

Ecological Reports – RWP2b

Combined Ecological reports for Roma West Phase 2b Project

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Prepared By:

Title	Department	Signature
Environmental Advisor	QBU Environment	

Well Lease Area / Infrastructure Zone Ecological Assessment Report: RCAP Pasadena, Zone Pine Ridge 5

Compiled by BOOBOOK for Santos

BOOBOOK
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

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A	19/12/2013	Draft issued to client for review	R. Johnson, R. Aisthorpe	C. Eddie	C. Eddie
B	19/2/2014	Draft incorporating client comment	R. Johnson	C. Eddie	C. Eddie
0	14/5/2014	Final report incorporating further client comments	R. Johnson, A. Bendall	C. Eddie	C. Eddie

I. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
cm	centimetre(s)
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DOE	Department of the Environment
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
km	kilometre(s)
m	metre(s)
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
TAR plant	Type A Restricted Plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

2. Introduction

2.1 Purpose & Scope

BOOBOOK was commissioned by Santos to undertake ecological assessments a number of well leases and associated infrastructure zones on the property 'Pasadena', located about 22km north-east of Roma, south central Queensland. The property is described as Lots 102 and 103 on Plan WV458.

This report refers to the linear infrastructure zone Pine Ridge 5 (hereafter PR5)

The areas to be assessed were defined as follows. A Construction Disturbance Zone (hereafter the 'Zone') was defined around the lease (non-linear) and linear infrastructure. Buffers of different dimensions were established around the non-linear and linear components of the Zone. A 200m radius Buffer was identified around the non-linear Zone (i.e. well lease) and a 100m width Buffer was established along the length of the linear Zone (e.g. access track).

BOOBOOK was requested to undertake the following assessments:

Within the Construction Disturbance Zone:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation community present;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the remnant/non-remnant communities present;
- Provide comment on the ecosystem function of vegetation present;
- Provide location and description of any plants of conservation concern listed in the *Nature Conservation Act 1992* (NC Act) or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) present;
- Provide comment on the presence and abundance of Least Concern (NC Act) plants and weeds; Provide location and characteristics of any Type A restricted plants (TAR plants) in the Zone;
- Provide location and description of any fauna of conservation concern listed in the *Nature Conservation Act 1992* (NC Act) or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) present;
- Provide location and characteristics of potential fauna habitat features, including summary data on the abundance of hollow-bearing trees, hollow logs, coarse woody debris and organic litter;
- Assess the presence/absence of general fauna habitat for EPBC Act and NCA Act listed EVNT fauna and flora;
- Assess the presence of Koala Habitat;
- Record any incidental records of non-EVNT fauna;
- Record any observed animal breeding places;
- Comment on the nature and location of watercourses and drainage features, wetlands, lakes and springs;

- Assess the presence or absence of any listed Threatened Ecological Communities (TEC) (EPBC Act);

Outside the non-linear Zone but within the 200m Buffer:

- Perform a quaternary vegetation assessment for each RE present;
- Provide location and characteristics of any unmapped/incorrectly mapped TEC and other matters under the EPBC Act; and
- Report on the presence of any lakes or springs present.

Outside the linear Zone but within the 100m Buffer:

- Comment on the nature and location of watercourses and drainage features, as defined by the *Water Act 2000*.

2.2 Survey Team

The project supervisor (Craig Eddie) was approved by 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.

The field survey described by this report was undertaken by BOOBOOK on 3rd December 2013 and was conducted by Richard Johnson (Senior Ecologist) and Rosamund Aisthorpe (Botanist). The following report was compiled by Rosamund Aisthorpe and Richard Johnson. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie (Principal Ecologist and Project Supervisor).

Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A desktop search was undertaken by interrogating the following datasets:

- RE and remnant vegetation at the property scale using mapping version 6.1 (DEHP 2013a);
- Essential Habitat mapping (DEHP 2013b);
- Regrowth Vegetation mapping (DEHP2013c);
- Referable Wetlands mapping (DEHP 2013d);
- Wildnet fauna and flora records (DEHP 2013e);
- Environmentally Sensitive Area mapping (DEHP 2013f); and
- EPBC Protected Matters summary (DOE 2013).

These datasets provided a baseline for subsequent field assessment.

The searches were conducted using either the lot/plan details as a reference or the coordinates -26.4771°S, 148.9953°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative survey site was selected for each RE present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Figure 1. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all GPS co-ordinates quoted within this report is GDA94. When referred to within this report the sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2012: Table 29);
4. RE type mapped;
5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;
9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;
11. observed and predicted presence of endangered, vulnerable or near threatened flora;
12. a list of all other flora encountered at the Site; and
13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2012) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

At each survey site, data was collected for potential fauna habitat features such as hollow trees, log piles and rock formations. This included a summary of baseline data for fauna microhabitat as follows:

- organic litter cover (%) including woody debris <10cm diameter;
- hollow-bearing trees (count, number/ha);
- hollow-bearing logs (count, number/ha); and
- fallen woody material (logs and other woody debris $\geq$ 10cm diameter)(count/ha and total length/ha).

Data was derived from 50 x 50m quaternary plot or multiple smaller quadrats within the plot and extrapolated to derive values/ha.

A search was made for TAR plants within the Zone. If found the location was established with a Toughbook and/or hand-held GPS unit and the species, height, DBH and possible management options were recorded. The presence of any lakes, springs or watercourses within 100m and wetlands within 200m of the Zone was recorded.

Prior to field assessment, a desk-top examination of satellite imagery was used to identify sites of potential interest within the Buffer. These sites were then inspected in the field. Where the inspection confirmed the presence of potential environmental values (e.g. Of Concern or Endangered RE, high-value regrowth, watercourses, lakes, springs and wetlands) the values were documented as above.

Representative photographs were taken at each quaternary survey site in the Zone and/or Buffer, as well as at any lakes, springs, wetlands or watercourses, habitat features or TAR plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

No remnant RE is mapped as present within the Zone (DEHP 2013a).

4.1.2 Regional Ecosystems Observed

Vegetation examined immediately adjacent to the Zone at survey site Q2-PR5 was found to be remnant RE; it was woodland of RE 11.9.7 (*Eucalyptus populnea*, *Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks). The patch area is below (<5ha) the threshold value for mapping at 1:100,000 scale used in RE mapping (Neldner *et al.*, 2012). Remnant vegetation in a retained strip at the southern extremity of the Zone was similar to that sampled at survey site Q4-PR6: this too is RE 11.9.7. The strip width is below (<75m) the threshold value for mapping at 1:100,000 scale used in RE mapping (Neldner *et al.*, 2012). Details of location and characteristics of the remnant RE at sites Q2-PR5 and Q4-PR6 are given in Table 2. Representative images are shown at Figures 2a-b. Quaternary site assessment sheets are presented in Appendix A.

Table 2: Floristics and Structure of Remnant Ecosystems at Survey Sites in Zone/Buffer PR5

Site	Location	Vegetation Description		
Q2-PR5	55J 698795E 7069903N	Woodland of <i>Eucalyptus populnea</i> . Tall shrub layer dominated by <i>Eremophila mitchellii</i> . Grassy understorey of numerous perennial species.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (m)
T1	12	20	96	25
S1	4	30	150	5
Site	Location	Vegetation Description		
Q4-PR6	55J 698091E 7069660N	Woodland of <i>Eucalyptus populnea</i> . Prominent tall shrub layer dominated by <i>Eremophila mitchellii</i> . Very sparse low shrub layer of <i>Geijera parviflora</i> . Grassy understorey dominated by <i>Paspalidium</i> sp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	14	10	64	38
S1	4.5	35	200	7
S2	1.2	5	50	0-2

4.1.3 Threatened Ecological Communities Observed

No TEC was observed within the Zone or the Buffer.

4.1.4 Non-remnant Vegetation Observed

The Zone and the surrounding area are predominantly vegetated by pasture with rare isolated trees following earlier property development. This vegetation was sampled within the Zone at survey site Q1-PR5 (Appendix A). The floristics and structure of the dominant

species in each woody stratum at this site are shown in Table 3. Representative images of the site are shown at Figure 3a.

Table3: Floristics and Structure of Vegetation at Survey Sites in Zone PR5

Site	Location	Vegetation Description		
Q1-PR5	55J 698924E 7069948N	Derived grassland dominated by <i>Cenchrus ciliaris</i> .		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
G	0.2	80	n/a	n/a

4.1.5 Ecological Function of Vegetation

As discussed at 4.1.4, the majority of the Zone and Buffer have been cleared of original forest or woodland during previous pastoral development. These areas now support scattered trees with a ground layer dominated by a non-native pasture species. Woodland ecological function, including potential habitat values for woodland-dependent fauna and flora, is now greatly reduced within most of the Zone. The present structure would provide very limited 'stepping stones' for mobile woodland fauna. It is unlikely that removal of vegetation within this part of the Zone would significantly impact on ecosystem functioning and connectivity in this landscape. Conversely the remnant vegetation sampled at Q2-PR5 and Q4-PR6 has high ecological value both as habitat and in maintaining connectivity in this landscape. Figure 4 shows that within a 5km radius of the Zone most remnant vegetation has been removed and now is confined to scattered small patches to the south and east. The existing (unmapped) areas of remnant RE mentioned provide habitat and connectivity from the upper reaches of Ferguson Creek to the riparian corridor along Blyth Creek. Though the area of this vegetation actually present within the Zone is small it should be managed appropriately.

4.2 Additional Observations

4.2.1 Additional Flora Species

Approximately 40 species of native flora were detected (Appendix B). In addition, nine non-native species were recorded. Two of these, Velvety Tree Pear (*Opuntia tomentosa*) and African Boxthorn (*Lycium ferocissimum*), are declared Class 2 weeds scheduled under the *Land Protection (Pest and Stock Route Management) Regulation 2003* and Weeds of National Significance (WoNS). Both species were detected at survey site Q2-PR5, where they both were rare (<10 plants observed).

4.2.2 Type A Restricted Plants

No TAR plants were detected within the Zone.

4.2.3 Fauna Habitat Features

Three hollow-bearing Poplar Box (*Eucalyptus populnea*) trees were located at survey site Q1-PR5. Location and details of these fauna habitat features have been provided within the Fauna Habitat layer within Santos GIS. They are illustrated at Figures 5a-c.

Summary data for habitat features present at quaternary sites Q1- and Q2-PR5 within the Zone are shown in Table 4. These data illustrate that for most of the Zone fauna

microhabitat is absent but remnant vegetation immediately adjacent to the Zone is comparatively rich in these features.

Table 4: Baseline data for potential fauna habitat features, Zone PR5

Habitat Feature	Count/ha	Length/ha (m)	Cover (%)
Q1-PR5			
Hollow-bearing trees	0	-	-
Hollow-bearing logs	0	-	-
Woody material = >10cm diam.	0	n/a	-
Organic litter <10cm diam.	-	-	5
Q2-PR5			
Hollow-bearing trees	32	-	
Hollow-bearing logs	52	-	
Woody material = >10cm diam.	68	224	
Organic litter <10cm diam.	-	-	7

4.2.4 Wetlands and Watercourses

A minor drainage line is present near the southern extremity of the linear disturbance zone where it flows to a farm dam. This feature meets the definition of a drainage feature (*Water Act 2000*) in that it does not have well-defined bed and banks and no fringing riparian vegetation is present indicating flows of insufficient volume and duration to maintain a riverine environment. The location and characteristics of this feature are given in Table 5. Representative images are shown in Figure 6.

No other drainage features or watercourses as defined by the *Water Act 2000* were detected in or within 100m of the Zone. No lakes, springs or High Ecological Significance or General Ecological Significance wetlands as shown on a Map of Referable Wetlands (DEHP 2013d) as defined in Santos Environmental Authority (Schedules B, M) were detected in or within 200m of the Zone.

Table 5: Wetlands and watercourses detected within Zone/Buffer PR5

Waypoint	Location	Description
W1-PR5	55J 698556E 7069668N	Drainage feature: A minor drainage line above a farm dam. Vegetation dominated by <i>Juncus usitatus</i> , <i>Paspalum dilatatum</i> and <i>Aristida</i> sp. Surrounded by cleared paddock dominated by <i>Cenchrus ciliaris</i> . Bed and banks poorly defined.

4.2.5 EVNT Fauna and Flora, Koala and General Habitat

No EVNT fauna or flora was detected within the Zone, nor were any records noted in a search of the Wildnet database (DEHP 2013e). The history of vegetation disturbance evident within the Zone and the current relatively low levels of potential fauna habitat present there (see Table 3 and Appendix A) indicate that the likelihood of EVNT flora and fauna being present is low. This situation also applies to the majority of the Buffer. These results are

preliminary only: further targeted surveys at appropriate times of the year would be required to better define the occurrence of EVNT fauna and flora within the study area.

No evidence of the presence of Koala was detected during the ecological survey. Blyth Creek, where Koalas (*Phascolarctos cinereus*) are known to be present (see, for example, the Mt Hope RM03-58 ecological assessment (BOOBOOK 2013)), is about 1.8km east of the Zone. Potential food trees, Poplar Box (*E. populnea*), are common in retained vegetation at survey sites Q2-PR5 and Q4-PR6. It is likely that these represent Koala Habitat as they are a food resource with retained connectivity via riparian and other corridors between known or potential Koala Habitat areas.

The potential for EVNT fauna to be present based on the presence or absence of general fauna habitat requirements is discussed in Appendix C. EVNT flora potentially present within the Zone and Buffer is discussed in Appendix D.

5. References

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Water Act 2000. (Queensland), viewed 14 February 2013,
<<http://www.legislation.qld.gov.au/legisltn/current/w/watera00.pdf>>

Figure 1: Map of Zone PR5 showing survey sites and other points of interest.

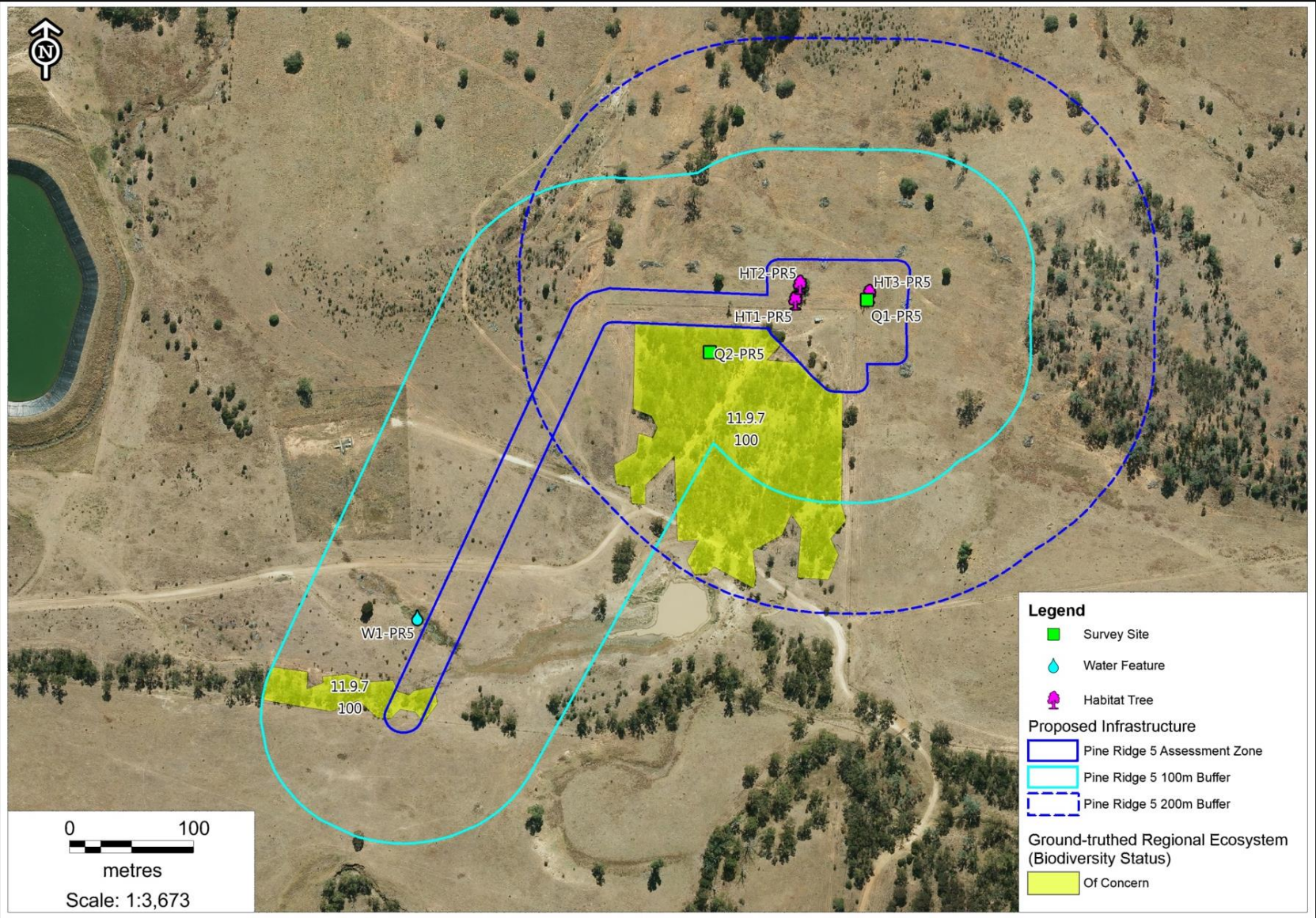




Figure 2a: Two views of remnant woodland (RE 11.9.7) at survey site Q2-PR5.



Figure 2b: Two views of remnant woodland in a retained strip at survey site Q4-PR6.



Figure 3: Derived grassland at survey site Q1-PR5. Retained trees are rare within the Zone.

Figure 4: Landscape context for Zone PR5

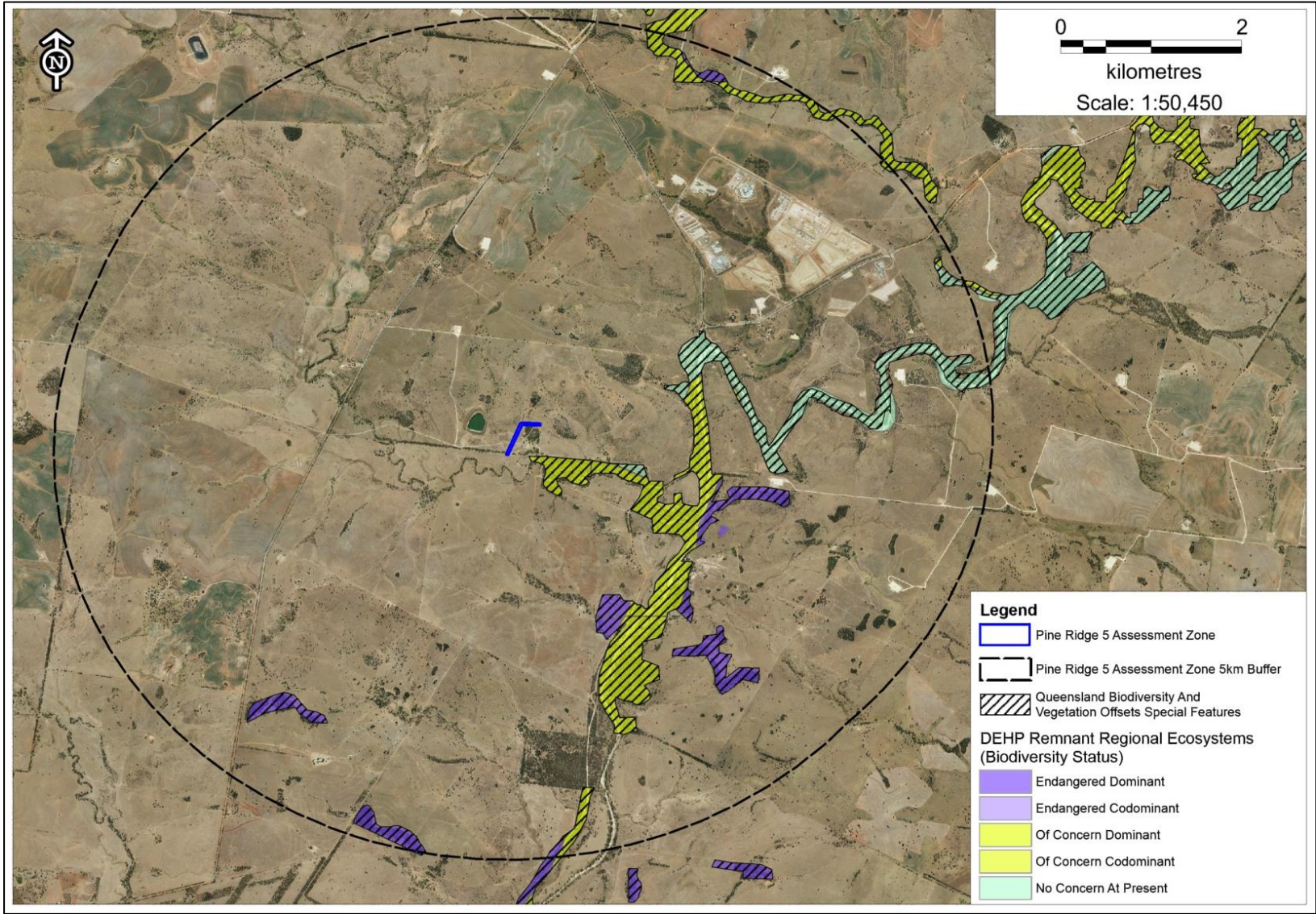




Figure 5a: A hollow-bearing Poplar Box (*Eucalyptus populnea*) at waypoint HT1-PR5 (left). **Figure 5b:** A hollow-bearing Poplar Box at waypoint HT2-PR5 (right).



Figure 5c: A hollow-bearing Poplar Box (*Eucalyptus populnea*) at waypoint HT3-PR5.



Figure 6: A drainage feature at waypoint W1-PR5 looking upstream (left) and downstream (right).

