as defined by the *Land zones of Queensland* (Wilson and Taylor, 2012), provided as *Att 2 Land Zones of Queensland*. Land Zone 9-10 includes undulating country on sedimentary rocks. The referral area is mapped as having Sodosol soils under the Australian Soil Classification (ASC) which are generally found in poorly drained sites with low agricultural potential and have low to moderate chemical fertility (refer *Att 3 ASRIS mapping*).

3.2 Flora and fauna

3.2.1 Describe the flora and fauna within the affected area and attach any investigations of surveys if applicable.

Flora

A total of ninety (90) flora species were recorded within the referral area during field surveys, as listed in *Att 1 MNES Report, Appendix D.* Of those, sixty-one (61) are native and twenty-nine (29) species are considered to be non-native / introduced species. No flora species listed under the EPBC Act and NCA were recorded in or adjoining the referral area.

Field surveys confirmed the majority of the referral area contains remnant vegetation generally consistent with the RE mapping of Least Concern 12.9-10.2. Vegetation is comprised of Eucalypt and Corymbia species and dominated by *Corymbia citriodora* (Spotted Gum) with *Corymbia tessellaris* (Moreton Bay Ash), *Eucalyptus siderophloia* (Grey Ironbark), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus melanophloia* (Silver-leaved Ironbark), and *Eucalyptus tereticornis* (Forest Red Gum). The shrub layer contains largely native species including *Alphitonia excelsa* (Soap Tree) and *Acacia sp.* with sparse patches of introduced species including *Lantana camara* (Lantana). The ground layer was observed to be variable throughout the site. Some areas were dominated by leaf litter, others by native species including *Entolasia stricta* (Wiry Panic), and *Cymbopogon refractus* (Barbed Wire Grass), and some patches by introduced species including *Lantana montevidensis* (Creeping Lantana).

Additionally, this remnant vegetation is intersected by two eroded drainage features originating from culverts to the north of the site and extending to the southern boundary where they merge into a low-lying area with standing water and *Typha orientalis* (Broad-leaved Cumbungi) present.

The balance of the referral area, in the southern portion, displayed significant disturbance as a result of historical land clearing. The Category X (non-remnant) mapped vegetation is located adjacent to the neighbouring lot where maintained lawn, overgrown exotic grass species and regrowth is present. A dam feature is located in the south-eastern corner of the property.

The referral area is on a gentle south facing slope at 50m AHD in the southern portion of the site and 60m AHD in the northern portion of the site. Desktop analysis indicates that no REs representative of Threatened Ecological Communities (TEC) are mapped on-site. Field surveys confirmed that no TECs are present on or adjacent to the site. Full details of field survey findings are presented within *Att 1 MNES Report, Section 5, pp 35 – 51*.

Fauna

A total of thirty-four (34) fauna species were recorded during field surveys, inclusive of motion sensor camera traps, nocturnal targeted surveys and incidental observations, including twenty (20) birds, eleven (11) mammals, two (2) reptiles and one (1) invasive amphibian. No conservation significant fauna species were recorded during the field survey. However, SAT surveys detected indirect evidence of Koala in the form of scats at SAT 2 (2 out of 30). Motion sensor camera traps also detected the presence of at least one Feral Cat, European Red Fox and dog prints which are known to pose a significant threat to native fauna, including the Koala. A complete fauna species list is provided in *Att 1 MNES Report, Table 11,* and the full SAT survey results are provided in *Att 1 MNES Report, Appendix E.*

Multiple targeted fauna survey methods completed in accordance with relevant Commonwealth and State survey methodologies were implemented during the field survey period to target presence of potential MNES. This included spotlighting, motion-triggered camera detection, crepuscular and diurnal meander surveys, active searches for signs of fauna usage (*i.e.,* Koala SAT surveys), and searches and assessment of foraging values and habitat suitability. Targeted surveys were conducted for Koala (*Phascolarctos cinereus),* Grey-headed Flying-fox (*Pteropus poliocephalus)*, Greater Glider (*Petauroides volans*), Yellow-bellied Glider (*Petaurus australis* australis), Regent Honeyeater (*Anthochaera Phrygia*), and White-Throated Needletail (*Hirundapus caudacutus*). Details of the methodology and survey dates are provided in summary of fauna survey techniques and effort is provided in *Att 1 MNES Report, Table 10*.

3.2.2 Describe the vegetation (including the status of native vegetation and soil) within the project area.

Dominant vegetation communities have been ground-truthed through multiple site walkovers using a GPS and aerial imagery to define boundaries. All communities present within and adjacent to the referral area are described below and displayed on *Att 1 MNES Report, Plan 5*.

The referral area is mapped as predominantly Category B (remnant) RE12.9-10.2. Field surveys identified vegetation across the referral area to be consistent with eucalypt woodland with indicator species of RE12.9-10.2 throughout. A constructed dam and associated areas of high disturbance were observed in the south.

The following vegetation communities have been delineated on-ground:

1. AU1 – Eucalypt woodland indicative of RE12.9-10.2 (7.18 ha)

Vegetation across the referral area is generally consistent with the RE mapping of 12.9-10.2 consisting of *Eucalypt* and *Corymbia* species dominated by *Corymbia citriodora* (Spotted Gum) with *Corymbia tessellaris* (Moreton Bay Ash), *Eucalyptus siderophloia* (Grey Ironbark), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus melanophloia* (Silver-leaved Ironbark), and *Eucalyptus tereticornis* (Forest Red Gum). The shrub layer contains largely native species including *Alphitonia excelsa* (Soap Tree) and *Acacia sp.* with sparse patches of introduced species including *Lantana camara* (Lantana). The ground layer was observed to be variable throughout the site, with some areas dominated by leaf litter, other areas dominated by native species including *Entolasia stricta* (Wiry Panic), and *Cymbopogon refractus* (Barbed Wire Grass) and patches of introduced species including *Lantana montevidensis* (Creeping Lantana).

Additionally, this remnant vegetation is intersected by two eroded drainage features originating from culverts to the north of the site and extending to the southern boundary where they merge into a low-lying area with standing water and *Typha orientalis* (Broad-leaved Cumbungi) present.

1. AU2 – Highly disturbed area (0.20 ha)

The balance of the referral area displayed significant disturbance as a result of historical land clearing. The Category X (non-remnant) vegetation is located adjacent to the neighbouring lot where maintained lawn, overgrown exotic grass species and regrowth is present. Additionally, a dam feature (0.14 ha) is located in the south-eastern corner of the property. This feature boarders the adjacent residential property and displayed evidence of disturbance.

The referral area is on a gentle south facing slope at 50m AHD in the southern portion of the site and 60m AHD in the northern portion of the site. The referral area itself is mapped as composite land zone 9-10 as defined by the *Land zones of Queensland* (Wilson and Taylor, 2012). Land Zone 9-10 includes undulating country on sedimentary rocks. The referral area is mapped as having Sodosol soils under the Australian Soil Classification (ASC) which are generally found in poorly drained sites with low agricultural potential and have low to moderate chemical fertility.

3.3 Heritage

3.3.1 Describe any Commonwealth heritage places overseas or other places recognised as having heritage values that apply to the project area.

No Commonwealth Heritage Places are known to be located within or adjacent to the referral area.

Mapping indicates commonwealth lands approximately 5km form the referral area, however the lands are separated from the referral area by a highly modified landscape inclusive of large-scale developments and major roads. Therefore, it is considered highly unlikely that the proposed action will have any direct or indirect impacts on these lands.

3.3.2 Describe any Indigenous heritage values that apply to the project area.

No Indigenous heritage values are known to occur within the referral area. A duty of care site assessment will be completed to identify any Aboriginal objects or natural features. The proponent is aware of their duty of care obligations and will engage with the traditional owners prior to the commencement of work.

3.4 Hydrology

3.4.1 Describe the hydrology characteristics that apply to the project area and attach any hydrological investigations or surveys if applicable. *

Under the *Water Act* 2000, two unmapped waterways are described on site, confirmed by field surveys to be eroded drainage lines originating from culverts to the north of the site and extending to the southern boundary where they merge into a low-lying area with standing water. A small are of the southern extent of the referral area is mapped as contains a 'low' risk waterway for waterway barrier works under the Fisheries Act 1994 associated with a low-lying area which extends to the south of the referral area.

The Moreton Bay Ramsar Site (MBRS) is approximately 30-40km upstream of the referral area and there is no direct hydraulic or any other connection from the referral area to the MBRS. The closest pathway to Moreton Bay is through the eroded drainage lines on site into the drainage lines south of the site that connect to Deebing Creek north of the site, then Brenner River, then east along the Brisbane River. Surface water would need to be conveyed at minimum 100 km through this series of waterways before reaching the MBRS. As such, the referral area is considered substantially separate from MBRS and is therefore not considered to impact it.

4. Impacts and mitigation

4.1 Impact details

Potential Matters of National Environmental Significance (MNES) relevant to your proposed action area.

EPBC Act section	Controlling provision	Impacted	Reviewed
S12	World Heritage	No	Yes
S15B	National Heritage	No	Yes
S16	Ramsar Wetland	No	Yes

EPBC Act section	Controlling provision	Impacted	Reviewed
S18	Threatened Species and Ecological Communities	Yes	Yes
S20	Migratory Species	No	Yes
S21	Nuclear	No	Yes
S23	Commonwealth Marine Area	No	Yes
S24B	Great Barrier Reef	No	Yes
S24D	Water resource in relation to large coal mining development or coal seam gas	No	Yes
S26	Commonwealth Land	No	Yes
S27B	Commonwealth Heritage Places Overseas	No	Yes
S28	Commonwealth or Commonwealth Agency	No	Yes

4.1.1 World Heritage

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

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4.1.1.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.1.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

No World Heritage Sites exist within or near to the referral area. The closest World Heritage Site is the Gondwanan Rainforests of Australia (Main Range National Park) of which is approximately 44 km south-west of the referral area. Due to the distance of the project site away from this area, it is unlikely that it will have an impact on any World Heritage places.

4.1.2 National Heritage

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

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4.1.2.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.2.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

No National Heritage places exist within or near to the referral area. No potential for impact on a National Heritage Place from the proposed action. The closest National Heritage Place is the Gondwanan Rainforests of Australia which is approximately 44 km south-west of the referral area. Due to the distance of the project site away from this area, it is unlikely that it will have an impact on any National Heritage places.

4.1.3 Ramsar Wetland

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

Direct impact	Indirect impact	Ramsar wetland
No	No	Moreton Bay

4.1.3.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.3.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

The Moreton Bay Ramsar Site (MBRS) is approximately 30-40km upstream of the referral area and there is no direct hydraulic or any other connection from the referral area to the MBRS. The closest pathway to Moreton Bay is through the eroded drainage lines on site into the drainage lines south of the site that connect to Deebing Creek north of the site, then Brenner River, then east along the Brisbane River. Surface water would need to be conveyed at minimum 100 km through this series of waterways before reaching the MBRS. As such, the referral area is considered substantially separate from MBRS and is therefore not considered to impact it.

No other wetlands of international importance occur within close proximity of the project extent. No direct impacts on the wetland are anticipated to occur as a result of the project construction and operation.

4.1.4 Threatened Species and Ecological Communities

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

Threatened species

Direct impact	Indirect impact	Species
Yes	No	Anthochaera phrygia
No	No	Argynnis hyperbius inconstans
No	No	Arthraxon hispidus
No	No	Bosistoa transversa
No	No	Botaurus poiciloptilus
No	No	Calidris acuminata
No	No	Calidris ferruginea
No	No	Calyptorhynchus lathami lathami
No	No	Chalinolobus dwyeri
No	No	Climacteris picumnus victoriae
No	No	Coleus habrophyllus
No	No	Cyclopsitta diophthalma coxeni
No	No	Dasyurus hallucatus
No	No	Dasyurus maculatus maculatus (SE mainland population)
No	No	Delma torquata

Direct impact	Indirect impact	Species
No	No	Dichanthium setosum
No	No	Erythrotriorchis radiatus
No	No	Falco hypoleucos
No	No	Fontainea venosa
No	No	Furina dunmalli
No	No	Gallinago hardwickii
No	No	Geophaps scripta scripta
No	No	Grantiella picta
No	No	Hemiaspis damelii
Yes	No	Hirundapus caudacutus
No	No	Lathamus discolor
No	No	Macroderma gigas
No	No	Notelaea lloydii
No	No	Notelaea x ipsviciensis
Yes	No	Petauroides volans
No	No	Petaurus australis australis
No	No	Petrogale penicillata
Yes	No	Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)
No	No	Planchonella eerwah
Yes	No	Pteropus poliocephalus
No	No	Rhaponticum australe
No	No	Rhodamnia rubescens
No	No	Rhodomyrtus psidioides
No	No	Rostratula australis
No	No	Samadera bidwillii
No	No	Stagonopleura guttata
No	No	Thesium australe
No	No	Tringa nebularia

Direct impact	Indirect impact	Species
No	No	Turnix melanogaster

Ecological communities

Direct impact	Indirect impact	Ecological community
No	No	Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community
No	No	Grey box-grey gum wet forest of subtropical eastern Australia
No	No	Lowland Rainforest of Subtropical Australia
No	No	Poplar Box Grassy Woodland on Alluvial Plains
No	No	Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions
No	No	Swamp Tea-tree (Melaleuca irbyana) Forest of South-east Queensland
No	No	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

4.1.4.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

Yes

4.1.4.2 Briefly describe why your action has a direct and/or indirect impact on these protected matters. *

A full description of the potential impacts of the proposed action on threatened species is provided in *Att 1 MNES Report Section 5.4.3, pp. 45 – 49.*

Koala (*Phascolarctos cinereus*)

Koala habitat can be broadly defined as any forest or woodland containing species that are known Koala food trees, or shrubland and emergent food trees. Preferred food and shelter trees are naturally abundant on fertile clay soils. Along the Great Dividing Range and the coastal belt throughout the species' range, Koalas inhabit moist forests and woodlands mostly dominated by *Eucalyptus* species.

The referral area contains 7.38 ha of Category B (remnant) vegetation comprised of RE 12.9-10.2, which is known to provide suitable Koala Habitat. The species is also known to be present within the locality, and indirect evidence of Koala activity was observed on site in the form of two (2) scats within one of three SAT surveys. Non-juvenile Koala Habitat Trees (NJKHTs) are present across the referral area including *Eucalyptus tereticornis* (Forest Red Gum), *E. siderophloia* (Grey Ironbark), *E. melanophloia* (Silver-leaved Ironbark), *E. crebra* (Narrow-leaved Ironbark), *Corymbia citriodora* (Spotted Gum), and *C. tessellaris* (Moreton Bay Ash). This potential habitat would be removed from the referral area under the proposed action.

Grey-headed flying-fox (*Pteropus poliocephalus*)

The GHFF is heavily dependent on the availability of foraging resources and roost sites. As canopy feeding frugivores and nectarivores, GHFFs frequent fruiting and flowering trees in rainforests, open eucalypt forests, woodlands, Melaleuca sp. swamps and Banksia woodlands.

The referral area contains 7.38 ha of open eucalypt forest and woodland considered potential habitat for this species, which will be removed under the proposed action.

Greater Glider (*Petauroides volans*)

The Greater Glider is largely restricted to eucalypt forest and woodlands. It is primarily folivorous with a diet mostly comprising of eucalypt leaves and occasionally flowers. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The species favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. During the day it shelters in tree hollows, with a particular preference for large hollows in large, old growth trees. As such, the presence of live, hollow-bearing trees is thought to be a limiting factor within otherwise suitable habitat.

The referral area contains 1.46 ha of potential habitat for this species, being mapped Category B (remnant) vegetation of eucalypt-dominated communities outside of a 100 m disturbance buffer and including nine (9) trees observed to contain hollows within the referral area. This will be entirely removed under the proposed action.

Regent Honeyeater (*Anthrochaera phrygia*)

Regent Honeyeaters mostly occur in dry Box-Ironbark Eucalypt woodland and dry sclerophyll forest associations in areas of low to moderate relief, wherein they prefer moister, more fertile sites. These areas are generally associated with creek flats and river valleys and foothills. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. They are a generalist forager, which mainly feed on nectar from a wide range of eucalypts and mistletoes.

The referral area contains 7.38 ha of *Corymbia citriodora* (Spotted Gum) dominated woodland with *Eucalyptus crebra* (Narrow-leaved Ironbark), considered potential habitat for this species, which will be removed under the proposed action.

White-throated Needletail (*Hirunduapus caudacutus*)

The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, callitris, and trees on farmland or gardens. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes. It is more common in wider blocks of remnant woodland than in narrower strips. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland.

The referral area contains 7.38 ha of wooded areas including open forests, considered potential habitat for this species, which will be removed under the proposed action.

4.1.4.4 Do you consider this likely direct and/or indirect impact to be a Significant Impact? *

No

4.1.4.6 Describe why you do not consider this to be a Significant Impact. *

Koala (*Phascolarctos cinereus*)

A full assessment against the Significant Impact Guidelines 1.1 is provided in *Att 1 MNES Report, Section 8.2, pp. 60-68.* This assessment determined the proposed action is unlikely to result in a Significant Impact to Koala.

The proposed action will require the removal of 7.38 ha of potential Koala habitat comprised of mapped Category B (remnant) RE12.9-10.2 vegetation. However, given the size, context, and assessment of Koala occurrence, it is unlikely the proposed action will have a significant impact on the species.

Historically the referral area contributed to a relatively well-connected patch of habitat, however the rapid development of the local area following designation of the Ripley Valley Priority Development Area (RVPDA) has completely isolated the vegetation within the referral area. As such, despite relatively intact vegetation within the referral area, connectivity potential is significantly limited given surrounding properties to the west, north and east are or are expected to be completely cleared. Whilst individuals may currently enter the referral area due to its marginal connectivity to the south, this landholding has had a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road present to the south is expected to be upgraded, further removing any connectivity value to the south. Therefore, the potential Koala habitat within the referral area is soon to be entirely isolated by large urban developments, and due to its zoning as 'Urban Living' is intended to follow suite.

Vegetation within the referral area is currently unlikely to be utilised by koala given its small size (7.52 ha) and minimal connected habitat. Field and desktop surveys confirmed this, finding Koala occurrence on site to be limited. A review of the Atlas of Living Australia demonstrated records of Koala observations within the local area are relatively dated (>10 years), with the nearest contemporary record from 2010, approximately 1 km north-east of the referral site. SAT surveys on site found scats under two (2) of the ninety (90) trees surveyed, which indicates low occurrence. Given the low evidence and lack of direct sightings it is likely a current population does not exist within the referral area.

Therefore, the removal of the small, relatively isolated patch of potential Koala habitat within the centre of the 'Urban Living' zone of the RVPDA is unlikely to significantly impact the species.

Grey-headed Flying-fox (*Pteropus poliocephalus*)

A full assessment against the Significant Impact Guidelines 1.1 is provided in *Att 1 MNES Report, Section 8.3, pp. 70 - 77.* This assessment determined the proposed action is unlikely to result in a Significant Impact to Grey-headed Flying-fox (GHFF).

Surveys did not record GHFF foraging within or adjacent to the referral area nor as a fly-over species. Additionally, no roosts are present within the referral area or directly adjacent. A review of the National Flying-fox monitoring viewer identified a GHFF roost approximately 2.5km north-east of the site (Yamanto (479)). The nearest roost of national significance (Inala, Lilac Street (1219)) is located approximately 21.5 km north-east of the site. Further, given the high mobility of the species and availability of suitable foraging habitat within less urbanised surroundings in the broader area, including White Rock – Spring Mountain Conservation Estate and the Flinders-Goolman Conservation Estate, it is considered unlikely that the species would consistently utilise the relatively small area of 7.38 ha of potential GHFF habitat associated with the referral area. Therefore, the removal of this potential habitat is unlikely to significantly impact the species.

Greater Glider (*Petauroides volans*)

A full assessment against the Significant Impact Guidelines 1.1 is provided in *Att 1 MNES Report, Section 8.4, pp. 79-85.* This assessment determined the proposed action is unlikely to result in a Significant Impact to Greater Glider.

The referral area is relatively small and isolated from other potential Greater Glider habitat areas, surrounded instead by existing and future urban developments. Given the known sensitivity of this species to disturbance, only 1.46 ha on site is considered potential habitat.

This species was not observed within the referral area, despite targeted nocturnal searches. Queensland Wildnet returned no sightings of Greater Glider within 5 km of the referral area, with the nearest recorded observation of the species 12 km north-east of the site. Furthermore, only 2 live hollow-bearing trees were present across the referral area, and none were present outside of the disturbance buffer. This indicates that the already limited potential habitat within the referral area is relatively low-quality, with very limited potential live hollows, which are a known limiting factor to Greater Glider occurrence.

Most sightings of this species are within nature reserves and conservation areas which provide a significant amount of intact, high-value remnant vegetation within the broader locality. In contrast, the referral area is located within a large 'Urban Living' zone within the RVPDA and is surrounded by developments, both existing and approved, to the west, north and east which are, or are expected to be, completely cleared. The site currently retains marginal connectivity potential to the south, but this landholding has a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road is present to the south which is expected to be upgraded and will limit any connectivity value south, and Daleys Road is present to the west.

Therefore, it is unlikely that the removal of 1.46 ha of low-value potential Greater Glider habitat within a Priority Development Area will significantly impact the species.

Regent Honeyeater (*Anthochaera Phrygia*)

A full assessment against the Significant Impact Guidelines 1.1 is provided in *Att 1 MNES Report, Section 8.5, pp. 88-94.* This assessment determined the proposed action is unlikely to result in a Significant Impact to Regent Honeyeater.

Surveys did not record Regent Honeyeater foraging within or adjacent to the referral area nor as a fly-over species. There are recorded observations of Regent Honeyeater within 5 km of the referral area on the Atlas of Living Australia. These observations are within the nearby conservation estate, which provides a large, contiguous area of high-quality habitat. Given the high mobility of this species and the availability of suitable foraging habitat within less urbanised surroundings in the broader area including White Rock – Spring Mountain Conservation Estate and the Flinders-Goolman Conservation Estate, it is considered unlikely that the species would consistently or preferentially utilise the relatively small area of 7.38 ha of potential habitat associated with the referral area.

The potential habitat on site is also relatively low-value since it is only 7.38 ha, has a low abundance of mature trees (approximately 5.85 mature trees per ha), and was observed to contain aggressive invasive species such as *Manorina melanocephla* (Noisy Miner) which are known to compete with Regent Honeyeater.

Therefore, the removal of this small, low-value potential habitat surrounded by urban developments is unlikely to significantly impact the species.

White-throated Needletail (*Hirundapus caudacutus*)

A full assessment against the Significant Impact Guidelines 1.1 is provided in *Att 1 MNES Report, Section 8.6, pp. 96-99.* This assessment determined the proposed action is unlikely to result in a Significant Impact to White-throated Needletail.

White-throated Needletails, being highly mobile and predominantly aerial including while foraging, are unlikely to focus solely on one area of habitat. Field surveys did not record White-throated Needletail foraging within or adjacent to the referral area nor as a fly-over species. There are recorded observations of White-throated Needletail within 5 km of the referral area on the Atlas of Living Australia, but many of these records are dated (>20 years old). In that time the area has experienced rapid urbanisation after its designation as the Ripley Valley Priority Development Area, and as such the quality of potential habitat has likely decreased for this species.

The referral area does not contain any unique or important habitat for White-throated Needletail. No mistletoe was observed on site, which they prefer to inhabit. The species' prefers mature trees, but despite its remnant status few were recorded on site, with only forty-four (44) trees with a recorded DBH above 500 mm, and eight (8) of these being dead/stag trees. There is also a similarly low abundance of hollow-bearing trees (nine total) that could be used for breeding. Compared to the alternative potential habitat within the broader locality, notably at White Rock Conservation Park to the east, which provide large areas of intact continuous potential habitat, the referral area provides relatively low-value habitat.

Therefore, the removal of this small, low-value potential habitat surrounded by urban developments is unlikely to significantly impact the species.

A full significant impact assessment for these species has been provided in *Att 1 MNES Report Section 8, pp. 59*

4.1.4.7 Do you think your proposed action is a controlled action? *

No

4.1.4.9 Please elaborate why you do not think your proposed action is a controlled action. *

The proposed action is not considered to be a controlled action because it is unlikely to cause Significant Impact to any MNES. The referral area is proposed for use that aligns with its current zoning under the Ripley Valley Priority Development Area ('Urban Living') and does not fragment any regulated vegetation or potential habitat for listed species. The referral area is surrounded by approved and existing development, and so lacks viable ongoing connectivity potential for any threatened species. Further, although the site contains relatively intact remnant vegetation, it does not comprise old growth forest, contains few mature and hollow-bearing trees, and is comprised of Least Concern regional ecosystems found abundantly in the broader landscape and across much larger, contiguous areas intended for conservation. The removal of 7.52 ha of relatively isolated, low-value potential habitat within the centre of a Priority Development Area does not constitute a controlled action. Additionally, no MNES species were observed within the referral area coupled with limited records in the broader locality indicate it is highly unlikely the referral area would be used by an MNES species at present or in the future. Therefore, the removal of vegetation within the referral area not considered to significantly impact any MNES

4.1.4.10 Please describe any avoidance or mitigation measures proposed for this action and attach any supporting documentation for these avoidance and mitigation measures. *

Vegetation clearing management plan

A Vegetation Clearing and Management Plan (VCMP) will form part of the broader management document for the proposed action. The VCMP will cover clearing of all vegetation within the referral area and include details on:

- Vegetation to be removed.
- All civil works likely to impact on existing vegetation.
- Temporary and permanent exclusion and protection fencing.
- Roles and responsibilities for site contractors, the developer and the consultant group.
- Stockpiling and site access locations.
- A clearing sequence plan showing the commencement of clearing and direction of removal (this will be in conjunction with the Fauna Management Plan to allow for the appropriate flushing of fauna towards safe havens and/or the application of an appropriate relocation program).
- Links to weed management and revegetation proposals.
- The stock piling and reuse of cleared vegetation.

Fauna Management Plan

A Fauna Management Plan (FMP) will be prepared for potential impacts of the construction phase covering the loss of vegetated areas, isolated trees and likely barriers and impediments to local dispersal. The FMP will link closely with the VCMP and include details on:

- Species surveyed as using the site with a focus on those most likely impacted by development works.
- A list of relevant State and Commonwealth legislation constraints and controls for the above listed fauna.
- A plan showing existing habitat opportunities and locations.
- Details of the threats to existing fauna species.
- Clearing sequence plan from the VCMP.
- Management and mitigation measures.
- Fauna spotter role, contacts and certification.
- Specific fauna management procedures for potential or known habitat trees.

Fauna Spotter Catcher

A registered and suitability qualified fauna spotter catcher/ecologist will need to be employed for clearing works to implement a protocol of best management practises. Significant habitat features, should any be identified on site, will be flagged prior to clearing events and these areas supervised by an appropriately experienced Ecologist. Identified within the clearing supervision protocol should be flagging of hollow bearing trees, if present, followed by the removal of vegetation surrounding them. After 24 to 72 hours, these trees should then be removed.

The objective of this is to enable hollow dependant fauna an opportunity to move on their own accord as many species utilise multiple den/roost sites within a given home range should they occur. Where required, native fauna situated within areas to be cleared will be relocated to a secure area of similar habitat prior to the commencement of vegetation clearance works by a registered fauna spotter/catcher. Should any removal and relocation of nests be required, it is to be undertaken by a suitably qualified and experienced person and advice sought where necessary.

4.1.4.11 Please describe any proposed offsets and attach any supporting documentation relevant to these measures. *

The project is recommended as ‘not a controlled action’ following assessment against the significant impact guidelines, therefore offsets are not proposed.

4.1.5 Migratory Species

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

Direct impact	Indirect impact	Species
No	No	Actitis hypoleucos
No	No	Apus pacificus
No	No	Calidris acuminata
No	No	Calidris ferruginea
No	No	Calidris melanotos
No	No	Cuculus optatus
No	No	Gallinago hardwickii
No	No	Hirundapus caudacutus
No	No	Monarcha melanopsis
No	No	Motacilla flava
No	No	Myiagra cyanoleuca
No	No	Rhipidura rufifrons
No	No	Symposiachrus trivirgatus
No	No	Tringa nebularia

4.1.5.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.5.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

A likelihood of occurrence assessment has been carried out by SHG using information from previous and contemporary ecological field surveys to assess the potential for listed threatened species and communities to utilise and / or occur on site. The likelihood assessment has been included at *Att 1 MNES Report, Appendix C*.

No migratory species were identified within the referral area, and all fifteen (15) species returned from the desktop search as having been previously recorded or predicted to occur within 5 km of the referral area were identified as having a 'low' or 'unlikely' likelihood of occurring on-site. This is predominantly a result of few sightings in the broader locality and a lack of suitable habitat such as vegetated gully lines or rainforests. As a result, the proposed action is not considered to significantly impact the availability of habitat for any migratory species.

4.1.6 Nuclear

4.1.6.1 Is the proposed action likely to have any direct and/or indirect impact on this protected matter? *

No

4.1.6.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

The proposed action does not comprise a nuclear action, and therefore a direct and / or indirect impact is not predicted.

4.1.7 Commonwealth Marine Area

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

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4.1.7.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.7.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

The proposed action is not being undertaken in or adjacent to a Commonwealth marine area. The proposed action is located 53 km west of a Commonwealth marine area. Therefore, the proposed action is not likely to impact on this Commonwealth marine area.

4.1.8 Great Barrier Reef

4.1.8.1 Is the proposed action likely to have any direct and/or indirect impact on this protected matter? *

No

4.1.8.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

The proposed action is more than 360km south of the Great Barrier Reef Marine Park and is not considered to directly and / or indirectly impact upon it.

4.1.9 Water resource in relation to large coal mining development or coal seam gas

4.1.9.1 Is the proposed action likely to have any direct and/or indirect impact on this protected matter? *

No

4.1.9.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

The proposed action does not comprise a CSG development or large coal mine.

4.1.10 Commonwealth Land

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

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4.1.10.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.10.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

The proposed action is not to occur on or adjacent to Commonwealth Land.

4.1.11 Commonwealth Heritage Places Overseas

You have identified your proposed action will likely directly and/or indirectly impact the following protected matters.

A direct impact is a direct consequence of an action taken – for example, clearing of habitat for a threatened species or permanent shading on an ecological community as the result of installing solar panels.

An indirect impact is an 'indirect consequence' such as a downstream impact or a facilitated third-party action.

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4.1.11.1 Is the proposed action likely to have any direct and/or indirect impact on any of these protected matters? *

No

4.1.11.3 Briefly describe why your action is unlikely to have a direct and/or indirect impact. *

The proposed action is not to occur on or adjacent to Commonwealth heritage places overseas.

4.1.12 Commonwealth or Commonwealth Agency

4.1.12.1 Is the proposed action to be taken by the Commonwealth or a Commonwealth Agency? *

No

4.2 Impact summary

Conclusion on the likelihood of significant impacts

You have indicated that the proposed action will likely have a significant impact on the following Matters of National Environmental Significance:

None

Conclusion on the likelihood of unlikely significant impacts

You have indicated that the proposed action will unlikely have a significant impact on the following Matters of National Environmental Significance:

- World Heritage (S12)
- National Heritage (S15B)
- Ramsar Wetland (S16)
- Threatened Species and Ecological Communities (S18)
- Migratory Species (S20)
- Nuclear (S21)
- Commonwealth Marine Area (S23)
- Great Barrier Reef (S24B)
- Water resource in relation to large coal mining development or coal seam gas (S24D)
- Commonwealth Land (S26)
- Commonwealth Heritage Places Overseas (S27B)
- Commonwealth or Commonwealth Agency (S28)

4.3 Alternatives

4.3.1 Do you have any possible alternatives for your proposed action to be considered as part of your referral? *

No

4.3.8 Describe why alternatives for your proposed action were not possible. *

The proposed action is for a residential development that will provide 125 residential dwellings within the ‘Urban Living’ zone of the Ripley Valley Priority Development Area (RVPDA), to cater for the increasing housing demands in South-East Queensland (SEQ). Since this development is proposed specifically to meet the need and designated Priority Development Area, alternative locations are not relevant. Given the zoning of the referral area and surrounds as ‘Urban Living’ under a priority development designation, the referral area is not intended to be retained. The referral area does not contain any important or unique environmental values and is not considered to have a significant impact on any MNES. Therefore, potential alternatives are both unnecessary and ineffective at meeting the needs this proposed action seeks to satisfy.

5. Lodgement

5.1 Attachments

1.2.1 Overview of the proposed action

	Type	Name	Date	Sensitivity	Confidence
#1.	Document	Att 1 MNES Report.pdf Technical report relating to Matters of National Environmental Significance	17/04/2024	No	High

3.1.4 Gradient relevant to the project area

	Type	Name	Date	Sensitivity	Confidence
#1.	Document	Att 2 Land Zones of Queensland.pdf Land zones of Queensland reference document	02/01/2012	No	High
#2.	Document	Att 3 ASRIS mapping.pdf ASRIS soil mapping	25/04/2024	No	High

5.2 Declarations

Completed Referring party's declaration

The Referring party is the person preparing the information in this referral.

ABN/ACN	24144972949
Organisation name	Saunders Havill Group Pty Ltd
Organisation address	4006 QLD
Representative's name	Liam Brzezinski
Representative's job title	Senior Ecologist
Phone	0431173273
Email	liambrzezinski@saundershavill.com
Address	9 Thompson Street, Bowen Hills, 4006 QLD

☑ Check this box to indicate you have read the referral form. *

☑ I would like to receive notifications and track the referral progress through the EPBC portal. *

☑ By checking this box, I, **Liam Brzezinski of Saunders Havill Group Pty Ltd**, declare that to the best of my knowledge the information I have given on, or attached to this EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence. *

☑ I would like to receive notifications and track the referral progress through the EPBC portal. *

✔ Completed Person proposing to take the action's declaration

The Person proposing to take the action is the individual, business, government agency or trustee that will be responsible for the proposed action.

ABN/ACN	26638077415
Organisation name	HB QLD PTY LTD
Organisation address	Qld 4218
Representative's name	Peter Johnson
Representative's job title	National Development Director
Phone	0400661594
Email	pj@hbland.com.au
Address	Suite 323, Oracle South, Level 3, 17 Elizabeth Avenue, Broadbeach, QLD, 4218

☑ Check this box to indicate you have read the referral form. *

☑ I would like to receive notifications and track the referral progress through the EPBC portal. *

☑ I, **Peter Johnson of HB QLD PTY LTD**, declare that to the best of my knowledge the information I have given on, or attached to the EPBC Act Referral is complete, current and correct. I understand that giving false or misleading information is a serious offence. I declare that I am not taking the action on behalf or for the benefit of any other person or entity. *

☑ I would like to receive notifications and track the referral progress through the EPBC portal. *

✔ Completed Proposed designated proponent's declaration

The Proposed designated proponent is the individual or organisation proposed to be responsible for meeting the requirements of the EPBC Act during the assessment process, if the Minister decides that this project is a controlled action.

Same as Person proposing to take the action information.

☑ Check this box to indicate you have read the referral form. *

☑ I would like to receive notifications and track the referral progress through the EPBC portal. *

☑ I, **Peter Johnson of HB QLD PTY LTD**, the Proposed designated proponent, consent to the designation of myself as the Proposed designated proponent for the purposes of the action described in this EPBC Act Referral. *

☑ I would like to receive notifications and track the referral progress through the EPBC portal. *

Ecological Assessment – Matters of National Environmental Significance

EPBC Act Referral – MNES Assessment

187-197 Binnies Road, Ripley, Queensland 4306

Prepared for HB QLD Pty Ltd
18 April 2024

Job 11826

saunders havill group

Document Control

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Prepared by
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ABN 24 144 972 949
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1. Introduction

Saunders Havill Group (SHG) was engaged by HB QLD Pty Ltd to carry out an ecological assessment of Matters of National Environmental Significance (MNES) to support a referral under the Commonwealth Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The purpose of this report is to identify potential MNES, specifically listed threatened species and communities that may be impacted by the proposed residential development ('the action') located at 187-197 Binnies Road, Ripley, Queensland ('the site').

1.1. Description of the Action

HB QLD Pty Ltd ('the Proponent') is proposing a residential development including residential allotments, internal roads, and detention/drainage areas on land located at Binnies Road, Ripley, Queensland described as Lot 335 on RP814578. The proposed action sits adjacent to several other current and future residential developments in the Ripley Valley Priority Development Area (RVPDA) to cater for the increasing housing demands in South-East Queensland (SEQ). The proposed development footprint that is subject to this referral is a vacant 7.52-hectare patch of vegetation situated between roads and existing/future developments.

Refer to **Figure 1** and **Figure 2** for site context and referral area respectively and **Figure 3** for the proposed development layout.

1.2. Purpose

This ecological assessment has been prepared to support a referral to the Australian Government's Department of Climate Change, Energy, the Environment and Water (DCCEEW) ('the Department') for assessment against the EPBC Act. The purpose is to:

- Identify biodiversity values within or near the project area including MNES
- Identify potential impacts of the proposed action on MNES
- Present a list of measures to avoid, minimise and / or mitigate the identified impacts; and
- Provide an assessment against the *Significant Impact Guideline 1.1* for MNES identified as having the potential to be impacted by the action, at its broadest scope.

The findings of this assessment will identify if the action is likely to have a significant residual impact on MNES and determine if it should be made a controlled action.

1.3. Areas of Investigation

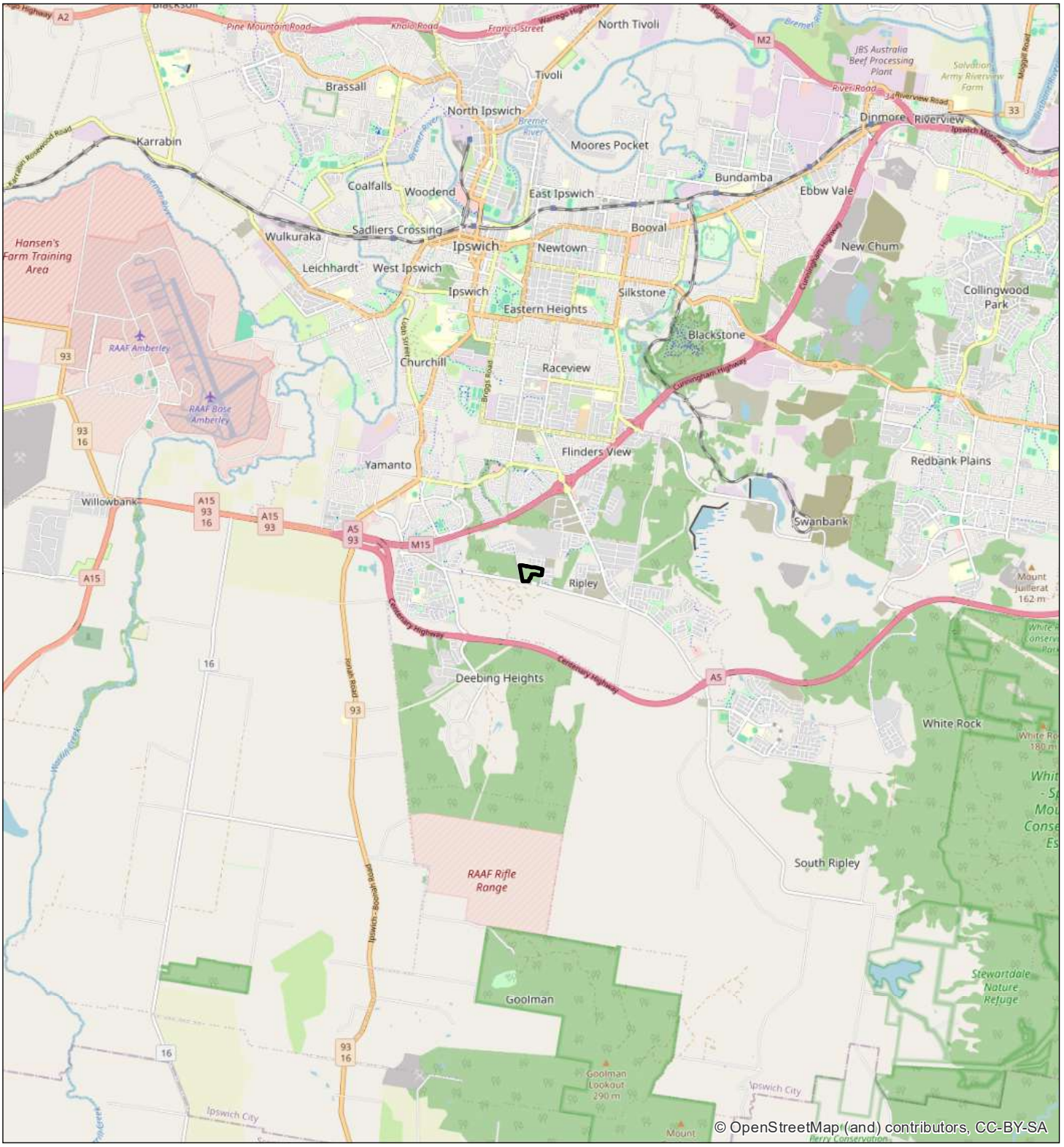
The areas of investigation for this ecological assessment include:

- Referral area – Lot 335 on RP814578 totalling approximately 7.52 ha.
- Locality – the extent of the 5 km radius database searches of the referral area.

1.4. Site Context

The referral area is located within the north-western portion of the Ripley Valley PDA, approximately 6 kilometres (km) south-east of Ipswich Town Centre, 1.2km north of the Centenary Highway and 1km south of the Cunningham Highway. The site is bound by Binnies Road to the south, Daleys Road to the west, and residential developments under construction

to the north and east. The broader landscape is shifting from large lot residential land uses to smaller lot residential development.



Legend

Site boundary

Figure 1

Site Context

HB Land Pty Ltd

File ref. 11826 E MNES Figure 1 Site Context A
Date 5/04/2024
Project Binnies Road, Ripley

0 1 2 3 4 km

N

Scale (A4): 1:100,000 [GDA 2020 MGA Z56]

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Layer Source: © State of Queensland 2024

Legend

Site boundary

Qld DCDB

Figure 2

Site Aerial

HB Land Pty Ltd

File ref. 11826 E MNES Figure 2 Site Aerial A
Date 5/04/2024
Project Binnies Road, Ripley

0 20 40 60 80 100 m

N

Scale (A4): 1:2,500 [GDA 2020 MGA Z56]

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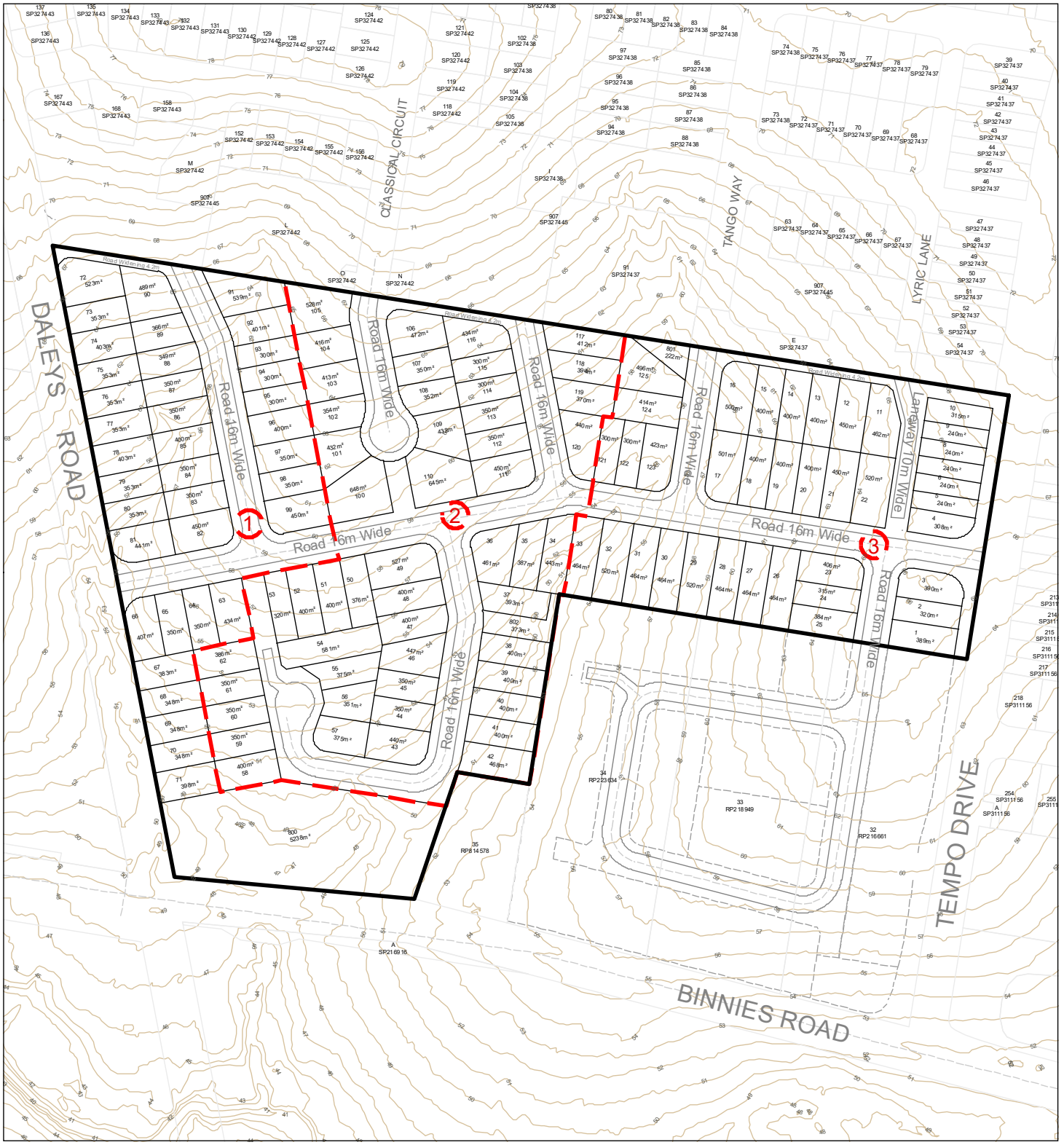
Layer Source: © State of Queensland 2024



Legend

- Site boundary
- Qld DCDB

11826 P 03 Rev H

- Stage boundary
- Proposed lots
- Proposed road pavements
- Contours
- Neighbouring lots - Indicative

Figure 3

Proposed Development

HB Land Pty Ltd

File ref. 11826 E MNES Figure 3 Development Proposal A
Date 18/04/2024
Project Binnies Road, Ripley

0 20 40 60 80 100 m

N

Scale (A4): 1:2,500 [GDA 2020 MGA Z56]

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2. Commonwealth Legislation and Policy

2.1. Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) establishes a requirement for Commonwealth environmental assessment and approval for actions that are likely to have a significant impact on any MNES protected under the EPBC Act, including:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (listed under the Ramsar Convention);
- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Commonwealth marine areas;
- The Great Barrier Reef;
- Nuclear actions (including uranium mines); and
- A water resource, in relation to coal seam gas development and large coal mining development.

Other matters protected under the EPBC Act, include:

- The environment, where actions proposed are on, or will affect Commonwealth land and the environment; and
- The environment, where Commonwealth agencies are proposing to take an action.

When a proponent proposes to take an action that they believe may need approval under the EPBC Act, they must refer the proposed action to the Australian Government Minister for the Environment (the Minister). The purpose of the referral is to determine whether or not a proposed action is a 'controlled action' and thereby requires approval under the EPBC Act. If the Minister determines that a proposed action is a 'controlled action', it would then proceed through the Commonwealth assessment and approval process.

2.2. Significant Impact Guidelines 1.1.

The *Significant Impact Guidelines 1.1* (DoE 2013) (SIG 1.1) define a 'significant impact' as an impact which is important, notable, or of consequence, having regard to its context or intensity, with whether or not an action is likely to have a significant impact depending upon the sensitivity, value, and quality of the environment to be impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

The Significant Impact Guidelines provide a set of criteria to assist in determining whether the impacts of a proposed action are likely to result in a significant residual impact on a MNES. When considering whether or not an action is likely to have a significant impact on a MNES it is relevant to consider all adverse impacts which result from the action, including indirect and offsite impacts.

2.3. Conservation Advices

When a native species or ecological community is listed as threatened under the Commonwealth EPBC Act, a conservation advice is developed to assist its recovery. Conservation advices guide recovery planning and identify actions required for conservation and recovery of the threatened species or ecological community. They inform the Australian Government in regulatory decision-making and investment for threatened species and ecological communities. For some species and ecological communities with more complex planning needs, recovery plans may also be developed to guide recovery.

Conservation advices and recovery plans list key habitat requirements, characteristics and life histories of threatened species and ecological communities. They can be used to assess whether habitat critical to threatened species or communities may be present on a site and, therefore, are a useful tool for assessing the potential for an action to impact on MNES.

2.4. EPBC Act Environmental Offsets Policy

Environmental offsets are measures that compensate for the residual adverse impacts of an action on the environment. At the national level, environmental offsets are governed by the EPBC Act and EPBC Act Environmental Offsets Policy (2012). Environmental offsets will be required for any significant residual impact on MNES resulting from the Project.

Offsets can comprise a combination of direct offsets (*i.e.,* on ground creation or rehabilitation of habitat) and indirect compensatory measures (*i.e.,* research or educational programs) that aligns with published conservation priorities and provides a conservation gain for the MNES being impacted.

Conservation gain is the benefit that a direct offset delivers to the MNES, which maintains or increases its viability or reduces any threats of damage, destruction or extinction. A conservation gain may be achieved by:

- improving existing habitat for the protected matter;
- creating new habitat for the protected matter;
- reducing threats to the protected matter;
- increasing the values of a heritage place; and/or
- averting the loss of a protected matter or its habitat that is under threat.

An environmental offset may be required if the action is considered to have a significant impact on a MNES.

3. Assessment Methodology and Process

3.1. Desktop analysis

Prior to the commencement of field surveys, a desktop analysis was conducted of Commonwealth, State and Local environmental databases and overlay mapping to identify potential MNES and included the following:

- Commonwealth MNES protected under the EPBC Act on and around the site using the protected matters search tool with a 5 km radius (**Appendix A**);
- *Nature Conservation Act 1992* (NCA) listed threatened species on and around the site using the wildlife online database search tool with a 5 km radius (**Appendix B**);
- Public environmental databases including Atlas of Living Australia and BioMaps;
- State regulated vegetation management and vegetation supporting maps under the *Vegetation Management Act 1999* (VMA) including essential habitat mapping; and
- Local government records where MNES threatened species and communities are known to occur in the area.

Additionally, a review of aerial photography history was undertaken via QImagery to assist with the broad delineation of vegetation communities and to determine historical patterns to local vegetation communities.

Initial desktop assessment identified seven (7) threatened ecological communities (TECs), sixteen (16) threatened flora species, thirty-three (33) threatened fauna species and fifteen (15) migratory species as having the potential to occur within 5 km of the referral area (refer **Appendix A**). An initial assessment for the likelihood of occurrence was undertaken based on desktop survey to inform field survey methodology for target flora and fauna species and communities (refer **Appendix C**).

3.2. Field survey methodology

Field surveys were conducted to describe the ecological value of the referral area and surrounds. Field surveys were undertaken during seasonal conditions generally favourable to the detection and identification of flora and fauna species. Field survey methods were determined based on target species and communities and EPBC Act listed species guidelines. Fauna surveys were conducted under the following permits held by Saunders Havill Group:

- Scientific Purposes Permit WA0022007 granted under Section 12(f) of Nature Conservation (Administration) Regulation 2017
- Department of Agriculture and Fisheries (DAF) Ethics clearance CA 2020/02/1355
- Scientific User Registration SUR000451

Specific survey guidelines targeting species listed under the EPBC Act are provided on the Species Profile and Threats Database (SPRAT) profile only where a guideline has been developed. The guidelines provided in **Table 1** were reviewed and incorporated into field survey methodology where required and appropriate in order to adequately identify the presence of targeted threatened species. The table also provides survey guidelines referenced for general flora and fauna surveys.

Table 1: Species-specific survey guidelines

Targeted species / ecological community	Guideline / method
Phascolarctos cinereus (Koala)	Spot Assessment technique (Phillps and Callaghan 2011)
Pteropus poliocephalus (Grey-headed Flying-fox)	*Survey guidelines for Australia's threatened bats*
General terrestrial surveys	*Terrestrial Vertebrate Fauna Survey Guidelines* *Modified Habitat Quality Assessment methodology utilising the Guide to determining terrestrial habitat quality v 1.2 April 2017.*
General for threatened mammals	*Survey guidelines for Australia's threatened mammals*
General for threatened birds	*Survey guidelines for Australia's threatened birds*

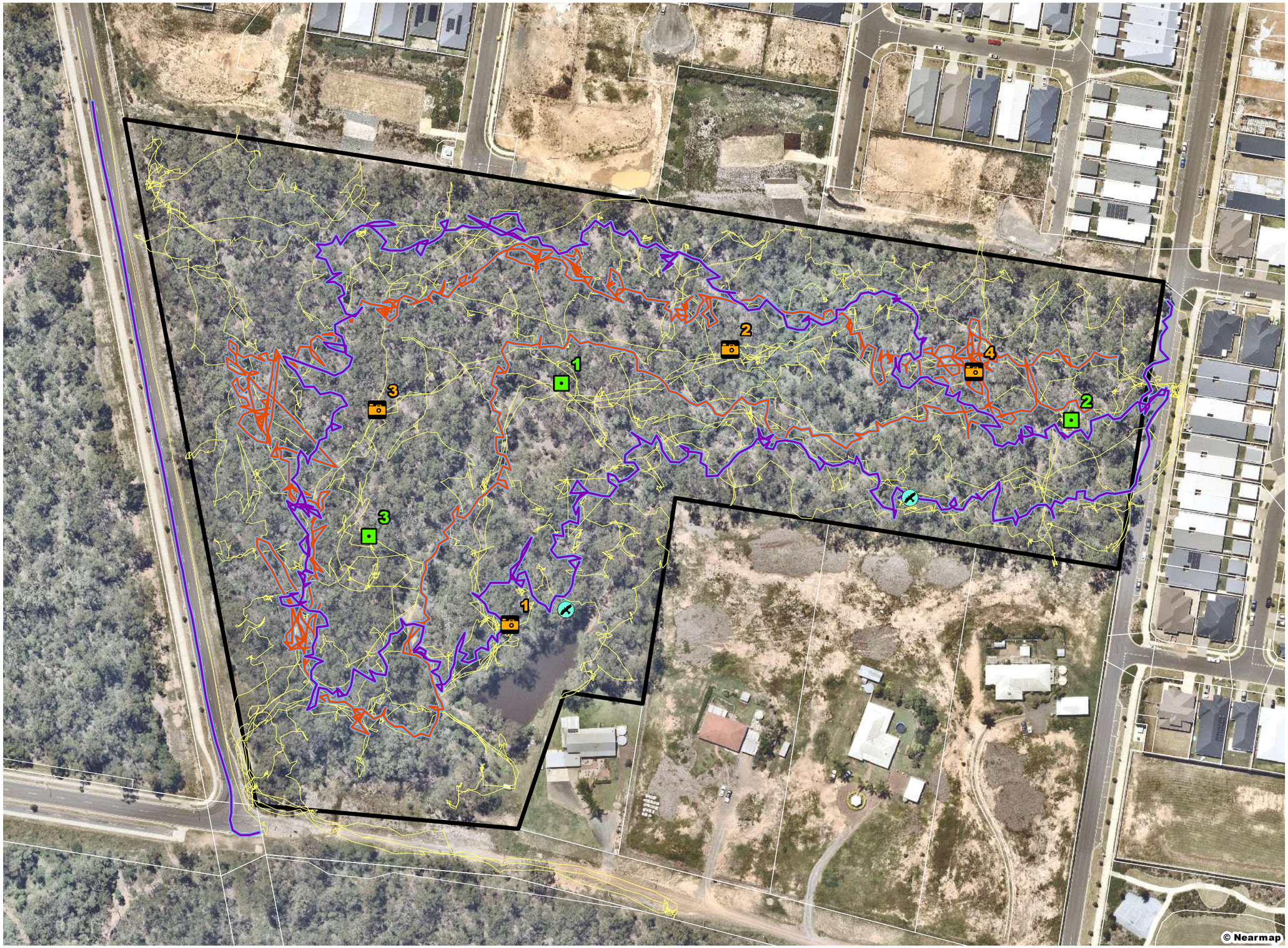
Field surveys were performed in February 2024 (refer **Table 2**). Field surveys utilising the methods outlined in the following subsections were conducted to describe ecological value of the subject site. Field survey effort is shown on **Plan 1.**

Table 2: Field Survey Methods Summary

Date	Weather Conditions	Methods
1 February 2024	20.7°C min – 32.1°C max, 0 mm rainfall	Initial site visit, general observational surveys, context analysis, camera set-up and SAT surveys.
14 February 2024	19.5°C min – 33.5°C max, 0 mm rainfall	General observational surveys, tree plot of large and hollow bearing trees, dusk bird survey, and spotlighting.
15 February 2024	23.1°C min – 30.9°C max, 0 mm rainfall	General observational surveys, camera collection, dusk bird survey, and spotlighting.

Source: Combination of Amberely (040004) and Greenbank (Defence) QLD (140009), BOM 2024

1. MNES - Field Survey Effort



Notes:
This plan was prepared as a desktop assessment tool. The information on this plan is not suitable for any other purpose. Property dimensions, areas, numbers of lots and contours and other physical features shown have been compiled from existing information and may not have been verified by field survey. These may need verification if the development application is approved and development proceeds, and may change when a full survey is undertaken or in order to comply with development approval conditions. No reliance should be placed on the information on this plan for detailed design or for any financial dealings involving the land. Saunders Havill Group therefore disclaims any liability for any loss or damage whatsoever or howsoever incurred, arising from any party using or relying upon this plan for any purpose other than as a document prepared for the sole purpose of accompanying a development application and which may be subject to alteration beyond the control of the Saunders Havill Group. Unless a development approval states otherwise, this is not an approved plan.

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Legend

- Site boundary
- Qld DCDB
- Koala SAT survey
- Bird survey
- Camera trap
- Spotlighting track (14/02/2024)
- Spotlighting track (15/02/2024)
- Observation surveys

Issue	Date	Description	Drawn	Checked
A	5/04/2024	Preliminary	TC	LB

0 20 40 60 m

Transverse Mercator | GDA 2020 | Zone 56 | 1:1,600 @ A3

Address / RPD: 335RP814578

5/04/2024 | 11826 E 01 MNES Field Survey A

saunders havill group

HB Land Pty Ltd

Binnies Road, Ripley

3.2.1 *Observational Survey for Significant Flora and Fauna, Habitat Trees and Biodiversity Values*

The referral area was walked several times where possible to ensure all species (flora and fauna) were recorded and identified. Particular attention was paid to any threatened species that were listed as possibly occurring on or within the vicinity of the referral area and specific micro-assemblages which may support these threatened species. This included observations for vertebrate fauna present on or that may utilise the referral area, including faunal lists and significance status of species under the Commonwealth's EPBC Act including the JAMBA, CAMBA, ROKAMBA and the Bonn Convention, and Queensland's NCA.

The observational survey included identification of ecological features and values such as broad vegetation communities, fauna habitats, and connectivity. Specific attention was paid to threatened flora and fauna species. Over 46 'man hours' were spent within the referral area over several days performing 'Observation Surveys' (refer **Plan 1**).

For the purposes of this report, a significant flora and fauna species has been defined as a species that is scheduled as 'critically endangered', 'endangered', 'vulnerable' or conservation dependent under the Commonwealth EPBC Act.

3.2.2 *Spot Assessment Technique (SAT) and Koala habitat surveys*

Spot Assessment Technique (SAT) surveys were conducted across the referral area with aim to assess Koala usage. SAT surveys follow the methodology designed by Phillips and Callaghan (2011). It involves a single ecologist combing the ground under Koala food plant trees (or non-food plant trees if necessary) for a 1-metre radius around the trunk searching for scats. Each tree searched must be greater or equal to 100 mm diameter at breast height (DBH) and search of each tree continues for up to 2 minutes. The search can cease prior to the 2-minute limit if scats are detected. Thirty trees meeting the specifications are analysed during each SAT survey.

3.2.3 *Scats, tracks and other traces search*

Surveys for scats, tracks and other fauna traces were conducted throughout field surveys in 2024 as part of the observational surveys. Both predator and non-predator scats were sought during all searches. Specific search efforts were made to locate the presence of Koalas or evidence of their occurrence on the subject lands and the local area. In addition, particular attention was paid to the identification of potential dens, scats and tracks for invasive species, such as European Red Fox and domestic cats, to identify predator-prey interactions and understand existing impacts within the referral area.

3.2.4 *Nocturnal active searches, dusk bird surveys and spotlighting*

This non-intrusive survey technique is the most effective method to obtain estimates of nocturnal arboreal mammal incidence and abundance in wooded habitats. Spotlighting also targets medium to large terrestrial nocturnal mammals, and can detect other nocturnal taxon groups (e.g., frogs, geckoes, nocturnal snakes, nocturnal birds, spiders).

A combination of high-powered spotlights and head torches were used to sample for nocturnal mammals, birds, reptiles and frogs across the proposed action area. This technique involved detecting eye shine, and a record of vegetation density was taken. Additional information recorded included the prevailing conditions and search effort. This method was completed on 14 and 15 February 2024.

Additionally, a series of 'point surveys' were conducted before dusk on both the 14 and 15 February 2024, as per *Survey Guidelines for Australia's threatened birds,* where bird activity is typically high. These surveys involved listening for bird calls and observing movement at a stationary point for 20 mins.

