15 Quintin Street
PO Box 924
Roma QLD 4455
Ph. 07 4622 2646
Fax 07 4622 1325
boobook1@bigpond.com
ABN: 94 617 952 309
www.boobook.biz

Ecological Assessment Report

Kentucky 2017 Core Hole

Compiled by BOOBOOK for Santos

Revision	Date	Description	Author	Verifier	Approved
A	28/6/2017	Draft issued to client for review	C. Eddie, R. Aisthorpe	C. Eddie	C. Eddie
0	6/7/2017	Final report incorporating client comments	C. Eddie	-	C. Eddie

Table of Contents

List of Abbreviations

CE	Critically Endangered
DEHP	Department of Environment and Heritage Protection (State)
DNRM	Department of Natural Resources and Mines (State)
DoEE	Department of the Environment and Energy (Commonwealth)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (Commonwealth)
DSITI	Department of Science, Information Technology and Innovation (State)
E	Endangered
EH	Essential Habitat
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GPS	Global Positioning System
ha	hectare (s)
km	Kilometre (s)
LC	Least Concern
m	metre (s)
NC Act	*Nature Conservation Act 1992*
NCAP	No Concern At Present
OC	Of Concern
RE	Regional Ecosystem (s)
REDD	Regional Ecosystem Description Database
SEVT	Semi-evergreen vine thicket
TEC	Threatened Ecological Community (ies)
TSSC	Threatened Species Scientific Committee
V	Vulnerable

1. Introduction

1.1. Purpose and Scope

BOOBOOK was commissioned by Santos (the Client) to undertake an ecological assessment for the proposed Kentucky 2017 Core Hole located approximately 46 km northeast of Injune, south central Queensland. The assessment included a 400 m buffer (the Buffer) surrounding the proposed core hole as well as client-identified parts of an associated access track (the Access Track). Hereafter, the assessment area including the Buffer and Access Track is collectively referred to as the Site.

BOOBOOK was requested to undertake the following assessments:

Within the Buffer:

- Perform a quaternary vegetation assessment for each Regional Ecosystem (RE) present;
- Assess the presence or absence of any *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed Threatened Ecological Communities (TEC);
- Search for the presence of any threatened flora listed under the EPBC Act and/or *Nature Conservation Act 1992* (NC Act);
- Conduct incidental searches for the presence of any threatened fauna listed under the EPBC Act and/or NC Act;
- Provided habitat mapping for Client-nominated EPBC Act listed fauna; and
- Provide comment on the presence of any wetlands and springs.

Within the Access Track:

- Perform a quaternary vegetation assessment for five client-nominated locations along the proposed access track; and
- Provide mapping of the extent of any TEC or endangered RE within or adjoining the Access Track.

1.2. Survey Team

A field survey of the Site was conducted by Craig Eddie (Principal Ecologist) and Rosamund Aisthorpe (Botanist) on 22 June 2017.

The project supervisor (Craig Eddie) was approved by the Department of the Environment and Energy (DoEE), formerly the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), in writing on the 28th of January 2011 for the purpose of undertaking ecological assessment works for the Gladstone Liquefied Natural Gas (GLNG) project. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie.

1.3. Site Description

The Site is located on the property 'Kentucky' (Lot 1 on Plan WT37), within PL90, situated approximately 46 northeast of Injune, south central Queensland (Appendix A). The Site is within the boundary of the Maranoa Regional Council and lies within Subregion 24 (Carnarvon Ranges) of the Brigalow Belt bioregion (Sattler and Williams 1999). Topography of the Site is undulating low hills with scattered sandstone outcrops; soils are predominantly light clay and loam/sandy loams. The Site is situated within a large tract of remnant vegetation, predominantly Narrow-leaved Ironbark *Eucalyptus crebra* and Mountain Coolibah *E. orgadophila* woodland to open woodland. The Site is grazed by cattle and other previous disturbances include vegetation clearing (mechanical clearing and thinning) and fire.

2. Methodology

2.1. Desktop Assessment

A desktop assessment was undertaken which included interrogation of the following data sets:

- Remnant RE (DSITI 2017a) and mature regrowth (DEHP 2012) mapping – biodiversity status;

- Essential Habitat (EH) (DNRM 2017) mapping;
- Environmentally Sensitive Area (ESA) mapping (DEHP 2017a);
- Referrable Wetlands mapping (DEHP 2017b);
- Ordered stream mapping (DNRM 2010);
- Wildlife Online fauna and flora records (DSITI 2017b);
- Queensland Herbarium specimen data; (DSITI 2017c);
- Protected Plants Flora Survey Trigger Map (DEHP 2016);
- EPBC Act Protected Matters Search Tool (DoEE 2017a); and
- Atlas of Living Australia (ALA 2017) fauna and flora records.

The searches were conducted using online spatial layers, and/or using searches using property lot/plan details, or the Site centre point co-ordinates of -25.54818°S, 148.86442°E with a 5 km buffer. These datasets provided a baseline for subsequent field assessment.

2.2. Field Survey

In-field verification of desktop findings and additional findings of significance were undertaken in general accordance with the following:

- *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland* (Neldner *et al*. 2012);
- *Methodology for Conducting Ecological Assessments* – GLNG Areas Rev 4.1 (Santos 2014); and
- *Functional Thresholds for Assessing Regional Ecosystem Functionality* (Santos 2015).

Methodologies that were employed for each element of the field survey are further described in the following sections.

2.2.1. RE and TEC Assessment

Ground-truthing of the DSITI regional ecosystem (RE) designation within the Buffer and designated locations along the Access Track was undertaken using the quaternary level of data collection as described by Neldner *et al*. (2012).

Assessments were undertaken within 50 m x 10 m plots (as appropriate) for the purpose of typifying the vegetation community under assessment. Plots were chosen within representative areas of each vegetation type encountered.

Vegetation community polygons were verified in accordance with Queensland RE description and biodiversity status as per the Regional Ecosystem Description Database (REDD) (DSITI 2016) and classified as remnant RE, vegetation consistent with RE or non-remnant vegetation (Santos 2014a). For each area of potential TEC an assessment of vegetation survey data was made against TEC threshold criteria (DoEE 2017a, TSSC 2013).

Vegetation community data was captured in the field and entered into Santos-specific data fields within spatial databases via Motion tablet devices. Representative photographs were taken via a Canon digital camera at each vegetation survey site. Capture and delineation of RE and TEC boundaries was undertaken using a combination of mobile GIS devices, GPS and/or delineation from imagery.

For identified regrowth (i.e. vegetation floristically equivalent to an RE but not meeting structural thresholds of remnant RE) an ecosystem functionality assessment was conducted where necessary. This assessed selected vegetation characteristics against the parameters described in Santos (2015).

Plant names used within this document conform to those given in Bostock and Holland (2016).

2.2.2. MNES Fauna Habitat Assessment and Mapping

Microhabitat assessments were undertaken in conjunction with vegetation community surveys at each survey plot, or as required where significant variation in the type and abundance of habitat features occurred.

The results of these assessments, combined with ecologist knowledge, were used to predict habitat suitability for the following Client-nominated MNES fauna:

- *Chalinolobus dwyeri* (Large-eared Pied Bat);
- *Dasyurus hallucatus* (Northern Quoll);
- *Delma torquata* (Collared Delma);
- *Denisonia maculata* (Ornamental Snake);
- *Egernia rugosa* (Yakka Skink);
- *Erythrotriorchis radiatus* (Red Goshawk);
- *Furina dunmalli* (Dunmall's Snake)
- *Geophaps scripta scripta* (Squatter Pigeon - Southern);
- *Nyctophilus corbeni* (South-eastern Long-eared Bat, Corben's Long-eared Bat);
- *Rostratula australis* (Australian Painted Snipe); and
- *Turnix melanogaster* (Black-breasted Button-quail).

These results were used to develop GIS-based mapping of potential habitat for the identified species within the Site.

2.2.3. Threatened Flora Survey

Targeted surveys for threat-listed flora were informed by the desktop search results and ecologist experience. Searches for threat-listed flora under the EPBC and/or NC Act were carried out at all quaternary vegetation assessment sites within the Site and during meanders throughout the Buffer.

