28 SOUTH Environmental

31 March 2017

Amy Schmidt
Reel Planning
By Email: amy@reelplanning.com

Dear Amy

RE: NORTH MACLEAN ENTERPRISE PRECINCT (4499-4651 MOUNT LINDESAY HIGHWAY, NORTH MACLEAN) – PROGRESSION OF ECOLOGICAL ISSUES

1.0 BACKGROUND AND PURPOSE OF THIS ADVICE

As you will recall, on 24 May 2016 we held a meeting with EDQ to discuss the North Maclean project in context of the EDQ assessment and approval framework. We advised EDQ that significant information on the ecological values of the Site had already been compiled for the EPBC Act assessment and approval process[1], and that much of that information would be relevant to EDQ's consideration of the Project[2]. However, we agreed to refine the ecological information to more relevantly address species and communities listed under Queensland environment planning legislation.

From an ecological perspective, the meeting identified four main issues to also consider in further detail. These were outlined in an email from EDQ dated 12 April 2016[3]

(i) The occurrence of Viable/Non-viable remnant endangered vegetation;

(ii) The validity of waterway mapping;

(iii) The need for an amended design response to address perceived ecological constraints; and

(iv) Further clarification around bushfire management.

The purposes of this advice are to:

(i) Present baseline ecological assessment for the proposed development - refer **Technical Attachment 1**; and

(ii) Provide a response to the four technical issues raised by EDQ.

Please note that, in preparing this advice, I have considered the context plans for the proposed development, and prepared my advice on the basis of the conceptual proposal.

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[1] The Project was deemed a controlled action under the Act, and assessed via the Preliminary Documentation pathway (Referral No. 2013/6941). Approval under the Act was granted on 10 February 2016.

[2] That information is available on the EPBC Referral list page http://epbcnotices.environment.gov.au/referralslist/ under the project reference 2013/6941.

[3] Email from Owen Haslam, Manager EDQ Development Assessment.

TECHNICAL ISSUE 1 – VIABLE/NON-VIABLE REMNANT ENDANGERED VEGETATION

The Greater Flagstone Development Scheme requires (amongst other matters) the protection of viable remnant vegetation containing endangered regional ecosystems. The definition of a non-viable area of remnant vegetation containing an endangered regional ecosystem is provided in Schedule 1 (Definitions) to PDA Guideline No. 17 (Remnant vegetation and koala habitat obligations in Greater Flagstone and Yarrabilba PDAs) (herein Guideline 17).

Prior to our meeting in May 2016, we provided EDQ with a summary of issues for discussion[4]. In that advice, we noted that the Site's remnant parcels met a considerable majority of the criteria to be identified as *non-viable*, and it was therefore reasonable for development to proceed as proposed (i.e. clearing of the whole site) based on providing an offset.

EDQ's email response advised that:

> *Based on the material presented to date, and pursuant to Guideline 17, the mapped RE endangered vegetation does not meet the criteria for non-viable. Consequently, EDQ policy does not support the clearing/offsetting of these areas. A possible option to overcome this would be to obtain PMAV which re-classifies the subject vegetation. Alternatives can be considered but the delegate is unlikely to support departures from the policy position in relation to the clearing/offsetting of RE endangered vegetation that meets the viability criteria.*

The PMAV application for the Site was underway at that time, and has now been obtained.

Detailed assessment of the *non-viable* criteria (informed by additional technical studies) follows. The parcel numbers noted in the following discussion are shown in **Attachment 1**.

- **Assessment Criterion 1 (Size):** The remnant parcels are (individually) less than 5 hectares in area. This *non-viable* criterion is satisfied;

- **Assessment Criterion 2(a) (Connectivity to remnant and high value regrowth vegetation): Attachment 1** shows that the Site's remnant vegetation does not adjoin other areas of remnant vegetation. The high value regrowth legislation has been repealed, and the high value regrowth mapping is no longer available. This *non-viable* criterion is satisfied;

- **Assessment Criterion 2(c) (Connectivity to a watercourse or waterbody):** The Vegetation Management Supporting Map (VMSM) shows that several mapped watercourses occur at the Site. One of these watercourses intersects with endangered vegetation in the Site's northeast (**Attachment 1**). However, the watercourse mapping is incorrect. Further discussion is provided in **Technical Attachment 2**. The *non-viable* criterion is satisfied;

- **Assessment Criterion 2(d) (Connectivity to a mapped corridor within or external to the PDA):** The South-east Queensland Biodiversity Planning Assessment (BPA) shows that the northern portion of the Site (north of the powerline easement) falls within the Greenbank to Tamborine Terrestrial Corridor.

[4] Advice dated 23 September 2016: North Maclean Enterprise Precinct – 4499-5651 Mount Lindesay Highway, North Maclean (Items for Discussion at Meeting with EDQ).

Attachment 2 shows the Site's relationship to the corridor, and the corridor's constituent remnant parcels.

While it might be argued that the Site's position close to the southern edge of the BPA corridor causes the two northernmost remnant parcels to fail Assessment Criterion 2(b) (and therefore the *non-viable* criteria overall), more careful consideration should be given to the importance of local-scale corridor mapping for properly understanding corridor values, and the biodiversity outcome achieved if the two northernmost clumps are retained.

Attachment 2 clearly shows that the Site's two northernmost remnant parcels are small outliers to much larger and more contiguous areas of remnant vegetation broadly associated with Norris Creek. When considered more specifically (i.e. at a local scale), it is apparent that these more contiguous remnant areas form the core elements of the Greenbank to Tamborine corridor. This is further borne out by local government corridor mapping, most notably: (a) Map 2.1A (Nature Conservation Overlay) of the former Beaudesert Planning Scheme 2007[5], showing the Site located to the south of an ecological corridor[6] (**Attachment 3**). The current Logan Planning scheme also fails to identify the Site as part of an environmental corridor; and (b) Logan's Koala Conservation Strategic Plan 2013-2023[7], showing that the Site is not part of a biodiversity or koala corridor (**Attachment 4**).

If the *non-viable* criteria are not achieved, Guideline 17 simply requires the remnant parcels to be retained. It does not require them to be connected to other remnant parcels in the locality. Retaining small patches of vegetation within an otherwise industrial landscape will make no meaningful contribution to the Greenbank to Tamborine Corridor, and it is apparent that much greater biodiversity outcomes could be achieved through the provision of offsets.

A properly balanced consideration of the issues suggests that this *non-viable* criterion is satisfied.

- **Assessment Criterion 3(a) (Within a State or Regional Corridor):** Refer discussion in response to 2(d). A properly balanced consideration of the issues suggests that this *non-viable* criterion is satisfied;

- **Assessment Criterion 3(b) (Within a Local Government Strategic Biodiversity Corridor):** (a) Map 2.1A (Nature Conservation Overlay) of the former Beaudesert Planning Scheme 2007[8] shows that the Site is located to the south of an ecological corridor (**Attachment 3**). The current Logan Planning scheme also fails to identify the Site as part of an environmental corridor; and (b) Logan's Koala Conservation Strategic Plan 2013-2023[9] which shows that the Site is not part of a biodiversity or koala corridor (**Attachment 4**). This *non-viable* criterion is satisfied;

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[5] Before the Site was included in the Greater Flagstone PDA, it was subject to the provisions of the former Beaudesert Planning Scheme 2007. Significant biodiversity planning assessment was undertaken to inform the scheme, and this is useful for assessing the Site's perceived role in the broader landscape at a more refined scale than the BPA mapping.

[6] The corridor is centred on Norris Creek, which when crossed by the Mt Lindesay Highway is provided with directional fencing and large pipe underpasses. By comparison, a recent upgrade of the Mt. Lindesay Highway adjoining the Site relies on a 100m long fauna culvert to maintain east-west habitat connectivity into the Site. It is highly unlikely that this corridor is effective (refer plates following the map in **Attachment 3**).

[7] Logan City Council 2013.

[8] Before the Site was included in the Greater Flagstone PDA, it was subject to the provisions of the former Beaudesert Planning Scheme 2007. Significant biodiversity planning assessment was undertaken to inform the scheme, and this is useful for assessing the Site's perceived role in the broader landscape at a more refined scale than the BPA mapping.

[9] Logan City Council 2013.

- **Assessment Criterion 3(c) (Adjacent to a Protected Area):** The Site is not located adjacent to a Protected Area. This *non-viable* criterion is satisfied;

- **Assessment Criterion 4 (Has become or is likely to become isolated or fragmented because of the surrounding land use pattern):** If the *non-viable* criteria are not achieved, Guideline 17 simply requires the remnant parcels to be retained. If retained, the remnant parcels will be isolated within an otherwise industrial landscape, and will be subject to gradual degradation over time due to this setting[10]. This *non-viable* criterion is satisfied;

- **Assessment Criterion 3(c) (Has greater than 50% weed species throughout the understorey and ground layer):** More detailed botanical assessment was undertaken to determine compliance with this criterion. The assessment found that the three patches of RE 12.9-10.12 in the Site's west failed this condition threshold, the assessment finding that the shrub layer was largely absent, or if present dominated by exotic flora species. Similarly, the groundcover layer was heavily degraded and primarily comprised of exotic grasses and weeds.

  The overall cover of native grasses (notably Blady grass) in the RE 12.3.3 parcel exceeded the required 50% of groundcovers, but other indicators of ecological condition established a moderately low bio-condition score. The *non-viable* criterion is satisfied regarding Clumps 1-3. The criterion is not entirely satisfied for Parcel 4, because the groundcover is wholly dominated by the native species Blady grass. However, the groundcover lacks the diversity commonly seen in other remnants of RE 12.3.3 (refer to typical groundcover diversity noted in the regional ecosystem technical description for RE 12.3.3 (**Attachment 5**).

Table 1 – Summary of Compliance with the *non-viable* criteria

Remnant Parcel No.	Criterion 1	Criterion 2a	Criterion 2b (refer discussion)	Criterion 2c (refer discussion)	Criterion 3a (refer discussion)	Criterion 3b	Criterion 3c	Criterion 4	Criterion 5
1	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	✓	✓	✓	✓	✓	✓	✓	✓	×

As shown by **Table 1**, the considerable majority of *non-viable* criteria are met. Discussion is provided under Criterion 2(c) and 3(a)to justify our position regarding compliance.

TECHNICAL ISSUE 2 – VALIDITY OF THE WATERWAY MAPPING

During the May 2016 meeting, we discussed our concerns regarding the accuracy of the watercourse mapping. EDQ's subsequent email response suggested that:

> *Rather than referring to Water Act 2000, it is suggested that waterway mapping be challenged through ground-truthing to, for example, demonstrate no defined bed or banks etc. EDQ is happy to undertake*

[10] Noting that there is no logical framework for their long-term management (e.g. Council reserve).

a site inspection to verify findings; however costs incurred by EDQ, by way of third party involvement, would be passed on to the proponent in accordance with EDQ's cost-recovery policy.

Further assessment of the watercourse mapping has already been made under Technical Issue 1 – Assessment Criterion 2(c). Further detailed discussion is provided in **Technical Attachment 2**.

TECHNICAL ISSUE 3 – THE NEED FOR AN AMENDED DESIGN RESPONSE TO ADDRESS PERCEIVED ECOLOGICAL CONSTRAINTS

During the May 2016 meeting, EDQ suggested that amendments may be required to address the retention of viable remnant vegetation containing endangered regional ecosystems. EDQ's subsequent email response suggested that:

> *In the event that the mapped RE endangered vegetation cannot be removed due to it meeting the viability criteria, the site will most likely require an urban design solution to respond to the site's constraints/opportunities. Whilst it is recognised that the site is included within the Industry and Business Zone, the Greater Flagstone Development Scheme also includes provisions which seek responses to site characteristics including natural constraints such as vegetation etc. In order to assist with working up a responsive urban design solution for the site, it is suggested that you review EDQ's suite of Guidelines, including Guideline 10 – Industry & Business Areas. Given the findings of investigations to date, a well-planned urban design solution could provide a balanced outcome for the site which retains and protects natural values, buffers impacts, and establishes a responsive development footprint.*

Table 1 (and the discussion that precedes it) demonstrates that the considerable majority of the *non-viable* criteria are achieved. For the single criteria that is not potentially achieved, a properly balanced consideration of the issues clearly indicates that a better environmental outcome can be accomplished by providing offsets rather than conserving the remnant parcels in a highly-urbanised landscape[11].

We note further that: (i) the Greater Flagstone Urban Development Scheme specifically notes that *the "ULDA guidelines provide guidance on how to achieve the UDA-wide criteria"* [12]. Accordingly, the guideline's requirements should not be considered mandatory; and (ii) offsetting what is considered to be *viable* remnant vegetation containing endangered regional ecosystems still achieves the purpose of the Guideline 17 insofar that there will be no net loss of such vegetation in the region[13]. The Applicant seeks to retain the layout in the interests of the design, construction and employment efficiencies it achieves. The loss of remnant vegetation will be addressed by way of offsets.

The Applicant proposes to offset the areas of non-viable endangered vegetation (7.51 hectares) at a ratio of 4:1 – establishing a further offset area of 30.04 hectares[14]. The Applicant proposes that the areas of endangered RE 12.9-10.12 be offset with endangered RE 12.3.3. RE 12.3.3 is in fact considerably more uncommon than RE 12.9-

[11]Retaining small patches of vegetation within an otherwise industrial landscape does not achieve a meaningful environmental outcome, particularly when there is no logical mechanism for the future management of the clumps (e.g. Council reserve).

[12] Refer Section 3.1.2 (Note: emphasis by 28 South Environmental)

[13] Refer *Purpose of the Guideline* on Page 1.

[14] Noting that Condition 2 of the DoE approval required an offset of 62.77 hectares. The 30.04 hectares is in addition to the 62.77 hectares required to satisfy the DoE condition.

10.12 in the southeast Queensland Bioregion[15], and creates much more beneficial habitat for conservation significant species such as Koala and Swift parrot than RE 12.9-10.12. Accordingly, a more significant biodiversity outcome can be achieved.

TECHNICAL ISSUE 4 – THE NEED FOR AN AMENDED DESIGN RESPONSE TO ADDRESS PERCEIVED BUSHFIRE CONSTRAINTS

During the May 2016 meeting, EDQ advised of a requirement to consider bushfire. EDQ's subsequent email response suggested that the Applicant consider relevant sections of the State Planning Policy. The Applicant has engaged Land and Environment Consultants (LEC) to prepare a bushfire protection plan for the proposed development. This report is provided bundle of documents accompanying the Request for Pre-Application Meeting (Reel Planning).

If you have any further questions regarding this matter, please give me a call.

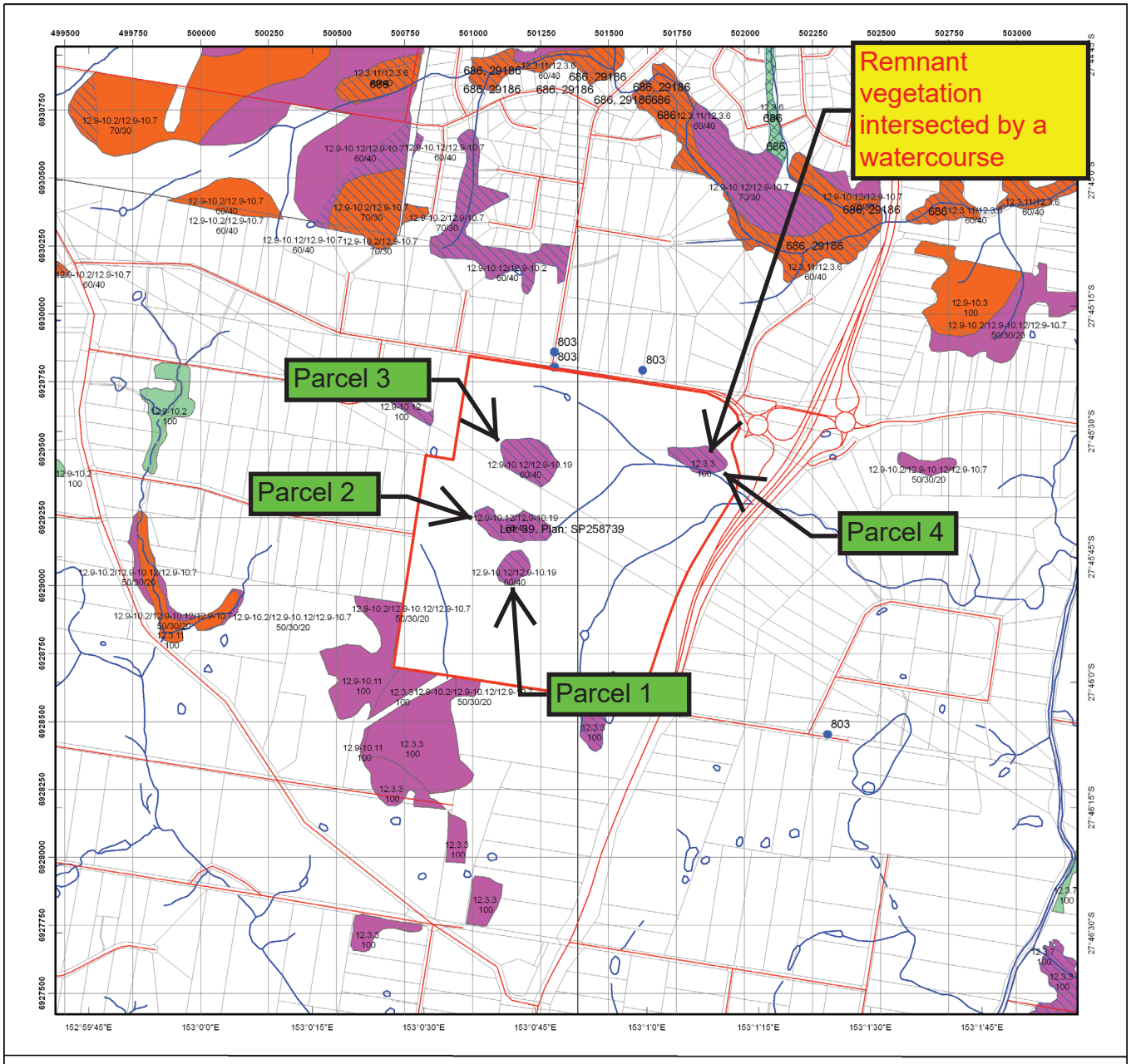
Regards

Wayne Moffitt
Director, 28 South Environmental

[15] In 2013, the remnant extent of RE 12.9-10.12 in the Southeast Queensland Bioregion was < 10 000 hectares. However, between 10-30% of the pre-clearing extent of RE 12.9-10.12 remained. By comparison, less than 10% of the pre-clear extent (of the formerly extensive) RE 12.3.3 remained.

ATTACHMENT 1

5.2 Vegetation management supporting map



Vegetation Management Supporting Map

Legend

- Lot and Plan
- 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 A or B area containing remnant vegetation
- Category A or B area under Section 20AH
  These areas are edged in yellow and filled with the remnant RE Status
- 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
- Category C area containing high value regrowth vegetation
- Category C area under Section 20AI
  These areas are edged in purple and filled with the remnant RE Status
- Non Remnant
- Water
- Wetland on the vegetation management wetlands map
- Essential habitat on the essential habitat map
- Essential habitat species record
- Watercourse on the vegetation management watercourse and drainage feature map (Stream order shown as black number against stream where available)
- Roads
- National Parks, State Forest and other reserves
- Cadastral line
  Property boundaries shown are provided as a locational aid only

Queensland Government

LOCALITY DIAGRAM

N

0 150 300 450 600 750 m

This product is projected into:
GDA 1994 MGA Zone 56

Labels for Essential Habitat are centred on the area of enquiry.

Regional ecosystem linework has been compiled at a scale of 1:100 000, except in designated areas where a compilation scale of 1:50 000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100 000 is +/- 100 metres.

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Natural Resources and Mines makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incurr as a result of the product being inaccurate or incomplete in any way and for any reason.

Additional information may be required for the purposes of land clearing or assessment of a regional ecosystem map or PMAV applications. For further information go to the web site: www.dnrm.qld.gov.au or contact the Department of Natural Resources and Mines.

Digital data for the vegetation management watercourse and drainage feature map, vegetation management wetlands map, essential habitat map and the vegetation management remnant and regional ecosystem map are available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

ATTACHMENT 2

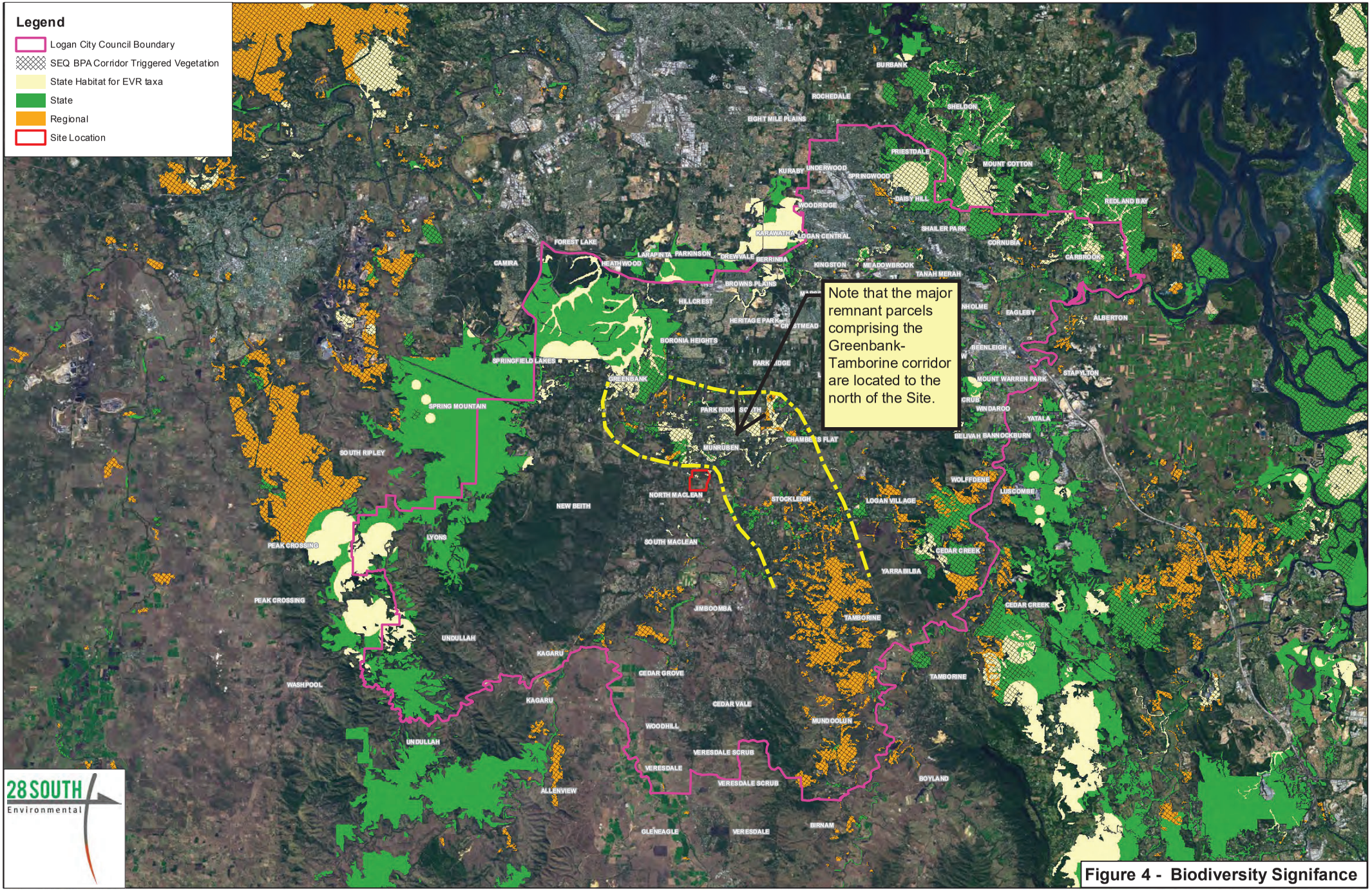


Figure 4 - Biodiversity Signifance

Coordinate System: GDA 1994 MGA Zone 56
Reference Scale: 1:200,000
Project Name : North Maclean
Title : Figure 4 - Biodeversity Signifance

0 1 2 4 6 8 10 Kilometers

N

Background imagery is supplied by Bing, and is not to be used for measurement. For visualisation purposes only.

Client: Reel Planning
Date: Friday, May 29, 2015

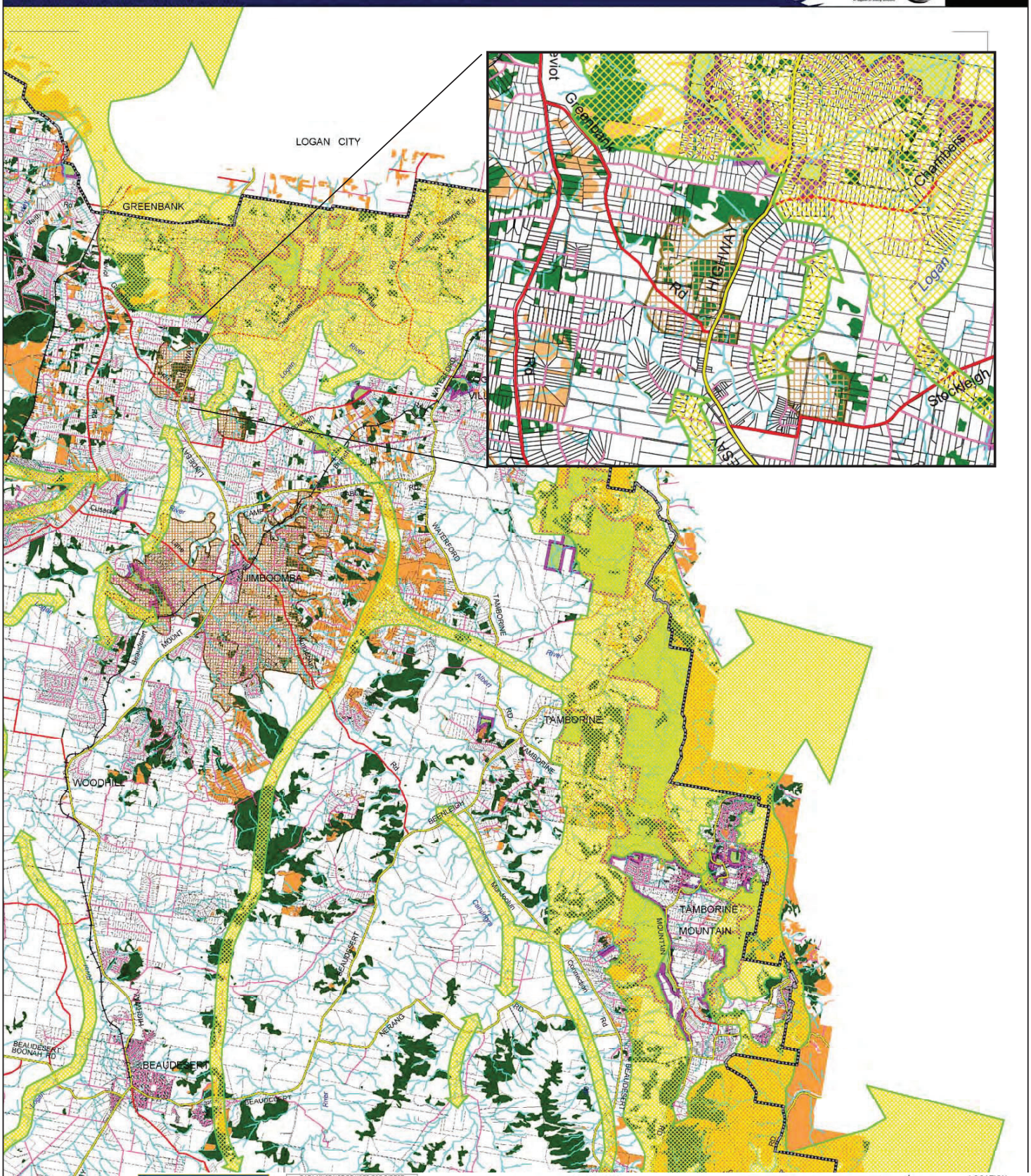
Document Path: S:\GIS\28_South\South_Maclean\Admin\mxd\NorthMaclean_Biodiversity_Fig4_Rev0_A3.mxd

ATTACHMENT 3

Nature Conservation Overlay – Conservation

Beaudesert Shire

OV 2.1A



Beaudesert Planning Scheme
Integrated Planning Act 1997

DATA MUST NOT BE USED FOR DIRECT MARKETING OR BE USED IN BREACH OF THE PRIVACY LAWS

SCALE 1:60000

Kilometres 5 4 3 2 1 0 5 Kilometres

Final Gazette : 30th MARCH 2007

LOCATION

D A C B

OV 2.1A

28 SOUTH Environmental

Geographical Information Services

Coordinate System: GDA 1994 MGA Zone 56
Reference Scale:
Project Name : South Maclean
Title : Nature Conservation

Document Path: V:\GIS\28_South\South_Maclean\Admin\mxd\SouthMaclean_Nature_Conservation.mxd

N

Background imagery is supplied by Google earth Pro, and is not to be used for measurement. For visualisation purposes only.

Client: Craven Ovenden Town Planning
Date: Friday, May 24, 2013

Plate 1 – Culvert with dry passage fauna pathways at the northeastern corner of the Subject Site

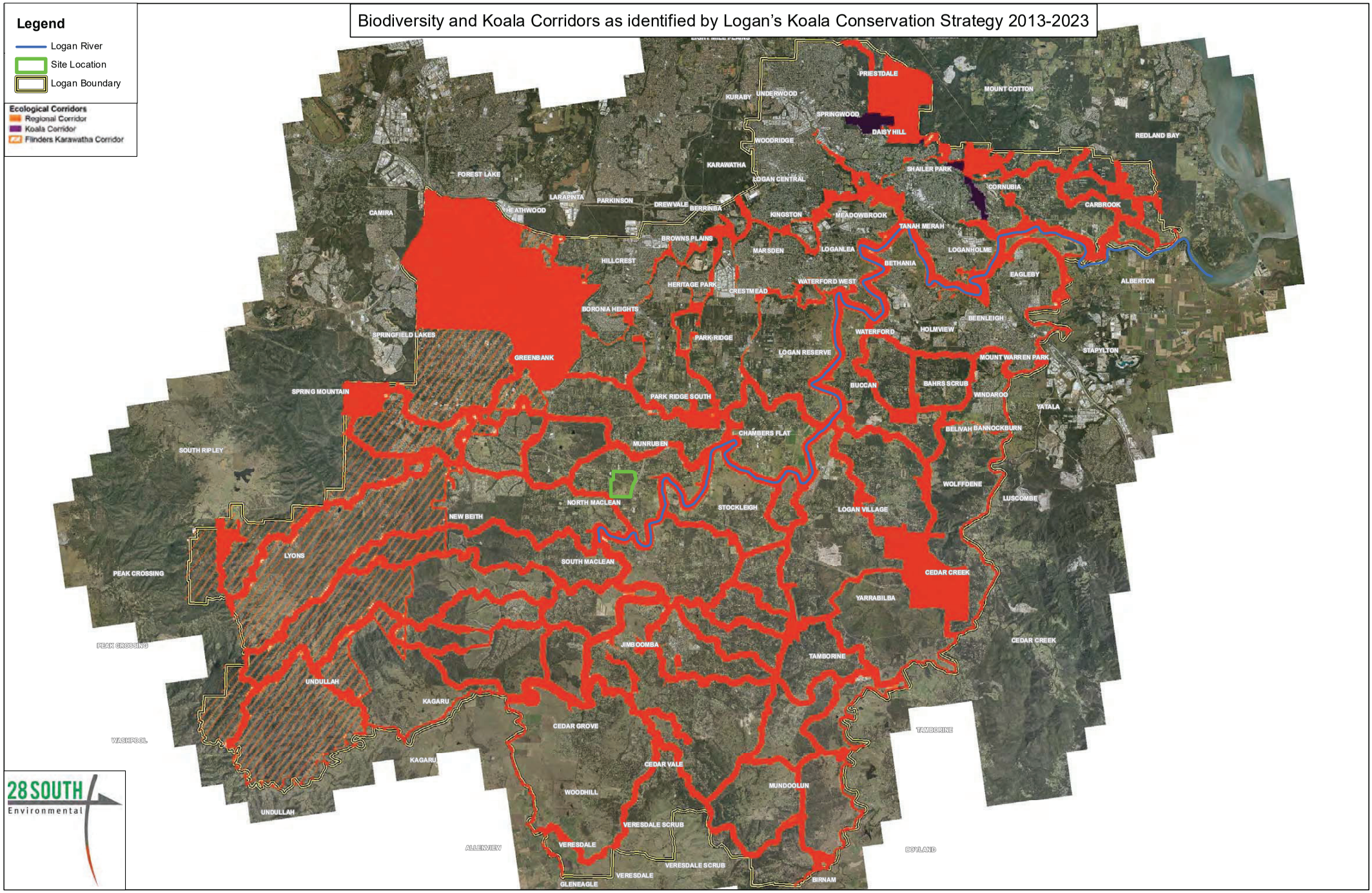
Plate 2 – View showing the long dark nature of the dry passage

Plate 3 – Norris Creek Underpass (northern culvert)

Plate 4 – Norris Creek Underpass (southern culvert – note stick is 1m tall)

ATTACHMENT 4

Biodiversity and Koala Corridors as identified by Logan's Koala Conservation Strategy 2013-2023



28 SOUTH Environmental

Coordinate System: GDA 1994 MGA Zone 56
Reference Scale: 1:160,000
Project Name : North Maclean
Title : Biodiversity and Koala Corridors

0 0.75 1.5 3 4.5 6 7.5 Kilometers

N

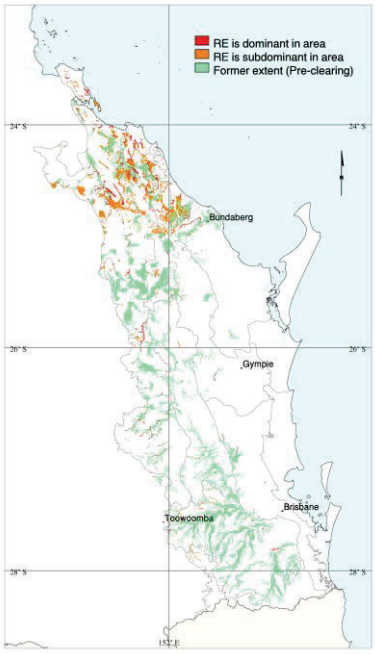
Background imagery is supplied by Queensland Government, and is not to be used for measurement. For visualisation purposes only.

Client: Reel Planning
Date: Friday, May 15, 2015

Document Path: E:\GIS\28_South\South_Maclean\Admin\mxd\NorthMaclean_Biodiversity_Koala_Corridors_Rev0_A3.mxd

ATTACHMENT 5

Eucalyptus tereticornis woodland on Quaternary alluvium



Pre-clearing area (ha), remnant area (ha) and per cent remaining:	412,046	39,440	10%

Species recorded: Total: 187; woody: 25; ground: 176; Avg. spp./site: 45.7; std dev.: 17.5, 9 site(s)

Basal area: Avg./site: 16.2 m²/ha, range: 8.0 - 31 m²/ha, std. deviation: 7 m²/ha, 9 site(s)

Structural formation: Woodland: 44%; open-woodland: 33%; tall woodland: 11%; open-forest: 11%, 9 site(s)

Representative sites: 14270, 14274, 14696, 14786, 14876, 15374, 15527, 38250, 38464.

Stratum: **T1**

Height avg. = 23.8m, range 17-32m, 8 sites

Crown cover avg. = 30.8%, range 12.0-65.0%, 9 sites

Stem density/ha avg. = 115, range 40-240, 5 sites

Dominant species (relative cover, frequency): Eucalyptus tereticornis (78, 100%), Eucalyptus crebra (42, 22%), Corymbia clarksoniana (7, 22%)

Frequent species (cover, frequency): Eucalyptus tereticornis (27, 100%), Corymbia clarksoniana (1, 22%), Eucalyptus crebra (5, 22%), Acacia disparrima subsp. disparrima (1, 11%), Angophora leiocarpa (5, 11%), Angophora subvelutina (18, 11%), Corymbia intermedia (5, 11%), Eucalyptus moluccana (1, 11%), Lophostemon suaveolens (1, 11%)

Stratum: **T2**

Height avg. = 14.8m, range 10.5-22m, 6 sites

Crown cover avg. = 16.8%, range 2.0-40.0%, 9 sites

Stem density/ha avg. = 160, range 30-280, 5 sites

Dominant species (relative cover, frequency): Lophostemon suaveolens (56, 44%), Angophora subvelutina (46, 33%), Melaleuca nervosa subsp. nervosa (38, 22%), Eucalyptus tereticornis (26, 89%), Corymbia tessellaris (23, 33%)

Frequent species (cover, frequency): Eucalyptus tereticornis (6, 89%), Lophostemon suaveolens (12, 44%), Angophora subvelutina (11, 33%), Corymbia tessellaris (2, 33%), Melaleuca nervosa subsp. nervosa (3, 22%), Acacia disparrima subsp. disparrima (1, 11%), Allocasuarina luehmannii (2, 11%), Banksia integrifolia (11%), Corymbia clarksoniana (1, 11%), Corymbia intermedia (1, 11%), Eucalyptus crebra (1, 11%), Eucalyptus melanophloia (2, 11%)

Dominant species: Relative cover (mean of cover of species / total cover of all species in that stratum for all values > zero) and frequency (percent of total sites) ordered by decreasing relative abundance. Up to five most dominant species with frequency > 20% listed for each stratum.

Frequent species: Cover (mean of all values > zero) and frequency (percent of total sites) of all species occurring in more than 5% of sites ordered by decreasing frequency. Ground layer species are listed as either graminoid or forb.

Naturalised species have an asterisk (*) after the name. indet. after listed name = indeterminate species or genus

23/05/2012

Stratum: **T3**

Height avg. = 7.1m, range 5-10m, 4 sites

Crown cover avg. = 9.7%, range 1.0-30.0%, 7 sites

Stem density/ha avg. = 90, range 20-160, 3 sites

Dominant species (relative cover, frequency): Melaleuca nervosa subsp. nervosa (55, 22%), Lophostemon suaveolens (51, 33%), Eucalyptus tereticornis (49, 33%), Angophora subvelutina (46, 22%), Eucalyptus crebra (5, 22%)

Frequent species (cover, frequency): Eucalyptus tereticornis (3, 33%), Lophostemon suaveolens (10, 33%), Angophora subvelutina (4, 22%), Eucalyptus crebra (22%), Melaleuca nervosa subsp. nervosa (1, 22%), Acacia disparrima subsp. disparrima (1, 11%), Allocasuarina luehmannii (4, 11%), Alphitonia excelsa (2, 11%), Corymbia clarksoniana (1, 11%), Corymbia intermedia (11%), Corymbia tessellaris (2, 11%), Eucalyptus melanophloia (11%), Petalostigma pubescens (10, 11%)

Stratum: **S1**

Height avg. = 3.1m, range 2-5m, 5 sites

Crown cover avg. = 5.6%, range 0.0-25.0%, 8 sites

Stem density/ha avg. = 540, range 120-960, 2 sites

Dominant species (relative cover, frequency): Corymbia tessellaris (63, 22%), Acacia disparrima subsp. disparrima (61, 33%), Angophora subvelutina (51, 22%), Jacksonia scoparia (29, 22%), Acacia leiocalyx (22, 22%)

Frequent species (cover, frequency): Acacia disparrima subsp. disparrima (8, 33%), Acacia leiocalyx (1, 22%), Acacia maidenii (1, 22%), Angophora subvelutina (22%), Corymbia tessellaris (22%), Jacksonia scoparia (2, 22%), Lophostemon suaveolens (1, 22%), Acacia blakei (3, 11%), Acacia concurrens (5, 11%), Acacia glaucocarpa (11%), Acacia salicina (11%), Alphitonia excelsa (3, 11%), Choretrum candollei (11%), Corymbia intermedia (11%), Lantana camara (11%), Melaleuca nervosa subsp. nervosa (1, 11%)*

Dominant species: Relative cover (mean of cover of species / total cover of all species in that stratum for all values > zero) and frequency (percent of total sites) ordered by decreasing relative abundance. Up to five most dominant species with frequency > 20% listed for each stratum.

Frequent species: Cover (mean of all values > zero) and frequency (percent of total sites) of all species occurring in more than 5% of sites ordered by decreasing frequency. Ground layer species are listed as either graminoid or forb.

Naturalised species have an asterisk (*) after the name. indet. after listed name = indeterminate species or genus

23/05/2012

Stratum: **G**

Height avg. = 0.6m, range 0.25-1m, 6 sites

PFC avg. = 78.7%, range 56-97%, 9 sites

Dominant species (relative cover, frequency): Eremochloa bimaculata (43, 33%), Imperata cylindrica (33, 44%), Heteropogon contortus (28, 44%), Themeda triandra (20, 56%), Digitaria didactyla (14, 33%)*

Frequent species (cover, frequency): GRAMINOIDS: Cymbopogon refractus (6, 56%), Themeda triandra (18, 56%), Cyperus gracilis (44%), Eragrostis brownii (8, 44%), Heteropogon contortus (24, 44%), Imperata cylindrica (28, 44%), Digitaria didactyla (10, 33%), Eragrostis spartinoides (33%), Eremochloa bimaculata (34, 33%), Fimbristylis dichotoma (33%), Melinis repens* (4, 33%), Abildgaardia ovata (22%), Aristida personata (1, 22%), Bothriochloa decipiens (2, 22%), Chrysopogon sylvaticus (6, 22%), Digitaria parviflora (4, 22%), Digitaria ramularis (5, 22%), Eragrostis curvula* (22%), Eragrostis lacunaria (1, 22%), Juncus continuus (22%), Panicum effusum (3, 22%), Panicum simile (5, 22%), Paspalidium distans (1, 22%), Sporobolus elongatus (22%), Alloteropsis semialata (1, 11%), Aristida benthamii var. benthamii (2, 11%), Aristida gracilipes (2, 11%), Aristida queenslandica var. dissimilis (1, 11%), Aristida warburgii (11%), Arundinella nepalensis (1, 11%), Bothriochloa decipiens var. decipiens (5, 11%), Capillipedium parviflorum (8, 11%), Capillipedium spicigerum (3, 11%), Cenchrus caliculatus (11%), Chloris gayana* (15, 11%), Chrysopogon fallax (11%), Cyperus enervis (1, 11%), Cyperus fulvus (11%), Cyperus subulatus (11%), Dichanthium sericeum (11%), Digitaria breviglumis (5, 11%), Digitaria brownii (5, 11%), Enneapogon polyphyllus (4, 11%), Eragrostis sororia (11%), Eriachne triseta (10, 11%), Hyparrhenia filipendula (11%), Juncus polyanthemus (1, 11%), Paspalum dilatatum* (11%), Paspalum scrobiculatum (11%), Setaria pumila subsp. pumila* (1, 11%), Setaria sphacelata* (1, 11%), Sporobolus pyramidalis* (5, 11%), Urochloa subquadripara* (11%)*
FORBS: Cyanthillium cinereum (56%), Gomphocarpus physocarpus (56%), Alphitonia excelsa (44%), Desmodium rhytidophyllum (44%), Dichondra repens (1, 44%), Emilia sonchifolia* (44%), Phyllanthus virgatus (44%), Acacia disparrima subsp. disparrima (33%), Bidens pilosa* (33%), Breynia oblongifolia (33%), Cheilanthes sieberi (33%), Chrysocephalum apiculatum (1, 33%), Desmodium varians (5, 33%), Dianella longifolia (33%), Dianella revoluta (33%), Eremophila debilis (33%), Lantana camara* (33%), Lobelia purpurascens (1, 33%), Lomandra longifolia (2, 33%), Opuntia stricta* (33%), Acacia glaucocarpa (1, 22%), Acacia leiocalyx (22%), Desmodium brachypodum (22%), Desmodium gunnii (22%), Desmodium triflorum* (22%), Eustrephus latifolius (22%), Flemingia parviflora (22%), Glycine clandestina var. sericea (22%), Glycine tabacina (22%), Hydrocotyle laxiflora (22%), Lomandra filiformis (22%), Lomandra multiflora subsp. multiflora (22%), Melaleuca nervosa subsp. nervosa (3, 22%), Mentha diemenica (1, 22%), Murdannia graminea (2, 22%), Opercularia diphylla (22%), Pomax umbellata (2, 22%), Pycnospora lutescens (22%), Rubus moluccanus (22%), Solanum stelligerum (22%), Tricoryne elatior (22%), Vittadinia dissecta var. hirta (22%), Wahlenbergia gracilis (22%), Acacia bidwillii (11%), Alternanthera nana (11%), Asparagus africanus* (11%), Bacopa indet. (11%), Brunoniella acaulis (11%), Brunoniella australis (11%), Calotis cuneata (1, 11%), Calotis cuneifolia (11%), Cassinia laevis (11%), Chamaesyce hyssopifolia* (1, 11%), Commelina lanceolata (11%), Corymbia clarksoniana (11%), Corymbia intermedia (11%), Crotalaria pallida (11%), Cyclophyllum coprosmoides var. coprosmoides (11%), Desmodium gangeticum (11%), Dianella longifolia var. longifolia (11%), Dianella rara (11%), Epaltes australis (11%), Eremophila indet. (11%), Eucalyptus melanophloia (11%), Eucalyptus tereticornis (11%), Euphorbia indet. (11%), Evolvulus alsinoides (11%), Exocarpos cupressiformis (11%), Ficus opposita (11%), Galactia tenuiflora (11%), Geitonoplesium cymosum (11%), Glossocardia bidens (11%), Glycine clandestina (11%), Glycine tomentella (11%), Gomphrena celosioides* (11%), Goodenia bellidifolia (11%), Haloragis heterophylla (11%), Hardenbergia violacea (11%), Hybanthus enneaspermus (1, 11%), Hybanthus stellarioides (11%), Indigofera linifolia (11%), Iphigenia indica (11%), Jacksonia scoparia (11%), Jasminum simplicifolium (11%), Lespedeza juncea (11%), Leucopogon trichostylus (11%), Livistona decora (11%), Lomandra confertifolia subsp. pallida (11%), Lomandra hystrix (11%), Lophostemon suaveolens (11%), Macroptilium atropurpureum* (1, 11%), Macroptilium lathyroides* (11%), Maytenus bilocularis (11%), Melaleuca viridiflora var. viridiflora (11%), Opuntia stricta var. stricta (11%), Oxalis corniculata* (11%), Passiflora aurantia (11%), Passiflora foetida* (11%), Pimelea neoanglica (11%), Pittosporum viscidum (11%), Planchonia careya (11%), Plectranthus parviflorus (11%), Polygala linariifolia (11%), Pratia concolor (5, 11%), Psydrax odorata (11%), Pterocaulon sphacelatum (11%), Rhynchosia minima (11%), Rumex brownii (1, 11%), Sida hackettiana (11%), Sida rhombifolia* (11%), Solanum americanum (11%), Solanum nemophilum (11%), Spermacoce brachystema (11%), Stackhousia viminea (11%), Stylosanthes indet. (11%), Tagetes minuta* (11%), Velleia spathulata (11%), Verbena bonariensis* (1, 11%), Verbena rigida* (11%), Veronica plebeia (11%), Vigna lanceolata var. lanceolata (11%), Wahlenbergia indet. (11%), Zornia muriculata (11%)*

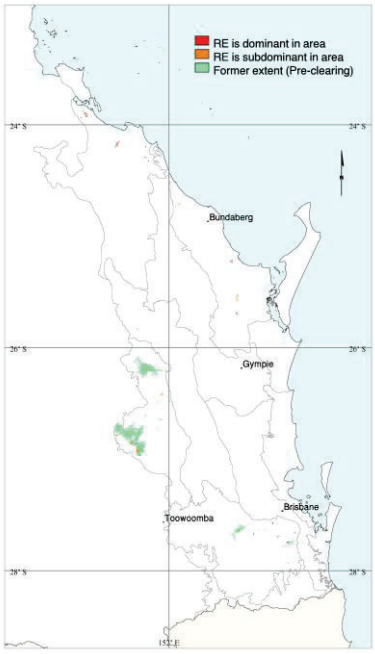
Dominant species: Relative cover (mean of cover of species / total cover of all species in that stratum for all values > zero) and frequency (percent of total sites) ordered by decreasing relative abundance. Up to five most dominant species with frequency > 20% listed for each stratum.