3.2.5 *Motion sensor camera trap*

Camera trapping involves setting up a fixed digital camera to capture images or video of animals that pass in front of a camera with an infrared trigger. It is a non-invasive technique designed to detect medium to large sized animals as they

pass, although it is possible to detect smaller animals depending on the set-up. This method identifies fauna activity beyond the scope of direct observational studies and with the absence of potential observer impacts. Four (4) camera traps were set up across the referral area and remained active for 15 days. Cameras were attached 30-100 cm from the ground on a tree trunk and directed towards landscape features. Traps were baited using a general fauna mammal bait consisting of a mixture of peanut butter and oats.

3.2.6 Tree Plot

A tree plot survey was conducted across the referral to locate and describe the vegetation values, namely the native mature tree specimens and those considered to contain habitat features. A handheld GPS device (Trimble) was used to record locations (accuracy ±1 m), and the following parameters of each tree specimen were recorded:

- tree species, via a combination of observations of the gum nuts, buds, leaves, bark and growth form;
- diameter of the trunk of the tree measured using the standard method of Diameter at Breast Height (DBH);
- height of the tree measured using a laser rangefinder with three-point measurement capability (inclinometer);
- canopy spread;
- health assessment (canopy, trunk); and
- habitat values (for example, presence and/or number of hollows, nests, termites, scratches and scats).

3.2.7 Fauna movement barrier assessment

A combination of contemporary aerial imagery, locality knowledge and field inspection can assist in understanding if there are barriers to fauna movement in the landscape. Once the aerial imagery is interrogated, location(s) for inspection are selected (typically roads) and barriers identified.

3.3. Likelihood of Occurrence Assessment

The likelihood of occurrence assessment was based upon publicly available species records and/or other information sources, such as field guides and web-based species profiles, including but not limited to:

- Australian Government's *Species Profile and Threats Database* (SPRAT) for the threatened species and ecological communities listed under the EPBC Act; and
- Queensland Government's *Department of Environment and Science* (DES) threatened species website.

The likelihood of occurrence assessment was informed by desktop assessment and field survey results, including an appreciation and understanding of the species habitats within the referral area. The assessment adopts a two-tiered approach; the first based on desktop analysis and the potential of occurrence and the second based on a combination of desktop and field survey to determine the likelihood of occurrence.

The likelihood of threatened species and ecological communities occurring in the referral area has been assessed against the criteria outlined in **Table 3**.

Table 3: Likelihood of occurrence assessment criteria

Likelihood of occurrence	Assessment criteria
Unlikely	No previous records of the species within the locality and one or more of the following criteria is met: • Not previously recorded on the referral area and surrounds and the referral area is beyond the current known geographic range; or • Dependent on specific habitat types or resources that are not present on the referral area; or

	• Considered extinct in the wild.
Low	No previous records of the species within the locality and one or more of the following criteria is met: • Site and local connectivity contains marginal habitat excluding suitable/critical habitat attributes; • Lack of recent records exist in a regional context (use 1980 as a delineation); or • Potential for vagrant or individual of the species to survive short-term;
Moderate	Species previously recorded within the locality and one or more of the following criteria is met: • Previously recorded in proximity to the referral area (*i.e.,* vagrant individuals); or • Potential habitat typologies or resources are present on the referral area.
High	Species previously recorded within the locality and one or more of the following criteria is met: • Previously recorded on the referral area; • Dependent on habitats or habitat resources that are available on the referral area; or • Suitable habitats are available on the referral area that are capable of supporting a resident population or individuals of the species.
Known	Flora species or ecological community positively identified during field surveys within the referral area. Fauna species positively recorded during field surveys within the referral area or adjacent habitats.

4. Desktop Assessment Results

4.1. Landscape Context and Historical Aerial Imagery Analysis

The referral area is located in a landscape that has been subject to extensive historical and contemporary modification. Historically, the surrounding area was used for rural land uses with major roads and high-density developments occurring from 1982. Following the designation of the RVPDA in 2010, a significant amount of development has occurred within the immediate vicinity of the referral area (refer to **Plan 2** for historical aerial imagery analysis).

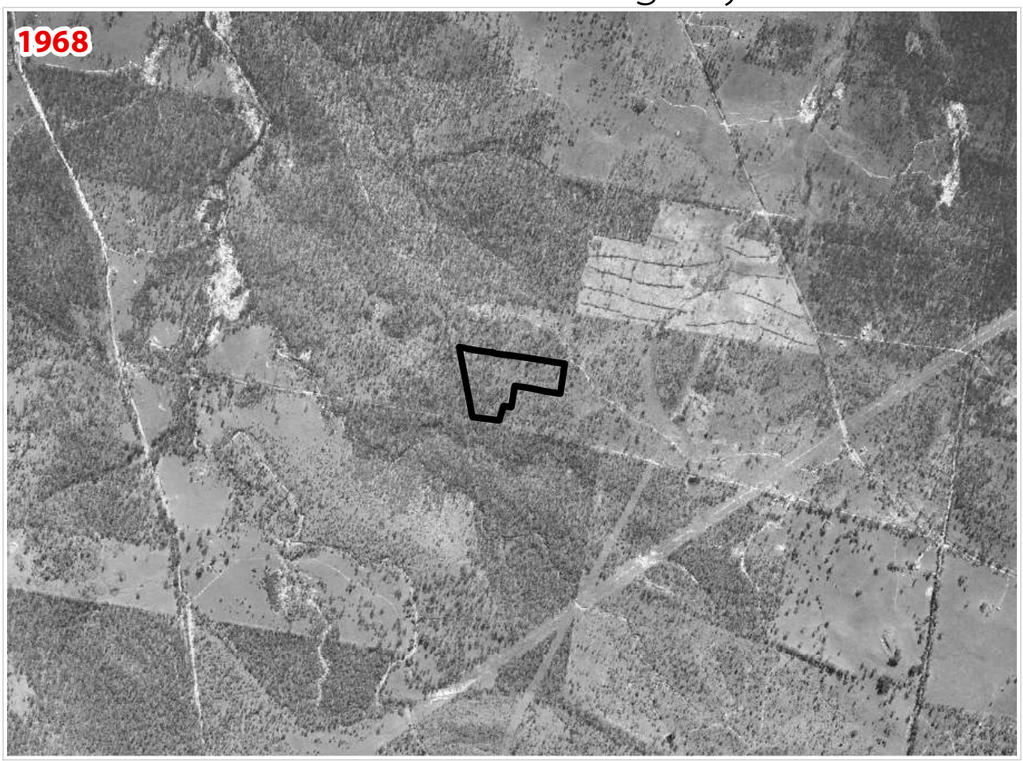
Contextually the referral area is bound by residential developments to the north and east (EDQ approval 2834/2019/PDA), with Daleys Road to the west and Binnies Round to the south. Daleys Road has been upgraded to facilitate new developments in the region with Binnies Road being dedicated catalyst funding from the Queensland Government to connect the west of RVPDA. Further west of Daleys Road, an approved development is present (EPBC 2010/5638) with several other EPBC approvals in the broader locality. Major arterial roads, Cunningham Highway and Ripley Road, are present to the north-west and north-east (refer **Plan 3**). The referral area is centrally located within the RVPDA with no environmental protection zoning on, or adjacent to, the referral area, indicating the area is not strategically designated to cater for corridor functionality at present and not intended to provide corridor functionality in the future. The planning intent of the region is highlighted by the significant number of approved developments over surrounding land holdings which are also zoned as 'urban living' (refer **Plan 4**).

The referral area itself has remained relatively unchanged with vegetation mapped almost entirely as Category B (remnant) vegetation under Queensland legislation. Minor clearing for tracks and property boundaries has occurred as well as recent clearing of the three lots to the south-east of the referral area. Despite relatively intact vegetation within the referral area, this vegetation provides significantly limited connectivity potential given surrounding properties to the west, north and east are, or are expected to be, completely cleared. The site retains marginal connectivity potential to the south, however this landholding has a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road is present the south which is expected to be upgraded and will limit any connectivity value in a southern direction.

4.2. Referral Area Topography and Soils

The referral area is on a gentle south facing slope at 50m AHD in the southern portion of the site and 60m AHD in the northern portion of the site. The referral area itself is mapped as composite land zone 9-10 as defined by the *Land zones of Queensland* (Wilson and Taylor, 2012). Land Zone 9-10 includes undulating country on sedimentary rocks. The referral area is mapped as having Sodosol soils under the Australian Soil Classification (ASC) which are generally found in poorly drained sites with low agricultural potential and have low to moderate chemical fertility.

2. Historical Aerial Imagery



Notes:
This plan was prepared as a desktop assessment tool. The information on this plan is not suitable for any other purpose. Property dimensions, areas, numbers of lots and contours and other physical features shown have been compiled from existing information and may not have been verified by field survey. These may need verification if the development application is approved and development proceeds, and may change when a full survey is undertaken or in order to comply with development approval conditions. No reliance should be placed on the information on this plan for detailed design or for any financial dealings involving the land. Saunders Havill Group therefore disclaims any liability for any loss or damage whatsoever or howsoever incurred, arising from any party using or relying upon this plan for any purpose other than as a document prepared for the sole purpose of accompanying a development application and which may be subject to alteration beyond the control of the Saunders Havill Group. Unless a development approval states otherwise, this is not an approved plan.

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Legend

Site boundary

Issue	Date	Description	Drawn	Checked
A	9/04/2024	Preliminary	TC	LB

0 200 400 600 800 m

Transverse Mercator | GDA 2020 | Zone 56 | 1:25,000 @ A3

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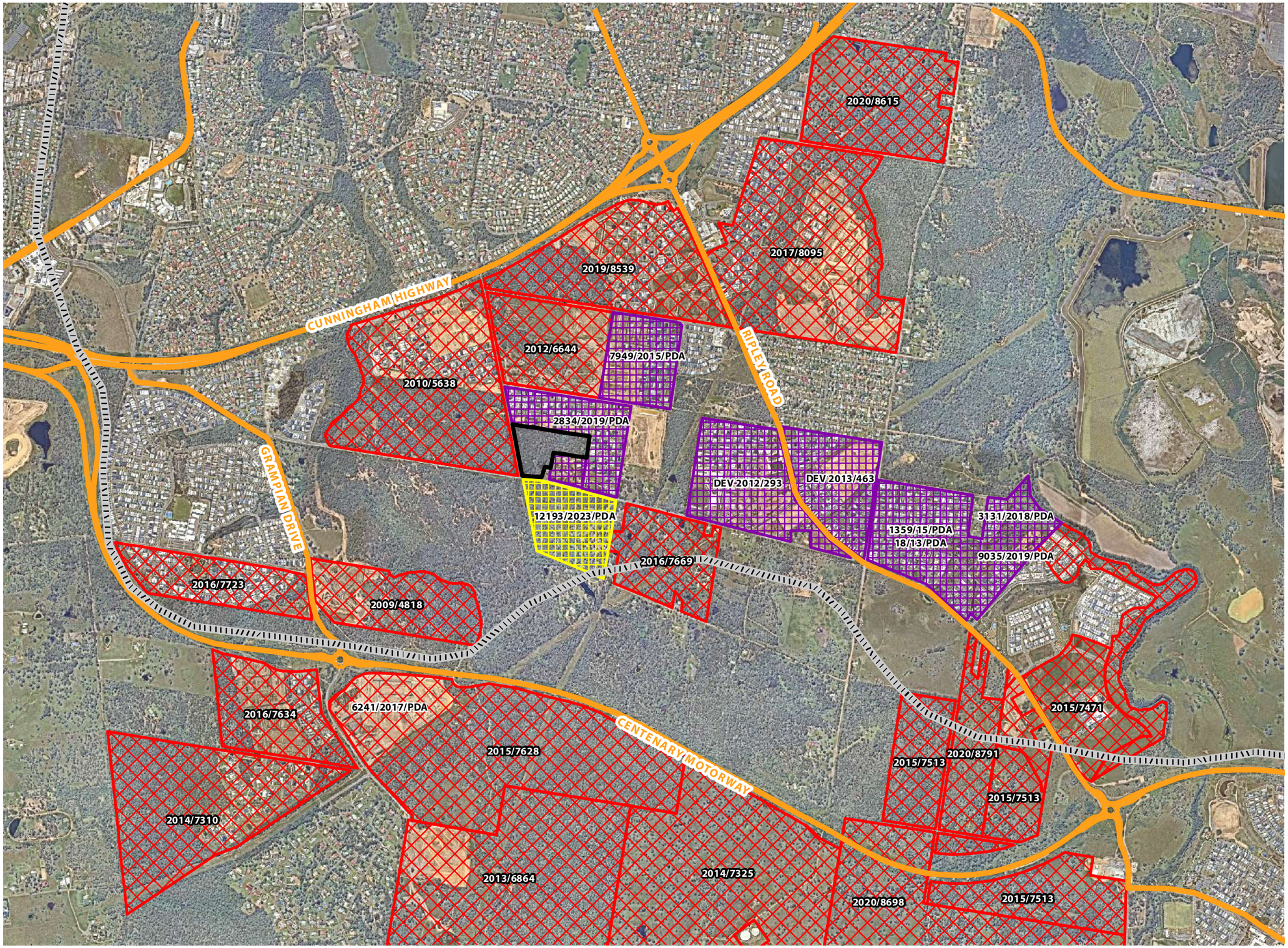
Binnies Road, Ripley

Address / RPD: 335RP814578

9/04/2024 | 11826 E 02 MNES Aerial History A

3. MNES - Context Analysis



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Legend

- Site boundary
- Major Roads
- Future rail corridor
- EDQ DA Approved Sites
- EDQ DA Application Sites
- EPBC Approvals / 'NCA' determinations

Issue	Date	Description	Drawn	Checked
A	5/04/2024	Preliminary	TC	LB

0 200 400 600 800 m

Transverse Mercator | GDA 2020 | Zone 56 | 1:21,415 @ A3

Address / RPD: 335RP814578

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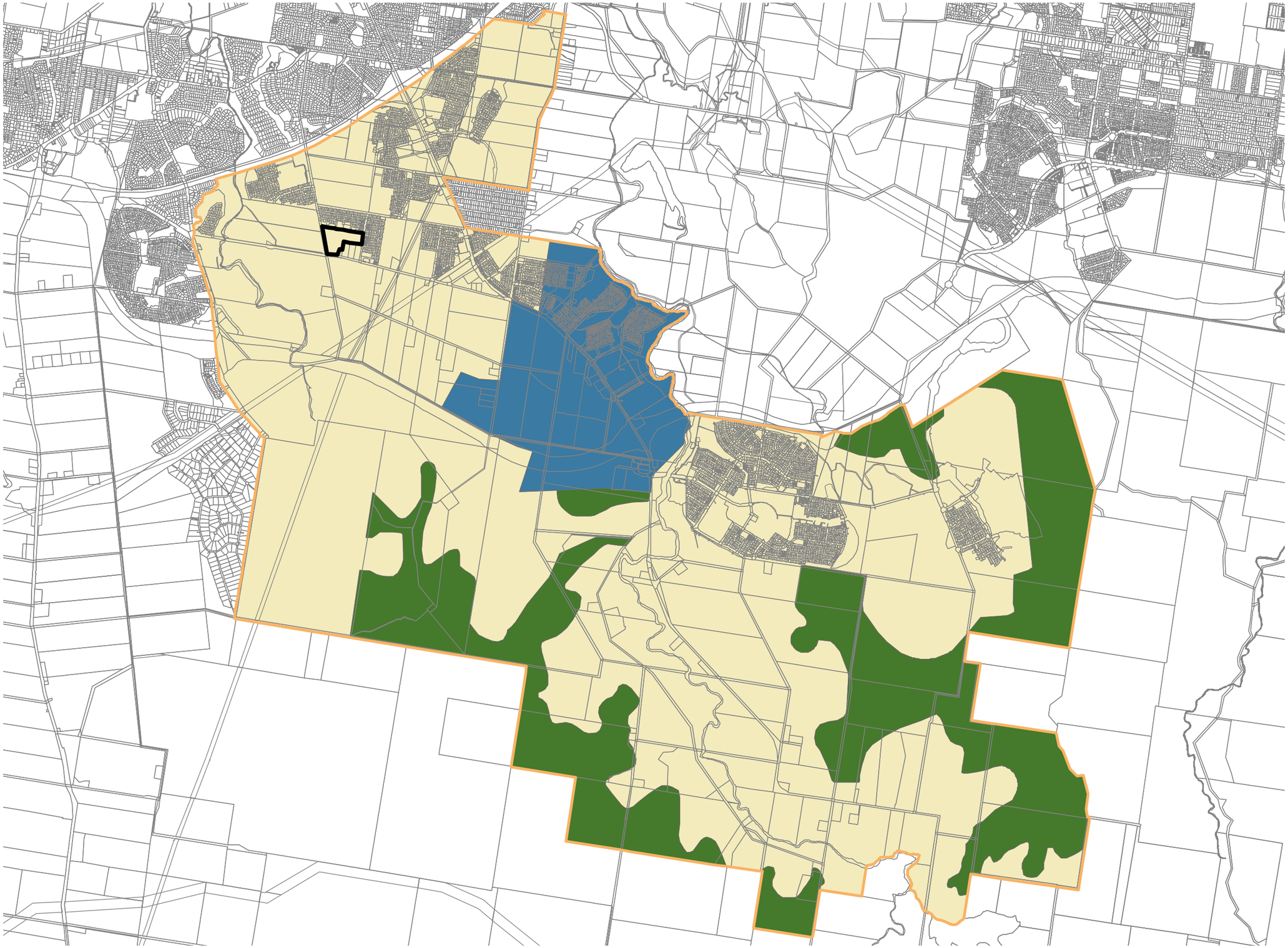
HB Land Pty Ltd

Binnies Road, Ripley

5/04/2024 | 11826 E 03 MNES Context Analysis A

4. MNES - Ripley Valley PDA Zoning



Notes:
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Legend

- Site boundary
- Qld DCDB
- Ripley Valley PDA Boundary

PDA Zoning

- Urban Living
- Urban Core
- Environmental Protection

Issue	Date	Description	Drawn	Checked
A	4/04/2024	Preliminary	TC	LB

0 200 400 600 800 1,000 m

Transverse Mercator | GDA 2020 | Zone 56 | 1:40,000 @ A3

Address / RPD: 335RP814578

4/04/2024 | 11826 E 04 MNES Ripley Valley PDA Zoning A

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Binnies Road, Ripley

4.3. Commonwealth and State Databases and Mapping

4.3.1 Protected Matters Search Tool – EPBC Act (Cth)

When a proponent proposes to take an action that they believe may need approval under the EPBC Act, they must refer the proposed action to the Australian Government Minister for the Environment (the Minister). The purpose of a referral is to determine whether or not a proposed action is a 'controlled action' and thereby requires approval under the EPBC Act. If the Minister determines that a proposed action is a 'controlled action', it would then proceed through the Commonwealth assessment and approval process.

A search using the Commonwealth's PMST was obtained to initially determine if any MNES have potential to be temporarily or permanently located within a 5 km radius of the site. **Table 4** lists a summary of these results relevant to the site. For the purposes of this assessment, marine animals including tuna, turtles, sharks and whales have been excluded as the site is outside of a marine environment. The complete results of this search are included in **Appendix A**.

Table 4: PMST summary search results

Wetlands of International Importance		
Moreton Bay – 30-40 km upstream of Ramsar Site		
Threatened Ecological Communities		
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community (Endangered) – Community may occur within area.		
Grey box-grey gum wet forest of subtropical eastern Australia (Endangered) – Community likely to occur within area		
Lowland Rainforest of Subtropical Australia (Critically Endangered) – Community may occur within area.		
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions (Endangered) – Community likely to occur within area.		
Poplar Box Grassy Woodland on Alluvial Plains (Endangered) – Community may occur within area.		
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community (Critically Endangered) – Community may occur within area.		
Swamp Tea-tree (*Melaleuca irbyana*) Forest of South-east Queensland (Critically Endangered) – Community likely to occur within area.		
Threatened Species		
Scientific Name	**Common Name**	**Status**
Birds		
Anthochaera phrygia	Regent Honeyeater	Critically Endangered
Botaurus poiciloptilus	Australasian Bittern	Endangered
Calidris acuminata	Sharp-tailed Sandpiper	Vulnerable
Calidris ferruginea	Curlew Sandpiper	Critically Endangered
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	Vulnerable
Climacteris picumnus victoriae	Brown Treecreeper (south-eastern)	Vulnerable
Cyclopsitta diophthalma coxeni	Coxen's Fig-Parrot	Critically Endangered
Erythrotriorchis radiatus	Red Goshawk	Endangered
Falco hypoleucos	Grey Falcon	Vulnerable

Gallinago hardwickii	Latham's Snipe	Vulnerable
Geophaps scripta scripta	Squatter Pigeon (southern)	Vulnerable
Grantiella picta	Painted Honeyeater	Vulnerable
Hirundapus caudacutus	White-throated Needletail	Vulnerable
Lathamus discolor	Swift Parrot	Critically Endangered
Rostratula australis	Australian Painted Snipe	Endangered
Stagonopleura guttata	Diamond Firetail	Vulnerable
Tringa nebularia	Common Greenshank	Endangered
Turnix melanogaster	Black-breasted Button-quail	Vulnerable
Fish		
Neoceratodus forsteri	Australian Lungfish	Vulnerable
Insects		
Argynnis hyperbius inconstans	Australian Fritillary	Critically Endangered
Mammals		
Chalinolobus dwyeri	Large-eared Pied Bat	Endangered
Dasyurus hallucatus	Northern Quoll	Endangered
Dasyurus maculatus maculatus (SE mainland population)	Spot-tailed Quoll	Endangered
Macroderma gigas	Ghost Bat	Vulnerable
Petauroides volans	Greater Glider (southern and central)	Endangered
Petaurus australis australis	Yellow-bellied Glider (south-eastern)	Vulnerable
Petrogale penicillata	Brush-tailed Rock-wallaby	Vulnerable
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)	Koala	Endangered
Potorous tridactylus tridactylus	Long-nosed Potoroo (northern)	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable
Plants		
Arthraxon hispidus	Hairy-joint Grass	Vulnerable
Bosistoa transversa	Three-leaved Bosistoa	Vulnerable
Coleus habrophyllus (listed as *Plectranthus habrophyllus*)	-	Endangered
Cupaniopsis shirleyana	Wedge-leaf Tuckeroo	Vulnerable
Cupaniopsis tomentella	Boonah Tuckeroo	Vulnerable
Dichanthium setosum	bluegrass	Vulnerable
Fontainea venosa	-	Vulnerable

Notelaea lloydii	Lloyd's Olive	Vulnerable
Notelaea x ipsviciensis (listed as *Notelaea ipsviciensis*)	Cooneana Olive	Critically Endangered
Picris evae	Hawkweed	Vulnerable
Planchonella eerwah	Shiny-leaved Condoo	Endangered
Rhaponticum australe	Austral Cornflower	Vulnerable
Rhodamnia rubescens	Scrub Turpentine	Critically Endangered
Rhodomyrtus psidioides	Native Guava	Critically Endangered
Samadera bidwillii	Quassia	Vulnerable
Thesium australe	Austral Toadflax	Vulnerable
Reptiles		
Delma torquata	Adorned Delma, Collared Delma	Vulnerable
Furina dunmalli	Dunmall's Snake	Vulnerable
Hemiaspis damelii	Grey Snake	Endangered

4.3.2 Wildlife Online – Nature Conservation Act 1992 (Qld)

The Queensland *Nature Conservation Act 1992* classifies and protects significant areas (Protected Areas) and protects threatened plant and animal species. The *Nature Conservation (Animals) Regulation 2020* and *Nature Conservation (Plants) Regulation 2020* lists plant and animal species presumed extinct, critically endangered, endangered, vulnerable, near threatened, special least concern, least concern, international or prohibited. The schedules of these regulations were considered in this report using a Wildlife Online Database Search with a 5 km radius of the referral area. Threatened species under the EPBC act with the potential to occur within the referral area are listed in **Table 5**. Refer to **Appendix B** for full search results.

Table 5: NCA Wildlife Online Database Search Results

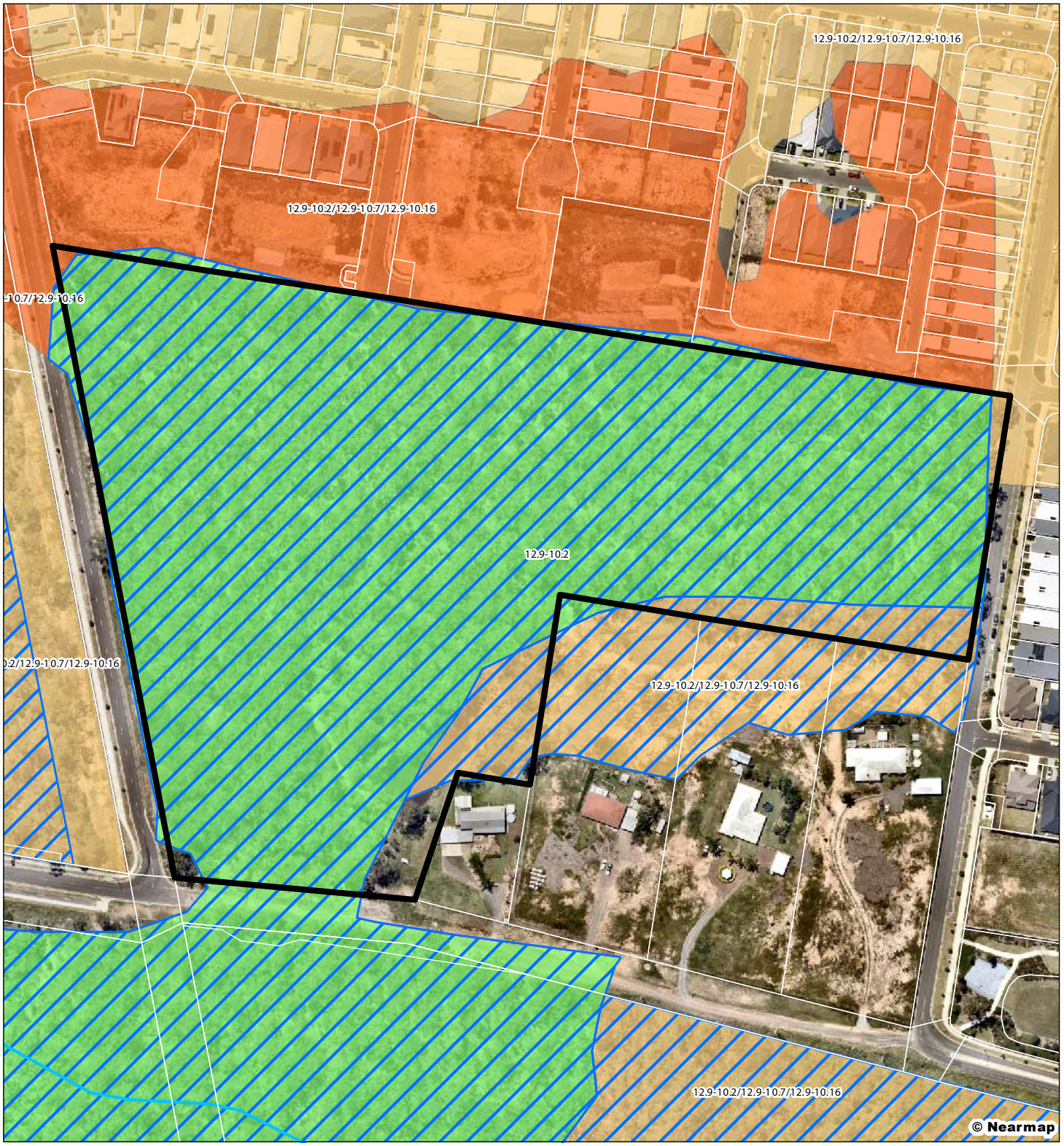
Scientific Name	Common Name	Status
Mammals		
Phascolarctos cinereus	Koala	Endangered
Birds		
Hirundapus caudacutus	White-throated Needletail	Vulnerable
Rostratula australis	Australian Painted-snipe	Endangered
Plants		
Callitris baileyi	Bailey's Cypress	Near Threatened
Coleus habrophyllus	-	Endangered
Calyptochloa gracillima subsp. ipsviciensis	-	Critically Endangered
Melaleuca irbyana	-	Endangered

4.3.3 State Regional Ecosystems – Vegetation Management Act 1999 (Qld)

A desktop review of the Queensland 'Regulated Vegetation Management Mapping' under the *Vegetation Management Act 1999* (VMA) was conducted, focusing on the referral area. The referral area is mapped as a combination of Category B (remnant), Category C (high-value regrowth) and Category X (non-remnant). Vegetation mapping shows the Category B (remnant) vegetation is mapped as Least Concern RE12.9-10.2 and the Category C (high-value regrowth) vegetation is mapped as Least Concern RE12.9-10.2 and Of Concern REs 12.9-10.7 and 12.9-10.16. Pre-clear mapping shows the Category X (non-remnant) vegetation is mapped as a composite of REs 12.9-10.2/12.9-10.7/12.9-10.16 (70/25/5%) (refer **Table 6** and **Figure 4**).

Table 6: Regional Ecosystem Descriptions

Regional ecosystem	VMA Status	Description
RE12.9-10.2	Least Concern	*Corymbia citriodora subsp. variegata* open forest or woodland usually with *Eucalyptus crebra.* Other species such as *Eucalyptus tereticornis, E. moluccana, E. acmenoides* and *E. siderophloia* may be present in scattered patches or in low densities. Understorey can be grassy or shrubby. Shrubby understorey of *Lophostemon confertus* (whipstick form) often present in northern parts of bioregion. Occurs on Cainozoic and Mesozoic sediments. Not a Wetland. (BVG1M: 10b).
RE12.9-10.7	Of Concern	*Eucalyptus crebra* +/- *E. tereticornis, Corymbia tessellaris, Angophora leiocarpa, E. melanophloia* woodland. Occurs on Cainozoic and Mesozoic sediments. Not a Wetland. (BVG1M: 13c). Vegetation communities in this regional ecosystem include: 12.9-10.7a: *Eucalyptus siderophloia, Corymbia intermedia* +/- E. *tereticornis* and *Lophostemon confertus* open forest. Occurs on Cainozoic and Mesozoic sediments in near coastal areas. Not a Wetland. (BVG1M: 12a).
RE12.9-10.16	Of Concern	Microphyll to notophyll vine forest +/- *Araucaria cunninghamii*. Characteristic species include *Argyrodendron sp.* (Kin Kin W.D.Francis AQ81198*), Araucaria cunninghamii, Agathis robusta, Backhousia myrtifolia, Cupaniopsis parvifolia, Dendrocnide photiniphylla, Rhodosphaera rhodanthema, Flindersia australis, F. xanthoxyla, Drypetes deplanchei, Olea paniculata, Diospyros geminata, Gossia bidwillii, Excoecaria dallachyana* and *Vitex lignum-vitae. Archontophoenix cunninghamiana* often present in gully floors. Occurs on Cainozoic and Mesozoic sediments. Not a Wetland. (BVG1M: 5a).



Legend

- Site DCDB
- Qld DCDB
- VM Watercourses
- VM Essential Habitat
- VM Wetland

Vegetation Management Regional Ecosystems Map

- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystem
- Category C area containing endangered regional ecosystems
- Category C area containing of concern regional ecosystems
- Category C area that is a least concern regional ecosystem

Figure 4

State - Vegetation Management Regional Ecosystem Map

HB Land Pty Ltd

File ref. 11826 E MNES Figure 4 VMRE A
Date 5/04/2024
Project Binnies Road, Ripley

0 20 40 60 80 m

N

Scale (A4): 1:2,500 [GDA 2020 MGA Z56]

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4.4. Threatened Species and Communities Desktop Likelihood of Occurrence

4.4.1 Threatened Ecological Communities

The Protected Matters Search Tool (PMST) (refer **Appendix A)** returned the following seven (7) threatened ecological communities (TEC), listed under the EPBC Act as having potential to occur within 5 km of the referral area:

- Coastal Swamp Oak (*Casuarina glauca)* Forest of New South Wales and South East Queensland ecological community
- Grey box-grey gum wet forest of subtropical eastern Australia
- Lowland Rainforest of Subtropical Australia
- Subtropical eucalypt floodplain forest and woodland of the New South Wales and North Coast and South East Queensland bioregions
- Poplar Box Grassy Woodland on Alluvial Plains
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland
- Swamp Tea-tree (*Melaleuca irbyana*) Forest of South-east Queensland

The likelihood of occurrence for each TEC within the referral area, as presented in **Table 7**, referred to State Government Regional Ecosystem mapping within the locality and known distributions of the TECs, to identify those TECs with potential to occur in the referral area or recorded during field surveys.

Table 7: Likelihood of occurrence of TECs within referral area

TEC	EPBC Act status	Desktop Potential of Occurrence
Coastal Swamp Oak (*Casuarina glauca)* Forest of New South Wales and South East Queensland ecological community	Endangered	**Low** The site is not mapped as containing any regional ecosystems associated with this threatened ecological community.
Grey box-grey gum wet forest of subtropical eastern Australia	Endangered	**Low** The site is not mapped as containing any regional ecosystems associated with this threatened ecological community.
Lowland Rainforest of Subtropical Australia	Critically Endangered	**Low** The site is not mapped as containing any regional ecosystems associated with this threatened ecological community.
Subtropical eucalypt floodplain forest and woodland of the New South Wales and North Coast and South East Queensland bioregions	Endangered	**Low** The site is not mapped as containing any regional ecosystems associated with this threatened ecological community.
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	**Low** The site is not mapped as containing any regional ecosystems associated with this threatened ecological community.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	**Low** The site is not mapped as containing any regional ecosystems associated with this threatened ecological community.
Swamp Tea-tree (*Melaleuca irbyana*) Forest of South-east Queensland	Critically Endangered	**Low** The site is not mapped as containing any regional ecosystems associated with this threatened ecological community

4.4.2 Threatened Flora Species

Database searches returned nineteen (19) flora species, listed as threatened under the EPBC Act and/or NCA, as being previously recorded or predicted to occur within 5 km of the referral area, as presented in **Appendix A** and **Appendix B.**

Based on the presence of species records within the locality and the habitats within the referral area, an assessment was conducted to determine those threatened flora species with potential to occur within the referral area. The desktop assessment identified that two (2) threatened flora species under the EPBC Act had a 'moderate' or higher potential to occur on the referral area (refer **Table 8**). All other threatened flora species were assessed as having a 'low' potential to occur.

Three (3) additional flora species not listed under the EPBC act but listed as threatened under the Queensland NC Act were identified as having a 'moderate' likelihood of occurrence based on a desktop assessment. This species *are Callitris baileyi* (Bailey's Cypress), *Calyptochloa gracillima subsp. ipsviciensis and Melaleuca irbyana* (Swamp Tea Tree).

Table 8: Likelihood of occurrence of flora species within referral area

Scientific Name	EPBC Act	NC Act	Desktop Potential of Occurrence
Notelaea x ipsviciensis (Cooneana Olive)	Critically Endangered	Endangered	**Moderate** RE mapping indicates that potential eucalypt dominated woodland is likely present on-site. Additionally, this species is known to occur adjacent to modified and developed land. While there are no records of the species in the locality, given the potential suitable habitat on-site and the species' tolerance to disturbance, the likelihood of occurrence for this species has been assigned 'moderate'.
Rhaponticum austral (Austral Cornflower)	Vulnerable	Vulnerable	**Moderate** RE mapping indicates that potential eucalypt woodland and associated species are likely present on-site. Additionally, this species is known to occur adjacent to modified land including roads and road reserves. While there are no records of the species in the locality, given the potential suitable habitat on-site and the species' tolerance to disturbance, the likelihood of occurrence for this species has been assigned 'moderate'.

The detailed likelihood of occurrence assessment is presented in **Appendix C**.

4.4.3 Threatened Fauna Species

Database searches returned thirty-three (33) fauna species listened as threatened under the EPBC Act and NCA as having been previously recorded or predicted to occur within 5 km of the referral area.

Based on the presence of species records within the locality and mapped habitats identified within the referral area, a likelihood of occurrence assessment was conducted to determine those threatened species with potential to occur within the referral area. This assessment determined eight (8) threatened fauna species listed under the EPBC Act as having 'moderate' or higher potential to occur on or near the referral area. These species are outlined in **Table 9**. All other threatened and/or migratory fauna species were assessed as having a 'low' potential to occur.

Table 9: Likelihood of occurrence of fauna species within referral area

Scientific Name	EPBC Act	NC Act	Desktop Potential of Occurrence
Anthochaera phrygia (Regent Honeyeater)	Critically Endangered	Endangered	**Moderate** The referral area is mapped as containing remnant eucalypt woodland. According to Queensland WildNet and ALA, there is one record of this species within 5km radius of the site. A review of these databases shows that the record is approximately 4.4km south-east of the site, with very few records in the broader area. However, as the species is known to occur within the broader landscape and there is potential habitat within the referral area, the likelihood of occurrence has been assigned 'moderate.'
Calyptorhynchus lathami lathami (Glossy Black Cockatoo)	Vulnerable	Vulnerable	**Moderate** The referral area is mapped as containing eucalypt woodland vegetation which may provide foraging and or breeding habitat for the species. There are no records of the species within 5km of the site with the nearest records being approximately 9km east. These records are both dated (1975) with the nearest contemporary records approximately 11.5km east, associated with White Rock Conservation Park. Given the potential for suitable habitat, the likelihood of occurrence for this species has been assigned 'moderate.'

Scientific Name	EPBC Act	NC Act	Desktop Potential of Occurrence
Hirundapus caudacutus (White-throated Needletail)	Vulnerable	Vulnerable	**Moderate** The referral area is mapped as containing wooded areas including open forests. A review of Queensland WildNet and ALA identified several records of the species within 5km of the site however the majority of these are 10+ years old. As the species has been recorded over a variety of habitat types the likelihood of the species to utilise the site or as fly-over has been assigned 'moderate.'
Lathamus discolor (Swift Parrot)	Critically Endangered	Endangered	**Moderate** The referral area is mapped as containing remnant eucalypt woodland and is likely to contain associated Swift Parrot habitat tree species. However, there are no records of the species within the locality with the closest record approximately 8km west of the referral area. Notably, given this species is Critically Endangered, the location of recorded sightings are generalised to 10km. As there is potential remnant eucalypt habitat within the referral area, the likelihood of occurrence has been assigned 'moderate.'
Petauroides volans (Greater Glider)	Endangered	Endangered	**Moderate** The referral area is mapped as containing remnant eucalypt woodland and is likely to contain associated Greater Glider habitat tree species. However, there are no records of the species within the locality, with the closest record approximately 12km north-east of the site. As there is potential remnant eucalypt habitat within the referral area, the likelihood of occurrence has been assigned 'moderate.'
Petaurus australis australis (Yellow-bellied Glider)	Vulnerable	Vulnerable	**Moderate** The referral area is mapped as containing remnant eucalypt woodland and open forest. However, there are no records of the species within the locality, with the majority of the records present approximately 15-20km east of the site. As there is potential remnant eucalypt habitat within the referral area, the likelihood of occurrence has been assigned 'moderate.'
Phascolarctos cinereus (Koala)	Endangered	Endangered	**Moderate** The referral area is mapped as containing remnant eucalypt woodland and is likely to contain associated Koala habitat tree species. According to Queensland WildNet Data, 126 Koalas have been known to occur within a 5 km radius of the site since 1980. The nearest contemporary record was from 2011 approximately 1km north-east of the referral area. Based on preliminary desktop searches, there are no records of the species within the referral area. As the species is known to occur within the broader landscape and there is potential habitat within the referral area, the likelihood of occurrence has been assigned 'moderate-high.'
Pteropus poliocephalus (Grey-headed Flying-fox)	Vulnerable	-	**Moderate** The referral area is mapped as containing remnant eucalypt woodland and open forest which likely includes potential Grey-headed Flying-fox (GHFF) foraging habitat. A review of the National Flying-fox monitoring viewer identified a GHFF roost approximately 2.5km north-west of the site (Yamanto, 479). As the species is known to forage in a variety of habitats, including eucalypt dominated vegetation likely present on-site, a desktop assessment of the likelihood of occurrence has been assigned 'moderate.'

The detailed likelihood of occurrence assessment is presented in **Appendix C**.

4.4.4 Migratory Species

Database searches returned fifteen (15) migratory fauna species listened as threatened under the EPBC Act and/or NCA as having been previously recorded or predicted to occur within 5 km of the Referral area.

Based on the presence of species records within the locality and the habitats identified within the referral area, an assessment was conducted to determine those threatened species with potential to occur within the referral area. The assessment determined that no migratory fauna species listed under the EPBC Act were identified as having moderate or greater potential to occur in the referral area.

The detailed likelihood of occurrence assessment is presented in **Appendix C**.

4.5. Other MNES

Of the remaining seven MNES, none were determined to have potential to be impacted by the proposed development. These are:

- World Heritage Properties - The closest World Heritage Site is the Gondwanan Rainforests of Australia (Main Range National Park) of which is approximately 44 km south-west of the referral area.
- National Heritage Places - The closest National Heritage Place is the Gondwanan Rainforests of Australia which is approximately 44 km south-west of the referral area.
- Wetlands of International Importance (Ramsar) – The Moreton Bay Ramsar Site is approximately 30-40km upstream of the referral area.
- Commonwealth marine areas - The action is not being undertaken in or adjacent to a Commonwealth marine area. The proposed action is located 53 km west of a Commonwealth marine area.
- The Great Barrier Reef Marine Park - The GBRMP is more than 360 km north of the proposed action.
- Nuclear actions - The proposed action is not a nuclear action.
- A water resource, in relation to coal seam gas development and large coal mining development - The proposed action is not a CSG development or large coal mine.

Further assessment against the Significant Impact Guidelines is not deemed necessary for these MNES.

5. Field Survey Results

The results of the flora and fauna surveys, and the potential of occurrence, enables an understanding of the ecological constraints and potential impacts to MNES associated with the Project.

The results of the targeted vegetation, flora and fauna surveys is presented within the following sections. Refer to **Plan 5** for the field survey results across the referral area and surrounding locality.

5.1. Flora Assessment Results

The referral area is mapped as predominantly Category B (remnant) RE12.9-10.2 with composite RE12.9-10.2/12.9-10.7/12.9-10.16 associated with regrowth vegetation. Field surveys identified vegetation across the referral area to be consistent with eucalypt woodland with indicator species of RE12.9-10.2 throughout. A constructed dam and associated areas of high disturbance were observed in the south.

No evidence of Of Concern 12.9-10.16 in the form of araucarian microphyll to notophyll vine forest was observed within the referral area.

The following vegetation communities have been delineated on-ground (refer **Plan 5**).

1. AU1 – Eucalypt woodland indicative of RE12.9-10.2 (7.18 ha)
2. AU2 – Highly disturbed area (0.20 ha)

AU1 – Eucalypt woodland indicative of RE12.9-10.2

Vegetation across the referral area is generally consistent with the RE mapping of 12.9-10.2 consisting of *Eucalypt* and *Corymbia* species dominated by *Corymbia citriodora* (Spotted Gum) with *Corymbia tessellaris* (Moreton Bay Ash), *Eucalyptus siderophloia* (Grey Ironbark), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus melanophloia* (Silver-leaved Ironbark), and *Eucalyptus tereticornis* (Forest Red Gum). The shrub layer contains largely native species including *Alphitonia excelsa* (Soap Tree) and *Acacia sp.* with sparse patches of introduced species including *Lantana camara* (Lantana). The ground layer was observed to be variable throughout the site, with some areas dominated by leaf litter, other areas dominated by native species including *Entolasia stricta* (Wiry Panic), and *Cymbopogon refractus* (Barbed Wire Grass) and patches of introduced species including *Lantana montevidensis* (Creeping Lantana) (refer **Photo set 1**).

Additionally, this remnant vegetation is intersected by two eroded drainage features originating from culverts to the north of the site and extending to the southern boundary where they merge into a low-lying area with standing water and *Typha orientalis* (Broad-leaved Cumbungi) present.

Photo set 1: Eucalypt dominated (RE12.9-10.2) remnant vegetation within the referral area.

AU2 - Highly disturbed area

The balance of the referral area displayed significant disturbance as a result of historical land clearing. The Category X (non-remnant) vegetation is located adjacent to the neighbouring lot where maintained lawn, overgrown exotic grass sp. and regrowth is present (refer **Photo set 2**). A dam feature is located in the south-eastern corner of the property and is surrounded by mature *Eucalypt* species. This feature boarders the adjacent residential property and displayed evidence of disturbance.

Photo set 2: Highly disturbed vegetation dominated by weeds and regrowth in the south-eastern extents of the referral area.

5.1.1 Flora Species

A total of ninety (90) flora species were recorded within the referral area during field surveys, as listed in **Appendix D.** Of those, sixty-one (61) are native and twenty-nine (29) species are considered to be non-native / introduced species.

No flora species listed under the EPBC Act and NCA were recorded in or adjoining the referral area.

5.2. Connectivity assessment

The referral area lacks viable movement opportunity for fauna as a result of current and future developments, roads and highly modified land-uses. To the north and east development is on-going and partially complete with all vegetation removed. To the west of the referral area is Daleys Road which runs along the entire western boundary. This road is approximately 35m in width and provides a significant barrier to fauna movement. To the south of the referral area is Binnies Road which has not been fully constructed and therefore retains marginal connectivity. However, this road is anticipated to be upgraded and has received catalyst funding from the Queensland Government. Additionally, only a 110 m section of the referral area boundary adjoins Binnies Road with the majority of the southern boundary adjacent to three rural residential properties which have been recently cleared of all vegetation. This significantly limits fauna movement potential in a southern direction (refer **Photo set 3**).

Photo set 3: Limited connectivity opportunity surrounding the referral area. Current residential developments to the north and east (top left and bottom left), Recently cleared properties to the south-east (top right) and Daleys Road to the south (boto right)

5.3. Fauna Assessment Results

A total of thirty-four (34) fauna species were recorded during field surveys, inclusive of motion sensor camera traps, nocturnal targeted surveys and incidental observations, including twenty (20) birds, eleven (11) mammals, two (2) reptiles and one (1) invasive amphibian. **No conservation significant fauna species were recorded during the field survey**. However, SAT surveys detected indirect evidence of Koala in the form of scats at SAT 2 (2 out of 30). Motion sensor camera traps also detected the presence of at least one Feral Cat and European Red Fox (refer to **Photo set 4**), which are known to pose a significant threat to native fauna, including the Koala.

A complete fauna species list is provided in **Table 11.**

5.3.1 Targeted Species and survey guidelines

A detailed fauna assessment has been conducted across the referral area to identify and describe on-ground habitat features (e.g. habitat trees, fallen logs, termite mounds, roosting sites etc.), signs of fauna activity (e.g. scats, tracks, scratch marks on trees, nests etc.) and observations of species present within the area. Consideration was also given to the ecological significance of the site in the context of the local area and the broader region. A summary of the methodologies employed by SHG (detailed in **Section 3.2**) and the targeted species are summarised in **Table 10**.

Table 10: Summary of fauna survey techniques and survey effort

Scientific Name	Common Name	Survey guidelines	Techniques Implemented and survey effort
Phascolarctos cinereus	Koala	*Survey guidelines for Australia's threatened mammals* Phillips and Callaghan, 2011	- 3 SAT surveys - 12 hours of spotlighting meanders - Assessment of foraging and breeding values (habitat suitability) - 4 motion triggered camera traps deployed for 14 nights in February 2024
Pteropus poliocephalus	Grey-headed Flying-fox	*Survey guidelines for Australia's threatened bats*	- Daytime roost/camp searches - 12 hours of spotlighting meanders - Assessment of foraging values and habitat suitability
Petauroides volans	Greater Glider	*Survey guidelines for Australia's threatened mammals* *Reporting detections of Southern Greater Gliders* (Conservation Regulator Victoria)	- 12 hours of spotlighting meanders - Assessment of breeding habitat (hollows) and foraging values
Petaurus australis australis	Yellow-bellied Glider	*Survey guidelines for Australia's threatened mammals*	- 12 hours of spotlighting meanders - Assessment of breeding habitat (hollows) and foraging values
Anthochaera phrygia	Regent Honeyeater	*Survey guidelines for Australia's threatened birds*	- Over 46 hours of meander surveys (observation searches) - Assessment of breeding habitat (hollows) and foraging values

Scientific Name	Common Name	Survey guidelines	Techniques Implemented and survey effort
Hirundapus caudacutus	White-throated Needletail	Nil. Species Profile and Threats Database (DCCEEW).	It is difficult to conduct systematic surveys of the white-throated needletail due to its mobility and ability to cover huge distances in a day.

5.3.2 Koala survey results

Three (3) SAT surveys to assess Koala activity within the referral area were completed in accordance with Philips and Callaghan (2011) (Refer to **Plan 1** for locations). SAT survey 1 and 3 both scored 0/30 while SAT survey 2 scored a 2/30 (refer to **Appendix E** for full SAT results). No direct observations of Koala occurred within the referral area during these targeted surveys.

5.3.3 Spotlight and nocturnal search results

A total of two (2) 3-hour spotlighting surveys were completed by two ecologists from SHG on the 14 and 15 February 2024. Only common fauna species were observed during nocturnal searches.

5.3.4 Camera monitoring results

A total of four (4) baited camera traps were installed on-site for a period of 14 nights each. The cameras were deployed on 1 February 2024 and removed 15 February 2024. Eight species were recorded by the cameras.

Refer to **Table 11** for fauna detected within the referral area and the method of detection.

5.3.5 Tree plot results

All trees mature trees (≥500 mm DBH) were recorded as well as any hollow-bearing trees. A total of 44 trees measuring ≥500 mm DBH were recoded with an additional 2 trees <500mm DBH but containing hollows. A total of 9 hollow-bearing tree were recorded with 7 of these being Dead/Stag trees (refer **Plan 5**).

Table 11: Fauna detected within the referral area

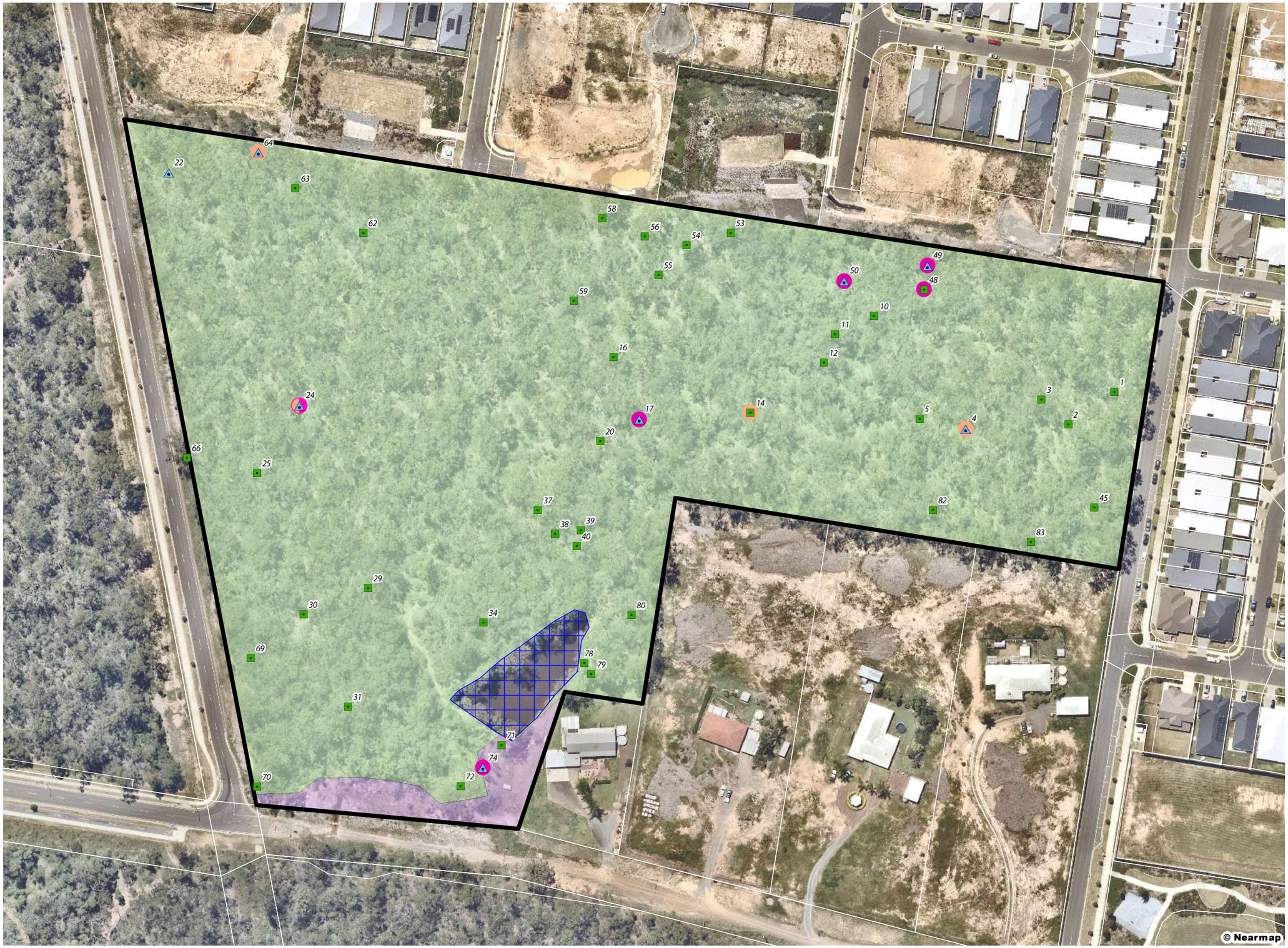
Scientific Name	Common Name	Diurnal survey	Spotlighting		Camera locations				Native/exotic
			Night 1 (14.02.2024)	Night 2 (15.02.2024)	Camera 1 (crab)	Camera 2 (duck)	Camera 3 (iris)	Camera 4 (possum)	
BIRDS									
Acridotheres tristis	Indian Myna	x							Exotic
Chenonetta jubata	Australian Wood Duck	x							Native
Corvus orru	Torresian Crow	x							Native
Dacelo novaeguineae	Laughing Kookaburra	x				x			Native
Dicrurus bracteatus	Spangled Drongo	x							Native
Entomyzon cyanotis	Blue-faced Honeyeater	x							Native
Eolophus roseicapilla	Galah	x							Native
Geopelia striata	Peaceful Dove	x			x				Native
Grallina cyanoleuca	Magpie-lark	x			x				Native
Gymnorhina tibicen	Australian Magpie	x				x			Native
Manorina melanocephala	Noisy Miner	x							Native

Scientific Name	Common Name	Diurnal survey	Spotlighting		Camera locations				Native/exotic
			Night 1 (14.02.2024)	Night 2 (15.02.2024)	Camera 1 (crab)	Camera 2 (duck)	Camera 3 (iris)	Camera 4 (possum)	
Meliphaga lewinii	Lewin's Honey Eater	x							
Phaps chalcoptera	Common Bronzewing	x							Native
Podargus strigoides	Tawny Frogmouth	x	x	x					Native
Rhipidura leucophrys	Willie Wagtail	x			x				Native
Strepera graculina	Pied Currawong	x							Native
Todiramphus sanctus	Sacred Kingfisher	x							Native
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet	x							Native
Trichoglossus haematodus moluccanus	Rainbow Lorikeet	x							Native
Vanellus miles	Masked Lapwing	x							Native
MAMMALS									
Canis lupus familiaris	Domestic Dog	x							Exotic
Felis catus	Cat					x			Exotic
Lepus europaeus	Hare	x			x				Exotic

Scientific Name	Common Name	Diurnal survey	Spotlighting		Camera locations				Native/exotic
			Night 1 (14.02.2024)	Night 2 (15.02.2024)	Camera 1 (crab)	Camera 2 (duck)	Camera 3 (iris)	Camera 4 (possum)	
Macropus giganteus	Eastern Grey Kangaroo	x			x	x		x	Native
Macropus rufogriseus	Red-necked Wallaby		x		x	x			Native
Mus musculus	Field Mouse				x			x	Exotic
Perameles nasuta	Long-nosed Bandicoot							x	Native
Phascogale tapoatafa	Brush-tailed Phascogale				x			x	Native
Pteropus alecto	Black Flying-fox			x					Native
Trichosurus vulpecula	Common Brushtail Possum		x	x		x			Native
Vulpes vulpes	Red Fox					x	x	x	Exotic
REPTILES									
Intellagama lesueurii	Australian Water Dragon	x			x				Native
Pogona barbata	Bearded Dragon	x							Native
AMPHIBIANS									
Rhinella marina	Cane Toad	x	x	x					Exotic

Photo set 4: Exotic Feral Cat (left) and European Red Fox (right) detected on-site via motion sensor camera traps.

5. MNES - Field Survey Results



Notes:
This plan was prepared as a desktop assessment tool. The information on this plan is not suitable for any other purpose. Property dimensions, areas, numbers of lots and contours and other physical features shown have been compiled from existing information and may not have been verified by field survey. These may need verification if the development application is approved and development proceeds, and may change when a full survey is undertaken or in order to comply with development approval conditions. No reliance should be placed on the information on this plan for detailed design or for any financial dealings involving the land. Saunders Havill Group therefore disclaims any liability for any loss or damage whatsoever or howsoever incurred, arising from any party using or relying upon this plan for any purpose other than as a document prepared for the sole purpose of accompanying a development application and which may be subject to alteration beyond the control of the Saunders Havill Group. Unless a development approval states otherwise, this is not an approved plan.

Layer Sources
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Updated data available at
http://qldspatialinformation.qld.gov.au/catalogue/

* This note is an integral part of this plan/data. Reproduction of this plan or any part of it without this note being included in full will render the information shown on such reproduction invalid and not suitable for use.

Legend

- Site boundary
- Qld DCDB
- Constructed dam
- Native tree with >=500mm DBH
- Stag/dead tree with >=500mm DBH
- Medium sized hollows
- Medium & large sized hollows
- Large sized hollows

MNES Assessment Units

- AU1 - Eucalytus Woodland (RE 12.9-10.2) - 7.18 ha
- AU2 - Highly disturbed area - 0.20 ha

Issue	Date	Description	Drawn	Checked
A	17/04/2024	Preliminary	TC	LB

0 20 40 60 m

Transverse Mercator | GDA 2020 | Zone 56 | 1:1,600 @ A3

saunders havill group

HB Land Pty Ltd

Binnies Road, Ripley

Address / RPD: 335RP814578

17/04/2024 | 11826 E 05 MNES Field Survey Results A

5.4. Threatened species and communities

5.4.1 Threatened Ecological Communities Assessment

Desktop analysis indicates that no REs representative of Threatened Ecological Communities (TEC) are mapped on-site. **Field surveys confirmed that no TECs are present on or adjacent to the site.**

5.4.2 Threatened Flora Species Assessment

Several flora species including *Notelaea x ipsviciensis* (Cooneana Olive) and *Rhaponticum austral* (Austral Cornflower) were identified as having a 'moderate' likelihood of occurring within the referral area. This assessment was based on the potential for remnant and regrowth eucalypt woodland and local records within the locality.

Following field surveys, it was concluded that these species have a 'low' likelihood of occurring as there was no evidence of the species on-site despite thorough field surveys across the referral area. Furthermore, specific habitat requirements such as creeks and rocky outcrops were absent. **No threatened flora species were recorded during detailed field surveys.**

5.4.3 Threatened Fauna Assessment

The following subsections present detailed findings on field results and potential habitat observed for threatened fauna listed under the EPBC Act, identified as having a 'moderate' likelihood to occur. Where presence of a species is confirmed on-site or a likelihood of occurrence of 'moderate', 'high' or 'known' has been applied, further assessment against the Significant Impact Guidelines may be required.

Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*)

The Glossy Black Cockatoo relies on two specific habitat types for foraging and breeding. Foraging habitat is defined as vegetation containing Casuarina or Allocasuarina species. In South-east Queensland these are usually *Allocasuarina littoralis* (Black She-oak) and *Allocasuarina torulosa* (Forest She-oak). The Glossy Black Cockatoo is known to be highly selective of individual feed trees, and a dense subcanopy of Casuarina or Allocasuarina species is required to provide suitable foraging habitat. Breeding habitat is understood to be equally selective with a preference for specific hollow characteristics, notably a minimum entrance diameter >15cm.

The referral area does contain relatively intact eucalypt woodland which is dominated by *Corymbia citriodora* (Spotted Gum) with *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Eucalyptus tereticornis* (Forest Red Gum). The sub-canopy is dominated by native species however is sparse throughout the referral area with only scattered Allocasuarina species (predominantly *Allocasuarina luehmannii*, Bull Oak) present. The species is highly selective of individual food trees and therefore require a dense stand of Allocasuarina. Given the lack of individual specimens and overall small area, the referral area is unlikely to provide adequate foraging habitat for the species. Furthermore, the ample availability of large areas of foraging habitat within White Rock Conservation Park, where the species is known to occur, is far more likely to be utilised than low-value habitat within the referral area. Field surveys recorded all hollow-bearing trees across the referral area and all trees ≥500mm DBH. Only 9 trees were recorded as containing potentially suitable hollows for the species (7 of which were dead/stag trees). It is therefore considered highly unlikely that the species would utilise extremely limited foraging or breeding habitat. There are no records of the species within 5km of the site with the nearest records being approximately 9km east. These records are both dated (1975) with the nearest contemporary records approximately11.5km east, associated with White Rock Conservation Park.

No sightings of Glossy Black Cockatoo were recorded within the referral area, and it is not expected to provide sufficient foraging or breeding habitat for the species. Further consideration of impacts to the species from the action, including assessment against the EPBC Act significant impact criteria, is not required.