If detected, counts and extent of each population of threat-listed flora were made as well as structural characteristics and representative photographs taken.

2.2.4. Incidental Threatened Fauna Records

Any incidental records of threatened fauna obtained during quaternary vegetation assessments and general site traverses were fully documented including species name, location (with site co-ordinates or area of extent), habitat and number detected. Threatened fauna searches were confined to incidental observations only (i.e. no trapping or targeted search techniques were employed). Additional survey effort would be required to provide a more comprehensive inventory of threatened fauna species present at the Site.

3. Results & Discussion

3.1. Vegetation Mapping

3.1.1. Desktop RE Mapping

State government mapped remnant RE (DSITI 2017a) and mature regrowth (DEHP 2012) RE is shown in Appendix AB. Remnant RE polygons mapped within the Site include 11.10.1 (*Corymbia citriodora* woodland on coarse-grained sedimentary rocks) and 11.10.1/11.3.39 (*Eucalyptus melanophloia* +/- *E. chloroclada* open woodland on undulating plains and valleys with sandy soils).

3.1.2. Ground-truthed RE Mapping

Three REs were ground-truthed within the Site (Table 3); these are mapped within Appendix C. The Buffer was predominantly vegetated by remnant RE 11.9.2 while the Access Track was vegetated by both remnant and regrowth RE 11.10.7 with smaller areas of remnant RE 11.9.2. Small patches of endangered RE 11.9.5 were present beside the Access Track and once patch was present within the western side of the Buffer. One patch beside the Access Track comprised mature regrowth while the other was remnant with portions of the patch disturbed by fire (these were regrowing at the time of the survey). The patch within the Buffer comprised both remnant and regrowth (i.e. the outer portion which had been disturbed by fire).

Table 1: Ground-truthed REs present within the Site.

RE Code	*VM Act* Class	Biodiversity Status	Short Description (DEHP 2015)	Location
11.9.2	LC	NCAP	*Eucalyptus melanophloia* +/- *E. orgadophila* woodland on fine-grained sedimentary rocks	Access Track, Buffer
11.9.5	E	E	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	Access Track, Buffer
11.10.7	LC	NCAP	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	Access Track

E = Endangered; OC = Of Concern; LC = Least Concern; NCAP = No Concern at Present

Quaternary survey site data are summarised within Table 2. Locations of quaternary assessment sites are mapped in Appendix A. Quaternary data sheets have been supplied separately to this report.

Table 2: Summary of quaternary survey site assessments within the Site.

Survey Site Code	Location (GDA94)	Vegetation Description	State Mapped RE	Ground-truthed RE Type
Q01-K	55J 684240E 7171353N	*Eucalyptus crebra* low woodland with associated *Callitris glaucophylla*; midlayer of canopy recruits, *Alphitonia excelsa* and *Acacia leiocalyx*; grassy ground layer dominated by native perennial spp.	Non-remnant	11.10.7 (regrowth)
Q02-K	55J 684156E 7171761N	*Eucalyptus crebra* low woodland with associated *Callitris glaucophylla*; midlayer dominated by canopy recruits, *Alphitonia excelsa*; grassy ground layer dominated by native perennial spp.	11.10.1/11.3.39	11.10.7 (regrowth)
Q03-K	55J 685502E 7173179N	*Eucalyptus crebra* open woodland with associated *Acacia sparsiflora* and *Callitris glaucophylla*; sparse shrub layer of *Alphitonia excelsa*; grassy ground layer dominated by *Themeda triandra*.	11.10.1/11.3.39	11.10.7 (remnant)
Q04-K	55J 686276E 7173389N	*Eucalyptus melanophloia* and *E. orgadophila* woodland; midlayer dominated by *Grewia latifolia* and *Eremophila mitchellii*; grassy ground layer dominated by native perennial spp.	11.10.1	11.9.2 (remnant)
Q05-K	55J 686523E 7173557N	*Acacia harpophylla* woodland with associated *Eucalyptus orgadophila* (thinned from fire); midlayer dominated by canopy recruits, *Geijera parviflora* and *Santalum lanceolatum*; grassy ground layer dominated by *Bothriochloa decipiens*.	11.10.1/11.3.39	11.9.5 (remnant)
Q06-K	55J 686776E 7173506N	*Eucalyptus crebra* woodland; midlayer dominated by *Acacia leiocalyx*; grassy ground layer dominated by native perennial spp.	11.10.1	11.10.7 (remnant)
Q07-K	55J 687367E 7173014N	*Eucalyptus orgadophila* woodland-open woodland with associated *E. crebra*; midlayer dominated by *Atalaya hemiglauca* and *Eremophila mitchellii*; grassy ground layer dominated by native perennial spp.	11.10.1	11.9.2 (remnant)
Q08-K	55J 686934E 7173015N	*Acacia harpophylla* open forest; midlayer of semi-evergreen vine thicket (SEVT) spp.; grassy ground layer.	11.10.1	11.9.5 (remnant)

3.1.3. TEC Assessment

The field survey confirmed the presence of one TEC, this being Brigalow (*Acacia harpophylla* dominant and co-dominant). Two patches of the endangered RE 11.9.5 occurred beside the Access Track and one patch occurred within the Buffer (Appendix C). Two of the patches met TEC criteria (Appendix D) while the remaining patches were fire-damaged and did not meet TEC condition criteria.

The PMST (DoEE 2017a) predicted the potential presence of three additional TEC including 'Coolibah-Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions', Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions' and 'Weeping Myall Woodlands'. None of these TEC were detected within the Site.

3.2. Threatened Fauna

3.2.1. Likelihood of Occurrence Assessment

The desktop assessment indicated that that no fauna listed as threatened under the EPCA Act and/or NC Act have been recorded within 5 km of the Site. No threatened fauna was detected within the Site; however comprehensive fauna surveys were not undertaken. An assessment of the likelihood of occurrence of EPBC Act and/or NC Act listed threatened fauna in the Site is summarised in Appendix E.

3.2.2. Habitat Assessment and Predictive Habitat Mapping

Fauna habitat assessments were performed at each quaternary survey site. The results of these assessments were then combined with ecologist knowledge to develop predictive habitat mapping for client-identified MNES fauna species (refer to list in section 2.2.2). Note that habitat mapping only applies to the Buffer (i.e. the Access Track is excluded from habitat mapping). Habitat mapping rules for the MNES fauna predicted to occur within the Sites are listed in Table 3. Mapping of General Habitat for these species is presented in Appendix F.

Table 3: List of potentially suitable RE and habitat mapping rules for nominated MNES fauna potentially present within the Buffer.

Species name	Potentially Suitable REs	Relevant Microhabitat Features Present	Habitat Mapping Rules/Notes
Chalinolobus dwyeri Large-eared Pied Bat	11.9.2, 11.9.5	No shelter sites – foraging habitat present.	Mapped General Habitat includes all areas of the nominated RE.
Dasyurus hallucatus Northern Quoll	11.9.2, 11.9.5	No shelter sites – foraging habitat present.	Mapped General Habitat includes all areas of the nominated RE.
Delma torquata Collared Delma	11.9.2, 11.9.5	Shelter sites present – small stones, logs, leaflitter.	Mapped General Habitat includes all areas of the nominated RE.
Denisonia maculata Ornamental Snake	n/a	n/a	n/a
Egernia rugosa Yakka Skink	n/a	n/a	n/a
Erythriotriorchis radiatus Red Goshawk	11.9.2, 11.9.5	No nest sites – foraging habitat present.	Mapped General Habitat includes all areas of the nominated RE.
Furina dunmalli Dunmall's Snake	11.9.2, 11.9.5	Shelter sites present – logs, leaflitter.	Mapped General Habitat includes all areas of the nominated RE.
Geophaps scripta scripta Squatter Pigeon - southern	11.9.2	Nesting and foraging habitat present.	Mapped General Habitat includes all areas of the nominated RE.
Nyctophilus corbeni South-eastern Long-eared Bat	11.9.2, 11.9.5	Shelter sites - Hollow-bearing trees, trees with loose bark.	Mapped General Habitat includes all areas of the nominated RE.
Rostratula australis Australian Painted Snipe	n/a	n/a	n/a
Turnix melanogaster Black-breasted Button-quail	n/a	n/a	n/a

3.3. Threatened Flora

The Site is not within a High Risk Area as shown on a Protected Plants Survey Trigger Map (DEHP 2016). The desktop assessment indicated that four species of threatened flora have been recorded within 5 km of the Site (DSITI 2017b) these being: *Apatophyllum teretifolium*, *Bertya opponens*, *Acacia islana* and *Xerothamnella herbacea*.