Appendix A: Quaternary assessment results Zone /Buffer PR5

Site No. Q1-PR5 Recorder: Rosamund Aisthorpe, Richard Johnson Date 03/12/2013
 Purpose Pine Ridge Wells RCAP Ecology Assessment Time 14:30

Locality:
 (inc. distance/direction to nearest town) 'Pasadena', 20km NE of Roma

Zone: 55J 0698924 E 7069948 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured <i>D – dense, M – mid dense, S – sparse, V – very sparse</i>				Record relative (numerical) dominance for each stratum; <i>d – dominant; c – codominant; s – subdominant, a – associated</i>		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				G	D	<i>Cenchrus ciliaris</i>
T1						
T2						
T3						
S1						
S2						
S3						
G	0.2	0.1 - 0.3	D (80)			
Structural formation: Grassland						
Ecologically dominant layer: G						

Geology, landform, soils

Geology code and rock types:	Fine-grained sedimentary rocks		
Landform:	Low undulating hills		
Soils:	Brown loam		
DEHP Mapped RE Code:	NR		
Observed RE Code:	NR	Landzone:	9
Vegetation Short Description			
Derived grassland dominated by <i>Cenchrus ciliaris</i> .			
Connectivity/Patch Characteristics			
Small patches of remnant woodland adjoin to south and southeast.			
Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed) <i>Cenchrus ciliaris</i> (C), <i>Glandularia aristigera</i> (C), <i>Lepidium bonariense</i> (R), <i>Melinis repens</i> (R), <i>Urochloa mosambicensis</i> (C)			
% Weed Cover:	95		
Field Wpt Code:	Nil		
Photo Nos.	BBK4 21742 - 21753		

Additional Flora:							
<i>Aristida</i> sp. (U)				<i>Cheilanthes sieberi</i> (U)			
<i>Eucalyptus populnea</i> (R)				<i>Goodenia glabra</i> (C)			
<i>Chrysocephalum apiculatum</i> (U)				<i>Wahlenbergia</i> sp. (R)			
<i>Calotis lappulacea</i> (U)							
<i>Dichondra repens</i> (U)							
<i>Maireana microphylla</i> (R)							
<i>Oxalis</i> sp. (R)							
<i>Glycine tabacina</i> (R)							
<i>Cyperus gracilis</i> (U)							
<i>Sida hackettiana</i> (C)							
<i>Cymbopogon refractus</i> (U)							
<i>Fimbristylis dichotoma</i> (C)							
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.							
Rocks - embedded	0	Boulders	0	Shrub layer	0	Ground cover	4
Rocks - loose	0	Fallen bark	0	Leaf litter	0	Bare ground	1
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges	0	Large logs (>30cm diameter)	0	Trees / logs bearing loose bark	0		
Underhangs /overhangs / caves	0	Logs with hollows	0	Termite mounds	0		
Small logs (<30cm diameter.)	0	Hollow bearing trees	0	Mistletoe	0		
Other							
Soil cracks	Nil						
Water	Nil						
Other (e.g. food trees):	Nil						
Disturbances							
Grazing : moderate, < 1 year ago							
Clearing : severe, 15+ years ago							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)				Structure of Woody Strata			
				Str.	Stems/ha	DBH (cm)	
Grey Butcherbird x 1 HE off-site				G	n/a	n/a	
Dollarbird x 1 HE							
Additional Notes							
Voucher Specimens							

Site No. Q2-PR5 Recorder: Rosamund Aisthorpe, Richard Johnson Date 03/12/2013
 Purpose Pine Ridge Wells RCAP Ecology Assessment Time 14:52

Locality:
 (inc. distance/direction to nearest town) 'Pasadena', 20km NE of Roma

Zone: 55J 0698795 E 7069903 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured <i>D</i> – dense, <i>M</i> – mid dense, <i>S</i> – sparse, <i>V</i> – very sparse				Record relative (numerical) dominance for each stratum; <i>d</i> – dominant; <i>c</i> – codominant; <i>s</i> – subdominant, <i>a</i> – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Eucalyptus populnea</i>
T1	12	9 - 14	S (20)	S1	D	<i>Eremophila mitchellii</i>
T2				G	C	<i>Cenchrus ciliaris</i>
T3				G	C	<i>Chloris ventricosa</i>
S1	4	2.5 - 5.0	M (30)			
S2						
S3						
G	0.2	0.1 - 0.5	M (70)			
Structural formation: Woodland						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types:	Fine-grained sedimentary		
Landform:	Mid-slope		
Soils:	Brown loam		
DEHP Mapped RE Code:	NR		
Observed RE Code:	11.9.7	Landzone:	9
Vegetation Short Description			
Woodland of <i>Eucalyptus populnea</i> . Tall shrub layer dominated by <i>Eremophila mitchellii</i> . Grassy understory of numerous perennial species.			
Connectivity/Patch Characteristics			
Small patch connected to remnant vegetation to south by disturbed vegetation.			
Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed) <i>Cenchrus ciliaris</i> (C), <i>Opuntia tomentosa</i> (R), <i>Sida Rhombifolia</i> (R), <i>Urochloa mosambicensis</i> (U), <i>Lycium ferocissimum</i> (R)			
% Weed Cover:			
Field Wpt Code:	Nil		
Photo Nos.	BBK4 21754 - 21765		

Additional Flora:							
<i>Callitris glaucophylla</i> (R)				<i>Alectryon oleifolius</i> (R)			
<i>Austrostipa verticillata</i> (R)				<i>Sida prostrata</i> (R)			
<i>Geijera parviflora</i> (U)				<i>Abutilon oxycarpum</i> subsp. <i>subsagittatum</i> (R)			
<i>Brunoniella australis</i> (C)				<i>Jasminum didymum</i> (R)			
<i>Sida hackettiana</i> (U)				<i>Leptochloa decipiens</i> (R)			
<i>Atalaya hemiglauca</i> (R)				<i>Solanum coracinum</i> (R)			
<i>Nyssanthès erecta</i> (R)				<i>Einadia nutans</i> (U)			
<i>Enteropogon ramosus</i> (C)				<i>Einadia hastata</i> (U)			
<i>Cyperus gracilis</i> (C)				<i>Dinebra decipiens</i> subsp. <i>asthenes</i> (U)			
<i>Paspalidium</i> sp. (U)							
<i>Ancistrachne uncinulata</i> (C)							
<i>Solanum parvifolium</i> (R)							
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.							
Rocks - embedded	0	Boulders	0	Shrub layer	2	Ground cover	1
Rocks - loose	0	Fallen bark	0	Leaf litter	1	Bare ground	1
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges	0	Large logs (>30cm diameter)	2	Trees / logs bearing loose bark	0		
Underhangs /overhangs / caves	0	Logs with hollows	2	Termite mounds	0		
Small logs (<30cm diameter.)	1	Hollow bearing trees	1	Mistletoe	0		
Other							
Soil cracks	Nil						
Water	Nil						
Other (e.g. food trees):	Nil						
Disturbances							
Previous ringbarking : approximately more than 20 years ago							
Grazing : to present, light							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)				Structure of Woody Strata			
				Str.	Stems/ha	DBH (cm)	
Red-necked Wallaby x 1 SE				T1	96	25	
Noisy Miner x 2 HE				T2			
				S1	150	5	
				S2			
Additional Notes							
Voucher Specimens							

Appendix B: Plant species list, Zone/Buffer PR5

Key: * indicates non-native plant species; NCA = *Nature Conservation Act 1992 (Qld)*; EPBC = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth); LC = least concern; Q = quaternary survey site; TAR = Type A restricted plant.

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	W1
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet	LC			x	
Adiantaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	LC		x		
Amaranthaceae	<i>Nyssanthus erecta</i>	Barbed-wire Weed	LC			x	
Asteraceae	<i>Calotis lappulacea</i>	Yellow Burr-daisy	LC		x		
Asteraceae	<i>Chrysocephalum apiculatum</i>	Yellow Buttons	LC		x		
Asteraceae	<i>Rhodanthe</i> sp.	A Daisy	LC	-			x
Brassicaceae	<i>Lepidium bonariense</i> *	Cut-leaf Peppergrass	-		x		
Cactaceae	<i>Opuntia tomentosa</i> *	Velvety Tree Pear	-			x	
Campanulaceae	<i>Wahlenbergia</i> sp. (indet.)	A Bluebell	LC		x		
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush	LC			x	
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush	LC			x	
Chenopodiaceae	<i>Maireana coronata</i>	Crown Fissure-weed	LC				x
Chenopodiaceae	<i>Maireana microphylla</i>	Cotton Bush	LC		x		
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	LC		x		
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC			x	
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge, Whisker Grass	LC		x	x	
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-rush	LC		x		
Fabaceae	<i>Glycine tabacina</i>	Glycine Pea	LC		x		
Goodeniaceae	<i>Goodenia glabra</i>	Smooth Goodenia	LC		x		
Juncaceae	<i>Juncus usitatus</i>	Common Rush	LC	-			x
Malvaceae	<i>Abutilon oxycarpum</i> subsp. <i>subsagittatum</i>	Flannel Flower	LC			x	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	W1
Malvaceae	<i>Sida hackettiana</i>	High Sida	LC		x	x	
Malvaceae	<i>Sida prostrata</i>	A Sida	LC			x	
Malvaceae	<i>Sida rhombifolia</i> *	Paddy's Lucerne	-			x	
Myoporaceae	<i>Eremophila mitchellii</i>	False Sandalwood	LC			x	
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		x	x	
Oleaceae	<i>Jasminum didymum</i>	Native Jasmine	LC			x	
Oxalidaceae	<i>Oxalis</i> sp. (infertile)	A Wood-sorrel	LC		x		
Poaceae	<i>Ancistrachne uncinulata</i>	Hooky Grass	LC			x	
Poaceae	<i>Aristida</i> sp.	A Grass	LC	-	x		x
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo Grass	LC			x	
Poaceae	<i>Cenchrus ciliaris</i> *	Buffel Grass	-	-	x	x	x
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	LC			x	
Poaceae	<i>Cymbopogon refractus</i>	Barbed-wire Grass	LC		x		
Poaceae	<i>Enteropogon ramosus</i>	Twirly Windmill Grass	LC			x	
Poaceae	<i>Leptochloa decipiens</i>	Slender Canegrass	LC			x	
Poaceae	<i>Melinis repens</i> *	Red Natal Grass	-		x		
Poaceae	<i>Paspalum dilatatum</i>	Paspalum	-	-			x
Poaceae	<i>Paspalidium</i> sp. (indet.)	A Grass	LC			x	
Poaceae	<i>Dinebra decipiens</i> subsp. <i>asthenes</i>	A Grass	LC			x	
Poaceae	<i>Urochloa mosambicensis</i> *	Sabi Grass	-		x	x	
Portulacaceae	<i>Portulaca oleracea</i> *	Common Pigweed	-	-			x
Rutaceae	<i>Geijera parviflora</i>	Wilga	LC			x	
Sapindaceae	<i>Alectryon oleifolius</i>	Boonaree, Rosewood	LC			x	
Sapindaceae	<i>Atalaya hemiglauca</i>	Whitewood	LC			x	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	W1
Solanaceae	<i>Lycium ferocissimum</i> *	African Boxthorn	-			x	
Solanaceae	<i>Solanum coracinum</i>	A Nightshade	LC			x	
Solanaceae	<i>Solanum parvifolium</i>	Small-leaved Nightshade	LC			x	
Verbenaceae	<i>Glandularia aristigera</i> *	Mayne's Pest	-		x		

Appendix C: EVNT fauna occurring or potentially occurring within the Zone, PR5 and presence of general habitat.

Key: NCA = Nature Conservation Act 1992 (Qld); EPBC = Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth); E = endangered; V = vulnerable; NT = near threatened; SLC = special least concern.

Class	Scientific Name	Common name	Status		General Habitat Requirements	Presence of General Habitat within Zone
			NCA	EPBC		
Amphibians	<i>Cyclorana verrucosa</i>	Rough Collared-Frog	NT		Within species known range (Robinson 1993); grasslands and woodlands on clay or clay-loam substrates with seasonally-filled shallow drainage depressions for breeding sites (Anstis 2013).	Yes
Birds	<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	V		Within species known range (Birdlife Australia 2013); food trees (e.g. Belah <i>Casuarina cristata</i> and other Casuarinaceae species); nesting habitat (hollow-bearing live or dead trees) (Higgins 1999).	No
	<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	NT		Within species known range (Birdlife Australia 2013); forages in shallow wetlands including farm dams, nests in tall trees near water (Marchant and Higgins 1990).	No
	<i>Erythrotriorchis radiata</i>	Red Goshawk	E	V	Within species known range (Birdlife Australia 2013); woodlands and open forests, especially near permanent water bodies; high prey bird populations; tall trees for nest site (Marchant and Higgins 1993).	No
	<i>Geophaps scripta scripta</i>	Squatter Pigeon (southern)	V	V	Within species known range, though no recent records for this area (Birdlife Australia 2013); grassy woodlands with open areas for foraging habitat, nearby water source (Higgins and Davies 1996).	Yes
	<i>Grantiella picta</i>	Painted Honeyeater	V		Within species known range (Birdlife Australia 2013); lives/breeds in woodlands and open forests with high densities of suitable food plants (mistletoes, family Loranthaceae) (Higgins et. al. 2001).	No
	<i>Lophoictinia isura</i>	Square-tailed Kite	NT		Within species known range (Birdlife Australia 2013) and 2 Wildnet records within 10km of Zone; forages and breeds in woodlands and open forests and the species is known to forage along tree lines in cleared country (Marchant and Higgins 1993).	Yes
	<i>Melithreptus gularis</i>	Black-chinned	NT		Within species known range (Birdlife Australia 2013); forages in tree canopy	No

Class	Scientific Name	Common name	Status		General Habitat Requirements	Presence of General Habitat within Zone
			NCA	EPBC		
		Honeyeater			and prefers tall open forest and woodland habitats (Higgins et. al. 2001).	
	<i>Neochmia ruficauda ruficauda</i>	Star Finch (eastern, southern)	E	E	Within species known historical range (Birdlife Australia 2013) but the subspecies is possibly extinct (Garnett et al. 2011). Formerly used tall grasslands associated with watercourses (DOE 2013).	No
	<i>Rostratula australis</i>	Australian Painted Snipe	V	E	Within species known range (Birdlife Australia 2013); forages at shallow edges and adjacent vegetated margins of freshwater wetlands (DOE 2013).	No
Insects	<i>Jalmenus eubulus</i>	Pale Imperial Hairstreak	V		Within species known range (Braby 2000); adults and larvae usually associated with Brigalow (<i>Acacia harpophylla</i>) open forests and woodlands (Valentine and Johnson 2012) but larvae will also forage on other <i>Acacia</i> spp. (Common and Waterhouse 1981).	No
Mammals	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Within species known range (Churchill 2008); forages in open forests and woodlands and roosts in adjacent caves and overhangs of cliffs and rocky hills; occasionally shelters in disused Fairy Martin nests (Hoye and Schultz 2008).	No
	<i>Chalinolobus picatus</i>	Little Pied Bat	NT		Within species known range (Churchill 2008); forages in woodlands and open forest; roosts in tree hollows and under loose bark sheets (Ford et. al. 2008).	Yes
	<i>Dasyurus hallucatus</i>	Northern Quoll	LC	E	Within species historical range (Oakwood 2008) though recent records are lacking (DEHP 2013). Shelter in crevices in rocky hills and escarpments, forage here and associated woodland and forest habitats (DOE 2013).	No
	<i>Nyctophilus corbeni</i>	Eastern Long-eared Bat	V	V	Within species known range (Churchill 2008); inhabits woodlands and roosts in tree hollows and crevices and under loose bark (DOE 2013).	Yes
	<i>Phascolarctos cinereus</i>	Koala	SLC	V	Within species known range (Martin et al. 2008) and a Wildnet sight record within 10km of Zone; requires eucalypt woodland and forest habitat with suitable food trees (primarily <i>Eucalyptus</i> spp) (DOE 2013).	Yes
Reptiles	<i>Acanthophis antarcticus</i>	Common Death Adder	NT		Within species known range (Wilson 2005); occupies woodlands, open forests, heathlands, requires abundant shelter/ambush predation cover e.g. low shrubs, rocks, logs, dense leaf litter (Wilson 2005).	No

Class	Scientific Name	Common name	Status		General Habitat Requirements	Presence of General Habitat within Zone
			NCA	EPBC		
	<i>Delma torquata</i>	Collared Delma	V	V	Within species known/predicted range (DSEWPac 2011) though occupancy within range apparently patchy; occupies eucalypt woodlands and open forests; lives under surface rock and large woody debris (Wilson 2005).	No
	<i>Egernia rugosa</i>	Yakka Skink	V	V	Within species known range (Wilson 2005); lives in woodland and open forests, also grassland with regrowth trees; requires suitable soils for burrows, sinkholes, abandoned rabbit warrens or large fallen woody material for shelter (Eddie 2012).	Yes
	<i>Furina dunmalli</i>	Dunmall's snake	V	V	Within species known range (DSEWPac 2011); occupies woodlands and open forests, may be reliant on presence of abundant fallen woody debris (Hobson 2012).	Yes
	<i>Paradelma orientalis</i>	Brigalow Scaly-foot	V		Within species known range (Wilson 2005); occupies woodland and open forests, shelters under woody debris and surface rock (DSEWPac 2011).	No
	<i>Strophurus taenicauda</i>	Golden-tailed Gecko	NT		Within species known range (Wilson 2005). Lives in dry open forest and woodlands, especially those with well-developed shrub layer; shelters in tree hollows and splits, under loose bark (QMDC 2008).	No

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Appendix D: EVNT flora occurring or potentially occurring within the Zone, PR5 and the likelihood of occurrence.

Key: NCA = Nature Conservation Act 1992 (Qld); EPBC = Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth); E = endangered; V = vulnerable; NT = near threatened.

Family	Scientific Name	Common name	Status		Likelihood of Occurrence
			NCA	EPBC	
Acanthaceae	<i>Xerothamnella herbacea</i>	Herbaceous Xerothamnella	E	E	Unlikely to be present – Pasadena is about 100km south-east of the nearest collection site (AVH 2013); potentially suitable habitat (TSSC 2008a) in small patches of regrowth Brigalow is absent within the Zone.
Apocynaceae	<i>Tylophora linearis</i>	Slender Tylophora	E	E	Unlikely to be present –the only known collection site in Queensland (AVH 2013) is about 110km southeast of Pasadena and no potentially suitable habitat (dry sclerophyll woodland: TSSC 2008b) is present within the Zone.
Asteraceae	<i>Cymbonotus maidenii</i>	Darling Daisy	E		Unlikely to be present – Pasadena is about 30 km northeast of the nearest collection site (DEHP 2013) but suitable habitat i.e. heavy clay soils (DEHP 2013) is absent within the Zone.
Cyperaceae	<i>Eleocharis blakeana</i>	Blake's Spikerush	NT		Absent – within species known range (AVH 2013) but suitable habitat (ephemeral drainage depressions and gilgai on heavy soils) is absent within the Zone.
Fabaceae	<i>Zornia pallida</i>	A pea	NT		Unlikely to be present – collected near Roma, about 22km to the southwest (AVH 2013); potential habitat on light –textured soils is absent within the Zone.
Poaceae	<i>Homopholis belsonii</i>	Belson's Panic	V	V	Unlikely to be present – Pasadena is within the known range of this species being approximately 15km from the closest known collection site (DEHP 2013) ; potentially suitable habitat of regrowth Brigalow (TSSC 2008c) is absent within the Zone or Buffer.
Solanaceae	<i>Solanum papaverifolium</i>	A nightshade	E		Unlikely to be present – Pasadena is within the species known range (DEHP 2013a) but suitable habitat i.e. heavy clay soils (Bean 2012) is absent within the Zone.
Solanaceae	<i>Solanum stenopterum</i>	Winged Nightshade	V		Potentially present - within known species range (AVH 2013) and potentially suitable habitat i.e. Poplar Box (<i>Eucalyptus populnea</i>) woodlands (DEHP 2013) is present to a limited extent in patches within the Zone.
Surianaceae	<i>Cadellia pentastylis</i>	Ooline	V	V	Absent – Pasadena is within the broader species range (AVH 2013 but potentially suitable habitat (TSSC 2008d) is absent within the Zone.

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Well Lease Area/ Infrastructure Zone Assessment Report: Mt Hope Zone RM02-26

Compiled by Boobook for Santos

Boobook
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

Revision	Date	Description	Author	Verifier	Approved
A	4/3/2013	Draft issued to client for review	RA	CE	CE
B	23/5/2013	Incorporating client comment and amended zone	RA	RJ	CE
0	4/6/2013	Final submitted to client	RJ	CE	CE

1. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
TAR plant	Type A Restricted Plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

2. Introduction

2.1 Purpose & Scope

Boobook was commissioned by Santos to undertake ecological assessments on a number of well leases and infrastructure zones (hereafter individually referred to as the Zone) located on the property 'Mt Hope', located about 40km north-east of Roma, south central Queensland. Boobook was requested to undertake the following:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation present within the Zone;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the assessment site;
- Comment on the nature and location of wetlands and watercourses within 100m of the Zone;
- Provide location and description of any plants of conservation concern listed in the NC Act or EPBC Act;
- Location and characteristics of any type A restricted (TAR) plants (NC Act) in the Zone; and
- Location and characteristics of habitat trees in the Zone, with reference to trees previously mapped by Santos.

An individual report was to be prepared for each Zone. This report refers to Zone RM02-26 located on Lot 81 on Plan WV763.

Changes to the boundaries of this Zone were made by Santos following completion of the ecological assessment described in this report for the Zone (Figure 1). Modifications of this infrastructure Zone were considered to be either minor in extent and/or involving areas where the ecological values were previously assessed on-site or nearby. Although the risk is acceptably small it is possible that some ecological values of the modified Zone may not have been documented. Based on professional judgement the modified zones are highly unlikely to contain populations of threatened flora or significant fauna habitat features. However, the presence of TAR plants, especially seedlings, cannot be ruled out.

2.2 Survey Team

The project supervisor (Craig Eddie) was approved by 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.

The field survey described by this report was undertaken by Boobook on 24th January 2013 and was conducted by Rosamund Aisthorpe (Botanist) and Ashley Hoffmann (Field Assistant). The following report was compiled by Rosamund Aisthorpe and Richard Johnson. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie (Principal Ecologist and Project Supervisor).

Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit

WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A comprehensive desktop search was not required by the client for the purposes of this report. However, a desktop search was undertaken for REs at the property scale using mapping version 6.1 (DEHP 2013). This dataset provides a baseline for subsequent field assessment.

The search was conducted using a 5km buffer around the coordinate -26.3558°S, 149.0847°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative site was selected for each RE present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Figure 1. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all GPS co-ordinates quoted within this report is GDA94. When referred to within this report the sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2012: Table 29);
4. RE type mapped;
5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;
9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;

11. presence of EVNT flora;
12. a list of all other flora encountered at the Site; and
13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2012) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

A search was made within the Zone for TAR plants: If found, the location was established with a hand-held GPS unit and the species, height, DBH and possible management options were recorded.

Where mapping supplied by Santos indicated the presence of habitat trees, a search was made for these. If found the location was established with a hand-held GPS unit and the species, height, DBH and habitat value(s) were recorded. In some instances unmapped habitat trees were located during the site survey and data was collected for these trees also.

The presence of any wetlands or watercourses within 100m of the Zone was recorded.

Representative photographs were taken at each quaternary survey site in the Zone, as well as at any wetlands or watercourses, habitat trees or TAR plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

No remnant REs are mapped as present in the Zone.

4.1.2 Regional Ecosystems Observed

Poplar Box (*Eucalyptus populnea*), Silver-leaved Ironbark (*E. melanophloia*) and White Cypress Pine (*Callitris glaucophylla*) woodland was recorded in the Zone at survey site Q1/RM02-26. This vegetation is part of a corridor fringing a minor gully travelling south towards Campbell Creek. This vegetation equates to RE 11.10.11 (no concern at present): *Eucalyptus populnea*, *E. melanophloia* +/- *Callitris glaucophylla* woodland on coarse-grained sedimentary rocks. The floristics and structure of the dominant species in each woody stratum of this survey site is given in Table 2. Representative site photos are given in Figure 2.

Table 2: Floristics and Structure of Remnant Ecosystems at Survey Sites in Zone RM02-26

Site	Location	Vegetation Description		
Q1/RM02-26	55J 707936E 7081943N	<i>Eucalyptus populnea</i> , <i>E. melanophloia</i> and <i>Callitris glaucophylla</i> woodland; midlayer dominated by <i>C. glaucophylla</i> saplings, <i>Eremophila mitchellii</i> , <i>Geijera parviflora</i> and <i>Acacia decora</i> ; ground layer dominated by <i>Ancistrachne uncinulata</i> and <i>Cenchrus ciliaris</i> .		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	16	30	320	20
T2	6	60	2080	5
S1	2	5	208	2

4.1.3 Threatened Ecological Communities Observed

No threatened ecological communities (TECs) were observed in the Zone.

4.1.4 Non-remnant Vegetation Observed

The Zone is dominated by cultivated pasture and a retained strip of regrowth that has occurred after mechanical disturbance (pulling) from earlier clearing event(s) (see Appendix A). The floristics and structure of the dominant species in each woody stratum at survey site Q2/RM02-26 are shown in Table 3. Because woody vegetation is essentially absent at survey site Q3/RM02-26, no values are given. Representative images of the survey sites are shown at Figure 3a and 3b.