Frequent species: Cover (mean of all values > zero) and frequency (percent of total sites) of all species occurring in more than 5% of sites ordered by decreasing frequency. Ground layer species are listed as either graminoid or forb.

Naturalised species have an asterisk (*) after the name. indet. after listed name = indeterminate species or genus

23/05/2012

Eucalyptus moluccana woodland on Quaternary alluvium



Pre-clearing area (ha), remnant area (ha) and per cent remaining:	13,072	1,100	8%

Species recorded: Total: 157; woody: 25; ground: 143; Avg. spp./site: 54.8; std dev.: 17.9, 5 site(s)

Basal area: Avg./site: 15.6 m²/ha, range: 8.0 - 26 m²/ha, std. deviation: 7 m²/ha, 5 site(s)

Structural formation: Woodland: 80%; open-forest: 20%, 5 site(s)

Representative sites: 14024, 14570, 19853, 38247, 38251.

Stratum: **T1**

Height avg. = 24.2m, range 22-26m, 5 sites

Crown cover avg. = 39.0%, range 30.0-55.0%, 5 sites

Stem density/ha avg. = 147, range 60-280, 3 sites

Dominant species (relative cover, frequency): Eucalyptus moluccana (97, 100%), Eucalyptus tereticornis (4, 40%)

Frequent species (cover, frequency): Eucalyptus moluccana (39, 100%), Eucalyptus tereticornis (2, 40%), Eucalyptus crebra (2, 20%)

Stratum: **T2**

Height avg. = 10.4m, range 6-15m, 5 sites

Crown cover avg. = 3.2%, range 1.0-5.0%, 5 sites

Stem density/ha avg. = 67, range 20-140, 3 sites

Dominant species (relative cover, frequency): Lophostemon suaveolens (48, 60%), Eucalyptus moluccana (41, 100%), Eucalyptus crebra (38, 40%), Casuarina glauca (5, 40%)

Frequent species (cover, frequency): Eucalyptus moluccana (1, 100%), Lophostemon suaveolens (2, 60%), Casuarina glauca (40%), Eucalyptus crebra (1, 40%), Alphitonia excelsa (20%), Angophora woodsiana (20%), Corymbia tessellaris (20%), Eucalyptus exserta (20%)

Dominant species: Relative cover (mean of cover of species / total cover of all species in that stratum for all values > zero) and frequency (percent of total sites) ordered by decreasing relative abundance. Up to five most dominant species with frequency > 20% listed for each stratum.

Frequent species: Cover (mean of all values > zero) and frequency (percent of total sites) of all species occurring in more than 5% of sites ordered by decreasing frequency. Ground layer species are listed as either graminoid or forb.

Naturalised species have an asterisk (*) after the name. indet. after listed name = indeterminate species or genus

23/05/2012

Technical Attachment 1 – Ecological Investigations

North MacLean Enterprise Precinct

4499-4651 Mount Lindesay Highway, North MacLean, Queensland

16 March 2016

Report to Wearco Pty Ltd

TABLE OF CONTENTS

1.0 Introduction and Site Context

This report describes the ecological surveys that have been undertaken for the proposed development. Largely, the surveys have been completed to satisfy Commonwealth Environment Protection and Biodiversity Act (1999) (EPBC Act) survey requirements, and this is reflected in much of the analysis and discussion. However, survey effort has also assisted in a more general understanding of the Site's more general ecological values.

In a bioregional sense, the Site is located in the Moreton Basin province of the Southeast Queensland Bioregion (as per Young and Dillewaard, 1999). In a sub-regional sense the Site is located at North Maclean, in the west of the Logan City Local Government Area (**Figure 1**). It is bound to the east by the Mount Lindesay Highway; to the north by Crowson Park Road; to the south and southwest by vegetated lands; and to the west by rural residential development. A Powerlink powerline easement crosses the Site from east to west (**Figure 2**). Assessment

The Site is gently undulating, rising from high level alluvial flats of Pleistocene age in the east to a low ridge of Jurassic age sandstone in the west. Before European settlement the Site and surrounding areas would have supported productive lowland sclerophyll forest. However, the Site is now within a highly-cleared landscape. Historic aerial photography (the earliest available being 1955) was reviewed to determine the disturbance history. The review found that by 1955 the Site and much of the surrounding landscape had been heavily cleared to promote pasture establishment (scattered clumps of trees and individual trees remained). The Site was retained in this state until 1983, from which time much of the regrowth vegetation now present has become established. Further clearing of land surrounding the Site occurred after 1983. Rural residential development was first apparent in photography from 1983, and transition from the original agricultural to the current peri-urban uses has continued to the present day. Photography from 1955 to 1983 is provided in (**Appendix 1** to this Technical Attachment 1).

The peri-urban landscape creates significant restriction to fauna movement. However, a formal habitat corridor is maintained along Norris Creek 1.5km to the north of the Subject Site (this providing a link between Jerry's Downfall Reserve and areas proposed for conservation under the Greater Flagstone Development Scheme to the north west of the Site). A large, well-vegetated parcel to the south of the Site (Lot 1 RP113251) also appears to provide an important connection between areas to the east of the Mt. Lindesay Highway and riparian corridors to the west of Greenbank Road connecting White Rock-Spring Mountain Conservation Estate in Ipswich City local government area.

The Queensland Department of Environment and Heritage Protection (DEHP) Regional Ecosystem and Remnant Map (RE Map) shows that the Site supports small areas of remnant vegetation comprising: (i) a mosaic of the endangered regional ecosystem (RE) 12.9-10.12 (60% of the remnant mosaic) and least concern RE 12.9-10.19 (40% of the remnant mosaic); and (ii) the Endangered RE 12.3.3 (100% of remnant area) (**Appendix 2** to this Technical Attachment 1). A description of these RE's is provided in **Appendix 3** to this Technical Attachment 1.

The Site is located outside of the Priority Koala Assessable Development Area (PKADA) and Koala Assessable Development Area (KADA) pursuant to the South-East Queensland Koala Conservation State Planning Regulatory Provisions (Koala SPRP). However, mapping completed for the South-East Queensland Koala Habitat Assessment and Mapping Project (DERM 2009) shows that the Site is dominated by the Low Value and Medium Value Rehabilitation Habitat designations (**Appendix 4** to this Technical Attachment 1).Small areas of the Low and Medium Value Bushland habitat designation occur in the western and eastern parts of the Site, although a significant proportion of the larger Medium Value clump in the north-eastern corner of the Site has been removed to allow construction of the Crowson Park Lane overpass (**refer Figure 2).** The habitat mapping is considered inaccurate at a site scale.

Before the Site was included in the Greater Flagstone UDA, it was subject to the provisions of the Beaudesert Planning Scheme 2007. Significant biodiversity planning assessment was undertaken to inform the Beaudesert Planning Scheme, and this is useful for providing a broad understanding of the Subject Site's ecological values and perceived role in the broader landscape. Relevant maps are provided in **Appendix 5** to this Technical Attachment 1. Map 2.1A (Nature Conservation Overlay) shows that the northern portions of the Subject Site are of local nature conservation value, while the southern portions are within an "*Irbyana sensitive area*" (a designation indicating the potential occurrence of the MNES Swamp tea-tree Forest of South-east Queensland). Map 2.1A also shows that the Subject Site is located to the south of a major ecological corridor. Map 3.1A (Biodiversity Planning Assessment) shows that the northern portions of the Site are defined as "*Local Significance Non Remnant*". Small areas of "*State Significance*" also occur, generally corresponding with the patches of remnant vegetation. Once again, the Subject Site is shown as being to the south of the major ecological corridor.

2.0 The Proposed Development

The Applicant's proposed development will require clearing and bulk earthworks over the whole of the Site. A conceptual layout has been proposed, but this will vary in response to market demands. Approvals from the Commonwealth Department of the Environment progressed on this basis (i.e not on an approved layout, but rather on the basis of clearing and bulk earthworks over the Site, with a notional future commercial / industrial development). Further detail is provided in the town planning report.

3.0 Desktop and Field Survey Methods

Database searches indicted the potential occurrence of conservation significant flora and fauna within a 5km search radius of the Site (**Appendix 6** to this Technical Attachment 1). In order to more accurately understand the occurrence (or potential occurrence) of these species, the following investigations were completed:

(i) Detailed survey of the Site's vegetation communities, including: (a) detailed survey for the Swamp tea tree TEC; and (b) Searches for endangered and vulnerable plant species listed under the EPBC Act, and Endangered, Vulnerable and Near Threatened (EVNT) plant species listed under the *Nature Conservation Act 1992*. Further discussion is provided in **Appendix 7** to this Technical Attachment 1;

(ii) Survey and assessment for the koala using the Interim Koala Referral Advice for Proponents (IKRAP) guideline (DSEWPaC 2012a)[1]. For the purpose of the assessment we established: (i) five line transect survey sites to conduct specific canopy searches for the koala; and (ii) seven Spot Assessment Technique scat search sites (Sites A-G). Survey locations and data are shown in **Appendix 8** to this Technical Attachment 1. During vegetation survey and general traverse of the Site, we also completed canopy searches and opportunistic searches for koala scat in the more fragmented vegetation in the Site's south. We did not complete spotlighting or call playback because the scat surveys provided clear indication that the Site supported koala;

During preparation of the PD Report, DoE released the Draft EPBC Act Referral Guidelines for the Vulnerable koala (combined populations in Queensland, New South Wales and the Australian Capital Territory) (DoE 2013b) (Draft Koala Referral Guideline). The PD Report addressed the Draft Koala Referral Guideline. Since completion of the PD Report, DoE has issued the (final) EPBC Act Referral Guidelines for the Vulnerable Koala (combined populations in Queensland, New South

[1] Which was in effect at the time of the EPBC Controlled Action referral.

Wales and the Australian Capital Territory) (DoE 2014) (Final Koala Referral Guideline). Assessment has also been completed against the Final Koala Referral Guideline;

(iii) Targeted survey and assessment for Spotted-tailed quoll (**Appendix 9** to this Technical Attachment 1);

(iv) Assessment of broad habitat values (**Appendix 10** to this Technical Attachment 1), a process used to refine fauna surveys;

(v) More general fauna survey (**Appendix 11** to this Technical Attachment 1); and

(vi) Assessment of the Site's strategic importance in the broader landscape as a habitat refugia, a stepping stone or a terrestrial corridor. The assessment was undertaken by reviewing aerial photography and driving through areas (to the extent possible) to ground truth corridor values.

4.0 Survey Results

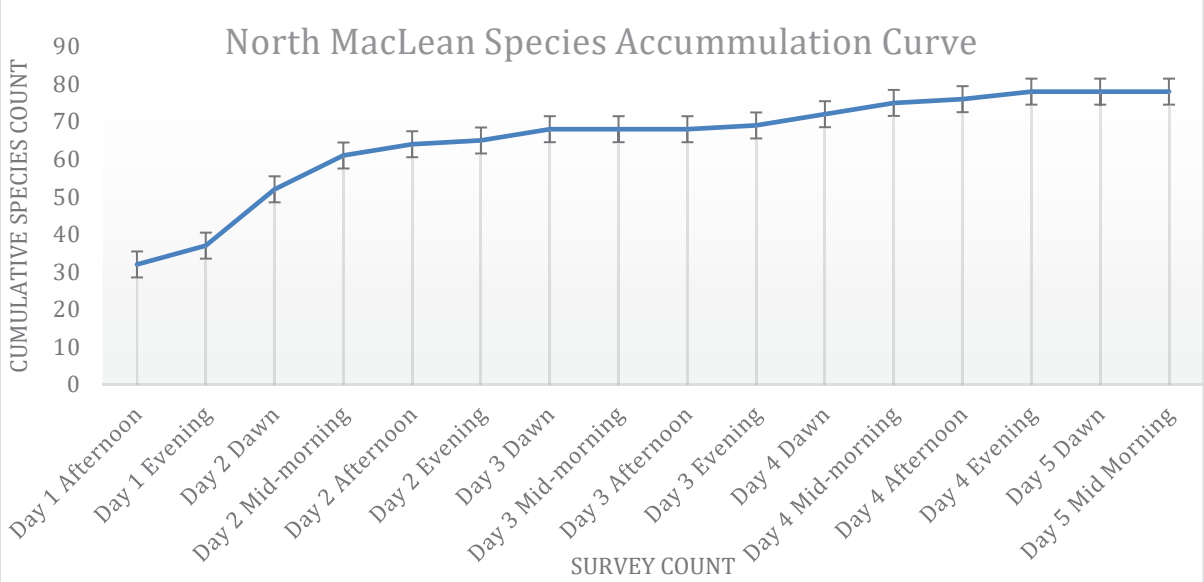
4.1 Overall Results

During surveys[2], 78 vertebrate fauna species were detected, comprising: 7 amphibian (9%); 60 birds (77%); 8 non-microbat mammals (10%); and 3 reptile (4%) **Appendix 12** to this Technical Attachment 1. Analysis of recorded bat calls revealed 8 species to be present, 9 species possibly present, and 10 species to be potentially present. A further 3 species are potentially present but were not detected in the call analysis (identified through desktop assessments). Further analysis of microbats by Nocturnal Ecology[3] is provided in **Appendix 13** to this Technical Attachment 1.

The relatively low diversity (95 species) of fauna observed during fauna surveys in comparison to the 229 fauna species recorded within 5km of the Site is likely attributed the lower quality of habitats supported across much of the Site coupled with: historical broad scale clearing events; continued intensive grazing; ecological impediments such as highways and open paddocks; inappropriate fire regimes; presence of exotic predatory fauna and aggressive sedentary avifauna; and a lack in microhabitat features across much of the Subject Site (such as fallen logs, woody debris, hollow bearing limbs and rocky outcropping).

A species accumulation curve was prepared based on the systematic data collection efforts over the survey period. The species accumulation curve was prepared based on daily accumulating data collected during trapping; census surveys and incidental observations over the course of each day. The data collected over this survey period plateaued quickly as survey efforts detected 63 of the 78 total species by the second day. The below graph illustrates species accumulation data collected during survey efforts.

[2] For the purposes this analysis and reporting, fauna species records from previous surveys have not been included. Records from historical fauna and habitat surveys are provided in attachments within this report.
[3] Julie Broken-Brow was engaged by 28 South on behalf of Wareco Pty Ltd to provide 3rd party analysis of full spectrum ultrasonic detection of microbat calls collected on SM2.



Fauna species detected over the course of survey effort is provided in **Attachment 11**[4]. Trapping data collected during survey efforts is presented in **Attachment 12**.

4.2 Amphibians

Desktop assessment of available databases indicated that 22 amphibian species have been recorded within 5km of the Site. Of these, a total of 7 amphibian species were detected during fauna surveys, the most abundant of which was the invasive cane toad. Many of the amphibian fauna species identified within database searches are associated with wetland or riparian habitats which are not present within the Subject Site. The lack of such habitat is a likely contributor to the relatively low numbers of amphibian species detected during survey.

Amphibian records collected from surveys were most abundant in the north of the Subject Site in lower areas or from on-line dams created in the Site's north and south-west. It was observed that dams within the Subject Site supported very dense abundance of cane toad tadpoles. Adult cane toads were detected in every AU of the Subject Site; however, the majority of records occurred in proximity to dams and farm infrastructure where there was sheltering opportunities. *Platyplectrum ornatum* (Ornate burrowing frog) was regularly captured in pitfall traps at Primary Site 3, which was located in in AU 4 proximate to the small stand of broad-leaved paperbark. The majority of native amphibian records were recorded from areas proximate to dams within the north of the Subject Site.

Historically, lower areas within the Subject Site would have supported higher quality habitats for amphibian species; however, these habitats have been significantly altered by historical clearing, earthworks and cattle grazing. These historical and ongoing impacts have detrimentally altered the quality of amphibian habitats across the entire Subject Site for many less robust amphibian species. It is unlikely that the Site provide habitat for amphibian species of conservation significance, nor would habitats be considered significant to native amphibian populations.

4.3 Avifauna

[4] This list only includes species collected as a part of fauna surveys excluding microbat species.

Desktop assessment of available databases indicated that 140 avian species have been recorded within the 5km of the Subject Site. Of these, a total of 60 avian species were detected during fauna surveys, the most abundant of which were lorikeet species regularly overflying the Subject Site, as well as foraging within the AU 2, 3 & 4. The open nature of habitats supported within the Subject Site is a likely contributor to relatively low numbers of avian species being detected during surveys. Survey noted the presence a of number of sedentary aggressive avian species such as *Manorina melanocephala* (noisy minor), *Corvus orru* (Torresian crow) and *Cracticus sp*. (butcherbird and magpie) which were regularly seen harassing other avian species throughout the Subject Site.

Most avian species detected during survey efforts were relatively cosmopolitan across the Subject Site; however, surveys observed that smaller passerine species were restricted to the northern areas of the Subject Site within AU 2 & 3 likely due to the presence of a more complex vegetative structure. Records of wetland and waterbird species were minimal and records were heavily restricted to the dams found in the south-western areas of the Subject Site within AU1.

A collard sparrowhawk nest was observed in a large eucalypt in the central areas of AU 1. Both male and female collard sparrowhawks were regularly observed foraging in in the northern portions of the Subject Site; however, they were routinely harassed by noisy minors, Torresian crows and other larger honeyeaters. Given the open nature of habitats within the Subject Site, raptors were readily detected and closely monitored by other avian species.

The migratory *Merops ornatus* (rainbow bee-eater) were observed across much of the Subject Site; however, were most abundant in open areas adjoining the high voltage transmission line easement. Rainbow bee-eater was most commonly observed hawking for insects from power lines.

The presence of Queensland blue gum across the Subject Site does however, provide a significant winter foraging resource for nectivorous avian species including the migratory *Lathamus dicolour* (swift parrot)[5]. The removal of this vegetation will reduce the availability of winter foraging resources for this species. No breeding habitat will be impacted.

A dense stand of black she-oak is supported within AU 2 and is restricted to the higher ridgeline found in the extreme north-western corner of the Subject Site. Scattered black she-oak also occurs within AU 3 of the Subject Site. Surveys for chewed black she-oak cones typical of *Calyptorhynchus lathami lathami* (glossy black-cockatoo[6]) foraging were undertaken throughout this stand and within habitats supporting scattered occurrences of black she-oak. No evidence of glossy black-cockatoo foraging was observed. It is unlikely that the Site forms a significant component of this species core habitat given the lack of suitable breeding habitat (e.g. larger hollow bearing limbs) and low levels foraging resources which supported within the Subject Site which showed no signs of foraging evidence.

Avian habitats supported within the Subject Site are common to the region and locality. Historical and on-going impacts are likely to have significantly reduced the Subject Sites avian assemblage, particularly with regard to hollow nesting avian species and many forest dependant species. Surveys for hollow bearing trees were undertaken across the Site to search for evidence of these important microhabitat features. These surveys failed to detect any hollow bearing trees[7]. Surveys, coupled with a review of historical aerial photography indicated

[5] The PD Report (Section 3.2.1) provide a more detailed assessment of this species. The supporting EPBC referral (2013/6951) and approval associated with the proposed development has considered impacts to this species and is seeking offsets to compensate for the loss of this habitat.

[6] The glossy black-cockatoo is listed as Vulnerable under the NC Act.

[7] This does not preclude these features from existing within Site; however, it is unlikely the surveys missed potential larger more visible hollows suitable for owls and larger parrots due to the scale and size of tree likely required to support a suitable hollow bearing feature.

that much of the vegetation supported within the Site is relatively young in age and unlikely to have development hollow bearing features suitable for larger parrots or forest owls[8]; however, small hollow bearing features may be present which may potentially be utilised by smaller avian species such as *Pardalotus striatus* (striated pardalote).

4.4 Mammals

Desktop assessment of available databases indicated that 26 mammal species have been recorded within 5km of the Site. Of these a total of 8 non-microbat mammalian fauna species were detected during fauna surveys[9], the most abundant of which was *Macropus giganteus* (eastern grey kangaroo). 3rd party expert analysis of ultrasonic data collected during surveys confirmed the presence of 8 microbat species and note that another 9 species are possibly present (**Appendix 13** to this Attachment 1). Of the 8 non-microbat mammal species detected during surveys, three species are noted as exotic being *Mus musculus* (house mouse), *Lepus europaeus* (European brown hare) and *Canis lupus familiaris* (domestic dog). Numerous domestic dogs were noted foraging throughout the Site over the course of the survey effort. Historical surveys also detected the presence of *Vulpes vulpes* (red fox) across the Site.

The density of eastern grey kangaroo observed is likely due to the augmentation of forest habitats in AU 5 into open grassy paddocks with dams adjoining densely vegetated areas south of the Site. These changes to the environment provide favourable conditions for population growth in this species. Eastern grey kangaroo abundance was significantly lower in the northern AUs of the Site, likely due to reduced foraging resources available and greater distance to dense shelter habitat supported to the south of the Site.

Three scansorial mammals were detected during survey efforts being: *Phascolarctos cinereus* (koala); *Pseudocheirus peregrinus* (common ringtail possum); and *Trichosurus vulpecula* (common brushtail possum). Koala was detected in AU 3 & 4 and is expected to forage across vegetated areas of the Site[10]. Both common ringtail and common brushtail possum were recorded in all AUs. Most records of these species were along the boundaries of the Site proximate to adjoining residential dwellings where denser shrub habitats were supported. No glider species were observed during surveys. The reduced complexity of vegetation communities in AU 1, 4 & 5 minimises foraging opportunities for glider species (particularly squirrel glider) due to the reduction of cyclic flowering events as well as the reduction of shrub strata which would also provide foraging opportunities.

One megachiropteran bat species was detected during surveys being, *Pteropus scapulatus* (little red flying-fox). This species was detected foraging within AU 1 & 2 along the western boundary and within adjoining residential properties. It is likely that this species and other flying-fox species noted from database searches would forage

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Given the majority of habitat supported within the Site is advanced regrowth vegetation it is unlikely any trees have had sufficient time to regenerate and senesce sufficiently to develop suitable hollows.

[8] Eucalyptus develop hollows at all ages, but hollows suitable for vertebrate fauna do not typically appear until trees are at least 120 years old. Hollows for larger species may not appear until trees are at least 220 years old (Gibbons. P. and Lindenmayer. D. 2002)

[9] It is noted that other surveys conducted over the Site such as the spotted-tail quoll survey have resulted in records of other mammal fauna; however, for the purposes of this report and analysis they have not been included data analysis.

[10] The PD Report (Section 3.2.3 & Attachment 12 & 28) provides a more detailed analysis of this species with regard to the Subject Site. The supporting EPBC referral (2013/6951) and approval associated with the proposed development has considered impacts to this species and is seeking offsets to compensate for the loss of this habitat.

across the Subject Site when vegetation is in flower including *Pteropus poliocephalus* (grey-headed flying-fox)[11]. No camps or suitable camp sites is present within the Site.

One small terrestrial mammal was detected during survey efforts being the exotic house mouse. Much of the Site does not support favourable terrestrial microhabitats for small terrestrial mammals. The lack of woody debris and leaf litter microhabitats across much of the Subject Site, coupled with much of the ground layer supporting lawn like grass, continual grazing pressures, exotic predators and competitors it is likely to have significantly reduced abundance and assemblage of small terrestrial mammals.

4.5 Reptiles

Desktop assessment of available databases indicated that 27 reptile species have been recorded within 5km of the Subject Site. Of these, a total of 3 reptile species were detected during fauna surveys, the most abundant of which was C*ryptoblepharus pulcher pulcher* (elegant snake-eyed skink) which was regularly encountered foraging in old timber piles and farm equipment in AU1.

One record of *Pogona barbata* (bearded dragon) was detected in the south-western areas of the Subject Site in AU5 proximate to road reserve vegetation. One *Dendrelaphis punctulatus* (green tree snake) was observed in AU 1 taking refuge below an Elliott trap positioned next to the base of a tree. Aggressive avian species were observed to harass this snake until it moved to denser garden habitats supported on the adjoining property to the west of the Subject Site.

It is likely that a wider range of reptilian fauna reside or forage within the Subject Site, particularly within more densely vegetated habitat supported within AU 2 & 3. The lack of terrestrial refuge and foraging microhabitats within AU 1, 4 & 5 coupled with much of the Subject Site supporting lawn like grass, continual grazing pressures, exotic predators and competitors is likely to have significantly reduced reptilian assemblages and abundance within the Subject Site.

4.6 Impact on Conservation Significant Fauna - Koala

Habitat Requirements

Koala naturally inhabits a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities dominated by Eucalyptus species. Koala habitat can be broadly defined as any forest or woodland containing species that are known koala food trees, or shrubland with emergent food trees. The distribution of this habitat is largely influenced by land elevation, annual temperature and rainfall patterns, soil types and the resultant soil moisture availability and fertility. 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. In coastal lowlands in Queensland and NSW, Koalas are also found in vegetation communities dominated by Melaleuca or Casuarina species.

On the western slopes, tablelands and plains in Queensland and NSW Koalas are found in sub-humid Eucalyptus-dominated forests and woodlands in riparian and non-riparian environments, and some Acacia-dominated forests and woodlands in non-riparian environments. In the dry, subtropical to semi-

[11] The PD Report (Section 3.2.4) provides a more detailed analysis of this species with regard to the Subject Site. The supporting EPBC referral (2013/6951) and approval associated with the proposed development has considered impacts to this species and is seeking offsets to compensate for the loss of this habitat.

arid environments in the western parts of the species' range, Koalas inhabit Eucalyptus-dominated forests and woodlands, particularly in the vicinity of riparian environments, and Acacia-dominated forests, woodlands and shrublands.

Koalas are also known to occur in modified or regenerating native vegetation communities, as well as urban and rural landscapes where food trees or shelter trees may be highly scattered (DoE 2015e).

The Koala is a leaf-eating specialist that feeds primarily during dawn, dusk or night (Crowther et al. 2013). Its diet is restricted mainly to foliage of Eucalyptus spp; however, it may also consume foliage of related genera, including Corymbia spp., Angophora spp. and Lophostemon spp. The Koala may, at times, supplement its diet with other species, including Leptospermum spp. and Melaleuca spp. While Koalas have been observed sitting in or eating up to 120 species of eucalypt, the diet of individual Koalas is usually limited to obtaining most of their nutrition from one or a few species present at a site. Species-level preferences may also vary between regions or seasons. Consequently, assessment of habitat quality for Koalas is usually based on the identification of local preferences for species and quantification of the availability of those species.

Koalas show strong preferences between individual trees within species. Experiments show that the chemical anti-feedants may limit or prevent Koalas feeding on foliage of individual trees even when the species is considered preferred. This variability creates a nutritional patchiness such that species-based assessments of habitat likely result in overestimates of the availability of high quality habitat and food trees (DoE 2015e).

Habitat Values of the Site, and Impacts of the Proposed Action

The Site is located outside of the Priority Koala Assessable Development Area (PKADA) and Koala Assessable Development Area (KADA) pursuant to the South-East Queensland Koala Conservation State Planning Regulatory Provisions (Koala SPRP). However, mapping completed for the South-East Queensland Koala Habitat Assessment and Mapping Project (DERM 2009) shows that the Site is dominated by Low and Medium Value Rehabilitation Habitat designations (**Appendix 4** to this Technical Attachment 1).

Small areas of the Low and Medium Value Bushland habitat designation occur in the western and eastern parts of the Site, although a significant proportion of the larger Medium Value clump in the north-eastern corner of the Site has been recently removed to allow construction of the Crowson Lane overpass (refer **Figure 2**).

The protected matters search tool indicates that koala (and its habitat) are known from the locality. A search of the Queensland Department of Environment and Heritage Protection Wildlife Online database provides 103 verified koala records within a 5km radius of the Site. The high number of koalas observed in the locality is a reflection of both koala habitat values and the number of observers contributing to the database[12].

For the purpose of the project's controlled action referral, we established: (i) five line transect survey sites to conduct specific canopy searches for koala; and (ii) seven Spot Assessment Technique scat search sites (Sites A-G). Survey locations and search data are shown in **Appendix 8** to this Technical Attachment 1. At the time that the CAR was submitted, there was a requirement to assess the proposed action against the Interim Koala Referral Advice for

[12] Noting the significant amount of rural residential development surrounding the Site.

Proponent (DSEWPaC 2012b). The following discussion references the required output of the IKRAP.

The diurnal canopy search did not record koalas, but SAT strike rates of 23%-53% were recorded in the regrowth blue gum woodland (Plots A-D). Lower strikes rates (0%-13%) were recorded in the remaining plots in the western portions of the Site.

The number of records from the locality (103 within a 5km radius) suggests that the broader koala population could be characterised as an east coast medium-high density population. The SAT survey results indicate medium to high levels of use in the north-eastern corner of the Site (areas sampled by Plots A-D) and low levels of use across the remaining vegetated areas of the Site (areas sampled by Plots E-G). Low levels of use were found in areas with only scattered trees in grassland.

Species within each of the SAT survey plots were recorded (along with diameter) for the purpose of identifying the specific occurrence of primary, secondary and supplementary habitat species. Further detail on the Site's vegetation communities is provided in the vegetation assessment (**Appendix 7** to this Technical Attachment 1).

The analysis found that across Plots A-D, the primary food tree species, *Eucalyptus tereticornis* comprises an average 71.5% of canopy stems. The secondary food tree species, *Eucalyptus seeana* comprises an average 30% of canopy stems in Plot A but is absent from the remaining plots. There are no other primary, secondary or supplementary species within this area.

Vegetation on the low sandstone ridge in the west of the Site was sampled by Plots E, F and G. The data shows that the primary food tree species *E. tereticornis* comprises an average 52% of canopy stems across these plots. The secondary food tree species, *E seeana* comprises an average 9% of canopy stems, although this is distorted by Plot F (in which it comprises 20% of stems). In plots E and G, *E seeana* comprises only 3% of canopy stems. With reference to Callaghan (unpublished) in DECC (2008), the assessment indicates that the vegetated components of the Site comprise primary habitat.

At that time, we believed that the koala densities observed were that of a naturally occurring population. However, further investigations have revealed anecdotal evidence that the Site is, in fact, being used as a drop off site by animal carers and koala spotter-catchers releasing koalas and other animals from other areas. More particularly, it is understood that at least one local wildlife spotter/catcher working in a neighbouring suburb has been instructed to release any captured wildlife onto Crowson Lane which, in effect, is a direct release onto the Site.

With respect to the CAR submissions, submitter 34 (Requested Name/Address details Not Published) states that the Site is used as a drop off for rehabilitated macropods, "*This land has some of my released macropods which I have raised*."

Submitters 37 and 40 allude to the Site being used as a drop off point for rehabilitated koalas. In particular, on page 35 of their submission, the submitter notes that "*the offset package will not allow rehabilitated koalas to return to the local area of North Maclean and Munruben*".

While the Proponent supports mitigation measures which advance the protection of koalas, it would not grant proper authority for the Site to be used as a drop off point for adjoining development as the Site is intended for further development, having been earmarked for such by the State for some time. In the broader circumstances, such mitigation measures would ultimately be counterproductive.

If the Site has been (or is being) used as a drop off point for rehabilitated or translocated koalas and other animals, then the densities observed by the baseline assessment will be over and

above the densities which would otherwise naturally occur. While it is not intended for there to be re-assessment of the koala habitat values of the Site because of this issue, it is relevant to observe that the impact assessment is potentially conservative.

The proposed action will require clearing of the Site in stages over a number of years. The CAR assessed the proposed action against the IKRAP, and found that the proposed action was likely to give rise to a Significant Impact on Koala.

The PD Report assessed the proposed action against the Draft Koala Referral Guideline (DoE 2013b), and also concluded that the proposed action would give rise to a Significant Impact on Koala. A response to the assessment criteria is provided in **Appendix 14** to this Technical Attachment 1. The current (final) Koala Referral Guideline (DoE 2014) is very similar in structure to the draft guideline, and still indicates the likelihood of the proposed action giving rise to a Significant Impact.

It is proposed that the impact be addressed by the provision of offsets. Submitters 24, 27, 28, 29, 37 and 40 expressed concern that the proposed offset was to be located in a rural area removed from North Maclean. In response, we note that a deliberate decision has been made to avoid placing offsets in close proximity to the Site because there are plans for significant future urban development in this area. In comparison, the area flagged for the offset is in a largely rural locality, where it is highly unlikely that large scale urban development will occur in the short to medium term[13]. There is also much greater potential to connect the proposed offset site into large areas of regionally significant habitat. Closer settlement and smaller land parcels limit such opportunities in North Maclean.

In regard to the area of impact, DoE has requested clarification as to why the 54.51 hectares of largely cleared land in the south of the Site has not been included in the overall impact area for koala. Survey of the scattered trees and small clumps that occur in the south of the Site did identify evidence of koala use, but to a considerably lower degree than was evident in the areas of bushland habitat in the north of the Site. Further, the overall density of trees present is not representative of forest or woodland habitats, and the area does not provide critical movement habitat. As such, we submit that the cleared areas in the south of the Site do not provide habitat critical to the survival of koala, and do not need to be included in the offset calculations.

4.7 Impact on Conservation Significant Fauna – Swift parrot

Habitat Requirements

The Swift parrot breeds in Tasmania during the austral summer, and the entire population migrates north to mainland Australia for the austral winter. The Swift parrot uses habitats across all tenures, with the majority of habitats occurring outside formal conservation reserves. Whilst on the mainland the Swift parrot disperses widely, foraging on flowers and lerps in Eucalyptus spp. mainly in Victoria and New South Wales, but small numbers are observed on a regular basis in Queensland.

Research within mainland over-wintering habitats has identified key foraging habitat types. In Southeast Queensland, these habitats include the following key species: *Eucalyptus microcarpa, Eucalyptus melliodora, Eucalyptus robusta* and *Eucalyptus tereticornis*. Within these habitats, Swift parrots have been found to preferentially forage in large, mature trees

[13] The area flagged for the offset has multiple planning restrictions limiting urban development. Further detail has been provided to DoE in the Offsets Report.

that provide more reliable foraging resources than younger trees. Although they are also known to use a wider range of habitat types, they are thought to do so opportunistically as these do not provide the quality and quantity of resources upon which the species can depend. Disturbed areas may be used, but are also thought to provide sub-optimal habitat insofar that co-existence with aggressive species that tend to inhabit such areas may be energetically expensive and reduce overall fitness and survival of the species (Saunders and Tzaros 2011).

The key foraging species, Queensland blue gum (*E. tereticornis*) is widespread at the Site. However, historic aerial photography shows that much of the area now supporting Queensland blue gum was heavily cleared until the early 1980's. An appreciation of the vegetation's maturity can be gained from: (a) vegetation survey field data (**Appendix 7** to this Technical Attachment 1, in particular height of the T1 layer; and (b) koala scat search plot data (showing tree DBH within scat search plots) (**Appendix 8** to this Technical Attachment 1).

Habitat Values of the Site, Impacts of the Proposed Action

The data shows that the T1 layer in areas supporting Queensland blue gum is up to 23m high. However, analysis of tree diameter (DBH) data shows that 66% of all trees are reasonably small (10cm-35cm size class). A further 25% are of moderate size (40cm-65cm DBH). Only 5% of trees are > 90cm DBH. The significant occurrence of regrowth vegetation at Subject Site indicates that the vegetation may be of moderate rather than high forage habitat value for the Swift parrot.

There are no Wildlife Online records of the swift parrot within a 5km radius of the Site, but expansion of the search area to a 15km radius reveals three records. GIS analysis of VM Act remnant and regrowth mapping[14] for RE 12.3.3 shows that: (i) there is 139 hectares of analogous remnant RE 12.3.3 and 320 hectares of analogous remnant RE 12.3.11 within a 20km radius of the Site; (ii) there is 4189 hectares of regrowth RE 12.3.3 and 4993 hectares of regrowth 12.3.11 within a 20km radius of the Site; and (iii) there is 3489 hectares of analogous remnant RE 12.9-10.12, and 8201 hectares of regrowth RE 12.9-10.12 within a 20km radius of the Site.

It is considered likely that the Site will provide occasional winter forage habitat for the Swift parrot. While the relatively low percentage of mature Queensland blue gum confers a moderate rather than high habitat value, the area of potential habitat to be affected by the proposed action indicates (in the absence of other data on the Site's use by the swift parrot) the potential for the proposed action to give rise to a Significant Impact on this species. It is proposed that the impact be addressed by the provision of offsets.

4.8 Impact on Conservation Significant Fauna – Grey-headed flying fox

Habitat Requirements

The grey-headed flying-fox occupies the coastal lowlands and slopes of southeastern Australia from Bundaberg to Geelong. It is usually found at altitudes < 200 m. Areas of repeated occupation extend inland to the tablelands and western slopes in northern New South Wales and the tablelands in southern Queensland

[14] While regrowth vegetation is no longer protected under the VM Act, the regrowth mapping dataset remain useful for determining the occurrence of regrowth vegetation which may attain remnant status in the near future. However, we also acknowledge that there is no longer statutory protection provided for regrowth under the VM Act.

The grey-headed flying-fox requires a continuous sequence of productive foraging habitats, the migration corridors or stopover habitats that link them, and suitable roosting habitat within nightly commuting distance of foraging areas. Areas supporting these characters are considered to be habitat critical to the survival of the grey-headed flying fox. On the basis of current knowledge, foraging habitat that meets at least one of the following criteria can be explicitly identified as habitat critical to survival, or essential habitat, for Grey headed Flying-foxes. Natural foraging habitat that is:

- productive during winter and spring, when food bottlenecks have been identified;
- known to support populations of > 30 000 individuals within an area of 50 km radius (the maximum foraging distance of an adult);
- productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May);
- productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes (months vary between regions);
- known to support a continuously occupied camp.

The grey-headed flying-fox roosts in large aggregations in the exposed branches of canopy trees. The locations of camps are generally stable through time, and several sites have documented histories that exceed 100 years. Camps provide resting habitat, sites of social interactions and refuge for animals during significant phases of their annual cycle, such as birth, lactation and conception. On the basis of current knowledge, roosting habitat that meets at least one of the following criteria can be explicitly identified as habitat critical to survival, or essential habitat, for Grey headed Flying-foxes. Roosting habitat that:

- is used as a camp either continuously or seasonally in > 50% of years;
- has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained > 10 000 individuals, unless such habitat has been used only as a temporary refuge, and the use has been of limited duration (i.e. in the order of days rather than weeks or months); and
- has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained > 2 500 individuals, including reproductive females during the final stages of pregnancy, during lactation, or during the period of conception (i.e. September to May).

Habitat Values of the Site, and Impacts of the Proposed Action

The Site does not support a camp of the grey-headed flying fox, and does not appear to provide suitable roost habitat. However, the winter-blossoming Queensland blue gum (*E. tereticornis*) dominated the regrowth and small areas of remnant vegetation in the Site's north. Blossom productivity is generally greater in large mature trees, and to this end the disturbance history of the Site is also a relevant factor to consider in determining habitat values for the Grey-headed flying fox.

Historic aerial photography shows that much of the area now supporting Queensland blue gum was heavily cleared until the early 1980's. An appreciation of the vegetation's maturity can be gained from: (a) vegetation survey field data (**Appendix 7** to this Technical Attachment 1, in

particular height of the T1 layer; and (b) koala scat search plot data (showing tree DBH within scat search plots) (**Appendix 8** to this Technical Attachment 1).

The data shows that the T1 layer in areas supporting Queensland blue gum is up to 23m high. However, analysis of tree diameter (DBH) data shows that 66% of all trees are reasonably small (10cm-35cm size class). A further 25% are of moderate size (40cm-65cm DBH). Only 5% of trees are > 90cm DBH. The significant occurrence of regrowth vegetation at Subject Site indicates that the vegetation may be of moderate rather than high forage habitat value for the Grey-headed flying fox.

There are three records of the grey-headed flying fox within a 5km radius of the Subject Site, but this is considered likely to significantly under-represent the actual occurrence of the Grey-headed flying fox in this area. Rather, it is considered likely that the Site provides regular forge habitat for the Grey-headed flying fox, particularly during the winter blossoming period of Queensland blue gum.

GIS analysis of remnant and regrowth mapping[15] for RE 12.3.3 shows that: (i) there is 139 hectares of analogous remnant RE 12.3.3 and 320 hectares of analogous remnant RE 12.3.11 within a 20km radius of the Subject Site; (ii) there is 4189 hectares of regrowth RE 12.3.3 and 4993 hectares of regrowth 12.3.11within a 20km radius of the Subject Site; and (iii) there is 3489 hectares of analogous remnant RE 12.9-10.12, and 8201 hectares of regrowth RE 12.9-10.12 within a 20km radius of the Subject Site.

The proposed action will affect an area of remnant and regrowth vegetation with characteristics indicative of habitat critical to the survival of the Grey-headed flying fox, and is likely to give rise to a Significant Impact on this species.

Submitters 28, 29, 33, 37, 40, 41 and 50 expressed concern that there had been inadequate survey for the Grey-headed flying fox. However, the surveys completed provided clear evidence that the Site did not support a roost, but winter blossom habitat which was likely to be habitat critical to the survival of this species. Based on the area of habitat to be affected, and the extent of alternate habitat in the locality, it was concluded that the proposed action would give rise to a Significant Impact on this species. There seems to be little utility in undertaking further survey for the grey-headed flying fox when the habitat values of the Site are well known, and the impacts of the development (a Significant Impact) is acknowledged.

4.9 Impact on Conservation Significant Fauna – Spotted-tailed quoll

The potential for impact on Spotted-tailed quoll was of significant interest during assessment under the EPBC Act. However, detailed assessment provides a strong indication that this species will not be significantly affected by the proposed development. Futher detail is provided in **Appendix 9** to this Technical Attachment 1.

4.10 Impact on Conservation Significant Fauna – Other State-listed Species

[15] While regrowth vegetation is no longer protected under the VM Act, the regrowth mapping dataset remain useful for determining the occurrence of regrowth vegetation which may attain remnant status in the near future. However, we also acknowledge that there is no longer statutory protection provided for regrowth under the VM Act.

Surveys indicate that the Site does not provide critical habitat or movement corridors for other State-listed fauna species.

5.0 Measures to Avoid, Minimise or Offset the Impacts of Development

5.1 Measures to Avoid the Impact

The footprint of the proposed action will require the following vegetation removal:

- 1.54 hectares of Tall Open Swamp Sclerophyll Forest (*E. tereticornis / E. crebra / C. intermedia*);
- 6.03 hectares of Tall Open Dry Sclerophyll Forest (E. tereticornis / C. intermedia / E. seeana / E. crebra / E. fibrosa / C. citriodora subsp. variegata);
- 21.93 hectares of Open (regrowth) Swamp Sclerophyll Forest (*E. tereticornis / E. crebra / C. intermedia*); and
- 33.27 hectares of Open (regrowth) Dry Sclerophyll Forest (E. tereticornis / C. intermedia / E. seeana / E. crebra / E. fibrosa / C. citriodora subsp. variegata);

The remainder of the Site (54.51 hectares) consists of open pasture with widely scattered trees[16]. It is anticipated that the clearing would be undertaken over approximately 5 years, and would be commensurate with staging of the development. Further detail on staged clearing is provided under Section 5.2.

Submitters 37 and 40 contend that the Proponent does not seek to avoid impacts in the first instance. However, it should be noted that the Site has been included in the Greater Flagstone PDA after significant assessment and planning by the Queensland State Government. The Queensland Department of Environment and Heritage Protection has been a party to this decision, and it is also supported by the local authority (Logan City Council) – refer Submitter Reference No. 8). The Greater Flagstone PDA Development Scheme has identified priority areas for conservation and also for development, and the Site has been included in the latter. This sub-regional planning process has ensured that impact on habitats of greatest significance have been avoided.

5.2 Measures to Mitigate the Impact (Environmental Management Plan)

Mitigation Measure 1 – Development Staging

Due to requirements for the proposed development to connect to Crowson Lane, it is unavoidable that development commence in the northern parts of the Site where habitat values for the species of interest are greatest. It is anticipated that staging will then see a general north-to-south progression of development across the Site. It is proposed that only the areas required for immediate development be subject to clearing and bulk earthworks. Land within future stages will remain vegetated. Clearing and development of the Site over the projected 5-year timeframe will allow for a more measured spatial and temporal relocation of mobile fauna to other areas of habitat in the locality.

Mitigation Measure 2 – Sequential Clearing

It is apparent that the Site is being used as a drop off point for animal carers and koala spotter-catchers. It is important for all stakeholders to recognise that this Site is designated under State law for future development, so that arrangements are made in regard to alternate drop off points. This will reduce the number of koalas which need to be managed during the clearing program, but it is acknowledged that koalas which remain at the time of clearing would need to be translocated.

[16] The species are characteristic of the vegetation communities described above.

Submitter 29 raised concern in regard to displacement of fauna from the area of the proposed action. In relation to assessment and approval under the EPBC Act, we note that such concerns are of greatest relevance to MNES. In this regard:

- The Swift parrot and Grey-headed flying fox are mobile species, and will readily disperse away from the Site at the time of clearing. The impact of habitat loss for these species is acknowledge;
- We have determined that the Spotted-tailed quoll will be only a very rare visitor to the Site, because the Site provides only dispersal habitat. The proposal for development staging will see what is already marginal habitat become increasingly unsuitable, encouraging a slow spatial and temporal relocation of this species. The proposed action will not result in displacement of a high-density population over a short period of time, an action which might be expected to cause an increase in roadkill on adjoining roads;
- Management requirements are most pertinent for koala. In the PD Report we noted that clearing would be undertaken in accordance with Policy 4 of the Nature Conservation (Koala Conservation) Plan and Management Program 2006-2016. However, in response to the concerns of Submitter 29 we have now proposed a strategy which would further slow the rate of displacement, and minimise the need for koala translocation by instigating a program of gradual habitat isolation in areas to be cleared.

While the Site's habitat will still ultimately be removed[17], the program will allow a slower spatial reorganisation of the koala population in this area than otherwise would have been achieved by sequential clearing, the strategy preferred for clearing of koala habitat in Queensland. It will also significantly reduce (and may avoid) the need for any translocation.

Conceptually, the following steps are proposed. Further detail will be provided in a fauna management plan, which will be written as development staging (and thus the extent of clearing required) is understood in greater detail. Lead time before clearing is the biggest determinant of the strategies success, insofar that a greater lead time will allow slower spatial reorganisation of the population to adjoining areas. It is proposed that captured koalas be radio collared and monitored to assess the success of the strategy[18]:

- Week 0 – Cordon off a 4-hectare area next to Crowson Lane (Zone 1). Complete a thorough search of the area for koalas. If a koala is located, capture and radio collar the individual[19] before moving it out of the zone to adjoining habitat on the Site that is not proposed for near-term clearing[20]. Establish a koala exclusion fence around the perimeter of the zone[21]. The fence is to restrict movement into the area, but allow for movement out of the area by any individuals that have been missed by the survey. Weekly canopy searches and spotlighting survey are to be undertaken to

[17] An issue addressed through the proposed offset.
[18] We have discussed the radio tracking survey with Dr Bill Ellis, Koala Ecology Unit at the University of Queensland. Dr Ellis' team are agreeable to completing such survey. Further detail will be provided in the proposed fauna management plan
[19] We have discussed the radio tracking survey with Dr Bill Ellis, Koala Ecology Unit at the University of Queensland. Dr Ellis' team are agreeable to completing such survey. Further detail will be provided in the proposed fauna management plan.
[20] These areas will be defined in the fauna management plan, which will be written as development staging (and thus the sequencing of clearing) is better defined.
[21] There may be a need to trim branches which hang or interconnect over the alignment of the fence. The fence will need to be designed to allow small terrestrial mammals to move out of the area. It will not be possible to allow for the continued movement of larger terrestrial species such as the echidna, and so careful survey will need to be undertaken to ensure that echidnas are removed from the fenced area.

locate any individuals that have been missed by the survey, or have managed to gain access to the area. Any new individuals are to be radio collared and moved out of the area as per the identified strategy;

- Week 4 – Cordon off Zone 2, and repeat the strategy identified for Zone 1;
- Week 8 – Cordon off Zone 3, and repeat the strategy identified for Zone 1;
- Week 12 – Cordon off Zone 4, and repeat the strategy identified for Zone 1.
- Week 14 – Undertake a final survey of the entire clearing area, and then undertake clearing. There will be no need to undertake sequential clearing, but a spotter-catcher will still be required to oversee the clearing program.
- At the final stage of clearing there will be no alternate habitat on Site into which displaced koalas can be relocated. If a koala is located in this final stage of clearing, then the spotter-catcher will relocate the individual to the closest area of public land providing suitable koala habitat. Alternately, individuals can be relocated to private land with the consent of the landowner. The spotter-catcher must comply with the requirements of their Rehabilitation Permit[22] and other relevant provisions set out in the Code of Practice – Care of Sick, Injured or Orphaned Protected Animals in Queensland (DEHP 2013).