PMST search results (DoEE 2017a) also predicted the potential occurrence of the following EPBC Act listed threatened flora species: *Tylophora linearis, Bertya opponens* and *Cadellia pentastylis*.

No threatened flora was detected within the Site. An assessment of the likelihood of occurrence of EPBC Act and/or NC Act listed threatened flora occurring in the Site is summarised in Appendix G.

3.4. Wetlands and Springs

No High ecological Significance or General Ecological Significance wetlands as shown on a Map of Referable Wetlands (DEHP 2017b) were detected within the Site. No other wetlands or springs were detected within the Site.

4. Conclusions

The desktop assessment and field survey identified the following potential ecological values and/or constraints within the Site:

- One TEC was detected within the Site: Brigalow (*Acacia harpophylla* dominant and dominant).
- One Endangered RE was detected within the Site: RE 11.9.5 '*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks'.
- The Site contains potentially suitable habitat for a range of EPBC Act and/or NC Act listed fauna.
- Indicative General Habitat mapping was provided for the following Client-nominated MNES fauna:
    - *Chalinolobus picatus* (Large-eared Pied Bat);
    - *Dasyurus hallucatus* (Northern Quoll);
    - *Erythrotriorchis radiatus* (Red Goshawk);
    - *Geophaps scripta scripta* (Squatter Pigeon – southern subspecies);
    - *Nyctophilus corbeni* (South-eastern Long-eared Bat, Corben's Long-eared Bat);
    - *Delma torquata* (Collared Delma); and
    - *Furina dunmalli* (Dunmall's Snake).
- No threatened flora were detected within the Site.
- No wetlands or springs were detected within the Site.

5. References

ALA (2017). Atlas of Living Australia. http://www.ala.org.au/

Bostock, P.D. and Holland, A.E. (eds.) (2016). *Census of the Queensland Flora 2016*. Queensland Herbarium, Department of Science, Information Technology and Innovation, Queensland Government, Brisbane. https://data.qld.gov.au/dataset/census-of-the-queensland-flora-2016

Burnett, S. (2012). Northern Quoll. In: Curtis, LK and Dennis, AJ (eds.) *Queensland's Threatened Animals*. CSIRO Publishing, Melbourne. Pp. 340-341.

DEHP (2012). *Environmental protection Act 1994 – mature regrowth*. Spatial dataset. Department of Environment and Heritage Protection, Queensland Government, Brisbane http://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={4EE2ABF6-B8FA-4E8B-B61B-70DA4D63E986}

DEHP (2016). *Nature Conservation Act protected plants flora survey trigger map spatial layer*. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

http://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={6F958DFC-C7F4-4F59-8FBC-A0E73770B720}

DEHP (2017a). *Environmentally Sensitive Areas- chapter 5A activities (EP Act)*. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

DEHP (2017b). *Map of Referable Wetlands, Wetland Protection Areas/Wetland Management Areas*. Map Request Form - Referable Wetlands. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

DoEE (2017a). *EPBC Act Protected Matters Search Tool*. Department of the Environment and Energy, Australian Government, Canberra. http://www.environment.gov.au/epbc/pmst/index.html

DoEE (2017b). *Species Profile and Threats Database*. Department of the Environment and Energy, Australian Government, Canberra. http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

DNRM (2010). *Ordered Drainage 100K – Queensland*. Department of Natural Resources and Mines, Queensland Government, Brisbane. http://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={2E074A5A-F00B-40C3-9C67-31F087F1F16F}

DNRM (2017). *Vegetation Management - Essential Habitat Map - Version 4.4.* Spatial dataset. Department of Natural Resources and Mines, Queensland Government, Brisbane. http://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={D9EDE20F-AAFB-497A-8A62-4DCD5C160BA9}

DSITI (2016). *Regional Ecosystem Description Database (REDD) – Version 10.0 (December 2016).* Queensland Herbarium, Department of Science, Information Technology and Innovation, Queensland Government, Brisbane. https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/download/

DSITI (2017a). *Biodiversity status of pre-clearing and 2015 remnant regional ecosystems - version 10.0 - South Central Qld*. Spatial dataset. Department of Science, Information Technology and Innovation, Queensland Government, Brisbane. http://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={B4E79402-A68B-4AE2-8820-7371D9D1A058}

DSITI (2017b). *Request a species list (Wildlife Online search)*. Department of Science, Information Technology and Innovation, Queensland Government, Brisbane. https://environment.ehp.qld.gov.au/report-request/species-list/

DSITI (2017c). *Queensland Herbarium specimen data (HERBRECS)*. Department of Science, Information Technology and Innovation, Queensland Government, Brisbane.

DSITI (2017d). *Species profile search.* WildNet database, Department of Science, Information Technology and Innovation, Queensland Government, Brisbane. https://environment.ehp.qld.gov.au/species-search/

Eddie, C. (2012). Yakka Skink. Pp. 224-225 in: Curtis, LK and Dennis, AJ (eds) *Queensland's Threatened Animals*. CSIRO Publishing, Melbourne.

Garnett, S.J., Szabo, J.K. and Dutson, G. (2011). *The Action Plan for Australian Birds 2010*. CSIRO Publishing, Melbourne.

Higgins, P.J. (ed.) (1999). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 4. Parrots to Dollarbird*. Oxford University Press, Melbourne.

Higgins, P.J. and Davies, S.J.J.F. (eds.) (1996). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 3. Snipe to Pigeons*. Oxford University Press, Melbourne.

Higgins, P.J., Peter, J.M. and Steele, W.K. (eds) (2001). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 5: Tyrant-flycatchers to Chats.* Oxford University Press, Melbourne.

Hobson, R. (2012). Dunmall's Snake. In: Curtis, LK and Dennis, AJ (eds) *Queensland's Threatened Animals*. CSIRO Publishing, Melbourne. Pp. 243-244.

Holmes, T. (2012). Glossy Black-Cockatoo. In: Curtis, LK and Dennis, AJ (Eds) *Queensland's Threatened Animals*. CSIRO Publishing, Melbourne. Pp. 282-283.

Limpus, C., Limpus, D., Parmenter, J., Hodge, J., Forest, M. and McLachlan, J. (2011). *The Biology and Management Strategies for Freshwater Turtles in the Fitzroy Catchment, with particular emphasis on* Elseya albagula *and* Rheodytes leukops: *A study initiated in response to the proposed construction of Rookwood Weir and the raising of Eden Bann Weir.* Queensland Department of Environment and Resource Management, Brisbane.

Lintermans, M. (2007). *Fishes of the Murray-Darling Basin: an introductory guide*. Murray Darling Basin Commission, Canberra.

Marchant, S. and Higgins, P.J. (1993). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 2. Raptors to Lapwings*. Oxford University Press, Melbourne.

Melzer, A., Cristescu, R., Ellis, W., Fitzgibbon, S. and Manno, G. (2014). The habitat and diet of koalas (Phascolarctos cinereus) in Queensland. *Australian Mammalogy* 36(2): 189-199.

Neldner, V.J., Wilson, B.A., Thompson, E.J. and Dillewaard, H.A. (2012). *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland. Version 3.2*. Department of Science, Information Technology, Innovation and the Arts, Queensland Government, Brisbane.

Pizzey, G. and Knight, F. (2010). *The Field Guide to the Birds of Australia*. Eighth edition. Harper Collins, Melbourne.

QMDC (2008). *Reptiles of the Brigalow Belt: an information kit.* WWF-Australia and Queensland Murray Darling Committee.

Reardon, T. (2012). South-eastern Long-eared Bat. In: Curtis, LK and Dennis, AJ (eds.) *Queensland's Threatened Animals.* CSIRO Publishing, Melbourne. Pp. 386-387.

Santos (2012). *Field Guide to Trees and Shrubs of Eastern Queensland Oil and Gas Fields*. Santos, Adelaide.