Yellow-bellied Glider

The Yellow-bellied Glider occur in tall mature eucalypt forest and den, often in family groups, in hollows of large trees usually more than one metre in diameter. The species is very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources. The referral area is mapped as containing remnant vegetation, however on-ground field surveys identified that the vegetation retained minimal mature specimens. 44 trees, including stags, were recorded above ≥500mm DBH and only 9 trees were observed as containing hollows (7 of which are dead/stag trees).

The referral area consists of a 7.52ha patch with significantly limited habitat connectivity as a result of current residential developments and roads. There are no records of the species within the locality, with the majority of the records present approximately 15-20km east of the site. The species was not observed within the referral area despite multiple targeted searches. Evidence of the species in the form of characteristic V-shaped cuts were also not observed during detailed individual tree surveys.

No sightings of Yellow-bellied Glider were recorded within the referral area, and it is not expected to provide habitat for this species. Further consideration of impacts to the species from the action, including assessment against the EPBC Act significant impact criteria, is not required.

Swift Parrot *(Lathamus discolor)*

The swift parrot migrates to the mainland where it follows a nomadic existence linked to the availability and timing of flowering trees. The species has a specific preference of large mature trees for feeding. The referral area contains predominantly remnant vegetation however a detailed review of individual trees found very few large trees were present (44 trees ≥500 mm DBH, inclusive of 8 dead/stag trees). There are no records of the species within the locality with the closest record approximately 8km west of the referral area. Notably, given this species is Critically Endangered, the location of recorded sightings are generalised to 10km.

The overall small referral area (7.52 ha) coupled with relatively low value habitat and limited recorded sightings in the broader locality indicates that it is highly unlikely that the vegetation within the referral area would be utilised by the species. Furthermore, the availability of habitat surrounding the site is limited by current residential developments. It is considered far more likely that vegetation associated with White Rock Conservation park further west would provide preferential habitat for the species.

No sightings of Swift Parrot were recorded within the referral area, and it is not expected to provide habitat for this species. Further consideration of impacts to the species from the action, including assessment against the EPBC Act significant impact criteria, is not required.

Koala (*Phascolarctos cinereus*)

The Koala occurs in a range of environments containing eucalypt forest or woodland. The referral area does support habitat for the species associated with remnant and regrowth eucalypt dominated vegetation. Spot Assessment Technique (SAT) surveys were utilised to detect evidence of Koala activity across the referral area and to determine the likelihood of occurrence on-site. Three (3) SATs were carried out across the referral area which involves searching the

base of the nearest 30 trees to a central point for scats. Evidence of Koala activity in the form of scats was recorded within the referral area (SAT 2, 2 out of 30 trees), indicating a 'low use' of the referral area by the species. However, no direct observations of Koala were recorded on-site.

The species is known to be present within the locality and Koala habitat was confirmed within the referral area. The referral area retains minimal connectivity value to the north, west and east by current roads and residential developments. Marginal connectivity value is present to the south although consideration needs to be given to the expected upgrade of Binnies road and development of land holdings to the south. Notably, evidence of predatory species (Dog, Fox and Cat) was observed within the referral area.

Indirect evidence of Koala in the form of scats was recorded within the referral area. Further consideration of impacts to the species from the action, including assessment against the EPBC Act significant impact criteria, is required. Refer to Section 8.2.

Grey-headed Flying-fox (*Pteropus poliocephalus*)

Pteropus poliocephalus (Grey-headed Flying-fox) requires foraging resources and roosting sites to persist. The species is known to use a wide variety of habitats including subtropical and temperate rainforests, tall sclerophyll forest and woodlands, heaths, swamps and also urban and agricultural areas where food trees have been cultivated.

The species is highly adaptive with its diverse native diet, which it can supplement with introduced species. It is known to forage within a variety of habitat areas as each resource does not produce food throughout the entire year. No Grey-headed Flying-fox roosts were observed within the referral area. A review of the National Flying-fox monitoring viewer identified a GHFF roost approximately 2.5km north-east of the site (Yamanto (479)). The nearest roost of national significance (Inala, Lilac Street (1219)) is located approximately 21.5 km north-east of the site. Given the availability of suitable foraging habitat within the broader area, it is considered unlikely that the species would utilise the relatively small area of 7.52 ha associated with the referral area.

No sightings of Grey-headed Flying Fox were recorded within the referral area, and it is not expected to provide significant or high value habitat for this species. However, the presence of a potential habitat within the referral area means further consideration of impacts to the species from the action, including assessment against the EPBC Act significant impact criteria, is required. Refer to Section 8.3.

Greater Glider (*Petauroides volans*)

The Greater Glider is largely restricted to eucalypt forests and woodlands of eastern Australia. It is typically found in highest abundance in taller, montane, moist eucalypt forests on fertile soils, with relatively old trees and abundant hollows associated with Category B (remnant) vegetation. While the referral area does contain mapped Category B (remnant) vegetation of eucalypt dominated communities, on-ground assessments observed minimal levels of hollow-bearing trees and therefore limited suitable shelter habitat exists. A total of 44 trees were recorded ≥500 mm DBH across the referral area. A total of 9 hollow-bearing trees were recorded, 7 of which are dead/stag trees. This represents approximately 1.19 hollow bearing trees per hectare which is well below the 2-4 hollows per hectare required by the species. Furthermore, the species has a preference for living hollows of which only 2 trees were recorded.

The site is also situated within neighbouring established and emerging residential development resulting in high levels of disturbance. Nocturnal surveys (spotlighting) were conducted across the referral area on two separate nights. No evidence of Greater Glider sightings has been recorded by the ALA within 5 km of the referral area and no activity was

recorded within the referral area. The evidence suggests that the referral area is not currently utilised by Greater Glider and is considered poor habitat for the species.

As stated in the Conservation Advice for *Petauroides volans* (Greater Glider (southern and central)) 2022, the species is particularly sensitive to disturbance associated with forest clearance and fragmentation and disperse poorly. The referral area is located in a landscape that has been partially subject to modification for past and on-going land-uses resulting in a mixture of undisturbed and highly disturbed environments. The referral area lacks suitable habitat for the species, retains extremely limited connectivity potential and is located adjacent to highly modified areas.

No sightings of Greater Glider were recorded within the referral area, and it is not expected to provide significant or high value habitat for this species. However, the presence of potential habitat within the referral area means further consideration of impacts to the species from the action, including assessment against the EPBC Act significant impact criteria, is required. Refer to Section 8.4.

Regent Honeyeater (*Anthochaera phrygia*)

Regent Honeyeaters mostly occur in dry Box-Ironbark Eucalypt woodland and dry sclerophyll forest associations in areas of low to moderate relief, wherein they prefer moister, more fertile sites. These areas are generally associated with creek flats and river valleys and foothills. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. They are a generalist forager, which mainly feed on nectar from a wide range of eucalypts and mistletoes.

The referral area consists of *Corymbia citriodora* (Spotted Gum) dominated woodland with *Eucalyptus crebra* (Narrow-leaved Ironbark). Despite remnant mapping over the majority of the referral area, detailed site survey identified only 44 mature trees, ≥500mm DBH, (of which 8 were dead/stag trees) which are a significant habitat requirement for the species (refer **Plan 5**). These results indicate the referral area contains 5.85 mature trees per hectare.

While no individuals were recorded on-site during field surveys, sightings displayed on the ALA database confirm the species presence within 5 km of the site. The absence of on-site sightings may be due to the sites high level of surrounding disturbance and common species associated with residential developments (Noisy Minor). The *Manorina melanocephala* (Noisy Minor) is a known competitor and was observed utilising the referral site. The presence of this species may reduce the potential for Regent Honeyeaters to opportunistically forage on-site.

No sightings of Regent Honeyeater were recorded within the referral area, and it is not expected to provide significant or high value habitat for this species. However, the presence of potential habitat within the referral area means further consideration of impacts to the species from the action, including assessment against the EPBC Act significant impact criteria, is required. Refer to Section 8.5.

White-throated Needletail (*Hirundapus caudacutus)*

The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, callitris, and trees on farmland or gardens. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes. It is more common in wider blocks of remnant woodland than in narrower strips. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps.

The referral area contains wooded areas including open forests. A review of Queensland WildNet and ALA identified several records of the species within 5km of the site within the last 5 years. Mapped remnant vegetation is present over the majority of the site however field surveys identified that the majority of the vegetation displays evidence of disturbance from historical land-uses and thus does not resemble old growth forest. Although the species has been observed within close proximity to the referral area and potential habitat was observed throughout the remnant vegetation on-site, the minimal number of hollow-bearing trees suitable for breeding and the species highly mobile state indicates the unlikeliness to occur within the referral area during roosting periods. There is a 'low' likelihood for this species to be found in airspace foraging given the small referral area and the species' high mobility and surrounding vegetation.

No sightings of White-throated Needletail were recorded within the referral area, and it is not expected to provide significant or high value habitat for this species. However, the presence of a potential habitat within the referral area means further consideration of impacts to the species from the action, including assessment against the EPBC Act significant impact criteria, is required. Refer to Section 8.6.

5.4.4 Migratory Species Assessment

Database searches returned fifteen (15) migratory fauna species listed as threatened under the EPBC Act and/or NC Act, as having been previously recorded or predicted to occur within 5 km of the referral area. Following the likelihood of occurrence assessment, all of these species were considered to have a 'low/unlikely' likelihood to occur within the referral area with the exception of the White-throated Needletail as per the above. This is predominantly a result of few sightings in the broader locality and a lack of suitable habitat such as vegetated gully lines or rainforests. As a result, the proposed action is not considered to significantly impact the availability of habitat for the species.

No migratory fauna species of conservation significance were recorded during the field survey. The species will not be impacted by the action therefore assessment further assessment against the EPBC Act significant impact criteria is not required.

5.5. Post Field Survey MNES Assessment

A tabulated assessment of the potential for the nine MNES to occur within the referral area or be impacted by the action is provided in **Table 12**. This assessment is based on the desktop and field survey results and makes the distinction between MNES that have either nil or a very low potential to be impacted by the project and those that have some potential and were investigated further. The likelihood of assessment has been finalised following completing of field survey (refer **Appendix C**).

Table 12: Potential for the proposed action to impact MNES

MNES	Description	Relevance to Site	Assessment
World Heritage Properties	A 'declared World Heritage property' is an area that has been included in the World Heritage list or declared by the minister to be a World Heritage property. World Heritage properties are places with natural or cultural	The closest World Heritage Site is the Gondwanan Rainforests of Australia which is approximately 44 km south-west of the referral area.	There is no potential for the proposed action to impact on a World Heritage Property. **Further assessment is not required.**

MNES	Description	Relevance to Site	Assessment
	heritage values which are recognised to have outstanding universal value.		
National Heritage Places	The National Heritage List contains places or groups of places with outstanding heritage value to Australia – whether natural, Indigenous or historic or a combination of these.	The closest National Heritage Place is the Gondwanan Rainforests of Australia which is approximately 44 km south-west of the referral area.	There is no potential for the proposed action to impact on a National Heritage Place. **Further assessment is not required.**
Wetlands of international importance (Ramsar)	A 'declared Ramsar wetland' is an area that has been designated under Article 2 of the Ramsar Convention or declared by the minister to be a declared Ramsar wetland under section 16 of the EPBC Act.	Moreton Bay is approximately 30-40km upstream of the development area.	There is no potential for the proposed action to impact on a Wetland of International Importance (Ramsar). **Further assessment is not required.**
Nationally threatened species and ecological communities	An action will require approval if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories: ▪ extinct in the wild ▪ critically endangered ▪ endangered, or ▪ vulnerable. An action will also require approval if the action has, will have, or is likely to have a significant impact on an ecological community listed in any of the following categories: ▪ critically endangered, or ▪ endangered.	The PMR identified forty-nine (49) listed threatened species and seven (7) TECs with the potential to occur in the development area or within 5 km of the proposed action.	Based on the desktop and field survey results, the following species have potential to be impacted by the action therefore require assessment against the relevant EPBC Act significant impact criteria: 1. *Phascolarctos cinereus* (Koala); 2. *Pteropus poliocephalus* (Grey-headed Flying-fox); 3. *Petauroides volans* (Greater Glider); 4. *Anthochaera Phrygia (*Regent Honeyeater), and; 5. *Hirundapus caudacutus (*White-throated Needletail). **Further assessment against the significant impact criteria is required for these MNES. All other nationally threatened species and ecological communities were considered and concluded as unlikely to undergo a significant impact as a result of the proposed development.**
Migratory species	An action will require approval if the action has, will have, or is likely to have a	The PMR identified fifteen (15) listed migratory species	It is considered unlikely that the development area has habitat critical for any migratory species with the exception of

MNES	Description	Relevance to Site	Assessment
	significant impact on a listed migratory species.	with the potential to occur in the development area or within 5 km of the proposed action.	*Hirundapus caudacutus* (White-throated Needletail) as stated above. **Further assessment against the significant impact criteria for all other migratory species is not required.**
Commonwealth marine areas	Marine protected areas are marine areas which are recognised to have high conservation value. Actions in or near marine protected areas, or other areas with high conservation value, have a greater likelihood of significant impacts on the Commonwealth marine environment.	The action is not being undertaken in or adjacent to a Commonwealth marine area. The proposed action development area is located approximately 53km west from the nearest Commonwealth marine area.	It is considered unlikely for the proposed action to impact on Commonwealth Marine Areas. **Further assessment is not required.**
The Great Barrier Reef Marine Park	The Great Barrier Reef Marine Park is established under the *Great Barrier Reef Marine Park Act 1975*. The GBRMP is an area recognised to have high conservation value and an action will require approval if it is likely to impact the environment.	The GBRMP is more than 360 km north of the development area.	There is no potential for the proposed action to impact on the GBRMP. **Further assessment is not required.**
Nuclear actions	A nuclear action (including uranium mining) will require approval if it has, will have, or is likely to have a significant impact on the environment.	The proposed action does not comprise a nuclear action.	**This MNES does not apply.**
A water resource, in relation to coal seam gas development and large coal mining development	Under the EPBC Act, an action which involves a CSG development or a large coal mining development requires approval from the Australian Government if the action has, will have, or is likely to have a significant impact on a water resource.	The proposed action does not comprise a CSG development or large coal mine.	**This MNES does not apply.**

6. Potential Impacts

6.1. Potential Project Related Impacts

The proposed action involves the establishment of a residential development including residential allotments, internal road, pedestrian links, and detention/drainage areas on land located at Binnies Road, Ripley, Queensland. This will involve the clearing of vegetation which has been assessed on-ground as:

1. AU1 – Eucalypt woodland indicative of RE12.9-10.2 (7.18 ha)
2. AU2 – Highly disturbed area (0.20 ha)
3. Constructed dam

6.1.1 Potential Direct Impacts

Vegetation Clearing

The project is predicted to directly impact the entirety of the described Lot 335 on RP814578. The proposed action sits adjacent to several other residential developments in the RVPDA to cater for the increasing housing demands in SEQ. The proposed development footprint that is subject to this referral is a vacant patch of vegetation immediately adjacent to current residential development under construction and local roads. A breakdown of vegetation to be impacted is provided in **Plan 6.**

Habitat Loss

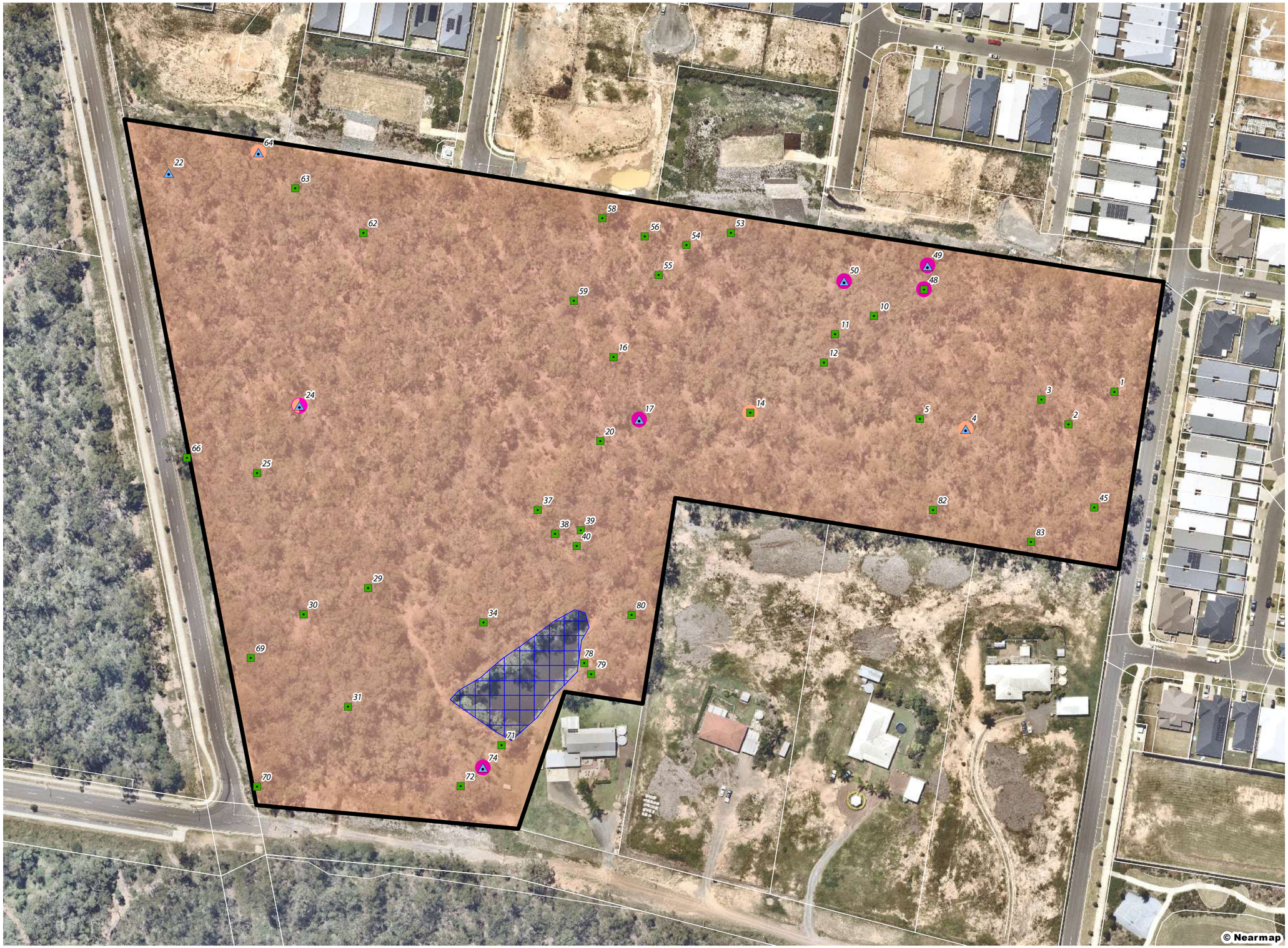
The Project is predicted to impact 7.52 ha Eucalypt woodland and highly disturbed areas, which provides marginal habitat values for a range of native flora and fauna species.

The MNES identified as having a moderate and higher likelihood of occurrence based on a desktop and field assessments include Koala, Grey-headed Flying-Fox, Greater Glider, Regent Honey Eater and White Throated Needletail. Subsequently, these species have been further assessed against the significant impact guidelines, refer **Section 8**.

The risk of impact is based on the potential extent of habitat loss resulting from the construction phase of the project and to a lesser degree the operational phase of the project. It considered, but was not limited to the following:

- The value of the impacted habitat to each respective matter;
- The amount of habitat to be directly impacted (lost) against that to be retained;
- Potential indirect impacts (e.g. dust, noise and soil erosion);
- Potential fragmentation of a population into two or more populations;
- Increased fragmentation of wildlife corridors in the Referral area;
- Risk of operational impacts (e.g. noise); and
- Each species ability (e.g. fauna) or inability (e.g. flora) to move away from areas of direct impact into retained habitat.

6. MNES - Impact Analysis



Notes:
This plan was prepared as a desktop assessment tool. The information on this plan is not suitable for any other purpose. Property dimensions, areas, numbers of lots and contours and other physical features shown have been compiled from existing information and may not have been verified by field survey. These may need verification if the development application is approved and development proceeds, and may change when a full survey is undertaken or in order to comply with development approval conditions. No reliance should be placed on the information on this plan for detailed design or for any financial dealings involving the land. Saunders Havill Group therefore disclaims any liability for any loss or damage whatsoever or howsoever incurred, arising from any party using or relying upon this plan for any purpose other than as a document prepared for the sole purpose of accompanying a development application and which may be subject to alteration beyond the control of the Saunders Havill Group. Unless a development approval states otherwise, this is not an approved plan.

Layer Sources
© State of Queensland (Department of Resources) 2024.
Updated data available at
http://qldspatialinformation.qld.gov.au/catalogue/

* This note is an integral part of this plan/data. Reproduction of this plan or any part of it without this note being included in full will render the information shown on such reproduction invalid and not suitable for use.

Legend

- Site boundary
- Qld DCDB
- Constructed dam
- Habitat impacted for Koala, Grey-headed Flying-fox, **Greater Glider**, Regent Honey-eater and White-throated Needletail (7.38 ha)
- Native tree with >=500mm DBH or hollowing bearing
- Stag/dead tree with >=500mm DBH or hollowing bearing
- Medium sized hollows
- Medium & large sized hollows
- Large sized hollows

Issue	Date	Description	Drawn	Checked
A	16/04/2024	Preliminary	TC	LB

0 20 40 60 m

Transverse Mercator | GDA 2020 | Zone 56 | 1:1,600 @ A3

saunders havill group

HB Land Pty Ltd

Binnies Road, Ripley

Address / RPD: 335RP814578

16/04/2024 | 11826 E 06 MNES Impacts Analysis A

6.1.2 Potential Indirect Impacts

Indirect impacts occur when project related activities affect vegetation or habitats in a manner other than a direct loss or clearing. Examples of indirect impacts include promotion of soil erosion, sedimentation of waterways, dust inhibiting plant pollination, provision of suitable seed bed for invasive plants, or increased noise activity within of directly adjacent to sensitive habitat areas.

The potential indirect impacts that may result from construction activities and/or the operational phase of the project have been identified below.

Weeds

Increased vehicle movement during the vegetation clearing phase has the potential to increase the spread of weeds in the area, however, adjacent land holdings are highly modified or completely cleared thus. With the implementation of standard mitigation measures, the project is likely to result in a negligible impact to ecological values due to the potential introduction/spread of weeds.

Vehicle Movement

During vegetation clearing, a number of vehicles will be required to access the referral area. Direct impacts from vehicle movements on threatened species and vegetation communities include:

- damage or destruction of vegetation or fauna habitat by vehicles traversing these areas; and
- fauna strike.

Indirect impacts include:

- interference of fauna through visual and noise impacts. This in turn can affect feeding, roosting, breeding or nesting behaviour;
- introduction and/or spreading of weeds or feral animals carried on/in vehicles, resulting in deterioration or loss of vegetation and fauna habitat;
- damage or destruction of vegetation and fauna habitat through smothering by dust generated by vehicles traversing the project area.

The site is situated between two relatively well used roads and the development within the surrounding area has resulted in vehicle movement being relatively high. With implementation of standard mitigation measures, such as exclusions fencing, the project is likely to result in a temporary and minor impact to ecological values due to vehicular movements. Further, ecological field surveys confirmed that most fauna species present on-site are common or highly mobile avifauna.

Earthworks

Construction activities have the potential to generate dust emissions. Dust emissions during construction will be temporary. The main sources of dust will be generated via:

- wheel-generated dust from the haul roads created for the construction phase;
- dust lift-off from exposed surfaces (e.g. construction roads and pads);
- earthworks, including construction of the embankments, and moving, dumping and shaping material; and
- vegetation and soil clearing of the land.

Excessive deposition of dust on leaves of plants can suppress their growth and photosynthesis, resulting in reduced habitat quality for fauna. High levels of airborne dust can irritate the respiratory systems of fauna and potentially result in ingestion of dust-coated seeds and other foods. Excessive deposition of dust on open water bodies may also degrade water quality and overall habitat quality for fauna. Notably the referral area exists within a relatively urbanised environment with surrounding areas developed for residential purposes. Surrounding properties are highly modified or completely cleared, with the implementation of standard mitigation measures, the project is likely to result in a temporary and minor impact to ecological values due to the generation of dust.

Light Emissions During Construction

Artificial light can affect both nocturnal and diurnal animals by disrupting behavioural patterns, with quality of light (e.g. wavelength, colour), intensity and duration potentially evoking different faunal responses. Impacts from increased light levels include disorientation from, or attraction toward, artificial sources of light; mortality from collisions with structures, and effects on light-sensitive cycles of species (e.g. breeding and migration for fauna and flowering in plants). An artificial increase in lighting can also affect abundance of predators.

Presence and intensity of artificial light in the project area will temporarily increase during the construction phase; however, night works will not be common. Lighting will be directed to construction areas within the project site. Some light spillage will be inevitable and is likely to be contained. Potential impacts associated with light emissions will be temporary and are unlikely to be significant given the general lack of surrounding vegetation.

Noise and Vibration

Noise levels greater than existing ambient noise levels are expected during the construction within the project area. Sources of noise are likely to consist of short, intense pulses from mobile plant equipment, and more prolonged noise, with consistent vibration, pitch and volume from generators, excavators and pumps, in addition from noise from vehicles.

Both steady continuous and single noise events have the potential to lead to ecological impacts. Construction noise is expected to elicit some avoidance response from fauna using the surrounding vegetation, albeit limited. Furthermore, the referral area is situated centrally in a region where significant development is occurring. Therefore, noise and vibration introduced as a result of the project are likely to be a temporary and negligible minor impact.

Waste Disposal

Inappropriate disposal of non-hazardous wastes can attract vermin and other wildlife to site. This may exacerbate potential impacts (e.g. road mortality). Litter may also enter surrounding environments. With implementation of standard mitigation measures, the project is likely to result in a negligible impact to ecological values due to the generation and handling of waste. Due to the temporary nature of the construction phase, waste generation opportunities will be limited.

Hazardous and Dangerous Goods

Spills and leaks from transfers (e.g. fuel and/or chemicals) and inadequate storage of dangerous goods and hazardous wastes could result in point-source contamination of surrounding land. Direct adverse impacts could include toxic impacts on vegetation (resulting in degradation or loss of vegetation and habitats), direct toxic impacts on fauna (from contact, inhalation or ingestion) or indirect impacts on threatened and migratory species from habitat loss. Direct adverse impacts on surface and groundwater quality are also possible.

With the application of standard mitigation and management measures, impacts from liquid and solid waste disposal will be avoided or localised and small in scale. Further to this, the likelihood of significant spillages is considered

extremely low. Therefore, the project is likely to result in a negligible impact to ecological values due to potential spills and leaks.

Increased Human Presence

Increased human activity during the construction of the project has the potential to disturb fauna within adjacent habitat areas. Resulting impacts to fauna include heightened vigilance and predator avoidance, which can disrupt foraging and roosting efficiency or deter wildlife from using particular areas. Impacts essentially represent a reduction in habitat availability due to edge effects. Given the referral area is situated centrally in the RVPDA and adjacent to current residential developments, it is likely that the increase in human presence will be negligible on fauna.

7. Avoidance, Mitigation and Management Measures

7.1. Clearing and Site Establishment Phase

General mitigation measures to be implemented during the construction phase of the Project are outlined below.

7.1.1 Vegetation Clearing and Management Plan

A Vegetation Clearing and Management Plan (VCMP) will form part of the broader management document for the proposed action. The VCMP will cover clearing of all vegetation within the referral area and include details on:

- Vegetation to be removed.
- All civil works likely to impact on existing vegetation.
- Temporary and permanent exclusion and protection fencing.
- Roles and responsibilities for site contractors, the developer and the consultant group.
- Stockpiling and site access locations.
- A clearing sequence plan showing the commencement of clearing and direction of removal (this will be in conjunction with the Fauna Management Plan to allow for the appropriate flushing of fauna towards safe havens and/or the application of an appropriate relocation program).
- Links to weed management and revegetation proposals.
- The stock piling and reuse of cleared vegetation.

7.1.2 Fauna Management Plan

A Fauna Management Plan (FMP) will be prepared for potential impacts of the construction phase covering the loss of vegetated areas, isolated trees and likely barriers and impediments to local dispersal. The FMP will link closely with the VCMP and include details on:

- Species surveyed as using the site with a focus on those most likely impacted by development works.
- A list of relevant State and Commonwealth legislation constraints and controls for the above listed fauna.
- A plan showing existing habitat opportunities and locations.
- Details of the threats to existing fauna species.
- Clearing sequence plan from the VCMP.
- Management and mitigation measures.
- Fauna spotter role, contacts and certification.
- Specific fauna management procedures for potential or known habitat trees.

7.1.3 Fauna Spotter Catcher

A registered and suitability qualified fauna spotter catcher/ecologist will need to be employed for clearing works to implement a protocol of best management practises. Significant habitat features, should any be identified on site, will be flagged prior to clearing events and these areas supervised by an appropriately experienced Ecologist. Identified within the clearing supervision protocol should be flagging of hollow bearing trees, if present, followed by the removal of vegetation surrounding them. After 24 to 72 hours, these trees should then be removed.

The objective of this is to enable hollow dependant fauna an opportunity to move on their own accord as many species utilise multiple den/roost sites within a given home range should they occur. Where required, native fauna situated within areas to be cleared will be relocated to a secure area of similar habitat prior to the commencement of vegetation clearance works by a registered fauna spotter/catcher. Should any removal and relocation of nests be required, it is to be undertaken by a suitably qualified and experienced person and advice sought where necessary.

8. Significant Impact Assessment

8.1. Significant Impact Assessment Definitions

The Significant Impact Guidelines 1.1 provides specific definitions for '*a population of a species or important population of a species*' and '*habitat critical to the survival of a species or ecological community*'. This definition is a key consideration when conducting significant impact assessments for a threatened species or ecological community listed under the EPBC Act. The definitions are presented below.

8.1.1 Population of a species

A 'population of a species' is defined by the Significant Impact Guidelines as:
"An occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- *A geographically distinct regional population, or collection of local populations*
- *A population, or collection of local populations, that occurs within a particular bioregion.*

8.1.2 Important population

An 'important population' is a population that is necessary for a species' long-term survival and recovery.
This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

8.1.3 Habitat critical to the survival of a species or ecological community

The Significant Impact Guidelines provide the following definition for '*habitat critical to the survival of a species*'
"Habitat critical to the survival of a species or ecological community' refers to areas that are necessary:

- *For activities such as foraging, breeding, roosting or dispersal*
- *For the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)*
- *To maintain genetic diversity and long-term evolutionary development*
- *For the reintroduction of populations or recovery of the species or ecological community.*

Such habitat may be, but is not limited to:

- *Habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community*
- *Habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.*

8.2. *Phascolarctos cinereus* (Koala)

8.2.1 Conservation Status

The Koala is listed as Endangered under the EPBC Act.

8.2.2 Description

Koalas (*Phascolarctos cinereus*) are native Australian tree-dwelling marsupials with predominantly grey coloured fur.

8.2.3 Distribution

The Koala is found from north-east Queensland to the south-east corner of South Australia. As a consequence of translocations, the Koala are found outside their historic range, for example, Kangaroo Island. The distribution of the Koala is influenced by altitude, temperature and leaf moisture. The density of the Koala population in coastal regions is generally greater than inland areas. Koalas are known to naturally inhabit a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by *Eucalyptus* sp.

8.2.4 Habitat

Koala habitat can be broadly defined as any forest or woodland containing species that are known Koala food trees, or shrubland and emergent food trees. Preferred food and shelter trees are naturally abundant on fertile clay soils. Along the Great Dividing Range and the coastal belt throughout the species' range, Koalas inhabit moist forests and woodlands mostly dominated by *Eucalyptus* sp.

Koalas are highly territorial, and individuals maintain their own home range which may overlap with other individuals. Home ranges are variable depending on the location, with those in "poorer" habitats being larger than in higher quality habitats. There is little evidence for longer movements in most cases, though dispersing individuals, mostly young males, may occasionally cover distances of several kilometres over land with little vegetation. In SEQ, the average distance between natal and breeding home ranges was similar for males and females, at approximately 3.5 km. Maximum dispersal distances were up to approximately 10 km for males and females. Other studies have reported movement of up to 16 km in rural SEQ.

8.2.5 Threats

Habitat loss and fragmentation, vehicle strike and predation by domestic or feral dogs are the main threats to the Koala. Extreme environmental events, such as drought, can also cause significant mortality.

8.2.6 Significant Impact Assessment

As of 12 February 2022, the EPBC Act referral guidelines for the vulnerable Koala have been redacted following the elevation of the Koala listing status under the EPBC Act to Endangered. As such, the Federal Significant Impact Guidelines are to be utilised in the interim to determine if a significant impact on Koala may occur as a result of the proposed action. The assessment methodology included referral area surveys and consideration of Commonwealth, State and Local Government environmental database searches.

To determine whether the proposed action is likely to have a significant impact on the Koala, an assessment against the *EPBC Significant Impact Guidelines 1.1* is provided in **Table 13**. The results of this assessment determined that a significant impact on the Koala is unlikely to occur.

Table 13: EPBC Significant impact criteria for critically endangered and endangered species – Koala

Significant Impact Criteria	Assessment	Impact
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:		
1. Lead to a long-term decrease in the size of a population	Under the *Queensland Vegetation Management Act 1999,* the referral area is mapped as containing predominantly Category B (remnant) vegetation, containing RE 12.9-10.2. This vegetation is known to provide suitable Koala Habitat. Non-juvenile Koala Habitat Trees (NJKHTs) are present across the referral area including *Angophora leiocarpa* (Smooth Bark-Apple), *Corymbia citriodora* (Spotted Gum), *Corymbia tessellaris* (Moreton Bay Ash), *Eucalyptus siderophloia* (Grey Ironbark), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus melanophloia* (Silver-leaved Ironbark) and *Eucalyptus tereticornis* (Forest Red Gum). A review of ALA indicates that local Koala sightings have been recorded in locations surrounding the site, mostly to the north of the Cunningham Highway and west of the Ipswich Boonah Road. From these records it is noted that the nearest contemporary record to the referral area is from 2010, approximately 1 km north-east of the referral area (refer **Plan 7**). Field assessments within the referral area detected indirect evidence of Koala in the form of scats at one of the three SAT locations, no direct observations were recorded. Despite relatively intact vegetation within the referral area, this vegetation provides significantly limited connectivity potential given surrounding properties to the west, north and east are, or are expected to be, completely cleared. The site retains marginal connectivity potential to the south however this landholding has a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road is present to the south which is expected to be upgraded and will limit any connectivity value south and Daleys Road is present to the west. Given only 2 trees of the 90 searched contained scats this indicates a 'low' likelihood of occurrence. Since the designation of the RVPDA in 2010, connectivity value of the vegetation within the referral to other habitat patches has become extremely limited. While koala habitat is present within the referral area, consideration should be given to the overall size and location of the referral area within the Ripley Valley PDA. The 7.52 ha referral site is not believed to contribute significantly to critical habitat in the region particularly given the isolated nature of vegetation It is considered highly unlikely that the removal of 7.38 ha of habitat within the referral area would affect the viability or size of any Koala populations in the area.	A significant impact is not likely

Significant Impact Criteria	Assessment	Impact
2. Reduce the area of occupancy of the species	Detailed studies utilising both direct and indirect survey methods to detect evidence of Koala within the referral area were conducted. While no direct observational sightings were recorded, indirect evidence of Koala was identified through the detection of scats at 2 of the 90 trees assessed. In addition, recorded sightings of the species in the local area are relatively dated (>10 years). The nearest contemporary record was from 2010 and recorded approximately 1 km north-east of the referral area. Minimal records within the last four (4) years have been recorded in the local area. Furthermore, despite relatively intact vegetation within the referral area, this vegetation provides significantly limited connectivity potential given surrounding properties to the west, north and east are or are expected to be completely cleared. The site retains marginal connectivity potential to the south however this landholding has a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road is present to the south which is expected to be upgraded and will limit any connectivity value south. Historically the referral area contributed to a relatively well-connected patch of habitat, however the rapid development of the local area following RVPDA designation has completely isolated the vegetation within the referral area. Currently, the vegetation within the referral area is unlikely to be utilised by koala given the small overall size (7.52ha) and lack of connected habitat. While marginal connectivity value is present to the south, the delivery of Binnies Road upgrade and the expected development of the adjacent land holding will remove this. It is not anticipated that the removal of vegetation within the referral area will significantly reduce the area of occupancy as it is highly unlikely the vegetation is being used by koala at present and in the future.	A significant impact is not likely
3. Fragment an existing population into two or more populations	Detailed studies utilising both direct and indirect survey methods to detect evidence of Koala within the referral area were conducted. While no direct observational sightings were recorded, indirect evidence of Koala was identified through the detection of scats at 2 of the 90 trees assessed. A review of ALA indicates that local Koala sightings have been recorded in locations surrounding the site, mostly to the north of the Cunningham Highway and west of the Ipswich Boonah Road. From these records it is noted that the nearest contemporary record to the referral area is from 2010, approximately 1 km north-east of the referral area. Minimal records within the last four (4) years have been recorded in the local area, with the majority of the records being greater than 10 years old.	A significant impact is not likely

Significant Impact Criteria	Assessment	Impact
	At present, connectivity potential is extremely limited given surrounding properties to the west, north and east are, or are expected to be, completely cleared. The site retains marginal connectivity potential to the south however this landholding has a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road is present to the south which is expected to be upgraded and will limit any connectivity value south. Given the rapid development of surrounding properties, the vegetation on-site is no longer considered likely to be utilised by Koala. The lack of direct sightings indicates a current population does not exist within the referral area. Therefore, it is considered unlikely that the relatively small referral area of isolated vegetation will fragment any existing Koala populations.	
4. Adversely affect habitat critical to the survival of a species	The proposed action results in the removal of tree species known to be used by the Koala such as *Angophora leiocarpa* (Smooth Bark-Apple), *Corymbia citriodora* (Spotted Gum), *Corymbia tessellaris* (Moreton Bay Ash), *Eucalyptus siderophloia* (Grey Ironbark), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus melanophloia* (Silver-leaved Ironbark) and *Eucalyptus tereticornis* (Forest Red Gum). Therefore, the vegetation present has the capacity to support foraging and dispersal by the species. Detailed studies utilising both direct and indirect survey methods to detect evidence of Koala within the referral area were conducted. While no direct observational sightings were recorded, indirect evidence of Koala was identified through the detection of scats at 2 of the 90 trees assessed. A review of ALA indicates that local Koala sightings have been recorded in locations surrounding the site, mostly to the north of the Cunningham Highway and west of the Ipswich Boonah Road. From these records it is noted that the nearest contemporary record to the referral area is from 2010, approximately 1 km north-east of the referral area. Minimal records within the last four (4) years have been recorded in the local area, with the majority of the records being greater than 10 years old. The habitat within the referral area does contain suitable Koala habitat however it is considered unlikely that this vegetation is being used at present given the general lack of evidence and lack of connectivity value. The removal of 7.52 ha of vegetation within the referral area is considered unlikely to adversely affect habitat critical to the survival of the species as the vegetation Is significantly compromised by surrounding developments. Whilst individuals may enter the referral area due to its marginal connectivity to the south, this landholding has a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road is present to the south which is expected to be upgraded and will limit any connectivity value south.	A significant impact is not likely

Significant Impact Criteria	Assessment	Impact
	The small overall impact area, lack of connected habitat and limited evidence of use indicates that a significant impact is unlikely.	
5. Disrupt the breeding cycle of a population	Detailed studies utilising both direct and indirect survey methods to detect evidence of Koala within the referral area were conducted. While no direct observational sightings were recorded, indirect evidence of Koala was identified through the detection of scats at 2 of the 90 trees assessed. Targeted Koala surveys assessing the area for overall occupancy suggested a low usage of the referral area by the species. A review of ALA indicates that local Koala sightings have been recorded in locations surrounding the site, mostly to the north of the Cunningham Highway and west of the Ipswich Boonah Road. From these records it is noted that the nearest contemporary record to the referral area is from 2010, approximately 1 km north-east of the referral area. Minimal records within the last four (4) years have been recorded in the local area, with the majority of the records being greater than 10 years old. There is no evidence that the referral area is contributing to the breeding cycle of a population following detailed site surveys. Furthermore, whilst individuals may enter the referral area due to its current connectivity to the south, there is significantly limited connectivity potential given surrounding properties to the west, north and east are, or are expected to be, completely cleared with Daleys Road also acting as a significant barrier. The site retains marginal connectivity potential to the south however this landholding has a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road is present to the south which is expected to be upgraded and will limit any connectivity value south. It is considered unlikely that the removal of this relatively small and isolated vegetation associated with the referral area will disrupt the breeding cycle of a population.	A significant impact is not likely
6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposed action will impact areas containing Koala habitat trees. Detailed studies utilising both direct and indirect survey methods to detect evidence of Koala within the referral area were conducted. While no direct observational sightings were recorded, indirect evidence of Koala was identified through the detection of scats at 2 of the 90 trees assessed. Targeted Koala surveys assessing the area for overall occupancy suggested a low usage of the referral area by the species. A review of ALA indicates that local Koala sightings have been recorded in locations surrounding the site, mostly to the north of the Cunningham Highway and west of the Ipswich Boonah Road. From these records it is noted that the nearest contemporary record to the referral area is from 2010, approximately 1 km north-east of the referral area. Minimal records within the last four (4) years have been recorded in the local area, with the majority of the records being greater than 10 years old.	A significant impact is not likely

Significant Impact Criteria	Assessment	Impact
	The referral area provides significantly limited connectivity potential given surrounding properties to the north and east are completely cleared. The site retains marginal connectivity potential to the south however this landholding has a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road is present to the south which is expected to be upgraded and will limit any connectivity value south. To the west Daleys Road provides a barrier to koala movement with the adjacent land holding expected to be cleared and holds a current 'not controlled action' determination. Although the proposed action will remove an area of vegetation containing Koala habitat, the relatively small size of the referral area (7.52 ha) and its location within the Ripley Valley PDA, contributes to the determination that it is a low likelihood that the proposed action will decrease the availability of habitat to the extent that the species is likely to decline.	
7. Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The referral area is situated centrally within RVPDA which is a highly modified urban center. A number of major threats to the Koala species are present within the local region, including major and arterial roads and residential housing likely to have domestic dogs. Notably, analysis of motion camera data revealed Red Fox and a feral cat within the referral area, both of which are a known threat to Koala populations. Therefore, the proposed action is not anticipated to result in the introduction or increase of invasive species that are harmful to the Koala or Koala habitat as these species are already present within and adjacent to the referral area.	A significant impact is not likely
8. Introduce disease that may cause the species to decline, or	Diseases including chlamydial disease and Koala retrovirus (KoRV) are prevalent among Koala populations in South East Queensland. The 7.52 ha referral area, (inclusive of a constructed dam) will not significantly decrease the availability of habitat in the local region nor fragment a population causing stress, which is directly linked to increasing outbreak of disease. In undertaking directional clearing which allows fauna to move into surrounding areas of intact bushland under the guidance of qualified fauna spotter catcher the proposed action will take all precautions in limiting stress on individuals in the area. It is considered unlikely that the prosed action will introduce disease to the area.	A significant impact is not likely

Significant Impact Criteria	Assessment	Impact
9. Interfere substantially with the recovery of the species.	The proposed action will impact areas containing Koala habitat trees. Detailed studies utilising both direct and indirect survey methods to detect evidence of Koala within the referral area were conducted. While no direct observational sightings were recorded, indirect evidence of Koala was identified through the detection of scats at 2 of the 90 trees assessed. Targeted Koala surveys assessing the area for overall occupancy suggested a low usage of the referral area by the species. The Action is unlikely to interfere substantially with the recovery of the Koala as the project is proposing to remove a relatively small area of vegetation (7.52ha) surrounded by threatening processes within the Ripley Valley PDA. Despite relatively intact vegetation within the referral area, this vegetation provides significantly limited connectivity potential given surrounding properties to the west, north and east are, or are expected to be, completely cleared. The site retains marginal connectivity potential to the south however this landholding has a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road is present to the south which is expected to be upgraded and will limit any connectivity value south and Daleys Road to the west. It is unlikely that that the proposed action will interfere substantially with the recovery of the species as habitat on-site is of a small total area and offers limited dispersal opportunity at present and into the future. Refer below for an assessment against the EPBC Act Recovery Plan for the Koala.	A significant impact is not likely

The EPBC Act National Recovery Plan for the Koala was published in March 2022. This recovery plan for the listed Koala replaces the National Koala Conservation and Management Strategy (2009-2014) (NRM Ministerial Council 2009). It has been developed with relevant State and Territory Governments to provide an overarching national conservation framework for the listed Koala that aligns with local, state and territory government plans, programs and strategies. However, it does not replace Local, State and Territory Government plans, programs and strategies. It is the first recovery plan for the nationally listed Koala.

The overall goal of the National Recovery Plan is 'to stop the trend of decline in population size of the listed Koala, by having resilient, connected, and genetically healthy metapopulations across its range, and to increase the extent, quality and connectivity of habitat occupied'.

Three (3) key objectives of the Draft National Recovery Plan are provided below with responses relevant to the proposed action:

1. **The area of occupancy and estimated size of populations that are declining, suspected to be declining, or predicted to decline are instead stabilised and then increased. The area of occupancy and estimated size of populations that are suspected and predicted to be stable are maintained or increased.**

The referral area is mapped as predominantly Category B (remnant) vegetation or RE12.9-10.2Vegetation mapping shows the Category B (remnant) vegetation is mapped as Least Concern RE12.9-10.2. The referral area itself has remained relatively unchanged with minor clearing for tracks and property boundaries. Recent clearing of the three lots to the south-east has occurred as well as the continues development of land to the north and east. Despite relatively intact vegetation within the referral area, this vegetation provides significantly limited connectivity potential given surrounding properties to the west, north and east are, or are expected to be, completely cleared. The site retains marginal connectivity potential to the south however this landholding has a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road is present the south which is expected to be upgraded and will limit any connectivity value south and Daleys road is present to the west.

Subsequently, the proposed action will impact areas containing Koala habitat trees. Detailed studies utilising both direct and indirect survey methods to detect evidence of Koala within the referral area were conducted. While no direct observational sightings were recorded, indirect evidence of Koala was identified through the detection of scats at 2 of the 90 trees assessed. Targeted Koala surveys assessing the area for overall occupancy suggested a low usage of the referral area by the species.

As mentioned above, the referral area is a relatively small patch of vegetation in a highly modified environment. The vegetation itself is relatively intact however, given the small overall area and known presence of threats/general lack of dispersal opportunity, the proposed action is not considered to significantly reduce the area of occupancy for the species.

2. **Metapopulation processes are maintained or improved.**

Detailed studies utilising both direct and indirect survey methods to detect evidence of Koala within the referral area were conducted. While no direct observational sightings were recorded, indirect evidence of Koala was identified through the detection of scats at 2 of the 90 trees assessed. Targeted Koala surveys assessing the area for overall occupancy suggested a low usage of the referral area by the species. While the species is known in the local area, very few contemporary sightings have been recorded close to the referral area.

The referral area is located in a highly modified landscape and is adjacent to existing and future residential developments, including local roads. Clearing of the relatively small referral area directly adjacent to existing residential development within the RVPDA is not intending to fragment areas of vegetation and is considered unlikely to impact metapopulation processes for the Koala. This is due to the relatively limited dispersal opportunities given the planning intent of the area.

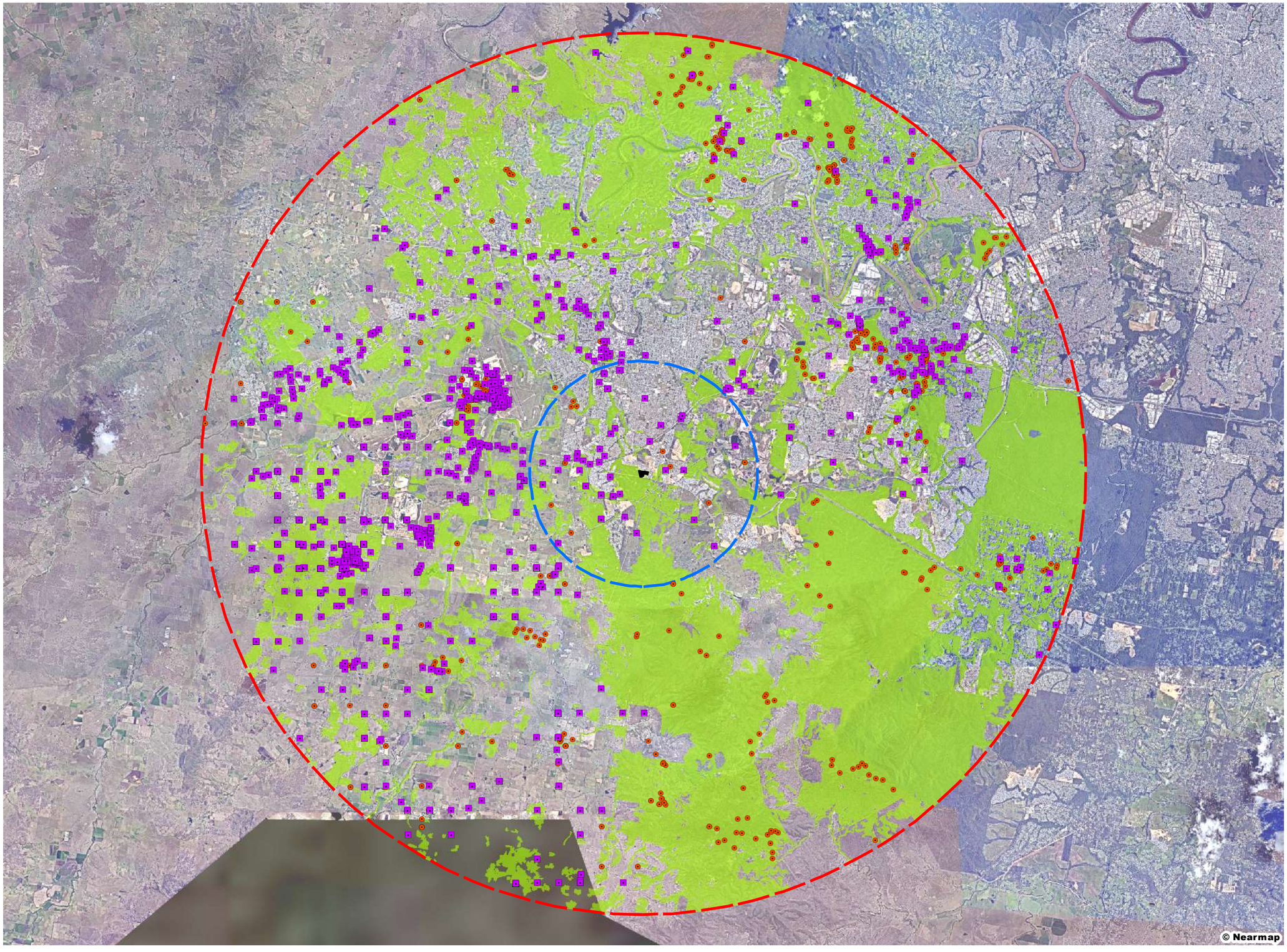
3. **Partners, communities, and individuals have a greater role and capability in listed Koala monitoring, conservation, and management.**

The proposed action will impact areas containing Koala habitat trees. Detailed studies utilising both direct and indirect survey methods to detect evidence of Koala within the referral area were conducted. While no direct observational sightings were recorded, indirect evidence of Koala was identified through the detection of scats at 2 of the 90 trees assessed. Targeted Koala surveys assessing the area for overall occupancy suggested a low usage of the referral area by the species.

Although the proposed action will involve the removal of Koala habitat, the potential for a significant impact is mitigated by the small overall area of impact, the existing levels of disturbance in the local area and the limited connectivity of the site. It is unlikely vegetation within the referral area would be routinely utilised by the species at present or into the future.

The results of this assessment determined that it is unlikely that the proposed action will have a significant impact on the Koala.

7. Koala Records & Habitat



Notes:
This plan was prepared as a desktop assessment tool. The information on this plan is not suitable for any other purpose. Property dimensions, areas, numbers of lots and contours and other physical features shown have been compiled from existing information and may not have been verified by field survey. These may need verification if the development application is approved and development proceeds, and may change when a full survey is undertaken or in order to comply with development approval conditions. No reliance should be placed on the information on this plan for detailed design or for any financial dealings involving the land. Saunders Havill Group therefore disclaims any liability for any loss or damage whatsoever or howsoever incurred, arising from any party using or relying upon this plan for any purpose other than as a document prepared for the sole purpose of accompanying a development application and which may be subject to alteration beyond the control of the Saunders Havill Group. Unless a development approval states otherwise, this is not an approved plan.

Layer Sources
© State of Queensland (Department of Resources) 2024.
Updated data available at
https://qldspatialinformation.qld.gov.au/catalogue/

* This note is an integral part of this plan/data. Reproduction of this plan or any part of it without this note being included in full will render the information shown on such reproduction invalid and not suitable for use.

Legend

- Site area
- Qld DCDB
- 20km site boundary buffer
- 5km site boundary buffer
- Koala habitat
- Koala record, last 20 yrs (Qld WildNet, 2024)
- Koala record, last 20 yrs (ALA, 2024)

Issue	Date	Description	Drawn	Checked
A	15/04/2024	Preliminary	TC	LB

0 2 4 6 km

Transverse Mercator | GDA 2020 | Zone 56 | 1:175,000 @ A3

saunders havill group

HB Land Pty Ltd

Binnies Road, Ripley

Address / RPD: 335RP814578

15/04/2024 | 11826 E 08 MNES Koala Records Habitat A

8.3. *Pteropus poliocephalus* (Grey-headed Flying-fox)

8.3.1 Conservation Status

The GHFF is listed as Vulnerable under the EPBC Act.

8.3.2 Description

The GHFF is the largest Australian bat with a wingspan of up to one metre. It has dark-grey body fur, a grey head, and a distinctive reddish-brown collar. It is also the only flying-fox with hairy legs right down to its ankles.

8.3.3 Distribution

The GHFF occurs along the south-east coast of Australia, from Rockhampton in central Queensland through New South Wales to western Victoria. During the last few years, the GHFF has also been recorded from Adelaide.

8.3.4 Habitat

The GHFF is heavily dependent on the availability of foraging resources and roost sites. As canopy feeding frugivores and nectarivores, GHFFs frequent fruiting and flowering trees in rainforests, open eucalypt forests, woodlands, *Melaleuca sp.* swamps and Banksia woodlands (Duncan *et al*. 1999). The GHFF is also known to forage in fruit crops and introduced tree species within urban environments. Roost sites for the GHFF are commonly within dense vegetation close to water, primarily rainforest patches, stands of *Melaleuca sp.*, mangroves or riparian vegetation.

8.3.5 Recovery Actions

There is now an adopted Recovery Plan for this species at the federal level. It focuses mainly on managing adverse impacts to roosting sites, culling controls, fenced entanglement and public awareness, with reference to foraging habitat. From the recovery guidelines:

Where the existence of <u>important</u> winter and spring flowering vegetation communities is verified in the field, they are considered habitat critical to the survival of the Grey-headed Flying-fox. Back yard fruit trees, orchards or non-native trees that may be used for foraging are not considered to be habitat critical to the survival of the Grey-Headed Flying-Fox. Habitat critical to the survival of the Grey-headed Flying-fox may also be vegetation communities which:

- contain native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May)
- contain native species used for foraging and occur within 20 km of a nationally important camp as identified on the Department's interactive flying-fox web viewer, or
- contain native and or exotic species used for roosting at the site of a nationally important Grey-Headed Flying-Fox camp as identified on the Department's interactive flying-fox web viewer.

Habitat critical to the survival of the Grey-headed Flying-fox should be the focus for protection and any revegetation initiatives aimed to support the species.

Notably, the recovery plan lists habitat loss as a key threat to the Grey-headed Flying-fox. It is understood that mapping of habitat critical to the survival of the grey-headed Flying-fox is an initiative of the recovery plan. The referral area is not considered to maintain <u>important</u> foraging habitat for the Grey-headed Flying-fox (refer below).

The Queensland Government identifies the following recovery actions:

- Identify and map important foraging and roosting habitats

- Prevent the destruction and degradation of important forested habitat, through: identifying guidelines to protect habitat; appropriate zoning; identifying development alternatives and incentives to retain habitat and educating communities.
- Encourage community partnerships and initiatives that protect important habitats, and where possible re-vegetate with foraging trees for GHFF
- Work with orchardists to improve the image of GHFF, and to identify and implement non-destructive methods to protect fruit crops, such as: appropriate netting (not monofilament netting) that is not hung loose over trees (which can entangle bats and birds)
- Reduce negative public attitudes and conflict with humans
- Develop accurate methods for monitoring population size

8.3.6 Significant Impact Assessment

EPBC Act, Grey-headed Flying-fox populations are listed as Vulnerable. The species is not specifically listed under Queensland's *Nature Conservation Act 1992* (Qld) (NCA), however, retains a Least Concern status for the purposes of the Act. The *Referral guideline for management actions in grey-headed and spectacled flying-fox camps* summarise the decision process in considering the likelihood of a significant impact on the Grey-headed Flying-fox or Spectacled Flying-fox schematically. The Guidelines are specifically for the assessment of impacts on Flying-fox camps.

GHFFs are heavily dependent on the availability of foraging resources and roost sites. As canopy feeding frugivores and nectivores, GHFFs frequent fruiting and flowering trees in rainforests, open eucalypt forests, woodlands, Melaleuca sp. swamps and Banksia woodlands (Duncan et al. 1999). The GHFF is also known to forage in fruit crops and introduced tree species within urban environments. Roost sites for the GHFF are commonly within dense vegetation close to water, primarily rainforest patches, stands of Melaleuca sp., mangroves or riparian vegetation. The value of vegetation to the grey-headed flying fox is difficult to assess due to the high mobility of the species in conjunction with timing of flowering of tree species within the assessment area. The maximum nightly foraging distance of GHFF is estimated at 50 kilometres, while most forage within a 15 km radius of daytime roost sites (Tidemann 1998).

Grey-headed Flying-foxes were not observed foraging or roosting within the assessment area during field survey efforts, nor were they observed as fly-over species. Suitable foraging habitat exists within the assessment area, therefore the GHFF has the potential to utilise the investigation area for foraging purposes.

The Referral guideline for management actions in grey-headed and spectacled flying-fox camps states that the guideline does not apply to the following relevant points:

- Actions in the vicinity of camps, such as development actions, firework displays or concerts, which may indirectly affect camps of EPBC Act-listed flying-fox species.
- Actions which may impact on the foraging habitat of EPBC Act-listed flying-fox species. Proponents of actions of this kind should refer to the significant impact guideline 1.1. (4.1.5).

To determine whether the proposed action is likely to have a significant impact on the Grey-headed Flying-fox, an assessment against the *EPBC Significant Impact Guidelines 1.1* is provided in **Table 14**.