Table 3: Floristics and Structure of Vegetation at Survey Sites in Zone RM02-26

Site	Location	Vegetation Description		
Q2/RM02-26	55J 707775E 7082047N	<i>Eucalyptus populnea</i> low woodland (regrowth); midlayer dominated by <i>Eremophila mitchellii</i> and <i>Acacia deanei</i> ; grassy ground layer dominated by <i>Aristida</i> sp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	7	20	512	10
S1	2	40	1600	4

Site	Location	Vegetation Description
Q3/RM02-26	55J 707746E 7082217N	Cultivated <i>Chloris gayana</i> pasture.

4.2 Additional Observations

4.2.1 Additional Flora Species

Approximately 26 species of native flora were detected (Appendix B). In addition, seven non-native species were recorded. Two of these, Common Pest Pear (*Opuntia stricta*) and Velvety Tree Pear (*O. tomentosa*), are declared class 2 weeds scheduled under the *Land Protection (Pest and Stock Route Management) Regulation 2003* and Weeds of National Significance (WoNS).

4.2.2 Type A Restricted Plants

No type A restricted (TAR) plants were detected within the Zone.

4.2.3 Fauna Habitat Features

A hollow-bearing Poplar Box (*Eucalyptus populnea*) was detected within the Zone. Location and details of this tree is shown in Table 4 and Figure 4. No other significant fauna habitat features were detected in the Zone.

Table 4: Details of Fauna Habitat Features, Zone RM02-26

Waypoint	Location	Species	Alive/ dead	DBH (cm)	Height (m)	Habitat features
HT1/RM02-26	55 J 707928E 7081934N	<i>Eucalyptus populnea</i>	Alive	63	15	3 hollows <10cm diam.; 2 hollows 10-30cm diam.

4.2.4 Wetlands and Watercourses

One drainage line (mapped as stream order 1) is present in the Zone at W1/RM02-26 (see Table 5). Riparian vegetation was absent and the bed and banks were not well defined, indicating that this is a drainage feature as defined by the *Water Act 2000*. A gully was also present in the Zone at W2/RM02-26 and details are shown in Table 5. The lack of riparian vegetation and defined bed and banks indicates this is a drainage feature and not a watercourse (*Water Act 2000*). The two features additionally meet the definition of a drainage feature according to the Act because they are likely to be only capable of flowing during and immediately after rainfall, for a short period and do not have enough continual flow to maintain a riparian ecosystem.

Images are shown in Figure 5a and 5b. No other watercourses or drainage features as defined by the *Water Act 2000* were observed at or within 100m of the Zone. No wetlands as defined by the Queensland Wetland Program (DERM 2011) as used in Santos Environmental Authority (Schedules C, M) were observed at or within 100m of the Zone.

Table 5: Wetlands and watercourses detected within Zone RM02-26

Waypoint	Location	Description
----------	----------	-------------

Waypoint	Location	Description
W1/RM02-26	55J 707943E 7081939N	Drainage feature: Mapped stream order 1 traversing the Zone from northeast to southwest. Dominated by <i>Sorghum</i> sp. (indet.) and <i>Cenchrus ciliaris</i> . Surrounded by <i>Callitris glaucophylla</i> , <i>Eucalyptus melanophloia</i> and <i>E. populnea</i> woodland. No apparent vegetation change associated with watercourse.
W2/RM02-26	55J 707781E 7082039N	Drainage feature (gully) running parallel to the Zone from north to south. Dominated by <i>Aristida</i> sp. (indet.) and surrounded by regrowth <i>Eucalyptus populnea</i> , <i>Acacia deanei</i> and <i>Eremophila mitchellii</i> . No apparent vegetation change associated with drainage feature.

5. References

Bostock, P.D. and Holland, A.E. (eds.) (2010). *Census of the Queensland Flora 2010*. Queensland Herbarium, Brisbane.

DEHP (2013). *Vegetation Management Act Regional Ecosystem and Remnant Map – Version 6.1*. Regional Ecosystem Maps/ Regrowth Vegetation Maps and PMAVs. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

<http://www.ehp.qld.gov.au/ecosystems/biodiversity/regional-ecosystems/maps/index.php>

DERM (2011). *Queensland Wetland Definition and Delineation Guideline*. Queensland Government, Brisbane.

Land Protection (Pest and Stock Route Management) Regulation 2003. (Queensland), viewed 13 May 2013, <<http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/L/LandPRPSRMR03.pdf>>

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*. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts, Brisbane.

Water Act 2000. (Queensland), viewed 14 February 2013, <<http://www.legislation.qld.gov.au/legisltn/current/w/watera00.pdf>>

Figure 1: Map of Zone RM02-26 showing survey sites and other points of interest

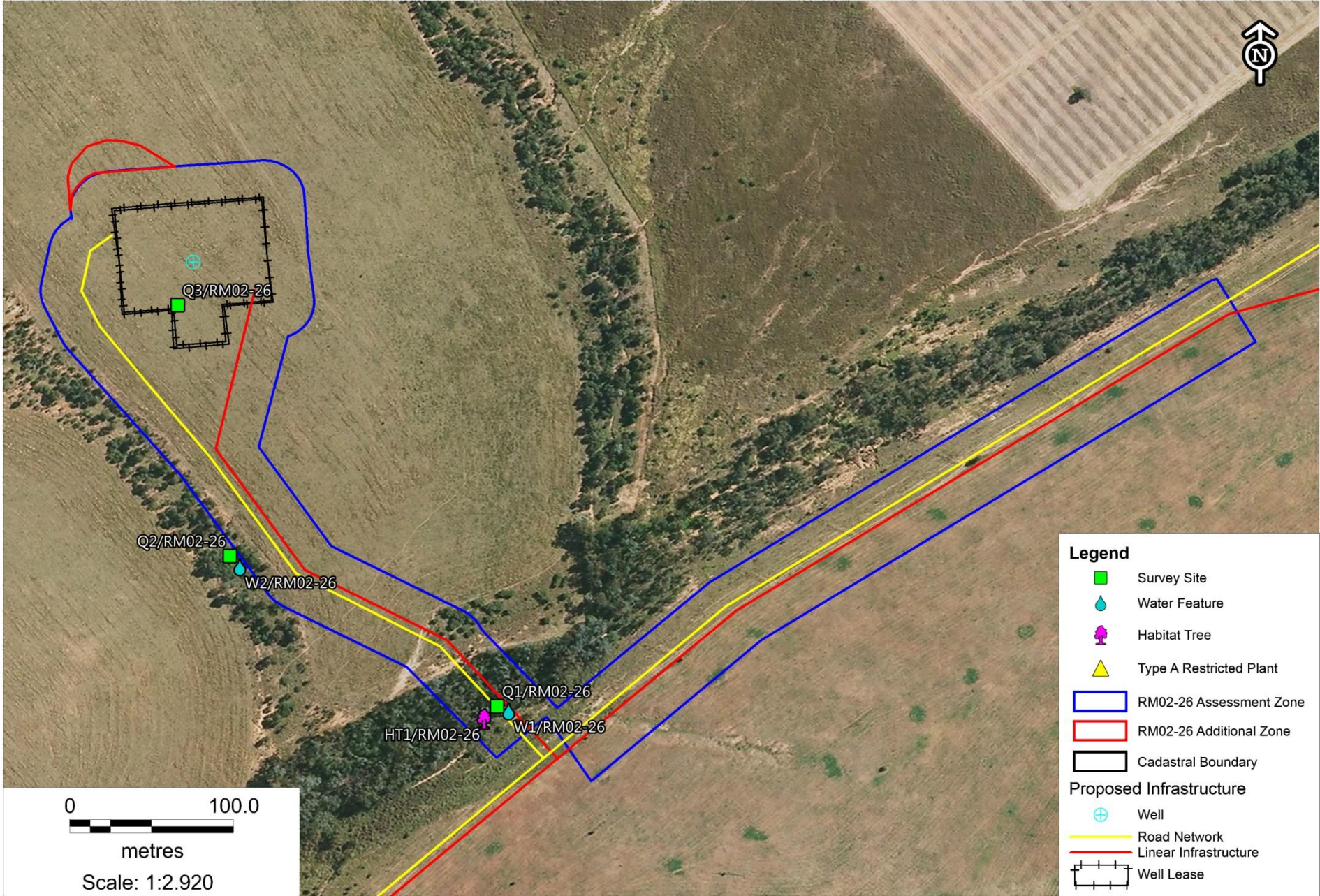




Figure 2: Poplar Box (*Eucalyptus populnea*), Silver-leaved Ironbark (*E. melanophloia*) and White Cypress Pine (*Callitris glaucophylla*) woodland at survey site Q1/RM02-26 looking northeast (left).

Figure 3a: Poplar Box (*E. populnea*) low woodland (regrowth) with False Sandalwood (*Eremophila mitchellii*) and Deane's Wattle (*Acacia deanei*) midlayer at survey site Q2/RM02-26 (right).



Figure 3b: Cultivated Rhodes Grass (*Chloris gayana*) pasture at survey site Q3/RM02-26 with adjoining regrowth to west (left) and remnant corridor to south (right).



Figure 4: A hollow-bearing Poplar Box (*E. populnea*) recorded at waypoint HT1/RM02-26.



Figure 5a: Drainage feature recorded at waypoint W1/RM02-26 looking downstream (left) and upstream (right). Banks and bed are poorly defined.



Figure 5b: Drainage feature recorded at W2/RM02-26 looking downstream (left) and upstream (right).

Appendix A: Quaternary assessment results, Zone RM02-26

Site No. Q1/
RM02-26 Recorder: Rosamund Aisthorpe, Ashley Hoffmann Date 24/01/2013
Purpose Well Zone Assessments Time 14:55

Locality:
(inc. distance/direction to nearest town) "Mt Hope" along RM02-26 linear infrastructure

Zone: 55J 0707937E 7081943 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D, M, S, V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Eucalyptus populnea</i>
T1	16	14 – 20	M (30)	T1	A	<i>E. melanophloia</i>
T2	6	4 – 8	M (60)	T1	A	<i>Callitris glaucophylla</i>
T3				T2	D	<i>C. glaucophylla</i>
S1	2	1 – 3	V (5)	T2	S	<i>Eremophila mitchellii</i>
S2				S1	D	<i>Geijera parviflora</i>
S3				S1	A	<i>Acacia decora</i>
G	0.6	0.1 – 1.0	M (70)	G	D	<i>Ancistrachne uncinulata</i>
Structural formation: Woodland				G	S	<i>Cenchrus ciliaris</i>
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types: coarse grained sedimentary rocks
Landform: low undulating hills (gentle slope adjoining minor drainage line)
Soils: pale brown sandy loam
DEHP Mapped RE Code: NR (PMAV category X)
Observed RE Code: 11.10.11 Landzone: 10

Vegetation Short Description

Eucalyptus populnea, *E. melanophloia* and *Callitris glaucophylla* woodland; midlayer dominated by *C. glaucophylla* saplings, *Eremophila mitchellii*, *Geijera parviflora* and *Acacia decora*; ground layer dominated by *Ancistrachne uncinulata* and *Cenchrus ciliaris*.

Connectivity/Patch Characteristics

Remnant corridor adjoining by cleared paddock to north and south.

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Opuntia tomentosa (R), *O. stricta* (R), *Cenchrus ciliaris* (C), *Sorghum* sp. (U), *Sida rhombifolia* (R)

% Weed Cover: 10

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code:

Photo Nos. BBK5 4370-4373

Additional Flora:				
<i>Cheilanthes distans</i>				
<i>Maireana microphylla</i>				
<i>Solanum parvifolium</i>				
<i>Parsonsia eucalyptophylla</i>				
<i>Einadia hastata</i>				
<i>Nyssanthus erecta</i>				
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)				
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.				
Rocks - embedded		Boulders		Shrub layer
Rocks - loose		Fallen bark		Ground cover
				Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100				
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark
Underhangs / overhangs / caves		Logs with hollows		Termite mounds
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe
Other				
Soil cracks				
Water	Minor drainage line within corridor (W1/RM02-26)			
Other (e.g. food trees):				
Disturbances				
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata		
		Str.	Stems/ha	DBH (cm)
NOT RECORDED		T1	320	20
		T2	2080	5
		S1	208	2
Additional Notes				

Site No. Q2/
RM02-26
Recorder: Rosamund Aisthorpe, Ashley Hoffmann
Date 24/01/2013
Purpose Well Zone Assessments
Time 15:30

Locality:
 (inc. distance/direction to nearest town) "Mt Hope" along RM02-26 linear infrastructure

Zone: 55J 0707775 E 7082047 N
Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Eucalyptus populnea</i>
T1	7	6 – 8	S (20)	S1	C	<i>Acacia deanei</i>
T2				S1	C	<i>Eremophila mitchellii</i>
T3				G	D	<i>Aristida</i> sp.
S1	2	1 – 4	M (40)			
S2						
S3						
G	0.3	0.1 – 0.5	M (60)			
Structural formation: Low woodland						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types: coarse-grained sedimentary rocks
Landform: low undulating hills (hill slope beside minor drainage line)
Soils: reddish-brown loam
DEHP Mapped RE Code: NR (PMAV category X)
Observed RE Code: NR (ex-11.10.11)
Landzone: 10

Vegetation Short Description

Eucalyptus populnea low woodland, midlayer dominated by *Eremophila mitchellii* and *Acacia deanei*; grassy ground layer dominated by *Aristida* sp.

Connectivity/Patch Characteristics

Corridor of regrowth retained along minor drainage line adjoined by cleared paddock to west and east

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Opuntia stricta (R), *Cenchrus ciliaris* (U), *Chloris gayana* (C), *Opuntia tomentosa* (R)

% Weed Cover: 10

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code:

Photo Nos. BBK5 4383-4385

Additional Flora:				
<i>Clematis microphylla</i>				
<i>Citrus glauca</i>				
<i>Maireana microphylla</i>				
<i>Sclerolaena birchii</i>				
<i>Sida hackettiana</i>				
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)				
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%				
Rocks - embedded		Boulders		
Rocks - loose		Fallen bark		
		Shrub layer		
		Leaf litter		
		Ground cover		
		Bare ground		
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100				
Crevices/ledges		Large logs (>30cm diameter)		
Underhangs /overhangs / caves		Logs with hollows		
Small logs (<30cm diameter)		Hollow bearing trees		
		Trees / logs bearing loose bark		
		Termite mounds		
		Mistletoe		
Other				
Soil cracks				
Water	Minor drainage line on site (W2/RM02-26)			
Other (e.g. food trees):				
Disturbances				
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata		
		Str.	Stems/ha	DBH (cm)
NOT RECORDED		T1	512	10
		S1	1600	4
Additional Notes				

Site No. Q3/ RM02-26 **Recorder:** Rosamund Aisthorpe, Ashley Hoffmann **Date** 24/01/2013
Purpose Well Zone Assessments **Time** 13:50

Locality: (inc. distance/direction to nearest town) "Mt Hope" at RM02-26
Zone: 55J 0707746 E 7082217 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				G	D	<i>Chloris gayana</i>
T1						
T2						
T3						
S1						
S2						
S3						
G	0.2	0.1 - 0.3	M (70)			
Structural formation: Grassland						
Ecologically dominant layer: G						

Geology, landform, soils

Geology code and rock types:	coarse-grained sedimentary rocks
Landform:	low undulating hills (hill slope)
Soils:	brown loamy clay
DEHP Mapped RE Code:	NR (PMAV category X)
Observed RE Code: NR	Landzone: 10
Vegetation Short Description	
Cultivated <i>Chloris gayana</i> pasture	
Connectivity/Patch Characteristics	
Cleared paddock adjoined by remnant corridor to south; regrowth corridor to west	
Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed) <i>Chloris gayana</i> (C), <i>Glandularia aristigera</i> (R)	
% Weed Cover:	99
EVNT Flora Present:	Nil
EVNT Flora Likely:	Nil
Field Wpt Code:	
Photo Nos.	BBK5 4386-4393

Appendix B: Plant species list, Zone RM02-26

Key: * indicates non-native plant species

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	Other
Adiantaceae	<i>Cheilanthes distans</i>	Bristly Cloak Fern	LC		P			
Amaranthaceae	<i>Nyssanthus erecta</i>	Barbed-wire Weed	LC		P			
Apocynaceae	<i>Parsonsia eucalyptophylla</i>	Gargaloo	LC		P			
Cactaceae	<i>Opuntia stricta</i> *	Common Pest Pear	-		P	P		
Cactaceae	<i>Opuntia tomentosa</i> *	Velvety Tree Pear	-		P	P		
Chenopodiaceae	<i>Einadia hastata</i>	Berry Saltbush	LC		P			
Chenopodiaceae	<i>Maireana microphylla</i>	Cotton Bush	LC		P	P		
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanised Burr	LC			P		
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC		P			
Malvaceae	<i>Sida hackettiana</i>	High Sida	LC			P		
Malvaceae	<i>Sida rhombifolia</i> *	Paddy's Lucerne	-		P			
Mimosaceae	<i>Acacia decora</i>	Pretty Wattle	LC		P			
Mimosaceae	<i>Acacia deanei</i>	Deane's Wattle	LC			P		
Myoporaceae	<i>Eremophila mitchellii</i>	False Sandalwood	LC		P	P		
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	LC		P			
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		P	P		
Poaceae	<i>Ancistrachne uncinulata</i>	Hooky Grass	LC		P			
Poaceae	<i>Aristida</i> sp. (infertile)	A Wiregrass	LC			P		P
Poaceae	<i>Cenchrus ciliaris</i> *	Buffel Grass	-		P	P		P
Poaceae	<i>Chloris gayana</i> *	Rhodes Grass	-			P	P	
Poaceae	<i>Sorghum</i> sp. (indet.)*	A Sorghum	-		P			P
Ranunculaceae	<i>Clematis microphylla</i>	Small-leaved Clematis	LC			P		
Rutaceae	<i>Citrus glauca</i>	Desert Lime	LC			P		
Rutaceae	<i>Geijera parviflora</i>	Wilga	LC		P			
Solanaceae	<i>Solanum parvifolium</i>	Small-leaved Nightshade	LC		P			
Verbenaceae	<i>Glandularia aristigera</i> *	Mayne's Pest	-				P	

Well Lease Area/ Infrastructure Zone Assessment Report: Mt Hope Zone RM02-19

Compiled by Boobook for Santos

Boobook
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

Revision	Date	Description	Author	Verifier	Approved
A	27/2/2013	Draft issued to client for review	RJ	CE	CE
B	23/5/2013	Incorporating client comments and amended zone	RA & RJ	CE	CE
0	8/7/2013	Final version	RJ		RJ

1. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
TAR plant	Type A Restricted Plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

2. Introduction

2.1 Purpose & Scope

Boobook was commissioned by Santos to undertake ecological assessments on a number of well leases and infrastructure zones (hereafter individually referred to as the Zone) located on the property 'Mt Hope', located about 40km north-east of Roma, south central Queensland. Boobook was requested to undertake the following:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation present within the Zone;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the assessment site;
- Comment on the nature and location of wetlands and watercourses within 100m of the Zone;
- Provide location and description of any plants of conservation concern listed in the NC Act or EPBC Act;
- Location and characteristics of any type A restricted (TAR) plants (NC Act) in the Zone; and
- Location and characteristics of habitat trees in the Zone, with reference to trees previously mapped by Santos.

An individual report was to be prepared for each Zone. This report refers to Zone RM02-19 located on Lot 81 on Plan WV763.

Changes to the boundaries of this Zone were made by Santos following completion of the ecological assessment described in this report for the Zone (Figure 1). Modifications of this infrastructure Zone were considered to be either minor in extent and/or involving areas where the ecological values were previously assessed on-site or nearby. Although the risk is acceptably small it is possible that some ecological values of the modified Zone may not have been documented. Based on professional judgement the modified zones are highly unlikely to contain populations of threatened flora or significant fauna habitat features. However, the presence of TAR plants, especially seedlings, cannot be ruled out.

2.2 Survey Team

The project supervisor (Craig Eddie) was approved by 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.

The field survey described by this report was undertaken by Boobook on 18th January 2013 and was conducted by Richard Johnson (Senior Ecologist) and Rosamund Aisthorpe (Botanist). The following report was compiled by Rosamund Aisthorpe and Richard Johnson. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie (Principal Ecologist and Project Supervisor). Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A comprehensive desktop search was not required by the client for the purposes of this report. However, a desktop search was undertaken for REs at the property scale using mapping version 6.1 (DEHP 2013). This dataset provides a baseline for subsequent field assessment.

The search was conducted using a 5km buffer around the coordinate -26.3558°S, 149.0847°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative site was selected for each RE present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Figure 1. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all GPS co-ordinates quoted within this report is GDA94. When referred to within this report the sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2012: Table 29);
4. RE type mapped;
5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;
9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;

11. presence of EVNT flora;
12. a list of all other flora encountered at the Site; and
13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2012) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

A search was made within the Zone for TAR plants: If found, the location was established with a hand-held GPS unit and the species, height, DBH and possible management options were recorded.

Where mapping supplied by Santos indicated the presence of habitat trees, a search was made for these. If found the location was established with a hand-held GPS unit and the species, height, DBH and habitat value(s) were recorded. In some instances unmapped habitat trees were located during the site survey and data was collected for these trees also.

The presence of any wetlands or watercourses within 100m of the Zone was recorded.

Representative photographs were taken at each quaternary survey site in the Zone, as well as at any wetlands or watercourses, habitat trees or TAR plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

No remnant REs are mapped as present in the Zone.

4.1.2 Regional Ecosystems Observed

The Zone crosses a narrow shadeline of retained remnant vegetation equivalent to RE 11.10.11. This is sampled at survey site Q2/RM02-19 (see Appendix A). It is not mapped as remnant RE (DEHP 2013), presumably because it does not meet mapping thresholds for narrow linear strips (Neldner *et. al* 2012). Location and characteristics of this vegetation are given in Table 2. Representative figures are shown at Figure 2.

Table 2: Floristics and Structure of Remnant Ecosystems at Survey Sites in Zone RM02-19

Site	Location	Vegetation Description		
Q2/RM02-19	55J 707254E 7083473N	Woodland of <i>Eucalyptus melanophloia</i> and <i>E. populnea</i> ; shrub layer dominated by <i>Eremophila mitchellii</i> ; mid-dense grassy layer dominated by <i>Aristida</i> sp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	15	30	160	25
S1	3.5	20	550	12

4.1.3 Threatened Ecological Communities Observed

No threatened ecological communities (TECs) were observed in the Zone.

4.1.4 Non-remnant Vegetation Observed

The Zone is vegetated by a shrubland of regrowth that has occurred after mechanical disturbance (pulling) of regrowth from earlier clearing event(s) (see Appendix A). The floristics and structure of the dominant species in each woody stratum at survey site Q1/RM09-37 are shown in Table 3. Representative images of the site are shown at Figure 3a. To the east the land has been extensively modified for cultivation and was sampled at survey site Q3/RM02-19. Because woody vegetation is essentially absent at this site, no values are given in Table 3 but images are shown at Figure 3b.

Table 3: Floristics and Structure of Vegetation at Survey Sites in Zone RM02-19

Site	Location	Vegetation Description		
Q1/RM02-19	55J 707173E 7083475N	Shrubland (regrowth) of <i>Eucalyptus populnea</i> with <i>Acacia deanei</i> and <i>Eremophila mitchellii</i> . Grassy layer of several perennial species dominated by <i>Bothriochloa decipiens</i> and <i>Aristida</i> sp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
S1	1.5	20	720	0-2
Site	Location	Vegetation Description		
Q3/RM02-19	55J 706988E 7082648N	Grassland of introduced pasture species dominated by <i>Chloris gayana</i> and <i>Sorghum</i> sp.		

4.2 Additional Observations

4.2.1 Additional Flora Species

Approximately 22 species of native flora were detected (Appendix B). In addition, eight non-native species were recorded. One of these, Common Pest Pear (*Opuntia stricta*), is a declared class 2 weed scheduled under the *Land Protection (Pest and Stock Route Management) Regulation 2003* and Weed of National Significance (WoNS).