Santos (2014). *Methodology for Conducting Ecological Assessments. Rev 2.* Santos internal document.

Santos (2015). *Functional Thresholds for Assessing Regional Ecosystem Functionality. Rev 2.* Santos internal document.

Sattler, P. and Williams, R. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Queensland Government, Brisbane.

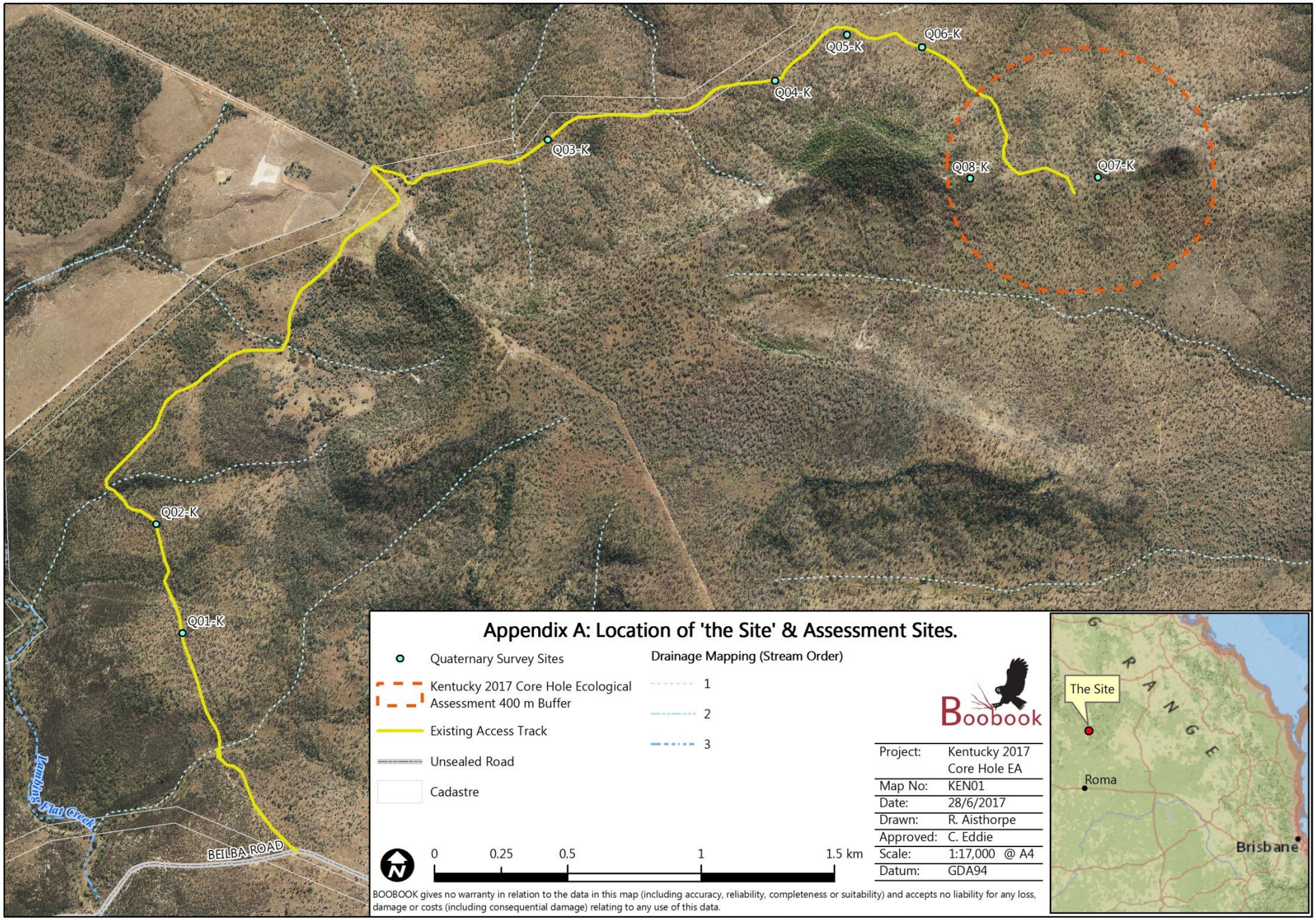
TSSC (2013). *Commonwealth Conservation Advice for Brigalow Ecological Community*. Threatened Species Scientific Committee, Department of Sustainability, Environment, Water, Population and Communities, Australian Government, Canberra. http://www.environment.gov.au/biodiversity/threatened/communities/pubs/028-conservation-advice.pdf

TSSC (2016). *Conservation Advice for Petauroides volans (greater glider).* Department of the Environment and Energy, Australian Government, Canberra. http://www.environment.gov.au/biodiversity/threatened/species/pubs/254-conservation-advice-05052016.pdf

Valentine, P. and Johnson, S. (2012). Pale Imperial Hairstreak Butterfly. In: Curtis, LK and Dennis, AJ (eds) *Queensland's Threatened Animals*. CSIRO Publishing, Melbourne. Pp. 34-35.

Wilson, S (2015). *A Field Guide to Reptiles of Queensland*. New Holland, Sydney.

Appendix A. Location of the Site and Assessment Sites.



Appendix A: Location of 'the Site' & Assessment Sites.

- Quaternary Survey Sites
- Kentucky 2017 Core Hole Ecological Assessment 400 m Buffer
- Existing Access Track
- Unsealed Road
- Cadastre

Drainage Mapping (Stream Order)