Displacement of non-MNES fauna does not require further consideration under the EPBC Act assessment and approval process, and will be managed in accordance with contemporary fauna and flora management practices.

Mitigation Measure 3 – Water quality management for the Swamp tea tree TEC

During the clearing and civil works phase it is proposed that the measures ordinarily established for development in this setting be designed in a precautionary manner[23]. It is appropriate that the identified erosion and sediment impacts be managed by condition of approval. In that respect, the Proponent proposes the submission of an erosion and sediment control plan to the DoE for approval prior to the commencement of clearing and civil works. Further detail is provided in the Umbrella Civil Consulting Engineers Site Based Stormwater Management Plan.

5.3 Measures to Offset the Impact

The Applicant's primary environmental response mechanism is the provision of an offset. The offset is a condition of development approval (Condition 2) issued under the EPBC Act. Further detail is provided in **Appendix 15** to this Technical Attachment 1. The offset targets koala, but given the parameters of the offset, is also beneficial to the other affected MNES fauna species, Swift parrot and Grey-headed flying fox. It will also benefit a wide range of other fauna, and establish an endangered regional ecosystem (RE 12.3.3 being the offset target). The Applicant is working with the Commonwealth Department of the Environment and Energy to identify a suitable offset site.

Further to this offset, the Applicant proposes to offset the Site's areas of non-viable endangered vegetation (7.51 hectares) at a ratio of 4:1 – establishing a further offset area of 30.04 hectares. The Applicant proposes that the areas of endangered RE 12.9-10.12 be offset with endangered RE 12.3.3. RE 12.3.3 is in fact considerably

[22] Issued under the *Nature Conservation (Administration) Regulation 2006* (Qld).
[23] For example, enlarged sediment ponds designed to accommodate larger storm events, and additional silt fence protection.

more uncommon than RE 12.9-10.12 in the southeast Queensland Bioregion[24], and creates much more beneficial habitat for conservation significant species such as Koala and Swift parrot than RE 12.9-10.12. Accordingly, a more significant biodiversity outcome can be achieved.

[24] In 2013, the remnant extent of RE 12.9-10.12 in the Southeast Queensland Bioregion was < 10 000 hectares. However, between 10-30% of the pre-clearing extent of RE 12.9-10.12 remained. By comparison, less than 10% of the pre-clear extent (of the formerly extensive) RE 12.3.3 remained.

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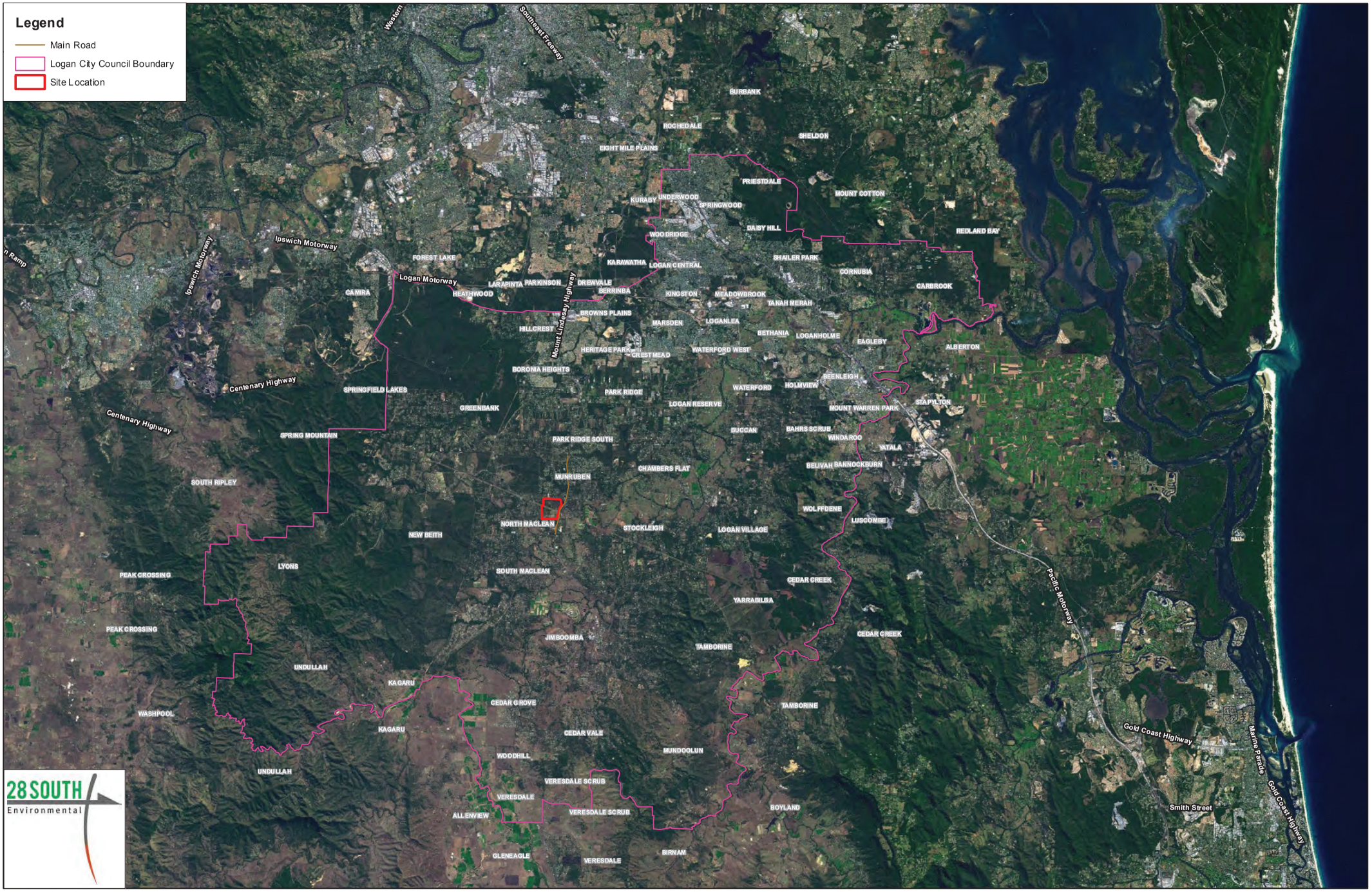

Coordinate System: GDA 1994 MGA Zone 56	
Reference Scale: 1:200,000	
Project Name : North Maclean	
Title : Figure 1 - Region	

0 1 2 4 6 8 10 Kilometers

N

Background imagery is supplied by Bing, and is not to be used for measurement. For visualisation purposes only.

Client: Reel Planning
Date: Friday, May 29, 2015

Document Path: S:\GIS\28_South\South_Maclean\Admin\mxd\SouthMaclean_Region_Fig1_Rev1_A3.mxd

Figure 2 - Locality

Coordinate System: GDA 1994 MGA Zone 56	
Reference Scale: 1:25,000	
Project Name : North Maclean	
Title : Figure 2 - Locality	

0 150 300 600 900 1,200 1,500 Meters

N

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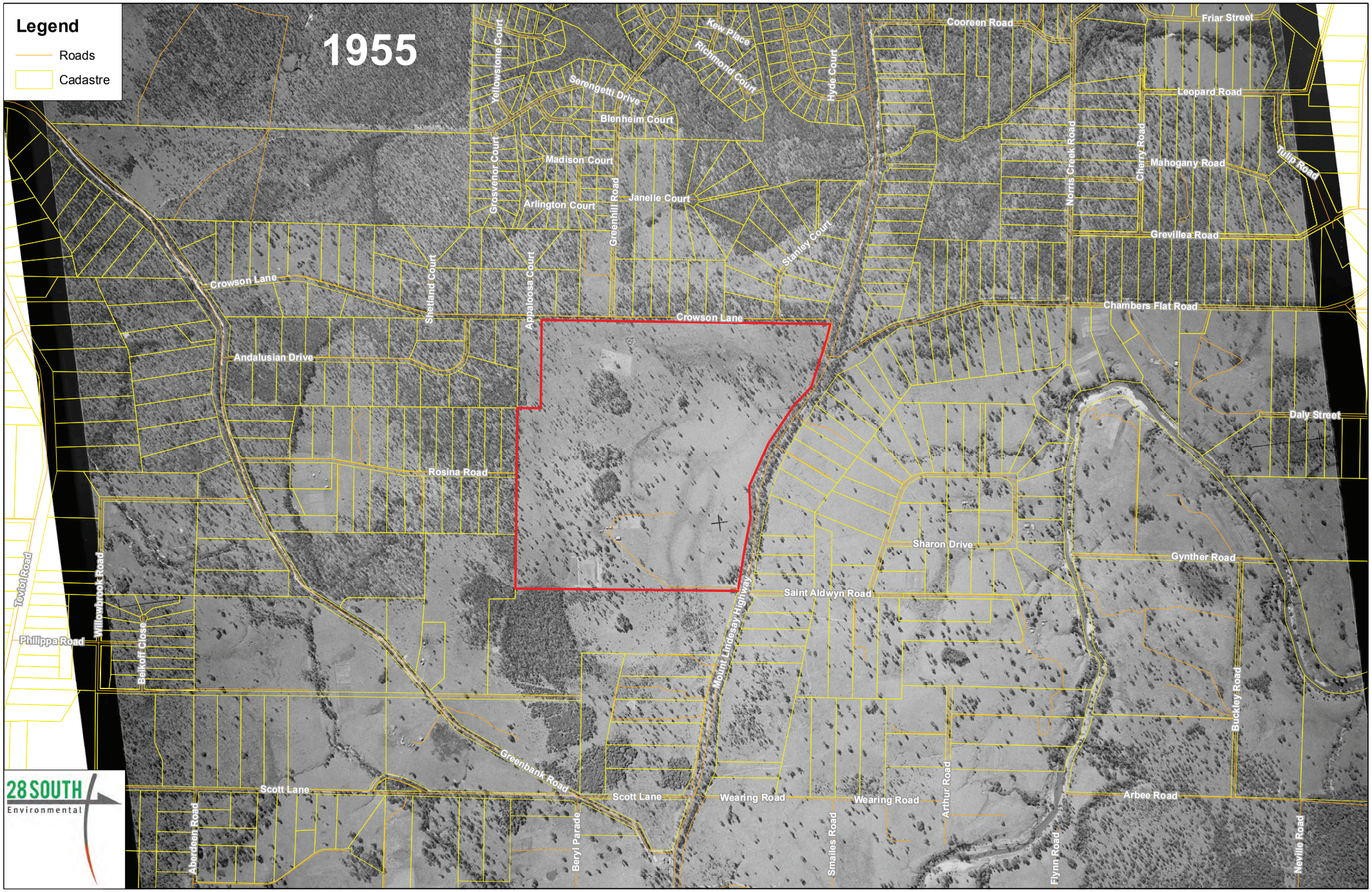
Client: Reel Planning	
Date: Monday, June 01, 2015	

Document Path: S:\GIS\28_South\South_Maclean\Admin\mxd\NorthMaclean_Location_Fig2_Rev3_A3.mxd

Appendix 1 to the Technical Attachment 1



28 SOUTH Environmental

Coordinate System: GDA 1994 MGA Zone 56	
Reference Scale:	1:15,000
Project Name : South Maclean	
Title : Figure A - 1955	

0 75 150 300 450 600 750 Meters

N

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Client: Craven Ovenden Town Planning	
Date: Friday, May 24, 2013	

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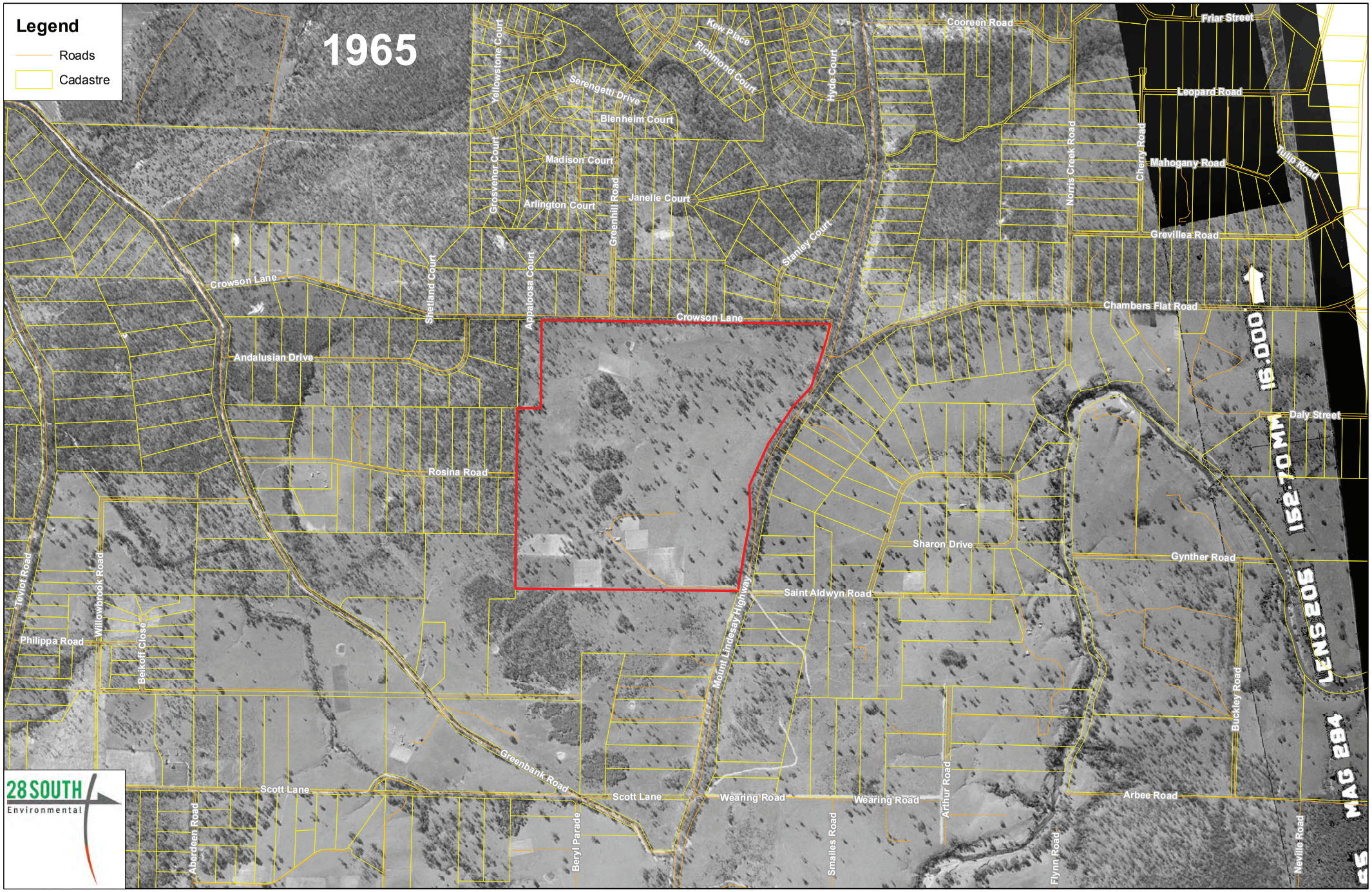

Page 26

Coordinate System: GDA 1994 MGA Zone 56
Reference Scale: 1:15,000
Project Name : South Maclean
Title : Figure A - 1965

0 75 150 300 450 600 750 Meters

N

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Client: Craven Ovenden Town Planning
Date: Friday, May 24, 2013

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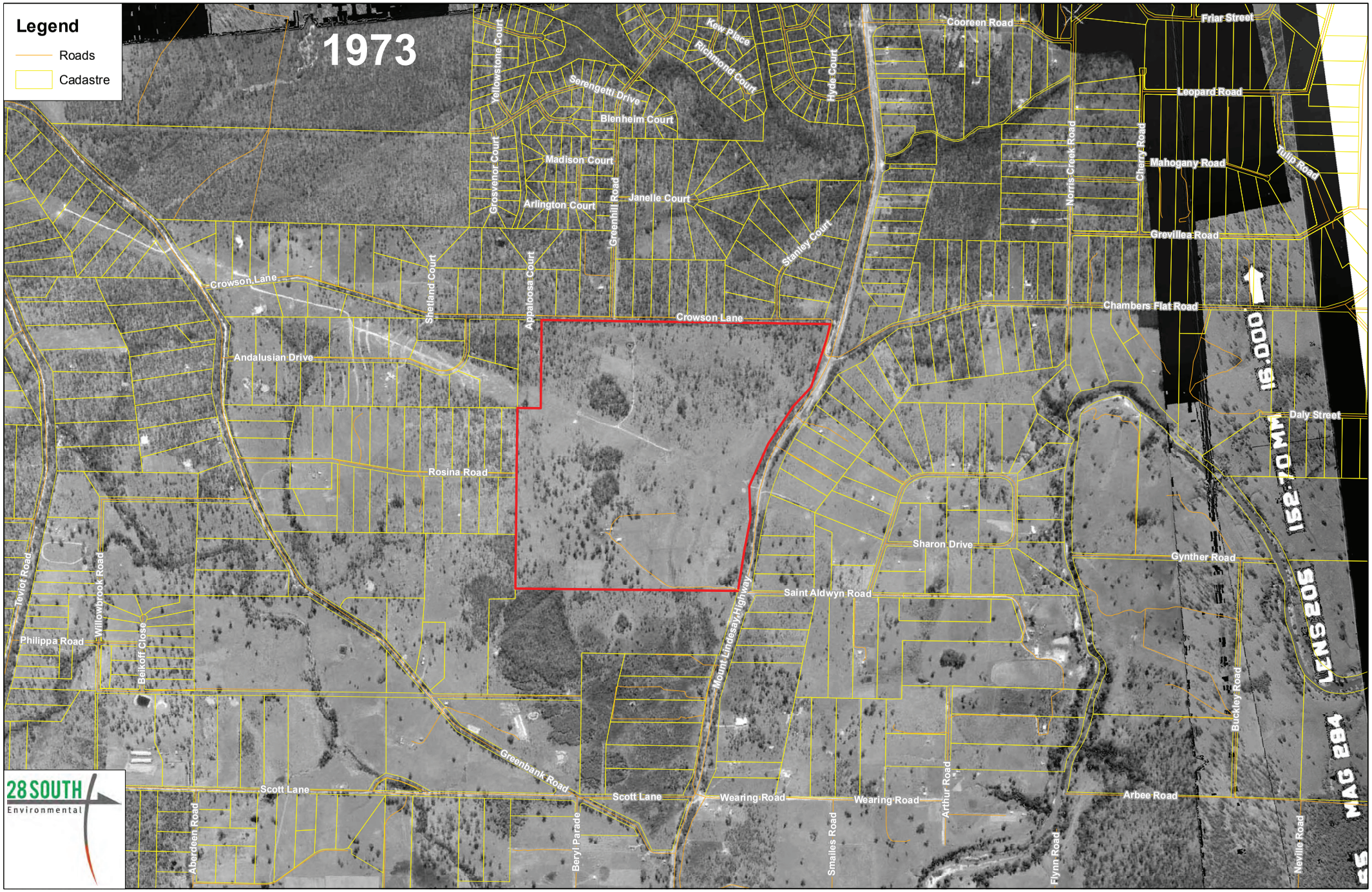


28 SOUTH Environmental

Coordinate System: GDA 1994 MGA Zone 56
Reference Scale: 1:15,000
Project Name : South Maclean
Title : Figure A - 1973

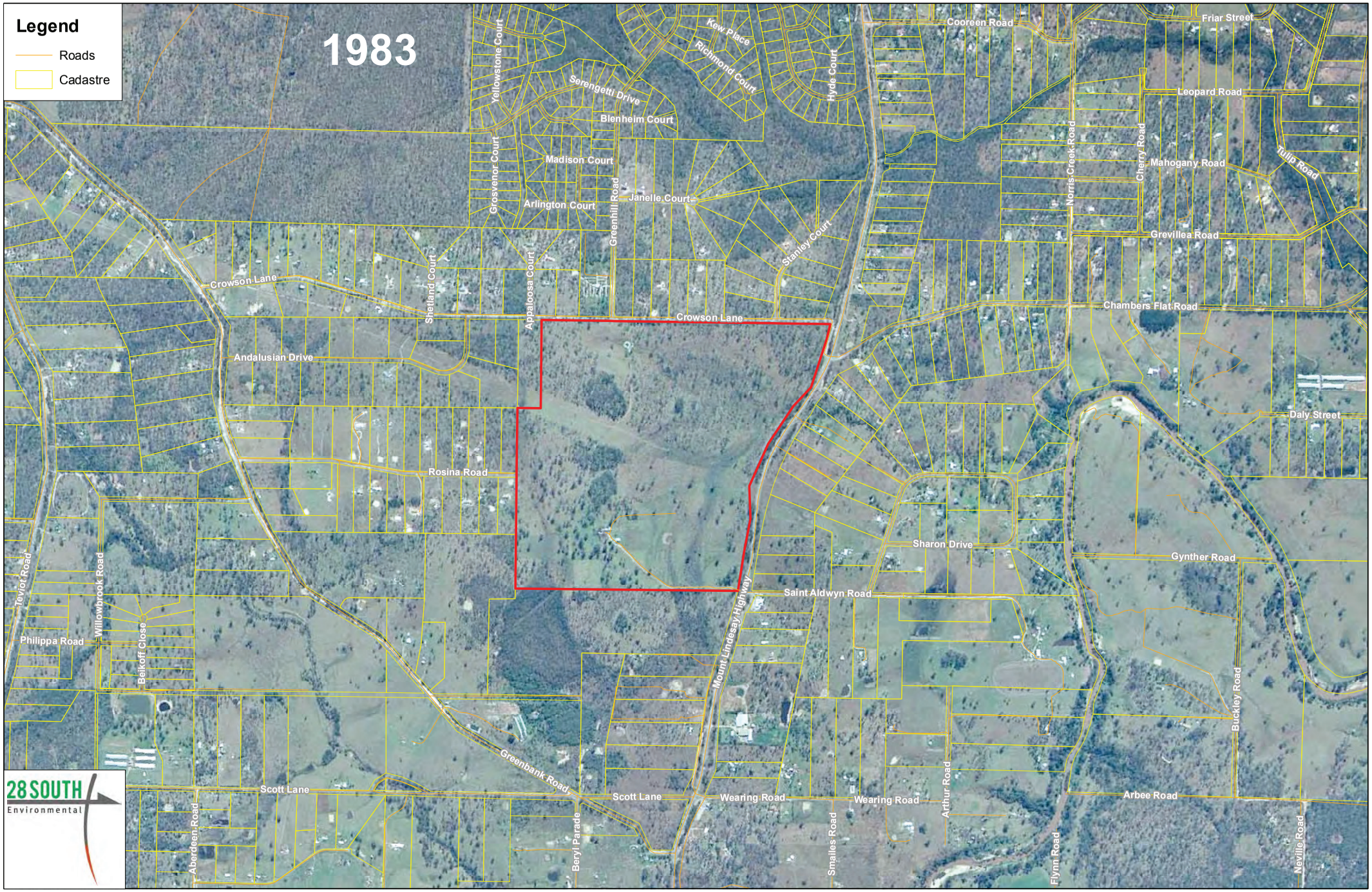
0 75 150 300 450 600 750 Meters

N

Background imagery is supplied by Bing, and is not to be used for measurement. For visualisation purposes only.

Client: Craven Ovenden Town Planning
Date: Friday, May 24, 2013

Document Path: V:\GIS\28_South\South_Maclean\Admin\mxd\SouthMaclean_Imagery_1973.mxd



Coordinate System: GDA 1994 MGA Zone 56
Reference Scale: 1:15,000
Project Name : South Maclean
Title : Figure A - 1983

0 75 150 300 450 600 750 Meters

N

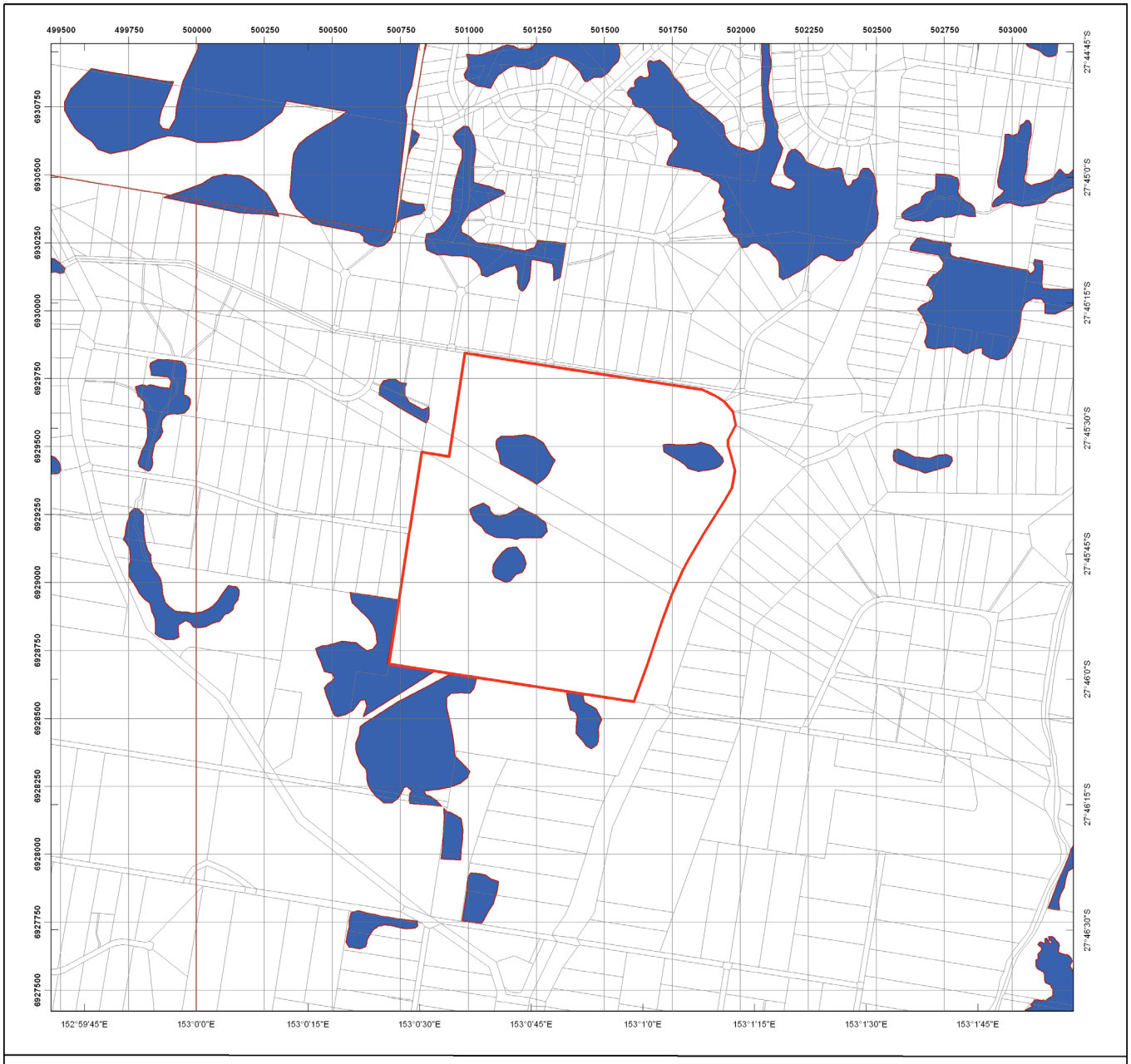
Background imagery is supplied by Bing, and is not to be used for measurement. For visualisation purposes only.

Client: Craven Ovenden Town Planning
Date: Friday, May 24, 2013

Document Path: V:\GIS\28_South\South_Maclean\Admin\mxd\SouthMaclean_Imagery_1983.mxd

Appendix 2 to the Technical Attachment 1

5.1 Regulated vegetation management map



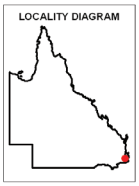
Regulated Vegetation Management Map

Please note, the Government has proposed changes to the Category C and Category R areas which are shown on the Proposed Regulated Vegetation Management Map. For more information on these changes, please refer to the Department's website.

Legend

- Lot and Plan
- Category A area (Vegetation offsets/compliance notices/VDecs)
- Category B area (Remnant vegetation)
- Category C area (High-value regrowth vegetation)
- Category R area (Reef regrowth watercourse vegetation)
- Category X area (Vegetation not regulated under the VMA)
- Water
- Area not categorised
- Cadastral line
  Property boundaries shown are provided as a locational aid only

LOCALITY DIAGRAM



N

0 200 400 600 800 1,000 m

This product is projected into:
GDA 1994 MGA Zone 56

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Natural Resources and Mines makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incurr as a result of the product being inaccurate or incomplete in any way and for any reason.

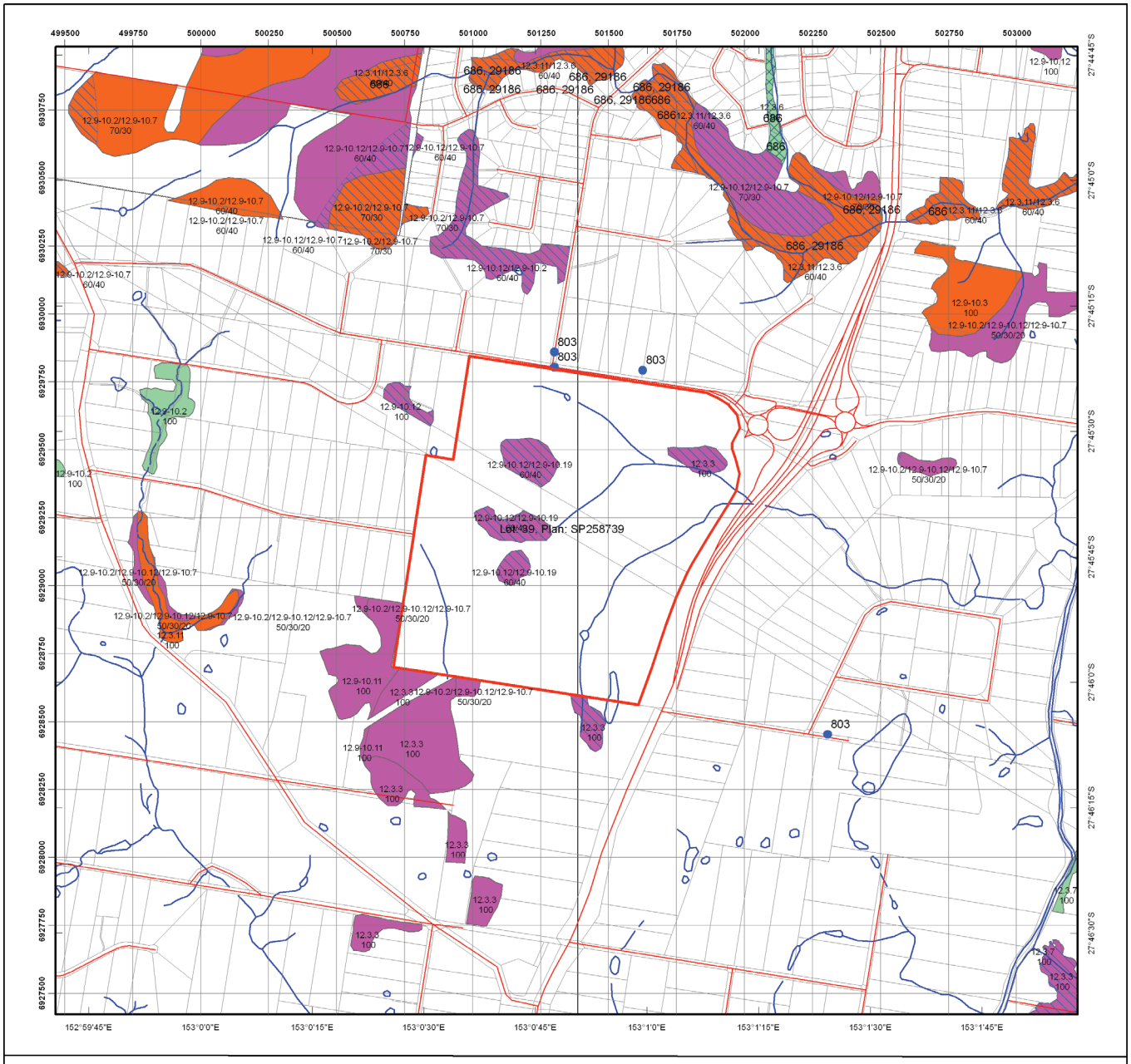
Additional information required for the assessment of vegetation values is provided in the accompanying "Vegetation Management Supporting map". For further information go to the web site: www.dnrm.qld.gov.au or contact the Department of Natural Resources and Mines.

Digital data for the regulated vegetation management map is available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

This map is updated on a monthly basis to ensure new PMAVs are included as they are approved.

Queensland Government

5.2 Vegetation management supporting map



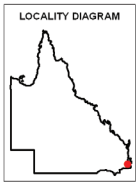
Vegetation Management Supporting Map

Legend

- Lot and Plan
- 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 A or B area containing remnant vegetation
- Category A or B area under Section 20AH
  These areas are edged in yellow and filled with the remnant RE Status
- 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
- Category C area containing high value regrowth vegetation
- Category C area under Section 20AI
  These areas are edged in purple and filled with the remnant RE Status
- Non Remnant
- Water
- Wetland on the vegetation management wetlands map
- Essential habitat on the essential habitat map
- Essential habitat species record
- Watercourse on the vegetation management watercourse and drainage feature map
  (Stream order shown as black number against stream where available)
- Roads
- National Parks, State Forest and other reserves
- Cadastral line
  Property boundaries shown are provided as a locational aid only

Queensland Government

LOCALITY DIAGRAM



N

0 150 300 450 600 750 m

This product is projected into:
GDA 1994 MGA Zone 56

Labels for Essential Habitat are centred on the area of enquiry.

Regional ecosystem linework has been compiled at a scale of 1:100 000, except in designated areas where a compilation scale of 1:50 000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100 000 is +/- 100 metres.

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Natural Resources and Mines makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incurr as a result of the product being inaccurate or incomplete in any way and for any reason.

Additional information may be required for the purposes of land clearing or assessment of a regional ecosystem map or PMAV applications. For further information go to the web site: www.dnrm.qld.gov.au or contact the Department of Natural Resources and Mines.

Digital data for the vegetation management watercourse and drainage feature map, vegetation management wetlands map, essential habitat map and the vegetation management remnant and regional ecosystem map are available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Appendix 3 to the Technical Attachment 1

Queensland Government

Regional ecosystem details for 12.3.3

Regional ecosystem	12.3.3
Vegetation Management Act class	Endangered
Wetlands	Floodplain (other than floodplain wetlands).
Biodiversity status	Endangered
Subregion	10, 7, 8, 6, 2, (5), (3), (11.31), (1), (4), (11.18), (11.22), (11.14)
Estimated extent	In September 2011, <10% of the pre-clearing area remained
Extent in reserves	Low
Short description	Eucalyptus tereticornis woodland on Quaternary alluvium
Structure category	Sparse
Description	Eucalyptus tereticornis woodland. Eucalyptus crebra and E. moluccana are sometimes present and may be relatively abundant in places, especially on edges of

plains and higher level alluvium. Other species that may be present as scattered individuals or clumps include Angophora subvelutina or A. floribunda, Corymbia clarksoniana, C. intermedia, C. tessellaris, Lophostemon suaveolens and E. melanophloia. Occurs on Quaternary alluvial plains, terraces and fans where rainfall is usually less than 1000mm/y. (BVG1M: 16c)
Vegetation communities in this regional ecosystem include:
12.3.3a: Floodplain (other than floodplain wetlands). Eucalyptus crebra, C. tessellaris woodland to open forest. Other species that may be present as scattered individuals or clumps include Corymbia clarksoniana, Eucalyptus melanophloia, E. tereticornis and C. citriodora subsp. variegata. Occurs on high level alluvial plains, terraces and fans where rainfall is usually less than 1000mm/y. (BVG1M: 18b)
12.3.3b: Floodplain (other than floodplain wetlands). Open forest to woodland of Eucalyptus moluccana and/or Eucalyptus tereticornis and E. crebra, with a sparse to mid-dense understorey of Melaleuca irbyana. Occurs on margins of Quaternary alluvial plains. (BVG1M: 13d)
12.3.3c: Palustrine wetland (e.g. vegetated swamp). Melaleuca irbyana low open forest or thicket. Emergent Eucalyptus moluccana, E. crebra, E. tereticornis or Corymbia citriodora subsp. variegata may be present. Occurs on Quaternary alluvial plains where drainage of soils is impeded. (BVG1M: 21b)
12.3.3d: Floodplain (other than floodplain wetlands). Eucalyptus moluccana woodland. Other frequently occurring species include Eucalyptus tereticornis, E. crebra, E. siderophloia and Corymbia intermedia. Occurs on margins of Quaternary alluvial plains usually adjacent sedimentary geologies. (BVG1M: 13d)

Supplementary description

Ryan, T.S. (ed.) (2012); Bean et al. (1998), E10.

Protected areas

Bulburin NP, Eurimbula NP, Littabella NP, Curtis Island NP, Bulburin East FR, Beninbi NP, Good Night Scrub NP, Bunya Mountains NP, Curtis Island RP, Grongah NP, Warro NP, Bania NP, Dawes NP, Nour Nour NP, Mount Barney NP, Mount Walsh NP, Kroombit Tops NP, Burrum Coast NP, Woowoonga NP, Main Range NP, Tarong NP, Glenbar NP, Lockyer NP, Deepwater NP, Castle Tower NP, D'Aguilar NP

Fire management guidelines

SEASON: Summer to late-autumn. INTENSITY: Low. INTERVAL: 3-6 years. STRATEGY: Aim to burn 40-60% of any given area. Spot ignition in cooler or moister periods encourages mosaics. ISSUES: Control of weeds is a major focus of planned burning in most areas. Maintain ground litter and fallen timber habitats by burning only with sufficient soil moisture. Burning should aim to produce fine scale mosaics of unburnt areas.

Comments

12.3.3: Sub-coastal and inland parts of bioregion. Also occurs in coastal areas north of Bundaberg. While Eucalyptus tereticornis remains common in the landscape, very few intact stands remain. Eucalyptus tereticornis grows into a very large hollow-forming tree and has a special significance for fauna species, especially in drier areas. The type is variable, ranging from woodland in drier parts to tall open forest in

higher rainfall areas and mono-specific to mixed with other canopy species. Eucalyptus tereticornis will regenerate readily but there is a lack of recruitment to replace old trees in stands that are logged, thinned or grazed and regularly burnt. The grasses and herbs associated with intact Eucalyptus tereticornis communities also persist in the landscape, so there is a potential for re-establishing the RE and increasing its remnant area. Eucalyptus tereticornis is replaced by E. grandis in highest-rainfall parts of the bioregion. 12.3.3a: Sub-coastal and inland parts of bioregion. Characteristic localities include Burnett River catchment and Ripley Valley. Too small to map at 1:100 000 scale. 12.3.3b: Restricted to the Ipswich and Jimboomba regions. 12.3.3c: Restricted to the Ipswich and Jimboomba regions. This floristic association on land zone 9-10 is mapped as 12.9-10.11.

Search

A. Regional ecosytem ID

e.g. 1.3.5 where 1 is bioregion, 3 is land zone and 5 is region.

12.3.3

Or

B. Ecosystem details

Land zone

(any)

Description

e.g. eucalyptus

Vegetation Management Act class

(any)

Biodiversity status

(any)

Or

C. List all regional ecosystem descriptions (https://environment.ehp.qld.gov.au/regional-ecosystems/list/)

Last updated 29 September

Queensland Government

Regional ecosystem details for 12.9-10.12

Regional ecosystem	12.9-10.12
Vegetation Management Act class	Endangered
Biodiversity status	Endangered
Subregion	2, (3)
Estimated extent	In September 2011, remnant extent was < 10,000 ha and 10-30% of the pre-clearing area remained
Extent in reserves	No representation
Short description	Eucalyptus seeana, Corymbia intermedia, Angophora leiocarpa woodland on sedimentary rocks
Structure category	Sparse
Description	Corymbia intermedia, Angophora leiocarpa, Eucalyptus seeana +/- E. siderophloia, E. tereticornis, E. racemosa subsp. racemosa, C. citriodora subsp. variegata woodland to open forest. Lophostemon suaveolens is often present as a sub-canopy or understorey tree. Occasional Melaleuca quinquenervia on lower slopes. Does

not include areas dominated by Eucalyptus racemosa subsp. racemosa. Occurs on Cainozoic and Mesozoic sediments. (BVG1M: 9g)
Vegetation communities in this regional ecosystem include:
12.9-10.12a: Angophora leiocarpa, Eucalyptus interstans +/- Corymbia intermedia, E. tereticornis C. tessellaris, E. siderophloia, C. citriodora subsp. variegata woodland to open forest. Lophostemon suaveolens is often present as a sub-canopy or understorey tree. Occasional Melaleuca quinquenervia on lower slopes. Occurs on Cainozoic and Mesozoic sediments. (BVG1M: 9g)

Supplementary description

Bean et al. (1998), H36, H39j, H7

Fire management guidelines

SEASON: Summer to winter. INTENSITY: Low to moderate. INTERVAL: 4-25 years. STRATEGY: Aim for 40-60% mosaic burn. Burn with soil moisture and with a spot ignition strategy so that a patchwork of burnt/unburnt country is achieved. ISSUES: The fire regime should maintain a mosaic of grassy and shrubby understoreys. Control of weeds is a major focus of planned burning in most areas. Careful thought should be given to maintaining ground litter and fallen timber habitats by burning only with sufficient soil moisture. Burning should aim to produce fine scale mosaics of unburnt areas. Variability in season and fire intensity is important, as well as spot ignition in cooler or moister periods to encourage mosaics.

Comments

12.9-10.12: Occurs on south-west outskirts of Brisbane. Subject to increasing fragmentation and urbanisation. Eucalyptus seeana is the diagnostic species for this regional ecosystem. It often occurs as a subdominant component. Areas of this regional ecosystem on remnant Tertiary surfaces that are mappable (>2ha) are defined as 12.5.3a. 12.9-10.12a: Occurs near Esk. Subject to increasing fragmentation and urbanisation. Eucalyptus interstans is the diagnostic species of this regional ecosystem. It often occurs as a subdominant component.

Or
Or

Search

A. Regional ecosytem ID

e.g. 1.3.5 where 1 is bioregion, 3 is land zone and 5 is region.

12.9-10.12

Queensland Government

Regional ecosystem details for 12.9-10.19

Regional ecosystem	12.9-10.19
Vegetation Management Act class	Least concern
Biodiversity status	No concern at present
Subregion	7, 8, 2, (6), (11.31), (5), (10), (3), (1), (4)
Estimated extent	In September 2011, remnant extent was > 10,000 ha and >30% of the pre-clearing area remained
Extent in reserves	Low
Short description	Eucalyptus fibrosa subsp. fibrosa woodland on sedimentary rocks
Structure category	Sparse
Description	Eucalyptus fibrosa subsp. fibrosa woodland +/- Corymbia citriodora subsp. variegata, E. acmenoides or E. portuensis, Angophora leiocarpa, E. major. Understorey often sparse. Localised occurrences of Eucalyptus sideroxylon. Occurs on Cainozoic and Mesozoic sediments. (BVG1M: 12a)

Vegetation communities in this regional ecosystem include:
12.9-10.19a: Corymbia henryi +/- Eucalyptus fibrosa subsp. fibrosa, Corymbia citriodora subsp. variegata, E. siderophloia, E. crebra open forest. Occurs in coastal areas on Cainozoic and Mesozoic sediments. (BVG1M: 10b)

Supplementary description

Ryan, T.S. (ed.) (2012); Bean et al. (1998), H29, H30

Protected areas

Wongi NP, Cordalba NP, Glenbar NP, Lamington NP, Littabella NP, Littabella RP

Fire management guidelines

SEASON: Summer to winter. INTENSITY: Low to moderate. INTERVAL: 4-25 years. STRATEGY: Aim for 40-60% mosaic burn. Burn with soil moisture and with a spot ignition strategy so that a patchwork of burnt/unburnt country is achieved. ISSUES: The fire regime should maintain a mosaic of grassy and shrubby understoreys. Control of weeds is a major focus of planned burning in most areas. Careful thought should be given to maintaining ground litter and fallen timber habitats by burning only with sufficient soil moisture. Burning should aim to produce fine scale mosaics of unburnt areas. Variability in season and fire intensity is important, as well as spot ignition in cooler or moister periods to encourage mosaics.

Comments

12.9-10.19: This RE has a very patchy distribution and often occurs as patches too small to map at 1:100 000 scale. 12.9-10.19a: Southern parts of bioregion. This RE is a mesic variant of 12.9-10.19. It has a very patchy distribution and often occurs as patches too small to map at 1:100 000 scale.