4.2.2 Type A Restricted Plants

No TAR plants were detected within the Zone.

4.2.3 Fauna Habitat Features

Three hollow-bearing trees were detected within the Zone, all associated with the strip of remnant vegetation discussed earlier. Location and details of these trees are shown in Table 4 and Figures 4a-c. No other significant fauna habitat features were detected in the Zone.

Table 3: Details of Fauna Habitat Features, Zone RM02-19

Waypoint	Location	Species	Alive/dead	DBH (cm)	Height (m)	Habitat features
HT1/RM02-19	55J 707249E 7083476N	<i>Eucalyptus melanophloia</i>	Alive	47	15	1 hollow <10cm diam.; 2 hollows 10-30cm diam.; 5% loose bark
HT2/RM02-19	55J 707249E 7083453N	<i>Eucalyptus populnea</i>	Alive	52	18	3 hollows <10cm diam.
HT3/RM02-19	55J 707269E 7083469N	<i>Eucalyptus melanophloia</i>	Dead	43	12	3 hollows <10cm diam.; 40% loose bark

4.2.4 Wetlands and Watercourses

No watercourses or drainage features as defined by the *Water Act 2000* were detected in or within 100m of the Zone. No wetlands as defined by the Queensland Wetland Program (DERM 2011) as used in Santos Environmental Authority (Schedules C, M) were detected in or within 100m of the Zone.

5. References

Bostock, P.D. and Holland, A.E. (eds.) (2010). *Census of the Queensland Flora 2010*. Queensland Herbarium, Brisbane.

DEHP (2013). *Vegetation Management Act Regional Ecosystem and Remnant Map – Version 6.1*. Regional Ecosystem Maps/ Regrowth Vegetation Maps and PMAVs. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

<http://www.ehp.qld.gov.au/ecosystems/biodiversity/regional-ecosystems/maps/index.php>

DERM (2011). *Queensland Wetland Definition and Delineation Guideline*. Queensland Government, Brisbane.

Land Protection (Pest and Stock Route Management) Regulation 2003. (Queensland), viewed 13 May 2013, <<http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/L/LandPRPSRMR03.pdf>>

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*. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts, Brisbane.

Water Act 2000. (Queensland), viewed 14 February 2013, <<http://www.legislation.qld.gov.au/legisltn/current/w/watera00.pdf>>

Figure 1: Map of Zone RM02-19 showing survey sites and other points of interest

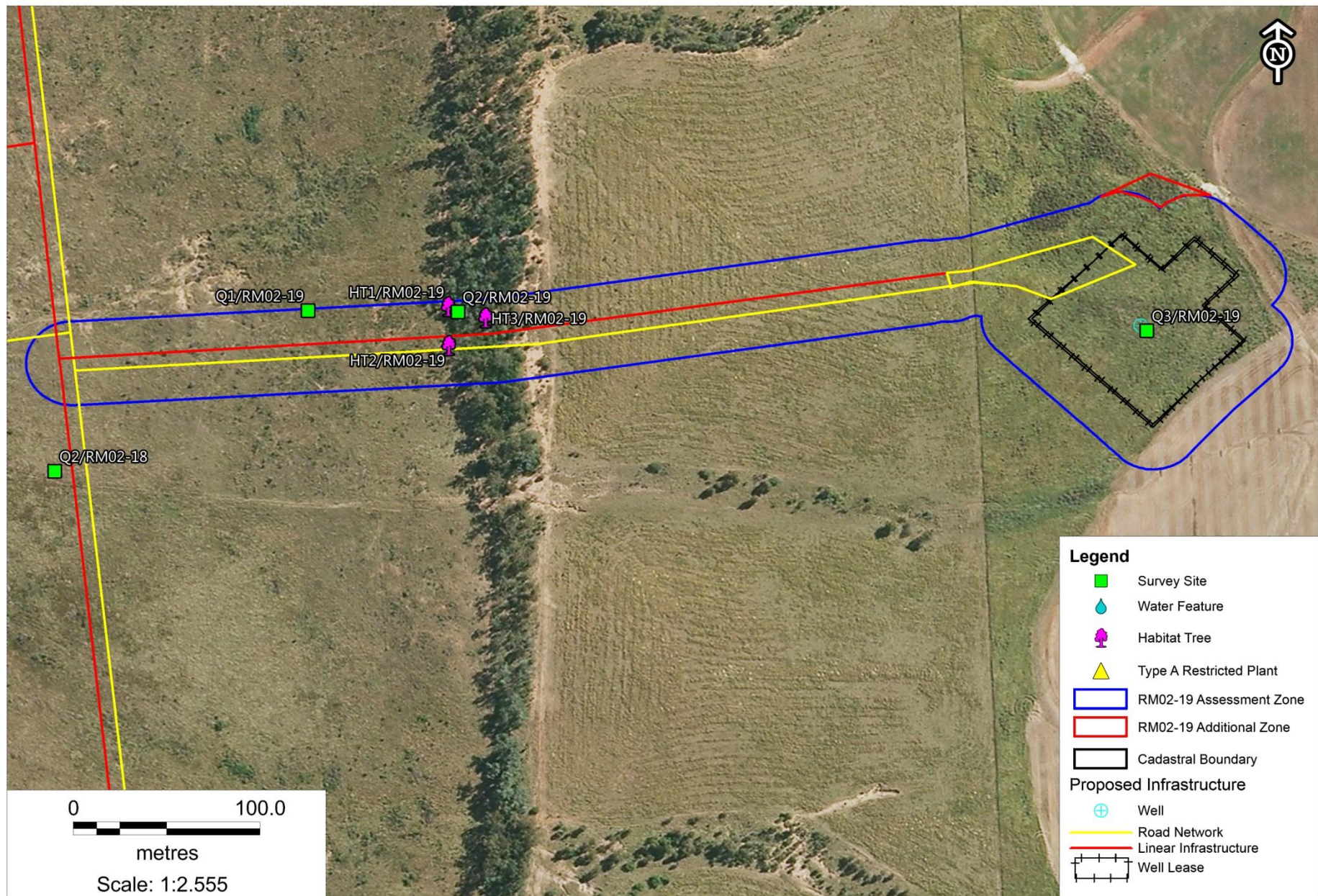




Figure 2: Woodland of Silver-leaved Ironbark (*Eucalyptus melanophloia*) and Poplar Box (*E. populnea*) at survey site Q2/RM02-19.



Figure 3a: Cleared paddock with shrubby regrowth of Poplar Box (*E. populnea*) at survey site Q1/RM02-19 (left). Other shrubs such as Deane's Wattle (*Acacia deanei*) are present to a lesser extent (right).



Figure 3b: Grassland dominated by introduced Rhodes Grass (*Chloris gayana*) and *Sorghum* sp. at survey site Q3/RM02-19.



Figure 4a: A live hollow-bearing Silver-leaved Ironbark (*Eucalyptus melanophloia*) with loose bark recorded at waypoint HT1/RM02-19.



Figure 4b: A live hollow-bearing Poplar Box (*E. populnea*) recorded at waypoint HT2/RM02-19.



Figure 4c: A hollow-bearing Silver-leaved Ironbark (*E. melanophloia*) with loose bark recorded at waypoint HT3/RM02-19.

Appendix A: Quaternary assessment results, Zone RM02-19

Site No. Q1/ RM02-19 Recorder: Rosamund Aisthorpe, Richard Johnson Date 18/01/2013
Purpose Well Zone Assessments Time 08:23

Locality: (inc. distance/direction to nearest town) "Mt Hope"
Zone: 55J 0707173 E 7083475 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				S1	D	<i>Eucalyptus populnea</i>
T1				S1	S	<i>Acacia deanei</i>
T2				S1	S	<i>Eremophila mitchellii</i>
T3				G	D	<i>Bothriochloa decipiens</i>
S1	1.5	0.9 - 2.5	S (20)	G	D	<i>Aristida</i> sp.
S2				G	S	<i>Cymbopogon refractus</i>
S3						
G	0.4	0.1 - 0.8	M (70)			
Structural formation: Shrubland						
Ecologically dominant layer: S1						

Geology, landform, soils

Geology code and rock types: coarse-grained sediments
Landform: hill slope
Soils: light brown sandy loam (duplex with sodic B horizon)
DEHP Mapped RE Code: NR
Observed RE Code: NR Landzone: 10

Vegetation Short Description

Shrubland (regrowth) of *Eucalyptus populnea*, with *Acacia deanei*, and *Eremophila mitchellii*. Grassy layer of several perennial species, dominated by *Bothriochloa decipiens* and *Aristida*.

Connectivity/Patch Characteristics

cleared

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Conyza bonariensis (R), *Cirsium vulgare* (R), *Glandularia aristigera* (R)

% Weed Cover: <5

EVNT Flora Present:

EVNT Flora Likely:

Field Wpt Code:

Photo Nos. BBK5 3445-3456

Additional Flora:				
<i>Themeda avenacea</i>				
<i>Enteropogon</i> sp.				
<i>Eremophila debilis</i>				
<i>Rhynchosia minima</i>				
<i>Eucalyptus melanophloia</i>				
<i>Podolepis longipedata</i>				
<i>Maireana microphylla</i>				
<i>Pterocaulon redolens</i>				
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)				
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.				
Rocks - embedded		Boulders		Shrub layer
Rocks - loose		Fallen bark		Leaf litter
				Ground cover
				Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100				
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark
Underhangs / overhangs / caves		Logs with hollows		Termite mounds
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe
Other				
Soil cracks				
Water				
Other (e.g. food trees):				
Disturbances				
Treated regrowth (chain-pulled); grazing				
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata		
		Str.	Stems/ha	DBH (cm)
		S1	720	0 - 2
Additional Notes				

Site No. Q2/ RM02-19 Recorder: Rosamund Aisthorpe, Richard Johnson Date 18/01/2013
Purpose Well Zone Assessments Time 08:47

Locality: (inc. distance/direction to nearest town) "Mt Hope"
Zone: 55J 0707254 E 7083473 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	C	<i>Eucalyptus melanophloia</i>
T1	15	8 - 18	S (30)	T1	C	<i>Eucalyptus populnea</i>
T2				S1	D	<i>Eremophila mitchellii</i>
T3				S1	S	<i>Callitris glaucophylla</i>
S1	3.5	2.5 - 5.0	S (20)	G	D	<i>Aristida</i> sp.
S2						
S3						
G	0.3	0.1 - 0.7	M (50)			
Structural formation: Woodland						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types: coarse-grained sediments
Landform: upper slope
Soils: light brown loam
DEHP Mapped RE Code: NR (not mappable at 1:100,000 scale)
Observed RE Code: 11.10.11 Landzone: 10

Vegetation Short Description

Woodland of *Eucalyptus melanophloia* and *E. populnea*; shrub layer dominated by *Eremophila mitchellii*; mid dense grassy layer dominated by *Aristida* sp.

Connectivity/Patch Characteristics

Shade line ~50m wide in cleared landscape

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Cenchrus ciliaris (U), *Opuntia stricta* (R)

% Weed Cover: <5

EVNT Flora Present:

EVNT Flora Likely:

Field Wpt Code:

Photo Nos. BBK5 3463-3468

Additional Flora:				
<i>Geijera parviflora</i>				
<i>Psydrax oleifolia</i>				
<i>Capparis lasiantha</i>				
<i>Acacia deanei</i>				
<i>Enteropogon</i> sp.				
<i>Solanum parvifolium</i>				
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)				
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.				
Rocks - embedded		Boulders		Shrub layer
Rocks - loose		Fallen bark		Leaf litter
				Ground cover
				Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100				
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark
Underhangs / overhangs / caves		Logs with hollows		Termite mounds
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe
Other				
Soil cracks				
Water				
Other (e.g. food trees):				
Disturbances				
grazed				
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata		
		Str.	Stems/ha	DBH (cm)
NOT RECORDED		T1	160	25
		S1	550	12
Additional Notes				

Site No. Q3/RM02-19 **Recorder:** Rosamund Aisthorpe, Richard Johnson **Date** 18/01/2013
Purpose Well Zone Assessments **Time** 9:30

Locality: (inc. distance/direction to nearest town) "Mt Hope"
Zone: 55J 0707622 E 7083456 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				G	D	<i>Chloris gayana</i> cultivar
T1				G	S	<i>Sorghum</i> sp.
T2						
T3						
S1						
S2						
S3						
G	0.5	0.2 - 1.0	D (90)			
Structural formation: Grassland						
Ecologically dominant layer: G						

Geology, landform, soils

Geology code and rock types: _____
Landform: broad hill crest
Soils: brown clay loam
DEHP Mapped RE Code: NR
Observed RE Code: NR (derived grassland) **Landzone:** 9

Vegetation Short Description

grassland of introduced pasture species

Connectivity/Patch Characteristics

cleared

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Conyza bonariensis (U), *Lepidium bonariense* (U), *Glandularia aristigera* (R), *Cynodon dactylon* (C)

% Weed Cover:

EVNT Flora Present:

EVNT Flora Likely:

Field Wpt Code:

Photo Nos. BBK5 3473-3481

Additional Flora:				
<i>Chamaesyce drummondii</i>				
<i>Xerochrysum bracteatum</i>				
<i>Capparis lasiantha</i>				
<i>Alstonia constricta</i>				
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)				
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.				
Rocks - embedded		Boulders		Shrub layer
Rocks - loose		Fallen bark		Leaf litter
				Ground cover
				Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100				
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark
Underhangs / overhangs / caves		Logs with hollows		Termite mounds
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe
Other				
Soil cracks				
Water				
Other (e.g. food trees):				
Disturbances				
ploughed, cultivated to pasture spp.				
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata		
		Str.	Stems/ha	DBH (cm)
Additional Notes				

Appendix B: Plant species list, Zone RM02-19

Key: * indicates non-native plant species

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	1	2	3
Apocynaceae	<i>Alstonia constricta</i>	Bitterbark	LC				P
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	-		P		
Asteraceae	<i>Conyza bonariensis</i> *	Flaxleaf Fleabane	-		P		P
Asteraceae	<i>Podolepis longipedata</i>	Tall Copper-wire Daisy	LC		P		
Asteraceae	<i>Pterocaulon redolens</i>	Applebush, Fruit Salad Plant	LC		P		
Asteraceae	<i>Xerochrysum bracteatum</i>	Golden Everlasting	LC				P
Cactaceae	<i>Opuntia stricta</i> *	Common Pest Pear	-			P	
Capparaceae	<i>Capparis lasiantha</i>	Wait-A-While, Nipan	LC			P	P
Chenopodiaceae	<i>Maireana microphylla</i>	Cotton Bush	LC		P		
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC			P	
Euphorbiaceae	<i>Chamaesyce drummondii</i>	Caustic Weed	LC				P
Fabaceae	<i>Rhynchosia minima</i>	Rhynchosia	LC		P		
Mimosaceae	<i>Acacia deanei</i>	Deane's Wattle	LC		P	P	
Myoporaceae	<i>Eremophila debilis</i>	Winter Apple	LC		P		
Myoporaceae	<i>Eremophila mitchellii</i>	False Sandalwood	LC		P	P	
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	LC		P	P	
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		P	P	
Poaceae	<i>Aristida</i> sp. (infertile)	A Wiregrass	LC		P	P	
Poaceae	<i>Bothriochloa decipiens</i>	Pitted Bluegrass	LC		P		
Poaceae	<i>Cenchrus ciliaris</i> *	Buffel Grass	-			P	
Poaceae	<i>Chloris gayana</i> *	Rhodes Grass	-				P
Poaceae	<i>Cymbopogon refractus</i>	Barbed-wire Grass	LC		P		
Poaceae	<i>Cynodon dactylon</i> *	Couch Grass	-				P
Poaceae	<i>Enteropogon</i> sp. (indet.)	A Windmill Grass	LC		P	P	
Poaceae	<i>Sorghum</i> sp. (indet.)*	A Sorghum	-				P
Poaceae	<i>Themeda avenacea</i>	Wild Oats	LC		P		
Rubiaceae	<i>Psydrax oleifolia</i>	Myrtle Tree	LC			P	
Rutaceae	<i>Geijera parviflora</i>	Wilga	LC			P	
Solanaceae	<i>Solanum parvifolium</i>	Small-leaved Nightshade	LC			P	
Verbenaceae	<i>Glandularia aristigera</i> *	Mayne's Pest	-		P		P

Well Lease Area/Infrastructure Zone Assessment Report: Mt Hope Zone RM03-58

Compiled by Boobook for Santos

Boobook
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
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Revision	Date	Description	Author	Verifier	Approved
A	13/2/2013	Draft issued to client for review	R. Johnson	C. Eddie	C. Eddie
B	15/2/2013	Draft issued to client for review incorporating client comment	R. Johnson	C. Eddie	C. Eddie
C	13/9/2013	Draft issued to client for review incorporating client comment	R. Johnson	C. Eddie	C. Eddie
0	1/11/2013	Final version	R. Johnson		R. Johnson

1. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
NC Act	<i>Nature Conservation Act 1992</i>
HVR	High Value Regrowth (as defined by <i>Vegetation Management Act 1999</i>)
RE	Regional Ecosystem
TAR plant	Type A restricted plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

2. Introduction

2.1 Purpose & Scope

Boobook was commissioned by Santos to undertake ecological assessments on a number of well leases and infrastructure zones (hereafter individually referred to as 'the Zone') located on the property 'Mt Hope', located about 40km north-east of Roma, south central Queensland. Boobook was requested to undertake the following:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation present within the Zone;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the assessment site;
- Comment on the nature and location of wetlands and watercourses within 100m of the Zone;
- Provide location and description of any plants of conservation concern listed in the NC Act or EPBC Act;
- Location and characteristics of any Type A restricted (TAR) plants (NC Act) in the Zone; and
- Location and characteristics of habitat trees in the Zone, with reference to trees previously mapped by Santos.

Subsequent to this work being completed, Santos advised that the location of the RM03-58 Zone was to be substantially modified (Figures 1a-c). Modifications of this infrastructure Zone were considered to involve areas where the ecological values were not previously assessed on-site or nearby and required an additional field inspection. The results of this inspection have been included with the original findings, where still relevant, of this and other reports.

. Further, the scope of works was expanded to incorporate the following;

- Comment on the nature and location of watercourses within 100m and wetlands within 200m of the Zone;

Additionally, for the area outside the Zone but within a 200m buffer, Boobook was requested to undertake the following:

- Provide location and characteristics of any unmapped/incorrectly mapped Environmentally Sensitive Areas (ESA); and
- Provide location and characteristics of any unmapped/incorrectly mapped Threatened Ecological Communities (TEC) and other matters under the EPBC Act.

This report refers to the modified Zone RM03-58 located on Lots 34, 35 and 36 on Plan WV421.

2.2 Survey Team

The initial field survey described by this report was undertaken by Boobook on 16th January 2013 and was conducted by Richard Johnson (Senior Ecologist) and Angela Bendall (Field

Assistant). Following the Zone modification, further field survey was undertaken by Boobook on 5th September 2013 and was conducted by Richard Johnson and Jeroen Lurling (Intermediate Ecologist). The following report was compiled by Rosamund Aisthorpe and Richard Johnson and reviewed by Craig Eddie (Principal Ecologist).

The project supervisor (Craig Eddie) was approved by 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.

Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A comprehensive desktop search was not required by the client for the purposes of this report. However, a desktop search was undertaken for regional ecosystems (RE) at the property scale using mapping version 6.1 (DEHP 2013). This dataset provides a baseline for subsequent field assessment.

The search was conducted using a 5km buffer around the coordinate -26.3558°S, 149.0847°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative site was selected for each regional ecosystem present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Fig. 1. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora

follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all GPS co-ordinates quoted within this report is GDA94. When referred to within this report the sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2012: Table 29);
4. RE type mapped;
5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;
9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;
11. presence of endangered, vulnerable or near threatened flora;
12. a list of all other flora encountered at the Site; and
13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2012) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

A search was made within the Zone for Type A restricted plants: If found, the location was established with a hand-held GPS unit and the species, height, DBH and possible management options were recorded.

Fauna habitat tree and other habitat features were searched for in the Zone. Where found the location was established with a hand-held GPS unit and the feature description was recorded.

The presence of any watercourses within 100m or wetlands within 200m of the Zone was recorded.

Representative photographs were taken at each quaternary survey site in the Zone, as well as at any wetlands or watercourses, habitat features or Type A restricted plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

No remnant regional ecosystems are mapped as present in the Zone.

4.1.2 Regional Ecosystems Observed

The north-western arm of the Zone terminates in a road reserve where remnant vegetation equivalent to RE 11.10.11 (*Eucalyptus populnea*, *E. melanophloia* +/- *Callitris glaucophylla* woodland on coarse-grained sedimentary rocks: no concern at present) is present as a narrow roadside strip. This was sampled at study site Q1-RM03-58. Vegetation equivalent to this RE is also present within and immediately adjacent to the Zone in the vicinity of Blyth Creek. It was previously reported for Zone RM03-55 at the survey site Q3/RM03-55. The data from that site is now reported here.

Queensland Blue Gum (*Eucalyptus tereticornis*) and Rough-barked Apple (*Angophora floribunda*) woodland with associated Poplar Box (*E. populnea*) is present within 200m of the Zone. It was previously reported for Zone RM03-55, having been sampled at survey site Q2/RM03-55, and the data is now presented here. This vegetation is part of a riparian corridor traversed by the Zone from the northeast to the southwest along the eastern bank and adjacent alluvial terrace of Blyth Creek. Currently it is mapped as category X under a Property Map of Assessable Vegetation (PMAV) except for a narrow corridor of HVR containing of concern REs following the creek channel and cadastral boundaries. However, field results indicate it equates to the of concern RE 11.3.25: Queensland Blue Gum (*E. tereticornis*) or River Red Gum (*E. camaldulensis*) woodland fringing drainage lines.

Advanced regrowth associated with a drainage line and sampled at study site Q3-RM03-58 is structurally and floristically analogous to the not of concern RE 11.3.39 (*Eucalyptus melanophloia* +/- *E. chloroclada* woodland on undulating plains and valleys with sandy soils). The floristics and structure of the vegetation at these sites are given in Table 2 and representative images are shown in Figures 2a-d.

Table 2: Floristics and Structure of Remnant Ecosystems at Survey Sites in Zone RM03-58

Site	Location	Vegetation Description
Q1-RM03-58	55J 706850E 7079431N	Open forest of <i>Eucalyptus melanophloia</i> , <i>E. populnea</i> and <i>Callitris glaucophylla</i> . A lower tree layer dominated by <i>C. glaucophylla</i>

		recruits. Very sparse shrub layer. Grassy ground layer dominated by <i>Heteropogon contortus</i> and non-native <i>Cenchrus ciliaris</i>		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	12	30	650	18
T2	5	10	400	10
S1	2	1	160	2
Site	Location	Vegetation Description		
Q2/RM03-55	55J 708361E 7079194N	<i>Eucalyptus tereticornis</i> and <i>Angophora floribunda</i> woodland with associated <i>E. populnea</i> ; midlayer composed of <i>E. tereticornis</i> , <i>A. floribunda</i> , <i>E. populnea</i> and <i>Callitris glaucophylla</i> recruits; grassy ground layer composed of <i>Chloris ventricosa</i> , <i>Austrostipa verticillata</i> , <i>Themeda avenacea</i> , <i>Cenchrus ciliaris</i> and <i>Lomandra longifolia</i>		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	23	25	100	67
T2	10	35	120	15
T3	5.5	10	66	12
Site	Location	Vegetation Description		
Q3/RM03-55	55J 708249E 7078995N	<i>Eucalyptus melanophloia</i> and <i>Eucalyptus populnea</i> woodland; midlayer dominated by <i>Allocasuarina luehmannii</i> and <i>Callitris glaucophylla</i> ; ground layer composed of <i>Dichanthium sericeum</i> , <i>Sporobolus</i> sp. and <i>Themeda triandra</i>		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	12	40	140	19
T2	5	50	330	5
Site	Location	Vegetation Description		
Q3-RM03-58	55J 708062E 7078762N	Woodland of <i>Angophora floribunda</i> with <i>Eucalyptus populnea</i> , <i>E. chloroclada</i> . Sparse lower tree layer of <i>Callitris glaucophylla</i> . Grassy ground layer dominated by <i>Bothriochloa bladhii</i> .		
		% foliage cover	Stems/ha	DBH (cm)
T1	12	20	560	22
T2	5	<5	16	14

4.1.3 Threatened Ecological Communities Observed

No TEC were observed in the Zone.