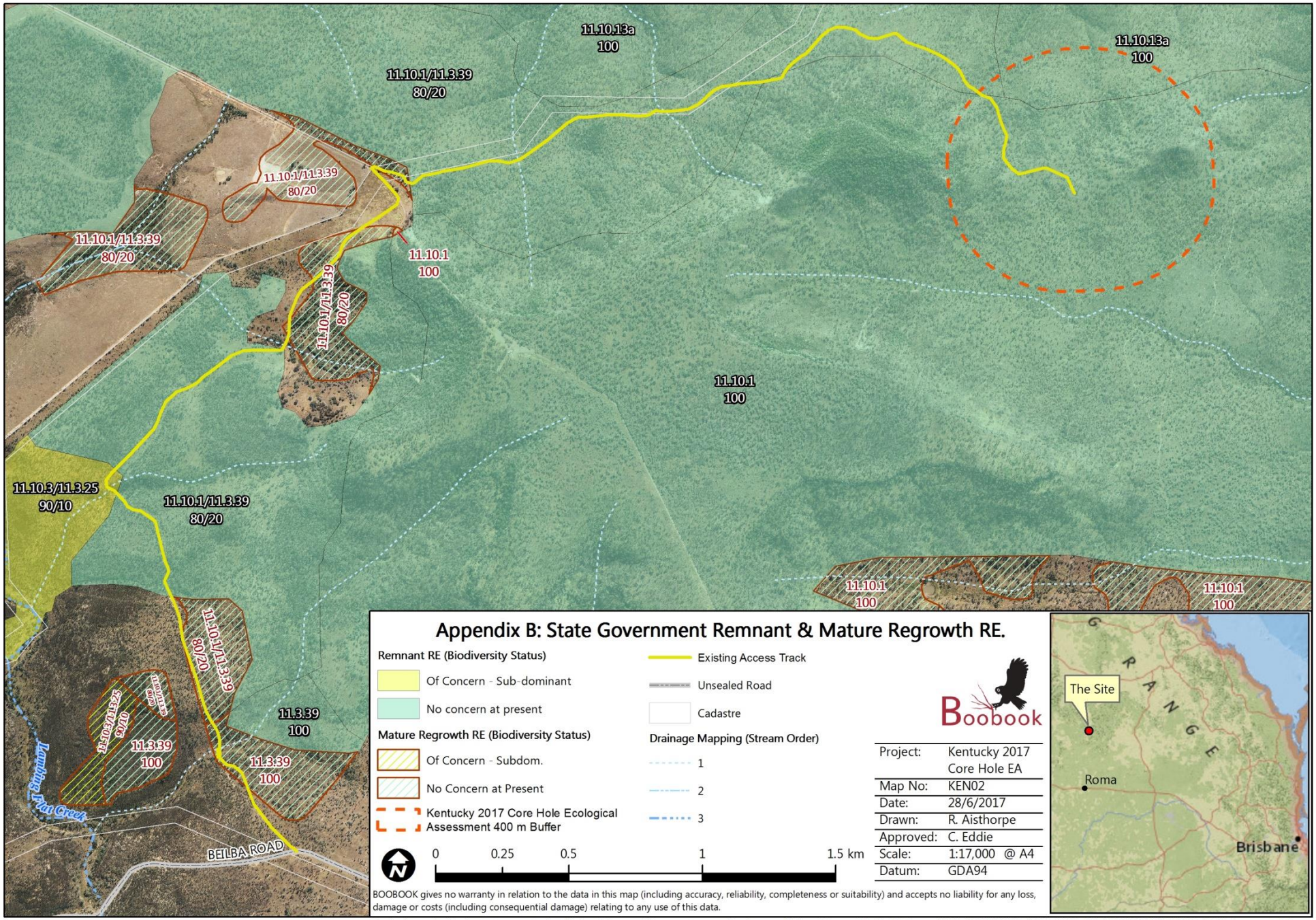
- 1
- 2
- 3

0 0.25 0.5 1 1.5 km

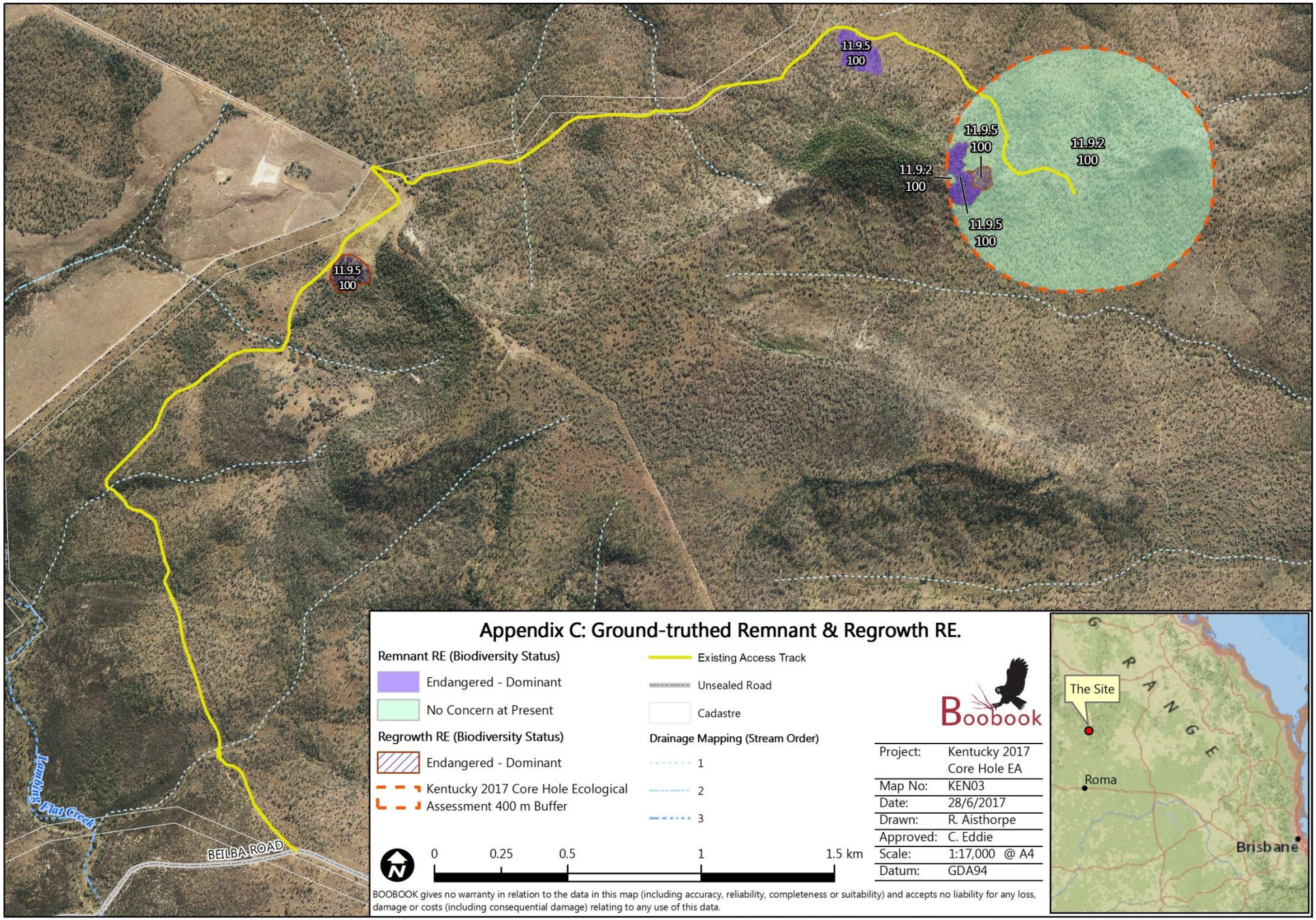
Boobook

Project:	Kentucky 2017 Core Hole EA
Map No:	KEN01
Date:	28/6/2017
Drawn:	R. Aisthorpe
Approved:	C. Eddie
Scale:	1:17,000 @ A4
Datum:	GDA94

Appendix B. State Government Remnant and Mature Regrowth RE.



Appendix C. Ground-truthed Remnant and Regrowth RE.



Appendix C: Ground-truthed Remnant & Regrowth RE.

Remnant RE (Biodiversity Status)

- Endangered - Dominant
- No Concern at Present

Regrowth RE (Biodiversity Status)

- Endangered - Dominant
- Kentucky 2017 Core Hole Ecological Assessment 400 m Buffer

- Existing Access Track
- Unsealed Road
- Cadastre

Drainage Mapping (Stream Order)