Table 14: EPBC Significant impact criteria for critically endangered and endangered species – Grey-headed Flying-fox

Significant Impact Criteria	Description	Impact
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
1. Lead to a long-term decrease in the size of an important population of a species	Surveys did not record GHFF foraging within or adjacent to the referral area nor as a fly-over species. Additionally, no roosts are present within the referral area or directly adjacent. A review of the National Flying-fox monitoring viewer identified a GHFF roost approximately 2.5km north-east of the site (Yamanto (479)). The nearest roost of national significance (Inala, Lilac Street (1219)) is located approximately 21.5 km north-east of the site (refer **Plan 8**). As the species is highly adaptive with its diverse native diet, it can supplement with introduced species. It is known to forage within a variety of habitat areas as each resource does not produce food throughout the entire year. Suitable foraging habitat is present within the referral area in the form of Eucalypt and Corymbia dominated vegetation consisting of *Angophora leiocarpa* (Smooth Bark-Apple), *Corymbia citriodora* (Spotted Gum), *Corymbia tessellaris* (Moreton Bay Ash), *Eucalyptus siderophloia* (Grey Ironbark), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus melanophloia* (Silver-leaved Ironbark) *and Eucalyptus tereticornis* (Forest Red Gum). However, given the availability of suitable foraging habitat within the broader area, including White Rock – Spring Mountain Conservation Estate and the Flinders-Goolman Conservation Estate, it is considered unlikely that the species would utilise the relatively small area of 7.52 ha associated with the referral area. Therefore, despite potential foraging habitat occurring within the referral area, the area is not considered to provide critical habitat supporting an important population of the species due to the small size of the referral area, significant availability of habitat in the wider region and lack of local roosts. For these reasons, the proposed action is unlikely to lead to a long-term decrease in the size of any local GHFF populations.	A significant impact is not likely
2. Reduce the area of occupancy of an important population	Surveys did not record GHFF foraging within or adjacent the referral area nor as a fly-over species. Additionally, no roosts are present within the referral area or directly adjacent. A review of the National Flying-fox monitoring viewer identifying a GHFF roost approximately 2.5km north-east of the site (Yamanto (479)). The nearest roost of national significance (Inala, Lilac Street (1219)) is located approximately 21.5 km north-east of the site.	A significant impact is not likely

Significant Impact Criteria	Description	Impact
	The proposed action not considered to reduce the area of occupancy of an important population of GHFF as there is no evidence the species utilises the vegetation within the referral area. Furthermore, potential foraging habitat is limited to 7.38 ha of eucalypt vegetation, which is a fraction of the available habitat within the broader locality.	
3. Fragment an existing important population into two or more	The SPRAT species profile outlines that while there are spatially structured colonies of GHFF, there are no separate or distinct populations due to the constant genetic exchange and movement between camps throughout the species' geographic range. Regardless, the high mobility of the species and significant availability of habitat in the wider region, indicate that the small overall impact area is unlikely to fragment a population into two or more populations.	A significant impact is not likely
4. Adversely affect habitat critical to the survival of a species	Surveys did not record GHFF foraging within or adjacent the referral area nor as a fly-over species. Additionally, no roosts are present within the referral area or directly adjacent. A review of the National Flying-fox monitoring viewer identifying a GHFF roost approximately 2.5km north-east of the site (Yamanto (479)). The nearest roost of national significance (Inala, Lilac Street (1219)) is located approximately 21.5 km north-east of the site. Field surveys did however identify the referral area to contain potential foraging habitat for the species. However, given the availability of suitable foraging habitat within the broader area, including White Rock – Spring Mountain Conservation Estate and the Flinders-Goolman Conservation Estate, it is considered unlikely that the species would utilise the relatively small area of 7.52 ha associated with the referral area. The habitat within the referral area is therefore not considered critical to the survival of this species due to its overall small size and low value in comparison to the surrounding region.	A significant impact is not likely
5. Disrupt the breeding cycle of an important population	Surveys did not record GHFF foraging within or adjacent the referral area nor as a fly-over species. Additionally, no roosts are present within the referral area or directly adjacent. A review of the National	A significant impact is not likely

Significant Impact Criteria	Description	Impact
	Flying-fox monitoring viewer identifying a GHFF roost approximately 2.5km north-east of the site (Yamanto (479)). The nearest roost of national significance (Inala, Lilac Street (1219)) is located approximately 21.5 km north-east of the site. The referral area does contain potential foraging habitat for the species, albeit limited to 7.38 ha of eucalypt woodland. However, given the availability of suitable foraging habitat within the broader area, including White Rock – Spring Mountain Conservation Estate and the Flinders-Goolman Conservation Estate, it is considered unlikely that the species would utilise the relatively small area of 7.52 ha associated with the referral area. The referral area is also not considered to contain an important population of GHFF. The proposed action therefore will not disrupt the breeding cycle of an important population as there is no evidence an important population is utilisng vegetation on-site.	
6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Although potential foraging habitat is present within the referral area, due to the presence of eucalypt vegetation, this area equates to only 7.38 ha and is unlikely to be utliised by the species given the availability of habitat in the broader locality. The high mobility of the species and availability of foraging habitat in the wider region, including conservation estates, indicates that the proposed action (7.52 ha total) is unlikely to decrease the availability of habitat to the extent that the species is likely to decline.	A significant impact is not likely
7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Invasive species were recorded within the referral area, particularly at the ground layer. It is not considered likely that the proposed action will result in invasive species that are harmful to GHFF.	A significant impact is not likely
8. Introduce disease that may cause the species to decline	Given the availability of suitable foraging habitat within the broader area including White Rock – Spring Mountain Conservation Estate and the Flinders-Goolman Conservation Estate, it is considered unlikely that the species would utilise the relatively small area of 7.52 ha associated with the referral area. Clearing of the referral area is not expected to impact an area of vegetation highly utilised or containing an important population of GHFF, meaning risk of stress to a roost is highly unlikely, which can aggravate disease.	A significant impact is not likely

Significant Impact Criteria	Description	Impact
	With standard practices associated with extraction activities, the proposed action is unlikely to introduce disease into the area.	
9. Interfere substantially with the recovery of the species	Recovery of the species has specifically targeted the broad scale culling of the species. In addition, conservation efforts have led to the protection of known roosting sites and important habitat. The referral area has not been identified as an important habitat nor roost site and the action is unlikely to interfere with the recovery of the species. Additionally, the high mobility of the species and availability of foraging habitat in the wider region indicates that the removal of 7.52 ha will not interfere with the recovery of the species.	A significant impact is not likely

The purpose of the National Recovery Plan for the Grey-headed Flying-fox is to set out the management and research actions necessary to stop the decline of, and support the recovery of the Grey-headed Flying-fox over the next 10 years. The overall objectives of this Grey-headed Flying-fox recovery plan are:

- to improve the Grey-headed Flying-foxes national population trend by reducing the impact of the threats outlined in this plan on Grey-headed Flying-foxes through habitat identification, protection, restoration and monitoring, and
- to assist communities and Grey-headed Flying-foxes to coexist through better education, stakeholder engagement, research, policy and continued support to fruit growers.

The plan addresses the key threats facing the Grey-headed Flying-fox and recovery objectives which are provided below with responses relevant to the proposed action:

1. Identify, protect and increase native foraging habitat that is critical to the survival of the Grey-headed Flying-fox

No roosts are present within the referral area or directly adjacent. A review of the National Flying-fox monitoring viewer identifying a GHFF roost approximately 2.5km north-east of the site (Yamanto (479)). The nearest roost of national significance (Inala, Lilac Street (1219)) is located approximately 21.5 km north-east of the site. Habitat critical to the survival of the species is considered important winter and spring flowering vegetation communities. Important winter and spring vegetation communities are those that contain *Eucalyptus tereticornis, E. albens, E. crebra, E. fibrosa, E. melliodora, E. paniculata, E. pilularis, E. robusta, E. seeana, E. sideroxylon, E. siderophloia, Banksia integrifolia, Castanospermum australe, Corymbia citriodora citriodora, C. eximia, C. maculata, Grevillea robusta, Melaleuca quinquenervia or Syncarpia glomulifera* (Eby and Law 2008; Eby 2016; Eby et al. 2019).

Of the species listed above, *Eucalyptus tereticornis, E. crebra, E. siderophloia, Corymbia citriodora*, and *Melaleuca quinquenervia* were recorded within the referral area. The Grey-headed Flying-fox is a highly mobile species with the closest known active Grey-headed Flying-fox camp approximately 2.5km north-east of the referral area. Therefore, there is potential for the species to occur within the vegetation of the referral area. However, it is noted that surveys did not record GHFF foraging within or adjacent the referral area nor as a fly-over species. Additionally, in general, the relatively small area of 7.52 ha associated with the proposed action is unlikely to provide habitat critical to the survival of the species.

Therefore, despite potential foraging habitat occurring within the referral area, the area is not considered to provide critical habitat supporting an important population of the species due to the small size of the referral area, significant availability of habitat in the wider region and lack of evidence of roost on or adjacent to the referral area.

2. Identify, protect and increase roosting habitat of Grey-headed Flying-fox camps.

No roosts were identified within the comprehensive surveys of the referral area in 2024 with the nearest known active roost site located approximately 2.5km north-east of the referral area. This species was also not observed roosting, foraging or as fly-over within the referral area.

Preferred roosting habitat for the Grey-headed Flying-fox is poorly understood. However it is considered unlikely that the 7.52 ha referral area provides significant potential roosting habitat for the species.

3. Determine trends in the Grey-headed Flying-fox population so as to monitor the species' national distribution, habitat use and conservation status.

Not applicable. Mitigation measures will be implemented during construction and operation of the proposed action to reduce threats.

4. Build community capacity to coexist with flying-foxes and minimise the impacts on urban settlements from new and existing camps while avoiding interventions to move on or relocate entire camps.
Not Applicable. There are no observed roosts within the referral area, with the nearest known active roost site located approximately 2.5km north-east of the referral area. Therefore, impacts on GHFF camps as a result of the proposed development are considered highly unlikely.

5. Increase public awareness and understanding of Grey-headed Flying-foxes and the recovery program and involve the community in the recovery program where appropriate.
Not Applicable. There are no observed roosts within the referral area, with the nearest known active roost site located approximately 2.5km north-east of the referral area.

6. Improve the management of Grey-headed Flying-fox camps in areas where interaction with humans is likely.
Not Applicable. There are no observed roosts within the referral area, with the nearest known active roost site located approximately 2.5km north-east of the referral area. Therefore, human interaction with GHFF as a result of the proposed development is considered highly unlikely.

7. Significantly reduce levels of licenced harm to Grey-headed Flying-foxes associated with commercial horticulture.
Not applicable – proposed action is for a residential development not commercial horticulture.

8. Support research activities that will improve the conservation status and management of Grey-headed Flying-foxes.
Not applicable.

9. Reduce the impact on Grey-headed Flying-foxes of electrocution on power lines, and entanglement in netting and on barbed-wire.
The proposed action is for a residential development where the implementation of netting and barbed wire is unlikely. Additionally, the risk of entanglement and electrocution associated with the proposed action is considered minor due to the limited potential for GHFF to enter the referral area following the removal of vegetation.

At current, the potential for GHFF to enter the referral area is already considered minor due to the relatively small size of the referral area. Additionally, no roosts were identified within the referral area, and the nearest known roost site located approximately 2.5km north-east of the referral area. Although vegetation within the referral area contains five (5) of nineteen (19) important winter and spring foraging species for the Grey-headed Flying-fox, the surrounding areas of intact remnant and regrowth vegetation provides higher value potential foraging habitat for this species.

While the risk of entanglement and electrocution is considered unlikely due to the low likelihood individuals will enter the area, potential impacts will be managed through the implementation of mitigation measures and procedures outlined within future management documents including the VC&MP and FMP. As such, the proposed action is considered unlikely to impact the recovery of this species.

The results of this assessment determined that it is unlikely that the proposed action will have a significant impact on the Grey-headed Flying -fox.

8. Grey-headed Flying-fox Roosts & Foraging Habitat

Notes:
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Legend

- Site area
- Qld DCDB
- 20km site boundary buffer
- 5km site boundary buffer
- Active Nationally Important Grey-headed Flying-fox roosts/camp within recent surveys with a population level 3 or higher
- Active Nationally Important Grey-headed Flying-fox roosts/camp within recent surveys
- Active Grey-headed Flying-fox roosts/camp within recent surveys with a population level 3 or higher
- Active Grey-headed Flying-fox roosts/camp within recent surveys
- Inactive Grey-headed Flying-fox roosts/camp within recent surveys
- Grey-headed Fly-fox foraging habitat

Issue	Date	Description	Drawn	Checked
A	15/04/2024	Preliminary	TC	LB

0 2 4 6 km

Transverse Mercator | GDA 2020 | Zone 56 | 1:175,000 @ A3

Address / RPD: 335RP814578

15/04/2024 | 11826 E 09 MNES GHFF Roosts Habitat A

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Binnies Road, Ripley

8.4. Petauroides Volans (Greater Glider)

8.4.1 Conservation Status

The Greater Glider is listed as Endangered under the EPBC Act and NCA as of July 2022.

8.4.2 Description

The greater glider (southern and central) is the largest gliding possum in eastern Australia. It has a head and body length of 35–46 cm, tail length of 45–60 cm, and a weight range of 900–1700 g, with females being larger than males. The greater glider (southern and central) has thick fur that increases its apparent size. Its fur colour is white or cream below and varies from dark grey, dusky brown through to light mottled grey and cream above. It has a long furry tail, large furry ears and a short snout. Its tail is not prehensile, and the gliding membrane extends from the forearm to the tibia.

8.4.3 Distribution

The Greater Glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria (Wombat State Forest), with an elevational range from sea level to 1200 m above sea level.

8.4.4 Habitat

The Greater Glider is largely restricted to eucalypt forest and woodlands. It is primarily folivorous with a diet mostly comprising of eucalypt leaves and occasionally flowers. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The species favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species.

During the day it shelters in tree hollows, with a particular preference for large hollows in large, old growth trees (Smith et al., 2007). The presence of live, hollow-bearing trees is thought to be a limiting factor within otherwise suitable habitat. Large, continuous tracts of mature woodland and forest with a minimum of 2-4 suitable hollows per 2 ha is considered essential for sustaining a population (Eyre, 2002). The species is considered to be particularly sensitive to forest clearance and intensive logging practices (Kavanagh and Wheeler, 2004). Subsequently, Greater Gliders have relatively low persistence in small forest fragments and disperse poorly across vegetation that is not native forest. Modelling suggest that they require native forest patches of at least 160 km^2 to maintain viable populations (Eyre, 2002).

8.4.5 Threats

Key threats to the greater glider (southern and central) are frequent and intense bushfires, inappropriate prescribed burning, climate change, land clearing and timber harvesting (DCCEEW. 2022). In particular is the loss of breeding habitat (hollows) and loss and fragmentation of old-growth forests.

8.4.6 Significant Impact Assessment

To determine whether the proposed action is likely to have a significant impact on the Greater Glider, an assessment against the *EPBC Significant Impact Guidelines 1.1* is provided in **Table 15**. The results of this assessment determined that a significant impact on the Greater Glider is not likely.

Table 15: EPBC Significant impact criteria for critically endangered and endangered species – Greater Glider

Significant Impact Criteria	Assessment	Impact
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:		
1. Lead to a long-term decrease in the size of a population	The referral area of 7.52 ha is mapped as containing predominantly Category B (remnant) vegetation. Native canopy species within the referral area include *Angophora leiocarpa* (Smooth Bark-Apple), *Corymbia citriodora* (Spotted Gum), *Corymbia tessellaris* (Moreton Bay Ash), *Eucalyptus siderophloia* (Grey Ironbark), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus melanophloia* (Silver-leaved Ironbark) and *Eucalyptus tereticornis* (Forest Red Gum). The species was not observed on-site despite targeted nocturnal surveys. Suitable potentially foraging habitat exists on site in the form of Eucalypt woodland however the site contains relatively few hollow bearing trees. The species is known to have a preference for large, mature trees for foraging and hollows for denning. All large, mature trees and hollow-bearing trees were plotted within the referral area with results indicating an average of 5.85 large trees per hectare utilising 500mm DBH as the threshold. Furthermore, only nine (9) hollow-bearing trees were recorded within the referral area, seven (7) of which were dead/stag trees. Given the species' preference for live denning trees, it is considered highly unlikely that the site supports a breeding population of the species. The vegetation on-site provides significantly limited connectivity potential given surrounding properties to the west, north and east are, or are expected to be, completely cleared. The site retains marginal connectivity potential to the south however this landholding has a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road is present to the south which is expected to be upgraded and will limit any connectivity value south and Dalyes Road is present to the west. The nearest record of the species is approximately 12km north-east from 2022 with additional records further north and east. The majority of these sightings have been recorded within nature reserves and conservation areas which provide a significant amount of intact, high-value remnant vegetation within the broader locality. Vegetation within the referral area retains limited connectivity to these areas as a result of its position within the RVPDA and associated residential development surrounding the site. The species is known to be particularly sensitive to area of high disturbance and are unlikely to utilise vegetation close to these areas. The referral area is located adjacent to current residential developments and highly modified areas. A 100m buffer disturbance buffer has been applied to the referral from the north and east leaving only a 1.46 ha area of vegetation that has the potential to be utilised by the species. This	A significant impact is not likely

Significant Impact Criteria	Assessment	Impact
	area is still adjacent to Binnies Road and Daleys road and therefore also unlikely to be utilised (refer **Plan 9** and **Plan 10**). It is considered highly unlikely that the removal of vegetation within the referral area would affect the viability or size of any Greater Glider populations in the area given no evidence of the species on-site, relatively low abundance of large and hollow-bearing trees, and level of disturbance likely to deter the species from dispersing through the site.	
2. Reduce the area of occupancy of the species	Targeted surveys did not detect any evidence of Greater Glider within the referral area, suggesting the vegetation is not utilised by Greater Glider. The vegetation within the referral area is considered low-value habitat for the species due to the relatively low abundance of large and hollow-bearing trees. There are no recorded sightings of the species within 5km of the site according to Queensland WildNet with clusters of records to the north and east of the referral area, largely within nature reserves and conservation areas. Connectivity to this area is limited by the site's position within the RVPDA and associated residential development surrounding the site. Of the 7.52 ha referral area, only 1.46 ha of vegetation is present outside of the disturbance buffer from the north and east and east. Furthermore, only 2 live hollow-bearing trees were present acrss the referral area and none were present outside of the disturbance buffer. No Greater Glider individuals were recorded on-site despite targeted surveys including spotlighting. Therefore, it is anticipated that the removal of 1.46 ha of potential, albeit low-quality, Greater Glider habitat on-site will not reduce the area of occupancy for Greater Glider.	A significant impact is not likely
3. Fragment an existing population into two or more populations	There is no evidence that an existing population is present on-site based on contemporary detailed field surveys and historical records. The small area of potential Greater Glider habitat on-site is considered low-value habitat for the species due to the relatively low abundance of large and hollow bearing trees. Furthermore, the removal of isolated vegetation is not likely to fragment an existing population, particularly as large areas of intact vegetation are present further south and east in nature reserves and conservation areas where multiple records of the species exist.	A significant impact is not likely
4. Adversely affect habitat critical to the survival of a species	Detailed targeted surveys did not detect any evidence of Greater Glider within the referral area, suggesting the vegetation on-site is not utilised by Greater Glider. Queensland Wildnet returned no sightings of	A significant impact is not likely

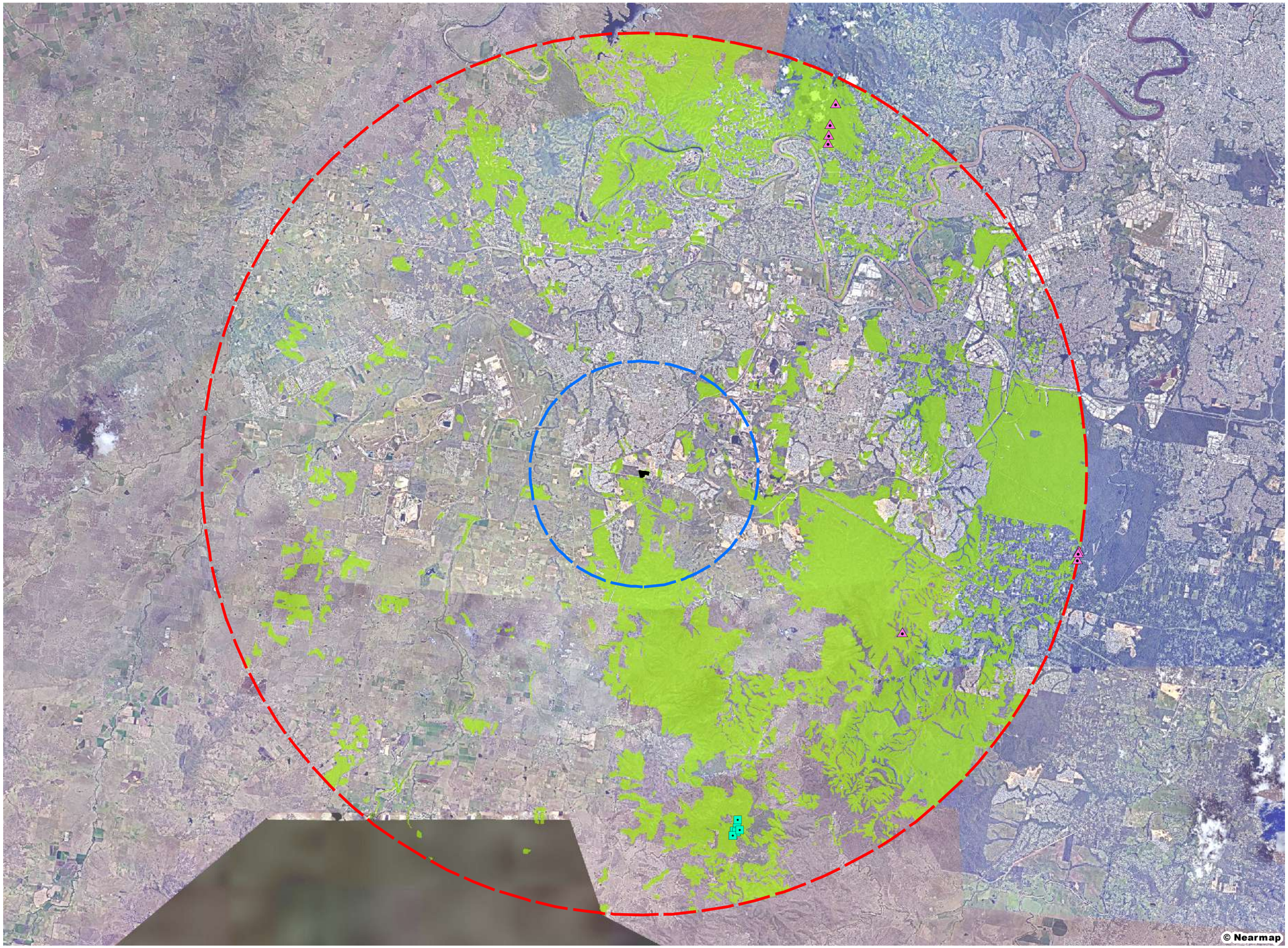
Significant Impact Criteria	Assessment	Impact
	Greater Glider within a 5 km radius of the referral area, however clusters of records occur to the north and east of the site, largely within nature reserves and conservation areas. The referral area does contain 2.96 ha of potential Greater Glider habitat, including species *Angophora leiocarpa* (Smooth Bark-Apple), *Corymbia citriodora* (Spotted Gum), *Corymbia tessellaris* (Moreton Bay Ash), *Eucalyptus siderophloia* (Grey Ironbark), *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus melanophloia* (Silver-leaved Ironbark) and *Eucalyptus tereticornis* (Forest Red Gum). This vegetation broadly meets the criteria as suitable foraging habitat for the species. However, field surveys identified that the referral area contains a relatively low abundance of large and hollow bearing trees which are known to be favoured by the species. The vegetation within the referral is not considered to facilitate dispersal for the species given surrounding properties to the west, north and east are, or are expected to be, completely cleared. The site retains marginal connectivity potential to the south however this landholding has a recent development application (12193/2023/PDA) for a large residential development. A review of the Ipswich PD online indicates no vegetation is proposed to be retained on this lot. Furthermore, Binnies Road is present to the south which is expected to be upgraded and will limit any connectivity value south and Daleys Road to the west. The *Petauroides volans* (greater glider (southern and central) Conservation Advice (DCCEEW, 2022) defines habitat critical to the survival of the Greater Glider as: • *large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees and a diverse range of the species' preferred food species in a particular region; and* • *smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonization; and* • *cool microclimate forest/woodland areas (e.g. protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes); and* • *areas identified as refuges under future climate changes scenarios; and* • *short-term or long-term post-fire refuges (i.e. unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonize burnt areas.* The overall referral area does contain potentially suitable habitat (albeit low value); however, impacts are considered relatively minor due to the area of potentially suitable habitat limited to 1.46 ha of isolated vegetation. Therefore, it is anticipated that the proposed development will not have any adverse effect on habitat critical to the survival of the species.	

Significant Impact Criteria	Assessment	Impact
5. Disrupt the breeding cycle of a population	Detailed targeted surveys did not detect any evidence of Greater Glider within the referral area, suggesting the vegetation on-site is not utilised by Greater Glider. Queensland Wildnet returned no sightings of Greater Glider within a 5 km radius of the referral area, however clusters of records occur to the north and east of the site, largely within nature reserves and conservation areas. The area of potentially suitable habitat within the referral area is limited to 1.46 ha which was identified on-ground as relatively low-value due to a low abundance of large and hollow-bearing trees. As a result, it is not considered that the proposed action would disrupt the breeding cycle of a population of Greater Glider as there is a lack of indication of breeding population on or near the site and the area is considered small and of low-value to be utilised by the species.	A significant impact is not likely
6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The proposed action will impact areas of the referral area containing eucalypt woodland, broadly considered as potential foraging habitat for the species. The presence of current highly modified areas to the north and east results in a 1.46 ha area outside disturbance buffers. No sightings of Greater Glider were detected on-site during targeted surveys nor incidental surveys. The referral area is small and consists of relatively low-value habitat for the species given the low abundance of large and hollow-bearing trees. As there is not evidence a local Greater Glider population utilises the referral area, it is not considered that the proposed action will impact the habitat on-site to the extent that the species is likely to decline.	A significant impact is not likely
7. Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The proposed action is not anticipated to significantly increase threats compared to baseline conditions as the referral area is located in a landscape that has been subject to extensive historical and contemporary modification. A number of major threats to the Greater Glider are present within the local region, including major and arterial roads and residential housing likely to have domestic dogs. Notably, analysis of motion camera data revealed Red Fox and a feral cat within the referral area, both of which are a known threat to Greater Glider populations. The proposed action is not anticipated to result in the introduction or increase of invasive species that are harmful to the Greater Glider or Greater Glider habitat as these species are already present within the referral area.	A significant impact is not likely
8. Introduce disease that may cause the species to decline, or	The project is unlikely to introduce disease into the area, and therefore no significant impact is considered to result from the proposed action.	A significant impact is not likely
9. Interfere substantially with the recovery of the species.	Detailed targeted surveys did not detect any evidence of Greater Glider within the referral area, suggesting the vegetation on-site is not utilised by Greater Glider. Queensland Wildnet returned no sightings of	A significant impact is not likely

Significant Impact Criteria	Assessment	Impact
	Greater Glider within a 5 km radius of the referral area, however clusters of records occur to the north and east of the site, largely within nature reserves and conservation areas. The recovery actions of the Greater Glider are generally around preventing impacts from fires to the species and the removal and fragmentation of habitat. The proposed action is not considered to interfere with the recovery of the species because the habitat on-site is relatively low-quality and adjacent to high levels of disturbance. In addition, the referral area contains only 1.46 ha of potentially suitable habitat outside the defined disturbance buffer which is also isolated by roads. This is an insignificant area impact within the region particularly as the species has been recorded in clusters within nature reserves and conservation parks in the broader locality where large contiguous areas of suitable vegetation area present. Hence, no significant impact is considered to result from the proposed action.	

The results of this assessment determined that it is unlikely that the proposed action will have a significant impact on Greater Glider

9. Greater Glider Records & Habitat



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Legend

- Site area
- Qld DCDB
- 20km site boundary buffer
- 5km site boundary buffer
- Greater Glider habitat
- Petauroides volans volans records within last 20 yrs (Qld WildNet 2024)
- Petauroides volans records within last 20 yrs (ALA, 2024)

Issue	Date	Description	Drawn	Checked
A	15/04/2024	Preliminary	TC	LB

0 2 4 6 km

Transverse Mercator | GDA 2020 | Zone 56 | 1:175,000 @ A3

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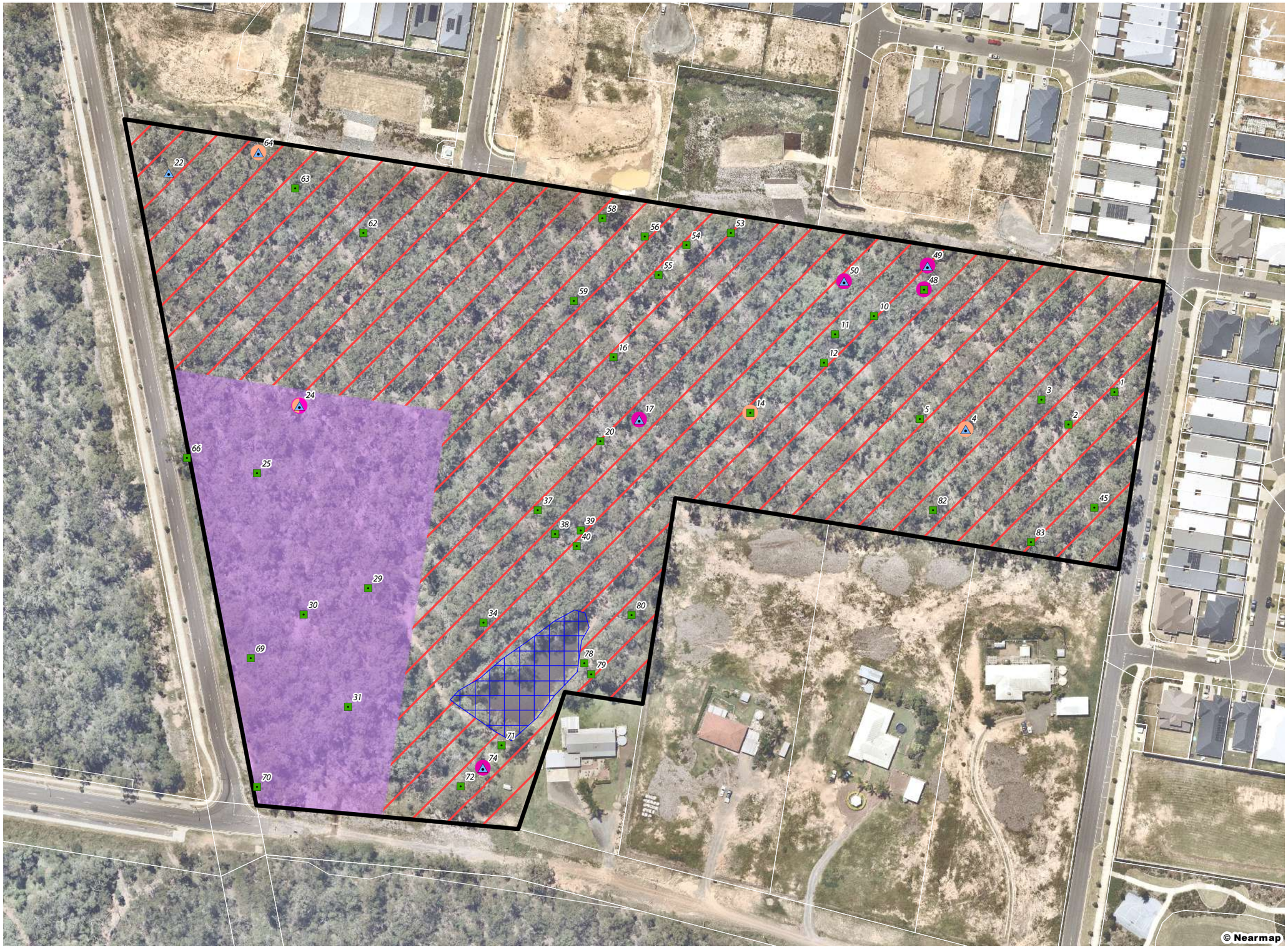
HB Land Pty Ltd

Binnies Road, Ripley

Address / RPD: 335RP814578

15/04/2024 | 11826 E 10 MNES Greater Glider Habitat A

10. MNES - Greater Glider Impact Analysis



Notes:
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Legend

- Site boundary
- Qld DCDB
- Constructed dam
- Greater Glider disturbance area (100m buffer from existing development & construction areas)
- Impacted Habitat for the Greater Glider (1.46 ha)
- Native tree with >=500mm DBH
- Stag/dead tree with >=500mm DBH
- Medium sized hollows
- Medium & large sized hollows
- Large sized hollows

Issue	Date	Description	Drawn	Checked
A	17/04/2024	Preliminary	TC	LB

0 20 40 60 m

Transverse Mercator | GDA 2020 | Zone 56 | 1:1,600 @ A3

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Binnies Road, Ripley

Address / RPD: 335RP814578

17/04/2024 | 11826 E 07 MNES GG Impacts Analysis A

8.5. *Anthochaera phrygia* (Regent Honeyeater)

8.5.1 Conservation Status

The Regent Honeyeater is listed as Critically Endangered under the EPBC Act and NCA.

8.5.2 Description

The Regent Honeyeater is a striking, predominantly black and yellow bird. Its head and neck are black, with warty pink or yellow skin around the eyes. The upperparts of its body are black and heavily scalloped with pale yellow. The breast and upper belly are black with a pale yellow to white v-shaped pattern, and the lower belly is a pure pale yellow. The wing and tail feathers have broad yellow edges.

8.5.3 Distribution

The Regent Honeyeater is endemic to mainland south-eastern Australia. It has a patchy distribution which extends from south-east Queensland, through NSW and the ACT, to central Victoria. Records are widely distributed across its range, but it only found regularly at a few localities in NSW and Victoria where most of the sightings have been recorded.

8.5.4 Habitat

The Regent Honeyeater mostly inhabits slopes of the Great Dividing Range, in areas of low to moderate relief with moist, fertile soils. It is most commonly associated with box-ironbark eucalypt woodland and dry sclerophyll forest, but also inhabits riparian vegetation such as She-oak (*Casuarina* spp.) where it feeds on needle-leaved mistletoe and sometimes breeds. Principally a canopy bird, it is reliant on select species of eucalypt and mistletoe which provide rich nectar flows. It sometimes utilises lowland coastal forest which may act as refuge when its usual habitat is affected by drought. It also uses a range of other habitats including remnant patches in farmland and urban areas, roadside reserves and travelling stock routes.

The Regent Honeyeater's movement patterns are thought to be determined by the flowering of select eucalypt species. The species is nomadic and partly migratory, with some predictable seasonal movements observed. The species is highly mobile and capable of travelling large distances; however, the regularity and extent of long-distance movements are unknown. It obtains nectar mainly from eucalypts and mistletoe and is reliant on species with reliable nectar flows. The species prefers mature trees that are taller and larger in diameter. Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. When nectar is scarce, lerp and honeydew can comprise a large proportion of the diet. Insects make up about 15% of the total diet and are important components of the diet of nestlings. Key tree species for the Regent Honeyeater include *Eucalyptus sideroxylon, Eucalyptus melliodora, Eucalyptus albens, Eucalyptus leucoxylon, Corymbia maculata/citriodora, Eucalyptus robusta, Casuarina cunninghamiana, Amyema cambagei* and *Dendropthoe vitellina* (DoE, 2016), however, other species may be regionally important. Broad-leaved Ironbark (*E. fibrosa*) can also contribute important nectar flows (DoE, 2016). Breeding habitats are restricted and patchy and occur in New South Wales and Victoria (DoE, 2016).

8.5.5 Threats

The decline of the Regent Honeyeater is thought to be mainly due to the clearing, fragmentation and degradation of its habitat. The species relies on a range of different food resources, and is particularly vulnerable to the removal of large mature trees which are important feeding and breeding habitat. Other threats include competition with other nectarivorous bird species such as the Noisy Miner or noisy friarbird for feeding and breeding areas (DoE, 2016).

8.5.6 Recovery Actions

The Regent Honeyeater has a National Recovery Plan published by the Commonwealth of Australia (2016). The National Recovery Plan aims to reverse the long-term population trend of decline and increase the numbers of Regent Honeyeaters to a level where there is a viable, wild breeding population, even in poor breeding years, and to enhance the condition of habitat across the Regent Honeyeater range to maximise survival and reproductive success, and provide refugia during periods of extreme environmental fluctuation. The strategies to achieve these objectives are:

- Action 1 – Improve the extent and quality of Regent Honeyeater habitat;
- Action 2 – Bolster the wild population with captive-bred birds until the wild population becomes self-sustaining;
- Action 3 – Increase understanding of the size, structure, trajectory and viability of the wild population; and
- Action 4 – Maintain and increase community awareness, understanding and involvement in the recovery program.

8.5.7 Significant Impact Assessment

To determine whether the proposed action is likely to have a significant impact on the Regent Honeyeater, an assessment against the *EPBC Significant Impact Guideline 1.1* is provide in
Table 16. The result of this assessment determined that a significant impact on the Regent Honeyeater are unlikely to occur.

Table 16: EPBC Significant impact criteria for critically endangered species – Regent Honeyeater

Significant Impact Criteria	Assessment	Impact
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:		
1. Lead to a long-term decrease in the size of a population	The proposed development will result in the removal of potential foraging habitat in the form of vegetation containing winter flowering eucalypt species including *Eucalyptus crebra, Eucalyptus melanophloia* and *Corymbia citriodora* specimens. Within the referral area several large, mature species which the species is known to prefer were identified. A review of the Atlas of Living Australia database identified the species presence within 5 km of the referral site (refer **Plan 11**). This sighting was recorded within the Conservation Estate to the south of the referral site. Field surveys did not detect presence or signs of the species. The suitability of the site was also considered in terms of observed habitat values. During surveys, aggressive honeyeater species *Manorina melanocephala* (Noisy Miner) was recorded. The presence of this species is likely to reduce the overall suitability of the site due to increased competition for food resources. Potential habitat for the Regent Honeyeater is limited to *Eucalyptus crebra, Eucalyptus melanophloia* and *Corymbia citriodora* specimens located across the site. Of the potential vegetation present on the referral site, the only species that occurs at dominant levels is *Corymbia citriodora*. Furthermore, the referral area generally lacked large mature species which are preferred by the species and also lacked hollow-bearing trees. Given the referral area is relatively small 7.52 ha and the availability of potentially suitable habitat within the broader locality (White Rock Conservation Park) it is considered unlikely the species would utilise vegetation within the referral area. A long-term impact on a Regent Honeyeater population may be linked to the removal of foraging habitat where fidelity has been demonstrated (DoE, 2016). The site is not located within a regular or subsidiary area used by Regent Honeyeaters for foraging and breeding. While there are records of the species presence within 5 km of the referral area, the identification was made within the Conservation area to the south of the site. Given the presence of abundant foraging habitat located proximal to the site, it is not considered that the proposed impact will lead to a long-term decrease in the size of a population.	A Significant impact not likely

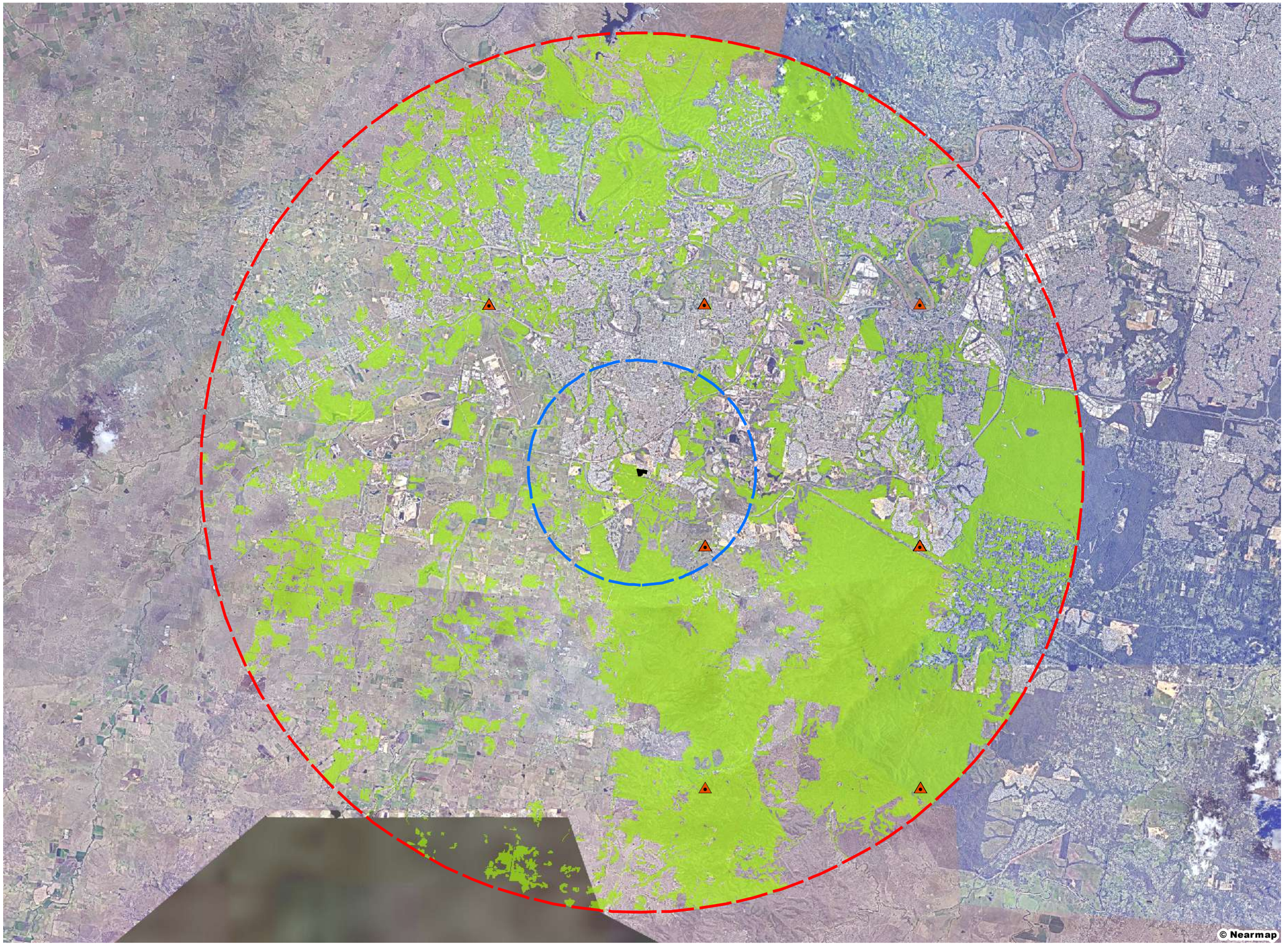
Significant Impact Criteria	Assessment	Impact
2. Reduce the area of occupancy of the species	The proposed development will result in the removal of potential foraging habitat in the form of preferred foraging species, being *Eucalyptus crebra, Eucalyptus melanophloia* and *Corymbia citriodora* species. A review of the Atlas of Living Australia database identified the species presence within 5 km of the referral site. This sighting was recorded within the Conservation Estate to the south of the referral site. Field surveys did not detect presence or signs of the species. The suitability of the site was also considered in terms of observed habitat values. During surveys, aggressive honeyeater species *Manorina melanocephala* (Noisy Miner) was recorded. The presence of this species is likely to reduce the overall suitability of the site due to increased competition for food resources. The project proposes to remove all 7.52 ha of vegetation. However, in the context of the broader locality, this area of vegetation within the referral is small. The species is far more likely to utilise large areas of continuous intact remnant vegetation associated within White Rock Conservation Park. Furthermore, the vegetation on-site is considered relatively low value due to limited mature specimens (44 trees measured at ≥500mm DBH across the referral area). It is considered that any foraging on-site would be limited to opportunistic and limited in capacity due the high level of surrounding disturbance, competitor species and the small overall area. The proposed development is therefore not considered to reduce the area of occupancy of the Regent Honeyeater.	Significant impact not likely
3. Fragment an existing population into two or more populations	The Regent Honeyeater is highly mobile and foraging habits of the species are difficult to predict. Due to the highly mobile nature of the species, the dispersal capability is unlikely to be impacted by the removal of potential foraging habitat.	Significant impact not likely
4. Adversely affect habitat critical to the survival of a species	The *National Regent Honeyeater Recovery Plan* (DoE, 2016) defines habitat critical to the survival as: • *Any breeding or foraging habitat in areas where the species is likely to occur; and* • *Any newly discovered breeding or foraging locations.* While the proposed development area contains potential foraging habitat for the species, the overall importance of the habitat is considered to be reduced. Firstly, the site is dominated by aggressive native bird species *Manorina melanocephala* (Noisy Miner) which are likely to outcompete vagrant Regent Honeyeater individuals, therefore reducing the suitability of the site and likelihood that an individual may occur; and secondly, the habitat associated with White Rock Conservation Park is considered more suitable for foraging if a Regent Honeyeater was present in the landscape. A review of the Atlas of Living	

Significant Impact Criteria	Assessment	Impact
	Australia database identified the species presence within 5 km of the referral site. This sighting was recorded within the Conservation Estate to the south of the referral site. It is considered more likely that Regent Honeyeaters would occur in the larger, more contiguous habitat present in the broader locality.	
5. Disrupt the breeding cycle of a population	The Regent Honeyeater has a patchy distribution of known breeding areas which are located in New South Wales and Victoria. The proposed development located in South East Queensland is not considered to have an impact on the breeding cycle of the Regent Honeyeater.	Significant impact not likely
6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The site contains potential foraging habitat for the Regent Honeyeater in the form of preferred *Eucalyptus crebra, Eucalyptus melanophloia* and *Corymbia citriodora* species. Field surveys identified aggressive native bird species *Manorina melanocephala* (Noisy Miner) which are likely to outcompete vagrant Regent Honeyeater individuals. Larger, more contiguous areas of habitat are present in the broader locality of the site which are more likely to be utilised by Regent Honeyeaters. It is unlikely that the removal of vegetation on-site will contribute to the decline of the Regent Honeyeater particularly due to the small referral area size and the location of large areas of contiguous foraging habitat in the broader locality.	Significant impact not likely
7. Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	It is unlikely that the proposal will introduce invasive species that are harmful to the Regent Honeyeater that are not already present within the local area.	Significant impact not likely
8. Introduce disease that may cause the species to decline	The proposed development is unlikely to introduce disease to the species.	Significant impact not likely

Significant Impact Criteria	Assessment	Impact
9. Interfere substantially with the recovery of the species	Long-term declines in the Regent Honeyeater population are attributed to broad-scale removal of preferred habitats according to the *National Recovery Plan for the Regent Honeyeater* (DoE, 2016). As such, recovery objectives for the species have focused on identifying and protecting habitat where the species is known or likely to occur. The National Recovery Plan highlights the importance of protecting high quality habitat and rehabilitating degraded habitats where the species is likely to occur. While the proposed development area contains limited foraging habitat for the species, the area lack mature specimens. Additionally, aggressive native bird species *Manorina melanocephala* (Noisy Miner) which are likely to deter vagrant Regent Honeyeater individuals are present. The overall small size of the area and low value habitat therefore reducing the suitability of the site and potential that an individual may occur. It is considered more likely that Regent Honeyeaters if present in the landscape, would occur in the larger, more contiguous habitat present in the broader locality.	Significant impact not likely

The results of this assessment determined that it is unlikely that the proposed action will have a significant impact on Regent Honeyeater

11. Regent Honeyeater Records & Foraging Habitat



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Legend

- Site area
- Qld DCDB
- 20km site boundary buffer
- 5km site boundary buffer
- Regent Honeyeater foraging habitat
- Regent Honeyeater records within last 20 yrs (ALA, 2024) *not actual sighting locations. sightings have be generalised to a 2km grid to protected species.

Issue	Date	Description	Drawn	Checked
A	15/04/2024	Preliminary	TC	LB

0 2 4 6 km

Transverse Mercator | GDA 2020 | Zone 56 | 1:175,000 @ A3

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Binnies Road, Ripley

Address / RPD: 335RP814578

15/04/2024 | 11826 E 11 MNES RHE Habitat A

8.6. *Hirundapus caudacutus* (White-throated Needletail)

8.6.1 Conservation Status

The White-throated Needletail is listed as Vulnerable under the EPBC Act and NCA.

8.6.2 Description

The White-throated Needletail is a large swift with a thickset, cigar-shaped body, stubby tail and long pointed wings (20 cm in length and approximately 115–120 g in weight). Sexes are alike, with no seasonal variation in plumage. The adults have a dark-olive head and neck, with an iridescent gloss on the crown; the mantle and the back are paler, greyish; and the upperwings are blackish, sometimes with a greenish gloss, with a contrasting white patch at the base of the trailing edge; the uppertail is black with a greenish gloss.

8.6.3 Distribution

White-throated Needletails are widespread in eastern and south-eastern Australia. In eastern Australia, the species is recorded in all coastal regions of Queensland and New South Wales, extending inland to the western slopes of the Great Dividing Range and occasionally onto the adjacent inland plains. Further south on the mainland, it is widespread in Victoria, though more so on and south of the Great Dividing Range, and there are few records in western Victoria. The species occurs in adjacent areas of south-eastern South Australia, where it extends west to the Yorke Peninsula and the Mount Lofty Ranges. It is widespread in Tasmania.

8.6.4 Habitat

The White-throated Needletail is almost exclusively aerial which affects the ease of conventional habitat descriptions. Although they occur over most types of habitats, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps. White-throated Needletails almost always forage aerially, feeding primarily on insects, at heights up to 'cloud level', above a wide variety of habitats ranging from heavily treed forests to open habitats, such as farmland, heathland or mudflats. White-throated Needletails are known to roost in woodland and forest habitat, amongst canopy or in hollows. Being a migratory species, breeding habitat is located in the northern hemisphere.

8.6.5 Threats

In Australia, threats to the species include loss of invertebrate prey attributed to insecticide use and removal of woodland habitats that support prey species. Other potential threats include collision with infrastructure such as wind turbines, overhead wires, windows and lighthouses.

8.6.6 Recovery Actions

There is no recovery plan in place for the species. Conservation actions for the White-throated Needletail include international coordination with countries in East Asia to protect key breeding habitats and at a national scale, protecting important habitats in Australia.

8.6.7 Significant Impact Assessment

Refer to

Table 17 **for assessment against the significant impact criteria. The project is not considered likely to have a significant impact on the White-throated Needletail.**

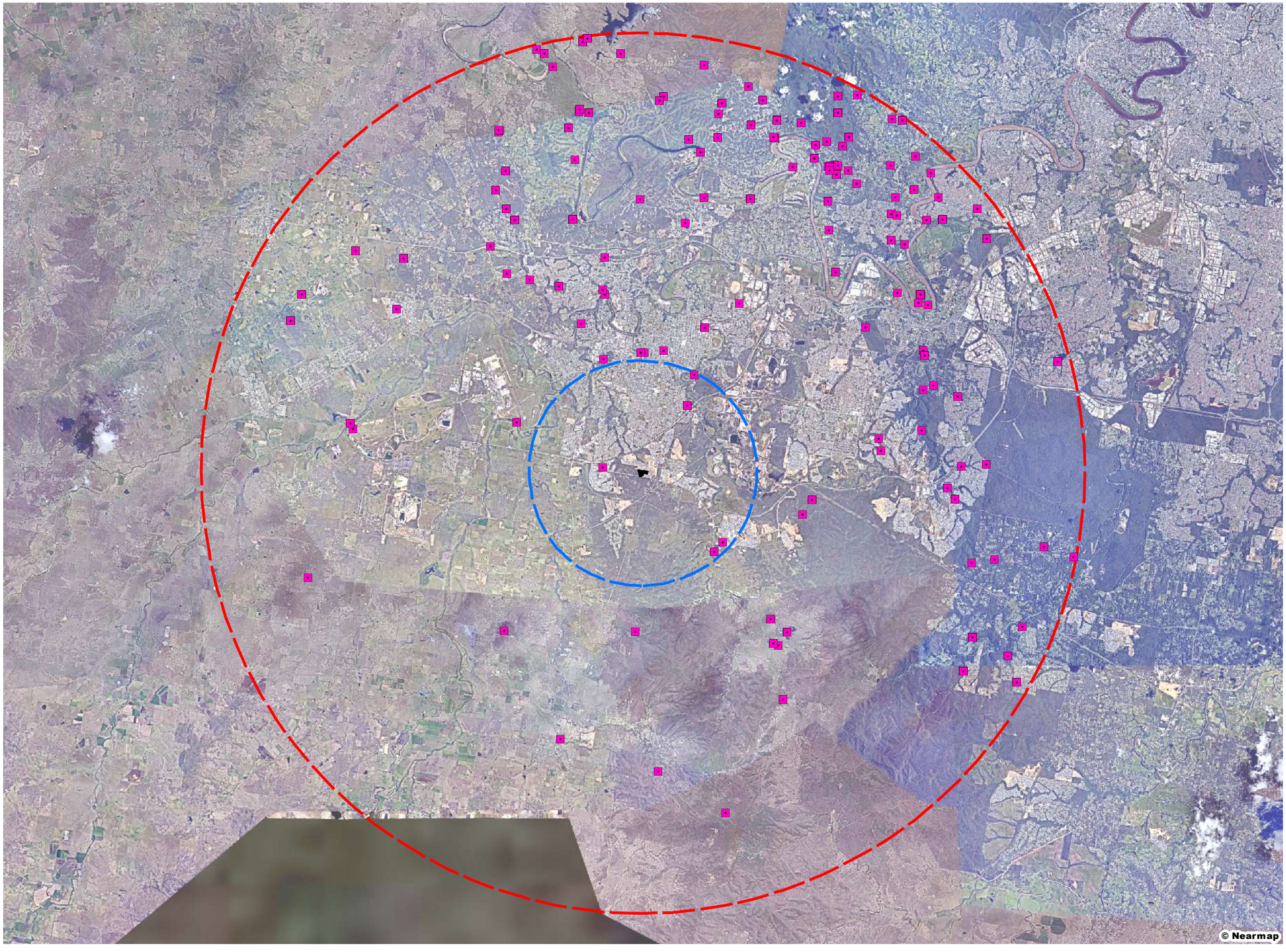
Table 17: EPBC Significant impact criteria for vulnerable species – White-throated Needletail

Significant Impact Criteria	Assessment	Impact
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
1. Lead to a long-term decrease in the size of an important population	The referral area is mapped predominantly as remnant vegetation. White-throated Needletails, being highly mobile and being predominantly aerial including while foraging, are unlikely to focus solely on one area of habitat. Potential foraging habitat for the White-throated Needletail is located on-site in the form of remnant eucalypt woodland. However, the overall small area of the project combined with limited mature hollow bearing trees for roosting indicates this vegetation is unlikely to be utilised by the species. Futhremore, areas of intact continuous habitat are present within the broader locality, notably at White Rock Conservation Park to the east. While there are several records of the species within 5km of the referral area, many of these are date records (>20 years old). The species was not observed during field surveys. The proposed development is unlikely to have a significant impact on the ability of White-throated Needletails to forage or roost in the landscape and, therefore; is not anticipated to lead to a long-term decrease in the size of an important population.	Significant impact not likely
2. Reduce the area of occupancy of an important population of the species	White-throated Needletails are predominantly aerial, however, require dense eucalypt woodland or hollows for roosting. Site surveys identified eucalypt woodland although habitat trees and mature specimens were limited. While there are several records of the species within 5km of the referral area, many of these are date records (>20 years old) (refer **Plan 12**). Thes species was not recorded within, or adjacent to, the referral area during field surveys. It is considered unlikely that the small referral area (7.52ha) would be utlised by the species in the context of the broader locality. Specifically, it is considered that areas of intact continuous habitat are present within the broader locality, notably at White Rock Conservation Park to the east. The area of occupancy of the White-throated Needletail is not anticipated to be significantly reduced as a result of the proposal due to the highly mobile nature of the species and location of large areas of contiguous habitat within the locality.	Significant impact not likely
3. Fragment an existing important population into two or more populations	White-throated Needletails are highly mobile and therefore do not require connected vegetation for dispersal. There is no evidence the vegetation within the referral area would be utlised by the species nor is it expected to be given the small overall area and availability of more suitable habitat in the broader locality.	Significant impact not likely

Significant Impact Criteria	Assessment	Impact
	It is therefore considered unlikely that the proposed action will fragment an existing population into tow or more populations.	
4. Adversely affect habitat critical to the survival of a species	The vegetation within the referral is considered unlikely to be utilised by the species given the small overall area and lack of mature trees. As such the proposed removal of this vegetation is not considered to aadversely affect habitat critical to the survival of a species	Significant impact not likely
5. Disrupt the breeding cycle of an important population	The White-throated Needletail breeds in East Asia. Therefore, the proposed development will not affect the breeding cycle of the White-throated Needletail.	Significant impact not likely
6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The White-throated Needletail is highly mobile and is able to forage over large expanses, thus reducing the individual importance of selected habitat fragments. The surrounding locality provides more substantial habitat including large contiguous vegetation areas which would adequately fulfil the foraging requirements of the species. As it is unlikely the species will utilise the small area of potentially suitable foraging habitat associated with the referral area, is it considered unlikely that the project would decrease the availability of habitat to the extent the species would decline.	Significant impact not likely
7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	It is unlikely the proposed development would introduce an invasive species that would harm or displace the White-throated Needletail.	Significant impact not likely
8. Introduce disease that may cause the species to decline	It is unlikely the proposed development would introduce disease that would harm the White-throated Needletail.	Significant impact not likely
9. Interfere substantially with the recovery of the species	According to the *Hirundapus caudacutus* Conservation Advice, recovery actions within Australia focus on identifying areas of vegetation to protect that may provide important foraging and roosting habitat. The proposed development will remove an area of potential foraging and roosting habitat for the White-throated Needletail; however, it is unlikely to form important foraging and roosting habitat given the level of surrounding disturbance. Due to the highly mobile nature of the species and the presence of large areas of potential habitat in the locality such, it is not considered that the proposal will interfere substantially with the recovery of the species.	Significant impact not likely

The results of this assessment determined that it is unlikely that the proposed action will have a significant impact on White-throated Needletail

12. White-throated Needletail Records



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Legend

- Site area
- Qld DCDB
- 20km site boundary buffer
- 5km site boundary buffer
- White-throated needletail records within last 20 yrs (ALA, 2024)

Issue	Date	Description	Drawn	Checked
A	16/04/2024	Preliminary	TC	LB

0 2 4 6 km

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9. EPBC Act Determination Advice

9.1. EPBC Act Significant Impact Guidelines

This ecological assessment has identified Matters of National Environmental Significance (MNES) recorded or predicted to potentially occur on or near the referral area. It presents the design and mitigation measures employed to avoid and minimise project related impacts to the matters of conservation significance and quantifies the extent of potential residual impacts.