Or
Or

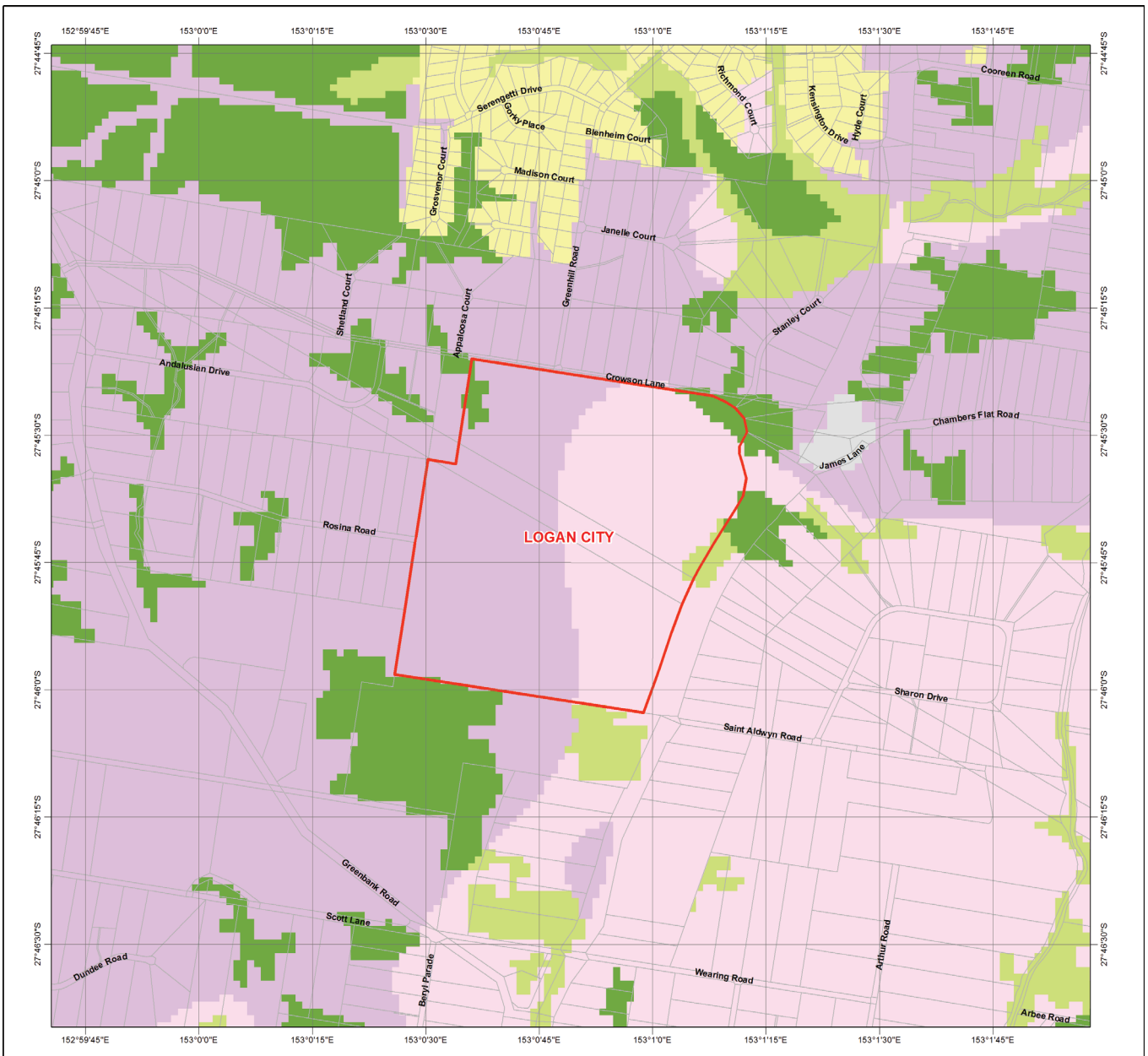
Search

A. Regional ecosytem ID

e.g. 1.3.5 where 1 is bioregion, 3 is land zone and 5 is region.

12.9-10.19

Appendix 4 to the Technical Attachment 1



Koala Habitat in South East Queensland

Lot and Plan

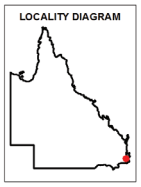
Koala SPP - Habitat Values

Bushland Habitat
- High Value Bushland
- Medium Value Bushland
- Low Value Bushland

Suitable for Rehabilitation
- High Value Rehabilitation
- Medium Value Rehabilitation
- Low Value Rehabilitation

Other Areas of Value
- High Value Other
- Medium Value Other
- Low Value Other
- Generally not suitable
- Water

South East Queensland Koala Habitat Values western SEQ
- Bushland Habitat
- Suitable for rehabilitation
- Other areas of value
- Generally not suitable
- Water
- Cadastral Boundaries
- Local Government Boundaries



N

0 200 400 600 800 1,000 m

This product is projected into GDA 1994 MGA Zone 56

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Based on or contains data provided by the State of Queensland 2010.

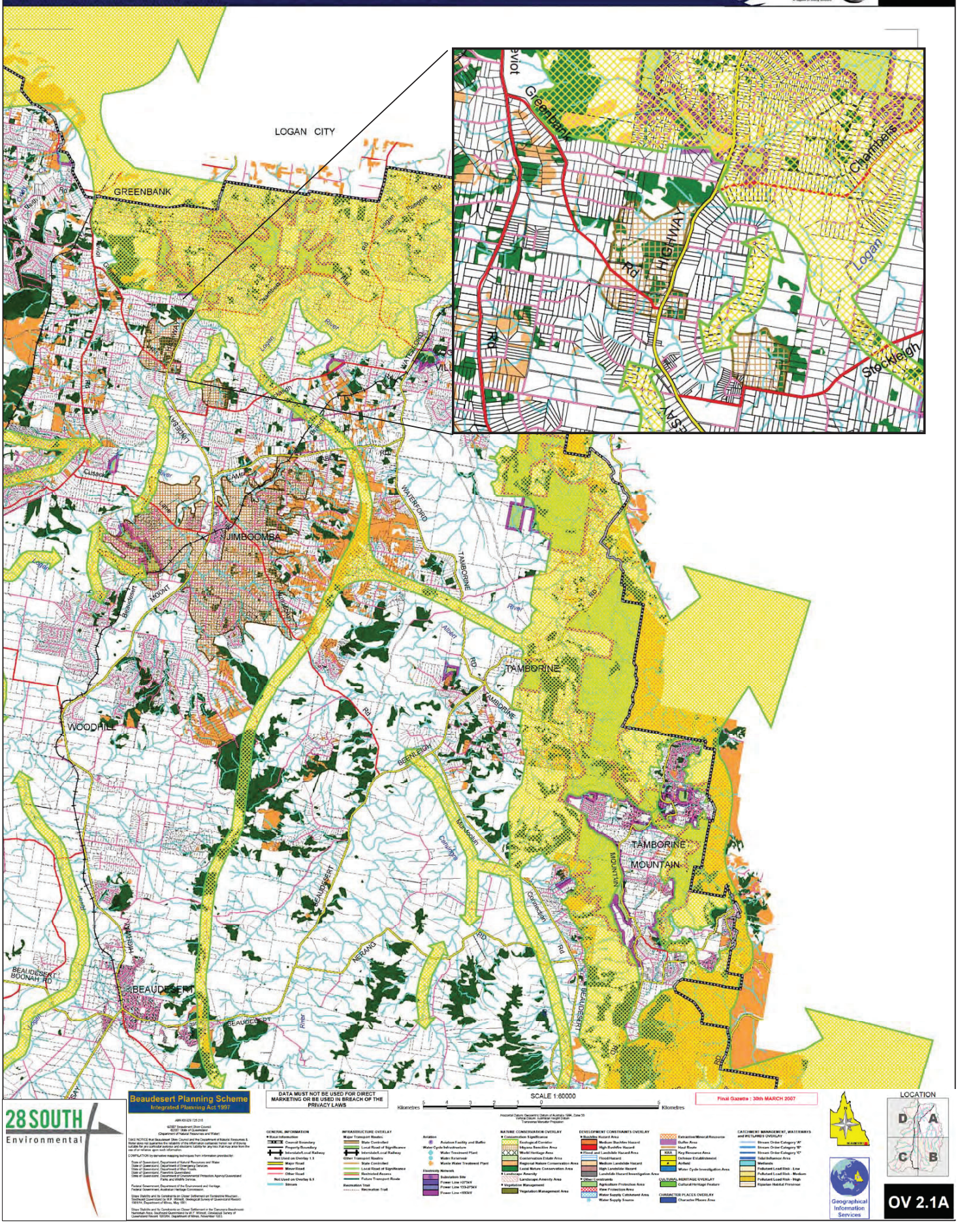
Note - These maps are not regulatory. Regulatory maps and requirements can be downloaded from the EHP website. Further information in relation to regulatory requirements for development and planning activities should be sought from the relevant Local Government Authority or the Department of Environment and Heritage Protection.

Appendix 5 to the Technical Attachment 1

Nature Conservation Overlay – Conservation

Beaudesert Shire

OV 2.1A



Beaudesert Planning Scheme
Integrated Planning Act 1997

DATA MUST NOT BE USED FOR DIRECT MARKETING OR BE USED IN BREACH OF THE PRIVACY LAWS

SCALE 1:60000

Kilometres 5 4 3 2 1 0 5 Kilometres

Final Gazette : 30th MARCH 2007

LOCATION

28 SOUTH Environmental

Geographical Information Services

OV 2.1A

Coordinate System: GDA 1994 MGA Zone 56	
Reference Scale:	
Project Name : South Maclean	
Title : Nature Conservation	

Document Path: V:\GIS\28_South\South_Maclean\Admin\mxd\SouthMaclean_Nature_Conservation.mxd

Background imagery is supplied by Google earth Pro, and is not to be used for measurement. For visualisation purposes only.

Client: Craven Ovenden Town Planning	
Date: Friday, May 24, 2013	

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Plate 1 – Culvert with dry passage fauna pathways at the northeastern corner of the Subject Site

Plate 2 – View showing the long dark nature of the dry passage

Plate 3 – Norris Creek Underpass (northern culvert)

Plate 4 – Norris Creek Underpass (southern culvert – note stick is 1m tall)

Appendix 6 to the Technical Attachment 1

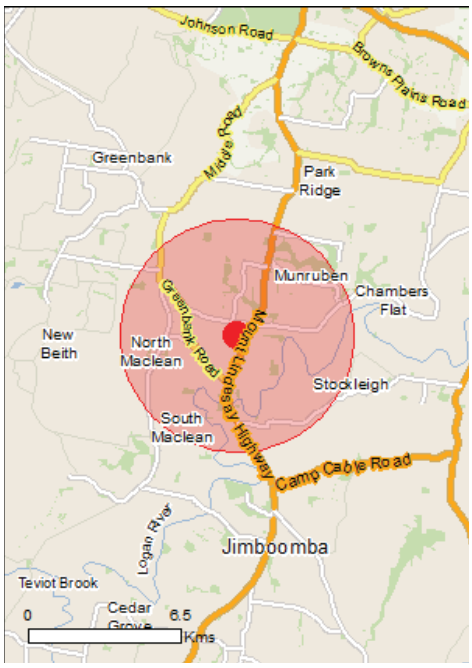
EPBC Act Protected Matters Report

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.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

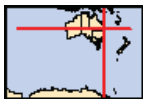
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 24/05/15 21:01:28



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates
Buffer: 5.0Km



Summary

Matters of National Environmental 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:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	29
Listed Migratory Species:	13

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 http://www.environment.gov.au/heritage/index.html

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 Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	42
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Moreton bay	Upstream from Ramsar

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.

Name	Status	Type of Presence
Lowland Rainforest of Subtropical Australia	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
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Poephila cincta cincta Black-throated Finch (southern) [64447]	Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Fish		

Name	Status	Type of Presence
Maccullochella mariensis Mary River Cod [83806]	Endangered	Translocated population known to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll [331]	Endangered	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within 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]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Other		
Cycas ophiolitica [55797]	Endangered	Species or species habitat may occur within area
Plants		
Bosistoa selwynii Heart-leaved Bosistoa [13702]	Vulnerable	Species or species habitat likely to occur within area
Bosistoa transversa Three-leaved Bosistoa, Yellow Satinheart [16091]	Vulnerable	Species or species habitat likely to occur within area
Notelaea ipsviciensis Cooneana Olive [81858]	Critically Endangered	Species or species habitat may occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat likely to occur within area
Phebalium distans Mt Berryman Phebalium [81869]	Critically Endangered	Species or species habitat may occur within area
Plectranthus habrophyllus [64589]	Endangered	Species or species habitat likely to occur within area
Streblus pendulinus Siah's Backbone, Sia's Backbone, Isaac Wood [21618]	Endangered	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		

Name	Status	Type of Presence
Coeranoscincus reticulatus Three-toed Snake-tooth Skink [59628]	Vulnerable	Species or species habitat may occur within area
Delma torquata Collared Delma [1656]	Vulnerable	Species or species habitat may occur within area
Furina dunmalli Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Pandion cristatus Eastern Osprey [82411]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
A&T Koala Billabong	QLD
Koolena	QLD

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		

Name	Status	Type of Presence
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus africanus Climbing Asparagus, Climbing Asparagus Fern [66907]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Cryptostegia grandiflora Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-27.76068 153.01502

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:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA 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, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-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.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Queensland Government

AUDAX AT FIDELIS

Wildlife Online Extract

Search Criteria: Species List for a Specified Point
Species: All
Type: All
Status: All
Records: Confirmed
Date: Since 1980
Latitude: -27.760
Longitude: 153.015
Distance: 5
Email: wayne@28south.com.au
Date submitted: Monday 25 May 2015 09:44:39
Date extracted: Monday 25 May 2015 09:50:02

The number of records retrieved = 94

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	amphibians	Bufonidae	*Rhinella marina*	cane toad	Y			4
animals	amphibians	Hylidae	*Litoria brevipalmata*	green thighed frog		C		1
animals	amphibians	Hylidae	*Litoria gracilenta*	graceful treefrog		C		2
animals	amphibians	Hylidae	*Litoria caerulea*	common green treefrog		C		6
animals	amphibians	Hylidae	*Litoria dentata*	bleating treefrog		C		1
animals	amphibians	Hylidae	*Litoria fallax*	eastern sedgefrog		C		6
animals	amphibians	Hylidae	*Litoria peronii*	emerald spotted treefrog		C		1
animals	amphibians	Hylidae	*Litoria rubella*	ruddy treefrog		C		3
animals	amphibians	Hylidae	*Litoria latopalmata*	broad palmed rocketfrog		C		1
animals	amphibians	Hylidae	*Litoria nasuta*	striped rocketfrog		C		1
animals	amphibians	Limnodynastidae	*Adelotus brevis*	tusked frog		V		1
animals	amphibians	Limnodynastidae	*Limnodynastes peronii*	striped marshfrog		C		5
animals	amphibians	Limnodynastidae	*Platyplectrum ornatum*	ornate burrowing frog		C		1
animals	amphibians	Limnodynastidae	*Limnodynastes tasmaniensis*	spotted grassfrog		C		1
animals	amphibians	Limnodynastidae	*Limnodynastes terraereginae*	scarlet sided pobblebonk		C		1
animals	amphibians	Myobatrachidae	*Crinia parinsignifera*	beeping froglet		C		6
animals	amphibians	Myobatrachidae	*Mixophyes fasciolatus*	great barred frog		C		2
animals	amphibians	Myobatrachidae	*Pseudophryne coriacea*	red backed broodfrog		C		1
animals	amphibians	Myobatrachidae	*Uperoleia rugosa*	chubby gungan		C		2
animals	birds	Anatidae	*Chenonetta jubata*	Australian wood duck		C		1
animals	birds	Ardeidae	*Egretta novaehollandiae*	white-faced heron		C		1
animals	birds	Ardeidae	*Ardea ibis*	cattle egret		SL		1
animals	birds	Artamidae	*Strepera graculina*	pied currawong		C		1
animals	birds	Artamidae	*Cracticus nigrogularis*	pied butcherbird		C		1
animals	birds	Artamidae	*Cracticus tibicen*	Australian magpie		C		1
animals	birds	Cacatuidae	*Cacatua galerita*	sulphur-crested cockatoo		C		1
animals	birds	Cacatuidae	*Eolophus roseicapillus*	galah		C		1
animals	birds	Campephagidae	*Coracina novaehollandiae*	black-faced cuckoo-shrike		C		2
animals	birds	Charadriidae	*Vanellus miles novaehollandiae*	masked lapwing (southern subspecies)		C		1
animals	birds	Coraciidae	*Eurystomus orientalis*	dollarbird		C		1
animals	birds	Corvidae	*Corvus orru*	Torresian crow		C		1
animals	birds	Halcyonidae	*Todiramphus sanctus*	sacred kingfisher		C		1
animals	birds	Halcyonidae	*Dacelo novaeguineae*	laughing kookaburra		C		2
animals	birds	Hirundinidae	*Hirundo neoxena*	welcome swallow		C		1
animals	birds	Meliphagidae	*Entomyzon cyanotis*	blue-faced honeyeater		C		2
animals	birds	Meliphagidae	*Philemon corniculatus*	noisy friarbird		C		2
animals	birds	Meliphagidae	*Manorina melanocephala*	noisy miner		C		1
animals	birds	Monarchidae	*Grallina cyanoleuca*	magpie-lark		C		1
animals	birds	Oriolidae	*Oriolus sagittatus*	olive-backed oriole		C		1
animals	birds	Pardalotidae	*Pardalotus striatus*	striated pardalote		C		1
animals	birds	Psittacidae	*Trichoglossus chlorolepidotus*	scaly-breasted lorikeet		C		1
animals	birds	Psittacidae	*Trichoglossus haematodus moluccanus*	rainbow lorikeet		C		2
animals	birds	Psittacidae	*Glossopsitta pusilla*	little lorikeet		C		1
animals	birds	Psittacidae	*Platycercus adscitus*	pale-headed rosella		C		1
animals	birds	Rhipiduridae	*Rhipidura leucophrys*	willie wagtail		C		1
animals	birds	Sturnidae	*Sturnus tristis*	common myna	Y			1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
animals	birds	Threskiornithidae	*Threskiornis spinicollis*	straw-necked ibis		C		1
animals	insects	Nymphalidae	*Euploea core corinna*	common crow				1
animals	mammals	Acrobatidae	*Acrobates pygmaeus*	feathertail glider		C		1
animals	mammals	Canidae	*Vulpes vulpes*	red fox	Y			1
animals	mammals	Dasyuridae	*Dasyurus maculatus maculatus*	spotted-tailed quoll (southern subspecies)		V	E	1
animals	mammals	Dasyuridae	*Phascogale tapoatafa tapoatafa*	brush-tailed phascogale (S mainland)		C		1
animals	mammals	Macropodidae	*Macropus rufogriseus*	red-necked wallaby		C		2
animals	mammals	Macropodidae	*Macropus giganteus*	eastern grey kangaroo		C		2
animals	mammals	Muridae	*Rattus norvegicus*	brown rat	Y			1
animals	mammals	Muridae	*Mus musculus*	house mouse	Y			1
animals	mammals	Petauridae	*Petaurus australis australis*	yellow-bellied glider (southern subspecies)		C		1
animals	mammals	Petauridae	*Petaurus norfolcensis*	squirrel glider		C		1
animals	mammals	Phalangeridae	*Trichosurus vulpecula*	common brushtail possum		C		2
animals	mammals	Phascolarctidae	*Phascolarctos cinereus (southeast Queensland bioregion)*	koala (southeast Queensland bioregion)		V	V	103
animals	mammals	Pseudocheiridae	*Pseudocheirus peregrinus*	common ringtail possum		C		1
animals	mammals	Pseudocheiridae	*Petauroides volans*	greater glider		C		1/1
animals	reptiles	Agamidae	*Diporiphora australis*			C		2
animals	reptiles	Agamidae	*Pogona barbata*	bearded dragon		C		2
animals	reptiles	Agamidae	*Intellagama lesueurii*	eastern water dragon		C		3
animals	reptiles	Boidae	*Morelia spilota*	carpet python		C		1
animals	reptiles	Colubridae	*Dendrelaphis punctulatus*	green tree snake		C		3
animals	reptiles	Elapidae	*Pseudechis porphyriacus*	red-bellied black snake		C		1
animals	reptiles	Elapidae	*Brachyurophis australis*	coral snake		C		1
animals	reptiles	Elapidae	*Vermicella annulata*	bandy-bandy		C		1
animals	reptiles	Elapidae	*Pseudonaja textilis*	eastern brown snake		C		3
animals	reptiles	Elapidae	*Demansia psammophis*	yellow-faced whipsnake		C		1
animals	reptiles	Elapidae	*Cacophis harriettae*	white-crowned snake		C		2
animals	reptiles	Elapidae	*Cryptophis nigrescens*	eastern small-eyed snake		C		1
animals	reptiles	Gekkonidae	*Hemidactylus frenatus*	house gecko	Y			3
animals	reptiles	Gekkonidae	*Gehyra dubia*			C		1
animals	reptiles	Scincidae	*Lampropholis delicata*			C		2
animals	reptiles	Scincidae	*Ctenotus spaldingi*			C		1
animals	reptiles	Scincidae	*Lygisaurus foliorum*			C		1
animals	reptiles	Scincidae	*Cryptoblepharus pulcher pulcher*	elegant snake-eyed skink		C		1
animals	reptiles	Scincidae	*Calyptotis scutirostrum*			C		1
animals	reptiles	Scincidae	*Carlia vivax*			C		2
animals	uncertain	Indeterminate	*Indeterminate*	Unknown or Code Pending		C		1
fungi	club fungi	Basidiomycota	*Pycnoporus coccineus*			C		1/1
fungi	club fungi	Basidiomycota	*Hyphoderma setigerum*			C		1/1
plants	higher dicots	Amaranthaceae	*Alternanthera pungens*	khaki weed	Y			1/1
plants	higher dicots	Asteraceae	*Senecio madagascariensis*	fireweed	Y			1/1
plants	higher dicots	Fabaceae	*Erythrina crista-galli*		Y			1/1
plants	higher dicots	Flacourtiaceae	*Dovyalis caffra*	kei apple	Y			1/1

Kingdom	Class	Family	Scientific Name	Common Name	I	Q	A	Records
plants	higher dicots	Moraceae	*Morus alba*	white mulberry	Y			1/1
plants	higher dicots	Rubiaceae	*Richardia brasiliensis*	white eye	Y			2/2
plants	higher dicots	Rutaceae	*Acronychia imperforata*	beach acronychia		C		1/1
plants	monocots	Najadaceae	*Najas tenuifolia*	water nymph		C		1/1
plants	monocots	Pontederiaceae	*Heteranthera reniformis*		Y			1/1

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 in the Wild (PE), Endangered (E), Vulnerable (V), Near Threatened (NT), Least Concern (C) or Not Protected ( ).

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

Records – The first number indicates the total number of records of the taxon for the record option selected (i.e. All, Confirmed or Specimens).
This number is output as 99999 if it equals or exceeds this value. The second number located after the / indicates the number of specimen records for the taxon.
This number is output as 999 if it equals or exceeds this value.

Appendix 7 to the Technical Attachment 1

4499 - 4651 MOUNT LINDESAY HIGHWAY, SOUTH MACLEAN: PRELIMINARY VEGETATION REPORT

Prepared by Christopher Beavon

CONTENTS

GLOSSARY, ACRONYMS & ABBREVIATIONS

*	(Preceding a plant species name) plant species not native to Australia
DEHP	(Queensland) Department of Environment and Heritage Protection [formerly DERM]
DERM	(Queensland) Department of Environment and Resource Management
DEWHA	(Commonwealth) Department of Environment, Water, Heritage and the Arts
DSEWPaC	(Commonwealth) Department of Sustainability, Environment, Water, Population and Communities [formerly DEWHA]
EDL	ecologically dominant layer
NC Act	Queensland *Nature Conservation Act 1992*
RE	Regional Ecosystem as defined under the Queensland Vegetation Management Regulation 2000
VM Act	Queensland *Vegetation Management Act 1999*
VM Regulation	Queensland Vegetation Management Regulation 2000

1.0 INTRODUCTION

The following information is presented as a preliminary vegetation assessment report for the use of 28 South Environmental. It is understood that this information, or part thereof, is to be incorporated into a detailed report.

2.0 ASSESSMENT METHODOLOGY

2.1 Desktop Research

A desktop assessment was undertaken which included searches of State and Commonwealth databases of the study area. The purpose of the desktop searches was to identify the presence or potential presence of near-threatened and threatened flora species and threatened ecological communities. Online database searches based on a 10km radius around the central coordinate of Latitude -27.7631, Longitude 153.0120 were undertaken prior to attending the study area.

Desktop searches included the following databases and mapping sources:

- Department of Environment and Heritage Protection - *Regional Ecosystem (Version 6) and regrowth vegetation mapping (Version 2)* at 1:100,000 scale (DEHP 2013a & b); and,
- Department of Sustainability, Environment, Water, Heritage, Population and Communities - *EPBC Act Protected Matters Search Tool* (DSEWPaC 2013a);
- Queensland Parks and Wildlife Service - *Wildlife Online database search* (DEHP 2013c); and,
- Geoscience Australia - *Geology mapping* (Department of Mines and Energy 2012).

2.2 Vegetation Survey Methodology

The following survey techniques were utilized during a detailed field-validation of the vegetation communities and flora composition within the study area.

2.2.1 Site Selection

The field flora survey methods were developed in order to ascertain:

- the structure, vegetation type and overall ecological condition of the study area; and
- the presence/absence of near-threatened or threatened flora and fauna species (as listed under the Qld NC Act and *Commonwealth* EPBC Act) within the study area.

The study area was surveyed in compliance with the "Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland, Version 3.2" (Neldner *et al.* 2012). The location and description of each assessment site is provided in **Appendix A**.

2.2.2 Quaternary Sites

Data recorded at each quaternary site included:

- precise location (with reference to iPad GPS);
- mid-stratum and canopy species composition and abundance;
- structural characteristics of ecologically dominant layer;
- condition; and
- limited photographs of the community.

2.2.3 Tertiary Sites

Data recorded at each tertiary site included:

- date and precise location (with reference to iPad GPS);
- soils, slope, aspect and landform observations;
- ground-layer, mid-stratum and canopy species composition and abundance;
- structural characteristics;
- condition and disturbance of existing vegetation communities (including distribution of weed species); and
- photographs of the community.

2.2.4 Flora Inventory and Abundance

The field survey undertaken was designed to obtain field-verified information on the extent and condition of remnant and regrowth vegetation values and presence/absence of threatened flora species within the survey area. A singular flora inventory was compiled during traverses of the site.

Abundance estimates were applied to species within each stratum of the community, with particular focus on the ecologically dominant layer (EDL) as it is by these species that the community is defined and from this, the regional ecosystem determined (Neldner *et al.* 2012).

The status (remnant / non-remnant) of existing vegetation is determined by comparing the existing predominant canopy with the undisturbed predominant canopy. In the VM Act, the EDL is defined as the stratum of the vegetation that contains the most above ground biomass. The EDL can be defined in terms of growth form, height, cover density and species. In the majority of cases, the EDL is equivalent to the upper stratum of Hnatiuk *et al.* (2009).

Abundance assessments of canopy species are quantitative (i.e. the basal area of stems per hectare was calculated using the Bitterlich stick methodology (Grosenbaugh 1953, Loetsch *et al.* 1973). This was utilised in conjunction with an estimation of crown cover (based on the crown or line intercept methodology (Greig-Smith 1964, Neldner *et al.* 2005). This allowed a descriptive measure of cover, which combined with growth form and median height, describe the structure of the vegetation community based on structural formation classes described by Hnatiuk *et al.* (2009).

The crown cover definitions and associated crown separation descriptions (e.g. sparse) were also applied to the lower strata to allow a consistent description of spatial distribution of the respective vegetative layers. Tree heights and spreads were approximated. However, two calibrations were undertaken daily. This involved measuring the tree heights of selected trees using a clinometer to calculate the percentages to the top and bottom of the tree as determined at the 25m mark of a measuring tape extended in a straight line from the base of the trunk (Abed and Stephens 2002).

The landform description upon which the field validated vegetation communities occurred was based on simple erosional landform patterns characterised by relief and modal slope and described by Speight (2009).

For compilation of detailed floristic inventories at all ecological equivalence level assessment sites and during foot traverses, the relative abundance of species was based on the Hurst and Allen interpretation of the Braun-Blanquet technique (Mueller-Dombois & Ellenberg 1974, Whittaker 1975) as follows: 1 = sparse, <5%; 2 = any number, <5%; 3 = 5 – 24%; 4 = 25 – 49%; 5 = 50 – 74%; 6 = 75 – 100%.

An inventory of flora species that were recorded within the study area are presented in **Appendix B**.

2.2.5 Nomenclature

Application of scientific names in this report follows Bostock and Holland (2010). In the first occurrence in the text common names of plants, if one exists, will be followed by its scientific name. Common names were derived from Harden *et al.* (2006a and 2006b), Simon & Alfonso (2011) and Leiper *et al.* (2008). Use of an asterisk (*) indicates that the species is not native to Queensland, *e.g.* Common Lantana (**Lantana camara* var. *camara*). Following the first in-text reference, flora species will be referred to by common name only.

2.2.6 Co-ordinate System and Map Datum

Positional data was collected with Avenza PDF Maps iPad Application - Geographic Positioning System (GPS), with an accuracy of 10 to 15 m. Locations were recorded using the UTM coordinate system. All locations presented in this report are within zone 56. The map datum used was GDA94.

3.0 RESULTS

3.1 Vegetation Description

The extents of remnant Regional Ecosystems (RE) were found to be accurate based on data obtained from quaternary and tertiary assessments.
The assessment site data is provided in **Appendix C.**

This site consisted mainly of cleared areas (for pasture) and non-remnant vegetation. Areas of remnant vegetation included mixed polygons of REs 12.9-10.12/12.9-10.19a and RE 12.3.11. Particular attention was paid to three areas of interest due to their likelihood of threatened species being present: 1) the polygon of RE 12.3.11 to the northeast; 2) the area of non-remnant vegetation in the north; and 3) a wetland area to the south.

The areas containing REs 12.9-10.12/12.9-10.19a generally had a sparse canopy dominated by Queensland blue gum (*Eucalyptus tereticornis*), associated with Pink bloodwood (*Corymbia intermedia*), Narrow-leaved red gum (*Eucalyptus seeana*), Narrow-leaved ironbark (*Eucalyptus crebra*), Boad-leaved ironbark (*Eucalyptus fibrosa* subsp. *fibrosa*) and Spotted gum (*Corymbia citriodora*). The median height of the canopy was 22m and the crown intercept ranged between 5 and 25%. The sparse to very sparse sub-canopy and low tree layers were dominated by the canopy species and Swamp box (*Lophostemon sauveolons*) and Broad-leaved tea tree (*Melaleuca quinquenervia*).

The sparse to isolated tall shrub layer was dominated by *Acacia* spp., *Melaleuca* spp. and Black sheoak (*Allocasuarina littoralis*), with occurrences of Soap tree (*Alphitonia excelsa*). The very sparse to isolated low shrub layer was dominated by canopy and tall shrub species recruits, Lantana (*Lantana camara*) and *Blackberry nightshade (*Solanum nigrum*).

The mid-dense to dense groundcover was dominated by Blady grass (*Imperata cylindrica*), Barbed wire grass (*Cymbopogon refractus*), Kangaroo grass (*Themeda triandra*), Wiry panic (*Entolasia stricta*), *Paspalum (*Paspalum dilatatum*), Button grass (*Dactyloctenium radulans*), Green couch (*Cynodon dactylon* var. *dactylon*) and *Blue billygoat weed (*Ageratum houstonianum*). Other commonly encountered species included *Cobbler's pegs (*Bidens pilosa*), Flannel weed (*Sida cordifolia*), Red natal grass (*Melinis repens*), White root (*Lobelia purpurascens*), *Eragrostis* spp. and *Digitaria* spp.

Many of the non-remnant areas were representative of this vegetation. However, due to thinning, under-scrubbing, grazing and patch size limitations these areas cannot be classified as remnant.

The area containing RE 12.3.11 had a very sparse canopy dominated by Queensland blue gum, associated with Narrow-leaved ironbark and Pink bloodwood. The median height of the canopy was 23m and the crown intercept ranged between 10 and 15%. The very sparse sub-canopy and low tree layers were dominated by the canopy species and Swamp box.

The isolated tall shrub layer was dominated by *Acacia* spp. and Black sheoak , with occurrences of Soap tree. The isolated to isolated low shrub layer was dominated by canopy and tall shrub species recruits, Lantana and *Acacia* spp.

The dense groundcover was dominated by Blady grass, Barbed wire grass and Wiry panic. Other commonly encountered species included Common rush (*Juncus usitatus*) and Common finger rush (*Fimbristylis dichotoma*).

No threatened species were identified in this area.

The area of non-remnant vegetation in the north was of interest as previous surveys had identified the threatened species Swamp tea-tree (*Melaleuca irbyanan*). Detailed traverse of this area failed to locate any individuals. It is suggested that this species was misidentified Melaleuca species present (i.e. *M.decora* or *M.linariifolia*).

The wetland area to the south is highly degraded and cannot be considered remnant, however the vegetation is representative of RE 12.3.11. No threatened species were identified in this area.

3.2 Significant Flora Species

Searches of Queensland's Wildlife Online database employed a 10km radius that was centred on the study area. This search identified a total of 206 vascular plant species of which 4 are listed as near threatened or threatened under either the NC Act and/or the EPBC Act. A search of the Commonwealth's Protected Matters database identified 13 species, which are listed as threatened under the EPBC Act.

The potential habitat for threatened flora species within the study area is low. The greater majority of the species that were identified during the desktop review are restricted to habitats that do not occur within the study area. These include littoral and sub-tropical rainforest.

Detailed traverses of the study area failed to locate any species of conservation significance.

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APPENDICES

Appendix A: LOCATION AND DESCRIPTION OF VEGETATION ASSESSMENT SITES

Waypoint	Zone	Easting	Northing	Assessment Site	DEHP mapped Regional Ecosystem	Field-validated Regional Ecosystem	Remnant Status	Vegetation Management Class	Photos
Vegetation Assessment Sites									
1	56			Q001	Non-rem	Non-rem	N	-	2484-2487
2	56			Q002	Non-rem	Non-rem	N	-	2529-2532
3	56			Q003	12.9-10.12/12.9-10.19a	12.9-10.12/12.9-10.19a	Y	Endangered	2554-2557
4	56			Q004	Non-rem	Non-rem	N	-	2560-2563
5	56			Q005	Non-rem	Non-rem	N	-	2566-2569
6	56			T001	12.3.11	12.3.11	Y	Endangered	2488-2493
7	56			T002	Non-rem	Non-rem	N	-	2497-2502
8	56			T003	Non-rem	Non-rem	N	-	2516-2520
9	56			T004	12.9-10.12/12.9-10.19a	12.9-10.12/12.9-10.19a	Y	Endangered	2523-2528
10	56			T005	12.9-10.12/12.9-10.19a	12.9-10.12/12.9-10.19a	Y	Endangered	2541-2546
11	56			T006	Non-rem	Non-rem	N	-	2548-2553

Appendix B: FLORA SPECIES LIST

Family	Scientific Name	Common Name	Status	T1	T2	T3	T4	T5	T6	Q1	Q2	Q3	Q4	Q5
Mimosaceae	*Acacia concurrens*	Black wattle	LC	1			2		1	1	1	1	1	
Mimosaceae	*Acacia disparrima* subsp. *disparrima*	Hickory wattle	LC			2	1	1		1	1	1	1	
Mimosaceae	*Acacia implexa*	Lightwood	LC	1									1	
Mimosaceae	*Acacia leiocalyx*	Early black wattle	LC	1			2	1	1		1	1	1	
Asteraceae	*Ageratum houstonianum*	Blue billygoat weed	*	1	2	2	1	1	2	1	1	1	2	1
Euphorbiaceae	*Alchornea ilicifolia*	Native holly	LC			1		1						
Casuarinaceae	*Allocasuarina littoralis*	Black she-oak	LC					1	2	1	3	1	1	
Poaceae	*Alloteropsis semialata*	Cockatoo grass	LC	1	3		2	1	1	1	1	1	1	
Rhamnanceae	*Alphitonia excelsa*	Soap tree	LC						1	1	1	1		
Ulmaceae	*Aphananthe philippinensis*	Rough-leaved elm	LC			1						1		
Poaceae	*Aristida queenslandica* var. *queenslandica*	ncn	LC	2			1	1	1	1	2	2	1	1
Poaceae	*Aristida vagans*	ncn	LC		1		1		1					
Proteaceae	*Banksia integrifolia*	Coastal banksia	LC	1						1	1			
Cyperaceae	*Baumea articulata*	Jointed twigrush	LC				2							1
Asteraceae	*Bidens pilosa*	Cobbler's pegs	*	1		1	1	1	1	1	1	1	1	1
Cyperaceae	*Bulbostylis barbata*	ncn	LC											1
Poaceae	*Capillipedium spicigerum*	Scentedtop	LC	4			1	1					1	
Ulmaceae	*Celtis sinesis*	Chinese elm	*			1					1			
Apiaceae	*Centella asiatica*	Pennywort	LC	1		1	1							1
Euphorbiaceae	*Chamaesyce dallachyana*	Caustic weed	LC		1	1			1					
Adiantaceae	*Cheilanthes distans*	Bristle cloak fern	LC	1		1	1	1		1	1		1	
Poaceae	*Chloris gayana*	Rhodes grass	*	1			1				1	1	1	1
Asteraceae	*Chrysocephalum apiculatum*	Yellow buttons	LC	2	2				1	1	1	1	1	1
Asteraceae	*Cirsium vulgare*	Spear thistle	*		1	1		1			1	1	1	1
Poaceae	*Cleistochloa subjuncea*	ncn	LC		2		2	1						
Commelinaceae	*Commelina diffusa*	Wandering jew	*					1				1		
Myrtaceae	*Corymbia citriodora*	Spotted gum	LC					2			1	1	1	
Myrtaceae	*Corymbia intermedia*	Pink bloodwood	LC		1		1	1	2	1	2	2	2	1
Fabaceae	*Crotalaria montana*	Rattlepod	LC		1		1	1				1		1
Poaceae	*Cymbopogon refractus*	Barbed wire grass	LC	3			2	2	2	2	2	2	2	1
Poaceae	*Cynodon dactylon* var. *dactylon*	Green couch	LC	1			3	3	3	1	2	2	1	1
Cyperaceae	*Cyperus gracilis*	Slender sedge	LC			1								1
Cyperaceae	*Cyperus haspan*	A flat sedge	LC		2	2	1				2			2

Poaceae	*Dactyloctenium radulans*	Button grass	LC	1			3	2	1	1	2	2	1	1
Hemerocallidaceae	*Dianella caerulea*	Flax lily	LC	1		1		1	1	1	1	1	1	1
Convovulaceae	*Dichondria repens*	Kidney weed	LC	2		2	1	1	1			1	1	2
Poaceae	*Digitaria ciliaris*	Summer grass	LC	1	3	2					1	2		
Poaceae	*Digitaria didactyla*	Queensland blue couch	LC	1			1	1	2	1	1	2	1	1
Poaceae	*Digitaria violascens*	Bastard summergrass	LC				2	2	2		1	2	2	
Croseraceae	*Drosera peltata*	Tall sundew	LC			1	1		1					1
Verbenaceae	*Duranata erecta*	Duranata	*			1								
Cyperaceae	*Eleocharis pallens*	Pale spike-sedge	LC											4
Cyperaceae	*Eleocharis philippinensis*	ncn	LC			1								4
Poaceae	*Entolasia stricta*	Wiry panic	LC	2	1	1	3	2	1		2	2	3	1
Poaceae	*Eragrostis brownii*	Brown's lovegrass	LC	1	2	2	3			1			1	1
Poaceae	*Eragrostis sororia*	Woodland lovegrass	LC	1	1			1	1		1	1	1	
Poaceae	*Eriochloa pseudoacrotricha*	Early spring grass	LC	2										
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved ironbark	LC		1		1					1	2	1
Myrtaceae	*Eucalyptus fibrosa* subsp. *fibrosa*	Broad-leaved ironbark	LC		1									
Myrtaceae	*Eucalyptus tereticornis*	Queensland blue gum	LC	3	3	3	3	3	3	3	3	3	3	2
Myrtaceae	*Eucalyptus seeana*	Fine-leaved red gum	LC		1	1	3		1	2	1	2		
Cyperaceae	*Fimbristylis dichotoma*	Common finger rush	LC	2	2	2	2	1			1	1	1	1
Cyperaceae	*Fuirena ciliaris*	ncn	LC				1	1			1			1
Juncaceae	*Juncus usitatus*	Common rush	LC	1		2								4
Scrophulariaceae	*Gratiola pendunculata*	ncn	LC					1			1			1
Fabaceae	*Glycine tabacina*	ncn	LC	1			1	1		1		1		
Apocynaceae	*Gomphocarpus physocarpus*	Ballon cotton bush	*		1	1		1			1	1		1
Amaranthaceae	*Gomphrena celosioides*	Soft khaki weed	LC	1								1		
Goodeninaceae	*Goodenia gracilis*	ncn	LC	1				1	1	1			1	
Dilleniaceae	*Hibbertia vestita*	ncn	LC				2							
Poaceae	*Imperata cylindrica*	Blady grass	LC	2	4	3	1		3	3	3	2	2	1
Verbenaceae	*Lantana camara*	Lantana	**WONS	1	1	1	1		1	1	1	1	1	
Anthericaceae	*Laxmannia gracilis*	Wire lily	LC	1			1	1	1	1			1	1
Cyperaceae	*Lepidosperma laterale* var. *laterale*	Variable swordsedge	LC	1			1				1			1
Campanulaceae	*Lobelia purpurascens*	White root	LC	2	2	2	1	2	1	1	1		1	
Campanulaceae	*Lobelia stenophhylla*	ncn	LC	1		1								
Myrtaceae	*Lophostemon suaveolons*	Swamp box	LC	1	1	1	1	1	1	1	2			1
Onagraceae	*Ludwigia octovalis*	Willow primrose	LC			1								2

Onagraceae	*Ludwigia peploides* subsp. *Montevidensis*	Water primrose	*												4
Moraceae	*Maclura cochinchinensis*	Cockspur thorn	LC				1	1			1	1			
Myrtaceae	*Melaleuca decora*	Decorative paperbark	LC										1		
Myrtaceae	*Melaleuca linariifolia*	Snow in summer	LC		1	1									
Myrtaceae	*Melaleuca saligna*	Willow bottlebrush	LC		1		1	1					1		
Myrtaceae	*Melaleuca quinquenervia*	Paperbark tea tree	LC							2			1		
Meliaceae	*Melia azedarach*	White cedar	LC			1							1		
Poaceae	*Melinis repens*	Red natal grass	*				1	1		1	1	1	1	1	
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping grass	LC		1		1	1			1	1			
Commelinaceae	*Murdannia graminea*	Slug lily	LC	1	1		1	1	1				1	1	
Apocynaceae	*Parsonsia straminea*	Monkey rope vine	LC	1		1		2		1	1	2			
Poaceae	*Paspalum dilatatum*	Paspalum	*	3	3	3		1	1	1	2	1			
Passifloraceae	*Passiflora suberosa*	Corky passion vine	*												
Polygonaceae	*Persicaria subsessilis*	A smartweed	LC		1	1								1	
Euphorbiaceae	*Petalostigma pubescens*	Quinine tree	LC				1	1			1	1			
Philydraceae	*Philydrum lanuginosum*	Woolly frogmouth	LC	1		1								1	
Phyllanthaceae	*Phyllanthus virgatus*	ncn	LC	1		1		1	1	1		1	1		
Phytolaccaceae	*Phytolacca octandra*	Inkweed	*					1							
Thymelaeaceae	*Pimelea linifolia*	Rice flower	LC	1											
Pinaceae	*Pinus elliottii*	Slash pine	*	1											
Asteraceae	*Senecio madagascariensis*	Fireweed	*	1				1							
Poaceae	*Schizachyrium fragile*	Fire grass	LC		1		1				1				
Cyperaceae	*Schoenoplectus litoralis*	Mangrove clubrush	LC	1		1	1				1			1	
Malvaceae	*Sida cordifolia*	Flannel weed	LC	1	1	1	1	1	1	1	1	1	1	1	
Malvaceae	*Sida rhombifolia*	Paddy's lucerne	LC		1			1	1				1		
Solanaceae	*Solanum linnaeanum*	Apple of sodom	*			1									
Solanaceae	*Solanum mauritianum*	Wild tobacco	*			1	1								
Solanaceae	*Solanum nigrum*	Blackberry nightshade	*		1	1	1	2	1	1	1	1	1	1	
Solanaceae	*Solanum seaforthianum*	Climbing/Brazilian nightshade	*			1									
Poaceae	*Themeda triandra*	Kangaroo grass	LC	1		1	1	1	1	2	3	2	2	1	
Anthericaceae	*Tricoryne elatior*	Yellow rush lily	LC	1						1				1	
Verbenaceae	*Vebena incompta*	ncn	*					1	1						
Asteraceae	*Xanthium occidentale*	Noogoora burr	*		1			1				1			
Xyridaceae	*Xyris complanata*	Feathered yellow-eye	LC	1	1	1	1							1	

Status indicates the Queensland conservation status of each taxon under the NC Regulation. The codes are Least Common (LC) and Naturalised Exotic (*). Threatened taxa were not recorded on site – Presumed Extinct (PE), Endangered (E), Vulnerable (V), Near Threatened (NT).

C3 refer to Class 3 pests that are listed under Queensland's *Lands Protection (Pest and Stock Route Management) Act 2002.*

WoNS refer to Weeds of National Significance as determined by the Australian Weeds Committee (2009-2012).

Relative abundance of species was based on the Braun-Blanquet technique cover-abundance scale (Mueller-Dombois & Ellenberg 1974, Whittaker 1975) as follows:

- + = individual specimen recorded
- **1** = sparse, <5%;
- **2** = any number, <5%;
- **3** = 5 – 24%;
- **4** = 25 – 49%;
- **5** = 50 – 74%; and,
- **6** = 75 – 100%.

Appendix C: FIELD DATA

QUATERNARY ASSESSMENT SITES

Date:	25/03/13	Collector:	Christopher Beavon	**Site:**	**Q001**
Time:	1230	Locality:	South Maclean, Qld.		
Mapped RE:	Non-rem	Field RE:	Non-rem	Lot on Plan:	

Description: Vegetation is representatvie of RE 12.9-10.12 - *Eucalyptus seeana, Eucalyptus tereticornis, Corymbia intermedia, Corymbia tessellaris* and *Melaleuca quinquenervia* open forest. Area has been thinned and low tree and shrub layers are very sparse to isolated.

Photos	Direction/Number:	N 2486	E 2485	S 2484	W 2487	GC
Structural Summary						
Remnant:	No	Zone:	56	Datum:		
Structure:	Open forest	Waypoint:	Q1	Easting:		Northing:
Stratum	Median	Height Range	Intercept	Dominance	Species	
T1	20.5	18-23	V-S 15-20%	d/c a	*Eucalyptus tereticornis, Eucalyptus seeana* *Corymbia intermedia*	
T2	16	14-18	V 5-10%	d/c a	T1 species and *Melaleuca quinquenervia* *Corymbia tessellaris*	

Plate 1: Q001 looking north

Plate 2: Q001 - looking east

Plate 3: Q001 – looking south

Plate 4: Q001 – looking west

Date:	25/03/13	**Collector:**	Christopher Beavon	**Site:**	**Q002**
Time:	1440	**Locality:**	South Maclean, Qld.		
Mapped RE:	Non-rem	**Field RE:**	Non-rem Lot on Plan:		

Description: Non-remnant vegetation representative of RE 12.9-10.12/12.9-10.19a. The canopy was dominated by *Eucalyptus tereticornis, Eucalyptus seeana* and *Corymbia intermedia*. The vegetation continued to the north until Crowson Lane and, both, to the east and west, and south until the power line easement.

Photos	Direction/Number:		N 2531	E 2530	S 2529	W 2532	GC
Structural Summary							
Remnant:	No	Zone:	56	Datum:			
Structure:	Open forest	Waypoint:	Q2	Easting:		Northing:	
Stratum	Median	Height Range	Intercept	Dominance	Species		
T1	18	16-20	V-S 15-20%	d/c	*Eucalyptus tereticornis, Eucalyptus seeana*		
				a	*Corymbia intermedia*		
T2	13	12-14	V 10-15%	d/c	T1 species and *Lophostemon suaveolons, Allocasuarina littoralis*		

Plate 5: Q002 looking north

Plate 6: Q002 - looking east

Plate 7: Q002 – looking south

Plate 8: Q002 – looking west

Date:	25/03/13	**Collector:**	Christopher Beavon	**Site:**	**Q003**
Time:	1620	**Locality:**	South Maclean, Qld.		
Mapped RE:	12.9-10-12/12.9-10.19a	**Field RE:**	12.9-10-12/12.9-10.19a	Lot on Plan:	

Description: Non-remnant vegetation representative of RE 12.9-10.12/12.9-10.19a. The canopy was dominated by *Eucalyptus tereticornis, Eucalyptus seeana, Eucalyptus crebra, Corymbia citriodora* and *Corymbia intermedia.* The vegetation continued to the south gradually getting thinner until becoming cleared areas/house block. Vegetation continued to the north. To the east was cleared grazing areas. To the west was thin non-remnant vegetation and cleared areas. Shrub layer very isolated. Ground cover was mix pasture grasses, weeds and native grasses.