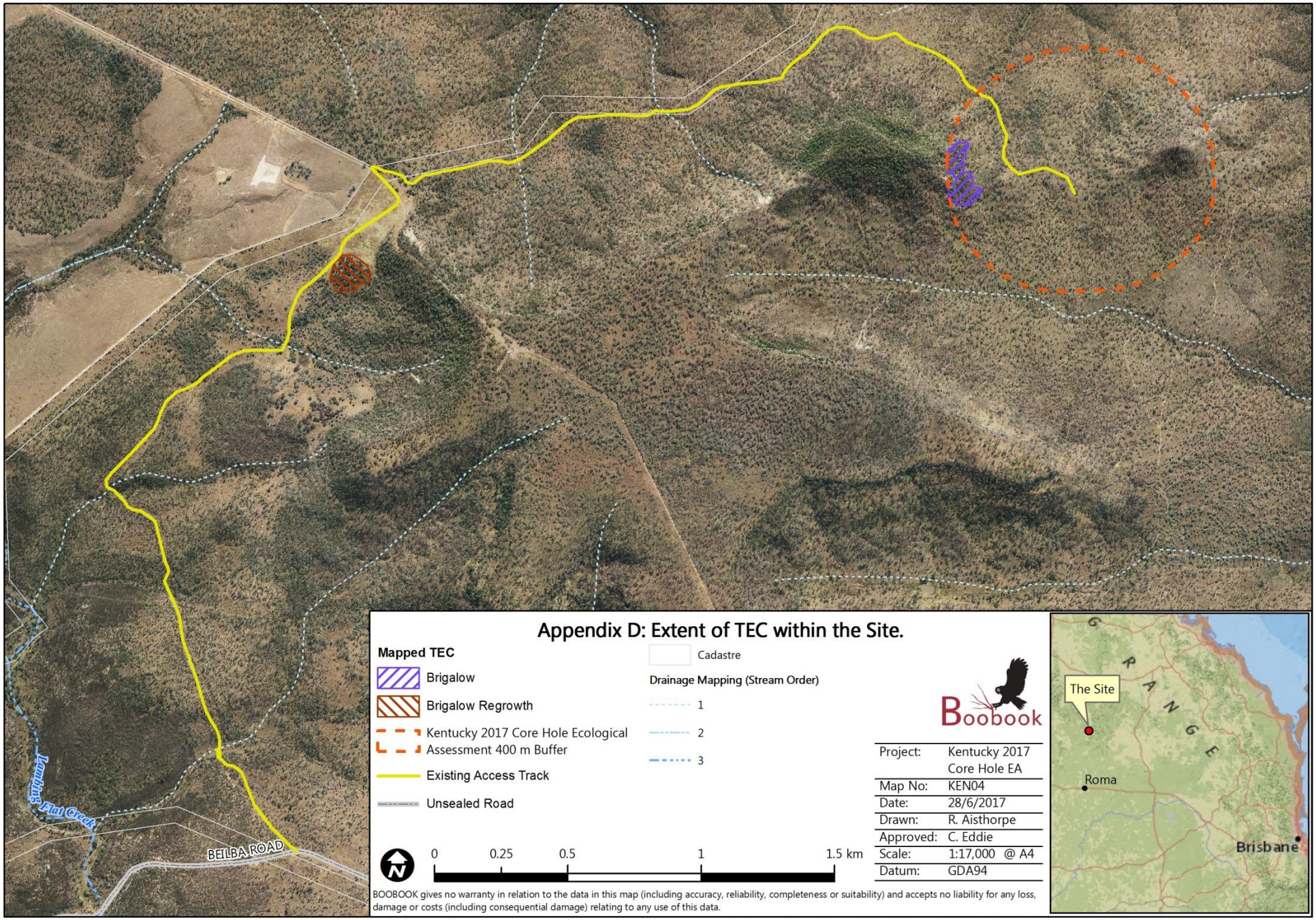
- 1
- 2
- 3

0 0.25 0.5 1 1.5 km

Boobook

Project:	Kentucky 2017 Core Hole EA
Map No:	KEN03
Date:	28/6/2017
Drawn:	R. Aisthorpe
Approved:	C. Eddie
Scale:	1:17,000 @ A4
Datum:	GDA94

Appendix D. Extent of Threatened Ecological Communities within the Site.



Appendix D: Extent of TEC within the Site.

Mapped TEC

- Brigalow
- Brigalow Regrowth
- Kentucky 2017 Core Hole Ecological Assessment 400 m Buffer
- Existing Access Track
- Unsealed Road
- Cadastre

Drainage Mapping (Stream Order)

- 1
- 2
- 3

0 0.25 0.5 1 1.5 km

Boobook

Project:	Kentucky 2017 Core Hole EA
Map No:	KEN04
Date:	28/6/2017
Drawn:	R. Aisthorpe
Approved:	C. Eddie
Scale:	1:17,000 @ A4
Datum:	GDA94

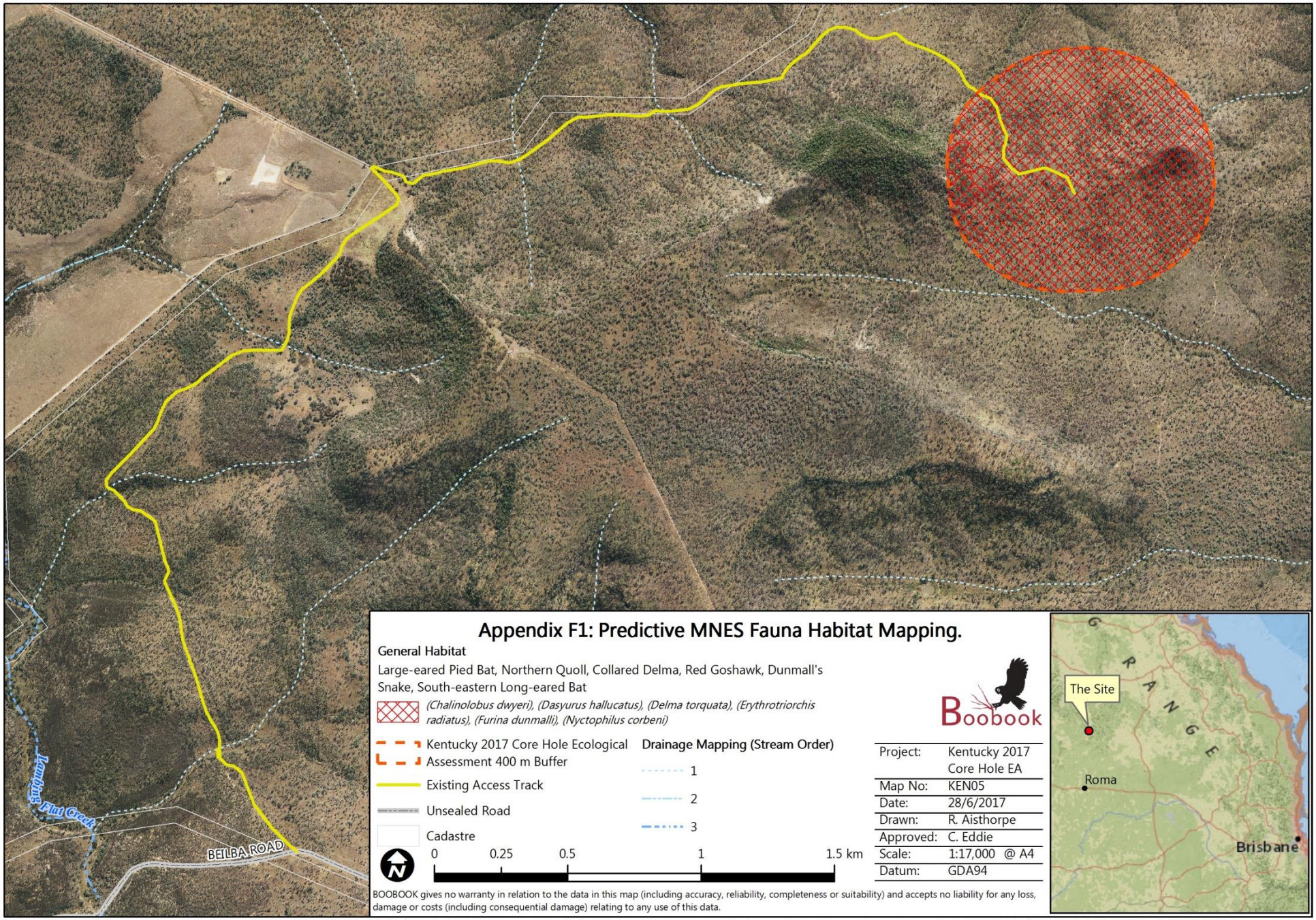
Appendix E. Likelihood of occurrence assessment for threatened fauna within the Site.

Class	Scientific & Common Name	EPBC Act Status	NC Act Status	Distribution and Known Habitat Use	Likelihood of Occurrence	Field Survey Results
Birds	*Calidris ferruginea* Curlew Sandpiper	CE	E	A migratory species usually encountered on coastal and near-coastal saline and freshwater wetlands (Pizzey and Knight 1997). Passage migrants are occasionally present on inland wetlands, and the species is sparsely recorded across inland Queensland (ALA 2017).	Unlikely to be present. Suitable wetland habitat is absent from the Site.	Not recorded within the Site.
	Calyptorhynchus lathami Glossy Black-Cockatoo	-	V	Dependent on the fruits of several species of *Casuarina* and *Allocasuarina* spp. and occurs in a variety of forest types (Pizzey and Knight 2010, Garnett *et al*. 2011). It will visit isolated trees and remnant patches where food trees are present (Holmes 2012). Nesting habitat is hollow-bearing live or dead trees (Higgins 1999).	Unlikely to be present. Potentially suitable habitat with food plants including *Casuarina cristata* are absent from the Site.	Not recorded within the Site.
	Erythrotriorchis radiatus Red Goshawk	V	V	A highly mobile species with a large home range; breeding habitat is in intact tall forest associated with major drainage lines, especially near permanent water bodies and where there is high avian prey diversity, but the species could potentially forage much further away from these areas (Marchant and Higgins 1993).	Potentially present. No riparian habitat with tall trees that could potentially support nesting sites for the species are present within the Site; however foraging habitat is present.	Not recorded within the Site.
	Geophaps scripta scripta Squatter Pigeon (southern subspecies)	V	V	Inhabits grassy woodlands with open areas for foraging habitat usually within proximity to a nearby water source (Higgins and Davies 1996). Previously recorded from Kentucky (C. Eddie pers. obs.).	Potentially present. Potentially suitable foraging and nesting habitat is present within the Site.	Not recorded within the Site.
	Grantiella picta Painted Honeyeater	V	V	Lives/breeds in woodlands and open forests with high densities of suitable food plants (i.e. mistletoes, family Loranthaceae) (Higgins *et al*. 2001).	Unlikely to be present. Mistletoe is largely absent from or n very low abundance within the Site.	Not recorded within the Site.
	Rostratula australis Australian Painted Snipe	E	V	Forages at shallow edges and adjacent vegetated margins of freshwater wetlands (DoEE 2017b) and is able to use both artificial and natural ephemeral and permanent wetlands (Marchant and Higgins 1993).	Unlikely to be present. Suitable wetland habitat is absent from the Site.	Not recorded within the Site.
Fish	*Maccullochella peelii* Murray Cod	V	-	In Queensland naturally-occurring populations of this species are confined to permanent water in riverine environments in the Condamine, Maranoa-Balonne, Weir and Moonie River catchments (Lintermans 2007).	Unlikely to be present. Does not occur naturally within Dawson River catchment and no suitable riverine habitat exists within the Site.	Not recorded within the Site.
Mammals	*Chalinolobus dwyeri* Large-eared Pied Bat	V	V	All known occurrences of this species are within or near forested landscapes with relatively high relief (DSITI 2017d). The species may be present in uplands with likely presence of appropriate geology (usually sandstone) providing essential habitat (caves, crevices, holes) and associated foraging habitat.	Potentially present. Potentially suitable foraging habitat is present within the Site.	Not recorded within the Site.