4.1.4 Non-remnant Vegetation Observed

The Zone is largely vegetated by a grassland of non-native pasture species sown following earlier clearing event(s). Woody regrowth of various ages, usually at low densities, is present throughout. The floristics and structure of the dominant species in each woody stratum at sites Q2-RM03-58 and Q4-RM03-58 are shown in Table 3. Representative images of the sites are shown at Figures 3a-b.

Table 3: Floristics and Structure of Non-remnant Vegetation at Survey Sites in Zone RM03-58

Site	Location	Vegetation Description		
Q2-RM03-58	55J 708148E 7078842N	Grassland dominated by non-native <i>Chloris gayana</i> cultivar.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
No woody stratum	n/a	n/a	n/a	n/a
Site	Location	Vegetation Description		
Q4-RM03-58	55J 706862E 7077890N	Shrubland of <i>Eucalyptus chloroclada</i> recruits		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
S1	1.8	50	375	2

4.2 Additional Observations

4.2.1 Additional Flora Species

Approximately 47 species of native flora were detected (Appendix B). In addition, 10 non-native species were recorded. Two of these, Common Pest Pear (*Opuntia stricta*) and Velvety Tree Pear (*O. tomentosa*) are declared Class 2 weeds scheduled under the *Land Protection (Pest and Stock Route Management) Regulation 2003* and Weeds of National Significance (WoNS). Common Pest Pear was encountered as patches of multiple plants at two locations. Velvety Tree Pear was common at site Q1-RM03-58 but seen at only one other location in the Zone.

4.2.2 Type A Restricted Plants

A Kurrajong (*Brachychiton populneus*) was recorded at waypoint BP1-RM03-58. Additionally, three other Kurrajongs were previously recorded in the Zone when it formed part of Zone RM03-55. The data for these plants is now presented here. An area containing numerous clumps of Forest Grass Tree (*Xanthorrhoea johnsonii*) was located at the south-western extremity of the Zone. Table 4 shows the location, species and characteristics of TAR plants detected within the Zone. Images of the plants are shown in Figures 4a-h.

Table 4: TAR Plants recorded in Zone RM03-58

Waypoint	Location	Species	Height (m)	DBH (cm)	Management
BP1-RM03-58	55J 706850E 7079413N	<i>Brachychiton populneus</i>	3.5	4	translocatable
BP1/RM03-55	55J 706880E 7079604N	<i>Brachychiton populneus</i>	5.5, 1.8	12, 1	2 adjacent plants: translocatable
BP2/RM03-55	55J 706875E 7079589N	<i>Brachychiton populneus</i>	5.5	10	translocatable
XJ1-RM03-58	55J 706719E 7077823N	<i>Xanthorrhoea johnsonii</i>	4 plants in 2m ² ; 0.9-1.2m height	n/a	translocatable
XJ2-RM03-58	55J 706714E 7077816N	<i>Xanthorrhoea johnsonii</i>	13 plants in 8m ² ; 0.8-1.0m height	n/a	translocatable
XJ3-RM03-58	55J 706717E	<i>Xanthorrhoea</i>	23 plants in	n/a	translocatable

Waypoint	Location	Species	Height (m)	DBH (cm)	Management
	7077807N	<i>johnsonii</i>	12m ² ; 0.8-1.1m height		
XJ4-RM03-58	55J 706727E 7077804N	<i>Xanthorrhoea johnsonii</i>	9 plants in 4m ² ; 0.8-1.0m height	n/a	translocatable
XJ5-RM03-58	55J 706742E 7077787N	<i>Xanthorrhoea johnsonii</i>	48 plants in 25m ² ; 0.7-1.1m height	n/a	translocatable

4.2.3 Fauna Habitat Features

Significant fauna habitat features were only located in the road reserve in the north-western extremity of the Zone. These include three habitat trees previously recorded as part of Zone RM03-55 assessment: the data is now presented here. Other features recorded include habitat logs and an arboreal termite mound. Details of these fauna habitat features are given in Table 5 and images are shown at Figures 5a-f.

Table 5: Details of Fauna Habitat Features, Zone RM03-58

Waypoint	Location	Species	Alive/dead	DBH (cm)	Height (m)	Habitat features
HT21/RM03-55	55J 706883E 7079603N	<i>Eucalyptus melanophloia</i>	Dead	55	18	1 hollow <10cm diam.; 50% loose bark
HT22/RM03-55	55J 706870E 7079596N	<i>Eucalyptus melanophloia</i>	Dead	55	10	1 hollow 10-30cm diam.; 1 hollow >30cm diam.; 60% loose bark
HT23/RM03-55	55J 706861E 7079613N	<i>Eucalyptus melanophloia</i>	Dead	60	15	1 hollow 10-30cm diam.; 30% loose bark
HL1_RM03-58	55J 706855E 7079465N	Myrtaceae sp.	Dead	30	2.5 (length)	Single log and smaller debris
HL2-RM03-58	55J 706835E 7079429N	Mixed species	Dead	n/a	Dimensions 6x2x1.5	Pile of logs, debris, wire and soil
TM1-RM03-58	55J 706853E 7079474N	<i>Eucalyptus melanophloia</i>	Dead	n/a	Dimensions 35x40x45cm	Arboreal termite mound 2.5m above ground; 1 nest burrow present

4.2.4 Wetlands and Watercourses

Part of the Zone runs approximately parallel to, and within 100m of, Blyth Creek. This is a mapped (DEHP 2013) fifth-order stream. It has well-defined bed and banks supporting riparian vegetation (RE 11.3.25: Queensland Blue Gum (*E. tereticornis*) or River Red Gum (*E. camaldulensis*) woodland fringing drainage lines), as described in section 4.1.2. As such it meets the *Water Act 2000* (Water Act) definition of a watercourse. This area was previously examined at waypoint W2/RM03-55 and this data is presented below. A drainage line crosses the Zone just south of the well lease area. At this point it does not support remnant vegetation but this is present immediately downstream (see Section 4.1.2). There are no defined bed and banks here though some channel scouring was observed downstream. The ground layer is dominated by non-wetland grasses and no evidence of riparian vegetation is present. Water flows in this drainage line are not of sufficient duration to maintain riverine condition. It therefore meets the definition of a drainage feature under the Water Act.

Location and characteristics of these features are shown in Table 6. Images are shown in Figures 6a-b.

Table 6: Wetlands and watercourses detected within Zone RM03-58

Waypoint	Location	Description
W2/RM03-55	55J 708366E 7078999N	Watercourse: Blyth Creek, fringed by <i>Eucalyptus</i> sp. (<i>camaldulensis/tereticornis</i>), <i>Angophora floribunda</i> woodland; <i>Callitris glaucophylla</i> midlayer.
W1-RM03-58	55J 708088E 7078746N	Drainage feature: drainage line with ground layer dominated by <i>Bothriochloa bladhii</i> . No evidence of prolonged presence of water

5. References

Bostock, P.D. and Holland, A.E. (eds.) (2010). *Census of the Queensland Flora 2010*. Queensland Herbarium, Brisbane.

DEHP (2013). *Vegetation Management Act Regional Ecosystem and Remnant Map – Version 6.1*. Regional Ecosystem Maps/ Regrowth Vegetation Maps and PMAVs. Department of Environment and Heritage Protection, Queensland Government, Brisbane. <http://www.ehp.qld.gov.au/ecosystems/biodiversity/regional-ecosystems/maps/index.php>

DERM (2011). *Queensland Wetland Definition and Delineation Guideline*. Queensland Government, Brisbane.

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*. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts, Brisbane.

Water Act 2000. (Queensland), viewed 14 February 2013, <<http://www.legislation.qld.gov.au/legisln/current/w/watera00.pdf>>

Figure 1a: Map of Zone RM03-58 (north-western end) showing survey sites and other points of interest

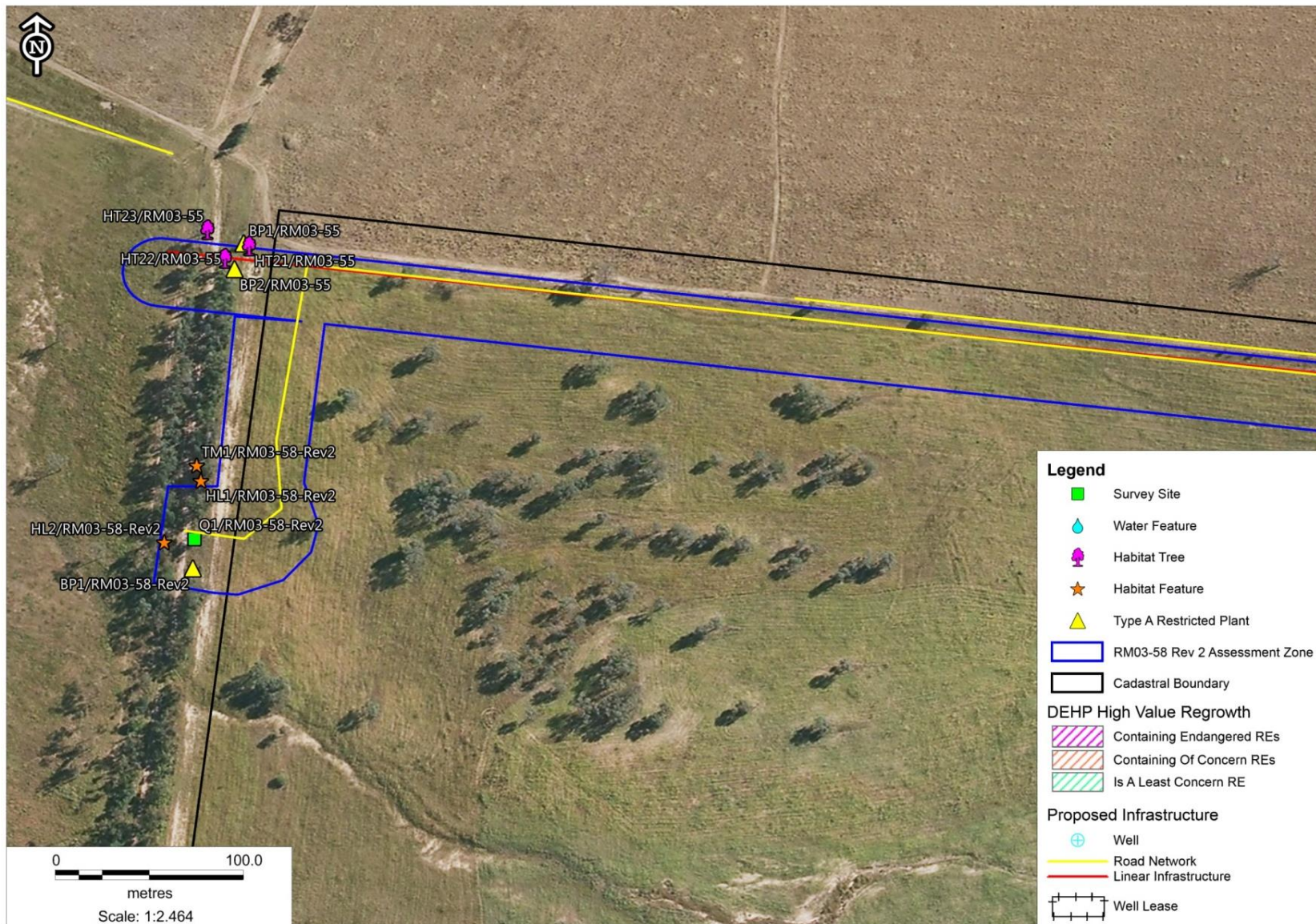


Figure 1b: Map of Zone RM03-58 (well lease and central Zone) showing survey sites and other points of interest

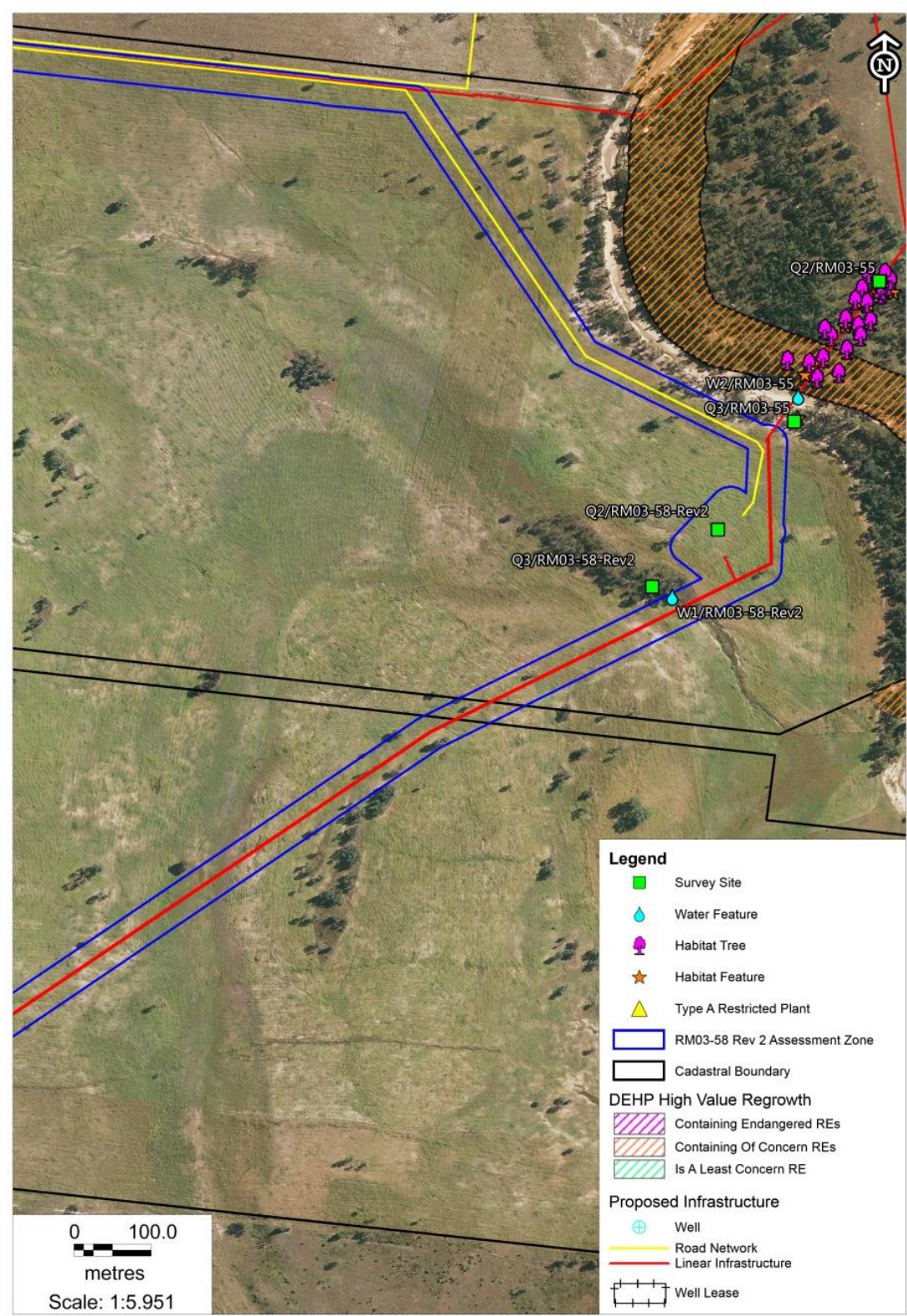


Figure 1c: Map of Zone RM03-58 (south-western end) showing survey sites and other points of interest

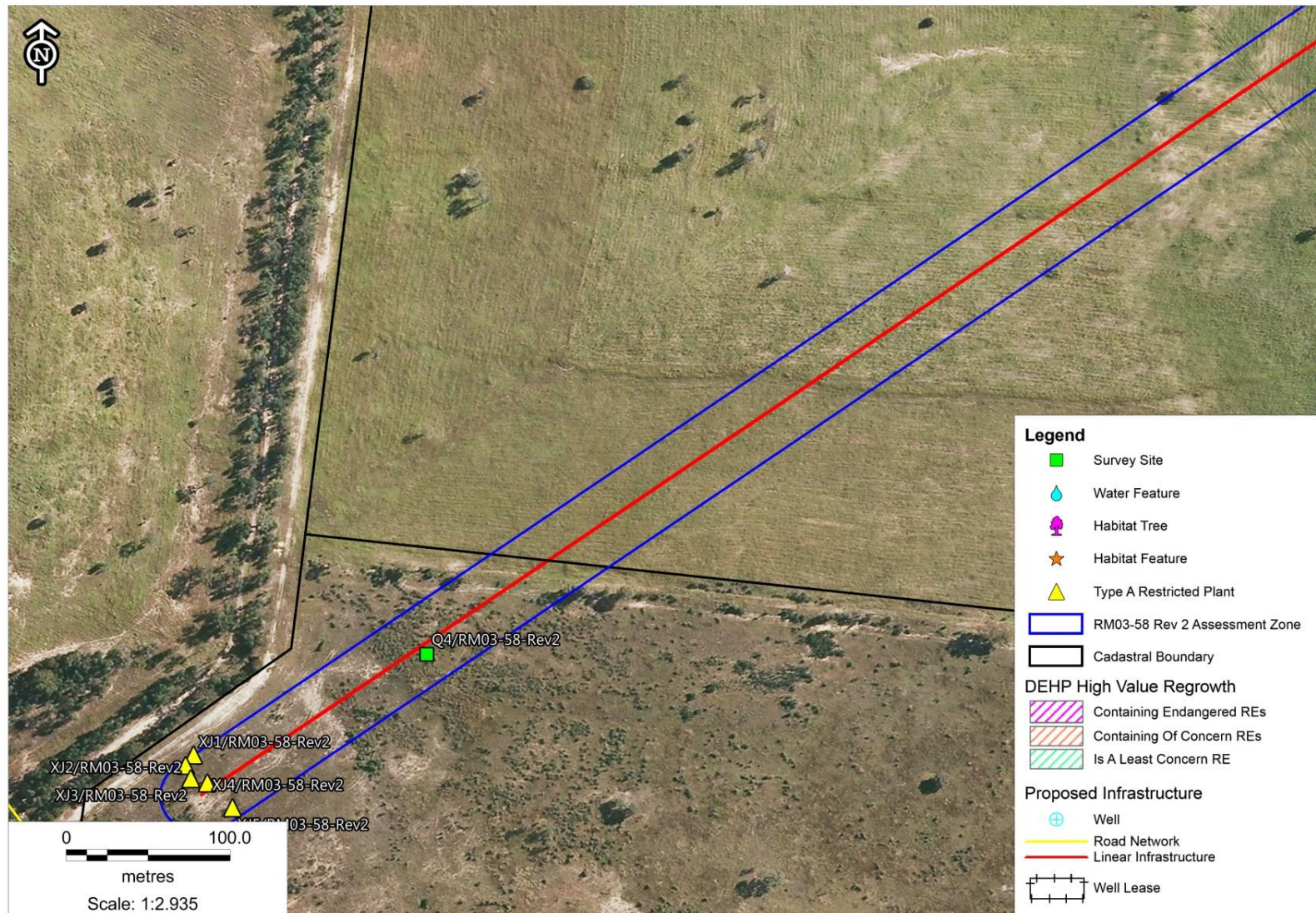




Figure 2a: Open forest (advanced regrowth) of *Eucalyptus populnea*, *E. populnea*, *Callitris glaucophylla* at site Q1-RM03-58. This vegetation is remnant RE 11.10.11.



Figure 2b: Advanced regrowth equivalent to remnant RE 11.10.11 at site Q3/RM03-55.



Figure 2c: Remnant RE 11.3.25 on the eastern bank (left) and adjacent alluvial terrace (right) of Blyth Creek.



Figure 2d: Woodland (advanced regrowth) of *Angophora floribunda*, *Eucalyptus populnea*, *E. chloroclada* at site Q3-RM03-58. This is equivalent to remnant RE 11.3.39.



Figure 3a: Grassland dominated by non-native *Chloris gayana* at site Q2-RM03-58.



Figure 3b: Shrubland of *Eucalyptus chloroclada* recruits at site Q4-RM03-58.



Figure 4a: A Kurrajong (*Brachychiton populneus*) sapling at waypoint BP1-RM03-58 (left). **Figure 4b:** Kurrajong tree at waypoint BP2/RM03-55 (right).



Figure 4c: A Kurrajong tree and sapling at waypoint BP1/RM03-55.



Figures 4d, e: Clumps of Forest Grass Trees (*Xanthorrhoea johnsonii*) at waypoint XJ1-RM03-58 (left) and waypoint XJ2-RM03-58 (right).



Figures 4f, g: Clumps of Forest Grass Trees (*Xanthorrhoea johnsonii*) at waypoint XJ3-RM03-58 (left) and waypoint XJ4-RM03-58 (right).



Figure 4h: Clump of Forest Grass Trees at waypoint XJ5-RM03-58.



Figures 5a, b: Fauna habitat trees (hollow-bearing dead *Eucalyptus melanophloia*) at waypoints HT21/RM03-55 (left) and HT22/RM03-55 (right).



Figure 5c: Fauna habitat tree (hollow-bearing dead *Eucalyptus melanophloia*) at waypoint HT23/RM03-55 (left). **Figure 5d:** Hollow log at waypoint HL1-RM03-58 (right).



Figure 5e: Pile of logs and other debris at waypoint HL2-RM03-58 (left). **Figure 5f:** An arboreal termite nest with nesting burrow present at waypoint TM1-RM03-58 (right).



Figure 6a: Blyth Creek, a stream order 5 watercourse, at waypoint W2/RM03-55 (left). **Figure 6b:** A drainage feature at waypoint W1-RM03-58 (left). Image captured looking upstream to the Zone, which has been cleared and supports pasture grasses (background).

Appendix A: Quaternary assessment results, Zone RM03-58 (including Q3/RM03-55)

Site No. Q1- RM03-5 Recorder: Richard Johnson & Jeroen Lurling Date 5/09/2013
 Purpose Mt. Hope revised infrastructure assessment Time

Locality: (inc. distance/direction to nearest town) Mt. Hope
 Zone: 55J 0706850 E 7079431 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured D – dense, M – mid dense, S – sparse, V – very sparse				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E		-		T1	C	<i>Eucalyptus melanophloia</i>
T1	12	10 - 14	M (30)	T1	C	<i>Eucalyptus populnea</i>
T2	5	3 - 6	S (10)	T1	C	<i>Callitris glaucophylla</i>
T3		-		T2	D	<i>Callitris glaucophylla</i>
S1	2	1.5 - 3.0	V (1)	T2	A	<i>Geijera parviflora</i>
S2		-		S1	D	<i>Dodonaea viscosa</i>
S3		-		G	C	<i>Cenchrus ciliaris</i> (non native)
G	0.4	0.1 - 0.6	M (80)	G	C	<i>Heteropogon contortus</i>
Structural formation: open forest						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types: course grained sedimentary
 Landform: upper slope : undulating hills
 Soils: grey-brown sandy loam
 DEHP Mapped RE Code: NR
 Observed RE Code: 11.10.11 (narrow: <75m) Landzone: 10

Vegetation Short Description

Roadside vegetation: open forest of *E. melanophloia*, *E. populnea* and *Callitris glaucophylla*. A lower tree layer dominated by *C. glaucophylla* recruits. Very sparse shrub layer. Ground layer dominated by *Cenchrus ciliaris* and *Heteropogon contortus*.