Photos	Direction/Number:		N 2556	E 2555	S 2554	W 2557	GC

Structural Summary

Remnant:	Yes	Zone:	56	Datum:	
Structure:	Open forest	Waypoint:	Q3	Easting:	Northing:
Stratum	Median	Height Range	Intercept	Dominance	Species
T1	20	18-22	V-S 15-25%	d/c	*Eucalyptus tereticornis, Eucalyptus seeana*
				a	*Corymbia intermedia, Corymbia citriodora*
				a	*Eucalyptus crebra*
T2	16.5	15-18	V -S 15-20%	d/c	T1 species

Plate 9: Q003 looking north

Plate 10: Q003 - looking east

Plate 11: Q003 – looking south

Plate 12: Q003 – looking west

Date:	25/03/13	**Collector:**	Christopher Beavon	**Site:**	**Q004**
Time:	1710	**Locality:**	South Maclean, Qld.		
Mapped RE:	Non-rem	**Field RE:**	Non-rem Lot on Plan:		

Description: Non-remnant vegetation representative of RE 12.9-10.12/12.9-10.19a. The canopy was dominated by *Eucalyptus tereticornis* and *Eucalyptus crebra* with *Corymbia intermedia* and *Eucalyptus seeana*. The low tree layer was dominated by *Melaleuca quinquenervia*. The vegetation continued to the south gradually getting thinner until becoming cleared areas. To the north was the power line easement. To the east was remnant vegetation of RE 12.9-10.12/12.9-10.19a and to the west non-remnant vegetation and the house block on the neighbouring property

Photos Direction/Number: N 2562 E 2561 S 2560 W 2563 GC

Structural Summary

Remnant: No Zone: 56 Datum:

Structure: Open forest Waypoint: Q4 Easting: Northing:

Stratum	Median Height	Range	Intercept	Dominance	Species
T1	22	20-24	V 10-15%	d	*Eucalyptus tereticornis*
				a	*Eucalyptus crebra*
				s	*Corymbia intermedia, Corymbia citriodora*
T2	19	18-20	V -S 15-25%	d/c	T1 species and *Melaleuca quinquenervia*

Plate 13: Q004 looking north

Plate 14: Q004 - looking east

Plate 15: Q004 – looking south

Plate 16: Q004 – looking west

Date:	25/03/13	**Collector:**	Christopher Beavon	**Site:**	**Q005**
Time:	1730	**Locality:**	South Maclean, Qld.		
Mapped RE:	Non-rem	**Field RE:**	Non-rem Lot on Plan:		

Description: Non-remnant vegetation representative of RE 12.3.11. The canopy was dominated by *Eucalyptus tereticornis and Eucalyptus crebra* and *Corymbia intermedia*. The low tree layer was dominated by T1 species with *Lophostemon suaveolons*. The shrub layer was very isolated to non-existent. To the south (outside of property boundry) the vegetation becomes more dense and is mapped a remnant. To the north, east and west areas are cleared for grazing.

Photos Direction/Number: N 2568 E 2567 S 2566 W 2569 GC

Structural Summary

Remnant:	No	Zone:	56	Datum:	
Structure:	Open forest/ Wetland	Waypoint:	Q5	Easting:	Northing:
Stratum	Median	Height Range	Intercept	Dominance	Species
T1	23	21-25	V 5-10%	d a	*Eucalyptus tereticornis* *Corymbia intermedia, Eucalyptus crebra*
T2	18	16-20	V 5%	d/c	T1 species and *Lophostemon suaveolons*

Plate 17: Q005 looking north

Plate 18: Q005 - looking east

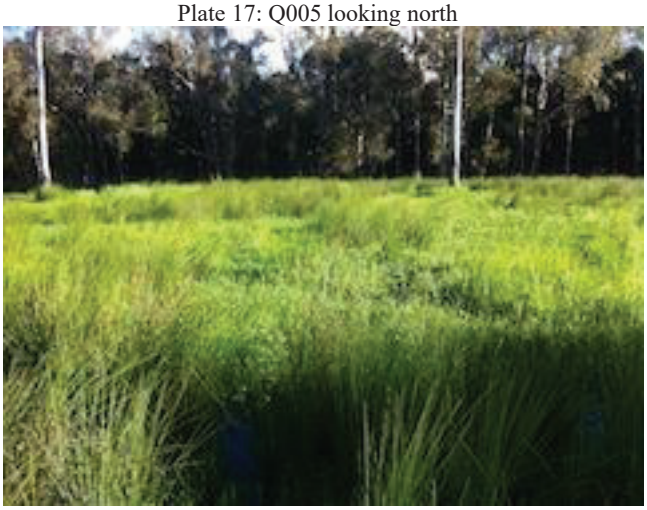


Plate 19: Q005 – looking south

Plate 20: Q005 – looking west

TERTIARY ASSESSMENT SITE

Date:	25/03/2013	**Collector:**	Christopher Beavon	**Site:**	**T001**
Time:	1320	**Locality:**	South Maclean, Qld.		
Mapped RE:	12.3.11	**Field RE:**	12.3.11	**Lot on Plan:**	

Description: *Eucalyptus tereticornis, Eucalyptus crebra* and *Corymbia intermedia* open forest. Area was inundated with water and appears to hold water for extended periods. The edges of this area may need to be extended.

Photos	Direction/Number:	N 2490	E 2489	S 2488	W 2491	GC 2492
Landform						
Situation:	Open depression	Element:	Drainage depression	Erosion:	-	Pattern: -
Slope						
Types:	-	Slope (%):	-	Aspect:	-	
Soils						
Colour:	Red-brown	Texture:	Loam-clay	Surface Photo	2493	
Geology						
Source:	Maps	Reliability:	L	Code:	Map Unit:	
Groundcover (%)						
Litter 5	Bare Ground 0	Timber <1	Rock 0	Cryptophyte <5	Vegetation 90	
Structural Summary						
Remnant:	Yes	Zone:	56	Datum:	GDA 1994 MGA	
Structure:	Open forest	Waypoint:	T1	Easting:	Northing:	

Stratum	**Median**	**Height Range**	**Intercept**	**Dominance**	**Species**
T1	23	20-26	V 10-15%	d	*Eucalyptus tereticornis*
				a	*Eucalyptus crebra, Corymbia intermedia*
T2	18	16-20	V 5-10%	d/a	T1 Species
T3	12	10-14	I 2%	d/c	T1 Species and *Lophostemon suaveolons*
S1	2.75	2-3.5	I 2%	d/c	*Acacia concurrens*, *Acacia leiocalyx, Acacia disparrima, Alphitonia excels, Allocasuarina littoralis*
				a	T1 recruits
S2	1	0.5-1.5	I 2%	a	*Acacia* spp., *Lantana camara*
G	0.3	0.01-0.5	D 80-90%	d/c	*Imperata cylindrica, Cymbopogon refractus, Entolasia stricta*
				a	*Juncus usitatus, Fimbristylis dichotoma*

Herbarium RE definitions

dominance: **d** - dominant; **c** - co-dominant; **a** - associated; **s** - suppressed

crown cover intercept: I: isolated (0.2-2%); **V:** very sparse (2-20%), **S:** sparse (20-50%); **M:** mid-dense (50-80%); **D:** dense (80-100%)

Walter and Hopkins height classess: **1-3m** - dwarf, **3-6m** - low, **6-12m** - mid-high, **12-20m** - tall, **20-35m** - very tall, >35m - *extremely tall*

Walter and Hopkins crown cover classes: <0.2% - isolated trees or clumps; 0.2-20% - open woodland, 20-50% - woodland; 50-80% - open forest, 80-100% - closed forest							
BASAL AREA [fixed point Bitterlich technique: factor 1cm]						**CONDITION**	
Species	**S1**	**T3**	**T2**	**T1**	**E**	**Type**	**Severity (0 to 3)**
E.tereticornis		6	10	12		**Fire (& height in m)**	-
E. crebra		4	6	9		**Clearing**	-
						Thinning/Ringbarking	1
						Grazing	-
						Exotic Flora	1
						Canopy Dieback	-
						Erosion	-
						Recruitment	<1

Plate 21: T001 looking north

Plate 22: T001 - looking east

Plate 23: T001 – looking south

Plate 24: T001 – looking west

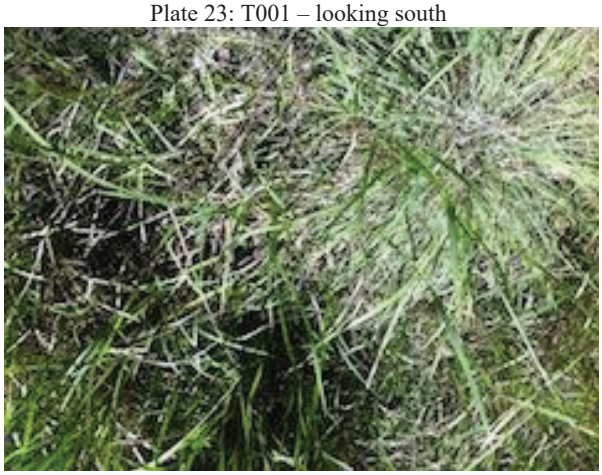


Plate 25: T001 – ground cover

Plate 26: T001 – surface soil

Date:	25/03/2013	**Collector:**	Christopher Beavon			**Site:**	**T002**
Time:	1400	**Locality:**	South Maclean, Qld.				
Mapped RE:	Non-rem	**Field RE:**	Non-rem	**Lot on Plan:**			

Description: The sparse canopy was dominated by *Eucalyptus tereticornis* and *Eucalyptus crebra*, with *Eucalyptus fibrosa* and *Corymbia intermedia*. The low tree layer includes *Lophostemon suaveolons*. The shrub layer is very isolated and the gorund cover is dominated by pasture grasses. The vegetation to the south becomes more sparse until the power line easement.

Photos	Direction/Number:	N 2499		E 2498			S 2497		W 2500		GC 2501
Landform											
Situation:	Plain	Element:		Gently undulating		Erosion:	-			Pattern	-
Slope											
Types:	Very gentle		Slope (%):	<3%			Aspect:			Northwest	
Soils											
Colour:	Brown		Texture:	Sand-loam			Surface Photo			2502	
Geology											
Source:	Maps	Reliability:		L		Code:				Map Unit:	
Groundcover (%)											
Litter	<5	Bare Ground	0	Timber	<5	Rock	0	Cryptophyte	<5	Vegetation	85-90
Structural Summary											
Remnant:	No	Zone:		56		Datum:	GDA 1994 MGA				
Structure:	Open forest	Waypoint:		T2		Easting:				Northing:	

Stratum	**Median Height**	**Height Range**	**Intercept**	**Dominance**	**Species**
T1	18	16-20	V 5-10%	d	*Eucalyptus tereticornis, Eucalyptus crebra*
T2	13	12-14	V 5%	d/a	T1 Species, *Corymbia intermedia*, *Eucalyptus fibrosa*
T3	11	10-12	I 2%	d/c	*Lophostemon suaveolons, Allocasuarina littoralis*
S1	6.5	5-8	I 2%	s	*Allocasuarina littoralis, Alphitonia excelsa*
S2	-	-	-		
G	0.15	0.01-0.3	D 85-90%	d/c a	*Imperata cylindrica, Paspalum dilatatum Cymbopogon refractus, Fimbristylis dichotoma Digitaria didactyla*

Herbarium RE definitions

dominance: **d -** dominant; **c** - co-dominant; **a** - associated; **s** - suppressed

crown cover intercept: I: isolated (0.2-2%); **V:** very sparse (2-20%), **S:** sparse (20-50%); **M:** mid-dense (50-80%); **D:** dense (80-100%)

Walter and Hopkins height classess: **1-3m** - dwarf, **3-6m** - low, **6-12m** - mid-high, **12-20m** - tall, **20-35m** - very tall, >35m - *extremely tall*

Walter and Hopkins crown cover classes: <0.2% - isolated trees or clumps; 0.2-20% - open woodland, 20-50% - woodland; 50-80% - open forest, 80-100% - closed forest							
BASAL AREA [fixed point Bitterlich technique: factor 1cm]						**CONDITION**	
Species	**S1**	**T3**	**T2**	**T1**	**E**	**Type**	**Severity (0 to 3)**
E.tereticornis		3	6	12		**Fire (& height in m)**	-
E.crebra		1	1	4		**Clearing**	1
E.fibrosa			1			**Thinning/Ringbarking**	2
C.intermedia		2	1			**Grazing**	1
L.suaveolons		1				**Exotic Flora**	2
A.littoralis	1	1				**Canopy Dieback**	-
						Erosion	-
						Recruitment	<1

Plate 27: T002 looking north

Plate 28: T002 - looking east

Plate 29: T002 – looking south

Plate 30: T002 – looking west

Plate 31: T002 – ground cover

Plate 32: T002 – surface soil

Date:	25/03/2013	**Collector:**	Christopher Beavon	**Site:**	**T003**
Time:	1420	**Locality:**	South Maclean, Qld.		
Mapped RE:	Non-rem	**Field RE:**	Non-rem	**Lot on Plan:**	

Description: Non-remnant vegetation representative of RE 12.9-10.12/12.3.11. Canopy dominated by *Eucalyptus tereticornis*, with a low tree layer of *Melaleuca quinquenervia* and *Lophostemon suaveolons*. Area was inundated with water and appears to hold water for extended periods. The vegetation continued to the north until Crowson Lane and, both, to the east and west. To the south was a swampy area dominated by *Melaleuca quinquenervia*, *M. saligna* and *M. linariifolia, M. decora*.

Photos	Direction/Number:	N 2517	E 2516		S 2515	W 2518		GC 2519	
Landform									
Situation:	Open depression	Element:	Drainage depression	Erosion:	-		Pattern	-	
Slope									
Types:	-	Slope (%):	-		Aspect:		-		
Soils									
Colour:	Brown	Texture:	Clay-loam-sand		Surface Photo		2520		
Geology									
Source:	Maps	Reliability:	L	Code:			Map Unit:		
Groundcover (%)									
Litter 5	Bare Ground	0	Timber 0	Rock	0	Cryptophyte	5	Vegetation	70-80
Structural Summary									
Remnant:	No	Zone:	56	Datum:	GDA 1994 MGA				
Structure:	Open forest	Waypoint:	T3	Easting:			Northing:		

Stratum	**Median**	**Height Range**	**Intercept**	**Dominance**	**Species**
T1	21	18-24	V 10-15%	d	*Eucalyptus tereticornis*
				a	*Melaleuca saligna*
T2	14.5	13-16	V 10-15%	d	T1 Species
				a	*Melaleuca saligna*
				s	*Eucalyptus crebra*
T3	11.5	10-13	I 2%	d	*Lophostemon suaveolons*
S1	4.75	2.5-7	V 5-10%	s	*Melaleuca decora, Melaleuca saligna*

				d	*Allocasuarina littoralis*
S2	1.5	0.5-2.5	I 2%	s	*Alphitonia excelsa*
G	0.3	0.01-0.5	D 70-80%	d/c a s	*Imperata cylindrica,* *Fimbristylis dichotoma, Juncus usitatus* *Ludwigia octovalis*

Herbarium RE definitions

dominance: **d -** dominant; **c** - co-dominant; **a** - associated; **s** - suppressed

crown cover intercept: I: isolated (0.2-2%); **V:** very sparse (2-20%), **S:** sparse (20-50%); **M:** mid-dense (50-80%); **D:** dense (80-100%)

Walter and Hopkins height classess: **1-3m** - dwarf, **3-6m** - low, **6-12m** - mid-high, **12-20m** - tall, **20-35m** - very tall, >35m - *extremely tall*

Walter and Hopkins crown cover classes: <0.2% - isolated trees or clumps; 0.2-20% - open woodland, 20-50% - woodland; 50-80% - open forest, 80-100% - closed forest

BASAL AREA [fixed point Bitterlich technique: factor 1cm]						**CONDITION**	
Species	**S1**	**T3**	**T2**	**T1**	**E**	**Type**	**Severity (0 to 3)**
E.tereticornis		4	3	7	2	**Fire (& height in m)**	-
E.crebra			1			**Clearing**	-
M.saligna	4	7	3			**Thinning/Ringbarking**	<1
M.decora	1	1				**Grazing**	<1
L.suaveolons		2	1			**Exotic Flora**	<1
A.littoralis	1	1				**Canopy Dieback**	-
						Erosion	-
						Recruitment	1-2

Plate 33: T003 looking north

Plate 34: T003- looking east

Plate 34: T003 – looking south

Plate 36: T003 – looking west

Plate 37: T003 – ground cover

Plate 38: T003 – surface soil

Date:	25/03/2013	**Collector:**	Christopher Beavon	**Site:**	**T004**
Time:	1520	**Locality:**	South Maclean, Qld.		
Mapped RE:	12.9-10.12/ 12.9-10.19a	**Field RE:**	12.9-10.12/ 12.9-10.19a	**Lot on Plan:**	

Description: Remnant vegetation analgous with RE 12.9-10.12/12.9-10-19a. The canopy was dominated by *Eucalyptus tereticornis*, *Eucalyptus seeana* and *Corymbia intermedia*. The low tree layer and shrub layer were sparse to isolated, and the ground cover was a mix a native grasses and pasture grasses. The vegetation to the north, east and west was non-remnant representative of REs 12.9-10.12/12.9-10-19a, south was the power line easement.

Photos	Direction/Number:	N 2525	E 2524	S 2523	W 2526	GC 2527					
Landform											
Situation:	Plain	Element:	Gently undulating	Erosion:	-	Pattern	-				
Slope											
Types:	-	Slope (%):	-	Aspect:	-						
Soils											
Colour:	Brown	Texture:	Sand-loam	Surface Photo	2528						
Geology											
Source:	Maps	Reliability:	L	Code:	Map Unit:						
Groundcover (%)											
Litter	<5	Bare Ground	0	Timber	<5	Rock	0	Cryptophyte	<2	Vegetation	85-95
Structural Summary											
Remnant:	Yes	Zone:	56	Datum:	GDA 1994 MGA						
Structure:	Open forest	Waypoint:	T4	Easting:	Northing:						

Stratum	**Median Height**	**Height Range**	**Intercept**	**Dominance**	**Species**
T1	18	16-20	V 10-15%	d a	*Eucalyptus tereticornis, Eucalyptus seeana* *Corymbia intermedia*
T2	13	12-14	V 10-15%	d a	T1 Species *Lophostemon suaveolons*
T3	11	10-12	I 2%	d	*Lophostemon suaveolons*
S1	5.5	3-8	V 5%	a	*Acacia disparrima, Acacia concurrens* *Corymbia intermedia*

				a	*Lantana camara, Solanum nigrum*
S2	0.75	0.5-1	I 2%	s	*Acacia leiocalyx*
G	0.15	0.01-0.3	D 80-90%	d/c a	*Cynodon dactylon var. dactylon, Dactyloctenium radulans, Entolasia stricta* *Themeda triandra, Cymbopogon refractus,*

Herbarium RE definitions

dominance: **d** - dominant; **c** - co-dominant; **a** - associated; **s** - suppressed

crown cover intercept: I: isolated (0.2-2%); **V:** very sparse (2-20%), **S:** sparse (20-50%); **M:** mid-dense (50-80%); **D:** dense (80-100%)

Walter and Hopkins height classess: **1-3m** - dwarf, **3-6m** - low, **6-12m** - mid-high, **12-20m** - tall, **20-35m** - very tall, >35m - *extremely tall*

Walter and Hopkins crown cover classes: <0.2% - isolated trees or clumps; 0.2-20% - open woodland, 20-50% - woodland; 50-80% - open forest, 80-100% - closed forest

BASAL AREA [fixed point Bitterlich technique: factor 1cm]						**CONDITION**	
Species	**S1**	**T3**	**T2**	**T1**	**E**	**Type**	**Severity (0 to 3)**
E.tereticornis		2	3	14		**Fire (& height in m)**	-
E.seeana		1	3	4		**Clearing**	1
C.intermedia			1	4		**Thinning/Ringbarking**	1-2
L.suaveolons		1	2			**Grazing**	2
A.concurrens	3					**Exotic Flora**	1
						Canopy Dieback	1
						Erosion	-
						Recruitment	-

Plate 39: T004 looking north

Plate 40: T004 - looking east

Plate 41: T004 – looking south

Plate 42: T004 – looking west

Plate 43: T004 – ground cover

Plate 44: T004 – surface soil

Date:	25/03/2013	**Collector:**	Christopher Beavon	**Site:**	**T005**
Time:	1550	**Locality:**	South Maclean, Qld.		
Mapped RE:	12.9-10.12/12.9-10.19a	**Field RE:**	12.9-10.12/12.9-10.19a	**Lot on Plan:**	

Description: Remnant vegetation analgous with RE 12.9-10.12/12.9-10-19a. The canopy was dominated by *Eucalyptus tereticornis*, *Eucalyptus seeana, Corymbia citriodora* and *Corymbia intermedia*. The low tree layer and shrub layer were sparse to isolated, and the ground cover was a mix a native grasses and pasture grasses. The vegetation to the west was non-remnant representative of REs 12.9-10.12/12.9-10-19a. To the north and east was the power line easement and cleared areas. To the south was non-remnant vegetation.

Photos	Direction/Number:	N 2543	E 2542	S 2541	W 2544	GC 2545
Landform						
Situation:	Gentle slope	Element:	Gently undulating	Erosion:	-	Pattern -
Slope						
Types:	Mid slope	Slope (%):	<5	Aspect:	East	
Soils						
Colour:	Red-brown	Texture:	Loam-sand	Surface Photo	2546	
Geology						
Source:	Maps	Reliability:	L	Code:	Map Unit:	
Groundcover (%)						
Litter 0	Bare Ground 0	Timber <5	Rock 0	Cryptophyte <1	Vegetation 85-95	
Structural Summary						
Remnant:	Yes	Zone:	56	Datum:	GDA 1994 MGA	
Structure:	Open forest	Waypoint:	T5	Easting:	Northing:	

Stratum	**Median Height**	**Height Range**	**Intercept**	**Dominance**	**Species**
T1	20	18-22	V-S 20%	d	*Eucalyptus tereticornis, Eucalyptus seeana*
				a	*Corymbia intermedia, Corymbia sitriodora*
T2	15	14-16	V 10-15%	d	T1 Species
				s	Stags
T3	11	10-12	V 5-10%	a	T1 Species and *Acacia concurrens*
S1	7	6-8	V 5%	a	*Allocasaurina littoralis, Acacia concurrens*
S2	0.75	0.5-1	I 2%	a	*Lantana camara, Solanum nigrum*
				s	*Alchornea ilicifolia*
G	0.15	0.01-0.3	D 85-95%	d/c	*Cymbopogon refractus, Cynodon dactylon var. dactylon*
				a	*Dactyloctenium radulans*
				s	*Themeda triandra*

Herbarium RE definitions

dominance: **d -** dominant; **c** - co-dominant; **a** - associated; **s** - suppressed

crown cover intercept: I: isolated (0.2-2%); **V:** very sparse (2-20%), **S:** sparse (20-50%); **M:** mid-dense (50-80%); **D:** dense (80-100%)

Walter and Hopkins height classess: **1-3m** - dwarf, **3-6m** - low, **6-12m** - mid-high, **12-20m** - tall, **20-35m** - very tall, >35m - *extremely tall*

Walter and Hopkins crown cover classes: <0.2% - isolated trees or clumps; 0.2-20% - open woodland, 20-50% - woodland; 50-80% - open forest, 80-100% - closed forest

BASAL AREA [fixed point Bitterlich technique: factor 1cm]						CONDITION	
Species	**S1**	**T3**	**T2**	**T1**	**E**	**Type**	**Severity (0 to 3)**
E.tereticornis		2	2	14		**Fire (& height in m)**	1
E.seeana			1	2		**Clearing**	1-2
C.intermedia		2	2	2		**Thinning/Ringbarking**	1-2
C.citriodora			1	1		**Grazing**	2
A.concurrens		1	1			**Exotic Flora**	1
A.littoralis	3	1				**Canopy Dieback**	-
Stag			5	2		**Erosion**	-
						Recruitment	-

Plate 45: T005 looking north

Plate 46: T005 - looking east

Plate 47: T005 – looking south

Plate 48: T005 – looking west

Plate 49: T005 – ground cover

Plate 50: T005 – surface soil

Date:	25/03/2013	**Collector:**	Christopher Beavon	**Site:**	**T006**
Time:	1650	**Locality:**	South Maclean, Qld.		
Mapped RE:	Non-rem	**Field RE:**	Non-rem	**Lot on Plan:**	

Description: Non-remnant vegetation representative of RE 12.9-10.12/12.9-10.19a. The canopy was dominated by Eucalyptus tereticornis, Eucalyptus seeana, Corymbia citriodora and Corymbia intermedia. The vegetation continued to the south gradually getting thinner until becoming cleared areas. To the north was the power line easement. To the east was remnant vegetation of RE 12.9-10.12/12.9-10.19a and to the west non-remnant vegetation continued.

Photos	Direction/Number:	N 2550	E 2549	S 2548	W 2551	GC 2552
Landform						
Situation:	Gentle slope	Element:	Gently undulating	Erosion:	-	Pattern -
Slope						
Types:	Top of slope	Slope (%):	<3	Aspect:	Southeast	
Soils						
Colour:	Red-brown	Texture:	Sand-loam	Surface Photo	2553	
Geology						
Source:	Maps	Reliability:	L	Code:	Map Unit:	
Groundcover (%)						
Litter <5	Bare Ground <5	Timber <5	Rock 0	Cryptophyte <1	Vegetation 80-90	
Structural Summary						
Remnant:	No	Zone:	56	Datum:	GDA 1994 MGA	
Structure:	Open forest	Waypoint:	T6	Easting:	Northing:	

Stratum	**Median**	**Height Range**	**Intercept**	**Dominance**	**Species**
T1	21	20-22	V 15-20%	d	*Eucalyptus tereticornis, Eucalyptus seeana*
				a	*Corymbia intermedia*
T2	17	16-18	V 10-15%	d	T1 Species
				s	*Lophostemon suaveolons*
T3	13	12-14	V 5-10%	a	T1/T2 Species
S1	6	4-8	V 5%	a	*Allocasaurina littoralis, Acacia concurrens*
					Acacia leiocalyx
S2	0.75	0.5-1	I 2%	a	*Lantana camara, Solanum nigrum*
G	0.3	0.01-0.5	D 80-90%	d/c	*Imperata cylindrica, Cymbopogon refractus, Cynodon dactylon var. dactylon*
				a	*Dactyloctenium radulans*
				s	*Themeda triandra*

Herbarium RE definitions

dominance: **d** - dominant; **c** - co-dominant; **a** - associated; **s** - suppressed

crown cover intercept: I: isolated (0.2-2%); **V:** very sparse (2-20%), **S:** sparse (20-50%); **M:** mid-dense (50-80%); **D:** dense (80-100%)

Walter and Hopkins height classess: **1-3m** - dwarf, **3-6m** - low, **6-12m** - mid-high, **12-20m** - tall, **20-35m** - very tall, >35m - *extremely tall*

Walter and Hopkins crown cover classes: <0.2% - isolated trees or clumps; 0.2-20% - open woodland, 20-50% - woodland; 50-80% - open forest, 80-100% - closed forest

BASAL AREA [fixed point Bitterlich technique: factor 1cm]						CONDITION	
Species	**S1**	**T3**	**T2**	**T1**	**E**	**Type**	**Severity (0 to 3)**
E.tereticornis		2	2	8		**Fire (& height in m)**	-
E.seeana			2	4		**Clearing**	1
C.intermedia		1	4	7		**Thinning/Ringbarking**	1-2
A.littoralis	1	2				**Grazing**	1-2
L.suaveolons			1			**Exotic Flora**	2
						Canopy Dieback	-
						Erosion	-
						Recruitment	-

Plate 51: T006 looking north

Plate 52: T006 - looking east

Plate 53: T006 – looking south

Plate 54: T006 – looking west

Plate 55: T006 – ground cover

Plate 56: T006 – surface soil

Appendix 8 to the Technical Attachment 1

28 SOUTH Environmental

Coordinate System: GDA 1994 MGA Zone 56
Reference Scale: 1:5000
Project Name : South Maclean
Title : Figure 5 - Koala Survey Effort

0 30 60 120 180 240 300 Meters

N

Background imagery is supplied by Bing, and is not to be used for measurement. For visualisation purposes only.

Document Path: V:\GIS\28_South\South_Maclean\Admin\mxd\SouthMaclean_Koala_Survey_Effort_Fig5_A3.mxd

SOUTH MACLEAN KOALA SCAT SEARCH Friday 5th April 2013

PLOT A

Vegetation analogous with RE 12.9-10.12 - *Eucalyptus seeana, Eucalyptus tereticornis, Corymbia intermedia, Corymbia tessellaris* and *Melaleuca quinquenervia* open forest.

This site was bordered by Crowson Lane to the north and merged into non-remnant vegetation then RE 12.3.11 to the south. To the west was non-remnant vegetation and the to the east was the Mount Lindesay Highway.

Tree ID	Species	Common Name	DBH	Koala Scats Present (Y/-)
A1	*Eucalyptus tereticornis*	Queensland blue gum	50	-
A2	*Eucalyptus seeana*	Fine-leaved red gum	30	-
A3	*Eucalyptus tereticornis*	Queensland blue gum	45	Y
A4	*Eucalyptus seeana*	Fine-leaved red gum	40	-
A5	*Eucalyptus seeana*	Fine-leaved red gum	30	-
A6	*Melaleuca quinquenervia*	Paperbarked tea tree	20	-
A7	*Eucalyptus seeana*	Fine-leaved red gum	55	-
A8	*Eucalyptus tereticornis*	Queensland blue gum	25	-
A9	*Eucalyptus tereticornis*	Queensland blue gum	20	-
A10	*Corymbia tessellaris*	Moreton Bay ash	20	-
A11	*Eucalyptus tereticornis*	Queensland blue gum	25	-
A12	*Eucalyptus tereticornis*	Queensland blue gum	40	-
A13	*Eucalyptus tereticornis*	Queensland blue gum	25	Y
A14	*Melaleuca quinquenervia*	Paperbarked tea tree	30	-
A15	*Eucalyptus tereticornis*	Queensland blue gum	20	-
A16	*Eucalyptus tereticornis*	Queensland blue gum	40	-
A17	*Eucalyptus tereticornis*	Queensland blue gum	30	Y
A18	*Eucalyptus tereticornis*	Queensland blue gum	40	Y
A19	*Eucalyptus tereticornis*	Queensland blue gum	70	Y
A20	*Eucalyptus tereticornis*	Queensland blue gum	55	Y
A21	*Eucalyptus tereticornis*	Queensland blue gum	25	Y
A22	*Corymbia intermedia*	Pink bloodwood	35	Y
A23	*Eucalyptus seeana*	Fine-leaved red gum	40	Y
A24	*Eucalyptus seeana*	Fine-leaved red gum	35	Y
A25	*Eucalyptus seeana*	Fine-leaved red gum	25	Y
A26	*Eucalyptus tereticornis*	Queensland blue gum	30	-
A27	*Eucalyptus seeana*	Fine-leaved red gum	30	-
A28	*Eucalyptus seeana*	Fine-leaved red gum	30	-
A29	*Eucalyptus tereticornis*	Queensland blue gum	50	-
A30	*Eucalyptus tereticornis*	Queensland blue gum	55	Y
				12/30=40%

PLOT B

Vegetation analogous with RE 12.3.11 - *Eucalyptus tereticornis, Eucalyptus crebra* and *Corymbia intermedia* open forest. Area was inundated with water and appears to hold water for extended periods.

This site was located on the northeast of the site and surrounded by non-remnant vegetation.

Tree ID	Species	Common Name	DBH	Koala Scats Present (Y/N)
B1	*Eucalyptus tereticornis*	Queensland blue gum	65	Y
B2	*Eucalyptus crebra*	Narrow-leaved ironbark	25	-
B3	*Eucalyptus tereticornis*	Queensland blue gum	20	-
B4	*Eucalyptus tereticornis*	Queensland blue gum	25	-
B5	*Eucalyptus tereticornis*	Queensland blue gum	30	-
B6	*Eucalyptus tereticornis*	Queensland blue gum	35	-
B7	*Eucalyptus crebra*	Narrow-leaved ironbark	45	Y
B8	*Eucalyptus tereticornis*	Queensland blue gum	50	-
B9	*Eucalyptus tereticornis*	Queensland blue gum	60	-
B10	*Eucalyptus crebra*	Narrow-leaved ironbark	45	-
B11	*Eucalyptus tereticornis*	Queensland blue gum	20	-
B12	*Eucalyptus tereticornis*	Queensland blue gum	20	-
B13	*Eucalyptus tereticornis*	Queensland blue gum	25	-
B14	*Eucalyptus tereticornis*	Queensland blue gum	35	Y
B15	*Eucalyptus tereticornis*	Queensland blue gum	25	Y
B16	*Eucalyptus tereticornis*	Queensland blue gum	30	Y
B17	*Eucalyptus crebra*	Narrow-leaved ironbark	30	Y
B18	*Eucalyptus tereticornis*	Queensland blue gum	25	Y
B19	*Eucalyptus crebra*	Narrow-leaved ironbark	35	-
B20	*Eucalyptus tereticornis*	Queensland blue gum	25	-
B21	*Eucalyptus tereticornis*	Queensland blue gum	30	-
B22	*Eucalyptus tereticornis*	Queensland blue gum	60	Y
B23	*Eucalyptus tereticornis*	Queensland blue gum	50	Y
B24	*Eucalyptus tereticornis*	Queensland blue gum	30	-
B25	*Eucalyptus crebra*	Narrow-leaved ironbark	35	Y
B26	*Corymbia intermedia*	Pink bloodwood	30	-
B27	*Eucalyptus crebra*	Narrow-leaved ironbark	35	Y
B28	*Eucalyptus tereticornis*	Queensland blue gum	30	
B29	*Eucalyptus tereticornis*	Queensland blue gum	25	Y
B30	*Eucalyptus tereticornis*	Queensland blue gum	25	
				12/30=40%

PLOT C

This plot was located in non-remnant vegetation south of Plots A and B. The sparse canopy was dominated by *Eucalyptus tereticornis* and *Eucalyptus crebra.* The vegetation to the south became more sparse until the power line easement.

Tree ID	Species	Common Name	DBH	Koala Scats Present (Y/N)
C1	*Eucalyptus tereticornis*	Queensland blue gum	30	Y
C2	*Eucalyptus tereticornis*	Queensland blue gum	20	-
C3	*Eucalyptus tereticornis*	Queensland blue gum	30	-
C4	*Eucalyptus tereticornis*	Queensland blue gum	25	-
C5	*Eucalyptus tereticornis*	Queensland blue gum	30	-
C6	*Eucalyptus tereticornis*	Queensland blue gum	30	-
C7	*Eucalyptus tereticornis*	Queensland blue gum	30	-
C8	*Eucalyptus tereticornis*	Queensland blue gum	35	-
C9	*Eucalyptus tereticornis*	Queensland blue gum	35	-
C10	*Eucalyptus tereticornis*	Queensland blue gum	30	-
C11	*Eucalyptus tereticornis*	Queensland blue gum	30	-
C12	*Eucalyptus crebra*	Narrow-leaved ironbark	40	Y
C13	*Eucalyptus tereticornis*	Queensland blue gum	35	Y
C14	*Eucalyptus tereticornis*	Queensland blue gum	40	Y
C15	*Eucalyptus crebra*	Narrow-leaved ironbark	35	-
C16	*Eucalyptus crebra*	Narrow-leaved ironbark	35	-
C17	*Eucalyptus tereticornis*	Queensland blue gum	25	Y
C18	*Eucalyptus crebra*	Narrow-leaved ironbark	35	-
C19	*Eucalyptus tereticornis*	Queensland blue gum	25	-
C20	*Eucalyptus tereticornis*	Queensland blue gum	25	-
C21	*Eucalyptus tereticornis*	Queensland blue gum	25	-
C22	*Eucalyptus tereticornis*	Queensland blue gum	25	-
C23	*Eucalyptus tereticornis*	Queensland blue gum	30	-
C24	*Eucalyptus crebra*	Narrow-leaved ironbark	30	-
C25	*Eucalyptus tereticornis*	Queensland blue gum	30	Y
C26	*Eucalyptus tereticornis*	Queensland blue gum	35	-
C27	*Eucalyptus tereticornis*	Queensland blue gum	45	Y
C28	*Eucalyptus tereticornis*	Queensland blue gum	35	-
C29	*Eucalyptus tereticornis*	Queensland blue gum	45	-
C30	*Eucalyptus tereticornis*	Queensland blue gum	30	-
				7/30 = 23%

PLOT D

Non-remnant vegetation representative of RE 12.9-10.12/12.3.11. Canopy dominated by *Eucalyptus tereticornis,* with a low tree layer of *Melaleuca quinquenervia* and *Lophostemon suaveolons.* The vegetation continued to the north until Crowson Lane and, both, to the east and west. To the south was a swampy area dominated by *Melaleuca quinquenervia, M. saligna* and *M. linariifolia*.

D24 was identified with scats.

Tree ID	Species	Common Name	DBH	Koala Scats Present (Y/N)
D1	*Eucalyptus tereticornis*	Queensland blue gum	110	Y
D2	*Melaleuca quinquenervia*	Paperbarked tea tree	30	Y
D3	*Eucalyptus tereticornis*	Queensland blue gum	20	-
D4	*Eucalyptus tereticornis*	Queensland blue gum	30	-
D5	*Melaleuca quinquenervia*	Paperbarked tea tree	25	Y
D6	*Eucalyptus tereticornis*	Queensland blue gum	40	Y
D7	*Melaleuca quinquenervia*	Paperbarked tea tree	45	Y
D8	*Eucalyptus tereticornis*	Queensland blue gum	50	Y
D9	*Eucalyptus tereticornis*	Queensland blue gum	25	-
D10	*Eucalyptus tereticornis*	Queensland blue gum	25	-
D11	*Melaleuca quinquenervia*	Paperbarked tea tree	30	-
D12	*Lophostemon suaveolons*	Swamp box	35	Y
D13	*Eucalyptus tereticornis*	Queensland blue gum	35	-
D14	*Eucalyptus tereticornis*	Queensland blue gum	45	-
D15	*Eucalyptus tereticornis*	Queensland blue gum	30	Y
D16	*Eucalyptus tereticornis*	Queensland blue gum	25	-
D17	*Eucalyptus tereticornis*	Queensland blue gum	40	Y
D18	*Eucalyptus tereticornis*	Queensland blue gum	30	Y
D19	*Melaleuca quinquenervia*	Paperbarked tea tree	35	-
D20	*Eucalyptus tereticornis*	Queensland blue gum	115	Y
D21	*Eucalyptus tereticornis*	Queensland blue gum	40	Y
D22	*Eucalyptus tereticornis*	Queensland blue gum	35	-
D23	*Melaleuca quinquenervia*	Paperbarked tea tree	40	Y
D24	*Eucalyptus tereticornis*	Queensland blue gum	85	Y
D25	*Eucalyptus tereticornis*	Queensland blue gum	30	-
D26	*Eucalyptus tereticornis*	Queensland blue gum	85	Y
D27	*Melaleuca quinquenervia*	Paperbarked tea tree	40	-
D28	*Eucalyptus tereticornis*	Queensland blue gum	95	-
D29	*Melaleuca quinquenervia*	Paperbarked tea tree	30	-
D30	*Eucalyptus tereticornis*	Queensland blue gum	60	Y
				16/30=53%

PLOT E

Non-remnant/remnant vegetation representative of RE 12.9-10.12. The canopy was dominated by *Eucalyptus tereticornis* and *Corymbia intermedia.* The vegetation continued to the north until Crowson Lane and, both, to the east and west, and south until the power line easement.

This site was located on the northwest of the site.

Tree ID	Species	Common Name	DBH	Koala Scats Present (Y/N)
E1	*Eucalyptus tereticornis*	Queensland blue gum	45	-
E2	*Eucalyptus tereticornis*	Queensland blue gum	40	-
E3	*Eucalyptus tereticornis*	Queensland blue gum	45	-
E4	*Eucalyptus tereticornis*	Queensland blue gum	40	-
E5	*Eucalyptus tereticornis*	Queensland blue gum	40	-
E6	*Eucalyptus tereticornis*	Queensland blue gum	35	-
E7	*Eucalyptus seeana*	Narrow-leaved red gum	50	-
E8	*Eucalyptus tereticornis*	Queensland blue gum	55	-
E9	*Lophostemon suaveolons*	Swamp box	35	-
E10	*Corymbia intermedia*	Pink bloodwood	35	-
E11	*Eucalyptus tereticornis*	Queensland blue gum	100	-
E12	*Corymbia intermedia*	Pink bloodwood	45	-
E13	*Eucalyptus tereticornis*	Queensland blue gum	25	-
E14	*Eucalyptus tereticornis*	Queensland blue gum	35	Y
E15	*Corymbia intermedia*	Pink bloodwood	25	-
E16	*Eucalyptus tereticornis*	Queensland blue gum	20	-
E17	*Corymbia intermedia*	Pink bloodwood	30	-
E18	*Eucalyptus tereticornis*	Queensland blue gum	30	-
E19	*Eucalyptus tereticornis*	Queensland blue gum	30	Y
E20	*Eucalyptus tereticornis*	Queensland blue gum	35	-
E21	*Eucalyptus tereticornis*	Queensland blue gum	45	Y
E22	*Eucalyptus tereticornis*	Queensland blue gum	30	-
E23	*Eucalyptus tereticornis*	Queensland blue gum	35	-
E24	*Eucalyptus tereticornis*	Queensland blue gum	20	-
E25	*Eucalyptus tereticornis*	Queensland blue gum	35	-
E26	*Eucalyptus tereticornis*	Queensland blue gum	30	Y
E27	*Corymbia intermedia*	Pink bloodwood	25	-
E28	*Corymbia intermedia*	Pink bloodwood	20	-
E29	*Eucalyptus tereticornis*	Queensland blue gum	35	-
E30	*Eucalyptus tereticornis*	Queensland blue gum	35	-
				4/30=13%

PLOT F

Non-remnant vegetation representative of RE 12.9-10.12/12.9-10.19a. The canopy was dominated by *Eucalyptus tereticornis, Eucalyptus seeana, Corymbia citriodora* and *Corymbia intermedia.* The vegetation continued to the south gradually getting thinner until becoming cleared areas. To the north was the power line easement. To the east was remnant vegetation of RE 12.9-10.12/12.9-10.19a and to the west non-remnant vegetation continued.

Tree ID	Species	Common Name	DBH	Koala Scats Present (Y/N)
F1	*Eucalyptus tereticornis*	Queensland blue gum	55	-
F2	*Eucalyptus tereticornis*	Queensland blue gum	25	-
F3	*Corymbia intermedia*	Pink bloodwood	50	-
F4	*Eucalyptus seeana*	Narrow-leaved red gum	30	-
F5	*Eucalyptus seeana*	Narrow-leaved red gum	35	-
F6	*Eucalyptus seeana*	Narrow-leaved red gum	35	-
F7	*Corymbia citriodora*	Spotted gum	45	-
F8	*Eucalyptus tereticornis*	Queensland blue gum	30	-
F9	*Corymbia citriodora*	Spotted gum	95	Y
F10	*Eucalyptus seeana*	Narrow-leaved red gum	55	-
F11	*Corymbia intermedia*	Pink bloodwood	45	-
F12	*Corymbia intermedia*	Pink bloodwood	65	-
F13	*Corymbia intermedia*	Pink bloodwood	30	-
F14	*Eucalyptus seeana*	Narrow-leaved red gum	60	-
F15	*Eucalyptus tereticornis*	Queensland blue gum	30	-
F16	*Corymbia intermedia*	Pink bloodwood	35	-
F17	*Eucalyptus tereticornis*	Queensland blue gum	110	Y
F18	*Corymbia intermedia*	Pink bloodwood	55	-
F19	*Eucalyptus tereticornis*	Queensland blue gum	25	-
F20	*Corymbia intermedia*	Pink bloodwood	50	-
F21	*Eucalyptus tereticornis*	Queensland blue gum	35	-
F22	*Eucalyptus tereticornis*	Queensland blue gum	25	-
F23	*Corymbia intermedia*	Pink bloodwood	25	Y
F24	*Corymbia intermedia*	Pink bloodwood	35	-
F25	*Corymbia intermedia*	Pink bloodwood	30	-
F26	*Eucalyptus seeana*	Narrow-leaved red gum	25	-
F27	*Eucalyptus tereticornis*	Queensland blue gum	25	-
F28	*Eucalyptus tereticornis*	Queensland blue gum	40	-
F29	*Eucalyptus tereticornis*	Queensland blue gum	25	-
F30	*Eucalyptus tereticornis*	Queensland blue gum	85	-
				3/13=10%

PLOT G

Non-remnant vegetation representative of RE 12.9-10.12/12.9-10.19a. The canopy was dominated by *Eucalyptus tereticornis* and *Corymbia intermedia,* with *Eucalyptus seeana.* The low tree layer was dominated by *Melaleuca quinquenervia*. The vegetation continued to the south gradually getting thinner until becoming cleared areas. To the north was the power line easement. To the east was remnant vegetation of RE 12.9-10.12/12.9-10.19a and to the west non-remnant vegetation and the house block on the neighbouring property.

Tree ID	Species	Common Name	DBH	Koala Scats Present (Y/N)
G1	*Eucalyptus tereticornis*	Queensland blue gum	30	-
G2	*Corymbia intermedia*	Pink bloodwood	35	-
G3	*Eucalyptus tereticornis*	Queensland blue gum	20	-
G4	*Eucalyptus tereticornis*	Queensland blue gum	35	-
G5	*Eucalyptus tereticornis*	Queensland blue gum	40	-
G6	*Eucalyptus tereticornis*	Queensland blue gum	90	-
G7	*Eucalyptus tereticornis*	Queensland blue gum	25	-
G8	*Eucalyptus tereticornis*	Queensland blue gum	100	-
G9	*Corymbia intermedia*	Pink bloodwood	40	-
G10	*Corymbia intermedia*	Pink bloodwood	20	-
G11	*Melaleuca quinquenervia*	Paperbarked tea tree	20	-
G12	*Melaleuca quinquenervia*	Paperbarked tea tree	20	-
G13	*Corymbia intermedia*	Pink bloodwood	20	-
G14	*Eucalyptus tereticornis*	Queensland blue gum	45	-
G15	*Eucalyptus seeana*	Narrow-leaved red gum	20	-
G16	*Corymbia intermedia*	Pink bloodwood	25	-
G17	*Eucalyptus tereticornis*	Queensland blue gum	35	-
G18	*Corymbia intermedia*	Pink bloodwood	24	-
G19	*Corymbia intermedia*	Pink bloodwood	30	-
G20	*Melaleuca quinquenervia*	Paperbarked tea tree	30	-
G21	*Eucalyptus tereticornis*	Queensland blue gum	30	-
G22	*Eucalyptus tereticornis*	Queensland blue gum	35	-
G23	*Eucalyptus crebra*	Narrow-leaved ironbark	30	-
G24	*Eucalyptus tereticornis*	Queensland blue gum	40	-
G25	*Melaleuca quinquenervia*	Paperbarked tea tree	40	-
G26	*Eucalyptus crebra*	Narrow-leaved ironbark	25	-
G27	*Melaleuca quinquenervia*	Paperbarked tea tree	25	-
G28	*Eucalyptus crebra*	Narrow-leaved ironbark	20	-
G29	*Eucalyptus tereticornis*	Queensland blue gum	25	-
G30	*Corymbia intermedia*	Pink bloodwood	55	-
				No Scats

Appendix 9 to the Technical Attachment 1

North Maclean Enterprise Precinct

4499-4651 Mount Lindesay Highway, North Maclean, Queensland

(EPBC Referral No. 2013/6941)

Results of Targeted Survey for Spotted-tailed quoll

13 August 2015

Report to Wearco Pty Ltd

TABLE OF CONTENTS

1 Background

In the Controlled Action referral for the Proposed Action, we identified the Spotted-tailed quoll (*Dasyurus maculatus*)[1] as a potential occurrence at the Site, but concluded that the Proposed Action would not give rise to a Significant Impact on this species[2] (28 South Environmental 2013). This position was reiterated in the Initial Preliminary Documentation Report (28 South Environmental 2014).