Desktop assessments and field surveys identified five (5) fauna species as having potential to utilise vegetation within the referral area. However, the overall small area or relatively low-value habitat (7.52 ha) and the location of the referral area adjacent to roads, residential developments and other high disturbed areas indicates a low potential to impact on MNES. A significant impact assessment was carried out for each of these 5 species, which concluded that the project has a '**low' potential to cause a significant impact on MNES as defined under significant impact guidelines** and therefore the Proposed Action is recommended as a **Not a Controlled Action.**

10. Appendices

Appendix A

EPBC Act Protected Matters Search Tool Results

Appendix B

NCA Wildlife Online Search Results

Appendix C

Likelihood of Occurrence Assessment

Appendix D

Flora Species Lists

Appendix E

SAT survey results

Appendix A

EPBC Act Protected Matters Search Tool Results

Australian Government

Department of Climate Change, Energy, the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 11-Mar-2024

Summary

Details

- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat

Acknowledgements

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	7
Listed Threatened Species:	49
Listed Migratory Species:	15

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	27
Commonwealth Heritage Places:	None
Listed Marine Species:	21
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	1
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	46
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity	Buffer Status
Moreton bay	30 - 40km upstream from Ramsar site	In feature area

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area	In feature area
Grey box-grey gum wet forest of subtropical eastern Australia	Endangered	Community likely to occur within area	In buffer area only
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may occur within area	In feature area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community may occur within area	In feature area
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	Endangered	Community likely to occur within area	In feature area
Swamp Tea-tree (Melaleuca irbyana) Forest of South-east Queensland	Critically Endangered	Community likely to occur within area	In feature area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour may occur within area	In feature area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Climacteris picumnus victoriae Brown Treecreeper (south-eastern) [67062]	Vulnerable	Species or species habitat may occur within area	In feature area
Cyclopsitta diophthalma coxeni Coxen's Fig-Parrot [59714]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat likely to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area	In feature area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Grantiella picta](#) Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area	In feature area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Lathamus discolor](#) Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area	In feature area
[Stagonopleura guttata](#) Diamond Firetail [59398]	Vulnerable	Species or species habitat may occur within area	In feature area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area	In feature area
[Turnix melanogaster](#) Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area	In feature area
FISH			
[Neoceratodus forsteri](#) Australian Lungfish, Queensland Lungfish [67620]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
INSECT			
[Argynnis hyperbius inconstans](#) Australian Fritillary [88056]	Critically Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
[Chalinolobus dwyeri](#) Large-eared Pied Bat, Large Pied Bat [183]	Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Dasyurus hallucatus			
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area	In feature area
Dasyurus maculatus maculatus (SE mainland population)			
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area	In feature area
Macroderma gigas			
Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
Petauroides volans			
Greater Glider (southern and central) [254]	Endangered	Species or species habitat likely to occur within area	In feature area
Petaurus australis australis			
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Petrogale penicillata			
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area	In feature area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)			
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area	In feature area
Potorous tridactylus tridactylus			
Long-nosed Potoroo (northern) [66645]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Pteropus poliocephalus			
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area	In feature area
PLANT			
Arthraxon hispidus			
Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area	In feature area
Bosistoa transversa			
Three-leaved Bosistoa, Yellow Satinheart [16091]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Coleus habrophyllus listed as Plectranthus habrophyllus [91378]	Endangered	Species or species habitat known to occur within area	In feature area
Cupaniopsis shirleyana Wedge-leaf Tuckeroo [3205]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Cupaniopsis tomentella Boonah Tuckeroo [3322]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Dichanthium setosum bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Fontainea venosa [24040]	Vulnerable	Species or species habitat may occur within area	In feature area
Notelaea lloydii Lloyd's Olive [15002]	Vulnerable	Species or species habitat known to occur within area	In feature area
Notelaea x ipsviciensis listed as Notelaea ipsviciensis Cooneana Olive [93460]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Picris evae Hawkweed [10839]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Planchonella eerwah Shiny-leaved Condoo, Black Plum, Wild Apple [17340]	Endangered	Species or species habitat may occur within area	In feature area
Rhaponticum australe Austral Cornflower, Native Thistle [22647]	Vulnerable	Species or species habitat may occur within area	In feature area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Rhodomyrtus psidioides](#) Native Guava [19162]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Samadera bidwillii](#) Quassia [29708]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Thesium australe](#) Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area	In feature area
REPTILE			
[Delma torquata](#) Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Furina dunmalli](#) Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area	In feature area
[Hemiaspis damelii](#) Grey Snake [1179]	Endangered	Species or species habitat likely to occur within area	In feature area

Listed Migratory Species		[Resource Information]	
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
[Cuculus optatus](#) Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat known to occur within area	In feature area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat known to occur within area	In feature area
[Symposiachrus trivirgatus as Monarcha trivirgatus](#) Spectacled Monarch [83946]		Species or species habitat known to occur within area	In feature area
Migratory Wetlands Species			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat known to occur within area	In buffer area only
[Tringa nebularia](#) Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area	In feature area

Other Matters Protected by the EPBC Act

Commonwealth Lands [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Commonwealth Land Name	State	Buffer Status
Defence		
Defence - AMBERLEY - AP3 REMOTE RECEIVERS SITE [31478]	QLD	In buffer area only
Defence - AMBERLEY - AP3 REMOTE RECEIVERS SITE [31479]	QLD	In buffer area only
Defence - AMBERLEY - AP89 BUFFER ZONE [31944]	QLD	In buffer area only
Defence - AMBERLEY - AP89 BUFFER ZONE [31943]	QLD	In buffer area only
Defence - AMBERLEY - AP89 BUFFER ZONE [31942]	QLD	In buffer area only
Defence - AMBERLEY - AP89 BUFFER ZONE [31941]	QLD	In buffer area only
Defence - AMBERLEY - AP89 BUFFER ZONE [31940]	QLD	In buffer area only
Defence - AMBERLEY - AP89 BUFFER ZONE [31938]	QLD	In buffer area only
Defence - AMBERLEY - AP89 BUFFER ZONE [31939]	QLD	In buffer area only
Defence - AMBERLEY - AP90 SMALL ARMS RANGE (PURGA) [31817]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31807]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31806]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31802]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31805]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31810]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31800]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31801]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31808]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31809]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31799]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31798]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31813]	QLD	In buffer area only

Commonwealth Land Name	State	Buffer Status
Defence - AMBERLEY - RAAF BASE [31812]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31811]	QLD	In buffer area only
Defence - AMBERLEY - RAAF BASE [31794]	QLD	In buffer area only
Defence - Commonwealth Centre - 3rd Floor [31877]	QLD	In buffer area only
Defence - IPSWICH TRAINING DEPOT [31953]	QLD	In buffer area only

Listed Marine Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area	In feature area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Pterodroma cervicalis White-necked Petrel [59642]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat known to occur within area overfly marine area	In feature area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Denmark Hill	Conservation Park	QLD	In buffer area only

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Australian Super Hornet Flying Operations at RAAF Base Amberley	2008/4410		Post-Approval	In buffer area only
AW Bidco 6 Pty Ltd - Urban Development Project	2023/09690		Referral Decision	In buffer area only
Bryants Road Residential Development	2023/09484		Assessment	In buffer area only
Greater Brisbane Greyhound Centre	2022/09321		Completed	In buffer area only
Greater Brisbane Greyhound Centre	2022/09252		Completed	In buffer area only
Redbank Plains Industrial Development	2023/09705		Referral Decision	In buffer area only
South Ripley Residential Development	2023/09656		Assessment	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Controlled action				
AV JENNINGS PTY LTD - Coleman Road, South Ripley - Residential Development	2021/9061	Controlled Action	Assessment Approach	In buffer area only
Casino Ipswich Pipeline	2007/3877	Controlled Action	Completed	In feature area
CROCODILE 03 Military Training Exercise	2002/888	Controlled Action	Post-Approval	In buffer area only
ECCO Ripley Residential Development, Ipswich, QLD	2015/7513	Controlled Action	Post-Approval	In buffer area only
Grampian Drive Deebing Heights Residential Development, Qld	2015/7628	Controlled Action	Post-Approval	In buffer area only
Hayfield School Site	2021/9070	Controlled Action	Assessment Approach	In buffer area only
Paradise Waters Residential Estate, Gampian Drive, Deebing Heights	2013/6864	Controlled Action	Post-Approval	In buffer area only
Providence West Residential Development	2020/8698	Controlled Action	Further Information Request	In buffer area only
Residential development, Rawlings Road, Ripley Valley	2016/7723	Controlled Action	Post-Approval	In buffer area only
Residential Development, Ripley	2020/8791	Controlled Action	Assessment Approach	In buffer area only
Ripley Road Residential Development	2019/8539	Controlled Action	Post-Approval	In feature area
Ripley Road residential development, Ripley Valley, Qld	2017/8095	Controlled Action	Post-Approval	In feature area
Ripley View Residential Subdivision	2020/8615	Controlled Action	Further Information Request	In buffer area only
Southern Regional Water Pipeline	2006/2593	Controlled Action	Post-Approval	In buffer area only
Talisman Saber 2005 Military Exercise	2004/1819	Controlled Action	Post-Approval	In buffer area only
Not controlled action				
Aerospace and Defence Support Centre - Amberley	2010/5579	Not Controlled Action	Completed	In buffer area only
Blackstone Power Station	2012/6252	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
BrisWest Holdings - Release 5 Operational Works	2021/9086	Not Controlled Action	Completed	In buffer area only
Daleys Road Residential Development	2010/5638	Not Controlled Action	Completed	In feature area
Divestment of Ipswich Post Office	2006/2750	Not Controlled Action	Completed	In buffer area only
Grampian Drive residential development, Deebing Heights, Qld	2016/7634	Not Controlled Action	Completed	In buffer area only
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Inland Rail Gowrie to Kagaru Geotechnical Project, QLD	2018/8263	Not Controlled Action	Completed	In buffer area only
Master planned residential community, Ripley Valley, QLD	2014/7325	Not Controlled Action	Completed	In buffer area only
Northern Link Parallel Road Tunnels Project	2007/3824	Not Controlled Action	Completed	In buffer area only
REMONDIS Waste to Energy Facility	2020/8806	Not Controlled Action	Completed	In buffer area only
Removal of Grey-headed Flying-fox Habitat	2005/2137	Not Controlled Action	Completed	In feature area
Residential/Commercial development Binnies Road, Ripley, Qld	2016/7669	Not Controlled Action	Completed	In feature area
Residential Subdivision on Monterea Road, Ripley	2012/6644	Not Controlled Action	Completed	In feature area
Ripley Town Centre,Ipswich, QLD	2015/7471	Not Controlled Action	Completed	In buffer area only
South West Transport Corridor	2006/2547	Not Controlled Action	Completed	In feature area
Swanbank Gas Fired Combined Cycle Plant	2008/4087	Not Controlled Action	Completed	In buffer area only
Swanbank Waste Management Facility Stage 1B extension Area, Qld	2015/7581	Not Controlled Action	Completed	In buffer area only
To develop the Paradise Heights residential subdivision, QLD	2014/7310	Not Controlled Action	Completed	In buffer area only
Underground Bus and Train Project, Brisbane	2013/7106	Not Controlled Action	Completed	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action (particular manner)				
168 Lot Residential and Commercial Development at Deebing Heights	2009/4818	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Construction & Operation 275/330kV Transmission Line	2006/2820	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Cross River Rail	2010/5427	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Paper Mill	2003/915	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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Appendix B

NCA Wildlife Online Search Results

Queensland Government

WildNet species list

Search Criteria: Species List for a Specified Point
Species: All
Type: Native
Queensland status: Rare and threatened species
Records: Confirmed
Date: Since 1980
Latitude: -27.6696
Longitude: 152.7705
Distance: 5
Email: josephinegeffen@saundershavill.com
Date submitted: Monday 11 Mar 2024 13:25:13
Date extracted: Monday 11 Mar 2024 13:30:03

The number of records retrieved = 7

Disclaimer
Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, the State of Queensland makes no statements, representations or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.
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Information about your Species lists request is logged for quality assurance, user support and product enhancement purposes only.
The information provided should be appropriately acknowledged as being derived from WildNet database when it is used. As the WildNet Program is still in a process of collating and vetting data, it is possible the information given is not complete. Go to the WildNet database webpage (https://www.qld.gov.au/environment/plants-animals/species-information/wildnet) to find out more about WildNet and where to access other WildNet information products approved for publication. Feedback about WildNet species lists should be emailed to wildlife.online@des.qld.gov.au.

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Apodidae	*Hirundapus caudacutus*	white-throated needletail		V	V	2
animals	birds	Rostratulidae	*Rostratula australis*	Australian painted-snipe		E	E	3
animals	mammals	Phascolarctidae	*Phascolarctos cinereus*	koala		E	E	126
plants	land plants	Cupressaceae	*Callitris baileyi*	Bailey's cypress		NT		1/1
plants	land plants	Lamiaceae	*Coleus habrophyllus*			E	E	1/1
plants	land plants	Myrtaceae	*Melaleuca irbyana*			E		7/6
plants	land plants	Poaceae	*Calyptochloa gracillima subsp. ipsviciensis*			CR		4/4

CODES

I - Y indicates that the taxon is introduced to Queensland and has naturalised.

Q - Indicates the Queensland conservation status of each taxon under the *Nature Conservation Act 1992.*
The codes are Extinct (EX), Extinct in the Wild (PE), Critically Endangered (CR), Endangered (E), Vulnerable (V), Near Threatened (NT), Special Least Concern (SL) and Least Concern (C).

A - Indicates the Australian conservation status of each taxon under the *Environment Protection and Biodiversity Conservation Act 1999.*
The values of EPBC are Extinct (EX), Extinct in the Wild (XW), Critically Endangered (CE), Endangered (E), Vulnerable (V) and Conservation Dependent (CD).

Records - The first number indicates the total number of records of the taxon (wildlife records and species listings for selected areas).
This number is output as 99999 if it equals or exceeds this value. A second number located after a / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Appendix C

Likelihood of Occurrence Assessment

Likelihood of occurrence	Assessment criteria
Unlikely	No previous records of the species within the locality and one or more of the following criteria is met: • Not previously recorded on the referral area and surrounds and the referral area is beyond the current known geographic range; or • Dependent on specific habitat types or resources that are not present on the referral area; or • Considered extinct in the wild.
Low	No previous records of the species within the locality and one or more of the following criteria is met: • Site and local connectivity contains marginal habitat excluding suitable/critical habitat attributes; • Lack of recent records exist in a regional context (use 1980 as a delineation); or • Potential for vagrant or individual of the species to survive short-term;
Moderate	Species previously recorded within the locality and one or more of the following criteria is met: • Previously recorded in proximity to the referral area (*i.e.,* vagrant individuals); or • Potential habitat typologies or resources are present on the referral area.
High	Species previously recorded within the locality and one or more of the following criteria is met: • Previously recorded on the referral area; • Dependent on habitats or habitat resources that are available on the referral area; or • Suitable habitats are available on the referral area that are capable of supporting a resident population or individuals of the species.
Known	Flora species or ecological community positively identified during field surveys within the referral area. Fauna species positively recorded during field surveys within the referral area or adjacent habitats.

Matters of National Environmental Significance						
Name	**Status**	**Type of presence**	**Description of the community/preferred habitat**	**Likelihood of Occurrence Analysis**	**Desktop Likelihood of occurrence (on-site)**	**Field Survey Confirmed Likelihood of occurrence (on-site)**
Wetlands of International Importance (Ramsar)						
Moreton Bay			The site is located approximately 30-40 kilometres south-west of Moreton Bay.	There will be no measurable affect to Moreton Bay.	Unlikely	Unlikely
Threatened Ecological Communities						
Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community	E	Community may occur within area	In Queensland, this ecological community coincides with two regional ecosystem communities including Of Concern RE12.1.1 (*Casuarina glauca* +/- mangroves woodland) as well as areas where the canopy is dominated by *Casuarina glauca* within 12.3.20 (*Melaleuca quinquenervia, Casuarina glauca +/- Eucalyptus tereticornis, Eucalyptus siderophloia* open forest on low coastal alluvial plains).	Desktop analysis and field surveys confirmed that regional ecosystems 12.1.1 and 12.3.20 do not occur on-site.	Unlikely	Unlikely
Grey box-grey gum wet forest of subtropical eastern Australia	E	Community likely to occur within area	Grey box-grey gum wet forest of subtropical eastern Australia is described as a forest where the canopy dominated by its characteristic Eucalyptus species (being *Eucalyptus moluccana* or *Eucalyptus propinqua* less commonly *Eucalyptus punctata*) with or without *Araucaria cunninghamii* (hoop pine) and with an understorey that typically includes significant cover of species with drier vine-forest (rainforest) affiliations. In Queensland REs	Desktop analysis and field surveys confirmed that regional ecosystems 12.9-10.3 and 12.8.14a do not occur on-site.	Unlikely	Unlikely

			likely to represent or contain the ecological community includes RE 12.9-10.3 and 12.8.14a.			
Lowland rainforest of subtropical Australia	CE	Community may occur within area	This TEC occurs mainly on basalt and alluvial soils and is characteristic of a low abundance of *Eucalyptus, Melaleuca* and *Casuarina* species. Specimens with buttress roots and a diversity of vines are common throughout this TEC. This community is usually associated with REs 12.3.1 (more recently mapped as 12.3.16), 12.5.13, 12.8.3, 12.8.4, 12.8.13, 12.11.1, 12.11.10, 12.12.1, and 12.12.16.	Desktop analysis and field surveys confirmed that regional ecosystems 12.3.1, 12.5.13, 12.8.3, 12.8.4, 12.8.13, 12.11.1, 12.11.10, 12.12.1, and 12.12.16 do not occur on-site.	Unlikely	Unlikely
Poplar Box Grassy Woodland on Alluvial Plains	E	Community may occur within area	The Poplar Box Grassy Woodland on Alluvial Plains ecological community is typically a grassy woodland with a canopy dominated by *Eucalyptus populnea* and understorey mostly of grasses and other herbs. The ecological community mostly occurs in gently undulating to flat landscapes and occasionally on gentle slopes on a wide range of soil types of alluvial and depositional origin. In Queensland, this TEC corresponds with 11.3.2, 11.3.17, 11.3.7, 11.4.12 and 12.3.10.	Desktop analysis and field surveys confirmed that regional ecosystems 11.3.2, 11.3.17, 11.3.7, 11.4.12 and 12.3.10 do not occur on-site.	Unlikely	Unlikely
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	E	Community likely to occur within area	This ecological community is found on alluvial landforms, including floodplains, the riparian zones of parent rivers and other order tributaries, alluvial flats, floodplain/alluvial terraces and periodically flooded depressions. The structure of this TEC varies from tall open forest to woodland. The canopy is dominated by eucalypts and/or other myrtaceous trees, (specifically from *Angophora*, *Corymbia*, *Lophostemon* and *Syncarpia* genera). A mid-layer or sub-canopy of small trees may be present – with scattered to dense shrubs. For example, Melaleuca, Leptospermum and related genera may form dense thickets beneath the main canopy, or in gaps between canopy trees. Typical examples of tree species include *Corymbia intermedia* (Pink Bloodwood), *Eucalyptus bancroftii* (Bancroft's Red Gum), *E. moluccana* (Grey Box), *E. grandis* (Flooded Gum), *E. siderophloia*	Desktop analysis and field surveys confirmed that regional ecosystems 12.3.2, 12.3.2a, 12.3.3, 12.3.3a, 12.3.3b, 12.3.3d, 12.3.4a, 12.3.7, 12.3.7c, 12.3.7d, 12.3.10, 12.3.11, 12.3.11a, 12.3.11b, 12.3.12, 12.3.14a, 12.3.15, and 12.3.19 do not occur on-site.	Unlikely	Unlikely

			(Grey Ironbark), and *E. tereticornis* (Forest Red Gum). In Queensland *Syncarpia glomulifera* (Turpentine) may also dominate, or co-dominate. Regional Ecosystems generally associated with this TEC where key diagnostic characteristics are met include RE 12.3.2, 12.3.2a, 12.3.3, 12.3.3a, 12.3.3b, 12.3.3d, 12.3.4a, 12.3.7, 12.3.7c, 12.3.7d, 12.3.10, 12.3.11, 12.3.11a, 12.3.11b, 12.3.12, 12.3.14a, 12.3.15, 12.3.19.			
Swamp Tea-tree (*Melaleuca irbyana*) Forest of South-east Queensland	CE	Community likely to occur within area	Low open forest dominated by dense thickets of Swamp Teatree, usually growing to about 8-12 m high. In south-east Queensland, Swamp Tea-tree occurs in monotypic stands uniquely linked to Tea Tree Clay soils which drain slowly after heavy rains, becoming waterlogged and forming temporary ponds. This ecological community comprises Queensland regional ecosystems 12.9-10.11 and 12.9-10.11a (more recently mapped as RE 12.3.27) (Land Zone 9-10) and 12.3.3c (more recently remapped as RE12.3.18 (Land Zone 3) which are listed as endangered under the VMA.	Desktop analysis and field surveys confirmed that regional ecosystem 12.9-10.11, 12.9-10.27 and 12.3.18 do not occur on-site.	Unlikely	Unlikely
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CE	Community may occur within area	Box – Gum Grassy Woodlands and Derived Grasslands are characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, and the dominance, or prior dominance, of White Box, Yellow Box or Blakely's Red Gum trees. In Queensland the ecological community is a primary component of the following Regional Ecosystems: 11.8.2a, 11.8.8, 11.9.9a, 13.3.1, 13.11.8, 13.12.8 and 13.12.9. It can also be a smaller component of the following regional ecosystems: 11.3.23, 12.8.16 (only at the far western edge of the bioregion), 13.3.4, 13.11.3 and 13.11.4. These regional ecosystems range in conservation status from 'not of concern at present' to 'endangered'.	Desktop analysis and field surveys confirmed that regional ecosystems 11.8.2a, 11.8.8, 11.9.9a, 13.3.1, 13.11.8, 13.12.8 and 13.12.9, 11.3.23, 12.8.16, 13.3.4, 13.11.3 and 13.11.4 do not occur on-site.	Unlikely	Unlikely

Scientific name	**Common name**	**Listing Status***		**EPBC code**	**Habitat and Distribution**	**Likelihood of Occurrence Analysis**	**Desktop Likelihood of occurrence (on-site)**	**Field Survey Confirmed Likelihood of occurrence (on-site)**
		EPBC Act	**NC Act**					
Birds								
Anthochaera phrygia	Regent Honeyeater	CE	E	82338	Regent Honeyeaters mostly occur in dry Box-Ironbark Eucalypt woodland and dry sclerophyll forest associations in areas of low to moderate relief, wherein they prefer moister, more fertile sites. These areas are generally associated with creek flats and river valleys and foothills. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. They are a generalist forager, which mainly feed on nectar from a wide range of eucalypts and mistletoes.	A review of the Atlas of Living Australia (ALA) database confirms that the species has been recorded within 5km of the site. The site does contain *Eucalyptus crebra* (Narrow-leaved Ironbark) however this species is not dominant. The referral area does contain suitable habitat for the Regent Honeyeater in the form of *Corymbia citriodora* dominated woodland. However, the site is surrounded by high levels of disturbance and Regent Honeyeaters experience competition from aggressive species such as Noisy Miner (*Manorina melanocephala)*. Noisy Miners were observed to be utilising the vegetation on-site which may reduce potential for Regent Honeyeaters to opportunistically forage on-site.	Moderate	Moderate

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
						Overall, suitable habitat is present within the referral area however given the small overall area and presence of competitor species, there is a moderate likelihood that the species would occur on-site.		
Botaurus poiciloptilus	Australasian Bittern	E	E	1001	The Australasian Bittern occurs in terrestrial wetlands and, rarely, estuarine habitats, mainly in the temperate south-east and south-west. It favours wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. It favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and / or reeds or cutting grass growing over muddy or peaty substrate. The Australasian Bittern occurs in the far south-east of Queensland; it has been reported North to Baralaba and West to Wyandra, although in most years it is probably confined to a few coastal swamps. It is rarely recorded in Queensland, and possibly survives only in protected areas such as the Cooloola and Fraser regions.	This site does not contain any terrestrial wetlands or swamps with tall dense vegetation. A large, constructed dam occurs on site which contains limited dense macrophyte vegetation or overhanging terrestrial vegetation. Given the lack of suitable habitat, the lack of local records, and the rarity of the species in Queensland, it is considered unlikely that this species would occur on-site.	Low	Unlikely

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
Calidris acuminata	Sharp-tailed Sandpiper	V	SL	874	In Australia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh, and beach cast algae / seaweed 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. They use flooded paddocks, sedgelands and other ephemeral wetlands, but leave when they dry. They use intertidal mudflats in sheltered bays, inlets, estuaries or seashores, and also swamps and creeks lined with mangroves.	A large, constructed dam occurs on site which contains limited dense macrophyte vegetation or overhanging terrestrial vegetation. Additionally, the Sharp-tailed Sandpiper is regarded as a marine species and is highly unlikely to occur inland as far as this site is located as evidenced by the lack of records within the locality.	Low	Unlikely
Calidris ferruginea	Curlew Sandpiper	CE	E	856	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. In Queensland, scattered records occur in the Gulf of Carpentaria,	No suitable foraging or breeding habitat in the form of wetlands and mudflats occurs on-site. A large, constructed dam occurs on site however contains limited bare edges of mud and sand. Additionally, this species is more likely to occur along coastal areas, with no records of the species within 5km of the site.	Low	Unlikely

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
					with widespread records along the coast south of Cairns.			
Calyptorhynchus lathami lathami	Glossy Black-cockatoo	V	V	67036	This species prefers woodland areas dominated by she-oak Allocasuarina, or open sclerophyll forests and woodlands with a stratum of Allocasuarina beneath Eucalyptus, Corymbia or Angophora. Glossy black-cockatoos have also been observed in mixed Allocasaurina, Casuarina, cypress Callitris and brigalow *Acacia harpophylla* woodland assemblages. In SEQ west of the Great Dividing Range, they have been observed feeding in remnant belah *Casuarina cristata* and bulloak *Allocasuarina luehmannii* forests. This species is also known to utilise appropriate remnant woodlands, and individual or small pockets of Allocasuarina and Casuarina feed trees in urban areas.	This species' preferred vegetation composition dominated by *Allocasuarina* or *Casuarina* trees is absent from site with only scattered . Additionally, only 9 trees were observed as containing hollows across the referral area. Therefore, the referral area does not provide foraging or breeding habitat. There are no records of the species within 5km of the site. Therefore, it is unlikely this species would utilise the vegetation on-site.	Moderate	Low
Climacteris picumunus victoriae	Brown Treecreeper (south-eastern)	V	-	67062	Brown treecreepers (south-eastern) occupy dry open eucalypt forests and woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. They also occur in mallee, forests and woodlands subject to periodic inundation. The subspecies is not usually found in woodlands with a dense shrub layer.	The site lacks the preferred habitat for this species, being stringybark/rough-barked eucalypt dominated vegetation. Additionally, there are no records of the species within 5km of the site.	Low	Low

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Cyclopsitta diophthalma coxeni	Coxen's Fig Parrot	CE	CE	59714	The Coxen's Fig Parrot occurs in rainforest habitats including subtropical rainforest, dry rainforest, littoral and developing littoral rainforest, and vine forest. Food is mainly taken from figs however other species fruit have been recorded in their diet including *Elaeocarpus grandis, Syzygium corynanthum, Litsea reticulata* and *Grevillea robusta.*	This site does not contain any rainforest/vine forest habitat, or species represented in this species diet. Additionally, there are no records of the species in the locality.	Unlikely	Unlikely
Erythrotriorchis radiatus	Red Goshawk	E	E	942	A wide ranging and highly mobile species generally observed over eucalypt habitats. This species prefers forest and woodland with a mosaic of vegetation types, large prey populations (birds) and permanent water. The vegetation types include eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest and rainforest margins. Habitat has to be open enough for fast attack and manoeuvring in flight, but provide cover for ambushing of prey.	Given the small overall area, the site does not contain the mosaic of vegetation types that this species favours. There is no evidence of permanent residence, and due to the scarcity of this species and lack of local records, its occurrence is highly unlikely.	Low	Unlikely
Falco hypoleucos	Grey Falcon	V	V	929	The Grey Falcon is a medium-sized, compact, pale falcon with a heavy, thick-set, deep-chested appearance. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey. Preys primarily on birds, especially parrots and	Field surveys confirmed that the site is largely vegetated at the canopy level but generally lacking in suitable cover for prey. Field surveys also confirmed the presence of at least one feral cat on-site which are a known threat to Grey Falcon roosts.	Low	Low

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		EPBC Act	NC Act					
					pigeons, using high-speed chases and stoops; reptiles and mammals are also taken. Like other falcons it utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring; two or three eggs are laid. The nests chosen are usually in the tallest trees along watercourses, particularly River Red Gum (*Eucalyptus camaldulensis*) and Coolibah (*E. coolabah*).	Additionally, there are no records of the species within 5km of the site. Therefore, given the presence of a known threat, a lack of suitable prey cover, and a lack of records in the locality, it is considered a low likelihood that the species would occur on-site.		
Gallinago hardwickii	Latham's Snipe	V	SL	863	Latham's Snipe occurs in permanent and ephemeral wetlands. They usually inhabit open, freshwater wetlands with low, dense vegetation.	No suitable foraging or breeding habitat in the form of wetlands occurs on-site. A large, constructed dam occurs on-site however contains limited dense macrophyte vegetation or overhanging terrestrial vegetation. Additionally, there are no records of the species within 5km of the site.	Low	Unlikely
Geophaps scripta scripta	Squatter Pigeon (southern)	V	V	64440	This species inhabits open grasslands and woodlands typically with a native understorey although may occur in artificial pasture.	This site does not contain suitable grassland habitat. In addition, the species is very rarely observed in southern Queensland, and thus this species is not expected to occur onsite.	Low	Unlikely

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		EPBC Act	NC Act					
Grantiella picta	Painted Honeyeater	V	V	470	The species inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of black box and river red gum, box-ironbark-yellow gum woodlands, acacia-dominated woodlands, paperbarks, casuarinas, callitris, and trees on farmland or gardens. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes. It is more common in wider blocks of remnant woodland than in narrower strips.	Potential suitable habitat was observed throughout the remnant vegetation on-site, however the vegetation is not dominated by the preferred canopy species and a low abundance of mistletoes was observed. Additionally, there are no records of the species in the local area.	Low	Low
Hirundapus caudacutus	White-throated Needletail	V	V	682	Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps.	Potential suitable habitat was observed across the referral area which is defined as remnant vegetation; however, this species is highly mobile and found over a range of habitat types. A review of the ALA and WildNet databases confirmed that there are multiple records of the species within 5km of the site. Notably, field surveys failed to confirm the presence of the species on-site with only 9 recorded hollow-bearing trees. Given the species is highly mobile	Moderate	Moderate

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		EPBC Act	NC Act					
						with records in the area, the likelihood of occurrence has been assigned as moderate.		
Lathamus discolor	Swift Parrot	CE	E	744	The Swift Parrot breeds in Tasmania during spring to early summer. During autumn and winter the species migrates to the mainland where it follows a nomadic existence linked to the availability and timing of flowering of trees in various locations.	Potential suitable habitat was observed throughout the remnant vegetation on-site. Corymbia citriodora (Spotted Gum) is the dominant canopy species on-site which is a winter flowering species. The Swift Parrot is highly mobile and found over a range of habitat types. Additionally, a review of the ALA and WildNet databases confirmed that there are no records of the species in the local area. Notably, field surveys failed to confirm the presence of the species on-site and limited hollow-bearing trees suitable for breeding were observed on-site.	Moderate	Low
Rostratula australis	Australian Painted-snipe	E	V	77037	The Australian Painted Snipe is usually found in shallow inland wetlands, either freshwater or brackish, that are either permanently or	No suitable foraging or breeding habitat in the form of wetlands occurs on-site. A large,	Low	Unlikely

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		EPBC Act	NC Act					
					temporarily filled. The species has a scattered distribution throughout many parts of Australia, with a single record from Tasmania.	constructed dam occurs on-site however contains limited foraging habitat. A review of the ALA and WildNet databases indicates that this species has been recorded within 5km of the site, however the records are generally associated with Swanbank Lake/Lagoon to the east of the site.		
Stagonopleura guttata	Diamond Firetail	V	V	59398	Diamond firetails occur in eucalypt, acacia or casuarina woodlands, open forests and other lightly timbered habitats, including farmland and grassland with scattered trees. They prefer areas with relatively low tree density, few large logs, and little litter cover but high grass cover. They feed predominantly at ground level, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects.	The referral area is dominated by eucalypt woodland vegetation. The preferred habitat of low tree density and high grass cover vegetation is not present. Additionally, there are no local records of the species.	Low	Low
Tringa nebularia	Common Greenshank	E	SL	832	The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. The species is known to forage at the edges of wetlands in soft mud or mudflats.	No suitable foraging or breeding habitat in the form of wetlands and mudflats occurs on-site. A large, constructed dam occurs on site however contains limited bare edges of mud and sand.	Low	Unlikely

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		EPBC Act	NC Act					
						Additionally, this species is more likely to occur along coastal areas, with no records of the species within 5km of the site.		
Turnix melanogaster	Black-breasted Button Quail	V	V	923	Typical habitat occurs in dry rainforest and vegetation immediately adjacent to rainforest. However, the species has also been recorded in a variety of low coastal heathlands around Fraser Island and nearby mainland. Deep leaf litter in which the species can forage appears to be particularly favoured.	Field surveys confirmed that the site does not contain dry rainforest or vegetation immediately adjacent to rainforest, and no heathlands are present. This, in combination with the lack of local records significantly reduces the likelihood that the species would occur on-site.	Low	Unlikely
Fish								
Neoceratodus forsteri	Australian Lungfish	V	-	67620	The Australian Lungfish requires still or slow-flowing, shallow, vegetated pools with clear or turbid water in which to spawn and feed. The species is restricted to areas of permanent water and cannot live in saline waters or migrate through sea water. Emergent or submerged vegetation are essential for successful deposition of eggs and for providing refuges for juveniles. It occurs naturally in the Burnett and Mary River systems although	A large, constructed dam occurs on-site however this is considered marginal habitat, with the species being less likely to occur in dams and weirs. Drainage line were also recorded within the referral area however these are considered to have an ephemeral flow regime and	Low	Low

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		EPBC Act	NC Act					
					has been introduced into other rivers and reservoirs in south-eastern Queensland.	therefore not suitable habitat for the species. Additionally, there are no records of the species within 5km of the site utilising inline databases.		
Insects								
Argynnis hyperbius inconstans	Australian Fritillary	CE	E	88056	Most specimens have been collected from river estuaries or swampy coastal areas at or near sea level. The Australian fritillary butterfly is restricted to open, swampy, coastal areas where the larval food plant, *Viola betonicifolia*, grows as a small, insignificant ground herb in association with *Lomandra longifolia* (Long Leaved Matrush) and grasses, especially the grass *Imperata cylindrica* (Blady Grass). This habitat is called *Melaleuca* wetlands, although the larval food plant does not occur in all sub-types of this plant community.	No suitable swampy coastal habitat was observed throughout the assessment area. Given the lack of suitable habitat and local records, it is considered unlikely that this species would occur on-site.	Unlikely	Unlikely
Mammals								
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	183	The Large-eared Pied Bat roosts on sandstone cliffs and fertile woodland valley habitat within close proximity of each other. However, in South East Queensland habitat includes rainforest and moist eucalypt forest habitats at high elevations.	No suitable rainforest, moist eucalypt forest, or high elevation habitat to support this species occurs on-site. There are no records of the species within the locality.	Unlikely	Unlikely

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Dasyurus hallucatus	Northern Quoll	E	-	331	The Northern Quoll occupies a diversity of habitats across its range which includes rocky areas, eucalypt forests and woodlands, rainforests, sandy lowlands and beaches, shrubland, grassland and desert. Northern Quoll 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. Dens are made in rock crevices, tree holes or occasionally termite mounds. Surveys in Queensland suggest that Northern Quolls are 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.	No suitable denning habitat to support this species occurs on-site, or in the nearby vicinity. There are no records of the species within the locality.	Unlikely	Unlikely
Dasyurus maculatus maculatus	Spot-tailed Quoll	E	V	75184	The Spot-tailed Quoll has a preference for mature wet forest habitat. Unlogged forest or forest that has been less disturbed by timber harvesting is also preferable. This predominantly nocturnal species rests during the day in dens. Habitat requirements include suitable den sites such as hollow logs, tree hollows, rock outcrops or caves. Individuals require an abundance of food such as birds and small mammals, and large areas of	No suitable denning habitat to support this species occurs on-site, or in the nearby vicinity. There are no records of the species within the locality.	Unlikely	Unlikely

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		EPBC Act	NC Act					
					relatively intact vegetation through which to forage.			
Macroderma gigas	Ghost Bat	V	E	174	Ghost bats are known to inhabit large complex caves and old mineshafts.	No suitable habitat occurs on-site. There are no records of the species within the locality.	Unlikely	Unlikely
Petauroides volans (NCA listed *Petauroides armillatus*)	Central Greater Glider	E	E	254	The Greater Glider is a nocturnal gliding marsupial with a broad distribution throughout mainland eastern Australia, mostly restricted to eucalypt forests and woodlands with abundant (large) hollow-bearing trees for shelter and a variety of eucalypt species for feeding. Diet consists of eucalypt leaves, and occasionally flowers. Six tree species were identified as dominant or co-dominant species to the majority of greater glider habitat; *Corymbia citriodora, Eucalyptus moluccana, E. tereticornis, E. crebra, C. intermedia* and *E. portuensis*. Additionally, a list of 503 regional ecosystems with a known or possible association with Queensland 'Guide to Greater Glider Habitat in Queensland' (DES 2022). Habitat identified as critical habitat in the Conservation Advice for Petauroides volans (DCCEEW, 2022) can be described as:	Field surveys confirmed that a variety of eucalypt species occur on-site including Greater Glider habitat. However only 9 hollow-bearing trees were recorded, 7 of which are dead/stag trees, so limited suitable shelter habitat exists. Additionally, targeted spotlighting surveys failed to locate the species on-site. A review of the ALA and WildNet databases confirm that there are no records of the species within 5km of the site. Field surveys also confirmed that the site is surrounded by high levels of disturbance, including roads and residential development. Given the species	Moderate	Low

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		EPBC Act	NC Act					
					• large contiguous areas of eucalypt forest, which contain mature hollow-bearing trees and a diverse range of the species' preferred food species in a particular region; and • smaller or fragmented habitat patches connected to larger patches of habitat, that can facilitate dispersal of the species and/or that enable recolonisation; and • cool microclimate forest/woodland areas (e.g. protected gullies, sheltered high elevation areas, coastal lowland areas, southern slopes); and • areas identified as refuges under future climate changes scenarios; and • short-term or long-term post-fire refuges (i.e. unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas.	is highly susceptible to disturbances and is unlikely to utilise an area in proximity to disturbance, it would be highly unlikely the species would utilise vegetation on-site.		
Petaurus australis australis	Yellow-bellied Glider	V	V	87600	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment	Field surveys confirmed that potentially suitable eucalypt forest habitat occurs on-site. However only 9 hollow-bearing	Moderate	Low

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		EPBC Act	NC Act					
					forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Den, often in family groups, in hollows of large trees. Very mobile and occupy large home ranges between 20 to 85 ha to encompass dispersed and seasonally variable food resources.	trees were recorded, 7 of which are dead/stag trees, so limited suitable shelter habitat exists.. Additionally, targeted spotlighting surveys failed to locate the species on-site. A review of the ALA and WildNet databases confirm that there are no records of the species within 5km of the site. Field surveys also confirmed that the site is surrounded by high levels of disturbance, including roads and residential development. Given the species is highly susceptible to disturbances and is unlikely to utilise an area in proximity to disturbance, it would be highly unlikely the species would utilise vegetation on-site.		
Petrogale penicillata	Brush-tailed Rock Wallaby	V	V	225	This species prefers rocky habitats, including loose boulder-piles, rocky outcrops, steep rocky slopes, cliffs, gorges and isolated rock stacks. It also utilises	No suitable steep or rocky habitat occurs on-site. Additionally, there	Unlikely	Unlikely

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		EPBC Act	NC Act					
					tree limbs. While it appears that most Brush-tailed Rock-wallaby colonies are on north-facing slopes and cliff lines, colonies have been found on south-facing cliffs in Kangaroo Valley, in the Macleay River Gorge, in the Warrumbungles and at Mt Kaputar, although usually in lower densities.	are no records of the species in the locality.		
Phascolarctos cinereus	Koala	E	E	85104	The Koala is found in a range of habitats, from coastal islands and tall eucalypt forests to low woodlands inland.	A review of the WildNet database indicates that the species has been recorded in the local area. Field surveys confirmed that potentially suitable eucalypt woodland habitat with Koala habitat trees is present on-site. Targeted surveys failed to locate any Koala individuals on-site, however some Koala scats were recorded at two trees in SAT 2, indicating a low level of Koala activity. Historically the referral area would have formed part of a larger patch of vegetation. However recent developments to	Moderate	Moderate

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
						the north and east as well as road developments to the south and west have significantly limited connectivity potential to the site. Therefore, the likelihood that the vegetation on-site would be utilised by the species has been reduced and will continue to be reduced following expected developments in Ripley Valley PDA.		
Potorous tridactylus tridactylus	Long-nosed Potoroo	V	V	66645	The Long-nosed Potoroo inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrub of tea-trees or melaleucas. A sandy loam soil is also a common feature.	Field surveys confirmed that the site lacks the dense understorey required by this species. Given the unsuitable habitat on-site and lack of local records, it is considered unlikely that this species would occur on-site.	Low	Unlikely
Pteropus poliocephalus	Grey-headed Flying-fox	V	-	186	Species generally roosts in camps in trees adjacent to larger permanent watercourse. 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	A review of the ALA database indicates that she species has been recorded within 5km of the site. While suitable foraging vegetation occurs on-site, the	Moderate	Moderate

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
					woodlands. It also feeds on commercial fruit crops. The primary food source is blossom from Eucalyptus and related genera.	species was not seen utilising this vegetation despite targeted surveys. In addition, no roosts were observed on-site, with the nearest known roost site located in Yamanto, approximately 2.5km to the north-west. Given that field surveys failed to locate the species or any roosts on-site, it is anticipated that if GHFF were to occur on-site, they would only occur in a transitional foraging capacity.		
Plants								
Arthraxon hispidus	Hairy-joint Grass	V	V	9338	Hairy-joint grass is found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps, as well as woodland.	No suitable rainforest or wet eucalypt forest habitat to support this species occurs on-site. Additionally, there are no records of this species within the local area.	Low	Unlikely
Bosistoa transversa	Three-leaved Bosistoa,	V		16091	This species occurs within the	Rainforest/wet forest and the species that the Three-leaved	Unlikely	Unlikely

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
	Yellow Satinheart				Northern Rivers (NSW), Fitzroy, Burnett Mary and South East Queensland Natural Resource Management Regions. Three-leaved Bosistoa grows in wet sclerophyll forest, dry sclerophyll forest and rainforest up to 300 m in altitude. Associated vegetation includes *Argyrodendron trifoliolatum*, *Syzygium hodgkinsoniae*, *Endiandra pubens*, *Dendrocnide photinophylla*, *Acmena ingens*, *Diploglottis australis* and *Diospyros mabacea*.	Bosistoa is commonly associated with were not located on site. Therefore, the species is unlikely to occur on-site due to lack of suitable habitat and local records.		
Callitris baileyi	Bailey's Cypress	-	NT	-	Grows on rocky slopes, hilly or mountainous areas, in shallow and often clay soils. It is found in eucalypt woodland, commonly associated with ironbark, blue gum and spotted gum. The New South Wales population occurs in an open grassy eucalypt forest near a creek.	A review of the WildNet database indicates that there is one record of the species within 5km of the site. Field surveys confirmed that eucalypt woodland and associated ironbark and spotted gum species are present on-site, however failed to identify the species on-site.	Moderate	Low
Calyptochloa gracillima subsp. ipsviciensis		-	CE	-	*Calyptochloa gracillima subsp. ipsviciensis* is a species of grass endemic to southeast Queensland in the vicinity of Ipswich where it is known from a few small areas. It is an uncommon to dominant species in woodlands dominated by Eucalyptus spp. including *E. crebra* and *E. moluccana* and/or	A review of the WildNet database indicates that the species has been recorded in the local area. The majority of the site is mapped as Regional Ecosystem	Moderate	Low

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
					Corymbia citriodora subsp. variegata on loam to clay loam duplex soils derived from shale on gently undulating to hilly terrain. Regional Ecosystems represented include 12.9–10.2, 12.9–10.3 and 12.9–10.19. It flowers from December to March during the wet season.	(RE) 12.9-10.2 which is associated with the species. Field surveys confirmed that eucalypt woodland and associated ironbark and spotted gum species are present on-site, however failed to identify the species on-site.		
Coleus habrophyllus	Shaggy-leaved Plectranthus	E	E	64589	Plants have been recorded growing on chert or sandstone outcrops, in open woodlands often in shaded situations near vine forest. Seven populations are known including: Oxley Creek, Greenbank; Opposum Creek, Springfield; Woogaroo Creek, Goodna; three populations within White Rock Conservation Park, incorporating Six Mile Creek and near Ormeau (south of Beenleigh).	No chert or sandstone outcrops, or vine forest occurs on-site. A review of the ALA and WildNet databases indicates that the species has been recorded within 5km of the site, in association with Bundamba Creek. Field surveys failed to identify this species on-site. This, in combination with the lack of suitable habitat means the species is unlikely to occur on-site.	Low	Unlikely
Cupaniopsis shirleyana	Wedge-leaf Tuckeroo	V	V	3205	The Wedge-leaf Tuckeroo occurs in a variety of dry rainforest vegetation types, including vine thicket communities on hillsides, stream beds and along	No suitable rainforest or vine thicket communities occur on-site. Additionally, there are no	Unlikely	Unlikely

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
					riverbanks at altitudes up to 550 m above sea level. This species is also likely to occur on the margins of native vegetation in scrubby urbanised areas. Predominately found on dark brown sandy loams and sandy clay loams (pH 5-7.5) and rocky scree slopes. Generally, these soils have formed from volcanic parent materials (mainly granites and granodiorites, basalt and andesitic flows, and pyroclastics).	records of the species within 5km of the site and the species was not observed during site surveys.		
Cupaniopsis tomentella	Boonah Tuckeroo	V	V	3322	Limited information of Boonah Tuckeroos is available. The species can be described as a small tree to 10m tall that occur in the drier rainforests of the Boonah District.	No suitable dry rainforest habitat occurs on-site. Additionally, there are no records of the species within 5km of the site and the species was not observed during site surveys.	Unlikely	Unlikely
Dichanthium setosum	Bluegrass	V	-	14159	In Queensland, bluegrass has been reported from the Leichhardt, Morton, North Kennedy and Port Curtis regions. *Dichanthium setosum* is associated with heavy basaltic black soils and stony red-brown hardsetting loam with clay. It can be found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture. The extent to which this species tolerates disturbance is unknown.	There are no local records of this species, with the closest sighting in the Toowoomba and surrounds. Field surveys failed to identify the species on-site.	Unlikely	Unlikely

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
Fontainea venosa		V	V	24040	Occurs in notophyll vine forest and vine thicket with a mean annual rainfall of 1000-1100 mm on soils derived from and containing abundant andesitic rocks, often on rocky outcrops or along creeks.	Field surveys confirmed that no suitable vine forest/thicket habitat occurs on-site. Additionally, there are no records of the species in the local area and field surveys failed to identify the species on-site.	Unlikely	Unlikely
Melaleuca irbyana	Swamp Tea-tree	-	E	-	Forms dense forest communities. The Swamp Tea-tree (Forest) grows on poorly draining clay soils on the plains and low hills of the Moreton basin. The clay soils drain slowly and often become waterlogged after heavy rains, resulting in the appearance of numerous temporary ponds.	A review of the WildNet database confirms that the species has been recorded within 5km of the site. However, field surveys failed to locate the species on-site.	Moderate	Low
Notelaea ipsviciensis	Cooneana Olive	CE	E	81858	The Cooneana Olive survives as an understorey plant in degraded, eucalypt dominated dry sclerophyll vegetation communities. Soils in the area are of low fertility, depauperate and sandstone-based. This species prefers open woodland communities with open canopies. The known population is adjacent to subdivided, modified and developed land.	Potential suitable habitat occurs on-site in the form of eucalypt dominated woodland. However, given that field surveys failed to locate the species on-site and there are no local records, there is a low likelihood that the species would occur on-site.	Moderate	Low
Notelaea lloydii	Lloyd's Olive	V	V	15002	The species occurs on undulating to hilly terrain either in moist gullies or on gentle to steep dry slopes, but is rarely found on rocky outcrops. Soil	No suitable habitat occurs on-site in the form of hilly/steep terrain or vine thicket ecotone.	Unlikely	Unlikely

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
					types are mostly shallow, well drained and stony to very rocky in texture. Found in the ecotone between eucalypt open forests and vine thickets at 80-480 m above sea level (asl).	Additionally, there are no local records and field surveys failed to locate the species on-site.		
Picris evae	Hawkweed	V		10839	Hawkweed occurs at 30 sites in the Darling Downs and Moreton pastoral districts in south-east Queensland. It occurs in *Eucalyptus* open woodland with a grassy understory composed of *Dichanthium* spp. Upper stratus species include *Eucalyptus melliodora, E. crebra, E. populnea, E. albens, Angophora subvelutina, Allocasuarina torulosa*, and *Casuarina cunninghamiana*.	Suitable eucalypt open woodland occurs on-site however *Dichanthium* spp. are absent from the site. Given that field surveys failed to locate the species on-site and there are no local records, it is unlikely that the species would occur on-site.	Low	Unlikely
Planchonella eerwah	Shiny-leaved Condoo, Black Plum, Wild Apple	E	E	17340	The species prefers subtropical rainforest, dry rainforest and *Araucaria cunninghamii* vine scrub.	No suitable rainforest or vine scrub habitat occurs on-site. There are no local records, and field surveys failed to locate the species on-site.	Unlikely	Unlikely
Rhaponticum australe	Austral Cornflower	V	V	22647	Austral Cornflower is known from Mt Moffat to Gatton in Queensland, a distance of 600 km. Austral Cornflower grows in eucalypt open forest with grassy understory on roadsides and on road reserves with *Chloris gayana*, *Cirsium vulgare*, *Eucalyptus tereticornis* and *Angophora floribunda* on black clay soil.	Field surveys confirmed that suitable eucalypt open forest with a grassy understorey occurs on-site. Associated species *Chloris gayana* and *Eucalyptus tereticornis* were also identified on-site. However, there are no records of	Moderate	Low

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
						the species within 5km of the site and field surveys failed to identify the species on-site.		
Rhodamnia rubescens	Scrub Turpentine	CE	CE	15763	Known to occur from coastal districts of NSW north from Batemans Bay to Bundaberg in Queensland. The distribution occasionally extends inland onto the escarpment up to 600 m ASL in areas with rainfall of 1000-1600 mm. Commonly occurs in all rain forest subforms except cool temperate rainforest. Species occupies a range of volcanically derived and sedimentary soils and is a common pioneer species in Eucalypt forests. Often found in wet sclerophyll associations in rainforest transition zones and Creekside riparian associations. Flowers from late winter through spring, with a peak in October and fruits appear in December in the Sydney region. Habitat is likely to include subtropical rainforests, northern warm temperate rainforests, littoral rainforest, for example.	No suitable rainforest/wet sclerophyll forest habitat occurs on-site. Additionally, there are no records within the locality and field surveys failed to identify the species on-site.	Unlikely	Unlikely
Rhodomyrtus psidioides	Native Guava	CE	CE	19162	Known to occur from coastal districts of NSW north from Gosford to Maryborough in Queensland. Occurrence records are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to c. 120 km inland in the Hunter and Clarence River catchments and along the Border Ranges. The	No suitable rainforest/wet sclerophyll forest habitat occurs on-site. Additionally, there are no records within the locality and field surveys failed to identify the species on-site.	Unlikely	Unlikely

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
					species flowers in late spring to early summer, producing fruits in summer. Habitat is likely to include subtropical rainforests, warm temperate rainforests, littoral rainforest, and wet sclerophyll forests.			
Samadera bidwillii	Quassia	V	V	29708	Quassia commonly occurs in lowland rainforest or on rainforest margins, but it can also be found in other forest types, such as open forest and woodland. Quassia is commonly found in areas adjacent to both temporary and permanent watercourses in locations up to 510 m altitude. The species occurs on lithosols, skeletal soils, loam soils, sands, silts and sands with clay subsoils.	This species favours lowland rainforest or rainforest margins which are absent from the site, and no local records exist, and thus Quassia is unlikely to be present on site.	Unlikely	Unlikely
Thesium australe	Austral Toadflax	V	V		Austral Toadflax is semi-parasitic on the roots of a range of grass species, notably *Themeda triandra* (Kangaroo Grass). It occurs in shrubland, grassland or woodland, often on damp sites.	Field surveys confirmed that host species *Themeda triandra* is present on-site. However, there are no local records and field surveys failed to identify the species on-site.	Low	Unlikely
Reptiles								
Delma torquata	Collared Delma	V	V	1656	In general, the species occurs on rocky hillsides on basalt and lateritic soils supporting open eucalypt and Acacia woodland with a sparse understorey of shrubs and tussocks or semi-evergreen vine thicket.	No suitable habitat was observed throughout the assessment area, with no rocky hillsides present on site.	Unlikely	Unlikely

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
Furina dunmalli	Dunmall's Snake	V	V	59254	Dunmall's Snake has been found in a broad range of habitats, including forests and woodlands on black alluvial cracking clay and clay loams dominated by Brigalow other Wattles, native Cypress or Bull-oak, and various Blue Spotted Gum, Ironbark, White Cypress Pine and Bull oak open forest and woodland associations on sandstone derived soils. Dunmall's Snake occurs primarily in the Brigalow Belt region in the south-eastern interior of Queensland. Records indicate sites at elevations between 200–500 m above sea level. The snake is very rare or secretive with limited records existing. It has been recorded at Archokoora, Oakey, Miles, Glenmorgan, Wallaville, Gladstone, Lake Broadwater, Mount Archer, Exhibition Range National Park, roadside reserves between Inglewood and Texas, Rosedale, Yeppoon and Lake Broadwater Conservation Park.	The species is found in a broad range of habitats however is primarily associated with the Brigalow belt. There are very few records east of the Great Dividing Range.	Unlikely	Unlikely
Hemiaspis damelii	Grey Snake	E	E	1179	The grey snake is a relatively small, venomous, front-fanged (proteroglyphous) snake. In Queensland, grey snake habitat is Brigalow *Acacia harpophylla* and Belah *Casuarina cristata* woodlands on heavy, dark brown to black cracking clay soils, particularly in association with water bodies, areas with small gullies and ditches, and	Habitat attributes to support this species are not present on-site and there is a lack of records within the local area.	Unlikely	Unlikely

Scientific name	Common name	Listing Status*		EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of occurrence (on-site)	Field Survey Confirmed Likelihood of occurrence (on-site)
		EPBC Act	NC Act					
					floodplain environments where the species shelters beneath logs, rocks and soil cracks.			

**Status abbreviations are as follows: CE = Critically Endangered, E = Endangered, V = Vulnerable, NT = Near Threatened, C = Least Concern, SL = Special Least Concern, - = Not Listed.*

Listed migratory species (not listed above)

Scientific name	**Common name**	**EPBC code**	**Habitat and Distribution**	**Likelihood of Occurrence Analysis**	**Desktop Likelihood of Occurrence (on-site)**	**Field Survey Confirmed Likelihood of Occurrence (on-site)**
Migratory marine birds						
Apus pacificus	Fork-tailed Swift	678	This species is almost exclusively aerial and mostly occur over inland plains but sometimes above foothills or in coastal areas.	No suitable habitat to support this species occurs on-site.	Unlikely	Unlikely
Migratory terrestrial species						
Cuculus optatus	Oriental Cuckoo	86651	Non-breeding habitat only: monsoonal rainforest, vine thickets, wet sclerophyll forest or open Casuarina, Acacia or Eucalyptus woodlands. Frequently at edges or ecotones between habitat types	Suitable habitat in the form of eucalypt dominated woodland is present on-site. However, there are no local records, and field surveys failed to identify the species on-site.	Low	Low
Monarcha melanopsis	Black-faced Monarch	609	The Black-faced Monarch mainly occurs in rainforest ecosystems, including semi-deciduous vine thickets, complex notophyll vine forests, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and occasionally cool temperate rainforest.	No suitable rainforest habitat to support this species occurs on-site. There are no local records of this species.	Unlikely	Unlikely
Motacilla flava	Yellow Wagtail	644	This species occupies a range of damp or wet habitats with low vegetation, from damp meadows, marshes, waterside pastures, sewage farms and bogs to damp steppe and grassy tundra.	No suitable damp or wet habitat occurs on-site to support this species. Additionally, there are no records within the locality.	Unlikely	Unlikely
Myiagra cyanoleuca	Satin Flycatcher	612	Satin Flycatchers inhabit heavily vegetated gullies in eucalypt dominated forests and taller woodlands, and on	Field surveys confirmed that while eucalypt dominated vegetation is present on-site, no	Low	Low

Scientific name	Common name	EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of Occurrence (on-site)	Field Survey Confirmed Likelihood of Occurrence (on-site)
			migration occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	suitable heavily vegetated gullies occur on-site to support this species. Additionally, there are no local records, and field surveys failed to identify the species on-site.		
Rhipidura rufifrons	Rufous Fantail	592	The Rufous fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by Eucalypts such as *Eucalyptus microcorys*, *Eucalyptus pilularis*, *Eucalyptus resiniferia* and a number of other Eucalyptus species.	No suitable wet sclerophyll habitat to support this species occurs on-site. Additionally, there are no records within the locality.	Low	Low
Symposiachrus trivirgatus as Monarcha trivirgatus	Spectacled Monarch	83946	The Spectacled Monarchs natural habitats are subtropical or tropical moist lowland forests, subtropical or tropical mangrove forests, and subtropical or tropical moist montane forests. Its preference is for thick understorey areas.	No suitable subtropical or tropical habitat to support this species occurs on-site. Additionally, there are no records within the locality.	Unlikely	Unlikely
Migratory wetland species						
Actitis hypoleucos	Common Sandpiper	59309	The Common Sandpiper utilises a wide range of coastal wetlands and some inland wetlands, including estuaries and deltas of streams, banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and clay pans, and occasionally piers and jetties. They are mostly found in shallow water, around muddy margins or rocky shores and sometimes in muddy areas littered with rocks or snags. The species commonly utilises mangroves for foraging and roosting but is rarely seen on mudflats.	This site does not contain any wetlands however a large, constructed dam occurs on site which contains limited muddy foraging habitat. Given the lack of suitable habitat and the lack of local records, it is considered unlikely that this species would occur on-site.	Low	Unlikely
Calidris melanotos	Pectoral Sandpiper	858	The Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries,	This site does not contain any wetlands however a large, constructed dam occurs on site which	Low	Unlikely

Scientific name	Common name	EPBC code	Habitat and Distribution	Likelihood of Occurrence Analysis	Desktop Likelihood of Occurrence (on-site)	Field Survey Confirmed Likelihood of Occurrence (on-site)
			bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. Occasionally found further inland.	contains limited foraging habitat. Given the lack of suitable habitat and the lack of local records, it is considered unlikely that this species would occur on-site.		
Pandion haliaetus	Osprey	952	Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers.	No suitable coastal or wetland habitat occurs on-site. There are no local records of this species.	Unlikely	Unlikely

Appendix D

Flora Species Lists

Flora species list

Scientific Name	Common Name	Native/Introduced
Acacia deanei	Green Wattle	Native
Acacia disparima	Hickory Wattle	Native
Acacia fimbriata	Brisbane Wattle	Native
Acacia leiocalyx	Early Flowering Wattle	Native
Acacia podalyriifolia	Silver Wattle	Native
Allocasuarina littoralis	Black She-oak	Native
Allocasuarina luehmannii	Bull Oak	Native
Alloteropsis semialata	Cockatoo Grass	Native
Alphitonia excelsa	Soap Tree	Native
Angophora leiocarpa	Smooth-barked Apple	Native
Aristida leptopoda	White Speargrass	Native
Aristida vagans	Threeawn Speargrass	Native
Cassytha pubescens	Devil's Twine	Native
Cheilanthes distans	Bristle Cloak Fern	Native
Chrysocephalum apiculatum	Yellow Buttons	Native
Commelina diffusa	Blue Commelina	Native
Corymbia citriodra	Spotted Gum	Native
Corymbia tessellaris	Moreton Bay Ash	Native
Cymbopogon refractus	Barbed Wire Grass	Native
Cynodon dactylon	Green Couch	Native
Cyperus haspan	Flat Sedge	Native
Desmodium rhytidophyllum	Hairy Trefoil	Native
Dianella caerulea	Blue Flax-lily	Native
Dianella longifolia	Pale Flax-lily	Native
Dichondra repens	Kidney Weed	Native
Emilia sonchifolia	Emilia	Native
Entolasia stricta	Wiry Panic	Native
Eragrostis brownii	Brown's Lovegrass	Native
Eremophila debilis	Winter Apple	Native
Eucalyptus crebra	Narrow-leaved Ironbark	Native
Eucalyptus melanophloia	Silver-leaved Ironbark	Native
Eucalyptus siderophloia	Grey Ironbark	Native
Eucalyptus tereticornis	Forest Red Gum	Native

Scientific Name	Common Name	Native/Introduced
Fimbristylis	A Fring Rush	Native
Gahnia aspera	Saw Sedge	Native
Geitonoplesium cymosum	Scrambling Lily	Native
Goodenia ovata	Hop Goodenia	Native
Goodenia rotundifolia	Star Goodenia	Native
Hardenbergia violacea	Native Sarsaparilla	Native
Heteropogon contortus	Black Speargrass	Native
Hybanthus stellarioides	Spade Flower	Native
Imperata cylindrica	Blady Grass	Native
Jacksonia scoparia	Dogwood	Native
Juncus usitatus	Common Rush	Native
Lobelia purpurascens	White Root	Native
Lomandra longifolia	Long-leaved Matrush	Native
Lophostemon suaveolens	Swamp Box	Native
Melaleuca quinquenervia	Broad-leaved Paperbark	Native
Murdannia graminea	Slug Herb	Native
Ottochloa gracillima	Graceful Grass	Native
Panicum decompositum	Native Millet	Native
Parsonsia straminea	Monkey Rope	Native
Persoonia cornifolia	Geebung	Native
Petalostigma pubescens	Quinine Bush	Native
Pimelea linifolia	Rice Flower	Native
Pomax umbellata	Pomax	Native
Themeda triandra	Kangaroo Grass	Native
Thysanotus tuberosus	Fringed Lily	Native
Trema tomentosa	Poison Peach	Native
Velleia spathulata	Wild Pansies	Native
Xyris complanata	Hat Pins	Native
Abrus precatorius	Crab's Eye Creeper	Introduced
Agave americana	Century Plant	Introduced
Ageratum houstonianum	Blue Billygoat Weed	Introduced
Ambrosia artemisiifolia	Annual Ragweed	Introduced
Asparagus aethiopicus	Ground Asparagus Fern	Introduced

Scientific Name	**Common Name**	**Native/Introduced**
Baccharis halimifolia	Groundsel	Introduced
Chloris gayana	Rhodes Grass	Introduced
Conyza sumatrensis	Tall Fleabane	Introduced
Crotalaria lanceolata	Lance-leaved Rattlepod	Introduced
Cyperus rotundus	Nutgrass	Introduced
Duranta erecta	Duranta	Introduced
Gomphocarpus physocarpus	Balloon Cotton Bush	Introduced
Heliotropium amplexicaule	Blue Heliotrope	Introduced
Jacaranda mimosifolia	Jacaranda	Introduced
Lantana camara	Lantana	Introduced
Lantana montevidensis	Creeping Lantana	Introduced
Leucaena leucocephala	Leucaena	Introduced
Macroptilium atropurpureum	Siratro	Introduced
Megathyrsus maximus	Guinea Grass	Introduced
Melinis repens	Red Natal Grass	Introduced
Opuntia tomentosa	Velvet Tree Pear	Introduced
Oxalis corniculata	Creeping Oxalis	Introduced
Passiflora suberosa	Corky Passion Vine	Introduced
Senecio madagascariensis	Fireweed	Introduced
Setaria sphacelata	South African Pigeon Grass	Introduced
Sida cordifolia	Flannel Weed	Introduced
Sida rhombifolia	Common Sida	Introduced
Typha orientalis	Broad-leaved Cumbungi	Introduced
Urochloa decumbens	Signal Grass	Introduced

Appendix E

SAT survey results

Spot Assessment Technique (SAT)				
Date:	01.02.2024	**Site: 11826**	**SAT ID: 1**	
Tree No.	**Scientific Name**	**Common Name**	**DBH**	**Scats**
1	*Corymbia citriodora*	Spotted Gum	150	N
2	*Corymbia citriodora*	Spotted Gum	140	N
3	*Corymbia citriodora*	Spotted Gum	280	N
4	*Corymbia citriodora*	Spotted Gum	130	N
5	*Corymbia citriodora*	Spotted Gum	160	N
6	*Corymbia citriodora*	Spotted Gum	380	N
7	*Corymbia citriodora*	Spotted Gum	190	N
8	*Corymbia citriodora*	Spotted Gum	150	N
9	*Corymbia tessellaris*	Moreton Bay Ash	100	N
10	*Corymbia citriodora*	Spotted Gum	120	N
11	*Corymbia tessellaris*	Moreton Bay Ash	310	N
12	*Corymbia tessellaris*	Moreton Bay Ash	140	N
13	*Corymbia citriodora*	Spotted Gum	180	N
14	*Corymbia citriodora*	Spotted Gum	450	N
15	*Corymbia citriodora*	Spotted Gum	170	N
16	*Corymbia tessellaris*	Moreton Bay Ash	200	N
17	*Corymbia citriodora*	Spotted Gum	140	N
18	*Eucalyptus tereticornis*	Forest Red Gum	650	N
19	*Corymbia citriodora*	Spotted Gum	180	N
20	*Corymbia intermedia*	Pink Bloodwood	200	N
21	*Corymbia citriodora*	Spotted Gum	270	N
22	*Corymbia intermedia*	Pink Bloodwood	160	N
23	*Eucalyptus tereticornis*	Forest Red Gum	120	N
24	*Corymbia intermedia*	Pink Bloodwood	160	N
25	*Corymbia citriodora*	Spotted Gum	150	N
26	*Corymbia citriodora*	Spotted Gum	200	N
27	*Lophostemon suaveolens*	Swamp Box	140	N
28	*Eucalyptus crebra*	Narrow-leaved Ironbark	110	N
29	*Corymbia intermedia*	Pink Bloodwood	120	N
30	*Corymbia citriodora*	Spotted Gum	120	N
		Total Scats	0	

Percentage	0.00
East Coast (med-high) Activity Category	Low

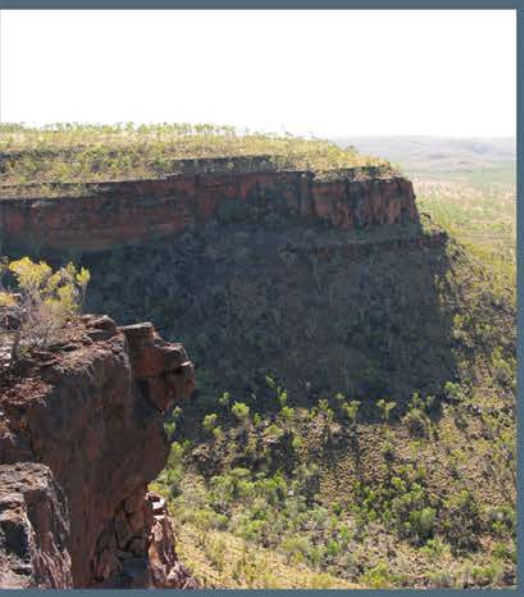
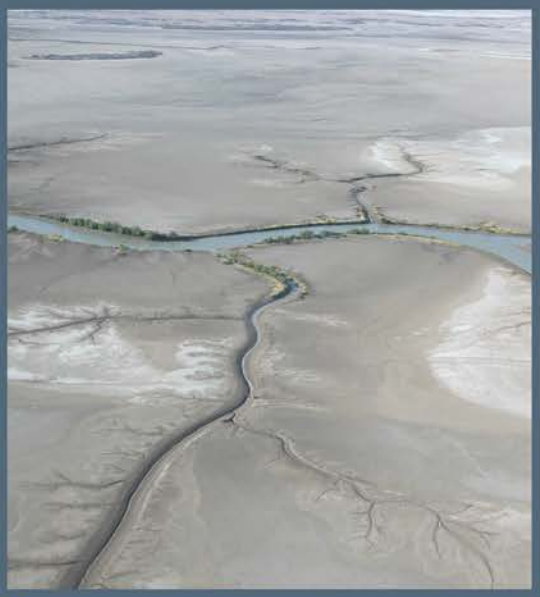
Spot Assessment Technique (SAT)				
Date:	01.02.2024	**Site: 11826**	**SAT ID: 2**	
Tree No.	**Scientific Name**	**Common Name**	**DBH**	**Scats**
1	*Corymbia tessellaris*	Moreton Bay Ash	130	N
2	*Corymbia citriodora*	Spotted Gum	200	N
3	*Corymbia citriodora*	Spotted Gum	680	N
4	*Corymbia citriodora*	Spotted Gum	230	Y
5	*Corymbia citriodora*	Spotted Gum	380	N
6	*Corymbia citriodora*	Spotted Gum	100	N
7	*Corymbia citriodora*	Spotted Gum	400	N
8	*Corymbia citriodora*	Spotted Gum	170	N
9	*Corymbia citriodora*	Spotted Gum	130	N
10	*Corymbia citriodora*	Spotted Gum	350	N
11	*Eucalyptus tereticornis*	Forest Red Gum	270	N
12	*Corymbia citriodora*	Spotted Gum	230	N
13	*Corymbia citriodora*	Spotted Gum	150	N
14	*Corymbia citriodora*	Spotted Gum	270	N
15	*Corymbia citriodora*	Spotted Gum	110	N
16	*Corymbia citriodora*	Spotted Gum	270	Y
17	*Corymbia citriodora*	Spotted Gum	390	N
18	*Corymbia citriodora*	Spotted Gum	850	N
19	*Eucalyptus tereticornis*	Forest Red Gum	170	N
20	*Corymbia intermedia*	Pink Bloodwood	140	N
21	*Corymbia citriodora*	Spotted Gum	340	N
22	*Corymbia citriodora*	Spotted Gum	220	N
23	*Corymbia citriodora*	Spotted Gum	210	N
24	*Corymbia citriodora*	Spotted Gum	240	N
25	*Corymbia citriodora*	Spotted Gum	300	N
26	*Corymbia citriodora*	Spotted Gum	230	N
27	*Corymbia citriodora*	Spotted Gum	100	N
28	*Corymbia citriodora*	Spotted Gum	130	N
29	*Corymbia citriodora*	Spotted Gum	210	N
30	*Corymbia citriodora*	Spotted Gum	180	N
		Total Scats	2	

Percentage	6.67
East Coast (med-high) Activity Category	Low

Spot Assessment Technique (SAT)				
Date:	01.02.2024	**Site: 11826**	**SAT ID: 3**	
Tree No.	**Scientific Name**	**Common Name**	**DBH**	**Scats**
1	*Corymbia citriodora*	Spotted Gum	430	N
2	*Corymbia citriodora*	Spotted Gum	180	N
3	*Corymbia citriodora*	Spotted Gum	110	N
4	*Corymbia citriodora*	Spotted Gum	200	N
5	*Corymbia citriodora*	Spotted Gum	160	N
6	*Eucalyptus crebra*	Narrow-leaved Ironbark	340	N
7	*Corymbia citriodora*	Spotted Gum	130	N
8	*Corymbia citriodora*	Spotted Gum	350	N
9	*Corymbia citriodora*	Spotted Gum	220	N
10	*Corymbia citriodora*	Spotted Gum	110	N
11	*Corymbia citriodora*	Spotted Gum	350	N
12	*Corymbia citriodora*	Spotted Gum	120	N
13	*Corymbia citriodora*	Spotted Gum	170	N
14	*Corymbia citriodora*	Spotted Gum	330	N
15	*Corymbia citriodora*	Spotted Gum	220	N
16	*Corymbia citriodora*	Spotted Gum	180	N
17	*Corymbia citriodora*	Spotted Gum	360	N
18	*Corymbia citriodora*	Spotted Gum	180	N
19	*Corymbia citriodora*	Spotted Gum	110	N
20	*Corymbia citriodora*	Spotted Gum	210	N
21	*Corymbia citriodora*	Spotted Gum	310	N
22	*Corymbia citriodora*	Spotted Gum	100	N
23	*Corymbia citriodora*	Spotted Gum	270	N
24	*Corymbia citriodora*	Spotted Gum	210	N
25	*Corymbia citriodora*	Spotted Gum	300	N
26	*Corymbia citriodora*	Spotted Gum	170	N
27	*Corymbia citriodora*	Spotted Gum	190	N
28	*Corymbia citriodora*	Spotted Gum	320	N
29	*Corymbia citriodora*	Spotted Gum	130	N
30	*Eucalyptus crebra*	Narrow-leaved Ironbark	240	N
		Total Scats	0	

Percentage	0.00
East Coast (med-high) Activity Category	Low

Land Zones of Queensland

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Front Cover: Design by Will Smith

Images – clockwise from top left: ancient sandstone formation in the Lawn Hill area of the North West Highlands bioregion – land zone 10 (D. Kelman); coastal estuarine mud flats, Gulf Plains bioregion – land zone 1 (R. Jaensch); granite tor field in the North West Highlands bioregion – land zone 12 (D. Kelman); flat clay plains on the Barkly Tableland – land zone 4 (B. Wilson); metamorphic hills in the Dajarra area of the North West Highlands bioregion – land zone 11 (D. Kelman); Quaternary coastal deposits on a beach, Central Queensland Coast bioregion – land zone 2 (J. Kemp).