Class	Scientific & Common Name	EPBC Act Status	NC Act Status	Distribution and Known Habitat Use	Likelihood of Occurrence	Field Survey Results
	Dasyurus hallucatus Northern Quoll	E	LC	Formerly widespread in south-central Queensland this species has declined markedly and is now confined to rugged and remote areas throughout its distribution (Burnett 2012). Forested uplands with high relief and/or containing abundant rock outcrops may support the species.	Potentially present. Potentially suitable foraging habitat is present within the Site.	Not recorded within the Site.
	Nyctophilus corbeni South-eastern Long-eared Bat	V	V	The distribution and habitat preferences of this species are very poorly known; it inhabits a range of dry forest types in south central Queensland (Reardon 2012).	Potentially present. Potentially suitable foraging and roosting habitat is present within the Site.	Not recorded within the Site.
	Petauroides volans Greater Glider	V	V	Occurs in eucalypt woodlands and open forest particularly those with mature trees containing large hollows (TSSC 2016).	Potentially present. Potentially suitable foraging habitat is present within the Site, however tall trees with large hollows are absent from the Site.	Not recorded within the Site.
	Phascolarctos cinereus Koala (combined populations of QLD, NSW and the ACT)	V	V	This species requires eucalypt woodland and forest habitat with suitable food trees (primarily *Eucalyptus* spp.) (DoEE 2017b). Woodlands containing food trees in riparian/alluvial areas are particularly favoured (Melzer *et al*. 2014). Potential food trees occurring within the Site include *Eucalyptus melanophloia*, *E. orgadophila* and *E. crebra*.	Potentially present. Potentially suitable food trees and foraging habitat is present within the Site.	Not recorded within the Site.
Reptiles	*Acanthophis antarcticus* Common Death Adder	-	V	A widespread but patchily distributed snake (ALA 2017). Lives in woodlands, open forests and heathlands; requires abundant shelter/ambush predation cover e.g. low shrubs, rocks, logs, dense leaf litter (Wilson 2015).	Potentially present. Potentially suitable habitat with shelter sites (e.g. dense low shrubs, rocks) is present within RE 11.9.5 within the Site.	Not recorded within the Site.
	Delma torquata Collared Delma	V	V	Occupies a range of eucalypt woodlands and open forests; lives under surface rock and large woody debris (Wilson 2015). The Site is within the species' known range with several records from locations north-west of Roma (ALA 2017).	Potentially present. Eucalypt woodland with potentially suitable shelter sites (e.g. small rocks, woody debris) is present within the Site.	Not recorded within the Site.
	Denisonia maculata Ornamental Snake	V	V	Occurs in lowlands associated with the Dawson and Fitzroy catchments (DoEE 2017b). Known southerly distribution limit is approximately Lake Nuga Nuga (ALA 2017). Lives in woodland and grassland with cracking clay soils, usually in close proximity to wet or seasonally wet areas e.g. billabongs, gilgais, floodplains, riparian corridors (DoEE 2017b).	Unlikely to be present. Habitat with preferred substrate (e.g. deep cracking clay, gilgais) is absent from the Site.	Not recorded within the Site.
	Egernia rugosa Yakka Skink	V	V	Lives in a range of woodland and open forests dominated by *Eucalyptus*, *Acacia* and *Callitris* spp.; also grassland with regrowth trees (DoEE 2017b). Requires suitable soils for burrows or shelters in sinkholes, abandoned rabbit warrens or large fallen/piled woody material (Eddie 2012).	Unlikely to be present. Eucalypt woodland with potentially suitable burrowing substrate and shelter sites (e.g. large logs, log piles) is absent from the Site.	Not recorded within the Site.

Class	Scientific & Common Name	EPBC Act Status	NC Act Status	Distribution and Known Habitat Use	Likelihood of Occurrence	Field Survey Results
	Elseya albagula White-throated Snapping Turtle	CE	E	Occurs in the Fitzroy and Dawson River catchments where it requires permanent water in riverine environments (Limpus *et al*. 2011).	Unlikely to be present. No suitable riverine habitat is present within the Site.	Not recorded within the Site.
	Furina dunmalli Dunmall's Snake	V	V	Occupies woodlands and open forests; may be reliant on presence of abundant fallen woody debris (Hobson 2012).	Potentially present. Potentially suitable foraging and shelter habitat is present in remnant and regrowth REs throughout the Site.	Not recorded within the Site.
	Rheodytes leukops Fitzroy River Turtle	V	V	The species is confined to the Fitzroy and Dawson River catchments where it requires permanent water in riverine environments (Limpus *et al*. 2011).	Unlikely to be present. No suitable riverine habitat is present within the Site.	Not recorded within the Site.
	Strophurus taenicauda Golden-tailed Gecko	-	NT	Lives in dry open forest and woodlands, especially those with well-developed shrub layer where it shelters in tree hollows and splits, and under loose bark (QMDC 2008).	Potentially present. Potentially suitable habitat with shelter sites (e.g. trees with loose bark) is present within parts of the Site.	Not recorded within the Site.
Insects	*Jalmenus eubulus* Pale Imperial Hairstreak	-	V	Usually associated with Brigalow (*Acacia harpophylla*) open forests and woodlands (Valentine and Johnson 2012).	Potentially present. Habitat with suitable food plants (e.g. *Acacia harpophylla*) is present within the Site.	Not recorded within the Site.

Appendix F. Predictive MNES Fauna Habitat Mapping



Appendix F1: Predictive MNES Fauna Habitat Mapping.