A common theme in submissions opposing the Proposed Action was Spotted-tailed quoll, including: (a) the species' potential occurrence at the Site; (b) need for seasonal surveys; and (c) impact of the Proposed Action. In particular, Logan and Albert Conservation Association Inc. (LACA) in its submission provided anecdotal evidence of spotted-tail quoll occurrence in the locality. Table 1 of the submission lists pre-2006 records, and Table 2 lists records from 2006-2012. LACA used the data to contend that there are further records of the spotted tail quoll in the locality than suggested by the Initial Preliminary Documentation Report. The location of sightings in relation to the Site is shown in **Attachment 1**.

While not a requirement for the submission of the Supplementary Preliminary Documentation Report, the Proponent having regard to the seasonal conditions and, on its own volition, commissioned 28 South Environmental to complete further targeted survey for Spotted-tailed quoll.

2 Survey Methods Employed

2.1 Searches for Optimal Habitat (target survey sites)

Site assessment since 2013 has provided us with a thorough understanding of the Site's general characters, and specific microhabitats. Before the commencement of survey, we were aware that the Site did not contain: (a) areas of rock outcrop; (b) large fallen logs[3]; (c) a significant number of large hollow-bearing trees or stags; or (d) dense areas of lantana (*Lantana camara*) or other weedy thickets. As such, a scoping survey was undertaken to identify the "best on offer" survey sites. Twelve survey sites were selected in the more heavily vegetated northern and western parts of the Site (**Attachment 2** and following plates showing the character of the survey sites).

2.2 Remote detection camera survey

Remote detection camera units were set at each of the survey sites. Cameras were attached to a tree, and baits[4] were attached to a plastic stake within the camera's detection range. Baits were refreshed every three days, and data downloaded approximately weekly. The survey ran from 18 June until 12 July 2015 inclusive (25 Days).

Despite best efforts to conceal the cameras, two were stolen during the survey period. At the day 6 bait change, the camera from Site 3 was found to be stolen. The camera was replaced immediately and remained operational for the remainder of the survey. Six days of survey data was lost. At the day 9 bait change, the camera from Site 12 was found to be stolen. Data from the first 6 days of survey was collected, but data from the remaining three days was not. Due to the level of theft being experienced; inability to conceal the cameras any further; and what we considered to be otherwise very good coverage of the Site, we decided that a camera would not be re-set at Site 12.

[1] Listed as Endangered under the EPBC Act.

[2] Within the meaning established by the Significant Impact Guideline 1.1 (DoE 2013).

[3] The property has been historically logged, and all large fallen timber was taken off site (*Pers. comm.* D Wearing).

[4] A mix of sardines, tuna oil, flour, and chicken necks.

275 equivalent camera detection nights were achieved, whereby: (a) 10 units detected for the full 25 nights; (b) one unit collected for 6 nights; and (c) one replacement unit collected for 19 nights. Despite the thefts, our surveys have achieved a high camera density over a reasonable period of time, which we consider provides an adequate survey. We note that the survey ran for a longer period of time than the other recent survey in the locality completed by the Wildlife Preservation Society of Queensland (**Attachment 3**), which did not target areas in close proximity to the Site.

2.3 Hairtube survey

Two Faunatech hairtubes were placed in optimised locations (under lantana or beside logs[5]) at each of the survey sites. The hairtubes were left in place for 25 days, achieving an equivalent 600 sample nights. The Hairtube survey samples were analysed by Barbara Triggs of *Dead Finish*.

2.4 Weather conditions prior to and during the survey

Bureau of Meteorology weather data for the survey period shows that the conditions were mild to warm, with calm winds and periods of light rain. The weather experienced is characteristic of winter conditions in this part of Southeast Queensland[6]. Data is provided in **Attachment 4**. Abnormal weather conditions did not unduly influence the survey results.

3 Results

3.1 Remote detection camera survey

A range of common rural / peri-urban mammals and birds were recorded by the survey (refer below). Most species were frequently detected across the suite of cameras deployed, indicating widespread occurrence at the Site. A selection of detection photos is provided in **Attachment 5**. It is relevant to note that the suite of species recorded is similar to species recorded by the Wildlife Preservation Society of Queensland data for the broader locality[7] (**Attachment 3**).

Mammals

Brush-tailed possum (*Trichosurus vulpecula*);

Eastern grey kangaroo (*Macropus giganteus*);

European hare (*Lepus europaeus*);

Koala (*Phascolarctos cinereus*);

Red fox (*Vulpes vulpes*);

Domestic cattle (*Bos taurus*);

Horse (*Equus caballus*);

Domestic dog (*Canis lupus familiaris*);

[5] Note: survey sites were chosen on the basis of having such structure available. The sites chosen were "best on offer".

[6] Comparisons were made with longer term weather data.

[7] The greater number of species recorded perhaps representing a greater diversity of habitats sampled by the WPSQ surveys.

Birds

Toressian crow (*Corvus orru*);

Tawny frogmouth (*Podargus strigoides*);

Australian magpie (*Cracticus tibicen*);

Straw-necked ibis (*Theskiornis spinicollis*);

Cattle egret (*Ardea ibis*);

Grey butcherbird (*Cracticus torquatus*);

Kookaburra (*Dacelo novaeguineae*);

Whistling kite (*Haliastur sphenurus*);

3.2 Hairtube Survey

The Hairtube survey recorded only Brush-tailed possum (*Trichosurus vulpecula*). Spotted-tailed quoll was not detected. Survey results are provided in **Attachment 6**.

4 Summary and Conclusion

- LACA data submitted to the public notification of the Initial Preliminary Documentation Report demonstrates that there are no recent reliable records of Spotted-tailed quoll in close proximity to the Site. All of the more recent (post 2006) records occur to the north and west of the Site.

- Recent camera detection and hairtube sampling surveys have failed to locate Spotted-tailed quoll at the Site. The sampling density and duration of survey exceeded the required survey effort, and the survey effort expended by Wildlife Preservation Society of Queensland in its attempts to locate Spotted-tailed quoll in the nearby locality.

The background material and this survey indicate that the Site may provide very occasional dispersal habitat for Spotted-tailed quoll, but is unlikely to provide habitat critical to the species' survival. We draw a similar conclusion to that reached by the Wildlife Preservation Society of Queensland in its Spotted-tailed quoll survey report from 2012, which notes that the lack of quolls caught on camera by that survey "*may be an indication urbanisation and lack of suitable habitat is pushing them further afield. Or, the population has declined, and feral species such as foxes, dogs and cats are out-competing them*…" (refer Page 2 of **Attachment 5**).

5 References and Other Sources

28 South Environmental. 2013. *Referral Under the EPBC Act in Regard to a Proposed Industrial Development – North Maclean, South East Queensland*: Report to Wearing Developments

28 South Environmental. 2014. *North Maclean Enterprise Precinct – 4499-4651 Mount Lindesay Highway, North Maclean, Queensland (EPBC Referral No. 2013/6941) Initial Preliminary Documentation Report*: Prepared for Wearco Pty Ltd.

28 South Environmental. 2015a. *North Maclean Enterprise Precinct – 4499-4651 Mount Lindesay Highway, North Maclean, Queensland (EPBC Referral No. 2013/6941) Response to Submissions Received from Exhibition of the Initial Preliminary Documentation Report*: Prepared for Wearco Pty Ltd.

28 South Environmental. 2015b. *North Maclean Enterprise Precinct – 4499-4651 Mount Lindesay Highway, North Maclean, Queensland (EPBC Referral No. 2013/6941) Final Preliminary Documentation Report*: Prepared for Wearco Pty Ltd.

Burnett, S and Whyte, I (2006) *Surveys for the Spotted-tailed Quolls in the northern section of Beaudesert Shire – Report Prepared for the Beaudesert Shire Council*: Wildlife Preservation Society of Queensland

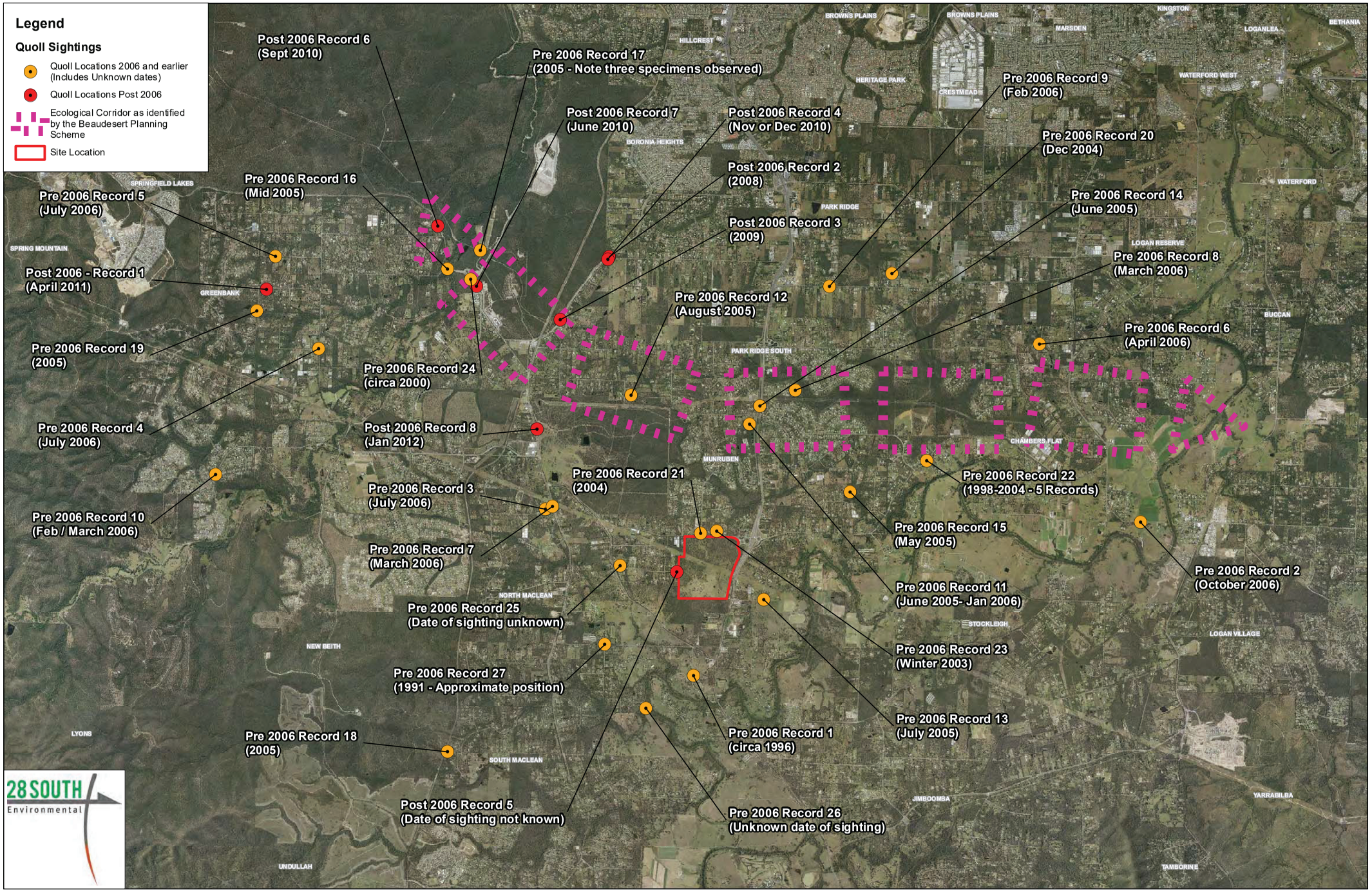
Department of the Environment (2013) *Matters of National Environmental Significance – Significant Impact Guidelines 1.*1: Commonwealth of Australia.

Department of the Environment (2015). *Dasyurus maculatus maculatus (SE mainland population)* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed Fri, 29 May 2015 14:44:17 +1000.

Department of Environment and Heritage Protection (2015) Flinders Karawatha Corridor: Queensland Government: Accessed at on 2 July 2015 at https://www.ehp.qld.gov.au/land/natural-resource/flinders-karawatha/index.html

Wildlife Preservation Society of Queensland. 2013. *Looking out for Quolls in Logan – summary of survey results, October 2012.*

ATTACHMENT 1. LACA RESULTS MAPPED



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Coordinate System: GDA 1994 MGA Zone 56
Reference Scale: 1:65,000
Project Name : North Maclean
Title : Figure 4 - Quoll Locations

0 0.375 0.75 1.5 2.25 3 3.75 Kilometers

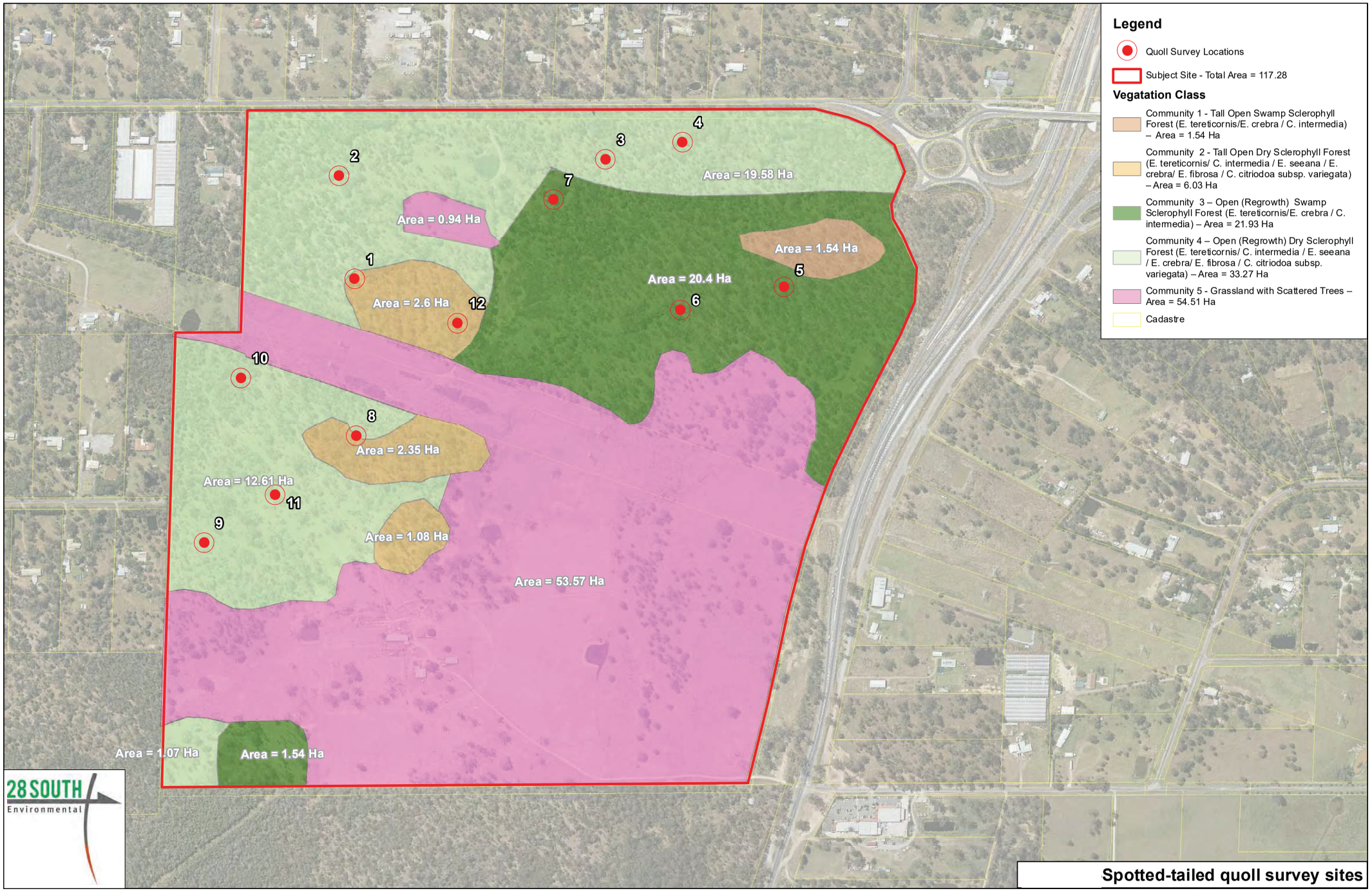
N

Background imagery is supplied by Queensland Government, and is not to be used for measurement. For visualisation purposes only.

Client: Reel Planning
Date: Tuesday, May 12, 2015

Document Path: E:\GIS\28_South\South_Maclean\Admin\mxd\NorthMaclean_Quoll_Analysis_Fig4_Rev1_A3.mxd

ATTACHMENT 2. SITE ASSESSMENT SURVEY LOCATIONS



Page 117

Coordinate System: GCS WGS 1984
Reference Scale: 1:6,000
Project Name : North Maclean
Title : Figure 5 -Spotted-tailed quoll survey sites

0 40 80 160 240 320 400 Meters

N

Background imagery is supplied by Qld Govt, and is not to be used for measurement. For visualisation purposes only.

Client: Reel Planning
Date: Monday, August 10, 2015

Document Path: S:\GIS\28_South\South_Maclean\Admin\mxd\NorthMaclean_QuollPlan_Figure5_Rev0_A3.mxd

SITE 1

VIEW NORTH 	**VIEW SOUTH** 	**HAIRTUBE 1** 
VIEW EAST 	**VIEW WEST** 	**HAIRTUBE 2** 

SITE 2

VIEW NORTH 	**VIEW SOUTH** 	**HAIRTUBE 1** 
VIEW EAST 	**VIEW WEST** 	**HAIRTUBE 2** 

SITE 3

VIEW NORTH 	**VIEW SOUTH** 	**HAIRTUBE 1** 
VIEW EAST 	**VIEW WEST** 	**HAIRTUBE 2** 

SITE 4

VIEW NORTH 	**VIEW SOUTH** 	**HAIRTUBE 1** 
VIEW EAST 	**VIEW WEST** 	**HAIRTUBE 2** 

SITE 5

VIEW NORTH 	**VIEW SOUTH** 	**HAIRTUBE 1** 
VIEW EAST 	**VIEW WEST** 	**HAIRTUBE 2** 

SITE 6

VIEW NORTH 	**VIEW SOUTH** 	**HAIRTUBE 1** 
VIEW EAST 	**VIEW WEST** 	**HAIRTUBE 2** 

SITE 7

VIEW NORTH 	**VIEW SOUTH** 	**HAIRTUBE 1** 
VIEW EAST 	**VIEW WEST** 	**HAIRTUBE 2** 

SITE 8

VIEW NORTH 	VIEW SOUTH 	HAIRTUBE 1 
VIEW EAST 	VIEW WEST 	HAIRTUBE 2 

SITE 9

VIEW NORTH 	**VIEW SOUTH** 	**HAIRTUBE 1** 
VIEW EAST 	**VIEW WEST** 	**HAIRTUBE 2** 

SITE 10

VIEW NORTH 	**VIEW SOUTH** 	**HAIRTUBE 1** 
VIEW EAST 	**VIEW WEST** 	**HAIRTUBE 2** 

SITE 11

VIEW NORTH 	**VIEW SOUTH** 	**HAIRTUBE 1** 
VIEW EAST 	**VIEW WEST** 	**HAIRTUBE 2** 

SITE 12

VIEW NORTH 	**VIEW SOUTH** 	**HAIRTUBE 1** 
VIEW EAST 	**VIEW WEST** 	**HAIRTUBE 2** 

ATTACHMENT 3. WPSQ 2012 SURVEY

Wildlife Preservation Society of Qld

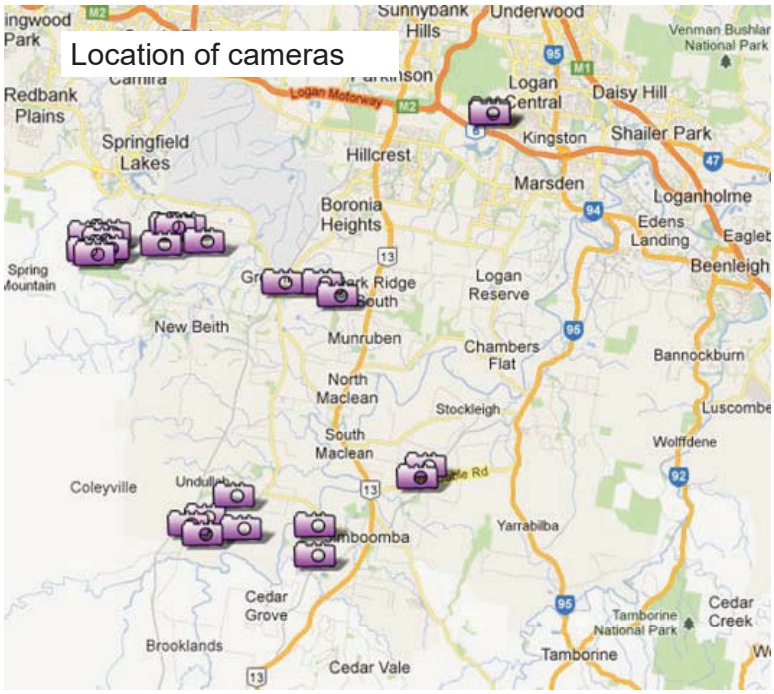
wildlife.org.au

Looking out for Quolls in Logan – summary of survey results, October 2012

The surveys for this year's Envirogrant from the Logan City Council have been completed. During the period from April – July 2012, a total of 15 sites were surveyed including:

- Private residences: 3 locations within Greenbank, 1 in Berrinba and 1 in Park Ridge, 2 in Undullah, 1 in Jimboomba
- Reserve X, Greenbank
- Spring Mountain Forest Park
- Campbell Park, Greenbank
- Blackwood, Henderson, and Edelston Reserve – Jimboomba

Depending on the size of the property, between 2 and 6 cameras were deployed for 3 weeks at a time (see map below). In larger areas such as Spring Mountain Forest Park, cameras were deployed in a number of locations.



A total of 115,033 images were taken, and 27 different species were captured. The most common captured species included: crows, then foxes, followed by Rattus sp., and Brush-tailed possums.

List of species caught on camera

Torresian crow	Red-necked wallaby
Northern brown bandicoot	Crow
Brushtail possum	Brown goshawk
Rattus sp.,	Brush-tailed phascogale
Wedge-tailed eagle	Fantailed cuckoo
Pied & grey butcherbird	Currawong
Bush rat	Lace monitor
Fox	Echidna
Cat	Black-striped wallaby
Magpie	Squirrel glider
Swamp wallaby	Dog & dingo
Cows & sheep	Eastern grey kangaroo

Despite a number of sighting records that continue to be reported to us from these areas by the community, no quolls were caught on camera. This may be an indication urbanisation and lack of suitable habitat is pushing them further afield. Or, the population has declined, and feral species such as foxes, dogs and cats are out-competing them, necessitating urgent conservation action.

We hope next year's result will prove us wrong!

Wildlife Queensland would like to thank the following people who assisted with this year's surveys:

Alina Zwar
Ivell & Jim Whyte
Kate Payne
Brenden Ward
Olivia Muller

Brushtail possum

Brush-tailed phascogale

Wedge-tailed eagle

Ivell Whyte (left) and Alina Zwar setting up a camera

ATTACHMENT 4. WEATHER DATA

Logan City, Queensland
June 2015 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	Mo	16.7	21.8	0	1.2					18.5	75	6	W	4		20.4	51	6	SW	2	
2	Tu	7.8		0	3.8					12.5	66	1	WSW	2		20.4	45	0	W	2	
3	We		20.6	0												18.3	51	7	SW	2	
4	Th	6.5	21.8	0.2	0.6					11.0	81	0	W	6		21.4	46	0	W	6	
5	Fr	3.9	22.1	0	1.4					10.6	76	0	SW	4		21.5	34	1	NW	6	
6	Sa	7.1	21.6	0	2.6					13.3	67	1	WNW	2							
7	Su	10.5	22.4	0	2.2					15.1	84	4	WNW	2							
8	Mo	9.9	23.0	0	3.2					14.1	88	1	SW	4							
9	Tu	11.6	24.8	0	1.2					15.0	84	7	W	9		23.0	56	8	SW	7	
10	We	11.0	23.6	0	2.9					14.5	90	6		Calm		22.5	59	6	E	15	
11	Th	13.7	20.1	1.6	2.4					19.9	76	7	SSE	22		18.7	75	6	S	19	
12	Fr	11.9	20.2	0.8						15.5	88	5	S	4		18.4	78	7	SSE	9	
13	Sa	13.1	19.9	0.4	3.2					18.5	76	8	SE	19							
14	Su	14.7	20.7	4.2	1.4					16.8	94	7	SW	2							
15	Mo	14.7	22.3	12.4	0.4					17.0	98	5		Calm		22.1	62	2	S	7	
16	Tu	14.5	21.4	6.4	2.6					16.7	99	8	SSE	4		21.0	87	8		Calm	
17	We	15.5	20.6	10.6	7.4					19.9	89	7	W	6		18.2	93	8	S	6	
18	Th	11.2	23.0	2.0	1.8					13.5	99	8		Calm		21.9	51	3	SW	7	
19	Fr	9.6	22.0	0	4.0					14.5	74	4	SW	4		20.8	41	4	SW	4	
20	Sa	6.5	20.7	0	0.2					11.0	81	0	W	4							
21	Su	7.0	20.2	0	1.0					12.6	76	0	W	2							
22	Mo		20.0	0	3.1					15.0	77	3	WNW	2		19.5	59	6	E	7	
23	Tu	11.5	20.6	0	4.0					15.0	85	7	W	2		20.0	63	7	SE	2	
24	We	11.0	18.1	1.4	1.2					14.9	93	8	N	2		17.4	83	8	ESE	4	
25	Th	9.5	20.5	0	0.8					11.8	92	5	WSW	7		19.3	74	8	SW	13	
26	Fr	10.6	21.5	0.9	0.1					18.3	73	2	S	11		20.4	62	3	S	19	
27	Sa	12.6	22.0	0	2.4					17.5	74	2	SW	9							
28	Su	13.0	22.2	2.4	3.0					16.0	97	3	SSW	4							
29	Mo	14.6	18.5	5.8	2.6					16.4	96	8	SSW	6		18.4	88	8	N	6	
30	Tu	12.7	22.2	4.4	1.6					15.7	93	4	SW	2		21.6	60	3	E	9	
Statistics for June 2015																					
	Mean	11.2	21.3		2.2					15.2	84	4		5		20.2	62	5		7	
	Lowest	3.9	18.1		0.1					10.6	66	0		Calm		17.4	34	0		Calm	
	Highest	16.7	24.8	12.4	7.4					19.9	99	8	SSE	22		23.0	93	8	S	19	
	Total			53.5	62.3																

Observations were drawn from Logan City Water Treatment Plant {station 040854}

IDCJDW4073.201506 Prepared at 16:05 UTC on 2 Aug 2015

Logan City, Queensland
July 2015 Daily Weather Observations

Australian Government
Bureau of Meteorology

Date	Day	Temps		Rain	Evap	Sun	Max wind gust			9am						3pm					
		Min	Max				Dirn	Spd	Time	Temp	RH	Cld	Dirn	Spd	MSLP	Temp	RH	Cld	Dirn	Spd	MSLP
		°C	°C	mm	mm	hours		km/h	local	°C	%	eighths		km/h	hPa	°C	%	eighths		km/h	hPa
1	We	11.1	23.5	0	1.6					13.8	97	5	W	9		22.9	64	4		Calm	
2	Th	9.5	20.7	0	2.2					13.0	86	1	SW	9		20.3	44	6	WSW	6	
3	Fr	5.0	19.3	0	2.4					9.8	69	8	SSW	7		18.6	45	4	S	6	
4	Sa	8.9	21.4	0	0.6					12.1	80	2	SSW	6							
5	Su	9.6	23.1	0	2.8					12.8	92	2	W	4							
6	Mo	8.0	24.3	0	2.4					11.9	89	0	W	2		23.9	43	1	W	11	
7	Tu	8.1	22.0	0	0.2					13.0	78	0	W	4		19.8		0	E	9	
8	We	6.5	18.6	0	3.0					14.1	88	2	SSW	2							
9	Th	10.6	17.7	0	2.4					14.5	90	3	W	4							
10	Fr	8.4	20.4	0	1.6					12.5	88	6	W	2		18.8	74	8	NNE	2	
11	Sa	10.0	21.9	1.2	0.2					12.8	97	4	W	2							
12	Su	10.9	18.9	0.6	2.4					13.0	51	0	WSW	9							
13	Mo	6.4	17.9	0	3.0					11.8	55	0	W	7		17.5	40	1	WSW	13	
14	Tu	7.5	19.7	0	2.9					11.6	60	0	SW	7		19.7	39	0	WSW	6	
15	We	4.0	17.9	0	1.8					7.7	79	6	W	9		17.5	51	7	NW	2	
16	Th	6.4	18.6	0	3.2					10.0	83	7	W	2		17.2	51	7	W	2	
17	Fr	5.3	16.1	0	0.2					9.0	68	1	W	2		15.5	46	1	SW	22	
18	Sa	4.2	18.5	0	3.4					8.4	70	1	WSW	13							
19	Su	6.9	19.1	0	0.8					12.5	73	2	W	7							
20	Mo	9.8	20.6	0	2.0					14.5	78	2	SW	2		17.9	61	5	S	37	
21	Tu	10.4	20.1	1.6	0.8					13.9	97	7		Calm		16.9	79	8		Calm	
22	We	9.0	17.4	2.0	0.6					11.7	97	8	W	4		17.1	95	8	E	6	
23	Th	11.0	21.9	8.8	2.2					15.7	98	7		Calm		19.8	82	5	E	4	
24	Fr	13.1	23.2	0.4	0.2					17.1	99	7		Calm		22.4	76	7	ENE	4	
25	Sa	15.2	23.7	4.4	1.8					16.2	90	8	WSW	4							
26	Su	12.1	24.1	0.2	1.0					15.0	91	7	SW	2							
27	Mo	10.6	22.4	0	1.0					15.5	75	1	W	2		21.9	42	6	S	6	
28	Tu	8.2	20.0	0	0.6					12.2	75	5	WSW	4		19.4	50	4	ESE	15	
29	We	6.4	21.2	0	4.6					14.0	62	0	SW	9		19.8	47	2	SE	7	
30	Th	11.0	22.0	0	4.0					15.1	78	2	WNW	2		20.0	67	3	ENE	2	
31	Fr	8.2	23.5	0	0.8					12.8	92	0	SW	7		23.1	40	0	WSW	2	
Statistics for July 2015																					
	Mean	8.8	20.6		1.8					12.8	81	3		4		19.5	56	4		7	
	Lowest	4.0	16.1		0.2					7.7	51	0		Calm		15.5	39	0		Calm	
	Highest	15.2	24.3	8.8	4.6					17.1	99	8	WSW	13		23.9	95	8	S	37	
	Total			19.2	56.7																

Observations were drawn from Logan City Water Treatment Plant {station 040854}

IDCJDW4073.201507 Prepared at 13:05 UTC on 7 Aug 2015

ATTACHMENT 5. EXAMPLE PHOTOS

Brush-tailed possum sample photos

Eastern grey kangaroo sample photos

Dog sample photo

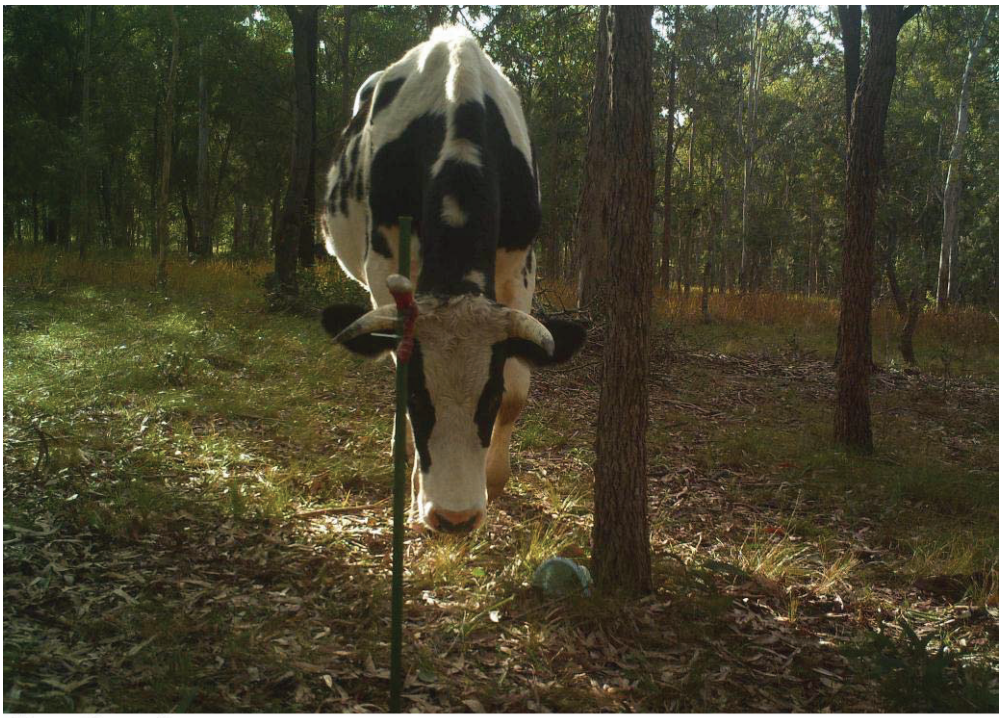
Red fox sample photos


KeepGuard
07-04-2015 22:23:06


KeepGuard
06-25-2015 04:10:15

European Hare sample photos

Cattle sample photos



Horse sample photo

Grey butcherbird sample photo

Magpie sample photo

Straw-necked ibis sample photo

Crow sample photos

Whistling kite sample photo

Kookaburra sample photo

ATTACHMENT 6. HAIRTUBE ANALYSIS

Wayne Mofitt

From: Mitch Taylor <ma.taylor@hotmail.com>
Sent: Monday, 20 July 2015 7:54 AM
To: Wayne Mofitt
Subject: Fwd: Analysis results
Attachments: SOUTHENVIRONMENTAL20715.xlsx; ATT00001.htm; 68South Environmental Invoice #5791.docx; ATT00002.htm

FYI

Sent from my iPad

Begin forwarded message:

> **From:** <barbarat@skymesh.com.au>
> **Date:** 19 July 2015 4:05:38 pm AEST
> **To:** <ma.taylor@hotmail.com>
> **Subject: Analysis results**
>
> Hi Mitch,
> I'll attach the results of the hair tube analysis. Not a very exciting result – lots of wafers had no hairs on them.
> Please let me know if you have any queries.
> I will also attach the invoice.
>
> Regards,
> Barbara

Hair tube analysis North McLean Dairy Farm 12/7/2015

No.	Location	Mammal ID - definite	Mammal ID - probable
1	1	no hairs - plant fibres	
2	2	Trichosurus sp.	T. vulpecula
3	2	no hairs - insect material	
4	3	no hairs - insect material	
5	4	no hairs - insect material	
6	4	no hairs - insect material	
7	5	no hairs - caterpillar setae	
8	5	no hairs - insect material	
9	5	no hairs - insect material	
10	6	Trichosurus sp.	T. vulpecula
11	6	no hairs - insect material	
12	7	Trichosurus sp.	T. vulpecula
13	7	no hairs - insect material	
14	7	no hairs - plant fibres	
15	8	Trichosurus sp.	T. vulpecula
16	8	no hairs - plant fibres	
17	9	no hairs - insect material	
18	10	no hairs - insect material	
19	10	no hairs - insect material	
20	11	no hairs - insect material	
21	11	human hair	
22	12	no hairs - insect material	
23	12	no hairs - plant fibres	

Appendix 10 to the Technical Attachment 1

1 AU 1 - Mixed Eucalypt Open Forest on lower slopes with minimal shrub layer

AU 1 is located in the central western component of the Subject Site and is bound: to the north by high voltage transmission line corridors; to the east and south by cleared paddocks associated with AU 5; and to the west by residential properties.

AU 1 is dominated by *Corymbia intermedia* (pink bloodwood) and *Eucalyptus tereticornis* (Queensland blue gum). The shrub layer within this AU is very sparse with scattered occurrences young *Allocasuarina littoralis* (black she-oak) and *Acacia disparrima* (hickory wattle) mostly in the extreme west of this AU. The ground layer is dense and dominated by a matting lawn of heavily grazed *Cynodon dactylon* (couch) with sporadic occurrences of other grass species.

AU 1 supported minimal microhabitat features with limited woody debris and no observable hollow bearing trees. No dams or watercourses were present within this AU. Canopy connectivity remained moderate-good throughout the AU; however, limited interlocking canopy occurred. This AU remains connective with habitats supported within rural residential properties to the west of the Site.

Constant cattle grazing pressure within this AU continues to limit microhabitat features such as woody debris and denser shrub from accumulating or regenerating.

2 AU 2 - Mixed Eucalypts on upper slopes with moderate shrub layer

This AU is located in the north-western component of the Subject Site and is bound to the south by the high voltage transmission line corridor, to the west by rural residential development; to the north by Crowson Lane; and to the east by an internal farm track.

AU 2 is dominated by Queensland blue gum with associated *Eucalyptus seeana* (narrow-leaved red gum), pink bloodwood and *Lophostemon suaveolens* (swamp box). The shrub layer within this AU was of moderate density, becoming denser in western portions of the AU. The shrub layer was dominated by black she-oak and hickory wattle with associated *Alphitonia excelsa* (soap tree) The ground layer within this community was spare where canopy cover and shrub cover was dense; however, were gaps in canopy and shrub cover occurred this layer became moderately dense. This layer is dominated by predominately native grasses and sedges with areas supporting denser grass being dominated by couch.

This AU supported moderate to high levels of leaf litter and small woody debris. One small area of outcropping sandstone was present in the northern areas of the Site (approximate 10m^2) with numerous larger logs scattered throughout. This AU provided relatively higher quality foraging and refuge habitat from terrestrial fauna in comparison to AU 1 and 4. No observable hollow bearing trees were noted within this AU. This AU remains connective with vegetation supported on residential properties to the west and with AU 3.

Although this AU supported higher quality habitats, impacts from cattle and horse grazing was evident.

3 AU 3 - Mixed Eucalypts on lower slopes with good shrub layer

AU 3 is relative small and isolated to the northern extremities of the Subject Site. This AU is bound: to the north by Crowson Lane, to the east and south by AU 4 and to the west by an internal farm track and dam.

AU 3 is dominated by Queensland blue gum and pink bloodwood with *Corymbia tessillaris* (carbeen), *Eucalyptus siderophloia* (northern grey ironbark) and narrow-leaved red gum. The canopy layer within this AU becomes sparse to non-existent on lower slopes were a drainage features is present prior to habitats transitioning to AU 4. The shrub layer was moderately dense and dominated by black she-oak, soap tree, and *Banksia integrifolia* (coast banksia). This shrub layer provided a good floristic diversity and density, particularly along the verge of Crowson Lane. The ground layer within this community was spare where canopy cover and shrub cover was dense; however, were gaps in canopy and shrub cover occurred this layer became moderately dense. This layer is dominated by predominately native grasses and sedges with areas supporting denser grass being dominated by *Imperata cylindrica* (blady grass).

This AU supported a moderate to dense level of leaf litter and small woody debris with only limited amounts of larger woody debris. The denser and more diverse vegetative structure in the north of this AU, notably on higher slopes provided higher quality foraging and refuge habitat. No observable hollow bearing trees were observed within this AU. This AU remains connective with habitats supported in AU 2 and 4.

Grazing pressures within the lower slopes of this AU were heavy and have significantly reduced habitat feature availability. Impacts from litter and weed incursion are also present along the verge of Crowson Lane.

4 AU 4 - Blue gum in lower alluvium with no shrub layer

AU 4 is located in the central northern component of the Subject Site in lower lying areas. This AU is bound: to the north by AU 3; to the east by the Mt Lindsay Highway; to the south by cleared paddocks associated with AU 5; to the west by an internal farm track and AU 2.

AU 4 is dominated by Queensland blue gum with associated northern grey ironbark. The shrub layer is generally absent within this AU with a small clump of *Melaleuca quinquenervia* (broad-leaved paperbark) occurring in the far west of the AU. The ground layer is dense and dominated by a blady grass or couch.

AU 4 supported minimal microhabitat features with limited to no woody debris or leaf litter of note. A dam is located in the extreme east of this AU while the majority of this AU is comprised of a broad overland drainage feature. Canopy connectivity remained moderate-good throughout the AU and remains connective with habitats supported in the north and north-west of the Site.

Constant cattle grazing pressure within this AU continues to limit microhabitat features such as woody debris and denser shrub from accumulating or regenerating.

Appendix 11 to the Technical Attachment 1

1 Fauna Assessment Methodology

1.1 Database Review

A review of literature pertaining to the terrestrial flora and fauna values of, and adjacent to, the Project area has been undertaken. Commonwealth and State database searches were defined by the coordinates -11.86668 latitude, 142.04155 longitude. The search area encompassed areas within 20km, 10km, 5km[1] and 2km of the Project to provide a sieving analysis of the likely suite of species which may occur within the Site.

The review was conducted prior to commencing field surveys and included:

- The Protected Matters Search Tool to identify MNES within approximately 20, 10, 5 & 2km of the Project area;
- DotE Species Profiles and Threats (SPRAT) Database;
- The DEHP Wildlife Online database to identify flora and fauna species potentially occurring within approximately 20, 10, 5 & 2km of the Project area;
- Queensland Museum records for the Project area;
- DEHP Essential Habitat Mapping (Version 4.1.5);
- Birds Australia Bird Atlas search;
- DEHP watercourse mapping;
- Published ecological information on threatened fauna species and vegetation communities; and
- Atlas of Living Australia spatial records and predicted distributions of fauna species.

1.2 Consideration of Survey Guidelines

Terrestrial fauna surveys used a range of techniques including trapping, motion cameras, bird surveys, spotlighting, acoustic detection, call playback, and active searches. Fauna survey methods were developed and implemented in general accordance with relevant survey guidelines, including:

- DEWHA (2010) Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act;
- DEWHA (2011a) Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act;
- DEWHA (2011b) Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act;
- DEWHA (2011c) Survey guidelines for Australia's threatened frogs: Guidelines for detecting amphibians listed as threatened under the EPBC Act;
- DEWHA (2011d) Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act; and

[1] Database searches undertaken in November have utilised a buffer of 5km. This database search has been used in the assessment of a species likelihood of occurrence. It is considered this buffer is adequate to capture relevant habitats and known records in the locality similar to that of the Subject Site and include any recently listed fauna which may be known from the locality.

- *Eyre et al.* (2014) Terrestrial vertebrate fauna survey guidelines for Queensland, Version 2.

28 South held pre-survey discussions with EDQ to determine the most appropriate methodologies and survey intensity to ensure efforts were satisfactory for the project. EDQ recommended any survey efforts should be in accord with *Eyre et al.* (2014) *Terrestrial vertebrate fauna survey guidelines for Queensland, Version 2* as threatened species listed under the EPBC Act have been covered through the recent EPBC controlled action approvals. Fauna surveys covered both the dry[2] and wet seasons and were scheduled in seasons where a number of fauna types such as reptiles and migratory birds were most active and likely to be on site.

1.3 Terrestrial Fauna Survey Timing

Terrestrial fauna surveys were undertaken between 7 and 11 December 2015, corresponding to the commencement of the wet season. The December survey was considered to occur during optimal weather conditions for most vertebrate fauna. Rainfall in the month preceding the survey period exceeded the median for November by 90.4mm with November 2015 receiving 196.6mm. Much of this rain came through storms in the early portions of the month; however, rain events occurred towards the end of November and the start of December. During the Survey period, the Site received one rain event on the last day; however all days preceding this rain event were very hot and humid, including warm humid nights. It is further noted, the preceding wet season also recording higher than average rainfall totals.

The total survey effort of detailed fauna surveys is summarised in the following fauna survey plan which is provided to demonstrate the extent of total terrestrial fauna survey effort across the Site associated with these efforts. Further, this illustrates the locality of various types of survey methods employed over the survey. It should be noted transition between all survey points was undertaken on-foot and as such opportunistic meander searches assisted in exhausting survey efforts.

The survey timing and conditions were suitable for the detection of a wide variety of vertebrates. December coincides with the return of summer Migratory bird species, such as cuckoos and wetland / wader species, and the warm temperatures encourage reptile activity. In particular, the rainfall recorded in the previous wet and dry seasons coupled within the significant rain experienced in November 2015, led to ideal spotlighting conditions with high humidity and warm temperatures. However, the lack of rainfall in the weeks preceding the survey led to generally dry conditions, with little surface water present outside of dammed areas. As such, overall herptile and small mammal activity was less pronounced.

During the surveys, spotlighting efforts were conducted during the late waning moon phase with survey commencing with 18.6% illumination and ceasing with 2.2% illumination. This reduced visibility during survey efforts; however, may have potentially increased the detectability of fauna species due to lower light levels and perceived reduction in predation.

1.4 Terrestrial Fauna Assessment

Terrestrial fauna values of the Site described in this report were derived from a combination of desktop assessments and in-field habitat condition surveys and historical ecological surveys. This report details terrestrial fauna values from two fauna surveys; dry season spotted-tail quoll survey and the early wet season survey. Results of all historical ecological assessments (e.g. koala SAT surveys and habitat analysis') have also been considered.

Terrestrial fauna surveys were designed to target threatened species known, or likely to occur, within the Site. These were identified through a desktop literature review, targeted searches of relevant databases (**Section 4.2**), and presence of habitats known to support likely threatened species. Consideration of least concern and pest species was incorporated into survey design and effort to maximise the detection of fauna assemblages (e.g. variety of trapping and survey methods).

[2] Dry season surveys were conducted specifically for spotted-tail quoll; however, the 25+ day/night survey effort provided good coverage of fauna present within the Site; however, do not align with the guidelines recommended timing for general fauna surveys, which wet season surveys aim to capture.

Fauna surveys utilised two main survey site types, being; primary and secondary. Primary sites were subject to a wide suite of trapping and survey methodologies; while secondary sites involved active survey methods. Survey sites were surveyed during consistent diurnal and nocturnal periods[3] to increase the statistical power of the data captured and provide greater coverage of the Site. Specific site survey timing was randomised to eliminate bias towards sites during each survey period.

To identify the most appropriate location of primary and secondary sites, a desktop review of vegetation communities was undertaken prior to a detailed walk through of the Site. Walk through assessment spatially defined the extent of habitats present within the Site, subsequently establishing Assessment Units (AU) over the Site which are illustrated in **Figure 4**. The location of primary and secondary sites should aim, where possible, to replicate sampling within each AU to reduce spatial variability in fauna assemblages. It is noted, this is not always possible given the quality and extent of habitat available to survey. The below provides an extract from *Eyre et. al.* (2014) with regard to locating survey sites:

> *The location of the site within the assessment unit must be representative of the RE and condition state, or other entity as determined by the objective of the assessment, and should be at least 50 m from a road and 100 m from a dam or other major disturbance. Terrestrial fauna survey sites should be positioned sufficiently far apart that individuals are unlikely to be detected at different survey sites. This will ensure the data are independent, if certain analytical procedures are to be performed on the data. As a rule of thumb, we recommend that generic sites are located at least 1 km apart from each other. However, fauna sites do need to be clustered to facilitate efficient and adequate servicing of sites (e.g. trap checking) during a survey period. Site location will be also be constrained by available access. Many fauna survey sites are located in close proximity to accessible roads and tracks, which may introduce a spatial bias. Consequently, it is advisable to acknowledge access issues in the limitations section of the report, particularly if a bias is suspected or identified during the data analysis.*

The Site is not of sufficient size and does not support sufficient variability in habitats for perform numerous replications within a survey effort. The Site is approximately 1km wide and 1km across, with significant portions existing habitats found on Site occurring as cleared paddocks with numerous dams. Further, the property supports active cattle grazing activities as well as an earth-moving depot and as such minimal shrub structure occurs across the Site with much of the ground layer supporting heavily grassed pastoral grass and minimal woody debris.