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1. Introduction

This publication provides detailed information on the interpretation and application of the land zone component of the regional ecosystem classification system across Queensland. This document should be read in conjunction with the regional ecosystem survey and mapping methodology (Neldner *et al.* 2012).

The regional ecosystem (RE) system is a framework for land classification that was developed in Queensland in the 1990s to assist in planning for biodiversity, both on and off conservation reserve estate. The classification system is a multiple attribute land classification system which describes the entire land surface of Queensland. Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil (Sattler and Williams 1999). The regional ecosystems classification is based on a hierarchy, which is reflected in the three-part code given to each regional ecosystem. The land is classified by bioregion, then land zone, and then vegetation and/or variations in geology/landform/soils within a land zone

Land zones are categories that describe the major geologies and associated landforms and geomorphic processes of the State of Queensland. The differences between land zones result in marked differences in the function of ecosystems and their associated biodiversity and this is due in part to the effects that geology (lithology, structure, alteration) has on landform, hydrology and landscape processes (geomorphology and soil formation).

One of the main strengths of the regional ecosystem and associated land zone classification is its ease of use. The entire state is classified in terms of twelve land zones and the definitions are, for the most part, uncomplicated. In some environments, determining the land zone will simply involve reference to a geology map and the land zone definition. In other circumstances a basic knowledge of geology and landscape processes (geomorphology and soil formation) is necessary. Once the land zone has been determined, the classification of the vegetation/landform/soils will identify the appropriate regional ecosystem.

The primary land zone differentiation is:

a) Quaternary coastal unconsolidated marine sediments and coastal sand masses developed by wind and wave action (Land Zones 1 and 2).

b) Cainozoic (Tertiary to Quaternary) unconsolidated sediments derived from alluvial and non-coastal aeolian processes and other geologies subject to “deep weathering” processes during the Cainozoic period (Land Zones 3 to 7).

c) Cainozoic (Tertiary to Quaternary) igneous rocks (Land Zone 8).

d) Sedimentary rocks (Land Zones 9 and 10).

e) Metamorphosed Cretaceous and older igneous rocks (Land Zones 11 and 12).

The geological time scale is an important factor when allocating geology units to Land Zones. The geological time scale* with significant geological events relevant to Queensland Land Zones is shown in **Table 1**.

Table 1 Geological Time Scale—Queensland
* Adapted from Gradstein FM, Ogg JG and Smith AG (2004)

ERA Period (Epoch)	Time (years)	NOTES
CAINOZOIC-Cz	0 – 65 m	
Quaternary - Q	0 – 2.5 m	Quaternary events: alluviums, sand dunes, volcanic activity, some lateritisation
(Holocene - Qh)	0 – 10,000	Second of two periods of Quaternary alluvial (Qha) deposition—lower active (current) Holocene alluvium
(Pleistocene – Qp)	10,000 – 2.5 m	
recent Pleistocene - Qp	10,000 – 140,000	Recent part of Pleistocene epoch associated with the first of two periods of Quaternary alluvial (Qpa) deposition in coastal streams within alluvial valleys; now slightly elevated and/or prior and abandoned streams
early Pleistocene - Q	140,000 – 2.5 m	Earlier part of Pleistocene epoch associated with paleo-alluvial deposition (TQ part)
Tertiary – T (Neogene & Paleogene)	2.5 m – 65 m	Tertiary events: lateritisation of erosional surfaces; volcanic activity; deposition in rivers and lakes—paleo-alluvial deposition (T, TQ part)
MESOZOIC - Mz	65 m – 251 m	
Cretaceous - K	65 m – 145 m	Great Artesian Basin formed; terrestrial and marine deposition; coal measures in Ipswich, Surat and Maryborough Basins
Jurassic - J	145 m – 200 m	
Triassic - R	200 m – 251 m	
PALAEOZOIC - Pz	251 m – 542 m	
Permian- P	251 m – 299 m	Close of the Tasman Geosyncline; coal measures in many basins; terrestrial marine and freshwater deposits; volcanic activity and igneous intrusions
Carboniferous - C	299 m – 359 m	
Devonian - D	359 m – 416 m	
Silurian - S	416 m – 444 m	Granite intrusions; marine deposition; Tasman Geosyncline formed
Ordovician - O	444 m – 488 m	Shallow water marine deposition in Georgina Basin
Cambrian - ε	488 m – 542 m	
SUPEREON Eon		
PRECAMBRIAN	542 m – 4600 m	
Proterozoic - Pt	542 m – 2500 m	Precambrian shield areas emerge from the sea.
Archaean - Ar	2500 m – 4600 m	Highly metamorphosed rocks

2. The land surface

Australia is a very old continent of generally low relief. Whilst many events and episodes have shaped the land surface, the low relief of the present day surface is dominantly the result of erosion. Much of the present day Queensland landscape reflects ancient geomorphic processes with unconsolidated deposits derived from various sources, often transported and reworked in various ways.

Rock and unconsolidated deposits

At the most basic level, land can be divided into bedrock landscapes and unconsolidated deposits of varying materials. Rocks at, or near, the earth's surface are subjected to constant weathering processes due to the action of water, wind, ice, extremes of temperature and living organisms. This physical disintegration and chemical decomposition of rocks marks the beginning of the soil forming process. At any stage the weathered rock and the soil itself are susceptible to transport by wind, water, and gravity. Geomorphic processes of the Australian landscapes are described in detail by Twidale and Campbell (2005).

An understanding of hard rock landscapes with in-situ/colluvial soils as opposed to landscapes based on unconsolidated deposits of transported material (ignoring induration during soil formation), is fundamental to land classification. This division is mirrored in the land zone classification: Land Zones 1, 2, 3, 4 and 6 describe unconsolidated deposits of sand, silt, clay and gravel (**Plate 1, 2** and **3**); Land Zone 5 relates to unconsolidated deposits and *in-situ* "deeply weathered" landscapes (**Plate 4**); Land Zone 7 describes the exposed duricrusted "deeply weathered" landscapes and Land Zones 8, 9, 10, 11 and 12 refer to the hard rock landscapes (**Plate 5** and **6**).

Plate 1 Unconsolidated Quaternary marine sediments, Burnett River (Land Zone 1)

Plate 2 Unconsolidated Quaternary alluvium, Burnett River floodplain (Land Zone 3)

Plate 3 Unconsolidated Pleistocene marine quartz sand deposits with organic staining, Maroochydore (Land Zone 2)

Plate 4 Deeply weathered Tertiary basalt, Childers (Land Zone 5)

Plate 5 Fine grained Cretaceous sediments of the Maryborough Basin (Land Zone 9)

Plate 6 Triassic granite, Childers (Land Zone 12)

2.1 Unconsolidated Cainozoic Deposits – Sand, silt, clay, gravel, soil

Unconsolidated sediment deposits form:

- tidal flats (Land Zone 1)
- coastal sand dunes and beach ridges (Land Zone 2)
- river and creek systems (landforms include alluvial plains, channel benches, stream channels, levees, terraces, flood plains, lunettes, etc.) (Land Zone 3)
- “old” alluvial clay plains and rises (Land Zone 4)
- aeolian clays (parna) forming arid plains, rises and low hills (Land Zone 4)
- “old” alluvial sands and loams on plains, rises and low hills (Land Zone 5)
- sand and other non-clay plains not developed *in-situ* from bedrock (Land Zone 5) and
- inland sand dunes (Land Zone 6).

2.1.1 Tidal flats and beaches – Land Zone 1

Contemporary off-shore marine and estuarine deposits are not part of the terrestrial land zones treated in this document. Tidal flats are a result of rivers and creeks depositing fluvial sand, silt and mud in estuarine and coastal areas that may be further mobilised or deposited by wave and current action. Tidal flats occur where coastal waters are protected from strong wave action, such as in estuaries or behind coastal barrier sand deposits and islands along the east coast (**Figure 1**). Extensive tidal flats occur in the protected waters of the Gulf of Carpentaria. Tidal inundation of tidal flats can vary from regular daily to an occasional one to two spring tides per year. The distinction between tidal lands and other lands, such as alluvium, is often gradual. Lands that are not subject to tidal inundation but are subject to storm surge above normal tides or river and creek flood waters are not included in Land Zone 1.

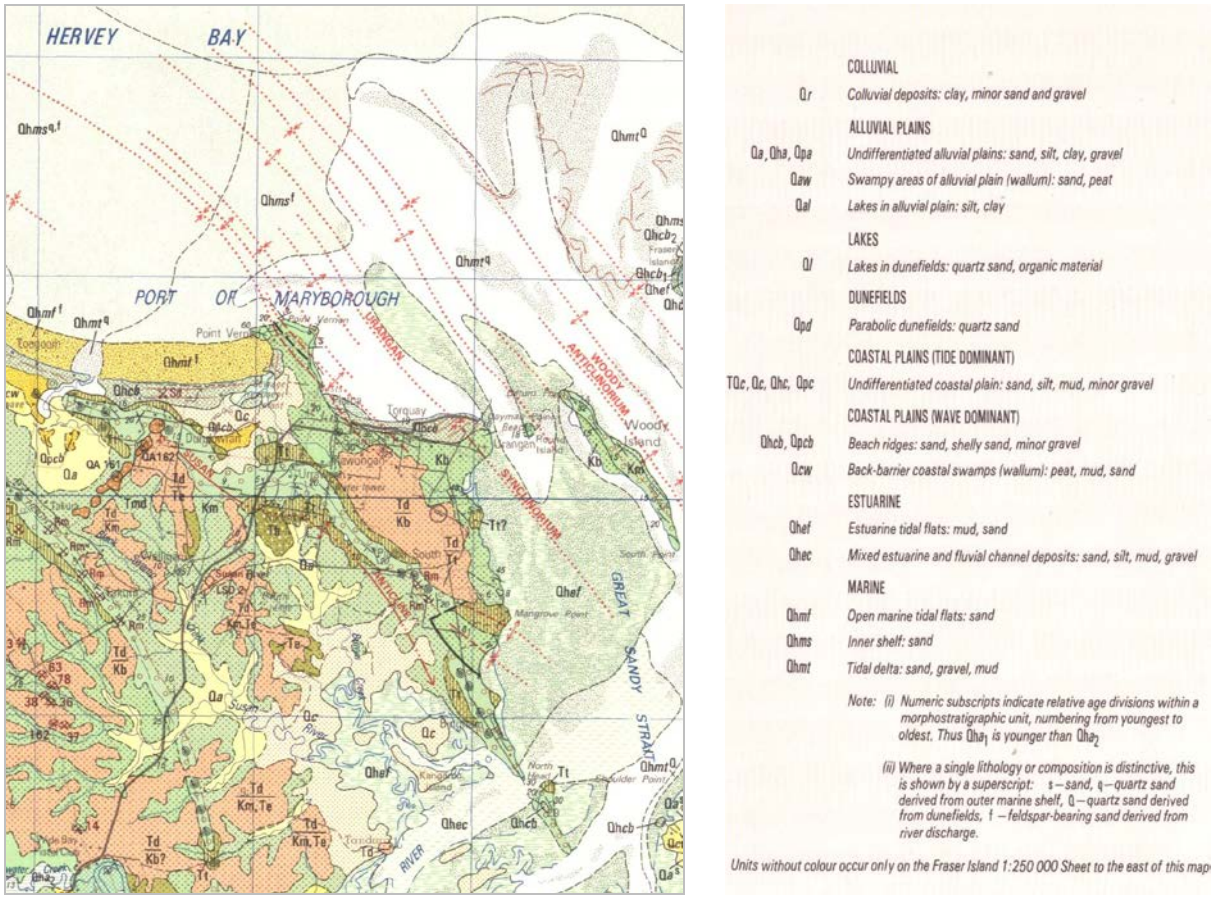


Figure 1 Geology mapping of Hervey Bay with numerous subdivisions of tidal and sub-tidal sediments (1:250 000 geology map)

2.1.2 Coastal sand dunes and beach ridges – Land Zone 2

During the Quaternary Era (Pleistocene and Holocene), sand materials were deposited along the coast. These materials have been reworked by wave and wind actions to form extensive dune fields and beach ridge plains.

During the previous interglacial period within the Pleistocene (140 000 to 120 000 years BP), evidence suggests that the sea level rose 4–6 metres higher than the present (Pickett *et al*. 1985) depositing a series of beach ridges parallel to the current coast mainly by wave action and modified by wind. Many of these "old" beach ridges with well-developed podzol indurated sand horizons (coffee rock) have been fragmented by "recent" sea level rises and alluvial processes, and degraded by wind and stream action. Examples of these old fragmented beach ridges many kilometres inland from the current coast occur in many areas, such as Bribie Island (**Plate 7**), Hervey Bay, Bundaberg, Ayr and Tully. Coarse textured (sand) paleo-estuarine deposits (Pleistocene) elevated above tidal influence and not subject to current alluvial processes are included.

The linear sand dunes typical of Moreton Island, Fraser Island and Cape Flattery (**Plate 10** and **9**) and numerous other areas developed predominantly during the dry Pleistocene glacial and interglacial periods (120 000 to 20 000 years BP) when the sea level receded and then fluctuated between 80 to 126 metres below present (Bloom *et al.* 1974). Prior to the sea level rises in the Holocene (10 000 years BP), sand was blown inland by the prevailing south-easterly winds to form linear dunes. These "old" dunes usually have several well developed podzol indurated sand horizons (coffee rock) reflecting a series of water table

fluctuations and associated erosion and deposition phases. Current sea levels and wave action have eroded some of the dune fields.

Plate 7 Pleistocene and Holocene beach ridges on Bribie Island
(Google Earth)

Plate 8 Linear Holocene beach ridges north of Karumba
(Google Earth)

Plate 9 Longitudinal dunes of Cape Flattery
(Google Earth)

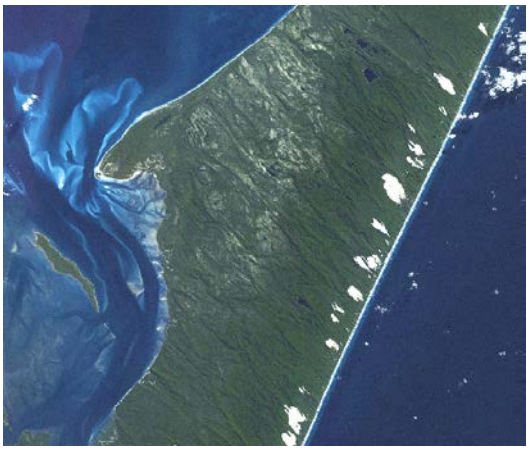


Plate 10 Longitudinal dunes of Fraser Island
(Google Earth)

Sea level rises above current levels in the Holocene around 6500 to 4000 years BP (Thorn and Chappell 1975; Lang et al. 1998) and current sea levels have deposited a series of beach ridges all along the coast from the Gold Coast to the western Gulf (**Plate 8**). Coral cays are included in this process. These “younger” beach ridges and associated low dunes usually have weakly developed podzol horizons where soils are acid. The “younger” frontal beach ridges, calcareous coral cays and dunes may have no or minimal sub-soil horizon development.

2.1.3 River and creek landforms – Land Zone 3

Erosion of uplands (erosion landscapes) and deposition of sediments (sand, silt, clay, gravels) by alluvial processes in relatively low areas (deposition landscapes) have formed a wide variety of alluvial landforms. When flow exceeds the ability of the stream channels to carry the throughput, overbank flow carries sediment away from the channel until the velocity is such that the suspended load is deposited forming alluvial landforms such as levees or alluvial plains.

Alluvial landform patterns as defined by The National Committee on Soil and Terrain (2009) include alluvial fan, alluvial plain, anastomotic plain, bar plain, covered plain, delta, flood plain, meander plain, playa plain, stagnant alluvial plain, and terrace. Each landform pattern contains one or more landform elements including backplain, bank (stream bank), bar (stream bar), channel bench, drainage depression, fan, flood-out, lagoon, lake, levee, lunette, ox-bow, playa, prior stream, scroll, stream bed, stream channel, swamp, terrace flat, terrace plain, or valley flat. In all these landforms, there may be frequent active erosion and aggradation by channelled and overbank stream flow, or the landforms may be relict from these processes (The National Committee on Soil and Terrain 2009).

As described in the coastal sand dunes (Land Zone 2), the high sea levels 4–6 metres higher than the present during the Pleistocene (140 000 to 120 000 years BP) resulted in the deposition of freshwater, estuary and marine sediments along the coast and in river systems. During the recent Pleistocene (120 000 to 20 000 years BP), the sea receded between 80 to 140 metres below present sea level. During this time, rivers and creeks cut deep channels through the previously deposited fluvial, estuarine and marine deposits. Sea level rises up to 1.5 metres above the current sea level in the Holocene (6500 to 4000 years BP) resulted in re-deposition of sediments into the incised and eroded Pleistocene alluvium.

In general terms, coastal streams show two periods of Quaternary alluvial (Qa) deposition within an alluvial valley. The first corresponds to the slightly elevated prior and/or abandoned stream of the recent Pleistocene alluvium (Qpa) (140 000–10 000 years BP). The second corresponds to the lower active Holocene alluvium (Qha) (<10 000 years BP). The recent coastal Pleistocene alluvium are easily recognised by relict alluvial features such as prior stream channels, abandoned channels, relict levees, and alluvial plains and alluvial fans not subject to active channelled or over-bank stream flow. Active Holocene alluvium is usually recognised by landform patterns associated with current stream channels and over-bank stream flow.

Soil developed from the Pleistocene alluvium usually (but not always) has a higher degree of profile development compared to the Holocene alluvium, however both landscapes usually grade into each other making distinction difficult (**Plate 11**). In many cases, the recent Pleistocene alluvium is inundated in part by flood events from creeks draining the local uplands. Because of these difficulties, recent alluvium (140 000 years to present) covers the Holocene (Qha is generally the active alluvial processes) and the recent relict sediments of the associated Pleistocene alluvium (Qpa).

Plate 11 Complex coastal geomorphology on the Townsville coastal plain
This involves: Crystal Creek and associated Holocene alluvium (Land Zone 3) deeply incised into the adjacent recent Pleistocene (140 000–10 000 years BP) alluvium (Land Zone 3). Ollera Creek to the south is incised into the alluvium and relict prior streams associated with recent Pleistocene as well as active Holocene alluvium (<140 000 years BP) (Google Earth). Codes represent soil mapping units.

The recent (<4000 years BP) lowering of sea levels to the current level has exposed previous estuarine and marine sediments, both Pleistocene and Holocene. These recent sediments now form various alluvial plains, flood plains and swamps not subject to current marine tidal influence and are regarded as river and creek alluvium of Land Zone 3.

In inland river systems, erosion of the Tertiary and upland landscapes has delivered large quantities of sediments to the Murray–Darling, Lake Eyre and Bulloo River systems as well as to internal drainage depressions such as the Lake Galilee and Lake Buchannan, and playas (ephemeral salt lakes) of arid Queensland (**Plate 12**).

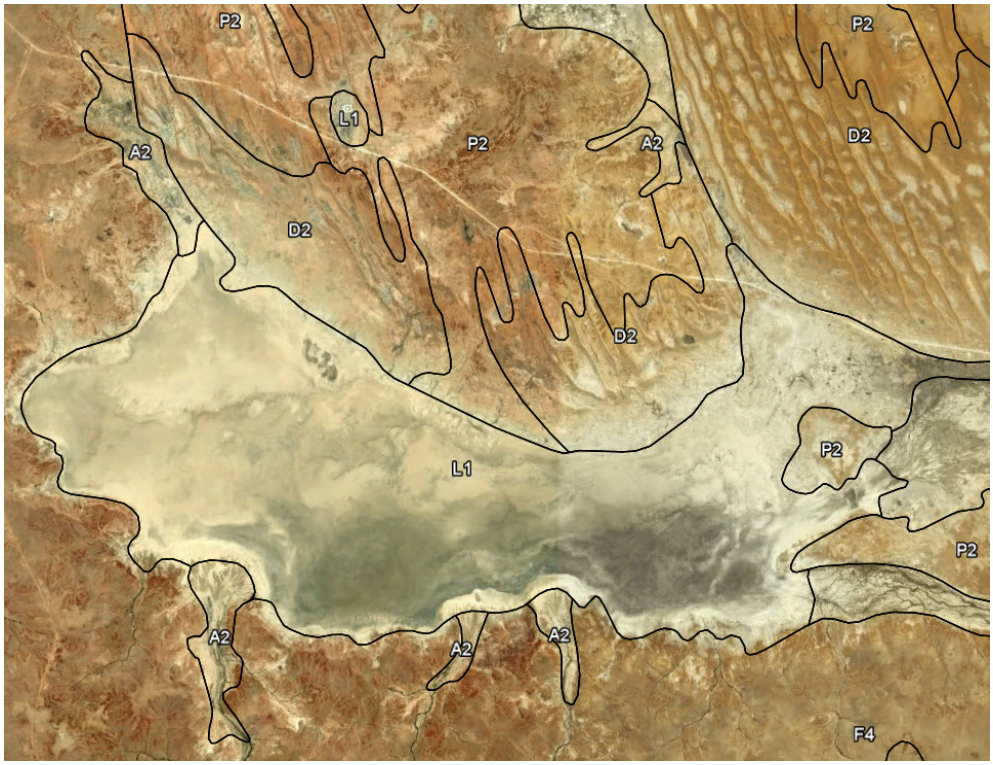


Plate 12 Playa (ephemeral salt lakes) of Land Zone 3 are common landforms in arid Queensland
Codes represent land systems from Wilson and Purdie (1990) (Google Earth).

These inland rivers generally have low gradients and frequently braided stream channels, and may have only a defined main channel in the headwaters. Several phases of erosion and deposition during the Tertiary to Quaternary periods and minor tectonic activity have resulted in several "old" and "recent" alluvial landscapes. The "recent" alluvium generally follows current stream channels while the "old" alluviums (Land Zone 4) remain as slightly elevated plains that are divorced from and often dissected by the recent alluvial processes and have a lack of distinct drainage patterns such as channels and levees (active or relict) or over-bank stream flow (flooding) as these features are removed, modified or degraded over time from the Tertiary to early Pleistocene.

Quaternary alluvial fans are prominent landforms in many areas of Queensland. These fans are predominantly very gently to gently inclined with low relief and rapidly migrating alluvial stream channels form a centrifugal to divergent, integrated, reticulated to distributary (fan) pattern. For example, coalescing alluvial fans form a continuous landform at the base of the granitic and metamorphic mountains on the wet tropical coast of north Queensland (**Plate 13**). The gently inclined (<10% slope) upper slopes frequently with incised stream channels (2–3 metres deep) indicating a non-active "older" alluvial system, that grade into very gently inclined (<3% slope) lower slopes with migrating distributary channels that are actively aggrading. In this example, the distinction between the "older" fans and active fans is difficult to distinguish and are combined into "recent" alluvium. These "recent" alluvial fans are often designated as Quaternary alluvium (Qa) on geology maps. Colluvial pediments (often mapped as Qr) are sometimes difficult to distinguish from alluvial fans, but in this example, the landform pattern originating form gullies and creeks draining the adjacent hills and mountains readily identifies fans from pediments.

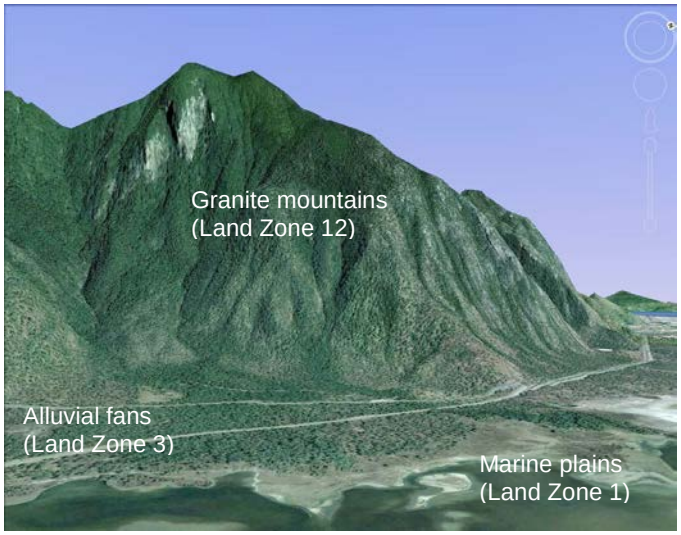


Plate 13 Quaternary alluvial fans of Mt Elliott, south of Townsville with streams and gullies from Mt Elliott aggrading fans onto the coastal marine plains
(Google Earth)

2.1.4 "Old" alluvial clay plains – Land Zone 4

*Paleo**-alluvial clay plains and gently undulating rises originating from "old" alluvial processes cover extensive areas of Queensland (Craig *et al*., 2008). Erosion of the Tertiary land surface (see Land Zone 5 and 7) during the wet interglacial periods of the Tertiary and early Pleistocene have deposited several phases of alluvium over the underlying geologies. Due to sea level fluctuations, tectonic activity, stream migration into basins and general lowering of the landscape by erosion, this "old" clay alluvium is now elevated above the "recent" alluvial valleys and plains. The "old" alluvium is recognised by the undulating landform elevated above recent alluvial landforms, and the lack of distinct drainage patterns such as channels and levees (active or relict) or over-bank stream flow (flooding) as these features are removed, modified or degraded over time from the Tertiary to early Pleistocene. In all cases, the same "old" alluvium that can be many metres thick may cover a range of geologies. For example, the "old" alluvium brigalow clays of the western Fitzroy Catchment have been deposited into the Eyre basin around Tambo and Blackall and continue west to become "old" alluvium supporting gidgee (**Plate 14**). In this example, the "old" alluvium covers a diverse range of Permian to Cretaceous formations.

* See Glossary

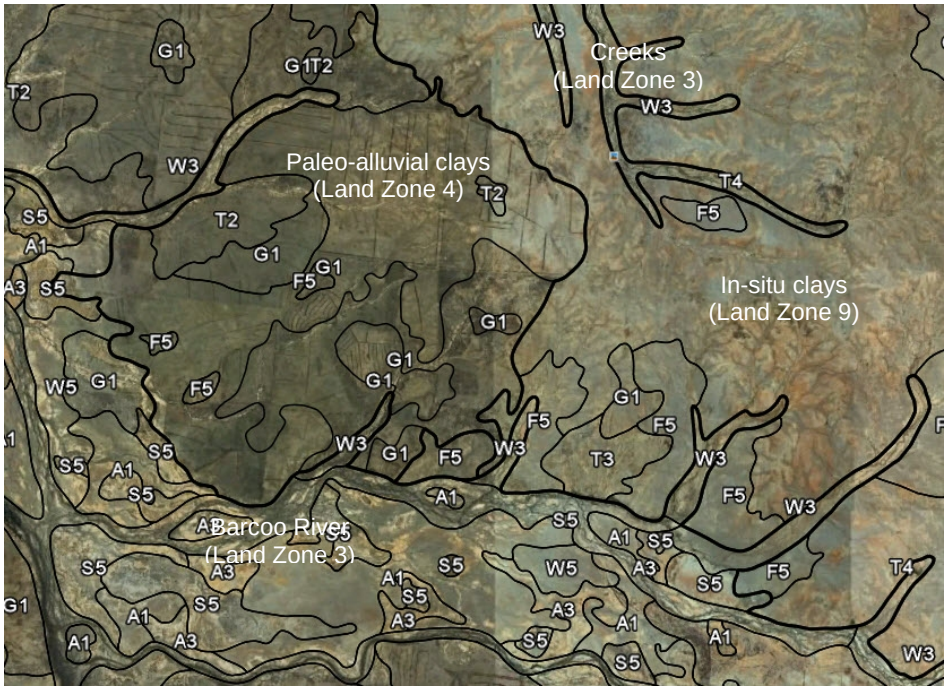


Plate 14 Paleo-alluvial clay soils of Land Zone 4 associated with gidgee (G1, T2)
They are overlying a range of geologies north of Blackall; and clay soils developed in-situ on labile sedimentary rocks of Land Zone 9 associated with Mitchell grass downs (F5, T3, T4). Alluvium of the Barcoo River (Land Zone 3) occurs to the south (Google Earth).

In other examples in far western Queensland, "old" clay alluvium overlies other geologies (**Plate 15**), including older duricrusted deeply weathered geologies.

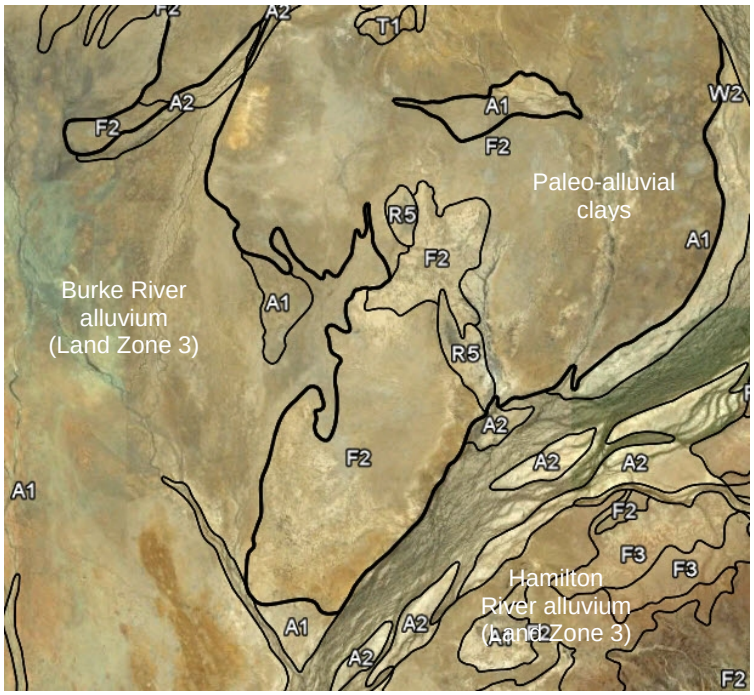


Plate 15 Paleo alluvial clay plains (F2) of Land Zone 4
These overlie Tertiary limestone and other geologies (F2). The paleo clays occur as elevated plains and have a different origin to the current Burke and Hamilton River alluvium (A1, A2 and wooded alluvium) of Land Zone 3 (Google Earth).

In most cases, these clays have surface gravels (coarse fragments) reflecting the underlying geology or transported from geologies where the "old" alluvium originated. In all cases, the gravel concentrates on the surface due to *vertic*[*] (shrink-swell) properties of the clay. Thin veneers (<0.5 m) of non-clay material may be deposited over the clay sediments but due to the *vertic** properties of the underlying clays, this non-clay material is usually mixed to various extents with the clay.

"Old" alluvial sands and loams on plains, rises and low hills (Land Zone 5) are often associated with Land Zone 4.

2.1.5 Aeolian clays (parna) forming arid plains, rises and low hills – Land Zone 4

Aeolian clays (parna*) have influenced many soil landscapes of south-eastern and arid Australia and were first reported by Butler (1958). Parna blankets large areas of western Queensland (Craig et al. 2008), New South Wales, Victoria and South Australia and were deposited over the landscape in a series of events mainly during the cold dry glacial periods (Bowler 1986) of the Quaternary. In arid western parts of the state, this parna overlies all geologies (including duricrusts) except recent alluvium where alluvial processes have removed, mixed or buried the aeolian deposits.

The clays have mainly originated from southern landscapes (Victoria and South Australia) during Tertiary and old Pleistocene low sea level glacial (dry) periods. Minor dust accumulation continues particularly in drought periods. The distribution of the parna has followed the circulating high pressure winds over the continent, with some parna deposited on the Australian Alps and in New Zealand. The clay material has vertic* (shrink-swell) properties resulting in cracking clays that are often gilgaied and thin surfaced texture contrast soils (desert loams), frequently with surface gravel of various origins (mainly silcrete and ironstone) (**Plate 16**). Gravel free clays also exist. In all cases in western Queensland, the clay soils are high in sodium chloride and gypsum salts reflecting their origin (**Plate 17**). The complex polygenetic processes and morphological properties are further discussed by Chartres (1982). These aeolian clays (**Plate 18** and **19**), which are mainly confined to the Channel Country Bioregion, grade into "old" alluvial clays to the north and east and are difficult to separate.

As the parna blankets the landscape, the landform reflects the original landform of gently undulating plains, rises and undulating low hills. Exposed duricrusted scarp retreat areas (Land Zone 7) exist on the edge of Tertiary plateaus where the parna has been removed by erosional processes. Parna is usually recognised by the same clay soil blanketing a range of landforms and geology, the undulating landform elevated above recent alluvial landforms, and the lack of distinct drainage patterns such as channels and levees (active or relict) or over-bank stream flow (flooding), as for paleo-clay alluvium.

Geology maps have not recognised parna as a separate geology code.

[*] See Glossary

Plate 16 Gravel pavements on Parna, Birdsville–Bedourie Road
Even after heavy rain, soils remain dry below the pavement.

Plate 17 Deep Parna deposits with gypsum in the lower profile, Windorah–Birdsville Road

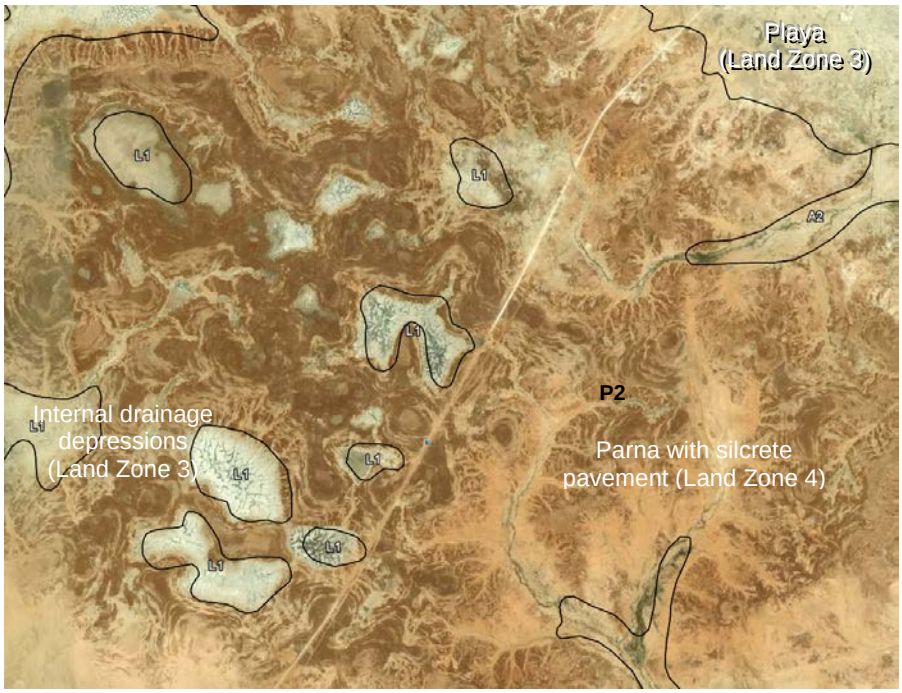


Plate 18 Parna (P2) of Land Zone 4 with silcrete gravel pavements
These overlie deeply weathered Winton Formation, Birdsville–Bedourie Road. Some internal drainage depressions (L1) of Land Zone 3 occur (Google Earth).

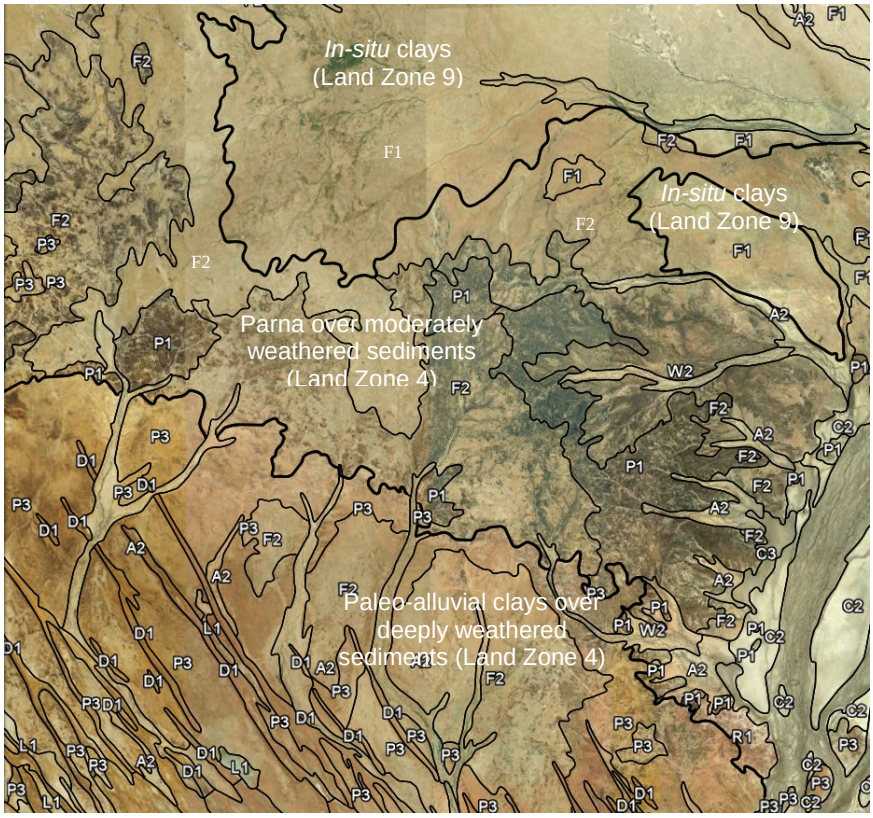


Plate 19 Complex geomorphology south-east of Bedourie
These involve: paleo-alluvial Vertosols (F2) and Sodosols (P3) of Land Zone 4 overlying deeply weathered Winton Formation in the southern half of the image; parna Vertosols (F2) and ironstone over parna (P1) of Land Zone 4 overlying moderately weathered Winton Formation in the northern half of the image; and clays of Land Zone 9 developed in-situ (F1) on moderately weathered labile sediments of the Winton Formation in the far north. Alluvium of the Diamantina River (Land Zone 3) occurs to the east (Google Earth).

2.1.6 "Old" alluvial sands and loams on plains, rises and low hills – Land Zone 5

As described for the "old" (*paleo**) alluvial clays (Land Zone 4), non-clay Tertiary and early Pleistocene alluvium is associated with the paleo-alluvial clays (**Plate 20**) and covers large areas of the state. These non-clay paleo-alluvial sediments have originated by similar process and are now elevated above the "recent" alluvium to form plains and gently undulating rises. In some cases, they have been dissected to persist as remnants on low hills (**Plate 21**). The "old" alluvium is recognised by the undulating landform elevated above recent alluvial landforms, and the lack of distinct drainage patterns such as channels and levees (active or relict) or over-bank stream flow (flooding) as these features are removed, modified or degraded over time from the Tertiary to early Pleistocene. These unconsolidated sediments often contain rounded gravels (coarse fragments) of various origins which are usually not related to the underlying geologies. In some cases, the more siliceous or ferruginous sediments have been indurated by the weathering and soil forming processes. Tertiary and early Pleistocene non-clay paleo-alluvial fans also exist elevated above "recent" alluvium of Land Zone 3.

* See Glossary

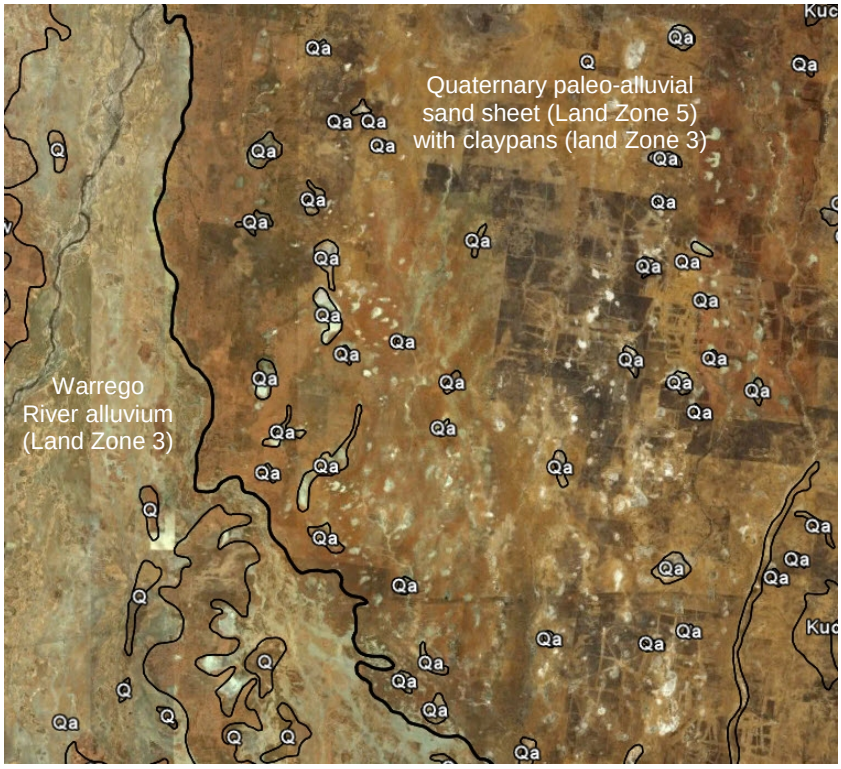


Plate 20 Image of paleo-sandy alluvium of Land Zone 5
This shows "old" degraded non-active alluvial deposition, and associated internal drainage clay pans of Land Zone 3, south of Charleville (Google Earth).

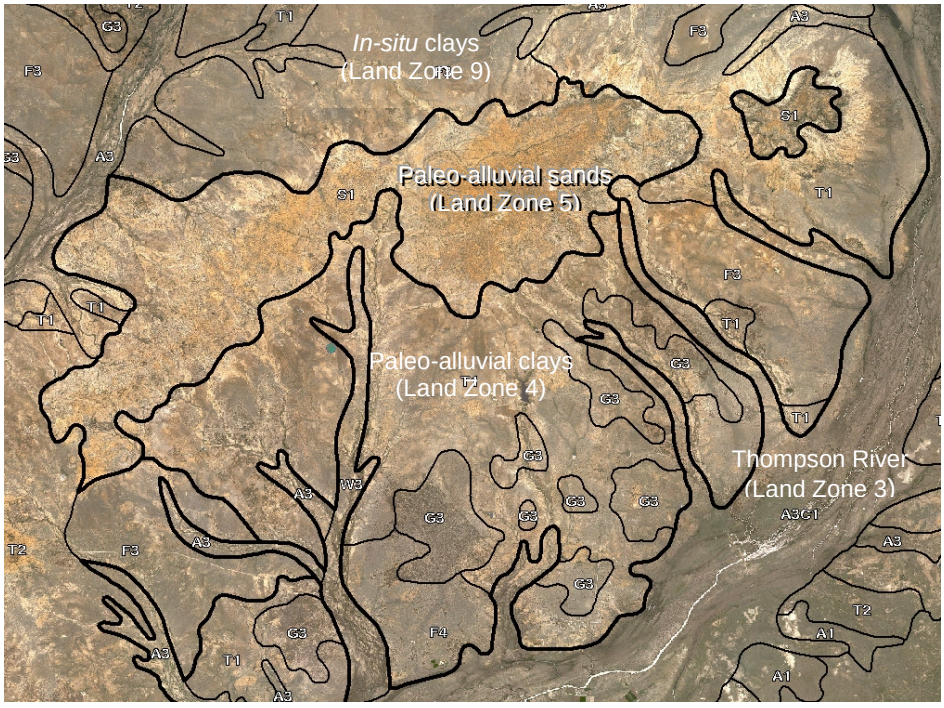


Plate 21 Elevated Tertiary sand alluvia (S1) associated with a paleo-river system not associated with the current Thompson River
The sand deposits (S1) of Land Zone 5 have been deeply weathered and duricrusted in part and eroded. Paleo-alluvial clay of Land Zone 4 is associated with the gidgee (G3, T1) and downs (F4). In-situ clays of Land Zone 9 occur on labile sediments (F3) (Google Earth).

Occasionally, a thin veneer (>0.5m) of transported non-clay sediment can overlie *in-situ* soils or "old" alluvial *vertic*[*] (shrink-swell) clays. In some cases, the underlying soil or clay sediments can be strongly *vertic** resulting in melon hole gilgai with non-clay surfaces up to approximately one metre thick. Land Zone 5 would apply here.

2.1.7 Sand and non-clay plains not developed *in-situ* from bedrock – Land Zone 5

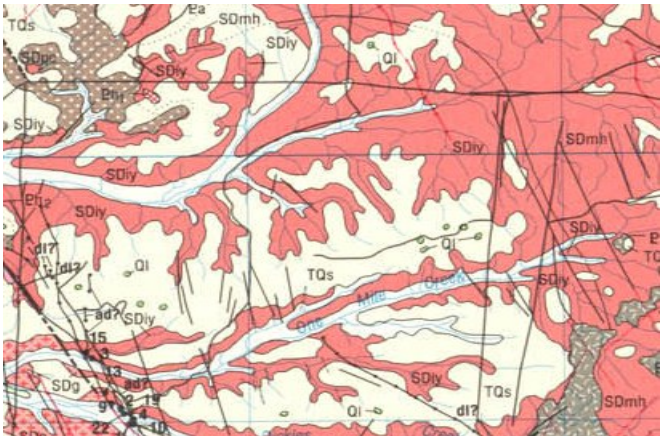


Figure 2 Deep transported sands (TQs) overlying granite (SDly) and other geologies

Erosion of any Tertiary landscape, including "old" alluvial sands and loams and deeply weathered geologies, has resulted in redeposition of sandy to loamy material lower in the landscape as colluvium and diffuse overland sheet wash. These sandy to loamy sediments overlie a range of geologies and have not developed *in-situ*.

For example, large areas of Cape York Peninsula have transported sands (TQs) overlying a range of geologies, including granite (**Figure 2**). These transported sands may have originated from granite but have not developed *in-situ* from the underlying geology. This is reflected by deeper soils, different vegetation communities and different radiometrics (K, Th and U radioisotope signature of the earth's surface) compared to soils developed *in-situ* on granites.

Also, large areas of Cape York Peninsula have loams containing pisolotic nodules and fine gravels (originating from erosion of the Tertiary landscape) overlying clays with no gravel developed *in-situ* from the underlying labile sedimentary rocks **(Plate 22**, **23** and **24)**.

[*] See Glossary

Plate 22 Batavia soil (Land Zone 5) on Cape York Peninsula
It has surface loams >0.5 m containing pisolotic nodules and fine gravels (originating from erosion of the Tertiary landscape) overlying clays with no gravel developed in-situ from the underlying labile sedimentary rocks.

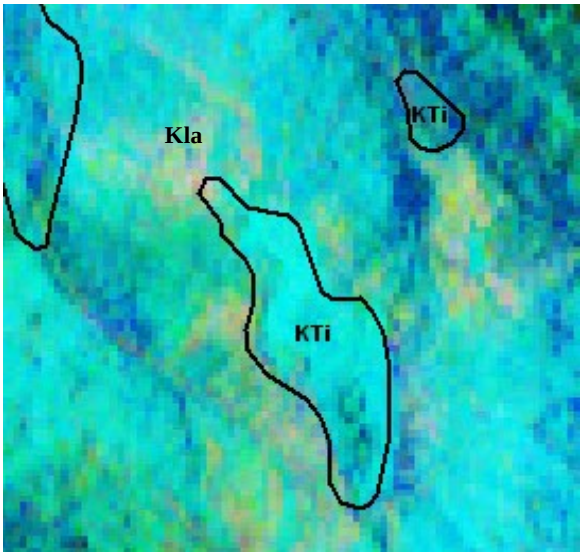


Plate 23 Geology and radiometrics (K, Th and U radioisotope signature of earth's surface) of Batavia Downs, Cape York Peninsula.
The high Th signature (blue) indicates deeply weathered geology (KTi) and associated colluvial material. The high K signature (pink) indicates K feldspars associated with the moderately weathered labile sediments (Kla).

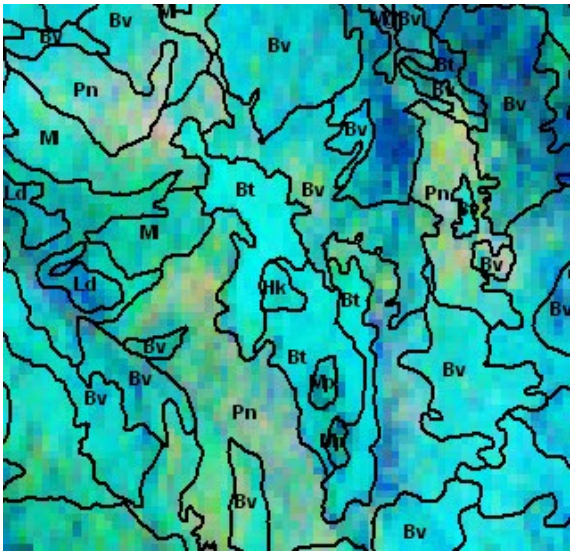


Plate 24 Picanninny (Pn) and Myall (Ml) clay soils developed *in-situ* on labile sediments of the Rolling Downs Group (Kla) (Land Zone 9) both have high K radiometrics.
The Batavia soil (Bv) (Land Zone 5) with high Th signature has colluvial material (see Plate 22) from erosion of the deeply weathered sediments (Bt) (Land Zone 5 and 7) being deposited over the labile sediments of the Rolling Downs Group (Kla).

Some sediment, particularly in semi-arid and arid areas, has been reworked and moved by wind to form level to gently undulating sandplains (**Plate 25**). Any substrate reworked by wind to form sandplains is included, for example, reworking of sandy colluvium and sheet

wash originating from non-deeply weathered quartz rich bedrock. Dunefields are excluded (refer *Inland sand dunes – Land Zone 6*).

Plate 25 Wind-blown sand plains (S2) of Land Zone 5 overlie paleo-alluvial clay plains (F6) of Land Zone 4 south of Winton.
The clay plains grade into mulga lands (H1, M1) on deeply weathered sediments of Land Zone 5. Minor wooded alluvial plains (W3). Reworking of Quaternary alluvium by wind has resulted in sandplains (and associated dunefields of Land Zone 6) overlying the "recent" alluvium or other geologies. In this example, the sand sediments are not developed directly from the "recent" alluvial processes, such as water deposited sandy levees or floodplains. (Google earth)

Sandy material developed *in-situ* (and associated colluvium) on deeply weathered or bedrock geologies (see Section 3.1.2) are excluded from this process.

2.1.8 Inland sand dunes – Land Zone 6

Erosion of the Tertiary landscape and quartz-rich substrates has deposited large amounts of sediments containing sand that have been reworked by wind to form sand dunes and associated sandplains. Dunes become more common to the west corresponding to dryer climatic conditions. Parallel dunes typical of the Simpson Desert (**Plate 26**) are the most common while reticulate dunes enclosing claypans are confined to alluvial landscapes (**Plate 27**). Isolated semi-stable and mobile dunes are associated with many river systems in western Queensland. The dunes follow the direction of the prevailing south-easterly winds with the mobile crests being steeper on the eastern side due to the westerly winds in winter.

The difference between sand dunes and the associated sand plains may be less obvious at times. In general, dunes predominate when the convex dune crests and concave dune flanks dominate over the level inter-dune sand plains

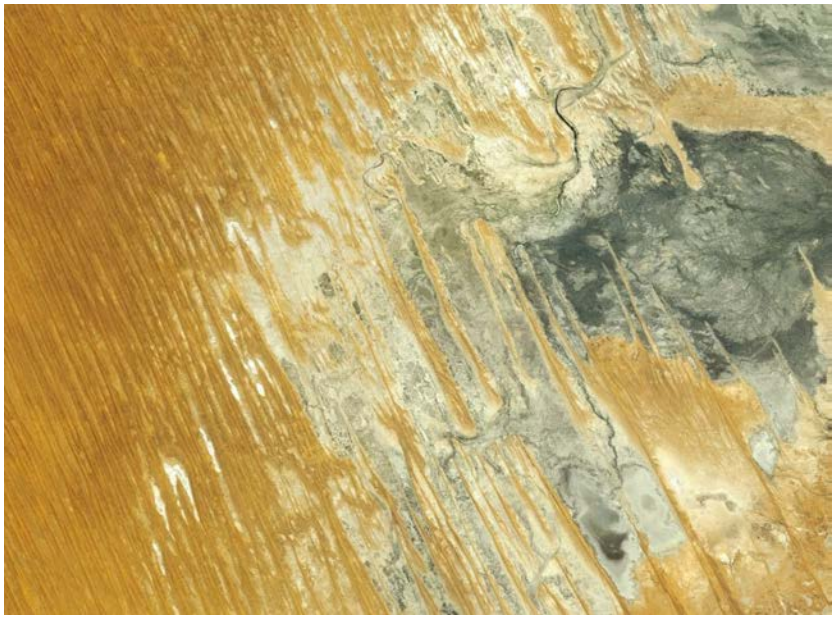


Plate 26 Longitudinal dunes of the Simpson Desert
The leading edge (south-east end) of the dunes on alluvium are frequently deflated (eroded by wind) and cemented (due to clay). In general, dunes are predominantly pale coloured on the north western side of the large alluvial plains of the Channel Country where the sand originates and becoming redder to the north-west. The red colour is due to the gradual oxidation of the iron minerals coating the sand grains (Google Earth).

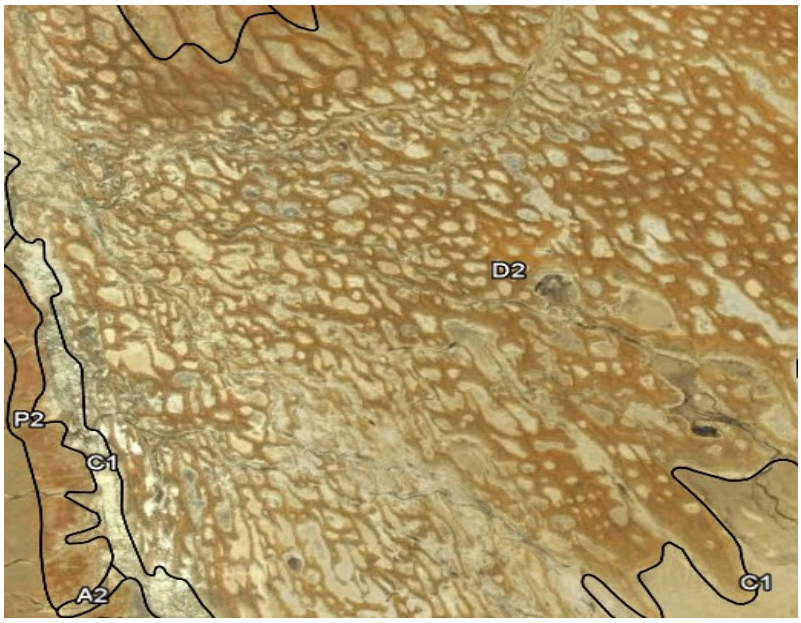


Plate 27 Reticulate dunes on alluvium south of Betoota (Land Zone 6)
Deflated (wind eroded) dunes composed predominantly of sodium salts and gypsum frequently occur on the north western edge of playas (ephemeral salt lakes). The gypsum becomes recrystallised and cemented to some extent by rain making the gypsum/sand mixture resistant to wind movement. These gypsum dunes grade into normal sand dunes further from the playas (Google Earth).