Connectivity/Patch Characteristics

narrow corridor in road reserve

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Cenchrus ciliaris (C); *Opuntia tomentosa* (C)

% Weed Cover: 20

EVNT Flora Present: None detected

EVNT Flora Likely: Nil

Field Wpt Code:

Photo Nos. BBK6 2651-2657

Additional Flora:							
<i>Brachychiton populneus</i>							
<i>Eucalyptus chloroclada</i>							
<i>Solanum parvifolium</i>							
<i>Petalostigma pubescens</i>							
<i>Psydrax oleifolia</i>							
<i>Alectryon diversifolius</i>							
<i>Cymbopogon refractus</i>							
<i>Aristida</i> sp. (infertile)							
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.							
Rocks - embedded	0	Boulders	0	Shrub layer	1	Ground cover	4
Rocks - loose	0	Fallen bark	1	Leaf litter	1	Bare ground	1
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges	0	Large logs (>30cm diameter)	1	Trees / logs bearing loose bark	1		
Underhangs /overhangs / caves	0	Logs with hollows	0	Termite mounds	1		
Small logs (<30cm diameter.)	2	Hollow bearing trees	1	Mistletoe	1		
Other							
Soil cracks	-						
Water	-						
Other (e.g. food trees):	-						
Disturbances							
road construction							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)				Structure of Woody Strata			
				Str.	Stems/ha	DBH (cm)	
Grey Butcherbird 2 SE				T1	650	18	
Torresian Crow 2 HE				T2	400	10	
Noisy Miner 1 HE				S1	160	2	
Additional Notes							

Site No. Q2- RM03-58 **Recorder:** Richard Johnson & Jeroen Lurling **Date** 5/09/2013
Purpose Mt. Hope ecology assessment **Time** 13:09

Locality:
 (inc. distance/direction to nearest town) Mt. Hope
Zone: 55J 0708148 E 7078842 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured D – dense, M – mid dense, S – sparse, V – very sparse				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s – subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E		-		G	D	<i>Chloris gayana</i> cultivar (non-native)
T1						
T2						
T3						
S1						
S2						
S3						
G	0.3	0.1 - 0.4	M (65)			
Structural formation: grassland						
Ecologically dominant layer: G						

Geology, landform, soils

Geology code and rock types: course grained sedimentary
Landform: lower slope : undulating hills
Soils: light brown sandy loam
DEHP Mapped RE Code: NR
Observed RE Code: NR **Landzone:** 10

Vegetation Short Description

Derived grassland dominated by *Chloris gayana* cultivar

Connectivity/Patch Characteristics

cleared

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Chloris gayana (C); *Sorghum* sp. (R); *Glandularia aristigera* (C); *Opuntia stricta* (U)

% Weed Cover: 60

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code:

Photo Nos. BBK6 2673-2675

Additional Flora:							
<i>Themeda avenacea</i>							
<i>Wahlenbergia</i> sp.							
<i>Swainsonia</i> sp.							
<i>Lomandra</i> sp.							
<i>Eragrostis</i> sp.							
<i>Podolepis longipedata</i>							
<i>Chrysocephalum apiculatum</i>							
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.							
Rocks - embedded	0	Boulders	0	Shrub layer	0	Ground cover	3
Rocks - loose	0	Fallen bark	0	Leaf litter	0	Bare ground	2
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges	0	Large logs (>30cm diameter)	0	Trees / logs bearing loose bark	0		
Underhangs /overhangs / caves	0	Logs with hollows	0	Termite mounds	0		
Small logs (<30cm diameter.)	1	Hollow bearing trees	0	Mistletoe	0		
Other							
Soil cracks	-						
Water	-						
Other (e.g. food trees):	-						
Disturbances							
Cultivation - sowing exotic pasture grass (current)							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)				Structure of Woody Strata			
				Str.	Stems/ha	DBH (cm)	
Nil							
Additional Notes							

Site No.	Q3- RM03-58	Recorder:	Richard Johnson & Jeroen Lurling	Date	5/09/2013
Purpose	Mt. Hope ecology assessment			Time	13:34

Locality:
(inc. distance/direction to nearest town) Mt. Hope

Zone: 55J 0708062 E 7078762 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured <i>D</i> – dense, <i>M</i> – mid dense, <i>S</i> – sparse, <i>V</i> – very sparse				Record relative (numerical) dominance for each stratum; <i>d</i> – dominant; <i>c</i> – codominant; <i>s</i> - subdominant, <i>a</i> – associated		
Stratum	Median height	Height interval	Est. cover density (^{D,M,S,V} %)	Str.	Rel. dom.	Scientific Name
E		-		T1	D	<i>Angophora floribunda</i>
T1	12	11 - 14	S (20)	T1	S	<i>Eucalyptus populnea</i>
T2	5	4 - 7	V (<5)	T1	S	<i>Eucalyptus chloroclada</i>
T3		-		T2	D	<i>Callitris glaucophylla</i>
S1	1.0	0.6 - 2.0	S (8)	S1	D	<i>A. floribunda</i> (recruits)
S2		-		G	D	<i>Bothriochloa bladhii</i>
S3		-				
G	0.5	0.1 - 0.6	M (75)			
Structural formation: woodland						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types:	alluvium
Landform:	Drainage line in undulating hills
Soils:	grey clay loam with some surface sand
DEHP Mapped RE Code:	NR
Observed RE Code: old regrowth = RE 11.3.39	Landzone: 10
Vegetation Short Description	
Woodland of <i>Angophora floribunda</i> with <i>Eucalyptus populnea</i> , <i>E. chloroclada</i> ; sparse lower tree layer of <i>Callitris glaucophylla</i> ; grassy ground layer dominated by <i>Bothriochloa bladhii</i>	
Connectivity/Patch Characteristics	
isolated small patch	
Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed) <i>Opuntia tomentosa</i> (R); <i>Sida rhombifolia</i> (R); <i>Opuntia stricta</i> (R)	
% Weed Cover:	
EVNT Flora Present:	
EVNT Flora Likely:	
Field Wpt Code:	
Photo Nos.	BBK6 2676-2682

Additional Flora:							
<i>Lomandra longifolia</i>							
<i>Nymphoides crenata</i>							
<i>Acacia salicina</i>							
<i>Imperata cylindrica</i>							
<i>Themeda triandra</i>							
<i>Arundinella nepalensis</i>							
<i>Heteropogon contortus</i>							
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.							
Rocks - embedded	0	Boulders	0	Shrub layer	1	Ground cover	4
Rocks - loose	0	Fallen bark	1	Leaf litter	1	Bare ground	1
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges	0	Large logs (>30cm diameter)	3	Trees / logs bearing loose bark	0		
Underhangs /overhangs / caves	0	Logs with hollows	1	Termite mounds	0		
Small logs (<30cm diameter.)	2	Hollow bearing trees	0	Mistletoe	0		
Other							
Soil cracks	-						
Water	Nil but probably present seasonally						
Other (e.g. food trees):	-						
Disturbances							
Historical clearing > 20 years ago							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)				Structure of Woody Strata			
				Str.	Stems/ha	DBH (cm)	
Noisy Miner 1 SE				T1	560	22	
Australian Magpie 1 SE				T2	16	14	
Galah 1 HE							
Torresian Crow 1 HE							
Additional Notes							

Site No.	Q4- RM03-5	Recorder:	Richard Johnson & Jeroen Lurling	Date	5/09/2013
Purpose	Mt. Hope ecology assessment			Time	15:00

Locality:
(inc. distance/direction to nearest town) Mt. Hope

Zone: 55J 0706862 E 7077890 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured <i>D</i> – dense, <i>M</i> – mid dense, <i>S</i> – sparse, <i>V</i> – very sparse				Record relative (numerical) dominance for each stratum; <i>d</i> – dominant; <i>c</i> – codominant; <i>s</i> - subdominant, <i>a</i> – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E		-		S1	D	<i>Eucalyptus chloroclada</i>
T1		-		G1	D	<i>Heteropogon contortus</i>
T2		-		G1	S	<i>Themeda triandra</i>
T3		-		G1	S	<i>Leptochloa decipiens</i>
S1	1.8	1.2 - 2.5	M (50)			
S2		-				
S3		-				
G	0.3	0.1 - 0.5	M (65)			
Structural formation: shrubland						
Ecologically dominant layer: S1						

Geology, landform, soils	
Geology code and rock types:	coarse-grained sedimentary
Landform:	mid slope - undulating hills
Soils:	light brown sandy loam
DEHP Mapped RE Code:	NR
Observed RE Code: NR (young regrowth)	Landzone: 10
Vegetation Short Description	
Shrubland of <i>Eucalyptus chloroclada</i> recruits	
Connectivity/Patch Characteristics	
Connects to road reserve vegetation	
Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed) Nil	
% Weed Cover:	
EVNT Flora Present:	
EVNT Flora Likely:	
Field Wpt Code:	
Photo Nos.	BBK6 2686-2688

Site No. Q2/RM03-55 **Recorder:** Rosamund Aisthorpe, Angela Bendall, David Chemello **Date** 01/05/2013
Purpose Mt Hope reinspection (MD) **Time** 1145

Locality:
 (inc. distance/direction to nearest town) "Mt Hope"
Zone: 55J 0708361 E 7079194 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Eucalyptus tereticornis</i>
T1	23	15 - 30	M (35)	T1	S	<i>Angophora floribunda</i>
T2	10	8 - 12	M (35)	T1	A	<i>E. populnea</i>
T3	5.5	5 - 6	S (10)	T2	A	<i>E. tereticornis</i>
S1				T2	A	<i>A. floribunda</i>
S2				T2	D	<i>E. populnea</i>
S3				T3	D	<i>Callitris glaucophylla</i>
G	0.5	0.1 - 0.1	D (85)	G	S	<i>Austrostipa verticillata</i>
Structural formation: Woodland				G	A	<i>Lomandra longifolia</i>
Ecologically dominant layer: T1				G	D	<i>Chloris ventricosa</i>
				G	A	<i>Cenchrus ciliaris</i>
				G	A	<i>Themeda avenacea</i>

Geology, landform, soils

Geology code and rock types: Alluvium
Landform: Alluvial levee
Soils: Dark brown clay loam
DEHP Mapped RE Code: HVR - containing of concern REs (confined to creek channel)
Observed RE Code: 11.3.25 **Landzone:** 3

Vegetation Short Description

Eucalyptus tereticornis and *Angophora floribunda* woodland with associated *E. populnea*; midlayer composed of *E. tereticornis*, *A. floribunda*, *E. populnea* and *Callitris glaucophylla* recruits; grassy ground layer composed of *Chloris ventricosa*, *Austrostipa verticillata*, *Themeda avenacea*, *Cenchrus ciliaris* and *Lomandra longifolia*

Connectivity/Patch Characteristics

Riparian corridor adjoined by cleared paddock to west and east

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common (= >50 plants observed)
Opuntia tomentosa (R), *Opuntia stricta* (R), *Cenchrus ciliaris* (C), *Glandularia aristigera* (R), *Megathyrsus maximus* (C), *Melinis repens* (R), *Froelichia floridana* (R)

% Weed Cover: <5%

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code: Nil

Photo Nos. BBK6 1273-1284

Additional Flora:							
<i>Arundinella nepalensis</i>				<i>Eulalia aurea</i>			
<i>Brachychiton populneus</i>				<i>Acacia excelsa</i>			
<i>Cymbidium canaliculatum</i>				<i>Ajuga australis</i>			
<i>Sporobolus</i> sp.							
<i>Wahlenbergia</i> sp.							
<i>Vittadinia dissecta</i>							
<i>Themeda triandra</i>							
<i>Digitaria brownii</i>							
<i>Dichondra repens</i>							
<i>Eragrostis</i> sp.							
<i>Heteropogon contortus</i>							
<i>Cymbopogon refractus</i>							
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.							
Rocks - embedded	0	Boulders	0	Shrub layer	1	Ground cover	4
Rocks - loose	0	Fallen bark	1	Leaf litter	1	Bare ground	1
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges	0	Large logs (>30cm diameter)	1	Trees / logs bearing loose bark	2		
Underhangs /overhangs / caves	0	Logs with hollows	1	Termite mounds	0		
Small logs (<30cm diameter.)	2	Hollow bearing trees	2	Mistletoe	0		
Other							
Soil cracks	-						
Water	Ephemeral water hole/lagoon (100m offsite)						
Other (e.g. food trees):	-						
Disturbances							
Grazing (moderate, <1 year)							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)				Structure of Woody Strata			
				Str.	Stems/ha	DBH (cm)	
Galah (4 SE and HE onsite)				T1	100	67	
Grey Butcherbird (1 HE offsite)				T2	120	15	
Striated Pardalote (1 HE offsite)				T3	66	12	
Cockatiel (1 HE FO)							
Pale-headed Rosella (2 HE onsite)							
Magpie-lark (1 HE onsite)							
Eastern Grey Kangaroo (2 SE offsite)							
Apostlebird (10 SE and HE offsite)							
Noisy Miner (2 SE and HE onsite)							
Torresian Crow (2 HE offsite)							
Meadow Argus (2 SE onsite)							
Lesser Wanderer (4 SE onsite)							
Additional Notes							
EVNT Fauna Likely - Yakka Skink, Little Pied Bat, South-eastern Long-eared Bat							

Site No. Q3/RM03-55 Recorder: Rosamund Aisthorpe, Angela Bendall Date 07/05/2013
 Purpose Mt Hope well zone reinspection Time 1150

Locality: "Mt Hope"
 (inc. distance/direction to nearest town)

Zone: 55J 0708249 E 7078995 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	C	<i>Eucalyptus melanophloia</i>
T1	12	10 - 14	M (40)	T1	C	<i>Eucalyptus populnea</i>
T2	5	3 - 8	m (50)	T2	C	<i>Allocasuarina luehmannii</i>
T3				T2	C	<i>Callitris glaucophylla</i>
S1				G	D	<i>Dichanthium sericeum</i>
S2				G	A	<i>Sporobolus</i> sp.
S3				G	A	<i>Themeda triandra</i>
G	0.3	0.1 - 0.5	M (40)			
Structural formation: Woodland						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types: Coarse-grained sedimentary rocks
 Landform: Low undulating hills (slope above creek channel)
 Soils: Pale brown clay loam
 DEHP Mapped RE Code: HVR - containing of concern REs
 Observed RE Code: 11.10.11 Landzone: 10

Vegetation Short Description

Eucalyptus melanophloia and *Eucalyptus populnea* woodland; midlayer dominated by *Allocasuarina luehmannii* and *Callitris glaucophylla*; ground layer composed of *Dichanthium sericeum*, *Sporobolus* sp. and *Themeda triandra*.

Connectivity/Patch Characteristics

Adjoins riparian corridor to north; cultivated (cleared and blade-ploughed) paddock to south

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common (= >50 plants observed)
Cenchrus ciliaris (R) *Opuntia tomentosa* (R) *Melinis repens* (R) *Opuntia stricta* (R)

% Weed Cover: <5%

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code:		Nil					
Photo Nos.		BBK6 1429 - 1440					
Additional Flora:							
<i>Acacia decora</i>							
<i>Acacia salicina</i>							
<i>Acacia excelsa</i>							
<i>Eremophila mitchellii</i>							
<i>Psyrax oleifolia</i>							
<i>Brunoniella australis</i>							
<i>Alternanthera nana</i>							
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.							
Rocks - embedded	0	Boulders	0	Shrub layer	2	Ground cover	2
Rocks - loose	0	Fallen bark	0	Leaf litter	1	Bare ground	2
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges	0	Large logs (>30cm diameter)	1	Trees / logs bearing loose bark	0		
Underhangs /overhangs / caves	0	Logs with hollows	1	Termite mounds	0		
Small logs (<30cm diameter.)	1	Hollow bearing trees	0	Mistletoe	0		
Other							
Soil cracks	Nil						
Water	Blyth Creek adjoins to north (W2/RM03-55); no water present						
Other (e.g. food trees):	2 x Grey-crowned Babbler nests in <i>Callitris glaucophylla</i>						
Disturbances							
Erosion; severe; 1-5 years							
Mechanical clearing; severe; 10-15 years (adjoining paddock)							
Grazing; minimal; <1 year							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)			Structure of Woody Strata				
			Str.	Stems/ha	DBH (cm)		
Grey-crowned Babbler (3 x SE & HE off site)			T1	140	19		
Budgerigar (1 x HE calling in distance)			T2	330	5		
Additional Notes							

Appendix B: Plant species list, Zone RM03-58

Key: * indicates non-native plant species

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	Q4	Other
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet	LC						x
Amaranthaceae	<i>Alternanthera nana</i>	Hairy Joyweed	LC						x
Amaranthaceae	<i>Froelichia floridana</i> *	Cottontails	-						x
Asteraceae	<i>Chrysocephalum apiculatum</i>	Yellow Buttons	LC			x			
Asteraceae	<i>Podolepis longipedata</i>	Tall Copper-wire Daisy	LC			x			
Asteraceae	<i>Vittadinia dissecta</i>	New Holland Daisy	LC						x
Cactaceae	<i>Opuntia stricta</i> *	Common Pest Pear	-			x	x		x
Cactaceae	<i>Opuntia tomentosa</i> *	Velvety Pest Pear	-		x		x		x
Campanulaceae	<i>Wahlenbergia</i> sp. (indet.)	A Bluebell	LC			x			x
Casuarinaceae	<i>Allocasuarina luehmannii</i>	Bullock	LC						x
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	LC						x
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC		x		x		x
Fabaceae	<i>Swainsona</i> sp. (indet.)	A Pea	LC			x			
Lamiaceae	<i>Ajuga australis</i>	Austral Bugle	LC						x
Laxmanniaceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	LC				x		x
Laxmanniaceae	<i>Lomandra</i> sp. (infertile)	A Mat-rush	LC			x			
Malvaceae	<i>Sida rhombifolia</i> *	Paddy's Lucerne	-				x		
Menyanthaceae	<i>Nymphoides crenata</i>	Yellow-fringed Water-flower	LC				x		
Mimosaceae	<i>Acacia decora</i>	Pretty Wattle	LC						x
Mimosaceae	<i>Acacia excelsa</i>	Ironwood	LC						x
Mimosaceae	<i>Acacia omalophylla</i>	Yarran	LC						x
Mimosaceae	<i>Acacia salicina</i>	Doolan, Sally Wattle	LC				x		x
Myoporaceae	<i>Eremophila mitchellii</i>	False Sandalwood	LC						x

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	Q4	Other
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	LC				x		x
Myrtaceae	<i>Eucalyptus chloroclada</i>	Baradine Red Gum	LC		x		x	x	
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	LC		x				x
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		x		x		x
Myrtaceae	<i>Eucalyptus tereticornis</i>	Queensland Blue Gum	LC						x
Orchidaceae	<i>Cymbidium canaliculatum</i>	Black Orchid	LC/TAR						x
Picrodendraceae	<i>Petalostigma pubescens</i>	Quinine Tree	LC		x				
Poaceae	<i>Aristida</i> sp. (infertile)	A Wiregrass	LC		x				
Poaceae	<i>Arundinella nepalensis</i>	Reedgrass	LC				x		x
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo Grass	LC						x
Poaceae	<i>Bothriochloa bladhii</i>	Forest Blue Grass	LC				x		
Poaceae	<i>Cenchrus ciliaris</i> *	Buffel Grass	-		x				x
Poaceae	<i>Chloris gayana</i> *	Rhodes Grass	-			x			
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	LC						x
Poaceae	<i>Cymbopogon refractus</i>	Barbed-wire Grass	LC		x				x
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	LC						x
Poaceae	<i>Digitaria brownii</i>	Cotton Panic	LC						x
Poaceae	<i>Eragrostis</i> sp. (indet.)	A Lovegrass	LC			x		x	x
Poaceae	<i>Heteropogon contortus</i>	Black Speargrass	LC		x		x	x	x
Poaceae	<i>Imperata cylindrica</i>	Blady Grass	LC				x		
Poaceae	<i>Leptochloa decipiens</i>	Canegrass	LC					x	
Poaceae	<i>Megathyrsus maximus</i> *	Green Panic	-						x
Poaceae	<i>Melinis repens</i> *	Red Natal grass	-						x
Poaceae	<i>Sorghum</i> sp. (infertile)*	A Grass	-			x			
Poaceae	<i>Sporobolus</i> sp. (indet.)	A Grass	LC						x

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	Q4	Other
Poaceae	<i>Themeda avenacea</i>	Tall Oat Grass	LC			x			x
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass	LC				x	x	x
Rubiaceae	<i>Psyrax oleifolia</i>	Myrtle	LC		x				x
Rutaceae	<i>Geijera parviflora</i>	Wilga	LC		x		x		
Sapindaceae	<i>Alectryon diversifolius</i>	Scrub Boonaree	LC		x				
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky Hop-bush	LC		x				
Sterculiaceae	<i>Brachychiton populneus</i>	Kurrajong	LC/TAR		x				x
Verbenaceae	<i>Glandularia aristigera*</i>	Mayne's Pest	-			x			x
Xanthorrhoeaceae	<i>Xanthorrhoea johnsonii</i>	Forest Grass Tree	LC/TAR						x

Well Lease Area/ Infrastructure Zone Assessment Report: Mt Hope Zone RM03-49

Compiled by Boobook for Santos

Boobook
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

Revision	Date	Description	Author	Verifier	Approved
A	21/2/2013	Draft issued to client for review	RJ	CE	CE
B	13/6/2013	Draft incorporating amended zone	RA	CE	CE
C	8/7/2013	Draft incorporating client comments	RA, RJ	RJ, CE	CE
0	23/7/2013	Final version	RJ		RJ

1. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DSEWPac	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
TAR plant	Type A Restricted Plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

2. Introduction

2.1 Purpose & Scope

Boobook was commissioned by Santos to undertake ecological assessments on a number of well leases and infrastructure zones (hereafter individually referred to as the Zone) located on the property 'Mt Hope', located about 40km north-east of Roma, south central Queensland. Boobook was requested to undertake the following:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation present within the Zone;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the assessment site;
- Comment on the nature and location of wetlands and watercourses within 100m of the Zone;
- Provide location and description of any plants of conservation concern listed in the NC Act or EPBC Act;
- Location and characteristics of any type A restricted (TAR) plants (NC Act) in the Zone; and
- Location and characteristics of habitat trees in the Zone, with reference to trees previously mapped by Santos.

An individual report was to be prepared for each Zone. This report refers to Zone RM03-49 located on Lot 80 on Plan WV763. Subsequent to initial field survey, observations indicated the current DEHP mapping differed to vegetation observed within the Zone and at the request of Santos, a map of ground-truthed REs for the Zone is provided in this report.

Changes to the boundaries of this Zone were made by Santos following completion of the ecological assessment described in this report for the Zone (Figure 1a and 1b). Modifications of this infrastructure Zone were considered to involve areas where the ecological values were not previously assessed on-site or nearby and required an additional field inspection. The results of this inspection have been included with the original findings of this report.

2.2 Survey Team

The project supervisor (Craig Eddie) was approved by 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.

The field survey described by this report was undertaken by Boobook on 22nd January 2013 and was conducted by Rosamund Aisthorpe (Graduate Botanist) and Angela Bendall (Field Assistant). The additional field survey was conducted on 1st May 2013 by Rosamund Aisthorpe, Angela Bendall and David Chemello (Fauna Spotter/ Field Assistant). The following report was compiled by Rosamund Aisthorpe and Richard Johnson. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie (Principal Ecologist and Project Supervisor). Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A comprehensive desktop search was not required by the client for the purposes of this report. However, a desktop search was undertaken for REs at the property scale using mapping version 6.1 (DEHP 2013a). This dataset provides a baseline for subsequent field assessment.