Nonetheless, desktop and walk through surveys teased out four main assessment units being:

1. Mixed Eucalypts on lower slopes with no shrub layer;
2. Mixed Eucalypts on upper slopes with moderate shrub layer;
3. Mixed Eucalypts on lower slopes with good shrub layer; and
4. Blue gum in lower alluvium with no shrub layer; and
5. Cleared paddocks with scattered trees.

One primary site and one secondary site were established within each of these AUs with two further secondary sites being established within cleared paddock areas. The two secondary sites established in the cleared paddock areas were located to include areas surrounding anthropogenic habitat features such as on-line farm dams or drains. This assisted in regular searches for cryptic wetland species such as bitterns given minimal to no wetland or riparian habitat occurs within the Site. All survey sites are shown in **Figure 4**.

1.5 Survey Techniques

[3] Survey periods included: Dawn; Morning; Afternoon; and Evening survey periods. This was complimented by opportunistic surveys conducted during all periods of the day and large portions of the evening.

Terrestrial fauna values of the Subject Site were assessed through a variety of techniques including:

- Trapping amphibians, reptiles and mammals, through the use of:
    - Elliott A traps
    - Elliott B traps
    - Arboreal Elliott Traps
    - Funnel traps
    - Hair tube traps
    - Pitfall traps
    - Remote camera traps
- Quantitative and qualitative survey for birds, including point census avifauna surveys and call playback;
- Spotlighting and call playback for nocturnal fauna, including amphibians, reptiles, birds and mammals;
- The use of ultrasonic bat recording (Song Metre 2) to record bat species present within the survey area;
- Hand searches for active and cryptic species;
- Opportunistic fauna observations;
- Waterhole and drainage features surveys; and
- Opportunistic scat and track analysis.

A summary of the survey trapping techniques and respective effort employed during the wet season and spotted-tail quoll dry season survey is presented in **Table1**.

TABLE 1: Trapping Efforts

Site	Method	Duration	Effort Size (Trap nights)	Total Effort (Trap nights)
All Primary Sites	Elliott A x 20	4 nights	EA: 80	EA: 320
	Elliott B x 4	4 nights	EB: 16	BE: 64
	Arboreal B x 5	4 nights	AEB: 20	AEB: 80
	Funnel Trap x 6	4 nights	FT: 24	FT: 96
	Hair Tube x 2	4 nights	HT: 8	HT: 32
	Pit fall x 4	4 nights	PF: 16	PF: 64
	Camera Trap x 2	4 nights	CT: 8	CT: 32
	SM2 X 2	4 nights	SM2: 8	SM2: 8

Spotted-tail Quoll Sites 1-12	Camera Traps x 12 Hair Tube x 24	25 nights 25 nights	CT: 275 HT: 600	CT: 275[4] HT: 600

Elliott A traps

Elliott A traps were baited with a mix of oats, peanut butter, honey and macadamia oil rolled into a ball. Traps were set approximately 10 m apart forming two rows of 10 either side of the pitfall array.

Trap placement was influenced by vegetation diversity, the size and shape of the vegetation patches and naturally occurring features such as logs, woody debris, tree bases, clumping vegetation and termite mounds (where present). Traps were cleared and closed each morning and reset late in the afternoon in accordance with animal ethics requirements.

Elliott B Traps

Elliott B traps were baited with a mix of oats, peanut butter, honey and macadamia oil rolled into a ball. Traps were set at either end of the two rows of Elliott A traps occurring either side of the pitfall array.

Arboreal Elliott Traps

Arboreal Elliott traps were established sporadically at each primary site. Traps were attached to an L bracket and mounted to tress at approximately 6m above the ground. Traps were baited with a mix of oats, peanut butter, honey and macadamia oil rolled into a ball. A mixture of honey and water was sprayed around the mounted trap as an attractant to arboreal fauna.

Funnel traps

Funnel traps approximately 500 x 20mm, with a 100mm opening at the funnel entrance were deployed on either side of a drift fence flush to the ground surface and covered with a wet hessian material to protect trapped fauna from the daytime heat. Funnel traps were cleared early morning and late afternoon in accordance with animal ethics requirements. Hessian bags were soaked with water each afternoon and placed over the funnel traps.

Pitfall traps

At each site a pitfall trap array was established consisting of both pitfall and funnel traps. The pitfall trap array was constructed using single buckets (200 x 600mm) dug into the ground so the rim was flush with the surface, connected by a vertical barrier of drift fencing (400mm high), also dug into the ground. All pitfall traps were filled with 20-30mm of soil with a small amount of leaf litter, woody debris and stones were place in each trap to provide refuge to fauna. Pitfall trap arrays were cleared every morning and water was added to saturate the soil when necessary.

Camera traps

At each primary site, two infrared cameras were securely attached to the trunk of a tree approximately 1 m above the ground. The camera was directed towards a bait attached to either a small tree stem or metal stake and located in an area likely to be frequented by fauna species. The bait contained chicken necks and approximately two table spoons of macadamia oil poured onto the ground surrounding the bait.

Walk-through surveys

[4] 275 equivalent camera detection nights were achieved, whereby: (a) 10 units detected for the full 25 nights; (b) one unit collected for 6 nights; and (c) one replacement unit collected for 19 nights. The minor reduction in total spotted-tail quoll trap nights from 300 to 275 was due to the theft of two cameras during survey periods.

Walk-through surveys recording incidental observations of fauna species were conducted between all primary and secondary sites. Surveys included habitat searches and records of incidental fauna observations.

Active diurnal searches

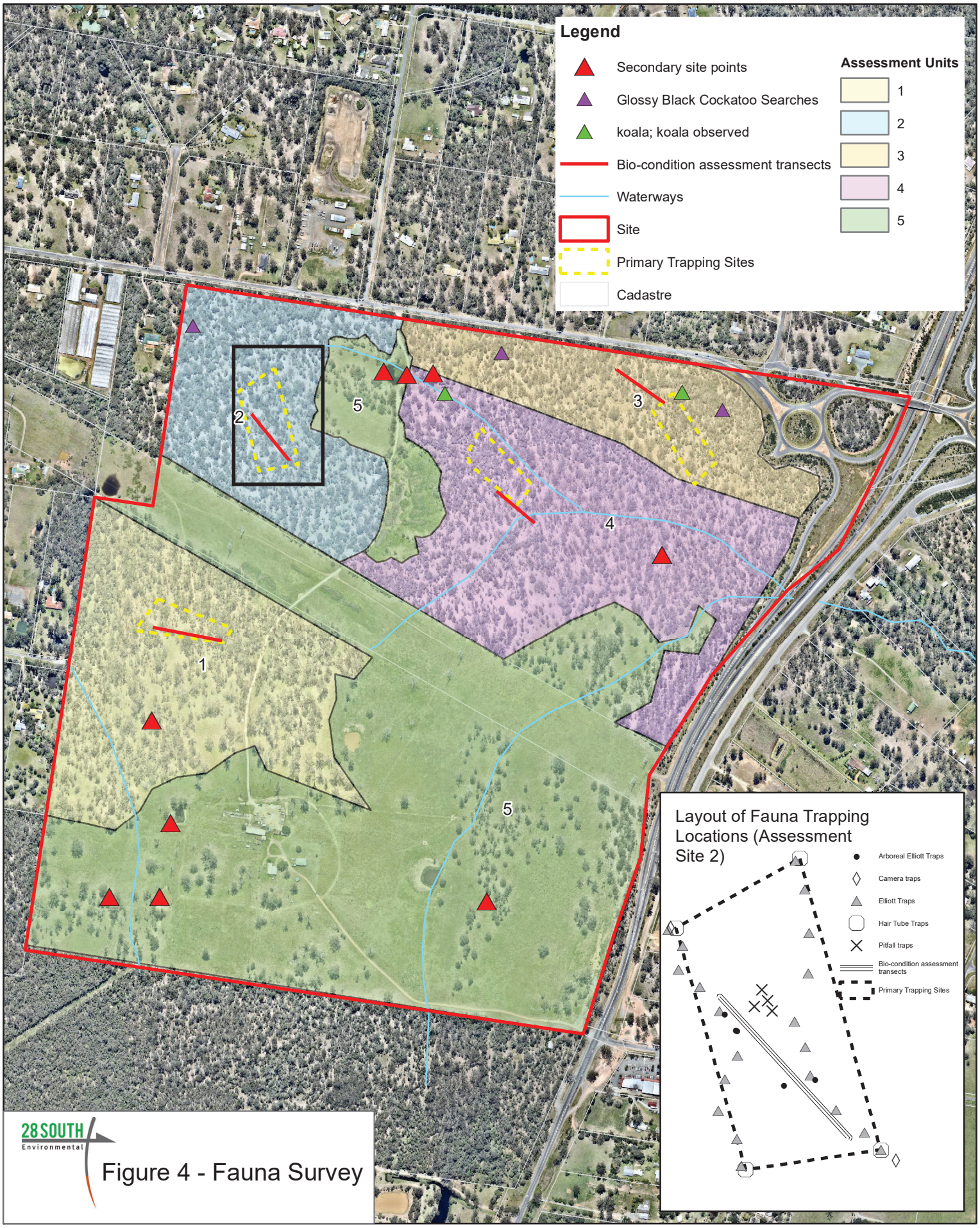
Diurnal surveys for cryptic and active fauna were undertaken by searching potential micro-habitats associated with woodland vegetation communities, including stripping loose decorticating bark on trees and logs, raking through woody debris and leaf litter, turning logs and rocks and inspecting termite mounds.

Point Census Surveys

Timed point census surveys were undertaken at each primary and secondary site to record all fauna species which were detected at that point in time during survey efforts. Point census surveys involved a 20 minute survey of a 0.5 hectare area and recorded all species detected.

Passive-acoustic monitoring (SM2)

To establish a bat species inventory a Song Meter 2 electronic bat detector was used to automatically monitor and record bat calls. Ultrasonic bat recording using Song Meter 2 was undertaken from dusk until dawn. Such devices recorded frequencies in the ultrasonic spectrum to enable the identification of bat species.



28 SOUTH Environmental

Figure 4 - Fauna Survey

Project Name: North MacLean
Client:
Title: Figure 4 - Fauna Survey
Date: 30th November 2016
Coodinate System: GDA 1994 MGA Zone 56
Reference Scale: 1:8,000

N

0 100 200 Metres

Reference: Cadastre - DNRM 2014, Imagery - Near Maps 2014

Appendix 12 to the Technical Attachment 1

	Species Name	Common Name
1	*Accipiter cirrocephalus*	collard sparrowhawk
2	*Corvus orru*	torresian crow
3	*Dacelo novaeguineae*	laughing kookaburra
4	*litoria nasuta*	striped rocketfrog
5	*Macropus giganteus*	eastern grey kangaroo
6	*Manorina melanocephala*	noisy miner
7	*Pachycephala rufiventris*	rufous whistler
8	*Philemon corniculatus*	noisy friarbird
9	*Pseudocheirus peregrinus*	common ringtail possum
10	*Todiramphus sanctus*	sacred kingfisher
11	*Trichoglossus chlorolepidotus*	scaly-breasted lorikeet
12	*Trichoglossus haematodus moluccanus*	rainbow lorikeet
13	*Trichosurus vulpecula*	common brushtail possum
14	*Vanellus miles*	masked lapwing
15	*Cracticus tibicen*	Australian magpie
16	*Cacatua galerita*	sulphur-crested cockatoo
17	*Grallina cyanoleuca*	magpie lark
18	*Cracticus nigrogularis*	pied butcherbird
19	*Scythrops novaehollandiae*	channel-billed cuckoo
20	*Rhinella marina*	cane toad
21	*Rhipidura leucophrys*	willie wag-tail
22	*Cracticus torquatus*	grey butcherbird
23	*Eolophus roseicapillus*	galah
24	*Chalcites minutillus barnardi*	little bronze cuckoo
25	*Chenonetta jubata*	Australian wood duck
26	*Anas superciliosa*	Pacific black duck
27	*Canis lupus familiaris*	Dog (Kelpie)
28	*Philemon citreogularis*	little friarbird
29	*Oriolus sagittatus*	olive-backed oriole
30	*Ardea ibis*	cattle egret
31	*Gerygone olivacea*	white-throated gerygone
32	*Cacomantis flabelliformis*	fan-tailed cuckoo
33	*Ocyphaps lophotes*	crested pigeon
34	*Coracina novaehollandiae*	black-faced cuckoo-shrike
35	*merops ornatus*	rainbow bee-eater
36	*Entomyzon cyanotis*	blue-faced honeyeater
37	*Sphecotheres vieilloti*	Australasian figbird
38	*Geopelia striata*	peaceful dove
39	*Phaps chalcoptera*	common bronzewing
40	*Litoria dentata*	bleating treefrog
41	*Ninox boobook*	southern boobook
42	*Parvipsitta pusilla*	little lorikeet
43	*Pomatostomus temporalis*	grey-crowned babbler
44	*Threskiornis spinicollis*	straw-necked ibis
45	*Colluricincla harmonica*	grey shrike-thrush
46	*Pardalotus striatus*	striated pardalote
47	*Geopelia humeralis*	bar-shouldered dove
48	*Myiagra rubecula*	leaden flycatcher
49	*Platycercus adscitus*	pale-headed rosella

50	*litoria fallax*	eastern sedgefrog
51	*Phascolarctos cinereus*	koala
52	*Caligavis chrysops*	yellow-faced honeyeater
53	*Todiramphus macleayii*	forest kingfisher
54	*Platyplectrum ornatum*	ornate burrowing frog
55	*Eurystomus orientalis*	dollarbird
56	*Ardea intermedia*	intermediate egret
57	*Strepera graculina*	pied currawong
58	*Eudynamys orientalis*	eastern koel
59	*Centropus phasianinus*	pheasant coucal
60	*Acridotheres tristis*	common myna
61	*Tachybaptus novaehollandiae*	australian grebe
62	*Hirundo neoxena*	welcome swallow
63	*Cryptoblepharus pulcher pulcher*	elegant snake-eyed skink
64	*Litoria gracilenta*	greaceful treefrog
65	*Lepus europaeus*	European brown hare
66	*Malurus melanocephalus*	red-backed fairywren
67	*Aviceda subcristata*	Pacific baza
68	*Platalea flavipes*	yellow-billed spoonbill
69	*Dendrelaphis punctulatus*	green tree snake
70	*Coracina tenuirostris*	cicadabird
71	*Mus musculus*	house mouse
72	*Litoria peronii*	emerald spotted treefrog
73	*Pogona barbata*	bearded dragon
74	*Artamus leucorynchus*	white-breasted woodswallow
75	*Pteropus scapulatus*	little red flying-fox
76	*Podargus strigoides*	tawny frogmouth
77	*Dendrocygna eytoni*	plumed wistling-duck
78	*Coturnix ypsilophora*	brown quail

Appendix 13 to the Technical Attachment 1

NOCTURNAL ECOLOGY

Call Analysis Report

North MacLean, December 2015

Revision	Author	Date
1.0	Julie Broken-Brow	31/12/2015

Document Notice:

Contents

List of Tables

1.0 Introduction

Acoustic detection involves the recording of bat echolocation calls with an ultrasonic detector, these calls are analysed to identify species/genus or activity. Acoustic detection can involve either passive and/or active surveys. In a passive survey the detectors are not held by the surveyor, but are stationary for a period of time. Call analysis is the identification of species from the acoustic detection survey.

1.1 Scope of Works

Nocturnal Ecology has been engaged to perform call analysis on a full spectrum data set collected by 28 South Environmental ecological consultants. This report will outline the methods of call analysis, the results of the call analysis and a desktop review of species likely to be present at the survey site.

1.2 Definitions and Abbreviations

Table 1. Definitions

Term	Definition
AnalookW	Zero Crossing Analysis software developed by Corben (2008)
Call	An ultrasonic echolocation signal produced by a microbat
Call Analysis	Analysing the echolocation calls to a species or genus
Call Pass	A series of echolocation call pulses as the bat “passes” the detector
Echolocation	The ultrasonic calls produced by microbats
Filter	A function of the AnalookW program which allows call pass files to be viewed without noise
Full Spectrum	Full Spectrum is an ultrasonic digital recording made at high sample rates which include all of the available noise element of the call (e.g., strength and harmonics)
Noise	Ultrasonic noise that is not bat calls, often insects and electrical interference
Pulse	A single echolocation call
Reference Call Library	A collection of calls from known species, used to cross-reference survey data for species identification
Zero Crossing Analysis	Zero crossing analysis can derive the frequency sweep of the echolocation call through time representing the strongest frequency components of the call

Table 2. Abbreviations

Abbreviation	Description
.wav file	Waveform file, full spectrum recording file type
eg.	For example
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
IUCN	International Union for Conservation of Nature
LC	Least Concern
SM2+Bat	Song Meter 2, formatted for ultrasonic bat recording, Wildlife Acoustics detector
sp.	Individual species
spp.	Multiple species
SPRAT Profile	Species Profile and Threats Database Profile, Australian Government
ZCA	Zero Crossing Analysis

1.3 Survey Context

The survey data was collected on two (2) SM2+Bat detectors (Wildlife Acoustics) in full spectrum. The acoustic detection survey was conducted between 7th December 2015 and 11th December 2015. Call files range between approximately 6:30pm and 5:45am. The survey was conducted at four (4) sites in the north MacLean area, south of Logan, Queensland.

2.0 Methodology

The following section will outline the methods utilised for call analysis and reporting.

2.1 Desktop Review

A desktop review was undertaken to establish a species list for the survey region, the conservation status of these species and the likelihood of presence on the survey site. This desktop search used the following sources:

- Churchill (2008) 'Australian Bats';
- Australian Government Species Profile and Threats Database (SPRAT) profiles;
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- *Nature Conservation (Wildlife) Regulation 2006*; and
- International Union for Conservation of Nature (IUCN) Red List of Threatened Species.

This desktop review was based on the survey location being North MacLean. The site descriptions were provided by 28 South Environmental.

2.2 Call Analysis

Echolocation calls were recorded in a full spectrum format (.wav) by SM2+Bat detectors (Wildlife Acoustics). For post-recording analysis, the calls were displayed as Zero-Crossing Analysis (ZCA) frequency/time graphs and analysed manually using *AnalookW* (Version 3.7; Corben 2008). Calls which could not be identified in the ZCA format were viewed as full spectrum files in .wav file viewing software; this sometimes assists with species identification. During the conversion from full spectrum to ZCA format, files with only noise were filtered from the data set. These noise files were kept and checked for bat calls.

A filter was applied to the data to remove ultrasonic noise from the calls; however this filter was removed on difficult-to-identify calls. Only calls with a minimum of three clear pulses were identified to species/genus. Call characteristics such as slope, duration, characteristic frequency, alternation, frequency of the knee and shape were used for the analysis. Calls were analysed using the key to bat calls of south-east Queensland and north-east New South Wales (Reinhold et al. 2001). Species identifications were matched against a local reference call library (Nocturnal Ecology). Whilst most calls could be identified to species, others could only be identified to species complexes.

3.0 Results

The following section outlines the results of the desktop review and call analysis.

3.1 Desktop Review Results

The desktop review found that 18 species were likely to be present, six (6) species were possibly present and three (3) species were unlikely to be present on the survey sites. **Table 3** shows these results.

3.2 Call Analysis Results

The data set contained 1091 call pass files (Site 1: 165; Site 2: 242; Dam 3: 379; Dam 1: 305), some of which contained multiple bat passes, and 1658 noise files. Analysis revealed eight (8) species present and nine (9) species possibly present on one or more sites. A further 10 species may have been present at the survey site but were not detected in the call analysis.

The following table (**Table 3**) shows the results of the desktop review and call analysis.

Table 3. Results of desktop review and call analysis

Family	Scientific Name	Common Name	ACS	QCS	GSC	Desktop Results	Call Analysis Results			
							Site 1	Site 2	Dam 1	Dam 3
Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied sheathtail bat	-	LC	LC	Likely	Not Detected	Present	Present	Not Detected
Molossidae	*Mormopterus lumsdenae**	Lumsden's freetail bat	-	LC	LC	Likely	Present	Possible	Not Detected	Present
Molossidae	*Mormopterus norfolkensis*	East coast freetail bat	-	LC	**Vulnerable**	Likely	Not Detected	Not Detected	Not Detected	Not Detected
Molossidae	*Mormopterus ridei*	Eastern freetail bat	-	LC	Not Assessed	Likely	Likely	Possible	Present	Present
Molossidae	*Austronomous australis*	White-striped freetail bat	-	LC	LC	Likely	Present	Present	Present	Present
Rhinolophidae	*Rhinolophus megaphyllus*	Eastern horseshoe bat	-	LC	LC	Possible	Not Detected	Not Detected	Not Detected	Not Detected
Miniopteridae	*Miniopterus australis*	Little bentwing bat	-	LC	LC	Likely	Not Detected	Not Detected	Not Detected	Not Detected
Miniopteridae	*Miniopterus schreibersii oceanensis*	Eastern bentwing bat	-	LC	LC	Likely	Possible	Possible	Possible	Possible
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared pied bat	**Vulnerable**	**Vulnerable**	**Near Threatened**	Possible	Not Detected	Not Detected	Not Detected	Not Detected
Vespertilionidae	*Chalinolobus gouldii*	Gould's wattled bat	-	LC	LC	Likely	Present	Present	Likely	Present
Vespertilionidae	*Chalinolobus morio*	Chocolate wattled bat	-	LC	LC	Likely	Possible	Not Detected	Not Detected	Not Detected
Vespertilionidae	*Chalinolobus nigrogriseus*	Hoary wattled bat	-	LC	LC	Possible	Not Detected	Possible	Likely	Present
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern falsistrelle	-	LC	LC	Possible	Not Detected	Not Detected	Not Detected	Not Detected
Vespertilionidae	*Kerivoula papuensis*	Golden-tipped bat	-	**Near Threatened**	LC	Unlikely	Not Detected	Not Detected	Not Detected	Not Detected
Vespertilionidae	*Myotis macropus*	Large-footed myotis	-	LC	LC	Likely	Present	Not Detected	Possible	Not Detected
Vespertilionidae	*Nyctophilus* spp.:	Long eared bats					Not Detected	Not Detected	Possible	Not Detected
	Nyctophilus bifax	Eastern long eared bat	-	LC	LC	Likely	Not Detected	Not Detected	Possible	Not Detected
	Nyctophilus geoffroyi	Lesser long eared bat	-	LC	LC	Likely	Not Detected	Not Detected	Possible	Not Detected

Table continues over page

Family	Scientific Name	Common Name	ACS	QCS	GSC	Desktop Results	Call Analysis Results			
							Site 1	Site 2	Dam 1	Dam 3
	Nyctophilus gouldi	Gould's long eared bat	-	LC	LC	Likely	Not Detected	Not Detected	Possible	Not Detected
Vespertilionidae	*Scoteanax rueppellii*	Greater broad-nosed bat	-	LC	LC	Likely	Not Detected	Not Detected	Not Detected	Not Detected
Vespertilionidae	*Scotorepens balstoni*	Inland broad-nosed bat	-	LC	LC	Unlikely	Not Detected	Not Detected	Not Detected	Not Detected
Vespertilionidae	*Scotorepens* spp.:	Broad-nosed bats					Possible	Present	Present	Present
	Scotorepens greyii	Little broad-nosed bat	-	LC	LC	Likely	Possible	Possible	Possible	Possible
	Scotorepens orion	South-eastern broad-nosed bat	-	LC	LC	Likely	Possible	Present	Possible	Present
	Scotorepens sp.	Central-eastern broad-nosed bat	Data deficient	LC	Not Assessed	Likely	Possible	Present	Present	Present
Vespertilionidae	*Vespadelus darlingtoni*	Large forest bat	-	LC	LC	Possible	Possible	Not Detected	Possible	Not Detected
Vespertilionidae	*Vespadelus pumilus*	Eastern forest bat	-	LC	LC	Possible	Not Detected	Not Detected	Not Detected	Not Detected
Vespertilionidae	*Vespadelus troughtoni*	Eastern cave bat	-	LC	LC	Possible	Not Detected	Not Detected	Not Detected	Not Detected
Vespertilionidae	*Vespadelus vulturnus*	Little forest bat	-	LC	LC	Unlikely	Possible	Not Detected	Possible	Not Detected

* *Mormopterus lumsdenae* is recently described species which was previously classified as *Mormopterus beccarii* (Reardon et al. 2014)

ACS – Australian Conservation Status; QCS – Queensland Conservation Status; GCS – Global Conservation Status; LC – Least Concern.

spp.: Is a species complex, where calls are often indistinguishable. A species complex may be present, but which individual species present may be uncertain.

3.4 Interpretation

3.4.1 Desktop Review

The results of the desktop review are an indication of species likely to be present on the site, based on a literature review; they may not be a true representation of the bat fauna on the site. Further information on the location and habitat of the survey site may affect bat fauna predictions.

Three categories were used to predict the bat fauna on the survey site based on the desktop review: Likely, Possible and Unlikely. See the table (**Table 4**) below for a description of the three categories.

Table 4. Definitions of desktop review categories

Category	Definition
Likely	Indicates the species is common in this region and is likely to occur on the site
Possible	Indicates the species occurs in this region, however the species: **a)** may not be common; **b)** may have specific/limited habitat associations which are rare in the survey region. It is possible the species occurs on the site.
Unlikely	Indicates the species: **a)** has a distribution bordering on (but not including) south-east Queensland; **b)** the species is uncommon; **c)** has known specific/limited habitat associations which are rare in the survey region. It is unlikely that the species occurs on the site, however it is possible.

3.4.2 Call Analysis

The results of this call analysis are only representative of the call data collected, and may not be an accurate representation of the bat fauna on the site. This should be acknowledged in any interpretation of this analysis. The following factors may affect the results and efficacy of detecting the full range of bat fauna at a site:

- Location of detectors (where on the site)
- Number of detectors (to ensure site coverage)
- Placement of detectors (including height of microphones)
- Survey timing (season and detector hours)
- Detector settings (trigger and sensitivity settings)

Variability in the calls produced from a single species means that there are a number of species with overlapping calls in south-east Queensland. Depending on the quality of the call pass, they can sometimes be identified to species. Otherwise a pass may be identified to a species complex. Some of the species complexes commonly identified in south-east Queensland include:

- *Mormopterus lumsdenae* and *Chalinolobus gouldii*
- *Chalinolobus gouldii* and *Mormopterus ridei*
- *Scotorepens* spp. (includes *Scotorepens* sp., *S. greyii* and *S. orion*)
- *Nyctophilus* spp. and *Myotis macropus*
- *Chalinolobus morio* and *Vespadelus* spp.
- *Chalinolobus nigrogriseus* and *Scotorepens* spp.
- *Scotorepens* spp. and *Miniopterus schreibersii oceanensis*

The likelihood of a species complex being attributed to one species or another will depend on the call quality, number of clear pulses and the call files immediately before/after. For example, a call pass may be identified as *Chalinolobus gouldii* and *Mormopterus ridei* complex; however if the call immediately preceding this (within a second or two) was clearly a *C. gouldii* then it is more likely this call will be a *C. gouldii*.

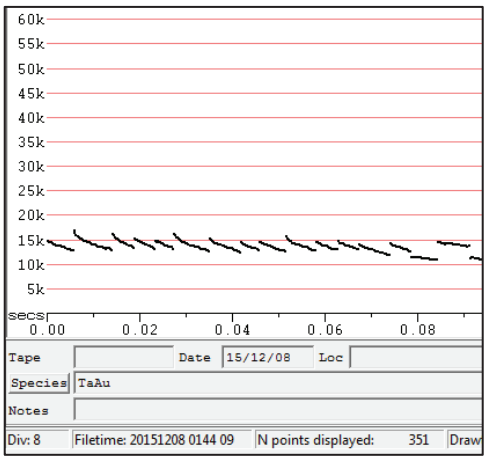
There are four categories which have been used for the call analysis: Present, Likely, Possible and Not Detected. The definitions of these categories can be seen in the table (**Table 5**) below.

Table 5. Definitions of call analysis categories

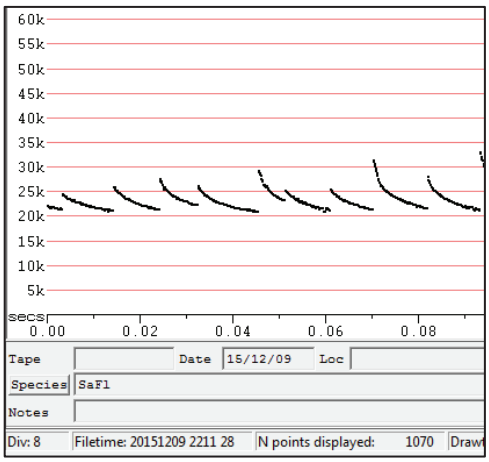
Category	Definition
Present	There are numerous call passes with clear call pulses which can be confidently identified to the species. This means that the species was present on the survey site.
Likely	There are several call passes which may be attributed to this species, however they have been identified as a species complex. It is possible that these calls may have been produced by another species. It is likely that the species is present on the survey site.
Possible	There are one or more call passes which may be attributed to this species, however they have been identified as a species complex. It is possible that the species is present on the survey site, however further acoustic detection is recommended to determine presence.
Not Detected	There were no call passes which were attributed to this species. This species was not detected in the call data, however this does **not** mean the species is absent from the survey site.

3.5 Identified Species Sequences from North MacLean Data

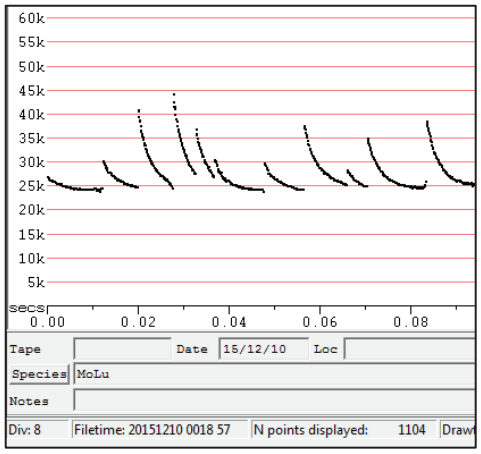
The following figures show examples of each of the species/species complex identified from this data set.



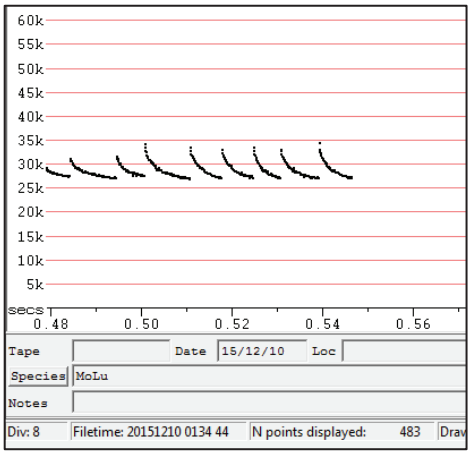
Austronomous australis



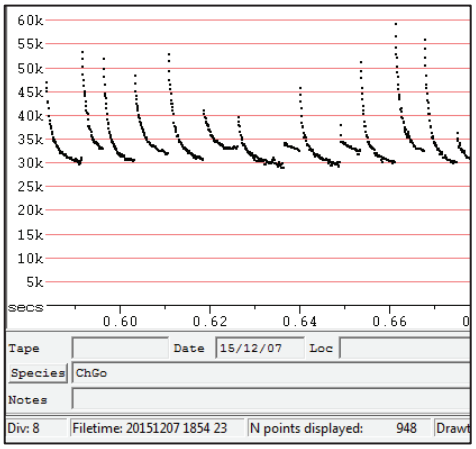
Saccolaimus flaviventris



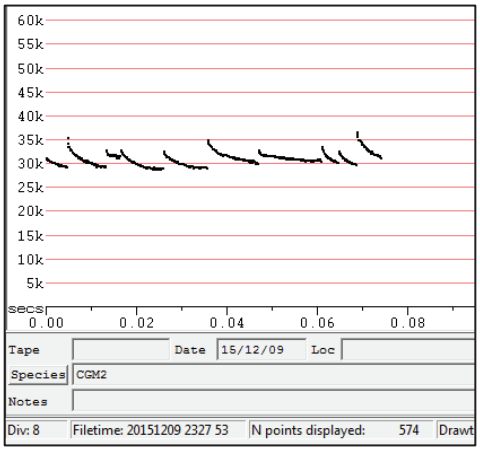
Mormopterus lumsdenae



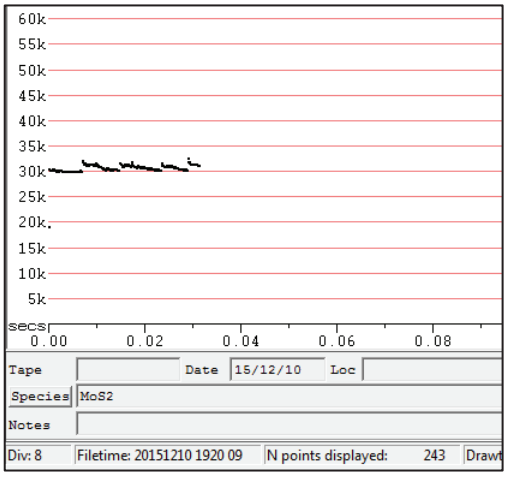
Mormopterus lumsdenae/Chalinolobus gouldii



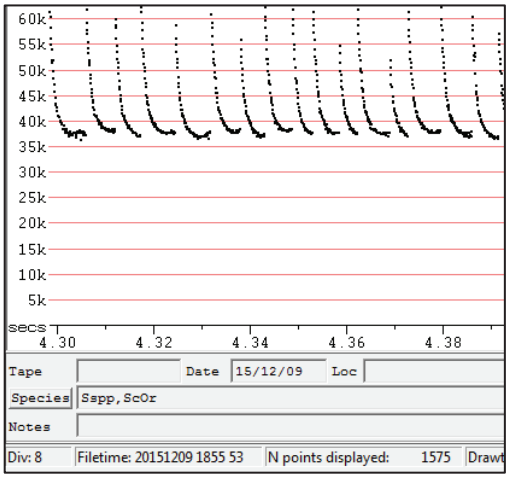
Chalinolobus gouldii



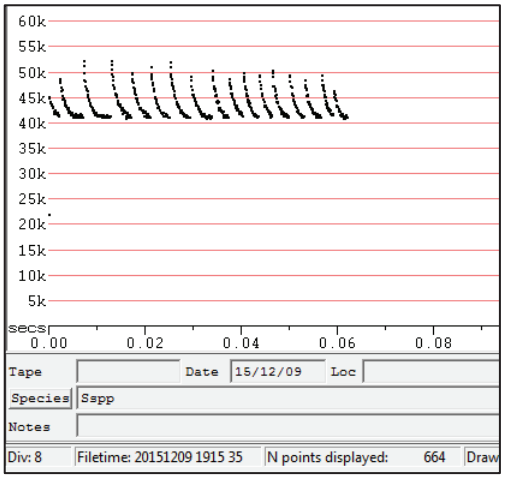
Chalinolobus gouldii/Mormopterus ridei



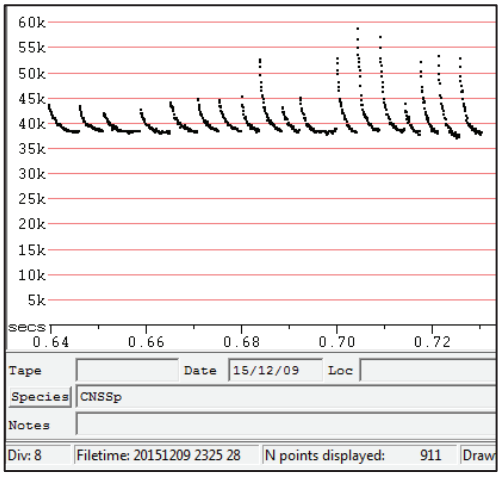
Mormopterus ridei



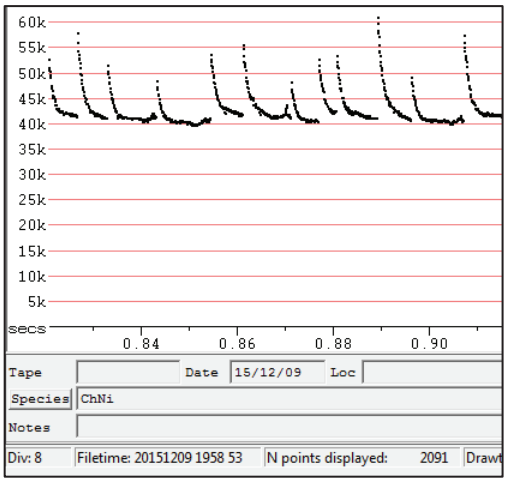
Scotorepens orion



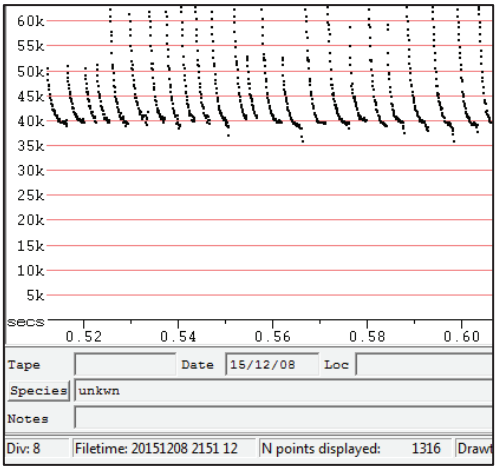
Scotorepens spp.



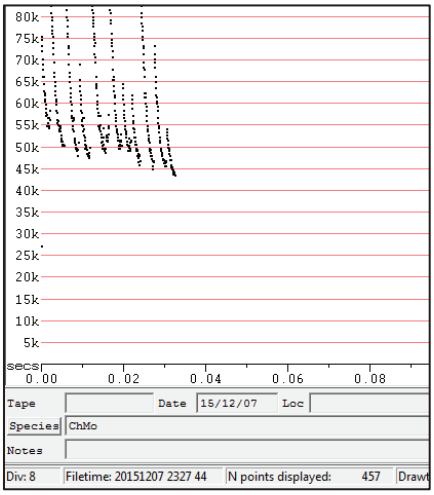
Chalinolobus nigrogriseus/Scotorepens spp.



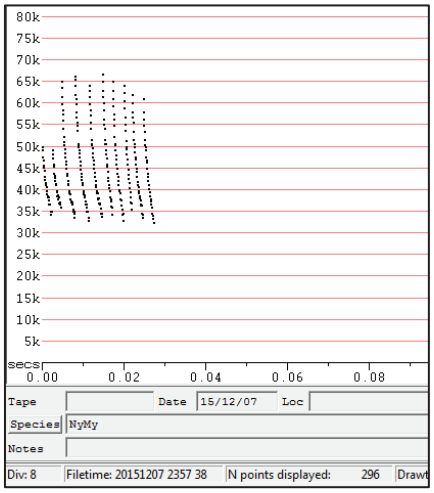
Chalinolobus nigrogriseus



Scotorepens spp./ *Miniopterus schreibersii oceanensis*



Chalinolobus morio/Vespadelus spp.



Myotis macropus

3.6 Species Considerations

Chalinolobus dwyeri

Chalinolobus dwyeri, the large-eared pied bat, is classified as Vulnerable both federally and within Queensland. Threats to this species include disturbance/interference with subterranean roosts, habitat clearance and predation by feral animals (Department of the Environment 2014). This species was not detected in the survey. The survey guidelines for Australia's threatened bats (Department of Environment, Water, Heritage and the Arts, 2010) recommend the following actions:

> *"Surveys are best conducted from October through to March…*
>
> *The use of electronic bat detectors is the best means of non-invasive survey, and the most efficient in terms of data collection and area coverage. Trapping with harp traps and mistnets, and roost searches in caves, mines, rock overhangs, culverts and crevices could be undertaken to confirm presence or roosting. Recommended acoustic detection devices include the Anabat ZCA system (recording to CF card), though other frequency-division and time expansion detectors connected to digital recorders could be used.*
>
> 1. Prior to the survey. *Determine the potential for rocky outcrops, caves and mines to occur in the area by examining topographic and geological maps, and contacting state government mines and forestry departments, Queensland Parks and Wildlife Service, caving groups, bat researchers and local councils. Where appropriate, information on caves and mines may be obtained from local residents.*

2. Passive acoustic detection. *A range of potential roost habitats can be examined by passive detection with unattended recorders placed in the vicinity of mines, caves and rocky outcrop, and also in foraging sites such as vegetation corridors and flyways, sandstone gorges, over watercourses, isolated waterholes and in representative vegetation types. Quality search-phase echolocation calls are diagnostic but these may not be recorded from bats emerging from underground roosts if bat detectors are placed at the entrance. Unattended detectors should be left overnight at multiple locations.*

3. Active acoustic detection. *For larger project areas, walking or driving transects using hand-held detectors may be used in conjunction with unattended detectors. Transects should begin at dusk.*

4. Roost searches. *Where no known roost sites have been identified in the planning stage, several hours may be required to conduct ground-based surveys for caves, mines, rock overhangs and crevices. For large project areas in gorge country, ground-based searching could be expected to take several days. Daytime entry of subterranean structures such as culverts, mines and caves should be undertaken carefully to avoid risking the safety of personnel and disturbance to resting bats. Identification can be made from capture within roosts. Disturbance resulting from capture of bats should be compensated by the collection of unambiguous and verifiable evidence of occupancy – in the form of photographs of the distinctive pelage, and external measurements.*

5. Trapping. *Success with trapping is most efficient in the vicinity of potential roosts. Harp traps and mistnets are useful for detecting this species, and can be set overnight in forest flyways, near scarps and cliffs and in riparian zones. Captured individuals should be released only at night, or into roosts during the day if these are known, and bats should be held for the minimum amount of time after being removed from traps and nets. If bats are cleared from harp traps in the early morning, they should be kept at room temperature until the following night. Reference calls should be recorded from individuals released after trapping so that identification information is available for verification.*

A combination of techniques is recommended.

Project area	*<50 ha*	
Survey techniques	***Total effort***	***Minimum number of nights***
Unattended bat detectors	*16 detector nights*	*4*
Attended bat detectors	*6 detector hours*	*3*
Harp traps and/or mistnets	*16 trap or net nights*	*4*

Kerivoula papuensis

Kerivoula papuensis, the golden-tipped bat, is classed as Near Threatened under the *Nature Conservation (Wildlife) Regulation 2006*. Threats to this species include habitat clearance, changing fire regimes and predation by feral cats and foxes (Hutson et al. 2008). The species was not detected in the survey. The targeted species survey guidelines (Department of Science, Information Technology, Innovation and the Arts, 2012), recommend the following actions:

> *"Kerivoula papuensis is best surveyed using capture techniques, specifically harp traps. The calls of this species are rarely recorded acoustically. The detection of high frequency, low intensity calls of short duration is difficult, particularly amongst dense vegetation. In addition, mist nets have been ineffective at capturing this species… surveys targeting this species are best conducted in warmer months (Oct to Apr)… [it is best to conduct] sampling during fair weather whenever possible, and survey periods should be extended if sampling is affected by adverse weather conditions."*

***Scotorepens* sp.**

Scotorepens sp., the central-eastern broad-nosed bat, was found to be present on the survey site. This species is as yet undescribed; however it is commonly recognised as a unique species (Churchill 2008). It is classified as "Least Concern" under Queensland legislation, and is reserved as data deficient under federal classification.

Mormopterus ridei

Mormopterus ridei, the Eastern freetail bat, was found to be present on the survey site. This species has undergone taxonomic revision. In Churchill (2008) the species is referred to as *M. ridei*, under state and federal legislation it is referred to as *M*. sp. 2; this revised name of *M. ridei* was used in this report.

Mormopterus lumsdenae

Mormopterus lumsdenae was found to be present on the survey site, the species has undergone taxonomic revision. In Churchill (2008) the species is referred to as *M. beccarii*, however the genus *Mormopterus* has recently been revised and this species is now classified as *M. lumsdenae* (Reardon et al. 2014); this revised name of *M. lumsdenae* was used in this report.

References

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Appendix 14 to the Technical Attachment 1

In regard to Criterion (Koala Occurrence) – Koalas have been recorded from the Subject Site. The score for koala occurrence is 2.

In regard to criterion (Vegetation Composition) – The Draft Koala Referral Guideline makes reference to a DEHP document[1] identifying koala food tree species. The document identifies several recognised food trees, one of which, Queensland blue gum (*Eucalyptus tereticornis*) is common at the Subject Site. While there are no further primary habitat species, there are some species of secondary significance. On balance, due to the extent of the primary habitat species Queensland blue gum, a score of 2 is assigned for vegetation composition.

In regard to criterion (habitat connectivity) – With reference to Figure 2, the Subject Site is located in a highly disturbed and rapidly urbanising landscape. The score for landscape connectivity is 0.

In regard to criterion (Key Existing Threats) – There are no formed roads within the Site, but the Mt. Lindesay Highway to the east represents a considerable threat to koala movement. The threat has (to a certain degree) has been averted by exclusion / directional fencing and fauna underpass under the highway, but areas to the south of the underpass remain open. Most of Crowson Lane is also unfenced. It is considered that vehicle strike represents a moderate threat to koalas in this locality.

No evidence of dog attack was observed during the survey, but the Site is located in a rural residential area, and it is considered likely that predation by domestic dogs occurs. Further, wild dogs are known to be problematic for koalas in the Greater Brisbane Region (Mifsud undated). The score for Key Existing Threats is 1.

In regard to criterion (Recovery Value) – Table 1 of the Draft Koala Referral Guidelines describes the interim recovery objectives for the coastal context as *Protect and conserve large connected areas of koala habitat, particularly large connected areas that support koalas that are:-genetically diverse/distinct; or–free of disease or have a very low incidence of disease; or – breeding (i.e. presence of back young or juveniles).*

While exhibiting evidence of reasonable use, the Subject Site's habitats are reasonably isolated, and will continue to be subject to decline in value and development in surrounding areas increases (as per the vision on the Greater Flagstone urban development scheme. Within the context of the species' interim recovery objectives the Site is considered unlikely to be of high importance. However, its values in an otherwise heavily cleared landscape are also acknowledged. A score of 1 is assigned for Recovery value.

Overall, the Site achieves a score of 6, indicting that it provides *Habitat Critical to the Survival of the koala*. However the regrowth Queensland blue gum woodland in the north east of the Subject Site is clearly the area of greatest significance for the koala, while the heavily cleared areas in the south east will be of relatively low value.

Could the Action Substantially Interfere with the Recovery of the Koala

In regard to criterion (Dog Attack) – No evidence of dog attack on koalas was observed during the survey, but the Subject Site is located in a rural residential area, and it is considered likely that predation by domestic dogs occurs. Further, wild dogs are known to be problematic for koalas in the Greater Brisbane Region (Mifsud undated).

The proposed action will result in clearing of the Subject Site and establishment of fenced properties. Post-development, it is considered unlikely that the Subject Site will provide significant koala habitat. While there may be an introduction of guard dogs on some larger

[1] Queensland Parks and Wildlife Service (undated) Planting Trees for Koalas – Coastal South East Queensland: Department of Environment and Resource Management

industrial lots, this is considered unlikely to invoke the substantially interfere threshold of multiple ongoing koala mortalities once development has been established.

In regard to criterion (Vehicle Strike) – The proposed action will result in clearing of the Subject Site. Post-development, it is considered unlikely that the Subject Site will provide significant koala habitat, and as such there is no proposal to establish typical mitigation measures such as fauna (koala) underpasses and directional fencing. All traffic will be directed towards Crowson Lane, and from this point the majority of vehicle movements will be towards the Mt. Lindesay Highway. It is considered unlikely that the proposed action will invoke the substantially interfere threshold of multiple ongoing koala mortalities once development has been established.