Lunettes deposited by wave action on lakes are excluded and allocated to Land Zone 3.

2.2 Deep weathering and duricrusts

During the Tertiary, up-warp and erosion of the original landscape, and deposition of sediments over extensive areas occurred, followed by a stable phase in which planation (flat or level) surfaces were common, and deep weathering under prolonged wet climatic conditions was the main process. Ferruginous, siliceous, or other types of duricrust formed during these stable phases. Because of their indurated nature, these surfaces are commonly still preserved (Day *et al.* 1983)

In general usage, the term "deep weathering" is considered synonymous with lateritisation* – the process of transformation of a (near) surface layer (rock or soil) into lateritic regolith (Eggleton 2001). In un-dissected profiles, the regolith typically has a red soil (*in-situ* or transported) over completely weathered* bedrock high in iron and/or aluminium oxides and kaolin clays and may contain quartz, and may be strongly mottled or pallid (pale) in colour in the lower part (**Plate 28**). Profiles are often very deep and can be >10 metres deep over the underlying moderately fresh bedrock. Typically, all rock structure, including bedding, has been destroyed and all minerals have been chemically weathered to kaolin with or without resistant quartz. In extreme weathering, gibbsite (aluminium hydroxides) and sesquioxides (iron and aluminium oxides) remain as the dominant material. The lower part of the deeply weathered profile grades to very highly weathered* rock. Very highly weathered bedrock is produced by the thorough decomposition of the rock mass but retains the structure of the original rock and all rock minerals have decayed. The deep weathering process is independent of rock type.

In many situations, the red soil (*in-situ* or transported) or the red upper part of the deep weathered profile is lacking due to landscape processes or erosion in part. Under wet conditions, the oxidised iron becomes reduced and soluble, and can be rapidly removed from the profile leaving pallid (pale) colours. Also, erosion processes can partially remove the upper part of the deeply weathered profile.

Very highly weathered bedrock then grades at depth to "moderately" weathered bedrock (**Plate 31**).

Plate 28 Lateritic profile (Land Zone 5) with iron-rich deep soil and lower pallid zone on deeply weathered sediments of the Maryborough Basin, Maryborough

* See Glossary

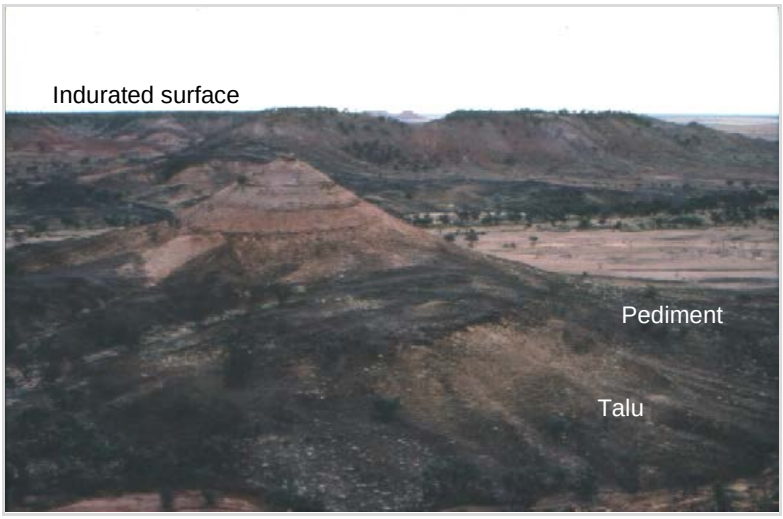


Plate 29 Duricrusted deeply weathered sediments of the *Winton Formation* (Land Zone 7), south-west of Winton
This involves: the level indurated Tertiary surface (background), talus slopes and pediments. Ironstone lag gravels originate from the ferruginous duricrust and iron-rich layers in the deeply weathered profile.

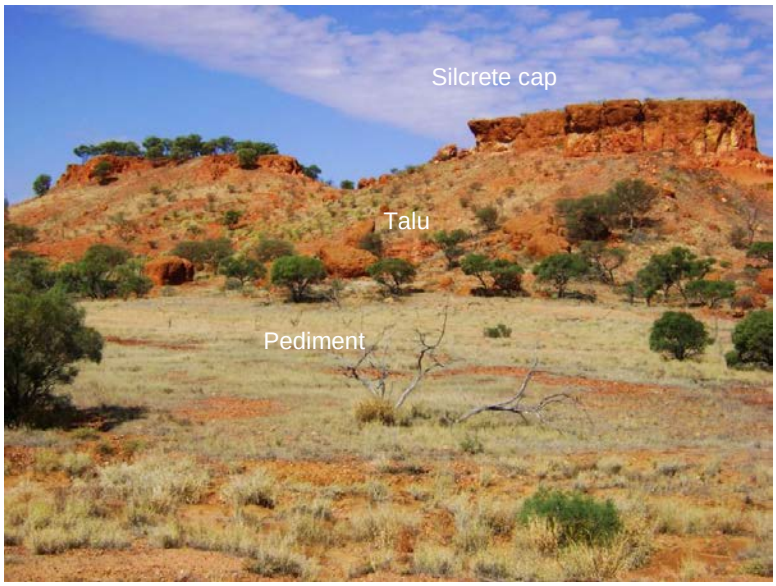


Plate 30 Duricrusted deeply weathered *Winton Formation* (Land Zone 7), west of Winton
This has a silcrete cap and talus slopes. Pediments with lag gravels (<0.5 m) overlie clay soil developed in-situ on moderately weathered labile sediments (Land Zone 9).

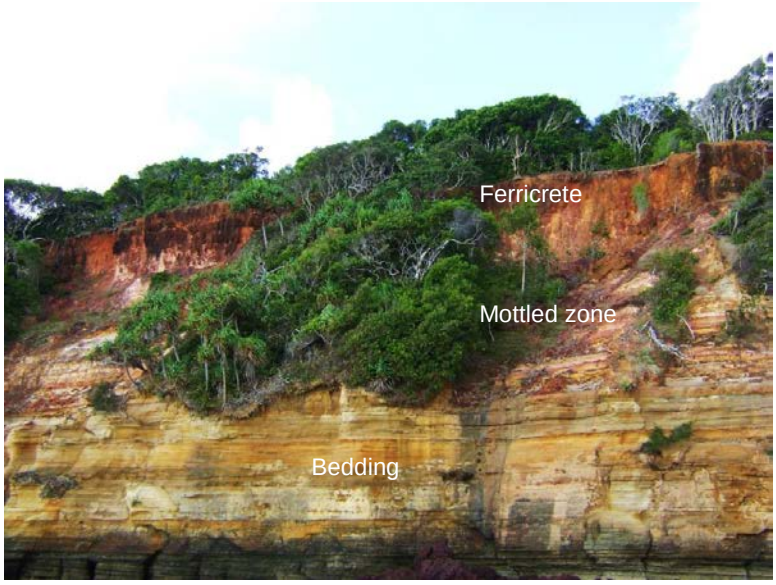


Plate 31 Deeply weathered *Helby Beds* (Land Zone 5) on Cape York Peninsula
Has deep soil over ferricrete over a mottled zone grading into moderately weathered sediments with distinct bedding at depth.

During the intense and prolonged weathering of the Tertiary landscape, many but not all of the deeply weathered profiles became indurated (cemented) due to the residual accumulation of secondary minerals within the profile, or due to the lateral mobilisation, accumulation and precipitation of soluble minerals such as silica (silcrete) and/or iron (ferricrete) (**Plate 29** and **30**). Accumulation and cementation are commonly a response to climate or drainage status (Craig *et al*. 2008). Silicification of carbonates during deep weathering may result in chalcedony and an indurated surface, such as the Tertiary limestone deposits in the Georgina Basin. Accumulation of calcareous indurated layers (calcrete) is not part of the deep weathering process because carbonates are partially soluble and are removed during the intense weathering process, but they may accumulate in profiles due to landscape processes post deep weathering. Indurated surfaces are commonly still preserved (Day *et al*. 1983).

While the deep weathering profile may have arisen low in the landscape, subsequent uplifting and erosion of the Tertiary landscape has resulted in elevated tablelands and plateaus now often high in the topography; a process termed ‘relief inversion’. The current landscape has resulted in a remnant Tertiary surface with dissected plateaus, mesas, buttes and scarp retreat areas remaining over large areas of western Queensland (**Plate 29)**. Stripping of the soil or other unconsolidated material off the duricrusted profile, particularly at the edge of plateaus and mesas, has exposed the duricrust and non-duricrusted deeply weathered profile (Land zone 7).

The distinction between the lower part of a deeply weathered profile and the upper part of a “moderately” weathered geology (**Plate 31**) can be difficult, especially where remnants of the deeply weathered profile remain as low rises surrounded by other land zones developed on bedrock. In this case, examination of rock specimens and reference to geology maps and accompanying notes is essential. Complete removal of the deeply weathered landscape exposes the underlying “moderately” weathered landscapes typical of Land Zones 8, 9, 10, 11 and 12. The erosion products have contributed to the development of the unconsolidated materials discussed earlier (typical of Land Zones 1, 2, 3, 4, 5 and 6).

The persistence of ancient deeply weathered surfaces to this day has greatly influenced contemporary landscapes over much of the state (**Figure 3**). Deeply weathered soil profiles may be tens of metres deep such as that formed on the Binjour Plateau (between Gayndah and Mundubbera) where the whole profile is 65 m deep (CSIRO, 1983).

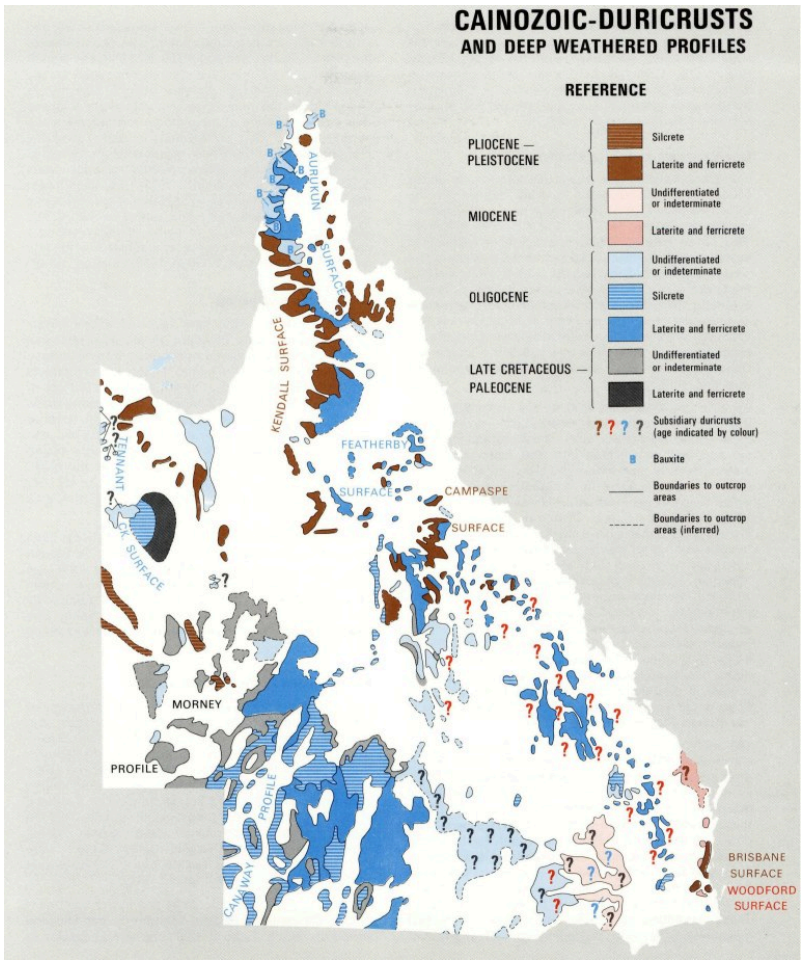


Figure 3 Cainozoic duricrusts and deep weathering profiles in Queensland (Day *et al.* 1983)

Many of the intact duricrusted remnants have scarp retreat areas where erosion of the underlying softer “moderately” weathered bedrock causes undercutting and collapse of the resistant upper part. Colluvial slopes in the scarp retreat areas often have a shallow (<0.5 m) surface veneer of weathered gravels covering soils developed in-situ. Colluvial slopes of deep weathered landscapes, including pediments, with colluvial material >0.5 metres thick are allocated to the deeply weathered land zones. Colluvial slopes with material <0.5 metres thick overlying soils developed *in-situ* are allocated to the adjoining land zone with *in-situ* soil (**Plate 30**).

2.3 Sedimentary, igneous and metamorphic rocks

Rocks are consolidated materials composed of one or more minerals originating from igneous, sedimentary and metamorphic processes. Landforms vary greatly from gently undulating plains to steep mountains, plateaus and ranges.

Rocks at, or near, the surface of the earth, break down under the influence of wind, water, ice, temperature extremes and living organisms. Fragments of varying sizes, produced by this weathering process, may remain on site or be transported by wind, water, ice and gravity.

In general, the bedrock is weathered to varying degrees and includes unweathered rock*, slightly weathered*, moderately weathered* and highly weathered*. In all cases, the rock structure and primary minerals (e.g. feldspars) are not completely weathered and are hereafter collectively referred to as "moderately weathered".

2.3.1 Sedimentary rocks

Sedimentary rocks originate from the consolidation of the sediments (fragmental material) transported and deposited by wind, water, and ice, chemically precipitated from solution, or secreted by organisms, and which forms in layers. Some deposits accumulate to great depth and are subjected to physical pressures, chemical change and heat over millions of years. The result is that a new rock type is formed from the deposit – a sedimentary rock. Sedimentary rock types generally reflect the deposition environment and grain size. Common sedimentary rocks include sandstones, siltstones, mudstones, shales, conglomerates and limestone.

Rocks formed primarily by volcanic activity and deposited in water or air but not transported by water (pyroclastics, pillow larva, and volcaniclastic conglomerate and agglomerates) are excluded and allocated to Land Zones 8 or 12. These volcanic deposits, such as the Neara Volcanics, are by definition sedimentary rocks as they were deposited in water, but are primarily formed from volcanic activity and do not show sedimentary layering. Sedimentary Land Zones (Land Zones 9 or 10) are allocated where volcanics are subdominant within sedimentary rocks.

2.3.1.1 *Fine grained sedimentary rocks with little or no deformation – Land Zone 9*

Fine grained sedimentary rocks refer to the grain size only and include siltstones, mudstones and shales. Sediments chemically precipitated or secreted by organisms include chert, chalk, limestones and dolomites, as well as oolitic sediments.

Depending on the lithology (mineral composition) of the lithic fragments, these fine grained sedimentary rocks are labile (readily decompose to clays) to sublabile (composed of quartz and clay forming minerals) forming clayey soils or soils with clay subsoils. Due to the general "soft" nature of the sedimentary rocks and the readily weathered nature of the lithology, the landforms are dominated by very gently undulating to undulating plains and rises.

Sandstones, arenites and other coarse grained sedimentary rocks with a high proportion of labile or sublabile lithology are included in the fine grained sedimentary rock group as these rocks weather to clayey soils. For example, the labile sandstones of the Winton Formation in the Great Artesian Basin form very gently undulating plains with cracking clay soils.

Little or no deformation corresponds to an interlimb angle* (angle between adjacent limbs of a fold* - 180° is planar or no fold) of 180° to 120° (Blyth and de Freitas, 1994). Moderately deformed* (folded) bedrock is excluded and allocated to Land Zone 11. Most un-deformed to weakly deformed bedrocks are younger than early Permian, but can include older sedimentary rocks such as the Carboniferous limestones and dolomites of the Georgina Basin and the gently deformed western part of the Bowen Basin.

Deeply weathered geologies are excluded and allocated to Land Zone 5 or 7.

* See Glossary

2.3.1.2 *Medium to coarse grained sedimentary rocks with little or no deformation – Land Zone 10*

Medium to coarse grained sedimentary rocks (sandstones, arenites, conglomerates) composed predominantly of resistant quartz form undulating to steep rises and hills, plateaus, and precipitous cliffs, and scarps (**Plate 32, Figure 4**) especially where "soft" easily eroded sediments underlie the sandstones. Interbedded fine grained sedimentary rocks and volcanics may be included but are subdominant. Soils are predominantly "shallow to moderately deep" sandy soils formed in-situ. Deep sandy soils may occur on colluvial slopes (**Plate 33**).

Overlying unconsolidated sediments, either transported or reworked by wind, and "deeply weathered" medium to coarse grained sedimentary rocks are excluded.

Little or no deformation corresponds to an interlimb angle* (angle between adjacent limbs of a fold*; 180° is planar or no fold) of 180° to 120°. Moderately to strongly deformed* (folded) bedrock is excluded and allocated to Land Zone 11. Most un-deformed to weakly deformed bedrocks are younger than early Permian, but older sedimentary rocks are occasionally included in Land Zone 10.

Plate 32 Cliffs and gorges of Jurassic quartzose sandstones typical of Land Zone 10 in the Carnarvon NP.
The gently undulating plains and rises in the north are typical of Land Zone 9 (Google Earth).

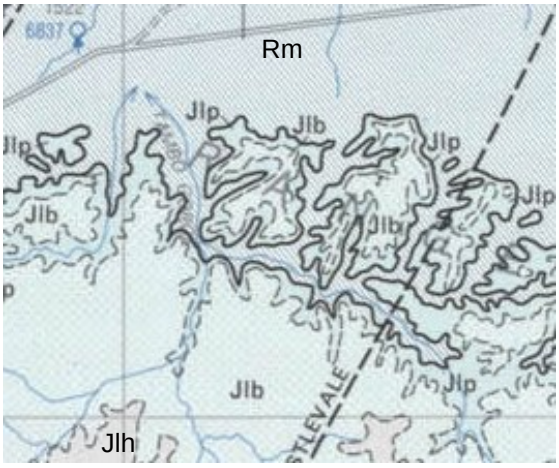


Figure 4 1:250 000 geology map of same area as Plate 32
The Jurassic Precipice Sandstone (Jlp), Evergreen Formation (Jlb) and Hutton Sandstone (Jlh) form the cliffs and gorges (Land Zone 10) in Plate 32. The labile sediments of the Moolayember Formation (Rm) in the north form gently undulating plains and rises typical of Land Zone 9.

* See Glossary

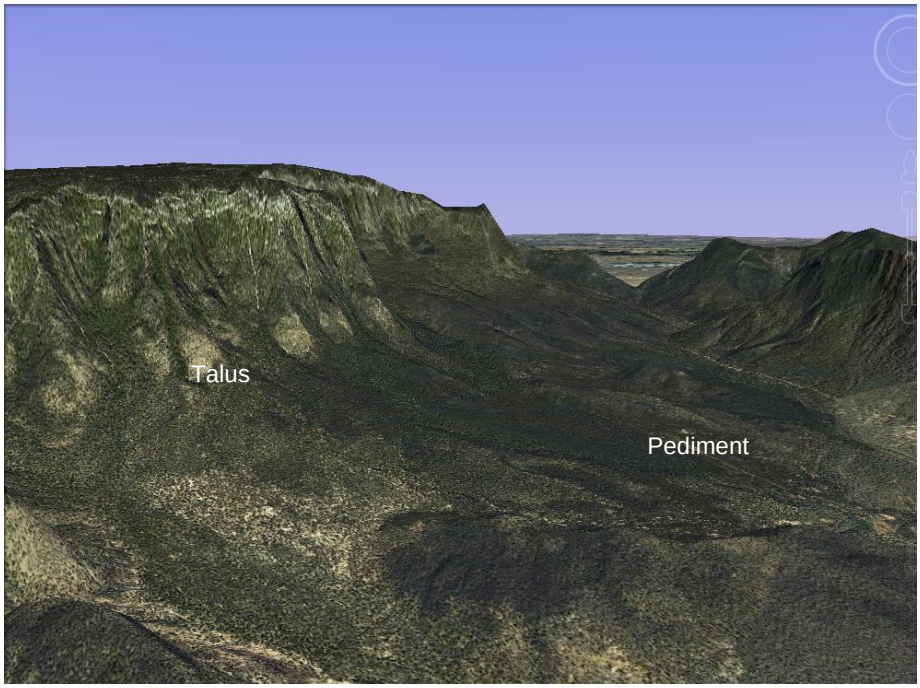


Plate 33 Sandstone cliffs, talus and sandy pediments of the Blackdown Tablelands are all Land Zone 10
(Google Earth)

2.3.2 Metamorphosed rocks – Land Zone 11

Existing rock may be subjected to extremes of heat and pressure sufficient to change their chemical and physical properties and a different type of rock is formed – *metamorphosed rock.* The degree of metamorphism, either alteration or *deformation*[*], is subjective. In general terms, moderately to strongly metamorphosed rocks show signs of partial or complete recrystallisation changed by the solid-state application of heat, pressure and fluids (excluding weathering and *diagenesis**).

Metamorphic rocks are associated with orogenic* phases where regions are subject to folding, faulting and deformations, and granitic intrusions, and intensive volcanic activity, usually associated with continental plate tectonic activity. The main metamorphic regions described by Day et al. (1983) are the Proterozoic rocks of Mt Isa Inlier of the north-west Highlands (**Plate 34**), Coen Inlier on Cape York Peninsula and the Georgetown Inlier of the Einasleigh uplands. Post Proterozoic metamorphism is associated with the Thompson Orogen (Townsville south through central Queensland), the Hodgkinson–Broken River Orogen (Cooktown to west of Ingham), and the New England Orogen along the coast/near coast of Queensland (Proserpine to the New South Wales border). The various Inliers and Orogens are shown in the geological structural framework for Queensland (**Figure 7**).

Some sedimentary basins have been moderately deformed (folded) but the rocks have not been significantly altered or recrystallised. Moderately to strongly deformed* (folded) sedimentary rocks are included in the metamorphosed land zone and have an interlimb angle* (angle between adjacent limbs of a fold*; 180° is planar or no fold) of less than 120° (Blyth and de Freitas 1994). The interlimb angle can operate as a site expressed as a foliated rock sample, or can be at a regional scale expressed on geology maps, geology notes and satellite imagery.

[*] See Glossary

For example, the Bowen Basin was affected by the closing phases of the New England Orogeny and moderately deformed (moderately folded) in the eastern part in contrast to the relatively gently deformed western part (**Plate 35** and **Figure 5** and **6**). Most sedimentary formations older than Permian are moderately to extensively deformed and are associated with the various Inliers' and Orogens' as shown in the geological structural framework for Queensland (**Figure 7**).

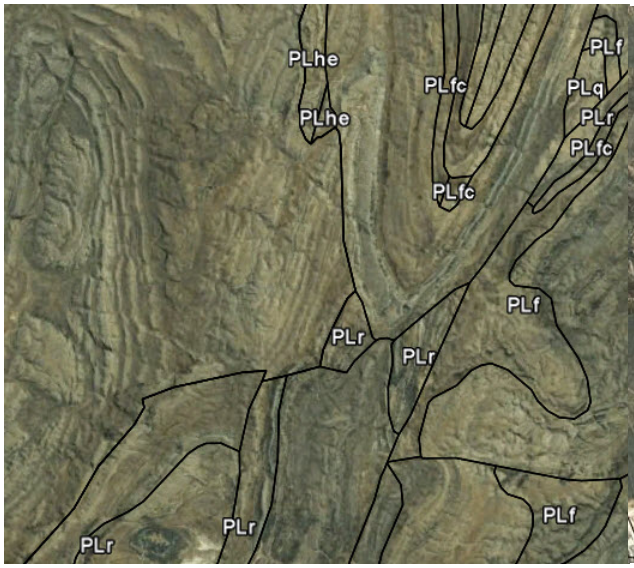


Plate 34 Strongly folded and strongly metamorphosed geologies
(Land Zone 11) of the Mt Isa Inlier (Google Earth)

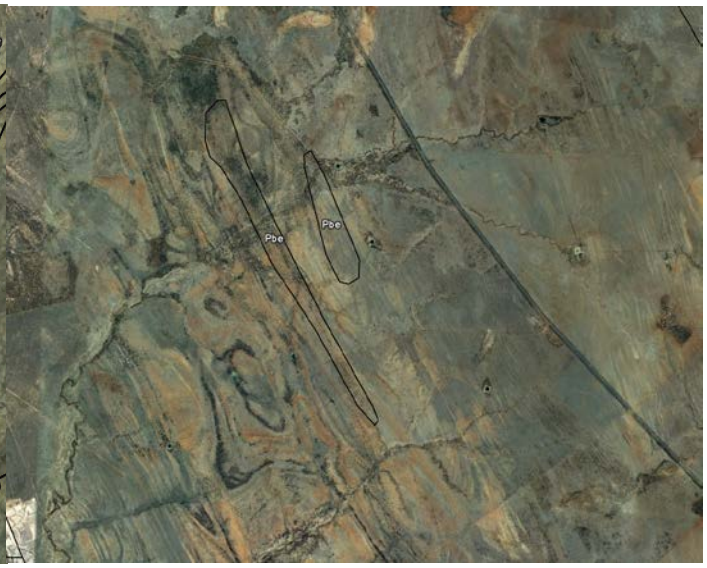


Plate 35 Strongly folded fine grained sedimentary rocks of the Blackwater Group (Puw) in eastern Bowen Basin
(Land Zone 11) (Google Earth)

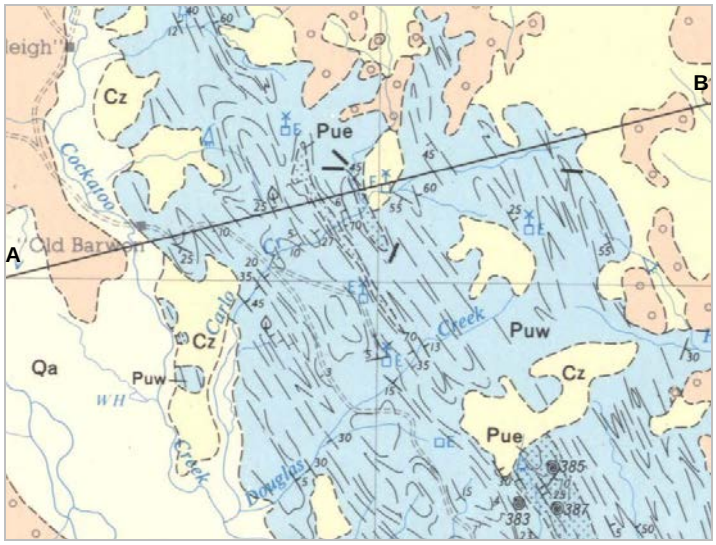


Figure 5 1:250 000 geology map of the same area as Plate 35 showing surface strike, dip and trend lines

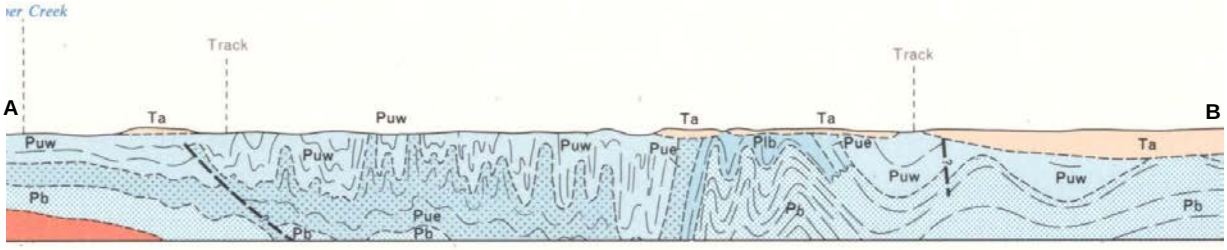


Figure 6 Cross section (A–B) showing strongly folded sediments of Blackwater Group (Puw) *(1:250 000 geology map)*

Metamorphic rock type is reflected in the degree of mineral alteration, crystallisation or deformation (excluding weathering and *diagenesis**) and does not reflect the mineral composition. For example, slate is a compact, fine grained metamorphic rock possessing cleavage, generally originating from metamorphosed shale. Limestone turns to crystalline marble through the process of metamorphism. Schist is a strongly foliated crystalline rock that has well developed lamellar minerals such as micas. Gneiss is an equivalent strongly foliated rock but has coarse mineral structure (often granitic origin). Phyllite is between slate and schist. Mylonite is a fine grained, intensely deformed rock. Quartzite is highly metamorphosed, recrystallised quartz sandstone.

Metamorphosed rocks are generally harder and more resistant to erosion when compared to similar unmetamorphosed rocks. Landforms derived from metamorphosed rocks are typically steeper and more elevated with shallower soil compared to those derived from similar unmetamorphosed rocks.

All metamorphosed rocks including metamorphosed igneous rocks are included in Land Zone 11.

* See Glossary

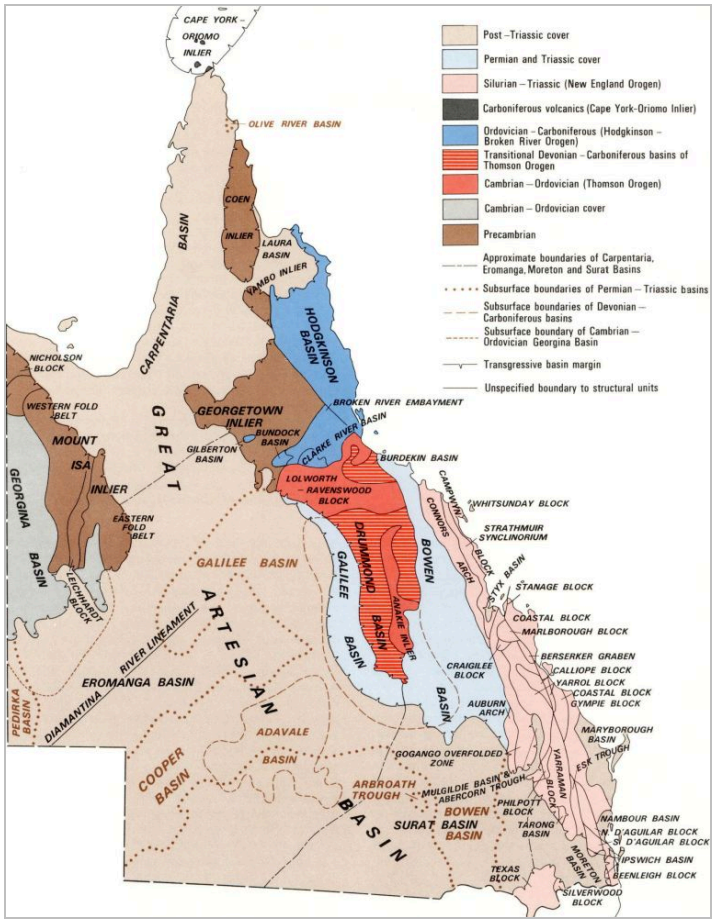


Figure 7 Geological structural framework (1: 2 500 000 Queensland Geology, Day *et al.* 1983)

2.3.3 Igneous rocks – Land Zones 8 and 12

Igneous rocks cover all rocks that solidified from molten or partly molten material originating from magma. Metamorphic rocks, Proterozoic to Mesozoic (Cretaceous and older) acid, intermediate and basic igneous rocks are associated with *orogenic*[*] phases where regions are subject to folding, faulting and deformations, granitic intrusions, volcanic activity, and metamorphism, usually associated with continental plate tectonic activity.

Rock type reflects specific lithology (mineral content) and the environment in which it formed (grain size). As with other rock types, coarse grained rocks weather faster than fine grained rocks; and mafic (generally dark coloured magnesium–iron clay forming) minerals weather faster than feldspars (aluminium silicate clay forming minerals) which weather faster than siliceous minerals.

2.3.3.1 Extrusive igneous rocks

Extrusive rocks are fine grained rocks which form as a result of volcanic activity at or immediately adjacent to the earth's surface. Structures include lava plains, vents and volcanic plugs. Common rock types include basalt, andesite, rhyolite, trachyte and tuffs (pyroclastics). Landforms are commonly plains, rises, craters, steep hills and mountains on the plugs, and dissected tablelands.

[*] See Glossary

Cainozoic (Tertiary to Quaternary) igneous rocks typical of Land Zone 8 occur as flood basalts and associated vents and volcanic plugs (**Plate 36**). Proterozoic to Mesozoic (Cretaceous and older) extrusive rocks are allocated to Land Zone 12.

Plate 36 Quaternary crater lakes of Coulstoun Lakes and cropping on the associated lava plains (Land Zone 8)
(Google Earth)

2.3.3.2 Intrusive igneous rock

Intrusive rocks of Land Zone 12 occur where magma emplaces in pre-existing rock and cools relatively slowly (compared to extrusive rocks) forming crystalline rocks. Intrusive structures include batholiths, sills and dykes. Common rocks include acidic (granite, adamelite), intermediate (granodiorite, diorite, syenite, monzonite), and basic (gabbro and dolerite) rocks (**Plate 37** and **38**). Landforms are dominated by undulating to steep rises, hills and mountains.

These intrusive rocks may have formed many kilometres below the earth's surface, but tectonic activity and subsequent erosion of the land surface over often hundreds of millions of years has now exposed these rocks at the surface. All Cretaceous or older intrusive igneous rocks are allocated to Land Zone 12.

In all cases metamorphosed igneous rocks are allocated to Land Zone 11, and deeply weathered geologies are allocated to Land Zone 5 or 7.

Plate 37 Granitic boulders, Eulo, western Queensland

Plate 38 Granite landscape west of Childers

3. Land Zones

The land zones have been distinguished on geology and geomorphic processes which influence landform, hydrology and soils, all of which influence the structure and function of ecosystems. The following section describes the major features of the 12 land zones and should be used in conjunction with Section 2 describing the land surface (geomorphology).

3.1 Land Zone 1 – Deposits subject to periodic tidal inundation

Definition

tidal flats and beaches	Quaternary estuarine and marine deposits subject to periodic inundation by marine waters. Includes mangroves, saltpans, off-shore tidal flats and tidal beaches. Soils are predominantly Hydrosols (saline muds, clays and sands) or beach sand.

Clarification

Land Zone 1 includes the sands and/or muds deposited by wind and waves in the inter-tidal zone* and higher supratidal* areas under the periodic influence of sea water (**Plate 39**). The substrate materials have been transported and deposited by river and ocean currents, waves and wind. This does not include sub-tidal areas, rock shelves, and rocky outcrops and headlands adjacent to the inter-tidal zone.

Beaches, tidal mud flats and sand deposits which are subjected to direct and repeated tidal influence and which support little or no vegetation other than seagrass communities, are dynamic. They are part of Land Zone 1, but are not mapped on remnant regional ecosystem maps due to community dynamics and water clarity issues for obtaining good quality imagery for mapping. Mangroves (rarely samphire forbland), bare salt pans and terrestrial plant communities tolerant to high salt levels from occasional tides (marine couch) delimit the seaward extent of this mapping programme.

* See Glossary

Plate 39 Mangroves and mud flats, Moreton Bay

Areas inundated by abnormally high tides during storm surges are not part of this land zone.

Extent

The extent of deposits subject to tidal inundation in Land Zone 1 is best indicated by evidence of the extent of tidal inundation and a consideration of the plant species present, with particular weighting being given to the plants in the ecologically dominant layer.

Highest Astronomical Tide

To avoid confusion, the landward extent of Land Zone 1 does not correlate well with the level of Highest Astronomical Tide* (HAT). Differing combinations of astronomical conditions may cause considerably higher tidal levels to occur. Consequently, the landward extent of Land Zone 1 may be higher than HAT.

Investigation in the Tinchi Tamba wetland reserve and the Bundaberg coastal district using differential GPS accurate to within centimetres, has shown that HAT does not correlate closely with obvious ecological boundaries, namely the distribution of halophytic plant species in the field such as *Casuarina glauca* (swamp sheoak) and/or *Sporobolus virginicus* (marine couch) (Tim Ryan pers. comm.).

Field determination

Difficulties arise in establishing the extent and effect of tidal influence in some field situations where saltwater competes with freshwater input. During rain fall events, the freshwater input to the coastal ecosystems increases, while abnormally high tidal surges increase the saltwater input to otherwise brackish or even freshwater environments. Furthermore, salinity can vary over time and often increases as areas dry out.

In most instances, the vegetation is used to clearly indicate which is the predominant influence and, hence, the appropriate Land Zone. Environments influenced by both saltwater and freshwater usually support plants which may indicate salty or freshwater

* See Glossary

environments respectively; for example, *Melaleuca* spp. (tea-trees) dominate the canopy and occur in association with mangroves and *Sporobolus virginicus* (marine couch). In this case, the dominant layer (the ecologically dominant layer – that layer or strata which conditions the habitat of the other layers) is dominated by tea-trees which indicate a freshwater, or, at best slightly brackish, environment. On this basis, ecosystems of this nature would be assigned to a land zone other than Land Zone 1, such as Land Zone 3 – Quaternary alluvial systems. *Eleocharis*[‡] communities, while tolerating some saltwater input, prefer a predominantly freshwater environment and indicate that Land Zone 3 is the appropriate choice. *Schoenoplectus litoralis* (bulrush) is generally influenced by tides and taken to indicate Land Zone 1 when associated with tidal waters.

Saltwater exclusion

Human disturbance to the near-coastal environments has induced significant change.

The exclusion of saltwater by placement of levees or bunds near the salt–fresh interface has allowed agricultural and pastoral pursuits to be extended towards the coast. Such activities have resulted in the conversion of a salty environment to a freshwater one. The Queensland Herbarium mapping methodology (Neldner *et al.* 2005) allows for these areas to be reclassified on the basis of the altered substrate and the corresponding freshwater plant assemblages. Such changes have occurred in the coastal parts of the Brigalow Belt where *Sporobolus virginicus* (marine couch) grasslands have been replaced by freshwater grasses and sedges, and where previously brackish wetlands have become exclusively freshwater wetlands.

The Environment

The geomorphology of coastal tidal sediments is covered in Section 2.1.1.

Soils are dominated by various tidal Hydrosols, typically salty with no agricultural potential.

The vegetation varies widely, both floristically and structurally. Communities are dominated by mangroves, samphire, marine couch and frequently bare salt pans. *Casuarina glauca* and/or *Schoenoplectus litoralis* often occur at the interface of fresh and salt water influence.

[‡] Plant names follow Bostock and Holland (2010).

3.2 Land Zone 2 – Quaternary coastal sand deposits

Definition

coastal dunes	Quaternary coastal dunes and beach ridges. Includes degraded dunes, sand plains and swales, lakes and swamps enclosed by dunes, as well as coral and sand cays. Soils are predominantly Rudosols and Tenosols (siliceous or calcareous sands), Podosols and Organosols.

Clarification

Land Zone 2 includes unconsolidated coastal and near coastal sand deposits originating from wind and wave action during the Quaternary period.

On-shore winds and wave action have transported marine and estuarine sands to above the high-tide level where they accumulate and form dunes and beach ridges which are often stabilised by vegetation tolerant of salt spray but generally intolerant of salty water.

The drainage system of the dune environment and the “swales, lakes and swamps” are considered part of Land Zone 2.

Coarse textured (sand) paleo-estuarine and tidal delta (Pleistocene and Holocene) deposits now elevated above tidal influence are not subject to current alluvial processes and have plant communities and soils (Podosols) similar to beach ridges, are included in Land Zone 2 (see Section 2.1.2).

Medium to fine textured (loams to clay) paleo-estuarine deposits, both Pleistocene and Holocene, make-up part of the contemporary alluvial system of Land Zone 3 (see Section 3.3). These recent sediments that are now not subject to marine tidal influence form various alluvial plains, flood plains and swamps.

Extent

The Queensland coast consists of three major linear dune process dominated regions as identified by Lees (2006) (**Figure 8**).

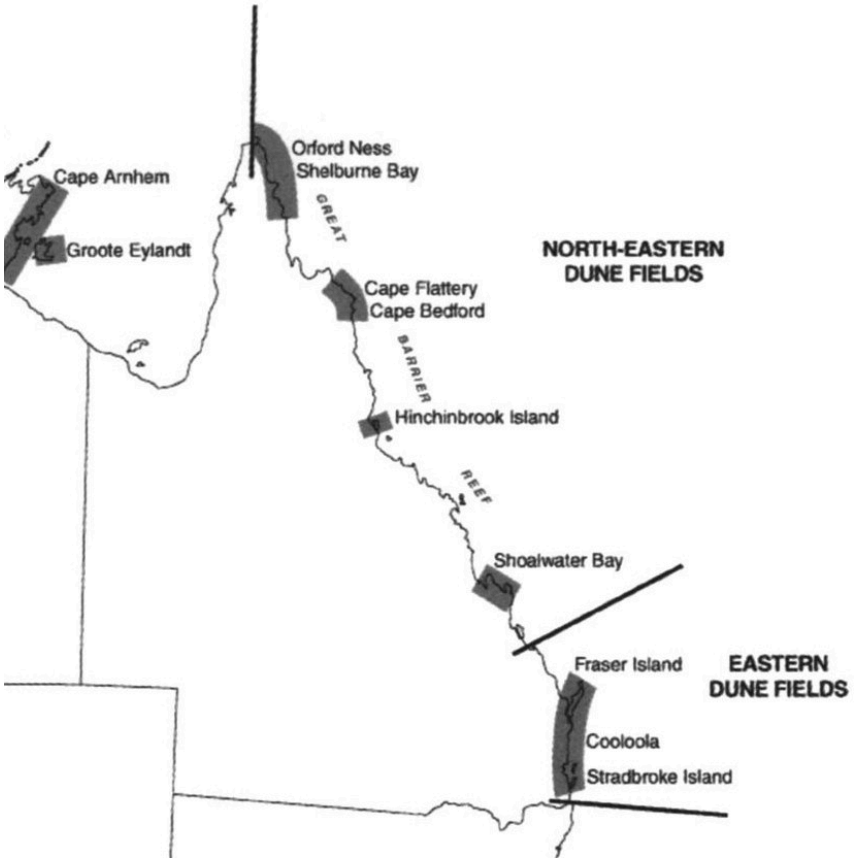


Figure 8 Location of major coastal dune fields in northern and eastern Australia (Lees 2006)

The south-east Queensland coast is characterised by dominant sand-moving winds from the south-east in a wave-dominated environment.

The north eastern and central Queensland coasts are dominated by strong and persistent southeast trade winds and are protected from ocean waves by the Great Barrier Reef.

The western side of Cape York is dominated by the winds of the northwest monsoon and is a tide-dominated environment.

The landward boundary of the dunefields of Land Zone 2 may be actively aggrading or subject to deflation. The seaward extent of Land Zone 2 is discussed in Section 3.1.

Quaternary beach ridges parallel to the current coast developed mainly by wave action and minor modification by wind occur all along the Queensland coast from the Gold Coast to the western Gulf. Many of the older Pleistocene beach ridges have been fragmented by recent Holocene sea level rises and alluvial processes, and degraded by wind and stream action.

The environment

The geomorphology of coastal dune fields and beach ridges is discussed in Section 2.1.2.

Acid sulfate soils originating from the accumulation of iron sulfides under marine environments pose a major constraint to land use practices in Land Zone 2. These soils are benign while they remain under anaerobic conditions such as below the water table however if exposed to oxygen they can release toxic quantities of sulfuric acid and heavy metals such as iron and aluminium into the environment. The highly permeable aerated sands above the water table and any wind-blown sands are of lower risk as the iron sulfides will have oxidised and any sulfuric acid will have been leached from the sand. The oxidised soil horizons may

retain some residual acidity in the presence of *jarosite*[*] which may also have implications for management.

The dominant soils are Podosols where soil organic matter and iron has leached from the surface and accumulated at depth corresponding to permanent or fluctuating water tables. Indurated Podosol B horizons (coffee rock) develop due to the precipitation of organic–iron compounds in aluminium–rich strongly acidic waters. These Podosols are typical of the older Pleistocene dunes, beach ridges and coarse textured (sand) paleo-estuarine deposits now under freshwater influence. Rapidly drained red and yellow sands (Tenosols) occasionally occur on older Pleistocene dunes and beach ridges. Podosols with a colour B horizon (stronger colour than the horizons above or below and no pan development) are typical of the younger Holocene beach ridges and dunes while siliceous sands (Rudosols) with minimal development (if at all) are typical of the frontal dunes, beach ridges and coral cays. Coral cays usually have no profile development but may have cemented pans (beach rock/calcrete) developed. Hydrosols with organic rich surfaces form in organic rich environments such as swamps within the swales.

Soils are generally not developed for agriculture due to low soil moisture availability and low fertility. Soils in low lying areas and swamps are often poorly drained further limiting productivity.

The vegetation communities of Land Zone 2 are diverse both floristically and structurally. Heathlands and Corymbia/Acacia dominant forests and woodlands are the dominant vegetation communities. Rain forests and vine forests may be locally dominant while turpentine (Syncarpia hillii) tall forests are prominent in Southeast Queensland, particularly on Fraser Island and the Cooloola sand mass. Melaleuca forests/woodlands and various low heathlands/sedgelands occur in the swamps.

[*] See Glossary

3.3 Land Zone 3 – Recent Quaternary alluvial systems

Definition

 Alluvial river and creek flats	Recent Quaternary alluvial systems, including closed depressions, paleo-estuarine deposits currently under freshwater influence, inland lakes and associated wave built lunettes. Excludes colluvial deposits such as talus slopes and pediments. Includes a diverse range of soils, predominantly Vertosols and Sodosols; also with Dermosols, Kurosols, Chromosols, Kandosols, Tenosols, Rudosols and Hydrosols; and Organosols in high rainfall areas.

Clarification

Alluvium is “sediment mass deposited from channelled stream flow or over-bank stream flow” (Speight and Isbell, 2009). Land Zone 3 includes Quaternary alluvium (Qa), comprising active Holocene alluvium (Qha) (<10 000 years BP) associated with active alluvial processes, and recent Pleistocene alluvium (Qpa) (140 000 to 10 000 years BP) usually occurring adjacent to and in association with current alluvial systems (see Section 2.1.3).

Coarse, medium to fine textured (sand to clay) paleo-estuarine deposits, both Pleistocene and Holocene that are now above tidal influence make-up part of the contemporary alluvial system of Land Zone 3 (see Section 2.1.3). These recent sediments form various alluvial plains, flood plains and swamps. Coarse textured (sand) paleo-estuarine (Pleistocene and Holocene) deposits under freshwater influence that have plant communities and soils (Podosols) similar to beach ridges and dunes are an exception and are included in Land Zone 2.

Quaternary alluvial systems include landform patterns such as alluvial fan, alluvial plain, anastomotic plain, bar plain, covered plain, delta, flood plain, meander plain, playa plain, stagnant alluvial plain, and terrace. Each landform pattern contains one or more landform elements including backplain, bank (stream bank), bar (stream bar), channel bench, drainage depression, fan, flood-out, lagoon, lake, levee, lunette, ox-bow, playa, prior stream, scroll, stream bed, stream channel, swamp, terrace flat, terrace plain, and valley flat. In all these landforms, there may be frequent active erosion and aggradation by channelled and overbank stream flow, or the landforms may be relict from these processes (The National Committee on Soil and Terrain 2009).

Colluvial deposits, where the net movement of weathered material is down-slope primarily under the influence of gravity, are excluded.

Notwithstanding the difficulty incurred in determining the nature of transported sediment masses in some field situations, the conceptual distinction between alluvium and colluvium is clear. The distinction is made on the basis of the primary agent of transport: alluvium is due to stream or over-bank deposition; colluvium is unconsolidated material at the base of a slope due mainly to gravity which includes sheet wash as a result of diffuse overland sheet erosion and deposition.

To some degree, colluvial material is deposited at/near the bottom of any slope. Recently deposited colluvium at the lower slopes of bedrock landforms is considered to be the land zone of the parent material. Alluvial material deposited in a fan shape issuing from a

constriction and built-up by flowing water is an alluvial structure and therefore Land Zone 3. Occasionally, alluvial fans are difficult to distinguish from pediments of Land Zones 5 to 12 (see Section 2.1.3) (**Plate 40** and **41**).

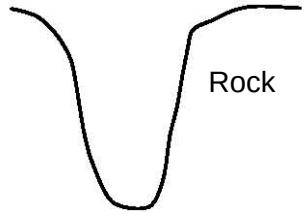
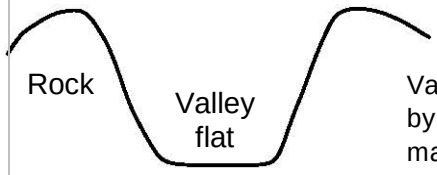
The classification of watercourses based on morphological type generally related to relative position between the source and end/mouth of the watercourse is presented in **Table 2**.

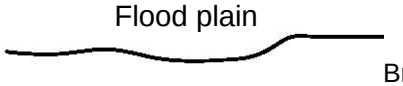
The alluvial systems of Land Zone 3 are confined to Quaternary age. Land Zone 3 includes contemporary active alluvial systems subject to deposition and/or erosion. Relict "recent" Pleistocene (140 000–10 000 years BP) alluvial landforms, such as older higher river alluvial plains and abandoned stream channels, are also included in Land Zone 3 (see Section 2.1.3). These relict alluvial systems occur adjacent to and in association with the active Holocene (<10 000 years BP) alluvium. A typical cross section is illustrated in **Figure 9** and **Plate 42**.

In all cases, geology codes (for example Qa, Qha, Qpa) are a guide to the identification of Land Zone 3. The recent alluvium usually has easily recognisable landform features such as lakes, stream channels (active or relict), levees (active or relict), and alluvial plains (active or relict) or alluvial fans. Playa lakes, clay pans and closed depressions are also included in Land Zone 3.

The drainage system of the dune environment (with vegetation and soils similar to the beach ridges and dunes) including swales, swamps enclosed lake systems, coarse textured (sand) paleo-estuarine deposits and lake deposits (Pleistocene and Holocene) that are elevated above tidal influence and not subject to current alluvial processes are excluded and considered part of Land Zone 2.

Table 2 Watercourse classification at various stages in a catchment

Morphological type	Notes
	Deeply incised valleys and gullies with little or no water transported sediments deposited in the valley floors. The substrate is dominated by exposed rock or other parent material from the surrounding geology. Vegetation influenced by the parent material (not Land Zone 3).
	Valley flat: level alluvial plain with/without a stream channel enclosed by surrounding hills. May have channel benches. Rocky outcrops may occur, especially in stream channel. Soils are generally deep with rudimentary layered alluvial soils (Rudosols) or minimal soil development (Tenosols). Alluvial transported gravels frequently occur in the soil profile.
	Flood plain with channel benches and terraces. The flood plain has broadened and the stream channel is meandering. Soils are generally very deep Rudosols, Tenosols, Dermosols and minor Vertosols on the channel benches, with a diverse range of soils on the occasionally flooded terraces (Dermosols, Kandosols, Sodosols, Kurosols, Chromosols, Vertosols). Gravel deposits uncommon.



Broad flood plain or delta with one or more stream channels, levees, scroll plains, prior streams and swamps. A very diverse range of soil with predominantly Vertosols and Sodosols; also with Dermosols, Kurosols, Chromosols and Hydrosols; and Organosols in the swamps in high rainfall areas.

Plate 40 Alluvial fan (mid-ground) issuing from a gully constriction (Land Zone 3)

Plate 41 Colluvial pediment deposit above alluvial flat (not Land Zone 3)

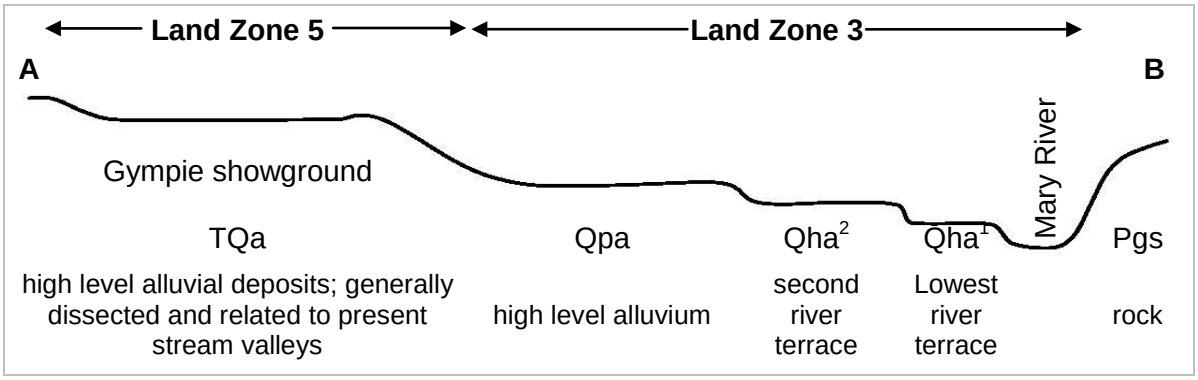


Figure 9 Cross-section (A-B) across the Mary River to Gympie showground (see Plate 42)

Plate 42 Cross-section (A-B) of the Mary River, Gympie
(see Figure 9) This involves elevated paleo-alluvial deposits (TQa) of Land Zone 5 elevated above the recent alluvium (Qha, Qpa) of Land Zone 3. Pgs rock represents Land Zone 11 (Google Earth)

Seepage areas in bedrock landscapes which support hydrophytes and/or vegetation characteristic of alluvial systems are also excluded and attributed to the parent land zone.

Tertiary and early Pleistocene unconsolidated alluvial and lacustrine deposits (see Section 2.1.4) are erosional surfaces in their own right and are discussed in detail in Land Zone 4. These are often depicted as Tertiary (T) or Tertiary–Quaternary (TQ) or Cainozoic (Cz) age on geology maps.

Extent

Quaternary alluvial deposits corresponding to alluvial systems (alluvial landform patterns and elements) are shown in **Figure 10**. The largest expanses occur on the western and northern plains, and the Eyre and Murray–Darling Basins. Broad alluvial deposits are absent from all upland areas such as in the Northwest Highlands and the Great Dividing Range.

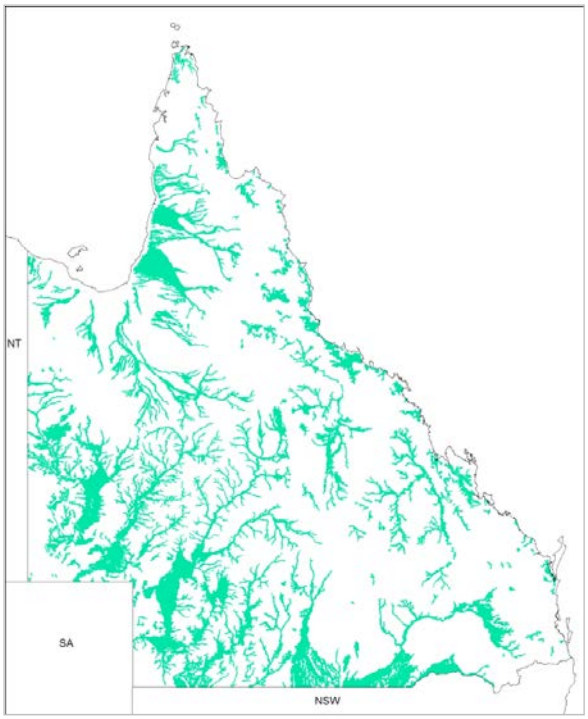


Figure 10 Major Quaternary alluvial deposits (Queensland Geology 1:2 500 000)

Due to scale limitations of the available geology mapping, much of the smaller and narrower deposits are not shown. The distribution of alluvial deposits in landscapes with marked relief is obvious in the field. Material eroded from rises, hills or mountains is transported downstream. When flow exceeds the ability of the stream channels to carry the throughput, over-bank flow carries sediment away from the channel until the velocity is such that the suspended load is deposited forming alluvial landforms such as levees or alluvial plains. In the field situation, the extent of alluvium is indicated by the break in slope between the deposit (± flat) and the steeper footslopes of the higher land. As terrain slope decreases, difficulties in determining the alluvial, or alternative, nature of the regolith arise. Where landscape features are uncertain, the soil profile will determine the nature of the regolith. Field observation alone is not always reliable.

The environment

The geomorphology of alluvial landscapes is discussed in Section 2.1.3.

Recent Quaternary alluvial landforms are mostly flat to gently undulating with active alluvial deposition in some part of the landscape. Levees, bars, stream bed and banks exhibit minor local relief. Stream channels may be incised into the alluvial plains and terrace deposits.

For a comprehensive list of alluvial landform elements and patterns refer to The National Committee on Soil and Terrain (2009).

Riparian vegetation on alluvial deposits immediately adjacent to watercourses exhibits higher species diversity than that of the surrounding landscape and is often denser due to water availability making it clearly visible on aerial photographs and satellite images. **Plate 43** shows riparian vegetation of Lawn Hill Creek as it flows from the Northwest Highlands to the Gulf Plains.

Plate 43 Actively growing riparian vegetation adjacent to Lawn Hill Creek
(Google Earth)

Floodplains can exhibit rapid vegetation growth after floods (**Plate 44**). This significantly improved moisture regime is greatly reduced away from watercourses due to deeper water tables, heavier textured soils with reduced effective rooting depth, and often *vertic*[*] properties of soils causing physical damage to tree and shrub root systems.

Plate 44 Channel Country alluvium of the Diamantina River after flood

Soils on alluvial sediments are very diverse, usually related to the parent material in the upper catchment. Soil developed from Pleistocene alluvium usually (but not always) has a higher degree of profile development (pedological development including horizon differentiation, colour, structure and segregations). The soils are dominated by Vertosols and Sodosols but include a diverse range of other soils including Dermosols, Kurosols, Chromosols, Kandosols, Tenosols, Rudosols and Hydrosols; and Organosols in high rainfall areas.

Soils are usually fertile (chemically and physically) resulting in extensive clearing and development for agriculture and pastures. Soil fertility reflects the chemical properties of the geology and soils of the catchment from which they are derived.

A diversity of species utilise the alluvial environment ranging from rain forests, vine thickets, eucalypt forests and woodlands, grasslands, sedgelands, forblands and shrublands. Prominent species include River red gum (*Eucalyptus camaldulensis*), Queensland blue gum (*E. tereticornis*), coolibah (*E. coolabah*), river sheoak (*Casuarina cunninghamiana*), Leichhardt pine (*Nauclea orientalis*), lignum (*Muehlenbeckia florulenta*), and tea-tree (*Melaleuca* spp.) communities.

[*] See Glossary

3.4 Land Zone 4 – Tertiary-early Quaternary clay plains

Definition

clay plains	Tertiary-early Quaternary clay deposits, usually forming level to gently undulating plains not related to recent Quaternary alluvial systems. Excludes clay plains formed *in-situ* on bedrock. Mainly Vertosols with gilgai microrelief, but includes thin sandy or loamy surfaced Sodosols and Chromosols with the same paleo-clay subsoil deposits.

Clarification

Land Zone 4 includes paleo-clay unconsolidated sediments originating from “old” alluvial processes and aeolian clays (parna) forming predominantly level to gently undulating plains, but includes lesser rises and low hills particularly in arid areas. These paleo-clay deposits are now elevated above and usually isolated from the alluvial valleys and plains of Land Zone 3. In all cases, the same “old” alluvium and parna, that can be many metres thick, may cover a range of geologies (see Sections 2.1.4 and 2.1.5)

The Land Zone 4 substrate is fine textured clay sediments deposited in lakes, basins or by over-bank river flow during the Tertiary to “early” Pleistocene Period (refer Table 1). Due to sea level fluctuations, tectonic activity, stream migration into basins and general lowering of the landscape by erosion, these paleo-clay sediments are now elevated above the active Holocene and recent Pleistocene alluvial valleys and plains. Consequently, the function of the landscape has changed from an active depositional system to that of an erosional landscape. The paleo-clay surfaces have only poorly defined drainage lines developed (**Plate 45**).

Aeolian clays (*parna*[*]) have influenced many soil landscapes of south-eastern and arid Australia as first reported by Butler (1958). Parna was deposited over the landscape in a series of events mainly during the cold dry glacial periods (Bowler 1986) of the Quaternary. Parna blankets large areas of western Queensland and overlies all geologies (including duricrusts) except recent alluvium (see Section 2.1.3). Exposed duricrusted scarp retreat areas exist on the edge of Tertiary plateaus where the parna have been removed by erosional processes. The clay material has *vertic*[*] (shrink-swell) properties resulting in cracking clays that are often gilgaied and thin surfaced texture contrast soils (desert loams), frequently with surface gravel of various origins (mainly silcrete and ironstone). Gravel free clays also exist. In all cases, the clay soils are high in sodium chloride and gypsum salts reflecting their origin. These aeolian clays grade into “old” alluvial clays of Land Zone 4 in the north and east of western Queensland and are difficult to separate.