The search was conducted using a 5km buffer around the coordinate -26.3558°S, 149.0847°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative site was selected for each RE present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Figure 1a and 1b. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all GPS co-ordinates quoted within this report is GDA94. When referred to within this report the sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2012: Table 29);
4. RE type mapped;
5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;
9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;

11. presence of EVNT flora;
12. a list of all other flora encountered at the Site; and
13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2012) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

A search was made within the Zone for TAR plants: If found, the location was established with a hand-held GPS unit and the species, height, DBH and possible management options were recorded.

Where mapping supplied by Santos indicated the presence of habitat trees, a search was made for these. If found the location was established with a hand-held GPS unit and the species, height, DBH and habitat value(s) were recorded. In some instances unmapped habitat trees were located during the site survey and data was collected for these trees also.

The presence of any wetlands or watercourses within 100m of the Zone was recorded.

Representative photographs were taken at each quaternary survey site in the Zone, as well as at any wetlands or watercourses, habitat trees or TAR plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

At its western end the Zone intersects two mapped remnant polygons: a mixed polygon containing RE 11.10.11/ 11.9.10 (70%/ 30%) which is adjoined by a RE 11.10.11 polygon (DEHP 2013a). An additional RE 11.10.11/ 11.9.10 (70%/ 30%) polygon (DEHP 2013a) occurs within the Zone along the southwest boundary of the well lease. These are described in Table 2 and mapped in Figure 1a and 1b.

Table 2: Remnant REs mapped in Zone RM03-49

RE Code	Vegetation Management Class	Biodiversity Status	Short Description*
11.9.10	Of Concern	Endangered	<i>Eucalyptus populnea</i> , <i>Acacia harpophylla</i> open-forest on fine-grained sedimentary rocks
11.10.11	Not Of Concern	No Concern At Present	<i>Eucalyptus populnea</i> , <i>E. melanophloia</i> +/- <i>Callitris glaucophylla</i> woodland on coarse-grained sedimentary rocks

* Short description as per Regional Ecosystem Description Database (REDD), Department of Environment and Heritage Protection, Queensland Government (DEHP 2013b).

4.1.2 Regional Ecosystems Observed

An ecotone between Poplar Box (*Eucalyptus populnea*) and False Sandalwood (*Eremophila mitchellii*) woodland and Silver-leaved Ironbark (*E. melanophloia*) and White Cypress Pine (*Callitris glaucophylla*) woodland was observed in the Zone at survey site Q1/RM03-49. Currently the vegetation at this location is mapped as RE 11.10.11/ 11.9.10 (DEHP 2013a). Field observations indicate that within the study site a boundary exists between RE 11.10.11 (no concern at present) and 11.9.7 (of concern). RE 11.9.7 is described as: Poplar Box (*E. populnea*), False Sandalwood (*E. mitchellii*) shrubby woodland on fine-grained sedimentary rocks. The extent of this RE within the Zone is mapped (Figure 2).

To the north of survey site Q1/RM03-49, the vegetation observed at survey site Q3/RM03-49 was composed of Silver-leaved Ironbark (*E. melanophloia*), Poplar Box (*E. populnea*) and White Cypress Pine (*C. glaucophylla*) woodland which conformed to current mapping of RE 11.10.11.

The floristics and structure of the dominant species in each woody stratum of these survey sites are given in Table 3. Mapping of observed REs is provided in Figure 2. Representative images of the survey sites are shown at Figure 3a and 3b.

Two small patches of remnant vegetation were observed beside the southwest boundary of the well lease. This vegetation was similar to that recorded at survey site Q3/RM03-49. The patches are currently mapped within a polygon identified as RE 11.10.11/ 11.9.10 (DEHP 2013a), however no evidence of RE 11.9.10 was observed, thus they have been mapped in Figure 2 as RE 11.10.11. The current areas of these patches are about 0.18ha and 0.05ha: these are less than the remnant vegetation threshold for DEHP RE mapping at 1:100,000 scale (Neldner *et. al.* 2012). It is included in Table 3 to flag its presence, should it be considered desirable to manage impacts on the patches.

Table 3: Floristics and Structure of Remnant Ecosystems at Survey Sites in Zone RM03-49

Site	Location	Vegetation Description		
Q1/RM03-49	55J 709380E 7080442N	<i>Eucalyptus populnea</i> woodland with associated <i>E. melanophloia</i> ; mid-layer composed of canopy recruits and <i>Callitris glaucophylla</i> or <i>Eremophila mitchellii</i> ; grassy ground layer dominated by native perennial grasses.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	16	40	416	18
T2	6	60	656	7
Site	Location	Vegetation Description		

Site	Location	Vegetation Description		
Q3/RM03-49	55J 709365E 7080849N	<i>Eucalyptus melanophloia</i> and <i>E. populnea</i> woodland; mid-dense low tree layer of <i>Callitris glaucophylla</i> ; grassy ground layer dominated by <i>Eragrostis</i> spp. and <i>Aristida caput-medusae</i> .		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	14	20	32	28
T2	8	70	720	7

4.1.3 Threatened Ecological Communities Observed

No threatened ecological communities (TECs) were observed in the Zone.

4.1.4 Non-remnant Vegetation Observed

The Zone is in part vegetated by a shrubland of regrowth that has occurred after mechanical disturbance (pulling) of regrowth from earlier clearing event(s) (see Appendix A). This was sampled at survey site Q2/RM03-49. The floristics and structure of the dominant species in each woody stratum at the survey site is shown in Table 4. Representative images of the survey site are shown at Figure 4.

Table 4: Floristics and Structure of Vegetation at Survey Sites in Zone RM03-49

Site	Location	Vegetation Description		
Q2/RM09-49	55J 709740E 7080441N	Shrubland (regrowth) of <i>Eucalyptus populnea</i> and <i>Callitris glaucophylla</i> ; ground layer dominated by <i>Aristida</i> sp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
S1	1.5	10	140	2

4.2 Additional Observations

4.2.1 Additional Flora Species

Approximately 36 species of native flora were detected (Appendix B). In addition, nine non-native species were recorded. Three of these, Tiger Pear (*Opuntia aurantiaca*), Common Pest Pear (*O. stricta*) and Velvety Tree Pear (*O. tomentosa*), are declared class 2 weeds scheduled under the *Land Protection (Pest and Stock Route Management) Regulation 2003* and Weeds of National Significance (WoNS).

4.2.2 Type A Restricted Plants

No TAR plants were detected within the Zone.

4.2.3 Fauna Habitat Features

Thirty-two hollow-bearing potential fauna habitat trees were detected within or immediately adjacent to the Zone. One log pile was recorded at HF1/RM03-49 within the Zone. Location and details of these trees are shown in Table 5 and Figures 5a - 5ae. No other significant fauna habitat features were detected in the Zone.

Table 5: Details of Fauna Habitat Features, Zone RM03-49

Waypoint	Location	Species	Alive/ dead	DBH (cm)	Height (m)	Habitat features
HT1/RM03-49	55J 709327E 7080424N	<i>Eucalyptus populnea</i>	Alive	36	15	4 hollows 10cm diam.; 1 hollow 10-30cm diam.
HT2/RM03-49	55J 709330E 7080427N	<i>Eucalyptus populnea</i>	alive	38	9	1 hollow 10-30cm diam.
HT3/RM03-49	55J 709344E 7080440N	Unknown	Dead	48	12	3 hollows <10cm diam.; 3 hollows 10-30cm diam.; 10% loose bark
HT4/RM03-49	55J 709326E 7080471N	<i>Eucalyptus melanophloia</i>	Alive	95	20	6 hollows 10-30cm diam.; 1 hollow >30cm diam.; double trunk with hollow at base
HT5/RM03-49	55J 709351E 7080470N	Unknown	Dead	24	10	2 hollows 10-30cm diam.
HT6/RM03-49	55J 709358E 7080465N	<i>Eucalyptus melanophloia</i>	Alive	43	25	2 hollows 10-30cm diam.; 1 hollow >30cm diam.
HT7/RM03-49	55J 709362E 7080470N	<i>Eucalyptus melanophloia</i>	dead	27	10	3 hollows 10-30cm diam.; minimal loose bark at base
HT8/RM03-49	55J 709365E 7080453N	Unknown	dead	38	8	1 hollow >30cm diam.
HT9/RM03-49	55J 709378E 7080465N	Unknown	dead	29	12	3 hollows <10cm diam.
HT10/RM03-49	55J 709382E 7080444N	<i>Eucalyptus populnea</i>	alive	145	15	2 hollows <10cm diam.; 7 hollows 10-30cm diam.; 3 hollows >30cm diam.
HT11/RM03-49	55J 709403E 7080452 N	Unknown	dead	52	12	6 hollows 10-30cm diam.
HT12/RM03-49	55J 709412E 7080449N	Unknown	dead	38	12	7 hollows <10cm diam.
HT13/RM03-49	55J 709401E 7080492N	Unknown	dead	48	18	3 hollows <10cm diam.; 4 hollows 10-30cm diam.
HT14/RM03-49	55J 709423E 7080441N	Unknown	dead	44	12	6 hollows <10cm diam.
HT15/RM03-49	55J 709460E 7080463N	<i>Eucalyptus melanophloia</i>	dead	60	10	1 hollow <10cm diam.; 1 hollow 10-30cm diam.; 1 hollow >30cm diam.; 10% loose bark
HT16/RM03-49	55J 709461E 7080465N	<i>Eucalyptus populnea</i>	alive	52	12	2 hollows 10-30cm diam.
HT17/RM03-49	55 J 709318E 7080518N	<i>Eucalyptus</i> sp.	dead	35	10	2 hollows <10cm diam.; nil loose bark
HT18/RM03-49	55 J 709323E 7080532N	<i>Eucalyptus populnea</i>	alive	40	12	3 hollows <10cm diam.; nil loose bark
HT19/RM03-49	55 J 709332E 7080506N	<i>Eucalyptus populnea</i>	alive	30	12	2 hollows <10cm diam.; nil loose bark

Waypoint	Location	Species	Alive/dead	DBH (cm)	Height (m)	Habitat features
HT20/RM03-49	55 J 709329E 7080503N	<i>Eucalyptus populnea</i>	alive	25	10	1 hollow <10cm diam.; 1 hollow 10-30cm diam.; nil loose bark
HT21/RM03-49	55 J 709328E 7080489N	<i>Eucalyptus</i> sp.	dead	30	10	1 hollow <10cm diam.; 1 hollow 10-30cm diam.; nil loose bark
HT22/RM03-49	55 J 709357E 7080492N	<i>Eucalyptus</i> sp.	dead	30	8	1 hollow <10cm diam.; 1 hollow 10-30cm diam.; nil loose bark
HT23/RM03-49	55 J 709371E 7080495N	<i>Eucalyptus melanophloia</i>	alive	45	8	Main stem broken off, new growth from break; 1 hollow 10-30cm diam.; nil loose bark
HT24/RM03-49	55 J 709347E 7080528N	<i>Eucalyptus populnea</i>	alive	30	12	2 hollows <10cm diam.; nil loose bark
HT25/RM03-49	55 J 709361E 7080546N	<i>Eucalyptus melanophloia</i>	dead	40	10	3 hollows <10cm diam.; 15% loose bark
HT26/RM03-49	55 J 709383E 7080556N	<i>Eucalyptus melanophloia</i>	alive	50	15	Multi-stemmed; 1 hollow <10cm diam.; 1 hollow 10-30cm diam.; nil loose bark
HT27/RM03-49	55 J 709381E 7080533N	<i>Eucalyptus</i> sp.	dead	35	12	2 hollows <10cm diam.; nil loose bark
HT28/RM03-49	55 J 709376E 7080531N	<i>Eucalyptus melanophloia</i>	alive	45	18	2 hollows <10cm diam.; 1 hollow >30cm diam.; nil loose bark
HT29/RM03-49	55 J 709394E 7080523N	<i>Eucalyptus melanophloia</i>	dead	40	12	3 hollows <10cm diam.; 2 hollows 10-30cm diam.; nil loose bark
HT29/RM03-49	55 J 709394E 7080523N	<i>Eucalyptus melanophloia</i>	dead	35	10	1 hollow 10-30cm diam.; <5% loose bark
HT30/RM03-49	55 J 709644E 7080446N	<i>Eucalyptus melanophloia</i>	alive	60	15	3 hollows <10cm diam.; 2 hollows 10-30cm diam.; nil loose bark
HT31/RM03-49	55 J 709666E 7080427N	<i>Eucalyptus melanophloia</i>	alive	35	15	2 hollows <10cm diam.; nil loose bark
HF1/RM03-49	55 J 709405E 7080500N	N/A	N/A	N/A	N/A	20m long pile of logs and debris; 3 hollows 10-30cm diam.

4.2.4 Wetlands and Watercourses

No watercourses or drainage features as defined by the *Water Act 2000* were observed at or within 100m of the Zone. No wetlands as defined by the Queensland Wetland Program (DERM 2011) as used in Santos Environmental Authority (Schedules C, M) were observed at or within 100m of the Zone.

5. References

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<http://www.ehp.qld.gov.au/ecosystems/biodiversity/regional-ecosystems/index.php>

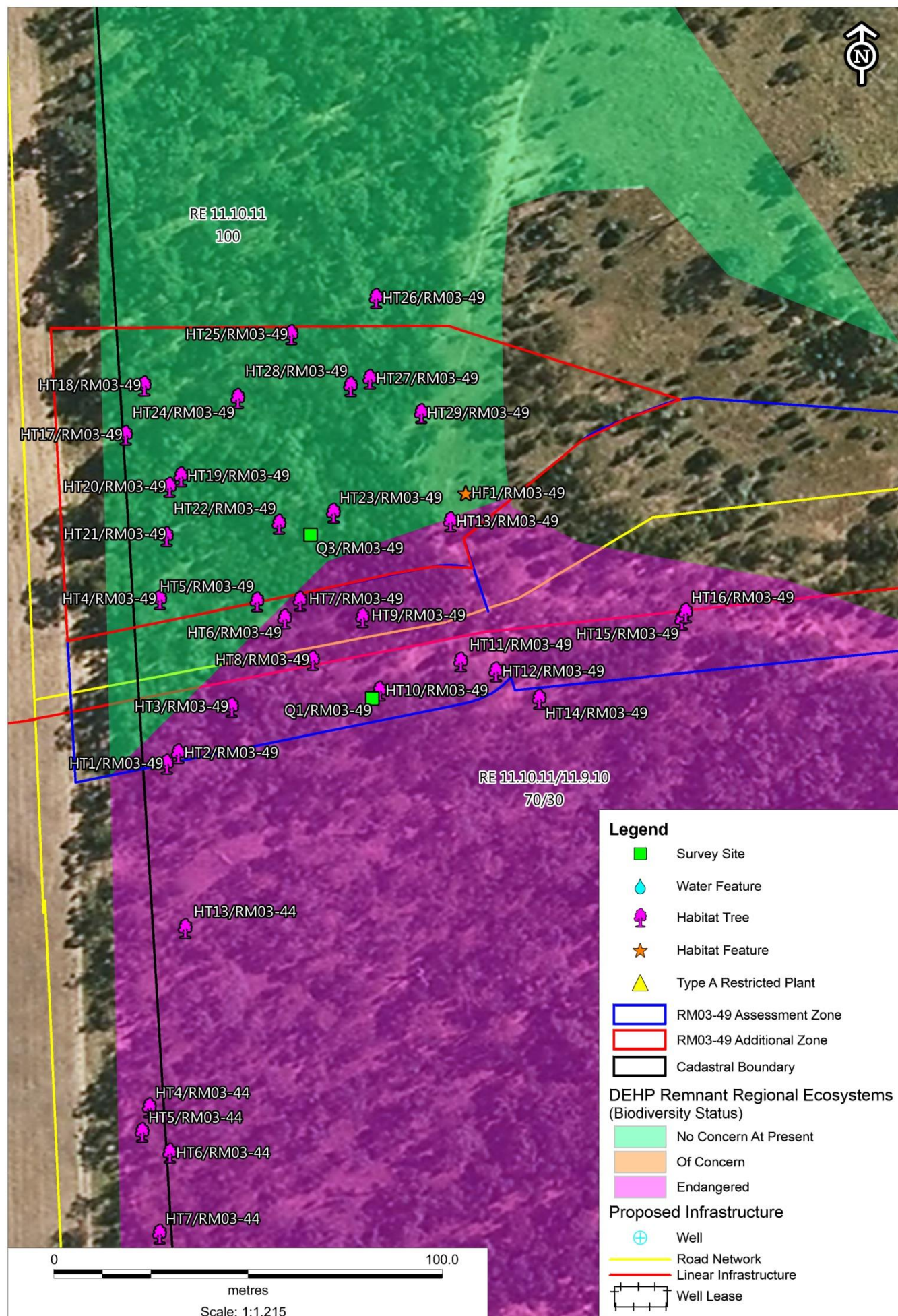
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Figure 1a: Map of Zone RM03-49 (western portion) showing survey sites and other points of interest



RE 11.10.11
100

RE 11.10.11/11.9.10
70/30

RE 11.10.11/11.9.10
70/30

RE 11.10.11/11.9.10
70/30

RE 11.10.11
100

HT30/RM03-49

HT31/RM03-49

Q2/RM03-49

0 100.0
metres
Scale: 1:1,595

Legend

- Survey Site
- Water Feature
- Habitat Tree
- Habitat Feature
- Type A Restricted Plant
- RM03-49 Assessment Zone
- RM03-49 Additional Zone
- Cadastral Boundary

DEHP Remnant Regional Ecosystems (Biodiversity Status)

- No Concern At Present
- Of Concern
- Endangered

Proposed Infrastructure

- Well
- Road Network
- Linear Infrastructure
- Well Lease

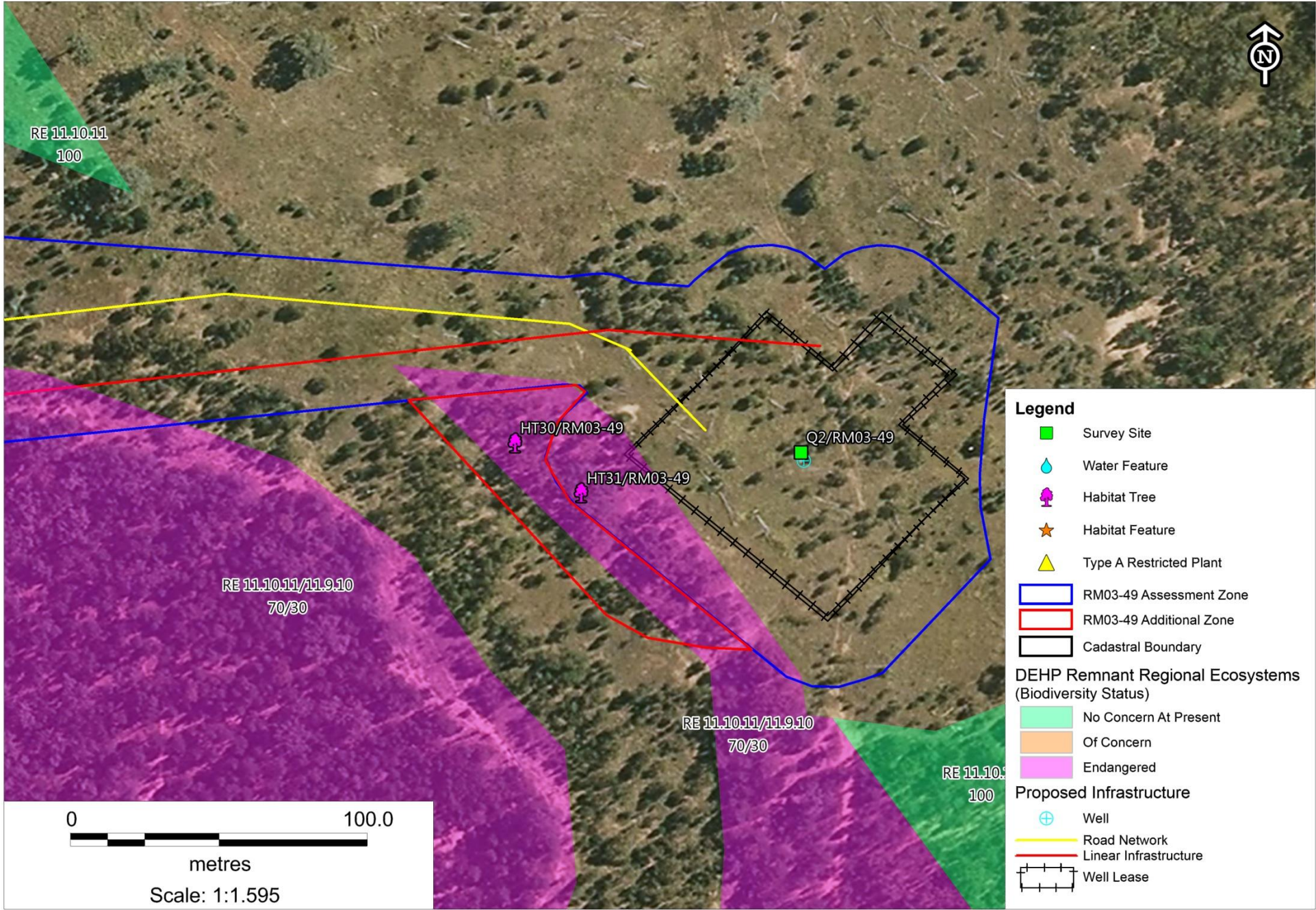


Figure 2: Map of amended RE polygons for Zone RM03-49

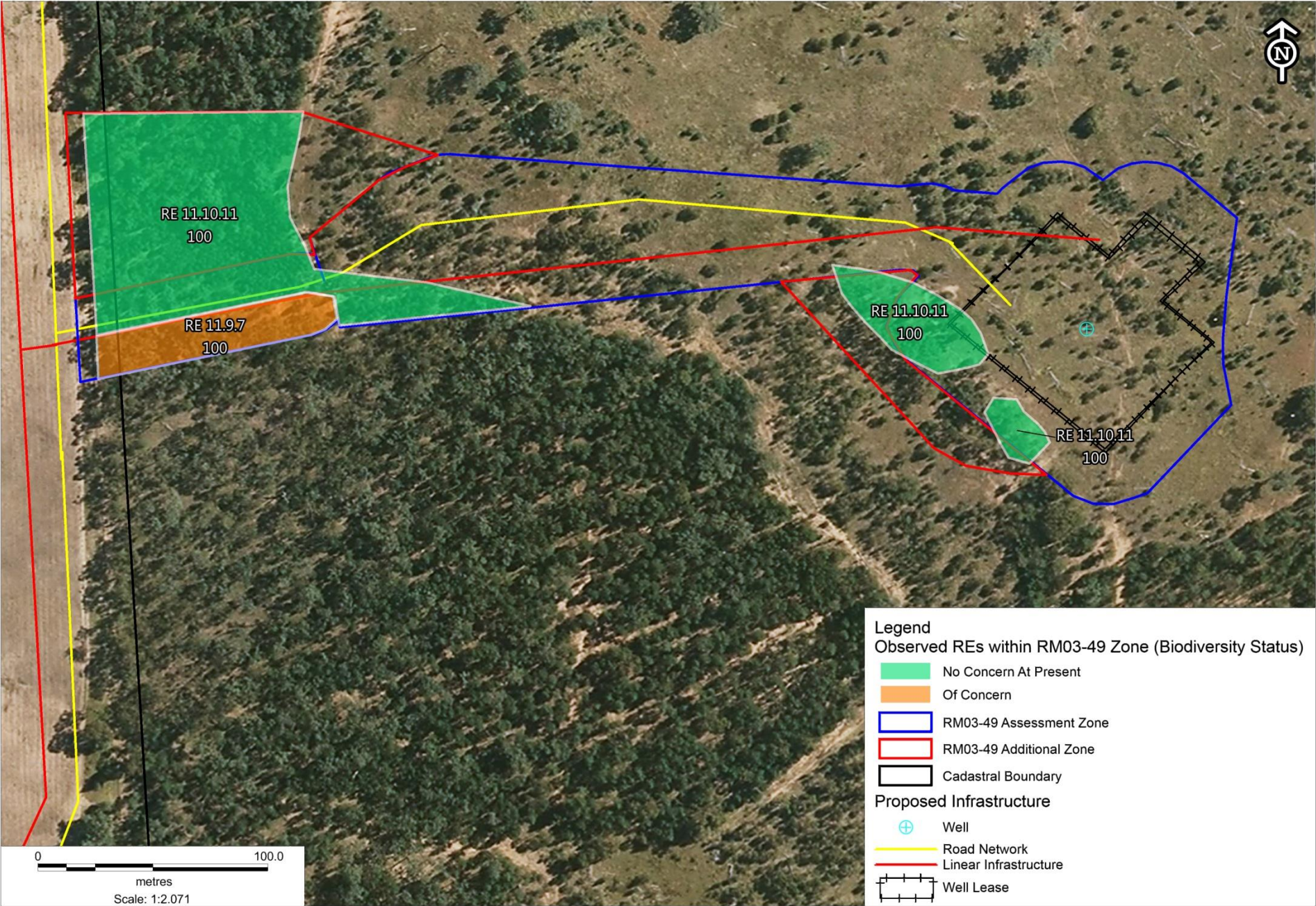




Figure 3a: Woodland of Poplar Box (*Eucalyptus populnea*) showing variation in shrub layer at survey site Q1/RM09-49. A sparse to mid-dense layer of False Sandalwood (*Eremophila mitchellii*) is present in RE 11.9.7 (left) and White Cypress Pine (*Callitris glaucophylla*) is present in RE 11.10.11 (right).