In regard to criterion (Barriers to Dispersal) – The proposed action will not retain koala habitat at the Subject Site or be configured in a manner which facilitates koala movement through the Subject Site. Rather, the proponent points to two alternate opportunities for koala movement in an east to west direction through this locality: (i) a formal habitat corridor is maintained along Norris Creek 1.5km to the north of the Subject Site (this providing a link between Jerry's Downfall Reserve and areas proposed for conservation under the Greater Flagstone Development Scheme to the north west of the Subject Site); and (ii) a large, well-vegetated parcel to the south of the Subject Site (Lot 1 RP113251), which provides an important connection between areas to the east of the Mt. Lindesay Highway and riparian corridors to the west of Greenbank Road connecting White Rock-Spring Mountain Conservation Estate in Ipswich City local government area.

In regard to criterion (Degradation through Hydrological change) – There is a proposal to retain an area in the north of the Subject Site for stormwater detention purposes. However, re-grading of this area will be required to achieve the necessary storage, and there will be no opportunity for retention of the existing vegetation. There may be some opportunity for planting this area with suitable landscape species, but there is no intention to identify this area as retained or rehabilitated koala habitat.

In regard to criterion (Fire) – The proposed action will require complete vegetation removal from the Subject Site, and as such is likely to reduce the fire threat to adjoining areas of retained vegetation.

In regard to criterion (Facilitating the introduction or spread of disease and pathogens) – koalas moved off-site will be re-located to very nearby areas of retained bushland such as Jerry's Downfall Reserve. It is considered unlikely that this action will introduce diseased animals into what is currently a disease free koala population. However, further assessment will be undertaken as part of the translocation management plan. If diseased animals are identified by the spotter – catcher responsible for managing the clearing program, then they will be transferred to an appropriate koala care facility for treatment.

In order to minimise the potential for introduction of pathogens such as myrtle rust and Phytopthora, the Applicant will use reputable and established contractors and suppliers to provide landscape vegetation for the streetscape areas.

Appendix 15 to the Technical Attachment 1

Australian Government
Department of the Environment

Approval

Commercial Development 4499-4651 Mount Lindesay Highway, North Maclean, Queensland (EPBC 2013/6941)

This decision is made under sections 130(1) and 133 of the *Environment Protection and Biodiversity Conservation Act 1999*.

Proposed action

person to whom the approval is granted	Wearco Pty Ltd
proponent's ACN	ACN: 162 925 082
proposed action	To establish an industrial development on a property described as 4499-4651 (Lot 39 on SP258739) Mount Lindesay Highway, North Maclean, Queensland [as described in EPBC Act referral 2013/6941 received on 22 July 2013 and the variation of proposal to take action received on 12 July 2015].

Approval decision

Controlling Provision	Decision
Listed threatened species and communities (sections 18 & 18A)	**Approved**

conditions of approval This approval is subject to the conditions specified below.

expiry date of approval

This approval has effect until 31 December 2050.

Decision-maker

name and position	Deb Callister Assistant Secretary Assessments (Queensland, Victoria, Tasmania) and Policy Implementation Branch
signature	
date of decision	10 February 2016

Conditions attached to the approval

1. The **approval holder** must not **clear** more than 117.28 hectares of vegetation located on Lot 39 on SP258739, 4499-4651 Mount Lindesay Highway, North Maclean, Queensland.

2. To compensate for the residual significant **impacts** of **clearing** 62.77 hectares of **habitat** for **listed threatened species**, the **approval holder** must provide, for the **Minister's** approval an **Offset Management Strategy** which meets the principles of the **EPBC Act Environmental Offsets Policy** and **Offsets Assessment Guide**. The **Offset Management Strategy** must include, but not be limited to:

    a. details of how the offset area provides **habitat** of a **quality** at least as good as the **impact site** and adequately compensates for residual significant **impacts** of the action on **listed threatened species,** in accordance with the principles of the **EPBC Act Environmental Offsets Policy** and **Offsets Assessment Guide;**

    b. details of the **legal mechanism for securing** the offset area, and an approach that will ensure that this security is obtained within 18 months of the commencement of the action;

    c. the location of the offset area, including **shapefiles** and map(s) in electronic Geographic Information System (GIS) format clearly defining the location and boundaries of the offset site;

    d. a detailed baseline description of the offset area, including surveys undertaken, condition of existing **habitat** and connectivity with other **habitat** areas;

    e. management measures for the offset area(s) that will improve **habitat** quality. These management measures must commence concurrently with **commencement of the action**;

    f. annual key performance indicators for management of the offset area(s) for the life of the approval, that are quantifiable and measurable, corrective actions to be undertaken if these indicators are not met and the timeframes within which these actions will be taken;

    g. a monitoring program for the offset area(s) suitable to assess the effectiveness of the management measures using key performance indicators, including monitoring locations and timing;

    h. a description of the potential risks to the successful implementation of the **Offset Management Strategy** and details of measures that will be implemented to mitigate these risks;

    i. an outline of how and when compliance with the **Offset Management Strategy** will be reported; and

    j. details of qualifications and experience of persons responsible for undertaking monitoring, review and implementation of the **Offset Management Strategy**.

    Note: Offsets for different species may overlap where they share the same habitat requirements.

3. The approval holder must not commence the action until the **Offset Management Strategy** has been approved by the Minister in writing. The approved **Offset Management Strategy** must be implemented.

4. To minimise the direct and indirect **impacts** to **listed threatened species** during **clearing**, the **approval holder** must ensure that the action is undertaken in accordance with the draft Queensland *Code of Practice for the welfare of wild animals affected by land-clearing and other habitat impacts and wildlife spotter/catchers* (Australian Wildlife Hospital, 2009).

5. To mitigate impacts to the EPBC listed *Swamp tea-tree (Melaleuca irbyana) forest of south-east Queensland* ecological community, prior to commencement of the action the **approval holder** must provide, for the **Minister's** approval, a Stormwater Management Plan that describes how the stormwater management system has been designed to meet the following outcome:

    a. post-development runoff from the catchment that drains towards the south is within 10% of pre-development runoff from this catchment.

6. The approval holder must not commence the action until the Stormwater Management Plan submitted in accordance with condition 5 has been approved by the Minister in writing. The approved Stormwater Management Plan must be implemented.

7. Within twenty (20) business days of the **commencement of the** action, the **approval holder** must advise the **Department** in writing of the actual date of **commencement**.

8. The **approval holder** must maintain accurate records substantiating all activities associated with or relevant to the conditions of approval, including measures taken to implement the plans or strategies required by this approval, and make them available upon request to the **Department**. Such records may be subject to audit by the **Department** or an independent auditor in accordance with section 458 of the **EPBC Act**, or used to verify compliance with the conditions of approval. Summaries of audits will be posted on the **Department's** website. The results of audits may also be publicised through the general media.

9. Within three (3) months of every twelve (12) month anniversary of the **commencement of the action**, the **approval holder** must publish a report on its website addressing compliance with each of the conditions of this approval, including implementation of any plans or strategies as specified in the conditions. Documentary evidence providing proof of the date of publication and non-compliance with any of the conditions of this approval must be provided to the Department at the same time as the compliance report is published. The requirement to submit compliance reports will cease following written agreement from the **Department**.

10. Upon the direction of the **Minister**, the **approval holder** must ensure that an independent audit of compliance with the conditions of approval is conducted and a report submitted to the **Minister**. The audit must not commence unless and until the **Minister** has approved the independent auditor and audit criteria. The audit report must address the criteria to the satisfaction of the **Minister.**

11. A. The person taking the action may choose to revise a management plan or strategy approved by the **Minister** under conditions 2 and 3, without submitting it for approval under section 143A of the EPBC Act, if the taking of the action in accordance with the revised plan, or strategy would not be likely to have a **new or increased impact**. If the person taking the action makes this choice they must:

i. notify the **Department** in writing that the approved plan or strategy has been revised and provide the **Department** with an electronic copy of the revised plan or strategy;
ii. implement the revised plan or strategy from the date that the plan or strategy is submitted to the **Department**; and
iii. for the life of this approval, maintain a record of the reasons the approval holder considers that taking the action in accordance with the revised plan or strategy would not be likely to have a **new or increased impact**.

11. B. The person taking the action may revoke their choice under condition 11A at any time by notice to the **Department**. If the person taking the action revokes the choice to implement a revised plan or strategy, without approval under section 143A of the Act, the plan or strategy approved by the **Minister** must be implemented.

11. C. Condition 11A does not apply if the revisions to the approved plan or strategy include changes to environmental offsets provided under the plan or strategy in relation to the matter, unless otherwise agreed in writing by the **Minister**. This does not otherwise limit the circumstances in which the taking of the action in accordance with a revised plan or strategy would, or would not, be likely to have **new or increased impacts**.

11. D. If the **Minister** gives a notice to the person taking the action that the **Minister** is satisfied that the taking of the action in accordance with the revised plan or strategy would be likely to have a **new or increased impact**, then:

i. Condition 11A does not apply, or ceases to apply, in relation to the revised plan or strategy; and
ii. The person taking the action must implement the plan or strategy approved by the **Minister**.

To avoid any doubt, this condition does not affect any operation of conditions 11A, 11B and 11C in the period before the day the notice is given.

At the time of giving the notice the **Minister** may also notify that for a specified period of time that condition A does not apply for one or more specified plans or strategies required under the approval.

11. E. Conditions 11A, 11B, 11C and 11D are not intended to limit the operation of section 143A of the EPBC Act which allows the person taking the action to submit a revised plan or strategy to the **Minister** for approval.

12. Unless otherwise agreed to in writing by the **Minister**, the **approval holder** must publish all plans and strategies referred to in these conditions of approval on its website. Each plan or strategy must be published on the website within one (1) month of being approved (unless otherwise specified in these conditions) and remain on the website for the duration of the project approval.

Definitions:

Approval Holder means the person to whom the approval is granted, or any person acting on their behalf, or to whom the approval is transferred under section 145B of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Clear/Clearing is the cutting down, felling, thinning, logging, removing, killing, destroying, poisoning, ringbarking, uprooting or burning of native vegetation, but does not include measures for weed and pest management.

Commencement/Commenced/Commencement of the action is the **clearing** of habitat for **listed threatened species**, and includes any preparatory works required to be undertaken including the erection of any fences, signage or on-site temporary structures and the use of construction or excavation equipment on site for the purpose of breaking the ground, or buildings or infrastructure.

Department is the Australian Government Department administering the *Environment Protection and Biodiversity Conservation Act 1999*.

EPBC Act is the *Environment Protection and Biodiversity Conservation Act 1999*.

EPBC Act Environmental Offsets Policy means the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (October 2012)* or subsequent revisions.

Habitat means areas containing species of trees and vegetation that provide food and shelter for the **listed threatened species**. Note that food trees may vary spatially and temporally, and information specific to the local area is likely to be most accurate.

Impact site means 4499-4651 Mount Lindesay Highway (Lot 39 on SP258739), North Maclean, Queensland.

Impact/s/ed has the definition assigned to it in section 527E of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Legal mechanism for securing means to secure a covenant or similar legal agreement in relation to a site, to provide enduring protection for the site against developments incompatible with conservation. The site can be secured by placing a covenant on the title and voluntary declaration under the Queensland *Vegetation Management Act 1999* or to establish a nature refuge under the Queensland *Nature Conservation Act 1992* or any other equivalent legally binding mechanism.

Listed threatened species means threatened species protected under Part 3 of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999,* specifically the koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) *(Phascolarctos cinereus),* grey-headed flying-fox *(Pteropus poliocephalus)* and swift parrot *(Lathamus discolour)*.

Minister is the Minister administering the *Environment Protection and Biodiversity Conservation Act 1999* and includes a delegate of the **Minister**.

New or increased impact(s) is a new or increased impact on any matter protected by the controlling provisions for the action, when compared to the management plan or strategy that has been approved by the Minister.

Offsets Assessment Guide means the tool that accompanies the **EPBC Act Environmental Offsets Policy** to assess the suitability of offset proposals.

Person taking the action means the person to whom the approval is granted.

Quality means habitat of the quality described in the *Final Preliminary Documentation Report* for EPBC 2013/6941 (28 South Environmental, 6 July 2015) on the **impact site** for **listed threatened species**.

TECHNICAL ATTACHMENT 2 – WATERWAY INVESTIGATION

North MacLean Enterprise Precinct 4499-4651 Mount Lindesay Highway, North MacLean, Queensland

16 March 2017

Report to Wearco Pty Ltd

TABLE OF CONTENTS

Task 1.0 – First Principles Assessment of Waterway Character

In our view, the Site's mapped waterways are no more than overland flow paths with anthropogenic channels in some areas. To illustrate this point, we conducted the following assessment:

- Overlayed the mapped waterways on a recent aerial photograph of the Site. At 100m intervals along the mapped waterway we established a photo point and a perpendicular transect extending 50m either side of the mapped waterway centreline. The plan was uploaded to a GPS-enabled tablet computer for field survey; and

- On 9 December 2015, we walked each of the mapped waterways using the GPS-enabled tablet computer for guidance. The mapped waterway centreline was used as a general guide for the traverse, but an "across and back" meander technique was used to determine if the waterway occupied a slightly different alignment to defined centreline. At each of the photo points, photographs were taken to capture: (i) views up-catchment; (ii) views down-catchment; (iii) views along the left axis of the perpendicular transect; and (iv) views along the right axis of the perpendicular transect. We then walked to the ends of the perpendicular axis to search for channels more significantly deviated from the mapped waterway centreline. Survey results are provided in **Appendix 1** to this Technical Attachment 2.

The survey found that:

- Mapped Waterway 1 commences in the northwestern corner of the Site and progresses in an easterly direction towards culverts under the Mt Lindesay Highway. The assessment found that mapped Waterway 1 is a simple broad overland flow path with no evident bed or banks. There is a dam at transect point 2, but this has formed behind a bund created by an access road. From transect point 2 to its confluence with mapped Waterway 2, mapped Waterway 1 appears to sheet flow across a floodplain. There are small pockets in which water appears to be retained for longer periods (characterised by *Melaleuca quinquenervia, Melaleuca decora* and *Melaleuca linariifolia*), but these are disparate and do no form an organised linear feature;

- Mapped Waterway 2 commences in the centre of the Site under the powerline easement and progresses in a north-easterly direction before turning east towards the culverts under the Mt Lindesay Highway. The assessment found that mapped waterway 2 in part follows an incorrect alignment, and is otherwise a simple broad overland flow path. There is evidence of minor ponding at transects 1 and 2 (indicated by *Juncus* sp.), but these characters are also common across the broader floodplain in the east of the Site. Between transects 2 and 3 there is a minor (but readily apparent) increase in elevation, and it is clear that runoff does not continue down the mapped waterway towards mapped Waterway 1. Rather, runoff appears to move in a sheet flow manner east along the base of the low ridge towards mapped Waterway 3;

- Mapped Waterway 3 commences in Lot 1 RP113251 to the south of the Site and progresses in a northerly direction through the eastern portions of the Site. Mapped Waterway 3 appears to have historically been a broad overland flow path. The assessment found that a small channel (approximately 50cm deep and 1m wide) has been established, presumably to assist with drainage in this area and direct flows to dams. At transect 9 there is very minor evidence of natural channel formation, but this again disappears with progression toward the Mt Lindesay Highway culvert; and

- Mapped Waterway 4 commences in the west of the Site and progresses south onto Lot 1 RP113251. The assessment found that mapped Waterway 4 is a simple broad overland flow path.

The assessment provides clear evidence that the mapped features are simply broad overland flow paths, and should not be defined as watercourses.

Task 2.0 – Geomorphic Assessment

28 South Environmental engaged Gilbert & Sutherland to undertake a geomorphic assessment of the mapped waterway corridors. Gilbert & Sutherland concluded that no watercourses exist on the Site, with all mapped locations either depicting drainage line or an area of general overland flow. The Gilbert & Sutherland advice is provided in **Appendix 2** to this Technical Attachment 2.

Task 3.0 – Aquatic Habitat Assessment

28 South Environmental engaged Ecological Service Professionals to undertake an assessment of waterways' aquatic habitat values. ESP have significant experience in aquatic habitat assessment in eastern Australia. ESP concluded that mapped watercourses 1, 2 & 4 do not have any obvious drainage lines, and do not have any aquatic ecological values (i.e. they are terrestrial habitat). Mapped watercourse 3 was a more well-defined feature, and supported dams providing aquatic habitat. However, it was noted that the values had arisen from anthropogenic works, and that the overall values of mapped watercourse 3 were low. The ESP report is provided in **Appendix 3** to this Technical Attachment 2.

Conclusion

There is clear "first principles" evidence that the Site's mapped watercourses are incorrectly assigned a watercourse designation. This is supported by my detailed geomorphic, and aquatic habitat assessment.

APPENDIX 1 to this Technical Attachment 2

28 SOUTH Environmental

Figure 1 - Mapped waterways

Project Name: 24 Weyers Road
Client:
Title: Figure 1 - Mapped waterways
Date: 10th November 2015
Coodinate System: GDA 1994 MGA Zone 56
Reference Scale: 1:8,000

N

0 100 200 Metres

Reference: Cadastre - DNRM 2014,
Imagery - Near Maps 2014

WATERWAY 1 (SAMPLE POINT 1)

UP-CATCHMENT 	**DOWN-CATCHMENT** 
LEFT VIEW 	**RIGHT VIEW** 

WATERWAY 1 (SAMPLE POINT 2)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 1 (SAMPLE POINT 3)

UP-CATCHMENT 	**DOWN-CATCHMENT** 
LEFT VIEW 	**RIGHT VIEW** 

WATERWAY 1 (SAMPLE POINT 4)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 1 (SAMPLE POINT 5)

UP-CATCHMENT 	**DOWN-CATCHMENT** 
LEFT VIEW 	**RIGHT VIEW** 

WATERWAY 1 (SAMPLE POINT 6)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 2 (SAMPLE POINT 1)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 2 (SAMPLE POINT 2)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 2 (SAMPLE POINT 3)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 2 (SAMPLE POINT 4)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 2 (SAMPLE POINT 5)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 2 (SAMPLE POINT 6)

UP-CATCHMENT 	**DOWN-CATCHMENT** 
LEFT VIEW 	**RIGHT VIEW** 

WATERWAY 2 (SAMPLE POINT 7)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 3 (SAMPLE POINT 1)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 3 (SAMPLE POINT 2)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 3 (SAMPLE POINT 3)

UP-CATCHMENT	**DOWN-CATCHMENT**
	
LEFT VIEW	**RIGHT VIEW**
	

WATERWAY 3 (SAMPLE POINT 4)

UP-CATCHMENT 	**DOWN-CATCHMENT** 
LEFT VIEW 	**RIGHT VIEW** 

WATERWAY 3 (SAMPLE POINT 5)

UP-CATCHMENT 	**DOWN-CATCHMENT** 
LEFT VIEW 	**RIGHT VIEW** 

WATERWAY 3 (SAMPLE POINT 6)

UP-CATCHMENT 	**DOWN-CATCHMENT** 
LEFT VIEW 	**RIGHT VIEW** 

WATERWAY 3 (SAMPLE POINT 7)

UP-CATCHMENT	**DOWN-CATCHMENT**
	
LEFT VIEW	**RIGHT VIEW**
	

WATERWAY 3 (SAMPLE POINT 8)

UP-CATCHMENT 	**DOWN-CATCHMENT** 
LEFT VIEW 	**RIGHT VIEW** 

WATERWAY 3 (SAMPLE POINT 9)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 3 (SAMPLE POINT 10)

UP-CATCHMENT

DOWN-CATCHMENT

LEFT VIEW

RIGHT VIEW

WATERWAY 4 (SAMPLE POINT 1)

UP-CATCHMENT 	**DOWN-CATCHMENT** 
LEFT VIEW 	**RIGHT VIEW** 

WATERWAY 4 (SAMPLE POINT 2)

UP-CATCHMENT 	**DOWN-CATCHMENT** 
LEFT VIEW 	**RIGHT VIEW** 

WATERWAY 4 (SAMPLE POINT 3)

UP-CATCHMENT 	**DOWN-CATCHMENT** 
LEFT VIEW 	**RIGHT VIEW** 

WATERWAY 4 (SAMPLE POINT 4)

UP-CATCHMENT	**DOWN-CATCHMENT**
	
LEFT VIEW	**RIGHT VIEW**
	

WATERWAY 4 (SAMPLE POINT 5)

UP-CATCHMENT 	**DOWN-CATCHMENT** 
LEFT VIEW 	**RIGHT VIEW** 

APPENDIX 2 to this Technical Attachment 2

13 December 2016

28 South Environmental Pty Ltd

[by email]

Attention: Mr Wayne Moffitt (Director)

Dear Wayne,

Re: Watercourse Assessment Proposed Industrial Estate, Lot 39 SP258739, Mt Lindesay Highway, North Maclean, Queensland

28 South Environmental Pty Ltd commissioned Gilbert & Sutherland Pty Ltd (G&S) to undertake a Watercourse Assessment on a proposed development site described as Lot 39 SP258739, 4499-4651 Mt Lindesay Highway, North Maclean, Queensland ('the site'). This letter details the assessment undertaken that supports the conclusion that no watercourses exist on the proposed development site.

The site

The land is located within the Greater Flagstone Priority Development Area and is understood to be earmarked for future industrial development.

Relevant definitions

Section 5 of the Water Act 2000 defines a watercourse as follows:

> ***"Meaning of watercourse***
>
> *(1) A **watercourse** is a river, creek or other stream, including a stream in the form of an anabranch or a tributary, in which water flows permanently or intermittently, regardless of the frequency of flow events—*
>
> *(a) in a natural channel, whether artificially modified or not; or*
>
> *(b) in an artificial channel that has changed the course of the stream.*
>
> *(2) A **watercourse** includes any of the following located in it—*

(a) in-stream islands;

(b) benches;

(c) bars.

*(3) However, a **watercourse** does not include a drainage feature."*

A drainage feature is defined under Section 4 of the Water Act 2000 as:

***"drainage feature** means—*

(a) if a feature is identified on the watercourse identification map as a drainage feature—the feature identified on the map; or

(b) otherwise—a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that—

(i) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and

(ii) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and

(iii) commonly, does not have enough continuing flow to create a riverine environment.

Example for paragraph (b)(iii)— There is commonly an absence of water favouring riparian vegetation."

The Vegetation Management Act gives the following definitions for watercourse and drainage feature:

***"watercourse** has the meaning given by the Water Act 2000, section 5, but a reference to a watercourse in this Act includes a reference to anywhere that is downstream of the downstream limit of the watercourse."*

***"drainage feature** see the Water Act 2000, schedule 4."*

Both the QLD Globe Watercourse Identification Map and the Vegetation Management Watercourse and Drainage Feature Map for the site show drainage features in place on the site. However, the latter does not differentiate between 'watercourse' and 'drainage feature'. The intent of the Vegetation Management Act (as discussed above) however, would indicate that the site contains only drainage features. It should also be noted that the Vegetation Management Watercourse and Drainage Feature Map shows an

additional small drainage feature in the south western corner of the site. The drainage features are labelled W1 to W4 on Drawing No. 11722_01 (Attachment 1 to this letter).

Ground-truthing

Under the definition of a drainage feature given above, if a feature is identified on the watercourse identification map as a drainage feature, then it may be considered one. However, In order to more accurately assess the presence or absence of watercourses on the site, a site investigation was undertaken on 10 May 2016.

The investigation included assessment of a total of 24 individual sites along the mapped drainage feature alignment/s (W1 to W4). At each 'waypoint' location, photos were taken and a determination made as to whether the location represented a watercourse, drainage feature, or other.

For the purposes of the assessment (and based on the definition of the Water Act 2000), a watercourse may be defined as such by the presence of:

- A defined channel (distinct bed and banks).
- A defined outer bank (as marked by a depositional feature or scour mark).
- Permanent or intermittent flow or ponding (in contrast to a drainage feature that only flows immediately after rainfall events and concentrates overland flow).
- A riverine environment (in contrast to a drainage feature that does not have enough flow to create a riverine environment).

For the majority of the assessed locations, a tablet-based GPS application with drainage feature overlay was utilised. However for locations WP249 to WP253, the application was not available and determination had to be made on the likely location of the mapped drainage feature by eye. The result at each of those locations gave an indication as to the lack of identifiable waterway features in the landscape, which was consistent with the conditions encountered in many of those locations where the GPS application was available (e.g. locations WP242 to WP246).

The attached Drawing No. 11722_01 shows the individual assessment locations on the site. The majority of locations indicated a drainage feature, with some locations exhibiting no apparent features (i.e. bed or bank) synonymous with either a watercourse or drainage feature. In no cases were features indicating the presence of a watercourse identified.

Provided as Attachment 2 to this letter are the photographic plates at each assessment location along the mapped drainage features on the site.

Conclusion

The assessment indicates that no watercourses exist on the proposed development site, with all mapped locations either depicting sufficient properties to indicate a drainage feature or no clear properties, thus indicating an area of general overland flow.

We trust this is acceptable. Please do not hesitate to contact this office if you require any further details or elaboration.

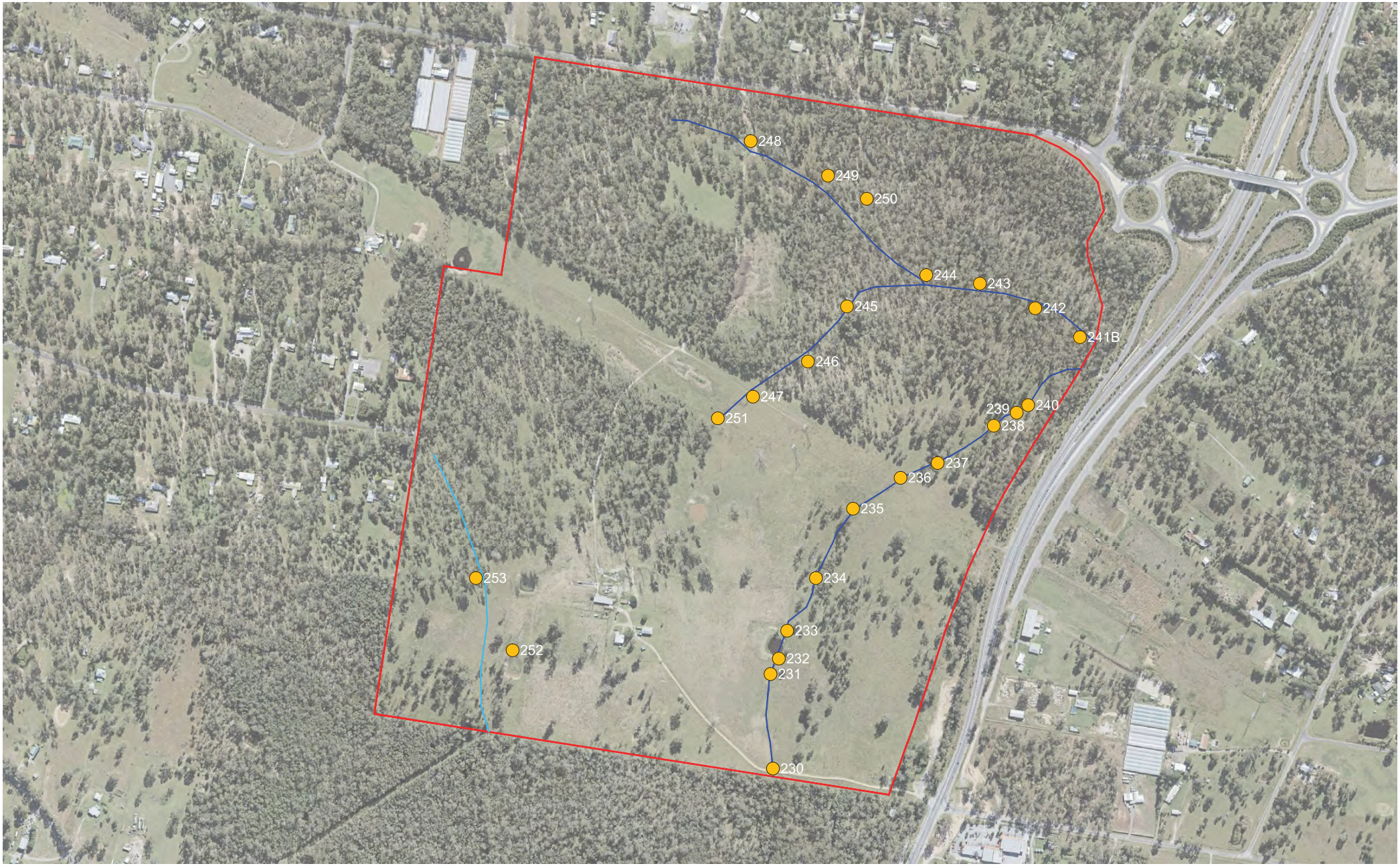
Yours sincerely,

Dr Phillip Matthew
Principal Agricultural Scientist
BAgSc DURP MResSc PhD MAIAST

Greg Holland
Principal Environmental Scientist
BSc(AES) Grad dip SustLanMan

Author Greg Holland
Our Reference 11722 Watercourse Assessment CGHF.docx
Your Reference
By ☐ Courier ☑ Email ☐ Facsimile ☐ Post
Enclosures 2 (Drawing and photo plates)

Attachment 1 – Drawing No. 11722_01



ORIENTATION

SCALE 1:6 250

50 100 150 200 250 300 metres

ROBINA

PO Box 4115 Robina QLD4230 07 5578 9944

Email robina@access.gs www.access.gs

LEGEND

- Site boundary
- Waypoint location
- Water Act 2000, Watercourse Identification Map
- Vegetation Management Act 1999, Vegetation Management And Drainage Feature Map

SOURCES

Image, site boundary and watercourses: QLD Globe via Google Earth Pro 2016

PROJECT	CLIENT	DRAWING
LOT 39 SP258739, MT LINDESAY HIGHWAY, NORTH MACLEAN, QLD	28 SOUTH ENVIRONMENTAL PTY LTD	WAYPOINT LOCATIONS MAP

SCALE	DATE	DRAWN	CHECKED	PROJECT	DRAWING	REVISION
1:6 250@A3	09/06/2016	WPS	GLH	11722	001	-

GILBERT SUTHERLAND

Attachment 2 – Photographic plates

Plate 1 WP230 Southern extent of W3 looking south across access road to site boundary. No clear defined drainage feature at boundary

Plate 2 WP230 Looking north. Clearly defined drainage feature

Plate 3 WP231 W3 At inflow point of small dam approx. 180 m from south boundary looking south. Defined drainage feature

Plate 4 WP231 Looking north at dam. Defined drainage feature

Plate 5 WP233 W3 Discharge point of dam looking south.

Plate 6 WP233 Looking north. No clearly defined channel

Plate 7 WP234 W3 Approx. 115 m north of dam looking south. Minor definition of bed and banks

Plate 8 WP234 Looking north

Plate 9 WP235 W3 Very slight definition of drainage feature

Plate 10 WP235 Looking north

Plate 11 WP236 W3 Looking north. Slight definition of bed and banks/drainage feature

Plate 12 WP236 Looking south

Plate 13 WP237 W3 Looking north. Minor definition of drainage feature

Plate 14 WP238 W3 Southern inflow point of small dam looking south at defined bed and banks

Plate 15 WP238 Looking north at dam

Plate 16 WP239 W3 Discharge point looking south. No clearly defined discharge or bed and banks

Plate 17 WP239 North of discharge point of dam looking north at clearly defined drainage feature

Plate 18 WP240 W3 Looking south at drainage feature north of dam discharge

Plate 19 WP240 Looking north. No defined bed or banks

Plate 20 WP241A Upstream of discharge point of W3 to culvert under Lindesay Highway. No clearly defined bed and banks

Plate 21 WP241A Looking south. No clearly defined channel

Plate 22 WP241B Downstream extent of W2 looking west. No defined channel

Plate 23 WP241B Looking east to culvert under Lindesay Highway. No defined channel

Plate 24 WP242 W2 Looking west. No defined drainage feature

Plate 25 WP242 Looking east. No defined drainage feature

Plate 26 WP243 W2 Looking west. No defined drainage feature

Plate 27 WP244 Looking east. No clearly defined channel

Plate 28 WP244 Confluence of W2 and W1 looking southwest

Plate 29 WP244 Looking northwest

Plate 30 WP245 W2 Looking southwest No defined drainage feature

Plate 31 WP245 Looking northeast. No defined drainage feature

Plate 32 WP246 W2 Looking southwest. No defined drainage feature

Plate 33 WP246 Looking northeast. No clearly defined channel

Plate 34 WP247 W2 looking southwest. Minor definition of drainage feature

Plate 35 WP247 Looking northwest. No defined channel

Plate 36 WP251 Southern extent of W2 Looking northeast. No defined drainage feature

Plate 37 WP251 Looking southwest. No defined drainage feature

Plate 38 WP248 W1

Plate 39 WP248 Looking northeast. No clearly defined channel

Plate 40 WP249 W1 Looking east. No defined drainage feature

Plate 41 WP249 Looking west. No defined channel

Plate 42 WP250 W1 Looking east. No defined drainage feature

Plate 43 WP250 Looking west. No defined drainage feature

Plate 44 WP252 Near southern extent of W4 looking south at overland flow discharge into small wetland. No defined channel

Plate 45 WP252 Looking north. No clearly defined channel

Plate 46 WP253 W4 Approx. 140 m north of WP252 looking west. No defined drainage feature

APPENDIX 3 to this Technical Attachment 2

Wayne Moffatt
28 South Environmental
wayne@28south.com.au

Our Reference: 1622.001

20 May 2016

RE: Waterways Assessment, North Maclean

Dear Wayne,

We understand that 28 South Environmental is coordinating environmental planning approvals for a proposed commercial and industrial development on Lot 39 SP258739 (4499–4651 Mt Lindesay Highway, North Maclean). The site is located in the Greater Flagstone Priority Development Area (PDA); as such Economic Development Queensland (EDQ) is coordinating the State planning approvals. Waterways are mapped on the site on the Vegetation Management Watercourse and Drainage Features Map (VMWDFM). We understand that EDQ has advised that these waterways need to be conserved and buffered.

Ecological Service Professionals (ESP) has undertaken an independent assessment of the site to confirm the potential aquatic ecological values of the waterways mapped on the site. This letter outlines the findings of the assessment.

Scope and Methodology

A desktop review was undertaken to describe the nature of the waterways on the site, and determine the native aquatic species that occur in the catchment. The desktop study included:

- database searches, including the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Protected Matters Search Tool and the Department of Environment and Heritage Protection's (DEHP's) *Wildlife Online* database (Queensland Government 2014a)
- Queensland Government mapping resources including DEHP's Queensland Wetlands Program (DEHP 2016), the Department of Agriculture and Fisheries (DAF) 'Queensland Waterways for Waterway Barrier Works' spatial layer (DAF 2016+); and the Queensland Government's State Planning Policy (SPP) interactive mapping system (DILGP 2016)
- review of the broad habitat requirements of aquatic species that may occur on or near the site, and
- review of the connectivity of the mapped waterways on the site through interpretation of aerial photography and existing mapping.

A site visit was completed on 10 May 2016 by Lauren Thorburn, to qualitatively (visually) assess the potential habitat values of the waterways on the site for aquatic species. This included observations and records (including photographs) of the habitat features and the presence and type of aquatic flora communities, at various points along the four waterways mapped on the site (referred to as W1, W2, W3 and W4 in accordance with mapping previously completed by 28 South Environmental, 2015). The culvert under the Mt Lindesay

Highway, directly downstream of the site, was also inspected. Observations were recorded at 25 points on the site (Appendix A, Map 1).

Limitations

The assessment of the waterways was preliminary in nature, and based on a desktop assessment and visual habitat assessment (during a single site visit). No sampling of water quality, aquatic flora or aquatic fauna was undertaken. The assessment did not include hydrology or terrestrial and semi-aquatic species such as birds and amphibians (these have been considered by others).

Site Characteristics

The site is located in the Logan River catchment. The site drains to a minor, unnamed second order waterway. The site boundary is approximately 1.6 km upstream of the confluence of this minor tributary with the Logan River.

Under the Queensland Wetlands Program (Appendix A, Map 1):

- the waterways on site are mapped as drainage lines that are consistent with the VMWDFM
- none of the dams on site are mapped as palustrine or lacustrine wetlands, and
- riverine wetlands are mapped in the tributary of the Logan River approximately 1.2 km downstream of the site, as well as in the Logan River.

Under the DAF spatial layer for waterway barrier works, the waterways on, and downstream of, the site have the following characteristics (Appendix A, Map 2):

- W1, W2 and W4 are not mapped as waterways
- W3 is mapped as a green (low risk of impact) waterway
- the minor tributary downstream of the site is mapped as a green (low risk of impact) waterway for the majority of its length, with a small section of amber (moderate risk of impact) immediately adjacent to the Logan River, and
- the Logan River downstream is a purple (major risk of impact) waterway.

Under the State Government SPP Interactive Mapping System, the waterways on and downstream of the site have the following characteristics:

- the drainage lines on the site are mapped as containing regulated vegetation (intersecting a watercourse) i.e. as per the VMWDFM
- there are no declared fish habitat areas on or adjacent to the site, and
- the Logan River (approximately 1.6 km downstream of the site) is mapped as a High Ecological Significance (HES) wetland (Appendix A; Map 3).

Aquatic Species of the Region

A range of aquatic flora species and fauna species (such as turtles, fish and macroinvertebrates) occur in the Logan River catchment . Based on the site characteristics, no turtles are expected to occur on the site, and they have not been discussed further.

A total of 35 species of fish (including both native and exotic species) have been recorded from waterways within the Logan City Council area and / or Logan River catchment (Queensland Government 2014a; Appendix B).

No endangered, vulnerable or near-threatened (EVNT) fish species have been recorded within 5 km of the site. However, two were identified as possibly occurring in the Logan River catchment based on online searches, as described below.

Australian Lungfish

The Australian lungfish (*Neoceratodus forsteri*) is listed as vulnerable under the EPBC Act; although it is not listed under Queensland's NC Act, it is a no-take species in Queensland under the Fisheries Regulation 2008, and collection for educational or research purposes requires a permit.

Australian lungfish inhabit still or slow-moving reaches of riverine systems. Unlike other species of lungfish, Australian lungfish cannot survive desiccation of its habitat and require areas of permanent water (Kemp 1986; Brooks and Kind 2002). This type of habitat is not present on the site.

Australian lungfish are endemic to Australia and are restricted to south-eastern Queensland (Wager 1993). They are currently found in the Burnett, Mary, North Pine, Coomera, Condamine, Albert, Logan and Brisbane Rivers (including Lake Wivenhoe) (DSITIA 2013; Kemp 2014). However, they are naturally occurring in only the Burnett, Brisbane and Mary River catchments; all other populations are considered to have originated from translocated individuals and are thought to consist of very low numbers of individuals (Allen et al. 2002; Arthington 2009). There is only one record from the Logan River in the 1980s, in a reach upstream of the site (Queensland Government 2014b).

Mary River Cod

The Mary River cod (*Maccullochella mariensis*) is listed as endangered under the EPBC Act, and was identified as having the potential to occur in the area based on the EPBC Protected Matters Search Report. Mary River cod are freshwater fish that are tolerant to a wide range of environmental conditions, but occur mainly in relatively undisturbed tributaries (Wager & Jackson 1993). They prefer relatively large and deep (0.8 to 3.2 m) slow-moving pools with overhanging riparian vegetation and ample in-stream shading (Simpson & Jackson 2000). This habitat is not present on the site. There are some records of translocated Mary River cod in the Logan River catchment from the South East Queensland Ecosystem Health Monitoring Program (EHMP 2008). It is therefore possible that this species occurs in the Logan River downstream of the site.

Aquatic Habitat of the Site

W1

No watercourse or drainage feature could be identified at W1, due to a lack of any obvious bed or banks. From an ecological perspective, this mapped 'waterway' did not contain any aquatic ecological features, and is considered to be terrestrial habitat (Figure 1a). The exception was a small dam which was constructed upstream of a track crossing in the upper extent of the mapped 'waterway' (Figure 1b). This dam contained aquatic plants that are common in the area, including:

- knotweeds (*Persicaria* sp.)
- ferny azolla (*Azolla pinnata*)

- water primrose (*Ludwigia peploides* subsp. *montevidensis*)
- water snowflake (*Nymphoides indica*)
- the introduced cape blue waterlily (*Nymphaea caerulea* subsp. *zanzibarensis*), and
- grasses, possibly including the introduced para grass (*Urochola mutica*).

No fish were observed in the dam (though it is possible that they occur). No EVNT species are likely to occur in the dam, and the overall aquatic ecological values of the dam are considered to be low, due to the lack of connectivity with the downstream catchment.

a) b)

Figure 1 **Photos of W1, showing a) no obvious drainage line (i.e. terrestrial habitat) downstream of the dam, and b) the dam formed by the track.**

W2

Similar to W1, no watercourse or drainage feature could be identified at W2, due to a lack of any obvious bed or banks (Figure 2a). The mapped confluence with W1 could not be identified in the field (Figure 2b). From an ecological perspective, this mapped 'waterway' did not contain any aquatic ecological features, and is considered to be terrestrial habitat.

a) b)

Figure 2 **Photos of W2, showing a) no obvious drainage line (i.e. terrestrial habitat), and b) the mapped location of the confluence with W1.**

W3

A drainage line was generally visible for the length of W3 on the site. It is likely that the drain has been modified (dug out) in places to assist in the conveyance of overland flows away from the site, as:

- much of it is a straight channel, which is often indicative of a modified flow path, and
- there was no obvious drainage line immediately upstream of the site (Figure 3a).

In places, the drainage line contains some species that are indicative of a wet environment, such as sedges (common species such as *Cyperus* sp. and / or *Juncus* sp.) (Figure 3b). No other aquatic habitat features (such as woody debris, coarser substrates such as gravel and cobble, undercut banks) were noted in the channel (e.g. Figure 3f).

Two constructed dams are located on W3, one larger dam near the upstream extent of the drainage line (Figure 3c), and one smaller dam near the downstream extent (Figure 3e). Both dams contained aquatic plants, similar in composition to those observed in the dam on W1. Small fish (either native gudgeons or the introduced mosquitofish; ID could not be confirmed) were observed in the most downstream dam. Movement / activity was also noted in the upstream dam, and was indicative of the presence of fish and/or yabbies. A freshwater mussel shell was also found adjacent to the upstream dam (Figure 3d).

The above observations are consistent with the designation of W3 as a green 'low risk of impact' waterway in the DAF *Waterways for Waterway Barrier Works* spatial layer. That is, it is likely that the waterway provides dispersal habitat for fish during periods of flow. However, as no drainage lines or aquatic habitat could be identified upstream of the site boundary, the drainage line does not provide an important fish passage corridor to fish habitats upstream of the site, and the drainage line itself does not provide good quality breeding or feeding habitat for fish.

The dams that have been constructed within the waterway provide more permanent fish habitat, including instream structure in the form of aquatic plants. However, their aquatic ecological value is likely to be low, due to the lack of connectivity with the sub-catchment.

a)

b)

c)

d)

e)

f)

Figure 3 Photos of W3, showing a) lack of a defined drainage feature upstream of the site, b) the drainage line between the site boundary and upstream dam, c) the upstream dam, d) freshwater mussel shell adjacent to the downstream dam, e) the downstream dam, and f) the drainage line between the downstream dam and the site boundary

W4

Similar to W1 and W2, no watercourse or drainage feature could be identified at W4, due to a lack of any obvious bed or banks (photos provided in 28 South Environmental, 2015). It is also noted that in the Queensland Wetlands Program mapping, this 'drainage line' dissipates and does not drain to any other mapped drainage lines. From an ecological perspective, this mapped 'waterway' did not contain any aquatic ecological features, and is considered to be terrestrial habitat.

There were two dams in the vicinity of W4 that were either dry or drying out at the time of the site visit. These dams contained some aquatic plants such as knotweeds and water primrose that appeared to be perishing as the dam dried out (Figure 4a). Sedges (e.g. *Cyperus* sp. and / or *Juncus* sp.) occurred on the fringes of the dams, and are more resilient to desiccation, so are likely to persist for longer (Figure 4b). These dams had no connectivity to a waterway and would not support EVNT species. As such, the overall aquatic ecological values of these dams are considered to be very low.

a) b)

Figure 4 **Photos of dam near W4, showing a) dry dam with dying aquatic vegetation, and b) the surrounding sedges.**

Other Aquatic Habitat on the Site

There was an isolated dam in the middle of the site, near the homestead. This dam was not connected to any of the mapped waterways, and had an orange and green film on the surface of the water (Figure 5), that had an unusual odour. This was indicative of a bacteria, algae and / or cyanobacteria bloom. The aquatic ecological values of this dam are negligible to non-existent.

Figure 5 Photo of dam near homestead showing orange and green film on water

Downstream of the Site

W2 and W3 drain towards a multi-cell culvert under the Mount Lindesay Highway. The drainage lines remain difficult to locate / define at the downstream boundary of the site. Flows travel across rocks placed for scour protection into the culvert (Figure 6a). There is also rock scour protection on the downstream end of the culvert, then a ponded area overgrown with bull rush (*Typha* sp.) (Figure 6b).

The culvert cells are relatively large in size, however the cells are long (100 m) and dark (Figure 6c), which may discourage fish passage. The culvert design appears to incorporate a low flow channel into one of the cells (Figure 6d), though this was not functioning at the time of the site visit (due to a lack of inflows to the culvert). There was no evidence of attempts to reduce high flows through the culvert through elements such as baffles (e.g. roughened walls) [1]. High water velocities through the culvert are likely to hinder or prevent fish passage upstream to the site during moderate to high flow events.

Overall, it is considered likely that some fish species would be able to move through the culvert under low to moderate flow conditions, but that these flow conditions would be short-lived.

[1] It is noted that roughening elements are not required for green waterways under the Fisheries Code for Self-assessable Development: Culvert Crossings (WWBW01)

a)

b)

c)

d)

Figure 6 Photos of culverts under the Mount Lindesay Highway, showing a) rock scour protection upstream of culvert apron, b) rocks and ponded area with *Typha* downstream of culvert, c) the culverts are long and dark, and d) possible low-flow channel incorporated into design of culverts.

Conclusions and Recommendations

The site is at the headwaters of a very small sub-catchment of a minor (second order) tributary of the Logan River.

Mapped waterways W1, W2 and W4 do not contain obvious drainage lines and do not have any aquatic ecological values, i.e. in our opinion they are best described as terrestrial habitats. These are also not mapped within the DAF *Waterways for Waterway Barrier Works* spatial layer, and as such are not considered to be waterways under the *Fisheries Act 1994* (DAFF 2013). There are some dams in the vicinity of these mapped 'waterways'; however, they are of low aquatic ecological value due to a lack of connectivity with drainage lines in the sub-catchment. As such, development of these areas will not result in the removal of any important aquatic habitats or species.

Mapped waterway W3 contains a more well-defined drainage line (although this is likely due to some human modification). There are also two dams on this drainage line that provide habitat for aquatic species (including aquatic plants, fish and macroinvertebrates). The overall aquatic ecological values of the drainage line and dams are low, due to a lack of connectivity with the catchment (e.g. no fish habitats located upstream of the site; and the long culvert immediately downstream of the site which is likely a barrier to fish passage most of the time). This is consistent with the DAF *Waterways for Waterway Barrier Works* spatial layer, which shows W3 as a green (low risk of impact) waterway.

Based on the above, no significant impacts to aquatic ecology are expected in association with development of the land on and around W3. However, if development over W3 is proposed (i.e. involving removal or partial removal of the drainage line), it is likely that this would be considered Waterway Barrier Works. As such, approvals may be required under the *Fisheries Act 1994*.

The Logan River downstream is mapped as a high ecological significance wetland, and provides important habitat for aquatic species (potentially including freshwater turtles and EVNT fish species). As such, development of the site should seek to protect the environmental values of the tributary downstream of the site (and subsequently the Logan River). This can be achieved through design and implementation of best-practice sediment and erosion control and stormwater treatment that mange the volume and quality of water discharged from the site.

Wayne, if you have any questions regarding the above assessment, please don't hesitate to contact me on 0428 115 664.

Kind Regards,

Lauren Thorburn
Ecological Service Professionals Pty Ltd