[*] See Glossary

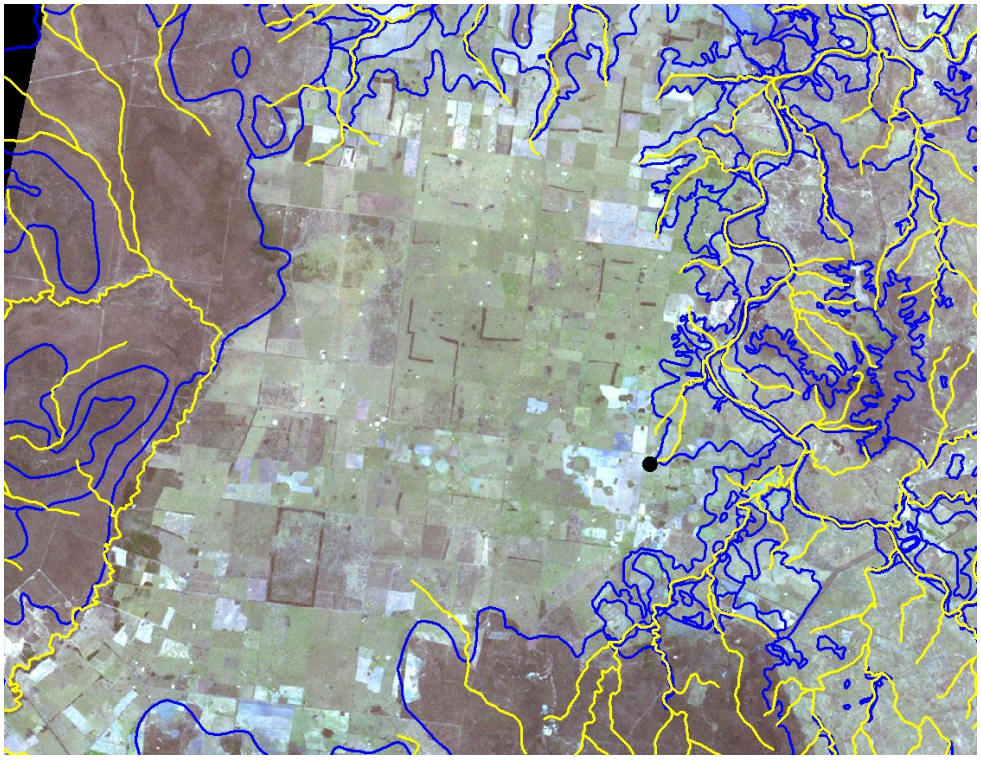


Plate 45 Brigalow clay plain (the large cleared area) near Durong, west of Kingaroy
This shows drainage system (yellow lines) and geology (blue lines). The clays were originally flood plain deposits of the Condamine River during the Tertiary to early Pleistocene Periods. The elevated nature of the clay plain is clearly demonstrated by the avoidance of local streams (yellow lines).

Extent

Paleo-clay deposits occur extensively throughout Queensland (Craig *et al*., 2008). Significant areas of Land Zone 4 have been mapped in the Desert Uplands, Brigalow Belt, Mulga Lands, Gulf Plains, Mitchell Grass Downs, Northwest Highlands and Channel Country Bioregions. The distribution of the clay plains is not clearly indicated in geological mapping. Extensive areas of Tertiary clay plains in the Brigalow Belt are shown as undifferentiated Cainozoic cover which includes various unconsolidated sediments with symbols Cz, Cza and Czs. These units may contain areas of alluvium, clay plain, sand plain, (Land Zones 3, 4 or 5) and even hard rock geologies.

Aeolian clays (*parna*[*]) blankets large areas of the western Queensland landscape (Craig *et al*., 2008) where the landform reflects the original underlying landform of gently undulating plains, rises and undulating low hills.

Reference to additional land resource data, in particular geomorphology in reports, together with interpretation of satellite imagery, aerial photographs and soil information is necessary to determine Land Zone 4.

The Environment

The geomorphology of paleo-clay unconsolidated sediments form the “old” alluvial and aeolian clay landscapes is discussed in Section 2.1.4.

[*] See Glossary

Soils are dominated by Vertosols with gilgai microrelief, often with a thin veneer of surface gravels originating from the Tertiary landscape accumulating on the mounds. Gravels mainly include silcrete, ironstone, chalcedony and chert. Shallow (<0.5 metres) sandy to loamy surfaced Sodosols and Chromosols are associated with the Vertosols as indicated by the same paleo-clay subsoils material.

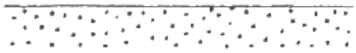
These clay soils have been extensively cleared for introduced pastures and cropping in higher rainfall areas due to their relatively high soil moisture availability and high fertility. Soils usually have restricted rooting depth due to the adverse effects of high sodium levels.

Land Zone 4 environments are typically gently undulating plains, with clay soils and texture-contrast soils derived from fine-grained sediments deposited in Tertiary to early Pleistocene lakes, basins and alluvial plains, and from aeolian clays (parna). These support brigalow (*Acacia harpophylla*) (**Plate 46**), gidgee (*A. cambagei, A georginae*), belah (*Casuarina cristata)*, blackwood (*A. argyrodendron*), and some box (*Eucalyptus populnea, E. brownii, E. moluccana*) communities, grasslands (*Astrebla pectinata,* various bluegrasses) herblands, and semi-evergreen vine thicket in more favourable areas.

Plate 46 Brigalow clay plains, Tara

3.5 Land Zone 5 –Tertiary-early Quaternary loamy and sandy plains and plateaus

Definition

 old loamy and sandy plains	Tertiary-early Quaternary extensive, uniform near level or gently undulating plains with sandy or loamy soils. Includes dissected remnants of these surfaces. Also includes plains with sandy or loamy soils of uncertain origin, and plateau remnants with moderate to deep soils usually overlying duricrust. Excludes recent Quaternary alluvial systems (land zone 3), exposed duricrust (land zone 7), and soils derived from underlying bedrock (land zones 8 to 12). Soils are usually Tenosols and Kandosols, also minor deep sandy surfaced Sodosols and Chromosols. There may be a duricrust at depth.

Clarification

The unconsolidated deposits which make-up Land Zone 5 are the result of several processes as described in Sections 2.1.6 and 2.1.7:

1. Paleo-sandy and loamy unconsolidated sediments originating from “old” alluvial processes during the Tertiary and early Pleistocene (**Plate 47**) have deposited several phases of alluvium over the underlying geologies. Due to sea level fluctuations, tectonic activity, stream migration into basins and general lowering of the landscape by erosion, these paleo-sandy to loamy alluviums are now elevated above the “recent” alluvial valleys and plains of Land Zone 3. The “old” alluvium can be >0.5 metres to many metres thick and may cover a range of geologies, overlie soils developed *in-situ* or cover “old” (paleo) alluvial clay sediments.

Plate 47 Quaternary paleo-alluvial sand plains, south of Charleville

2. Sand plains not developed *in-situ* include:

Erosion of any Tertiary landscape, including “old” alluvial sands and loams and deeply weathered geologies, resulting in redeposition of sandy to loamy material lower in the landscape as colluvium and diffuse overland sheet wash (**Plate 48** and **49**). These sandy to loamy sediments overlie a range of geologies and have not developed *in-situ*. Some

sediment, particularly in semi-arid and arid areas, have been reworked and moved by wind to form level to gently undulating sandplains (and associated dunefields of Land Zone 6).

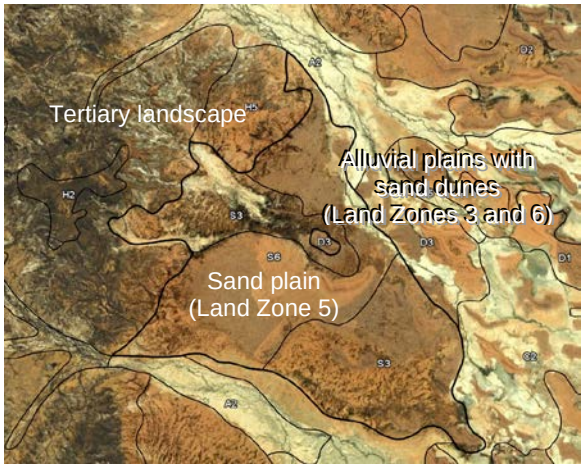


Plate 48 Sheet wash sand plains (Land Zone 5) southwest of Windorah developed from the erosion of the Tertiary landscape *(western side of image) (Google Earth)*

Plate 49 Mulga sheet wash sand plains east of Charleville (Land Zone 5)

- Any sandy substrate reworked by wind to form sandplains is included, for example, reworking of paleo-alluvium or sandy colluvium and sheet wash originating from any geology including non-deeply weathered quartz rich bedrock (see **Plate 25**).
- Reworking of recent Quaternary alluvium by wind resulting in sandplains overlying the "recent" alluvium or other geologies. In this example, the sand sediments are not developed directly from the current alluvial processes, such as water deposited sandy levees or floodplains.

3. During deep weathering, the bedrock is *completely weathered** resulting in "deep" profiles high in iron and/or aluminium oxides and kaolin clays. The profiles may also contain quartz, and may be strongly mottled and/or pallid (pale) in colour in the lower part. Typically, all rock structure, including bedding, has been destroyed and all minerals have been chemically weathered to kaolin with or without resistant quartz. In extreme weathering, gibbsite (aluminium hydroxides) and sesquioxides (iron and aluminium oxides) remain as the dominant material. During the intense and prolonged weathering of the Tertiary landscape, many (but not all) of the deeply weathered profiles became indurated (cemented) due to the residual accumulation of secondary minerals within the profile or due to the lateral mobilisation, accumulation and precipitation of soluble minerals such as silica (silcrete) and/or iron (ferricrete) (**Plate 50** and **51**). The deep weathering and duricrust processes are independent of substrate type. Some of the more common parent materials include unconsolidated sediment of various origins, quartz sandstones, sub-labile and labile sedimentary rocks, granites and basalt. Soils can be developed *in-situ* or the deeply weathered profile can develop from transported old (paleo) unconsolidated sediments. Soils are >0.5 metres deep.

* See Glossary

Plate 50 Deep soil with ferricrete over deeply weathered Tertiary volcanics, Red Clay Island, south-east of Sarina (Land Zone 5)

Recent alluvial processes (as described in Sections 2.1.3 and 3.3) that have deposited sands and loams in alluvial landforms (such as fans, levees, plains) are excluded and are allocated to Land Zone 3. Also, landscapes developed *in-situ* (including colluviums) on non-deeply weathered bedrock (as described in Section 3.1.3) are excluded and allocated to Land Zones 8 to 12.

Stripping of the soil or other unconsolidated material off the duricrusted profile, particularly at the edge of plateaus and mesas, has exposed the duricrust. In many situations, erosion has removed the duricrust or removed the deep soil on the deeply weathered surface to expose the non-duricrusted deeply weathered profiles. Exposed duricrust or deeply weathered profiles with soils <0.5 metres deep are excluded and allocated to Land Zone 7.

In many situations, multiple processes are involved. For example, unconsolidated sandy Tertiary alluvial sediments can be deeply weathered, duricrusted and then the sandy soils reworked by wind or eroded by water resulting in sandy material deposited down-slope as colluvium over adjacent landscapes (see **Plate 21**).

Reworking of sandplains and Quaternary alluvium by wind has resulted in dunefields (Land Zone 6). The difference between sand dunes of Land Zone 6 and associated sand plains of Land Zone 5 may be indistinct. In general, sand plains predominate when the area of the level inter-dune sand plains dominate over the convex dune crests and concave dune flanks.

Plate 51 Duricrusted *Glendower Formation* south of Blackall with Land Zone 5 in the centre of the plateau and Land Zone 7 on the edges
(Google Earth)

Plate 51 shows moderately deep soils of Land Zone 5 and exposed duricrust of Land Zone 7 on the edges.

A common feature of tropical northern Australia is the occurrence of “creek rock” often associated with induration of Holocene river sediments of Land Zone 3 and gully sediments in the siliceous lithologies of Land Zones 12. This “creek rock” is associated with “recent” precipitation of iron and/or silica cementing sediments on exposure to the atmosphere. It is not to be confused with “deep weathering” and requires reference to geological maps and associated notes to determine if the substrate is deeply weathered (**Plate 52**). Soil pans (duripan, ferric, calcrete) are also excluded.

Plate 52 Indurated Quaternary alluvium at Hann River, Cape York Peninsula, showing “creek rock” fully encasing old bottles.

Extent

Sandsheets, deeply weathered and duricrusted land surfaces, and sandy to loamy old alluvium cover extensive areas of the state (**Figure 11** and **12**).

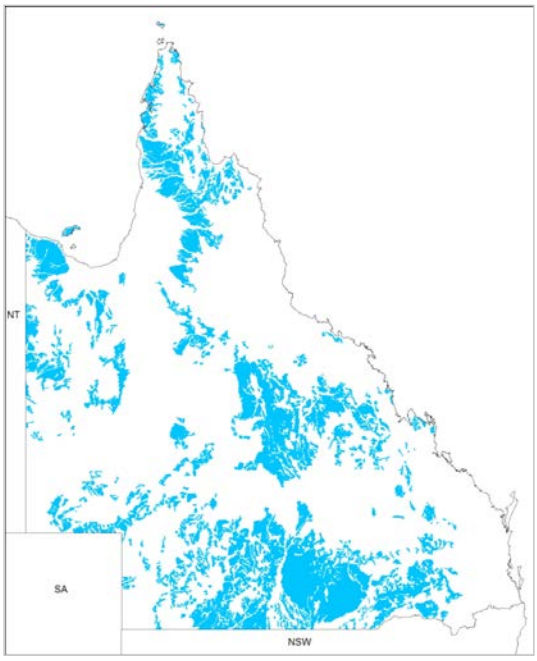


Figure 11 Late Cainozoic floodout and residual sand, soil and gravel

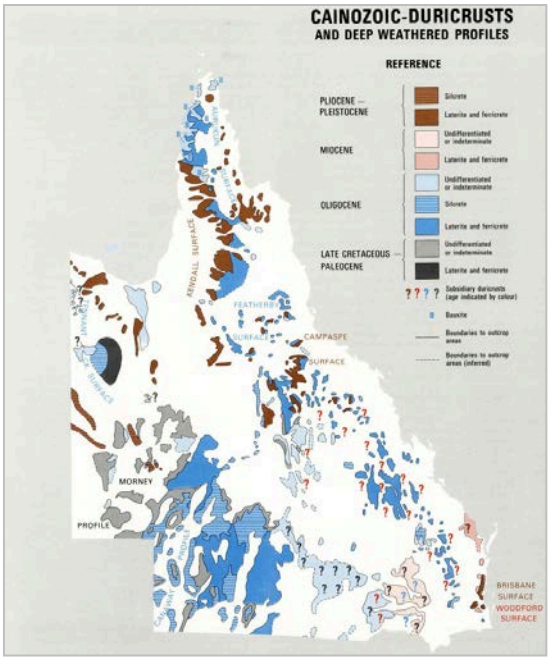


Figure 12 Cainozoic duricrusts and deeply weathered profile (Day *et al*. 1983)

All available resource data (geology, soils, geomorphology, land systems) needs to be reviewed to achieve some understanding of the true nature of unconsolidated Tertiary to Quaternary paleo-deposits, and deeply weathered landscapes.

In practice, determination of the extent and nature of unconsolidated deposits can be problematic as field observation and landscape interpretation may be misleading and can only be accurately determined with the aid of soil cores. The nature and extent of regolith in landscapes with a long and complex history requires knowledge of what is happening at depth (Gibson 2004).

Geological mapping reliably shows areas of consolidated geologies however it does not reliably show unconsolidated surface layers. Phrases such as “alluvial, colluvial and residual deposits” in the lithological summaries of published geology maps contribute little to an understanding of *in-situ* or transported regolith. The information is less informative when the age of the deposits is denoted as Cainozoic age (65 million years BP to present).

The environment

The geomorphology of paleo-sandy to loamy unconsolidated sediments from the “old” alluvial, sandplains and deeply weathered landscapes is discussed in Section 2.1.6 and 2.1.7.

Typically, western expressions of Land Zone 5 are flat to gently undulating plains, plateaus and dissected tablelands. In coastal catchments, dissected “old” alluvial landscapes often occur as undulating rises and low hills (**Plate 53**). Deeply weathered basaltic landscapes frequently occur as plateaus, dissected tablelands, and undulating to steep hills.

Plate 53 Tertiary–Quaternary alluvial deposits overlooking the Brisbane River valley, Moggill

The loamy and sandy Tertiary surfaces occur in twelve of the thirteen bioregions (excluding the New England Bioregion). Soils vary depending mainly on origin of the parent material. In western Queensland, all Tertiary landscapes are predominantly sandy to loamy red Kandosols and Tenosols. The deeply weathered basalts are dominated by red Ferrosols with yellow to brown Ferrosols or Dermosols in wetter landscape positions. Coastal catchments with deeply weathered and "old" transported landscapes have a very diverse range of soils, including Kandosols, Dermosols, Chromosols, Sodosols and in minor situations Podosols, Hydrosols, Kurosols and Tenosols.

Land development is limited with some clearing in higher rainfall areas for cropping, particularly on deeply weathered well drained geologies. In lower rainfall areas, cropping is occurring where irrigation is available. Fertility is generally low due to the highly weathered and leached soils.

A broad diversity of vegetation communities exploit the environments provided within Land Zone 5. These are driven by climate, past and present, and soil attributes. Present day climates vary from tropical and monsoonal in the north and northwest to humid and subhumid in coastal and subcoastal areas and arid in the west. Eucalypts predominate in the humid to semi-arid coastal and sub-coastal bioregions; cypress pine and *Melaleuca* species are characteristic of deep sands and wet soils respectively. Rainforests are typical of the high rainfall basalt landscapes while vine forests occur in a range of landscapes often with relatively lower rainfall and fertile soils. Inland, semi-arid conditions favour mulga and poplar box communities. *Acacia* species are common in arid to semi-arid landscapes. Heath and eucalypt communities are common on Cape York Peninsula.

3.6 Land Zone 6 – Quaternary inland dunefields

Definition

inland dunefields	Quaternary inland dunefields, interdune areas, degraded dunefields, and associated aeolian sandplains. Excludes recent Quaternary alluvial systems, which may traverse this zone, and intermittent lakes and claypans (land zone 3).Soils are predominantly Rudosols and Tenosols, some Kandosols and minor Calcarosols.

Clarification

Most of the Australian arid zone is covered by sand sheets, often in the form of dunes, with sand being derived mainly from the weathering of ancient laterites, and partly from sandstones or from alluvial deposits laid down along watercourses or in basins (Beadle 1981)

Continental dunefields (**Plate 54**) occupy about 40% of the surface of Australia. At the continental scale, the dunes form a giant anticlockwise whorl with dunes in South Australia orientated from west to east; western New South Wales from south to north; western Queensland from south-east to north-west, northern Western Australia from east to west. Despite the size of this whorl, most sand in it has not been moved very far by wind from its source, often only a matter of kilometres (McKenzie *et al.* 2004).

Plate 54 Longitudinal dunes of western Queensland

As described in Section 2.1.8, erosion of the Tertiary landscape and quartz–rich substrates has deposited large amounts of sediments containing sand that have been reworked by wind to form sand dunes and associated sandplains. Parallel dunes typical of the Simpson Desert are the most common while reticulate dunes enclosing claypans are confined to/and overlie alluvial landscapes (Land Zone 3). In general, dunes are predominantly pale coloured on the north western side of the large alluvial plains of the Channel Country where the sand originates and become redder in colour to the north-west. The red colour is due to the gradual oxidation of the iron minerals coating the sand grains. Isolated semi-stable and mobile dunes are associated with many river systems in western Queensland.

The difference between sand dunes and associated sand plains may be indistinct. In general, dunes of Land Zone 6 predominate when the area of convex dune crests and concave dune flanks dominate over the level inter-dune sand plains of Land Zone 5. For example, land unit 9 in the Badalia (S2) land system in the Georgina Basin (Wilson and Purdie 1990) comprises “level plains with low rounded dunes and sand rises (<4m high)” while the remainder of the land units in the land system are sand plains. In this example, land unit 9 only is Land Zone 6 while the remainder is Land Zone 5.

The leading edge (south-east end) of the dunes on alluvium are frequently deflated (eroded by wind) and cemented (due to clay).

Recent Quaternary alluvial systems and ephemeral lakes within dunefields are excluded and allocated to Land Zone 3 because sand dunes overlie alluvial plains and lower dune flanks are occasionally buried by alluvium.

Extent

In Queensland the dunes are restricted to the south-western corner of the state and form part of the Simpson and Strezlecki Dunefields (**Figure 13)** with minor occurrences in the Northwest Highlands Bioregion.

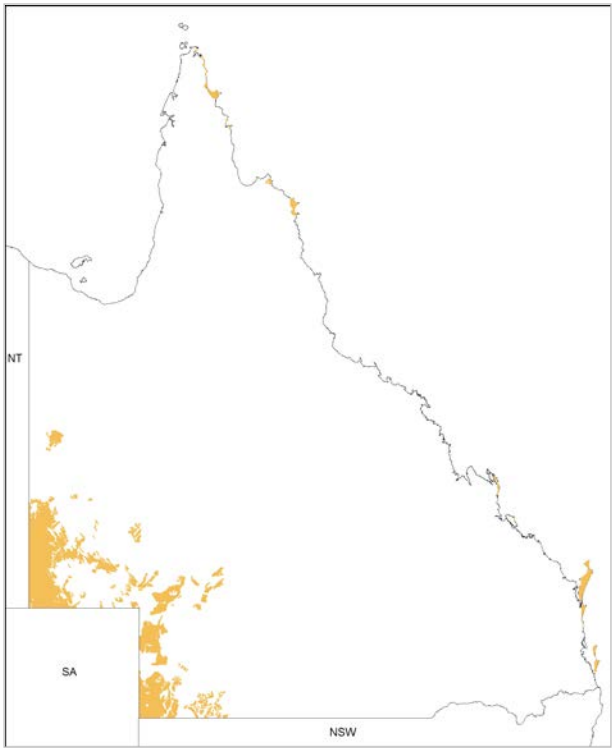


Figure 13 Location of major coastal (Land Zone 2) and inland (Land Zone 6) dunefields

Geology mapping, land system mapping, aerial photographs and satellite images clearly indicate their extent.

Isolated stable to semi-stable dunes are associated with western river systems often forming low (<4m) isolated to interconnecting sand rises overlying alluvial plains.

The environment

The geomorphology of the western sand dunes is described in Section 2.1.8.

Landforms are mobile parallel dunes and associated inter-dune areas, reticulate dunes with inter-dune claypans and isolated semi-stable to stable dunes on alluvial plains.

Soils are dominated by red, yellow and grey Rudosols on dune crests, and red, yellow and grey Tenosols and some sandy surfaced Kandosols on inter-dune areas. Pale grey and

yellow dunes frequently occur on alluvial plains, particularly on the north western side of the plains. These pale colours become redder to the north-west. Minor saline (mainly gypsum) Rudosols occur on the north western edge of playas (ephemeral salt lakes). Minor cemented Rudosols also occur on eroded lower dune flanks and leading south-eastern edge of dunes, particularly on alluvial plains.

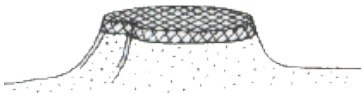
Development is very limited due to very low soil water availability and low fertility.

In arid areas, mobile crests are dominated by sparse to scattered sandhill canegrass (*Zygochloa paradoxa*) and ephemeral herbs and shrubs, while upper dune flanks and semi-stable crests frequently have grevilleas, whitewood (*Atalaya hemiglauca*); areas of forbland with isolated stunted trees and shrubs, and large bare areas of wind-blown sand. There are also more stable isolated dunes in the more eastern river systems are frequently dominated by eucalypts.

On inter-dune areas, the vegetation is dominated by spinifex (*Triodia* spp.) hummock grassland ± wattles (*Acacia* spp.), *Senna* spp., grevilleas and eucalypts (including *Eucalyptus pachyphylla* in the Georgina Basin). In the Georgina Basin and northern Simpson Desert, Georgina gidgee (*Acacia georginae*) is a prominent species.

3.7 Land Zone 7 – Cainozoic duricrusts

Definition



ironstone jump-ups

Cainozoic duricrusts formed on a variety of rock types, usually forming mesas or scarps. Includes exposed ferruginous, siliceous or mottled horizons and associated talus and colluvium, and remnants of these features, for example low stony rises on downs. Soils are usually shallow Rudosols and Tenosols, with minor Sodosols and Chromosols on associated pediments, and shallow Kandosols on plateau margins and larger mesas.

Clarification

During the intense and prolonged weathering of the Tertiary landscape, many (but not all) of the deeply weathered profiles became indurated (cemented) due to the residual accumulation of secondary minerals within the profile or due to the lateral mobilisation, accumulation and precipitation of soluble minerals such as silica (silcrete) and/or iron (ferricrete). Silicification of carbonates during deep weathering may result in chalcedony and an indurated surface. Because of their indurated nature, these surfaces are resistant to erosion and are commonly still preserved.

Stripping of the soil or other unconsolidated material off the duricrusted profile, particularly at the edge of plateaus and mesas, has exposed the duricrust and non-duricrusted deeply weathered profiles (**Plate 55**). The eroded non-duricrusted mottled and pallid zones of the deeply weathered profile may become cemented on exposure resulting in resistant low remnants. Soils are <0.5 metres deep.

Many of the intact duricrusted remnants have scarp retreat areas where erosion of the underlying softer “moderately” weathered bedrock causes undercutting and collapse of the resistant upper part. Colluvial slopes (talus) with shallow soils (<0.5 m) over deeply weathered rock in the scarp retreat areas are included in Land Zone 7.

Colluvial slopes and pediments with a thin surface veneer (<0.5 m thick) of weathered gravels covering soils developed *in-situ* are excluded and allocated to the adjacent land zone. Pediments with >0.5 metres of detritus material from erosion of the deeply weathered profile are allocated to Land Zone 5.

All available resource data (geology, soils, geomorphology, land systems) needs to be reviewed to achieve some understanding of the true nature of the deeply weathered landscapes. Due to the resistant and exposed nature of the duricrusts, recognition is usually rapid.

Plate 55 Cemented mottled zone of an eroded deeply weathered profile

Extent

Land Zone 7 is closely associated with the deeply weathered and duricrusted land surfaces of Land Zone 5 which covers extensive areas of the state (Figure 12).

The environment

The geomorphology of the duricrusts and subsequent exposure is described in Section 3.1.2.

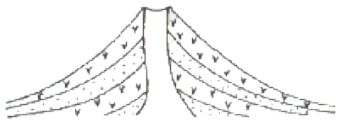
Landforms are dominated by steep sided mesas, buttes and edges of dissected tablelands and plateaus and inclined lower scree (talus) slopes. Gravels are dominated by the parent material, including silcrete, ironstone and lateritic gravels. Eroded undulating remnants are included.

Soils are either absent (exposed rock) or dominated by shallow (<0.5 m) Rudosols and Tenosols, with Kandosols on plateau and tableland margins where they grade to Land Zone 5. Sodosols and Chromosols may occur on the pediments. Soils have minimum development potential as they are typically shallow infertile soils or exposed rock.

Vegetation is extremely variable depending on climatic conditions, depth of soil and position in the landscape. The absence of vegetation on the bare rock and scarp areas is typical. In western areas, lancewood (*Acacia shirleyi*) and bendee (*A. catenulata*) and Spinifex (*Triodia* spp.) are dominant communities on the edges of the exposed duricrusts. Mulga (*A. aneura*) and bastard mulga (*A. clivicola*) are dominant on shallow soils on the level to gently undulating flat tops, especially where grading to Land Zone 5. Lower slopes range from *Acacia* shrublands, including gidgee (*A. cambagei*) to various eucalypt communities, including *Eucalyptus normantonensis* and mountain yapunyah (*E. thozetiana*)

3.8 Land Zone 8 – Cainozoic igneous rocks

Definition



basalt plains and hills

Cainozoic igneous rocks, predominantly flood basalts forming extensive plains and occasional low scarps. Also includes hills, cones and plugs on trachytes and rhyolites, and associated interbedded sediments, and talus. Excludes deep soils overlying duricrust (land zone 5). Soils include Vertosols, Ferrosols and shallow Dermosols.

Clarification

Extrusive rocks form as a result of volcanic activity at or immediately adjacent to the earth's surface. Structures include lava plains, vents and volcanic plugs. Common rock types are typically fine grained or porphyritic (containing phenocrysts in a fine grained matrix) due to rapid cooling of the magma, and include acid, intermediate and basic rocks such as basalt, andesite, rhyolite, trachyte and tuffs. Intrusive rocks, such as gabbros and syenites, associated with the volcanic plugs are included.

The definition of Land Zone 8 is simple, unequivocal and without exceptions to the rule: all Cainozoic (Tertiary to Quaternary) igneous rocks of whatever type are Land Zone 8.

Interbedded sedimentary rocks, such as shales, siltstones and sandstones, are included as long as the volcanic rocks are dominant within the formations. Springs originating directly from the lava flows are included but any springs originating in alluvial systems which drain the volcanic landforms are excluded and are allocated to Land Zone 3. Deeply weathered Cainozoic volcanic geologies are excluded and allocated to Land Zone 5.

Extent

The extent of Cainozoic igneous rocks, predominantly flood basalts, is shown in **Figure 14**.

There are three major areas, each of which is less than 250 kilometres from the coast:

- north and northeast of Hughenden;
- the Springsure – Clermont area; and
- the Main Range – Lamington Basalt Province.

The most recent are the Tertiary–Quaternary basalt flows north of Hughenden; the Great Basalt Wall being the most recent event at about 13 000 years ago.

The central and south-east Queensland volcanic activity dates from the Tertiary although minor more recent eruptions have occurred, for example, the Coulstoun Lakes volcanic activity, the most recent in south-east Queensland, whose age is estimated at about 600 000 years (Geological Society of Australia Queensland Division 1976).

Field examination of fresh rock type, landforms and soils readily determine the land zone.

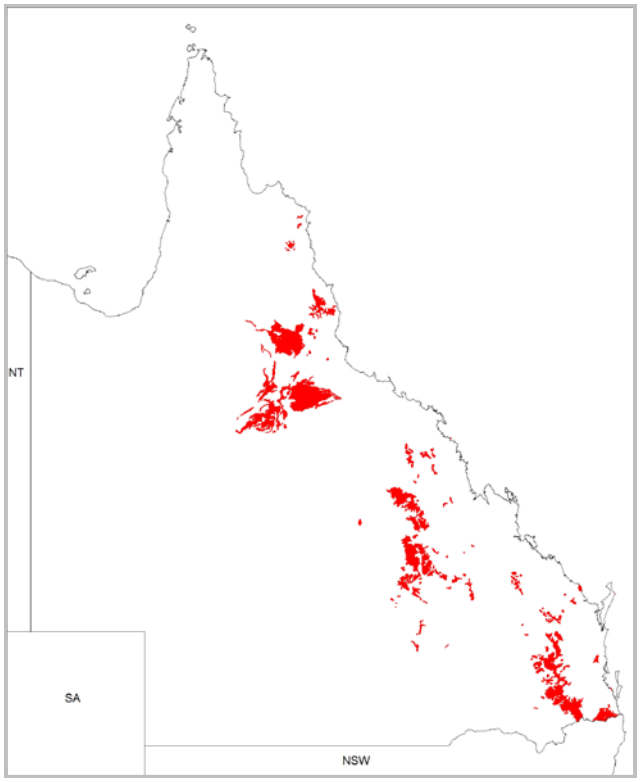


Figure 14 Location of Cainozoic igneous rocks

The environment

Land Zone 8 is the Tertiary to Quaternary lava plains and associated volcanic cones and plugs (**Plate 56**). The flood basalts form extensive undulating plains broken occasionally by low scarps, hills, and plateaus. Tertiary lava flows (mainly basalts and rhyolites) frequently occur as elevated dissected tablelands and plateaus with steep scarps due to the hard resistant rock overlying softer more easily eroded bedrock (**Plate 57**). Rhyolitic flows are particularly resistant due to the high quartz content (**Plate 58**).

Plate 56 Coulstoun Lakes National Park Pleistocene volcano (~ 600 000 years)

Plate 57 Tertiary basalt plateau remnants and gently undulating plain, Minerva Hills, north of Springsure

Plate 58 Tertiary rhyolite cliffs, Springbrook

Soils on basalt are predominantly black and brown Vertosols on the level to gently undulating landscapes grading to black and brown Dermosols/Ferrosols on steeper and/or rocky landscapes associated with erosion of lava landscapes or younger flows. Red and brown and occasionally yellow Ferrosols predominate in well drained elevated landscape positions in higher rainfall areas. These Ferrosols overlie fresh basalt or contain basalt floaters (rounded rocks surrounded by soil). Soils developed on the more basic andesite are generally similar to basalts while soils on the more acidic andesites and trachytes include Sodosols. Soils on rhyolites are predominantly shallow Tenosols and Sodosols, and occasionally Hydrosols in higher rainfall areas.

Basaltic soils have been extensively developed for cropping and introduced pastures due to their high fertility and generally high soil moisture availability (depending on soil depth). Rhyolite landscapes generally have limited development due to shallow infertile soils.

The vegetation includes vine forest in more favourable sites, eucalypt open forest and woodland, and open woodlands and grasslands.

3.9 Land Zone 9 – Fine grained sedimentary rocks

Definition

undulating country on fine grained sedimentary rocks

Fine grained sedimentary rocks, generally with little or no deformation and usually forming undulating landscapes. Siltstones, mudstones, shales, calcareous sediments, and labile sandstones are typical rock types although minor interbedded volcanics may occur. Includes a diverse range of fine textured soils of moderate to high fertility, predominantly Vertosols, Sodosols, and Chromosols.

Clarification

Sedimentary rocks are consolidated fragmental material transported and deposited by wind, water, and ice, chemically precipitated from solution, or secreted by organisms, and that form in layers. Sedimentary rock types generally reflect the deposition environment and grain size (see Section 3.1.3). Consolidated fine grained sedimentary rocks of Quaternary age are not known to occur.

Fine grained sedimentary rocks refer to the grain size only and include sediments transported by water (alluvial and marine) such as siltstones, mudstones and shales, and those sediments chemically precipitated or secreted by organisms including chert, chalk, limestones and dolomites, and oolitic sediments.

Sandstones, arenites and other coarse grained sedimentary rocks composed of lithic fragments (rock fragments) with a high proportion of labile or sublabile lithology (feldspars and mafic minerals) are included in the fine grained sedimentary rock group as these rocks weather to clayey soils or soils with clayey subsoils. For example, the labile sandstones of the *Winton Formation* in the Great Artesian Basin form very gently undulating plains with cracking clay soils.

Plate 59 Gentle dipping Cambrian limestones (Land Zone 9), Lawn Hill Gorge

Most un-deformed to weakly deformed unaltered fine grained bedrocks are Permian and younger, but can include older sedimentary rocks such as the Carboniferous to Ordovician limestones of the Georgina Basin (**Plate 59**) and the Proterozoic fine grained sedimentary rocks of the Nicholson Basin north west of Mt Isa. *Moderately deformed*[*] (folded) unmetamorphosed bedrock is excluded and allocated to Land Zone 11. Sedimentary strata that are not deformed or altered by orogenesis, but are deeply dipping sediments due to basin slumping, are included in Land Zone 9.

In all cases, the rock structure (bedding and lithic fragments) and primary minerals (e.g. feldspars) are not completely weathered. In general, this land zone includes *unweathered rock*[*], *slightly weathered**, *moderately weathered** and *highly weathered** bedrock.

Rocks formed primarily by volcanic activity and deposited in air or water but not transported by water (pyroclastics, pillow larva, and volcanic conglomerates and agglomerates) are excluded and allocated to Land Zone 8 or 12. For example, the Triassic volcanic conglomerates and agglomerates of the *Neara Volcanics* in the inland Burnett are allocated to Land Zone 12.

Coarse grained siliceous (quartzose) sedimentary rocks, primarily quartz sandstones, are excluded and allocated to Land Zone 10. Deeply weathered fine grained sedimentary rocks are excluded and allocated to Land Zone 5 and 7.

Extent

Tertiary to Proterozoic (Cretaceous and older) fine-grained sedimentary rocks, generally with little or no deformation, cover extensive areas of the state including the Great Artesian, Moreton, Maryborough, Bowen, Laura and the Georgina basins (see Figure 5).

Coarse grained quartzose sedimentary rocks may be associated with outcropping fine grained sedimentary rocks. In Southeast Queensland, the ortho-quartzite (sedimentary quartzite) beds in the *Myrtle Creek Sandstones* form prominent hills and cliffs but are only a minor component of the predominant sub-labile lithology. Therefore, the composite Land Zone 9/10 in the Southeast Queensland Bioregion replaces Land Zones 9 and 10.

The environment

Due to the general “soft” nature of the sedimentary rocks and the readily weathered nature of the lithology, the landforms are dominated by very gently undulating to undulating plains and rises (**Plate 60**). Some limestones form undulating to steep rises and low hills (**Plate 59**).

[*] See Glossary

Plate 60 Mitchell grass downs on labile sediments of the Great Artesian Basin

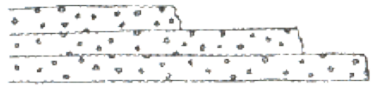
Depending on the lithology (mineral composition) of the lithic fragments, these fine grained sedimentary rocks are labile (readily decompose to clays) to sub-labile (composed of quartz and clay forming minerals) forming clayey soils or soils with clay subsoils. Soils are predominantly Vertosols, Sodosols, and Chromosols. A diverse range of other soils can occur, including Dermosols and Kurosols. Calcarosols are restricted to the Cambrian–Ordovician limestones of the Georgina Basin and Tertiary limestones of western Queensland.

Soils have been extensively developed for introduced pastures or cleared to increase native pasture production, or developed for cropping in higher rainfall areas. The Mitchell grass downs and herbfields of western Queensland have been used traditionally for grazing by sheep and cattle. Soil fertility is generally moderate to high.

The vegetation includes a diverse range of eucalypt open forest and woodland, *Acacia* woodlands (gidgee, brigalow), grasslands and herbfields, and some vine forest in more favourable sites.

3.10 Land Zone 10 – Coarse grained sedimentary rocks

Definition

 sandstone ranges	Medium to coarse grained sedimentary rocks, with little or no deformation, forming plateaus, benches and scarps. Includes siliceous (quartzose) sandstones, conglomerates and minor interbedded volcanics, and springs associated with these rocks. Excludes overlying Cainozoic sand deposits (Land Zone 5). Soils are predominantly shallow Rudosols and Tenosols of low fertility, but include sandy surfaced Kandosols, Kurosols, Sodosols and Chromosols.

Clarification

Sedimentary rocks are consolidated fragmental material transported and deposited by wind, water, and ice, chemically precipitated from solution, or secreted by organisms, and that form in layers. Sedimentary rock types generally reflect the deposition environment and grain size (see Section 3.1.3). Consolidated quartzose sedimentary rocks of Quaternary age are not known to occur.

Medium to coarse grained sedimentary rocks refer to the grain size only and include sediments transported by water (alluvial and marine) such as sandstones, arenites, conglomerates and breccia. Only coarse grained quartz rich sedimentary rocks apply to Land Zone 10. Subdominant thin interbedded fine grained sedimentary rocks and volcanics that cannot be mapped separately may be included.

In all cases, the rock structure (bedding and lithic fragments) and primary minerals (e.g. feldspars) are not completely weathered. In general, includes *unweathered rock*[*], *slightly weathered**, *moderately weathered** and *highly weathered** bedrock.

Most un-deformed to weakly deformed unaltered bedrocks are Permian and younger. *Moderately deformed** (folded) unmetamorphosed bedrock is excluded and allocated to Land Zone 11. Sedimentary strata that are not deformed or altered by orogenesis, but are deeply dipping sediments due to basin slumping, are included in Land Zone 10.

“Deeply weathered” medium to coarse grained sedimentary rocks are excluded and allocated to Land Zone 5 or 7.

In the Southeast Queensland Bioregion, the ortho-quartzite (sedimentary quartzite) beds in the *Myrtle Creek Sandstones* (and some other siliceous sandstone formations) form prominent hills and cliffs but are a minor component of the predominant sub-labile lithology. Therefore, the composite Land Zone 9/10 replaces Land Zones 9 and 10.

Extent

Distribution is mainly restricted to the massive quartz sandstone formations, such as the Jurassic *Precipice Sandstone* of central Queensland. Occurrences occur elsewhere, such as the Proterozoic sandstones in the South Nicholson Basin north-west of Mt Isa.

Due to their resistant nature and level to gently inclined bedding, outcrops frequently occur as continuous plateaus or dissected remnants.

[*] See Glossary

The environment

Medium to coarse grained sedimentary rocks (sandstones, arenites, and conglomerates) composed predominantly of resistant quartz form undulating to steep rises and hills, plateaus, and precipitous cliffs and scarps, and talus. Cliffs and scarps and associated gorges (**Plate 61**) occur especially where "soft" easily eroded sediments underlie the gently dipping sandstones result in under-cutting and collapse of the massive sediments. Colluvial talus and pediments (>0.5 m of colluvial material over the underlying bedrock) at the base of the scarps and cliffs are common features of Land Zone 10.

Plate 61 Sandstone cliffs of the *Precipice Sandstone Formation*, Carnarvon Gorge

Soils are predominantly "shallow to moderately deep" sandy Tenosols and Rudosols formed *in-situ* on the bedrock. Sandy surfaced Kandosols, Kurosols, Sodosols and Chromosols are common on colluvial slopes. Rock outcrops are typical of the cliffs and immediate edges.

A broad diversity of vegetation communities exploit the environments provided within Land Zone 10. These are driven by climate and the low fertility sandy soils, and occasionally the micro-climates within gorges. Climates vary from tropical and monsoonal in the north to dry summer dominated rainfall in central Queensland. Eucalypts predominate in all bioregions; with cypress pine on some deep colluvial sands.

3.11 Land Zone 11 – Metamorphic rocks

Definition

 hills and lowlands on metamorphic rocks	Metamorphosed rocks, forming ranges, hills and lowlands. Primarily lower Permian and older sedimentary formations which are generally moderately to strongly deformed. Includes low- to high-grade and contact metamorphics such as phyllites, slates, gneisses of indeterminate origin and serpentinite, and interbedded volcanics. Soils are mainly shallow, gravelly Rudosols and Tenosols, with Sodosols and Chromosols on lower slopes and gently undulating areas. Soils are typically of low to moderate fertility.

Clarification

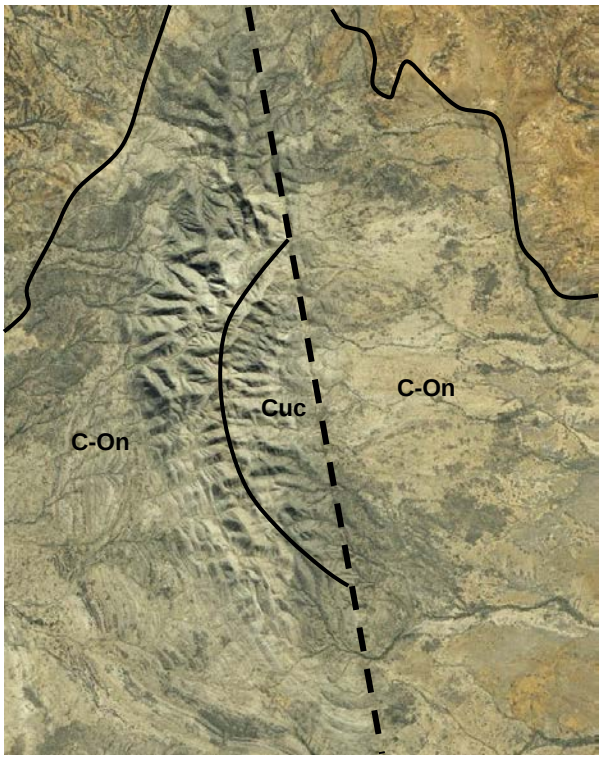
Metamorphic rocks include all rocks that have been subjected to extremes of heat and pressure sufficient to change their chemical and physical properties. Metamorphic rocks are associated with orogenic phases where regions are subject to folding, faulting and deformations, and granitic intrusions, and intensive volcanic activity, usually associated with continental plate tectonic activity (see Section 3.1.3). Hydrothermal metamorphism as a result of the interaction of a rock with a high-temperature fluid from volcanic activity or granitic intrusion is included.

Metamorphic rock type is reflected in the degree of mineral alteration, crystallisation or deformation and does not reflect the mineral composition. For example, moderately to strongly metamorphosed rocks are relatively easy to determine based on the degree of foliation, lamellation of minerals, and degree of crystallisation, and include slate, marble, quartzite, phyllite and schist. All metasediments (metamorphosed sedimentary rocks) are included. Associated interbedded volcanics are also included. All metamorphosed igneous rocks such as metavolcanics (metamorphosed volcanics including metabasalt), greenstone (metamorphosed basic igneous rocks), gneiss (which is often of granitic origin) and serpentinite (which was originally of plutonic origin) are included.

The differentiation between non-metamorphosed and weakly metamorphosed rocks is difficult considering all formations are subject to some degree of heat and pressure alterations when buried by more recent formations. The degree of metamorphism is subjective. In general terms, moderately to strongly metamorphosed rocks show signs of re-crystallisation and lamellation, changed by the solid-state application of heat, pressure and fluids (excluding weathering and *diagenesis* *). Reference to geological maps and associated notes is essential. In general, metamorphosed rocks are harder and more resistant to erosion resulting in landforms that are typically steeper and more elevated with shallower soil compared to similar unmetamorphosed rocks. For example, the slightly metamorphosed sediments of the Gympie Group (*Tamaree Formation, South Curra Limestone* and *Rammutt Formatio*n) have also been moderately deformed and folded but still retain their sedimentary structures resulting in undulating landscapes that are more undulating than expected on equivalent non-metamorphosed sedimentary rocks. The Gympie Group is allocated to Land Zone 11.

* See Glossary

Moderately to strongly deformed* (folded) formations, but not necessarily subject to the heat and pressure sufficient to change their chemical or physical properties such as recrystallisation or evidence of lamellar minerals, are included. Moderately to strongly deformed* (folded) sedimentary or volcanic rocks have an interlimb angle* (angle between adjacent limbs of a fold*; 180° is planar or no fold) of less than 120°. For example, the Bowen Basin was affected by the closing phases of the New England Orogeny resulting in deformed (folded) sedimentary rocks in the eastern part in contrast to the relatively gently deformed western part. Many formations older than Permian are moderately to extensively deformed and allocated to Land Zone 11. Younger metamorphosed sedimentary rocks are rare but the Triassic Kin Kin Beds at Gympie are an exception where the rocks are composed predominantly of phyllites. Moderate to strong deformation along faults or adjacent to intrusions are included (**Plate 62**).



The scale of deformation or the distance over which the folding occurs is undefined. In general terms, if strata show characteristic landform features of moderate to steep dipping (interlimb angle <120^{o}) beds with associated steep, rises, hills and mountains, the geology should be considered deformed. For example, **Plate 62** shows moderately deformed sediments with associated steep hills up to 4 kilometres from the fault. Beyond this distance, the interlimb angle is >120^{o} and is not considered moderately to strongly deformed.

In the Drummond Range of central Queensland, the Devonian – Carboniferous sediments of the Drummond Basin (Thompson Orogeny) have been deformed with the crests of the folds occurring up to 20 kilometres apart. In this example, broader scale landform features need to be considered with reference to the dip angles on the geology map and reference to the associated geology notes.

Plate 62 A fault north east of Boulia with moderately deformed sediments of Land Zone 11 to the west and weakly deformed sediments of Land Zone 9 to the east
The Burke River Structure (fault) north east of Boulia is shown with moderately deformed Cambrian–Ordovician limestones (C-On, Cuc) of Land Zone 11 occurring west of the fault while weakly deformed sediment of Land Zone 9 occur east of the fault (Google Earth)

Extent

The extent of Land Zone 11 is directly related to the various Inliers and Orogens as shown in the geological structural framework for Queensland (**Figure 6**). Deformed sedimentary rocks in sedimentary basins (such as Bowen and Georgina Basins) are determined by reference to geological maps and associated notes, and local interpretation (as defined above).

* See Glossary

In many cases, the distinction between unmetamorphosed and metamorphosed formations may be unclear and reference to geological maps, associated notes, land form features, imagery and soils is fundamental to determining the land zone.

The environment

Land Zone 11 forms extensive undulating to steep hills, ranges and mountains, and associated gently undulating colluvial slopes and pediments. Linear ridges, associated with strong folding of relatively hard and soft geologies, are common features of the Mt Isa Inlier (Northwest Highlands Bioregion) (**Plate 34**) and Coen Inlier (Cape York Peninsula Bioregion).

Soils are greatly influenced by the lithology (mineral content). In general terms, the acidic rocks form mainly shallow gravelly Rudosols and Tenosols on steeper slopes with Chromosols and Sodosols on lower slopes and gently undulating areas. Other rocks with more clay forming minerals such as micas, feldspars and mafic minerals form a very diverse range of soils, ranging from shallow Tenosols, Chromosols and Dermosols on steeper slopes to Sodosols and Vertosols on lower slopes.

The vegetation includes a diverse range of eucalypt open forest and woodland, with spinifex (*Triodia* spp.) shrublands and open woodlands in arid areas, and rainforests and vine forest in more favourable sites.

3.12 Land Zone 12 – Mesozoic to Proterozoic igneous rocks

Definition

 hills and lowlands on granitic rocks	Mesozoic to Proterozoic igneous rocks, forming ranges, hills and lowlands. Acid, intermediate and basic intrusive and volcanic rocks such as granites, granodiorites, gabbros, dolerites, andesites and rhyolites, as well as minor areas of associated interbedded sediments. Excludes serpentinites (Land Zone 11) and younger igneous rocks (Land Zone 8). Soils are mainly Tenosols on steeper slopes with Chromosols and Sodosols on lower slopes and gently undulating areas. Soils are typically of low to moderate fertility.

Clarification

Land Zone 12 includes all Mesozoic to Proterozoic (Cretaceous and older) unmetamorphosed igneous rocks (see Section 2.3.3). Extrusive rocks have formed as a result of volcanic activity at or immediately adjacent to the earth's surface and include rock types such as basalt, andesite, rhyolite, trachyte and tuffs. Intrusive rocks occur where magma emplaces in pre-existing rock and cools relatively slowly (compared to extrusive rocks) forming coarse crystalline rocks. Intrusive structures include batholiths, sills and dykes with crystalline rocks such as granite, adamelite, granodiorite, diorite, syenite, monzonite, gabbro and dolerite. Pyroclastic rocks/tuffs and ignimbrites are included.

The definition of Land Zone 12 is simple, unequivocal and without exceptions to the rule; all pre-Cainozoic non-metamorphosed igneous rocks of whatever type are Land Zone 12. In many cases, the distinction between un-metamorphosed and metamorphosed formations may be unclear and reference to geological maps and associated notes is fundamental to distinguishing the land zone.

Cainozoic (Tertiary–Quaternary) igneous rocks of Land Zone 8 and metamorphosed igneous rocks (such as metavolcanics, greenstones, granitic gneiss and serpentinite) of Land Zone 11 are excluded. Deeply weathered igneous rocks of Land Zone 5 or 7 are also excluded.

Extent

Mesozoic and older igneous intrusive rocks are associated with the Mt Isa, Coen and Georgetown inliers, the Thompson Orogen (Townsville south through central Queensland), the Hodgkinson–Broken River Orogen (Cooktown to west of Ingham), and the New England Orogen along the coast/near coast of Queensland (Proserpine to the New South Wales border) as described in Section 3.1.3. Some of these older volcanic and intrusive rocks have been metamorphosed.

Field examination of fresh rock type with reference to geological mapping and associated notes readily determines the land zone.

The environment

Landforms of Land Zone 12 form extensive gently undulating rises to steep mountains (**Plate 63**). Fine grained rocks and siliceous rock types are generally more resistant to weathering and subsequent erosion resulting frequently in steeper to more undulating landscapes compared to more basic or coarse grained rocks of equivalent age and climatic conditions.

Soils are greatly influenced by the lithology (mineral content). In general terms, the acidic rocks (such as granites and rhyolites) form mainly shallow Tenosols on steeper slopes (Plate 64) with Chromosols and Sodosols on lower slopes and gently undulating areas. In high rainfall areas, Kandosols and Podosols can occur on colluvial slopes. Intermediate rocks (such as granodiorite, diorite, syenite, monzonite) form a very diverse range of soils depending on their mineral content, ranging from shallow Tenosols, Chromosols and Dermosols on steeper slopes to Sodosols and Vertosols on lower slopes. On mafic rocks types (such as gabbro, dolerite and pre-Cainozoic basalts), soils are predominantly black and brown Vertosols on the gently undulating landscapes grading to black and brown Dermosols/Ferrosols on steeper and/or rocky landscapes.

Plate 63 Granitic mountains, Mt Walsh, Biggenden

Plate 64 Shallow soils on a granite hill, quarry at The Gap, Brisbane

The vegetation includes a diverse range of eucalypt open forest and woodland, with rainforests and vine forest in more favourable sites.

4. Glossary

Completely weathered: Completely weathered rock retains no structure from the original rock. There are no corestones, but there may be mottling. It is composed completely of earth material.

> Completely weathered sediment retains no structures from the original sediment. It is composed completely of earth material. There may be mottling.

Deformation: A geological process in which the application of force causes a change in geometry, such as the production of a fold, fault or fabric, often associated with metamorphic reactions.

Diagenesis: All physical, chemical and biological processes that occur in a sediment after deposition and before metamorphism, during which time interstitial pore fluids react and attempt to reach equilibrium with their evolving geochemical environment.

Fold: A curved or angular shape of an originally planar geological surface.

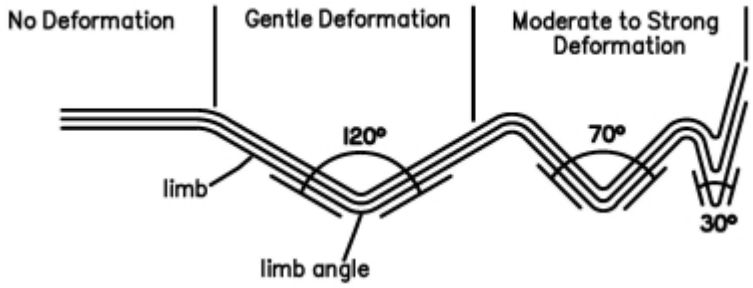
Gentle Folding: A fold with an *interlimb angle* of 180° to 120°.

Highest Astronomical Tide: The highest levels which can be predicted to occur under average meteorological conditions and any combination of astronomical conditions. HAT is not the extreme levels which can be reached, as storm surges may cause considerably higher levels to occur.

Highly weathered: Highly weathered rock has strong iron staining, and more than 50% earth material. Corestones, if present, are free and rounded. Nearly all feldspars are decayed, and there are numerous microfractures. The material can be broken apart in the hands with difficulty.

> Highly weathered sediment has strong iron staining, and more than 50% earth material. All except the largest particles are weathered right through. Boulders have thick weathering skins.

Interlimb angle: The angle between the fold limbs



Inter-tidal zone: The land between high and low tide levels.

Jarosite: an acidic pale yellow iron sulfate mineral $KFe_3(SO_4)_2(OH)_6$. Jarosite is a by-product of the acid sulfate soil oxidation process, formed at pH less than 3.7; commonly found precipitated along root channels and other soil surfaces exposed to air.

Lateritisation: A prolonged process of chemical weathering which produces a wide variety in the thickness, grade, chemistry and ore mineralogy of the resulting soils.

Moderately weathered: Moderately weathered rock has strong iron staining, up to 50% earth material. Corestones, if present, are rectangular and interlocked. Most feldspars have decayed, and there are microfractures throughout. It can be broken by a pick, but not by the hand.

Moderately weathered sediments have strong iron staining, and up to 50% earth material. Labile particles up to gravel size are completely weathered. Larger particles have thick weathering skins. Most feldspars in larger particles have decayed.

Moderate to Strong Folding: A fold with an interlimb angle of less than 120°.

Orogenic or orogeny: The process of formation of mountains – the process by which structures within fold belt mountainous areas were formed, including thrusting, folding, faulting, metamorphism and plutonism.

Paleo: Old or ancient.

Parna: A wind-blown clay, mobilised from inland Australia as the result of a series of intermittent high wind events during the Quaternary. Parna can be recognised on the basis of colour, texture, distributional patterns, and pedology.

Slightly weathered: Slightly weathered rock has traces of alteration, including weak iron staining, and some earth material. Corestones, if present, are interlocked, there is slight decay of feldspars and a few microfractures. It is easily broken with a hammer.

Slightly weathered sediments have traces of alteration on the surfaces of the sedimentary particles, including weak iron staining. Some earth minerals may be present, filling voids between coarse particles.

Supratidal: Lands subject to infrequent (spring tides) tidal inundation, normally bare of vegetation except for halophytes such as samphires.

Unweathered: Regolith with no visible signs of weathering (normally confined to some transported regolith types).

Vertic: Soil material with a clayey texture (35% or more clay), which cracks strongly when dry and has slickensides and/or lenticular peds – shrink-swell properties.

Very highly weathered: Very highly weathered rock is produced by the thorough decomposition of rock masses due to exposure to land surface processes. The material retains structures from the original rock. It may be pallid in colour, and is composed completely of earth material. Corestones, if present, are rare and rounded. All feldspars have decayed. It can easily be broken by hand.

Very highly weathered sediment is thoroughly decomposed, but still retains the shapes of the original sediment particles, as well as laminations and bedding. It is completely composed of earth material.

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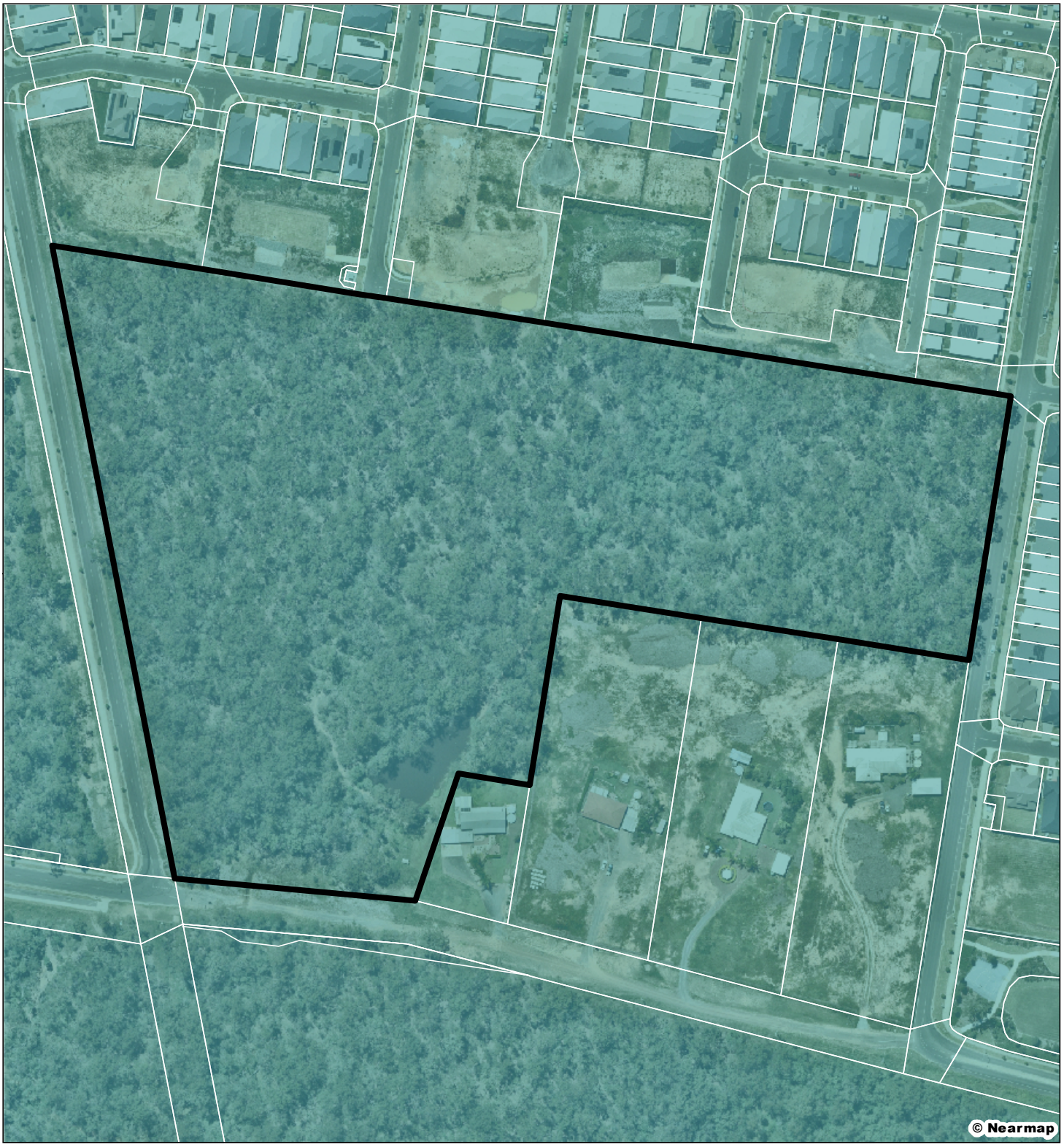

Legend

Site DCDB

Australian Soil Classification

Sodosols

Figure 1

ASIRIS Soil Classification
(Level 5)

HB Land Pty Ltd

File ref. 11826 E MNES Figure 1 ASRIS Soils A
Date 26/04/2024
Project Binnies Road, Ripley

0 20 40 60 80 m

N

Scale (A4): 1:2,500 [GDA 2020 MGA Z56]

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