General Habitat

Large-eared Pied Bat, Northern Quoll, Collared Delma, Red Goshawk, Dunmall's Snake, South-eastern Long-eared Bat

(Chalinolobus dwyeri), (Dasyurus hallucatus), (Delma torquata), (Erythrotriorchis radiatus), (Furina dunmalli), (Nyctophilus corbeni)

Kentucky 2017 Core Hole Ecological Assessment 400 m Buffer

Existing Access Track

Unsealed Road

Cadastre

Drainage Mapping (Stream Order)

1

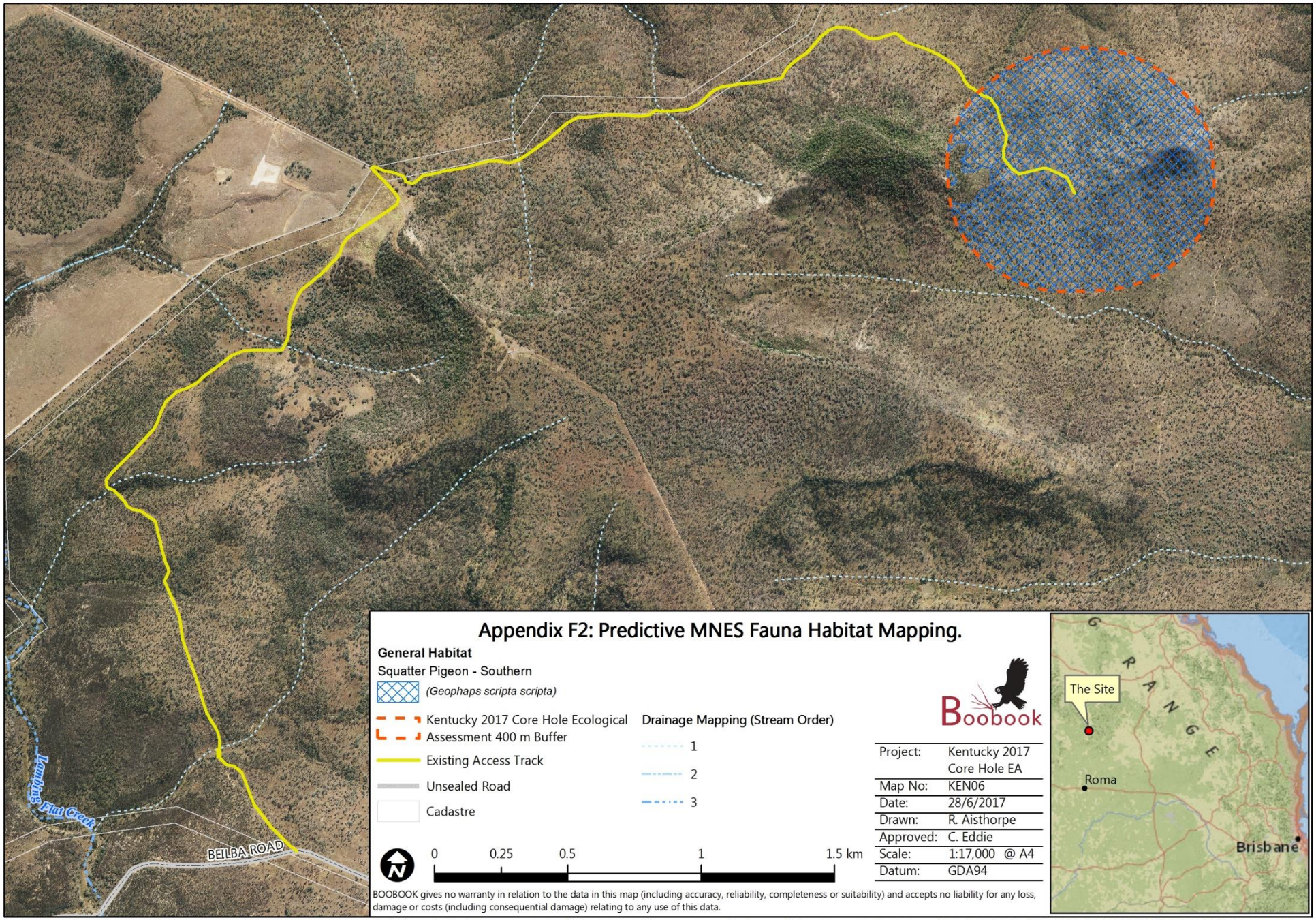
2

3

0 0.25 0.5 1 1.5 km

Boobook

Project:	Kentucky 2017 Core Hole EA
Map No:	KEN05
Date:	28/6/2017
Drawn:	R. Aisthorpe
Approved:	C. Eddie
Scale:	1:17,000 @ A4
Datum:	GDA94


Appendix F2: Predictive MNES Fauna Habitat Mapping.
General Habitat
Squatter Pigeon - Southern
(Geophaps scripta scripta)
Kentucky 2017 Core Hole Ecological Assessment 400 m Buffer
Existing Access Track
Unsealed Road
Cadastre
Drainage Mapping (Stream Order)
1
2
3
0
0.25
0.5
1
1.5 km
Boobook
Project: Kentucky 2017 Core Hole EA
Map No: KEN06
Date: 28/6/2017
Drawn: R. Aisthorpe
Approved: C. Eddie
Scale: 1:17,000 @ A4
Datum: GDA94
The Site
Roma
Brisbane
GRANGE
Lamington Flat Creek
BEILBA ROAD
BOOBOOK gives no warranty in relation to the data in this map (including accuracy, reliability, completeness or suitability) and accepts no liability for any loss, damage or costs (including consequential damage) relating to any use of this data.
Service Layer Credits: Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Appendix G. Likelihood of occurrence assessment for threatened flora within the Site.

Family	Scientific & Common Name	EPBC Act Status	NC Act Status	Distribution and Known Habitat Use	Likelihood of Occurrence	Field Survey Results
Acanthaceae	*Xerothamnella herbacea*	E	E	Occurs in Brigalow-dominated communities in shaded situations, often in leaf litter and is associated with gilgais (shallow ground depressions), alluvial plains and/or minor drainage lines (DSITI 2017d). Known from a number of widely scattered sites ranging from near Yelarbon north to Kokotungo west of Gladstone (ALA 2017). Recorded within 5 km of Site (DSITI 2017b).	Unlikely to be present. Suitable habitat Brigalow-dominated habitat on alluvial plains or associated with drainage lines is absent from the Site.	Not recorded within the Site.
Apocynaceae	*Tylophora linearis* Slender Tylophora	E	E	Found in drier open forests and woodlands of *Eucalyptus, Callitris* and *Allocasuarina* species (DoEE 2017b). It has been collected at numerous localities in NSW, principally on the western slopes of the Great Dividing Range from Temora to the Linton - Yetman area (ALA 2017). It is only known in Queensland from one specimen collected near Glenmorgan in 1960 (ALA 2017).	Unlikely to be present. Although potentially suitable habitat is present the Site is outside the known range of this species (ALA 2017).	Not recorded within the Site.
Celastraceae	*Apatophyllum teretifolium* Sandstone Prickle Bush	-	NT	Occurs in dry sclerophyll woodland on crests of sandstone ridges with coarse sandy soil and along cliff edges (Santos 2012). Recorded within 5 km of Site (DSITI 2017b).	Unlikely to be present. Suitable habitat is absent from the Site.	Not recorded within the Site.
Euphorbiaceae	*Bertya opponens*	V	LC	Occurs in southern to central Queensland and NSW (DoEE 2017a). In Queensland it is widely distributed within an area bounded by Emerald in the north and Charleville in the west, with outliers near Moranbah and Charters Towers (ALA 2017, DoEE 2017a). Grows in a variety of community types including mixed shrubland, lancewood woodland, mallee woodland, eucalypt/*Acacia* open forest with shrubby understorey, Eucalyptus/Callitris open woodland and SEVT on shallow and rocky or much deeper and well-drained soils (DoEE 2017a, DSITI 2017d). Specimen records from the Fairview Gas Field indicate that the species has been recorded from sandstone plateaus and slopes in remnant and regrowth eucalypt/acacia woodland including where these communities occur along the margins of SEVT (DSITI 2017c, BOOBOOK unpublished data). Recorded within 5 km of Site (DSITI 2017b).	Unlikely to be present. Suitable habitat is absent from the Site.	Not recorded within the Site.
Mimosaceae	*Acacia islana* Isla Gorge Wattle	-	V	Occurs in dry sclerophyll woodland on sandy and shallow stony soils within dry sclerophyll woodlands usually associated with dissected sandstone ridges (DSITI 2017b). Recorded within 5 km of Site (DSITI 2017b).	Unlikely to be present. Suitable habitat is absent from the Site.	Not recorded within the Site.
Surianaceae	*Cadellia pentastylis* Ooline	V	V	Occurs in northern NSW and southern Queensland (DoEE 2017b). Within Queensland it occurs patchily from near Rockhampton westward to near Blackall and southward to the State border (ALA 2017) where it occurs on undulating plains, valley slopes, hillsides and scarps, often in association with Brigalow and SEVT communities (DoEE 2017b, Santos 2012). Potentially suitable RE within the Site includes 11.9.5.	Unlikely to be present. Although some areas of potentially suitable habitat are present this species, a large and conspicuous tree, was not recorded from the Site.	Not recorded within the Site.