Figure 3b: Silver-leaved Ironbark (*Eucalyptus melanophloia*) and Poplar Box (*E. populnea*) woodland with a low tree layer of White Cypress Pine (*Callitris glaucophylla*) at survey site Q3/RM03-49.



Figure 4: Shrubland of regrowth of Poplar Box (*Eucalyptus populnea*) and White Cypress Pine (*Callitris glaucophylla*) at survey site Q2/RM03-49. Note evidence of at least two clearing events with scattered older timber and more common small trees on the ground.



Figure 5a: A hollow-bearing Poplar Box (*Eucalyptus populnea*) tree at waypoint HT1/RM03-49 (left). **Figure 5b:** A small dead tree with hollows at waypoint HT2/RM03-49 (right).



Figure 5c: A dead hollow-bearing tree at waypoint HT3/RM03-49 (left). **Figure 5d:** A large double-stemmed Silver-leaved Ironbark (*E. melanophloia*) at waypoint HT4/RM03-49 (right).



Figure 5e: Hollow-bearing dead tree at waypoint HT5/RM03-49 (left). **Figure 5f:** Large Silver-leaved Ironbark (*E. melanophloia*) with hollows at waypoint HT6/RM03-49 (right).



Figure 5g: Dead Silver-leaved Ironbark (*Eucalyptus melanophloia*) with hollows and loose bark at waypoint HT7/RM03-49 (left). **Figure 5h:** A dead hollow tree at waypoint HT8/RM03-49 (right).



Figure 5i: A dead hollow-bearing tree at waypoint HT9/RM03-49 (left). **Figure 5j:** A multi-stemmed Poplar Box (*E. populnea*) with numerous hollows at waypoint HT10/RM03-49 (right).



Figures 5k: A dead hollow-bearing tree at waypoint HT11/RM03-49 (left). **Figure 5l:** A dead hollow-bearing tree at waypoint HT12/RM03-49 (right).



Figure 5m: A dead hollow-bearing tree at waypoint HT13/RM03-49 (left). **Figure 5n:** A dead hollow-bearing tree at waypoint HT14/RM03-49 (right).



Figure 5o: A dead Silver-leaved Ironbark (*Eucalyptus melanophloia*) with hollows and loose bark at waypoint HT15/RM03-49. To the left of this feature, a large hollow-bearing live Poplar Box (*E. populnea*) at waypoint HT16/RM03-49. **Figure 5p:** A dead *Eucalyptus* sp. hollow-bearing tree at waypoint HT17/RM03-49 (right).



Figures 5q: A live hollow-bearing Poplar Box (*E. populnea*) at waypoint HT18/RM03-49 (left); **Figure 5r:** A live hollow-bearing Poplar Box (*E. populnea*) at waypoint HT19/RM03-49 (right).



Figure 5s: A live hollow-bearing Poplar Box (*Eucalyptus populnea*) at waypoint HT20/RM03-49 (left). **Figure 5t:** A dead hollow-bearing *Eucalyptus* sp. at waypoint HT21/RM03-49 (right).



Figure 5u: A dead hollow-bearing *Eucalyptus* sp. at waypoint HT22/RM03-49. **Figure 5v:** A live Silver-leaved Ironbark (*E. melanophloia*) hollow-bearing tree with broken trunk at waypoint HT23/RM03-49 (right).



Figures 5w: A live hollow-bearing Poplar Box (*E. populnea*) at waypoint HT24/RM03-49 (left); **Figure 5x:** A dead hollow-bearing Silver-leaved Ironbark (*E. melanophloia*) with loose bark at waypoint HT25/RM03-49 (right).



Figure 5y: A live hollow-bearing Silver-leaved Ironbark (*Eucalyptus melanophloia*) at waypoint HT26/RM03-49 (left). **Figure 5z:** A dead hollow-bearing *Eucalyptus* sp. at waypoint HT27/RM03-49 (right).



Figure 5aa: A live hollow-bearing Silver-leaved Ironbark (*E. melanophloia*) at waypoint HT28/RM03-49. **Figure 5ab:** Two dead hollow-bearing Silver-leaved Ironbark (*E. melanophloia*) trees at waypoint HT29/RM03-49 (right).



Figures 5ac: A live hollow-bearing Poplar Box (*E. populnea*) at waypoint HT30/RM03-49 (left); **Figure 5ad:** A live hollow-bearing Silver-leaved Ironbark (*E. melanophloia*) at waypoint HT31/RM03-49 (right).



Figure 5ae: A 20m long pile of logs and debris at waypoint HF1/RM03-49. Note presence of other smaller log piles and scattered timber nearby in cleared paddock.

Appendix A: Quaternary assessment results, Zone RM03-49

Site No. Q1/
RM03-49 Recorder: Rosamund Aisthorpe, Angela Bendall Date 22/01/2013
Purpose Well Zone Assessments Time 08:54

Locality:
(inc. distance/direction to nearest town) "Mt Hope" along RM03-49 linear infras.

Zone: 55J 0709380 E 7080442 N Datum GDA94

Vegetation structure

Median height of the EDL is to be measured

Plant species

Record relative (numerical) dominance for each stratum;
d – dominant; **c** – codominant; **s** - subdominant, **a** – associated

Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)
E			
T1	16	14 - 18	M (40)
T2	6	4 - 8	M (60)
T3			
S1			
S2			
S3			
G	0.3	0.1 - 0.4	D (80)

Structural formation: Woodland

Ecologically dominant layer: T1

Str.	Rel. dom.	Scientific Name
T1	D	<i>Eucalyptus populnea</i>
T1	A	<i>E. melanophloia</i>
T2	C	<i>Callitris glaucophylla</i>
T2	A	<i>E. populnea</i>
T2	C	<i>Eremophila mitchellii</i>
G	C	<i>Chloris ventricosa</i>
G	C	<i>Aristida</i> sp.

Geology, landform, soils

Geology code and rock types: coarse-grained / fine-grained sedimentary rocks

Landform: low undulating hills (upper slope / crest)

Soils: brown clay loam

DERM Mapped RE Code: 11.10.11 and 11.10.11 / 11.9.10

Observed RE Code: 11.10.11 / 11.9.7 (50/50) Landzone: 10/9

Vegetation Short Description

Eucalyptus populnea woodland with associated *E. melanophloia*; midlayer composed of canopy recruits and *Callitris glaucophylla* or *Eremophila mitchellii*; grassy ground layer dominated by native perennial spp.

Connectivity/Patch Characteristics

Part remnant patch surrounded by cleared paddock with scattered regrowth; riparian corridor (Blythe Creek) to north and west

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Opuntia tomentosa (R), *Cenchrus ciliaris* (R), *Opuntia stricta* (R)

% Weed Cover: <5

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code:

Photo Nos. BbK5 3823-3832

Additional Flora:					
<i>Alectryon oleifolius</i>					
<i>Atalaya hemiglauca</i>					
<i>Sida hackettiana</i>					
<i>Pterocaulon</i> sp. (infertile)					
<i>Nyssanthes</i> sp.					
<i>Desmodium</i> sp.					
<i>Dichondra repens</i>					
<i>Eremophila debilis</i>					
<i>Boerhavia dominii</i>					
<i>Cyperus gracilis</i>					
<i>Cymbopogon refractus</i>					
<i>Wedelia spilantheidoides</i> (off)					
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)					
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.					
Rocks - embedded		Boulders		Shrub layer	Ground cover
Rocks - loose		Fallen bark		Leaf litter	Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100					
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark	
Underhangs / overhangs / caves		Logs with hollows		Termite mounds	
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe	
Other					
Soil cracks					
Water					
Other (e.g. food trees):					
Disturbances					
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)			Structure of Woody Strata		
			Str.	Stems/ha	DBH (cm)
NOT RECORDED			T1	416	18
			T2	656	7
Additional Notes					

Site No. Q2/
RM03-49 Recorder: Rosamund Aisthorpe, Angela Bendall Date 22/01/2013
Purpose Well Zone Assessments Time 10:20

Locality:
(inc. distance/direction to nearest town) "Mt Hope" @ RM03-49

Zone: 55J 0709740 E 7080441 N Datum GDA94

Vegetation structure

Median height of the EDL is to be measured

Plant species

Record relative (numerical) dominance for each stratum;
d – dominant; **c** – codominant; **s** - subdominant, **a** – associated

Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				S1	D	<i>Eucalyptus populnea</i>
T1				S1	S	<i>Callitris glaucophylla</i>
T2				G	D	<i>Aristida sp.</i>
T3						
S1	1.5	1 - 2	S (10)			
S2						
S3						
G	0.3	0.1 - 0.5	M (60)			
Structural formation: Shrubland						
Ecologically dominant layer: S1						

Geology, landform, soils

Geology code and rock types: coarse-grained sedimentary rocks

Landform: undulating low hills (hill crest)

Soils: pale brown loam

DEHP Mapped RE Code: NR (PMAV category X)

Observed RE Code: NR Landzone: 10

Vegetation Short Description

Cleared paddock with scattered *Eucalyptus populnea* and *Callitris glaucophylla* regrowth; ground layer dominated by *Aristida sp.*

Connectivity/Patch Characteristics

Cleared paddock adjoined by remnant in all directions; riparian corridor along north

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Opuntia stricta (R), *Lepidium bonariensis* (R), *Glandularia aristigera* (R), *Conyza bonariensis* (R), *Cirsium vulgare* (U)

% Weed Cover: <5

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code:

Photo Nos. BBK5 3861-3872

Additional Flora:							
<i>Lomandra</i> sp.							
<i>Alectryon oleifolius</i>							
<i>Desmodium</i> sp.							
<i>Fimbristylis dichotoma</i>							
<i>Chloris ventricosa</i>							
<i>Podolepis longipedata</i>							
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%							
Rocks - embedded		Boulders		Shrub layer		Ground cover	
Rocks - loose		Fallen bark		Leaf litter		Bare ground	
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark			
Underhangs / overhangs / caves		Logs with hollows		Termite mounds			
Small logs (<30cm diameter)		Hollow bearing trees		Mistletoe			
Other							
Soil cracks							
Water							
Other (e.g. food trees):							
Disturbances							
Mechanical clearing ~ <1 year							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)				Structure of Woody Strata			
				Str.	Stems/ha	DBH (cm)	
				S1	140	2	
Additional Notes							

Site No. Q3/RM03-49 Recorder: Rosamund Aisthorpe, Angela Bendall, David Chemello Date 01/05/2013
Purpose Mt Hope reinspection (MD) Time 0745

Locality: (inc. distance/direction to nearest town) "Mt Hope"
Zone: 55J 0709365 E 7080849 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	C	<i>Eucalyptus melanophloia</i>
T1	14	12 - 15	S (20)	T1	C	<i>E. populnea</i>
T2	8	5 - 10	M (70)	T2	D	<i>Callitris glaucophylla</i>
T3				G	A	<i>Aristida caput-medusae</i>
S1				G	D	<i>Eragrostis</i> spp.
S2						
S3						
G	0.2	0.1 - 0.3	M (35)			
Structural formation: Woodland						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types: Coarse-grained sedimentary rock
Landform: Low undulating hills
Soils: Pale brown loamy sand
DEHP Mapped RE Code: 11.10.11
Observed RE Code: 11.10.11 Landzone: 10

Vegetation Short Description

Eucalyptus melanophloia and *E. populnea* woodland; mid-dense low tree layer of *Callitris glaucophylla*; grassy ground layer dominated by *Eragrostis* spp. and *Aristida caput-medusae*.

Connectivity/Patch Characteristics

Isolated remnant patch surrounded by blade-ploughed paddock to west and cleared paddock with recently pulled regrowth to southeast and north. Blyth Creek to north and west.

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Cenchrus ciliaris (R), *Opuntia tomentosa* (R), *Portulaca pilosa* (R), *Opuntia aurantiaca* (R), *Opuntia stricta* (R)

% Weed Cover: <5%

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code: Nil

Photo Nos. BBK6 1184-1195

Additional Flora:							
<i>Cymbopogon refractus</i>				<i>Nyssanthes erecta</i>			
<i>Chrysocephalum apiculatum</i>				<i>Alternanthera nana</i>			
<i>Sporobolus</i> sp.				<i>Cyperus gracilis</i>			
<i>Cyanthillium cinereum</i>				<i>Pimelea microcephala</i>			
<i>Dianella caerulea</i>				<i>Geijera parviflora</i>			
<i>Cyperus fulvus</i>				<i>Acacia decora</i>			
<i>Panicum effusum</i>				<i>Laxmannia gracilis</i>			
<i>Cheilanthes sieberi</i>							
<i>Einadia nutans</i>							
<i>Chloris ventricosa</i>							
<i>Eremophila debilis</i>							
<i>Eucalyptus chloroclada</i>							
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.							
Rocks - embedded	0	Boulders	0	Shrub layer	1	Ground cover	2
Rocks - loose	0	Fallen bark	1	Leaf litter	1	Bare ground	2
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges	0	Large logs (>30cm diameter)	2	Trees / logs bearing loose bark	2		
Underhangs /overhangs / caves	0	Logs with hollows	2	Termite mounds	1		
Small logs (<30cm diameter.)	2	Hollow bearing trees	3	Mistletoe	0		
Other							
Soil cracks	-						
Water	-						
Other (e.g. food trees):	-						
Disturbances							
Grazing (minimal, <1 year)							
Logging (minimal-moderate, 10-15 years)							
Ring-barking (moderate, 10-15 years)							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)				Structure of Woody Strata			
				Str.	Stems/ha	DBH (cm)	
Red-winged Parrot (3 SE & HE onsite)	Crested Pigeon (2 HE offsite)			T1	32	28	
White-winged Chough (6 SE & HE onsite)	Apostlebird (10 SE & HE onsite)			T2	720	7	
Sulphur-crested Cockatoo (1 HE offsite)	Oedura monilis (2 HA onsite)						
Australian Magpie (2 HE offsite)	Heteronotia binoei (2 SE onsite)						
Grey Butcherbird (1 HE offsite)	Caper White (2 SE onsite)						
Galah (1 HE FO)	Torresian Crow (6 SE & HE offsite)						
Striated Pardalote (1 HE offsite)	Noisy Miner (2 SE onsite)						
Weebill (2 HE onsite)	Pied Currawong (1 HE offsite)						
Magpie-lark (1 HE offsite)	Mistletoebird (1 HE onsite)						
Cockatiel (1 HE FO)	Pied Butcherbird (2 SE & HE offsite)						
Pale-headed Rosella (1 HE onsite)							
Laughing Kookaburra (1 HE offsite)							
Additional Notes							
EVNT Fauna Likely: Golden-tail Gecko, Yakka Skink, Little Pied Bat, South-eastern Long-eared Bat							

Appendix B: Plant species list, Zone RM03-49

Key: * indicates non-native plant species

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3
Adiantaceae	<i>Cheilanthes sieberi</i>	Mulga Fern	LC				P
Amaranthaceae	<i>Alternanthera nana</i>	Hairy Joyweed	LC				P
Amaranthaceae	<i>Nyssanthes erecta</i>	Barbed-wire Weed	LC		P		P
Asteraceae	<i>Chrysocephalum apiculatum</i>	Yellow Buttons	LC				P
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	-			P	
Asteraceae	<i>Conyza bonariense</i> *	Fleabane	-			P	
Asteraceae	<i>Cyanthillium cinereum</i>	Vernonia	LC				P
Asteraceae	<i>Podolepis longipedata</i>	Tall Podolepis	LC			P	
Asteraceae	<i>Pterocaulon</i> sp. (infertile)	An Applebush	LC		P		
Asteraceae	<i>Wedelia spilanthis</i>	A Daisy	LC		P		
Brassicaceae	<i>Lepidium bonariensis</i> *	Cut-leaf Peppergrass	-			P	
Cactaceae	<i>Opuntia aurantiaca</i> *	Tiger Pear	-				P
Cactaceae	<i>Opuntia stricta</i> *	Common Pest Pear	-		P	P	P
Cactaceae	<i>Opuntia tomentosa</i> *	Velvety Tree Pear	-		P		P
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush	LC				P
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	LC		P		
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC		P	P	P
Cyperaceae	<i>Cyperus fulvus</i>	Sticky Sedge	LC				P
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	LC		P		P
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-rush	LC			P	
Fabaceae	<i>Desmodium</i> sp.	A Tick-trefoil	LC		P	P	
Hemerocallidaceae	<i>Dianella caerulea</i>	Blue Flax Lily	LC				P
Laxmanniaceae	<i>Laxmannia gracilis</i>	Slender Wire Lily	LC				P
Laxmanniaceae	<i>Lomandra</i> sp. (infertile)	A Matrush	LC			P	
Mimosaceae	<i>Acacia decora</i>	Pretty Wattle	LC				P
Myoporaceae	<i>Eremophila debilis</i>	Winter Apple	LC		P		P
Myoporaceae	<i>Eremophila mitchellii</i>	False Sandalwood	LC		P		
Myrtaceae	<i>Eucalyptus chloroclada</i>	Baradine Red Gum	LC				P
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	LC		P		P
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		P	P	P
Nyctaginaceae	<i>Boerhavia dominii</i>	Tar Vine	LC		P		
Poaceae	<i>Aristida caput-medusae</i>	Many-headed Wiregrass	LC				P
Poaceae	<i>Aristida</i> sp. (infertile)	A Wiregrass	LC		P	P	
Poaceae	<i>Cenchrus ciliaris</i> *	Buffel Grass	-		P		P
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	LC		P	P	P
Poaceae	<i>Cymbopogon refractus</i>	Barbwire Grass	LC		P		P

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3
Poaceae	<i>Eragrostis</i> sp. (indet.)	A Lovegrass	LC				P
Poaceae	<i>Panicum effusum</i>	Hairy Panic	LC				P
Poaceae	<i>Sporobolus</i> sp. (indet.)	A Rats-tail Grass	LC				P
Portulacaceae	<i>Portulaca pilosa</i> *	Hairy Pigweed	-				P
Rutaceae	<i>Geijera parviflora</i>	Wilga	LC				P
Sapindaceae	<i>Alectryon oleifolius</i>	Boonaree	LC		P	P	
Sapindaceae	<i>Atalaya hemiglauca</i>	Whitewood	LC		P		
Thymelaeaceae	<i>Pimelea microcephala</i>	Shrubby Rice-flower	LC				P
Verbenaceae	<i>Glandularia aristigera</i> *	Mayne's Pest	-			P	

Well Lease Area/ Infrastructure Zone Assessment Report: Mt Hope Zone RM03-45

Compiled by Boobook for Santos

Boobook
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

Revision	Date	Description	Author	Verifier	Approved
A	21/2/2013	Draft issued to client for review	RJ	CE	CE
B	15/5/2013	Draft incorporating client comment and amended zone	RA	RJ	CE
C	9/7/2013	Draft incorporating further client comment	RJ	CE	CE
0	23/7/2013	Final version	RJ		RJ

1. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DSEWPac	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
TAR plant	Type A Restricted Plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

2. Introduction

2.1 Purpose & Scope

Boobook was commissioned by Santos to undertake ecological assessments on a number of well leases and infrastructure zones (hereafter individually referred to as the Zone) located on the property 'Mt Hope', located about 40km north-east of Roma, south central Queensland. Boobook was requested to undertake the following:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation present within the Zone;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the assessment site;
- Comment on the nature and location of wetlands and watercourses within 100m of the Zone;
- Provide location and description of any plants of conservation concern listed in the NC Act or EPBC Act;
- Location and characteristics of any type A restricted (TAR) plants (NC Act) in the Zone; and
- Location and characteristics of habitat trees in the Zone, with reference to trees previously mapped by Santos.

An individual report was to be prepared for each Zone. This report refers to Zone RM03-45 located on Lot 80 on Plan WV763.

Changes to the boundaries of this Zone were made by Santos following completion of the ecological assessment described in this report for the Zone (Figure 1). Modifications of this infrastructure Zone were considered to be either minor in extent and/or involving areas where the ecological values were previously assessed on-site or nearby. Although the risk is acceptably small it is possible that some ecological values of the modified Zone may not have been documented. Based on professional judgement the modified zones are highly unlikely to contain populations of threatened flora or significant fauna habitat features. However, the presence of TAR plants, especially seedlings, cannot be ruled out.

2.2 Survey Team

The project supervisor (Craig Eddie) was approved by 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.

The field survey described by this report was undertaken by Boobook on 23rd January 2013 and was conducted by Rose Aisthorpe (Graduate Botanist) and Ashley Hoffman (Field Assistant). The following report was compiled by Rosamund Aisthorpe and Richard Johnson. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie (Principal Ecologist and Project Supervisor).

Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit

WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A comprehensive desktop search was not required by the client for the purposes of this report. However, a desktop search was undertaken for REs at the property scale using mapping version 6.1 (DEHP 2012). This dataset provides a baseline for subsequent field assessment.

The search was conducted using a 5km buffer around the coordinate -26.3558°S, 149.0847°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative site was selected for each RE present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Figure 1a and 1b. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all GPS co-ordinates quoted within this report is GDA94. When referred to within this report the sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2012: Table 29);
4. RE type mapped;
5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;

9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;
11. presence of EVNT flora;
12. a list of all other flora encountered at the Site; and
13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2012) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

A search was made within the Zone for TAR plants: If found, the location was established with a hand-held GPS unit and the species, height, DBH and possible management options were recorded.

Where mapping supplied by Santos indicated the presence of habitat trees, a search was made for these. If found the location was established with a hand-held GPS unit and the species, height, DBH and habitat value(s) were recorded. In some instances unmapped habitat trees were located during the site survey and data was collected for these trees also.

The presence of any wetlands or watercourses within 100m of the Zone was recorded.

Representative photographs were taken at each quaternary survey site in the Zone, as well as at any wetlands or watercourses, habitat trees or TAR plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

No remnant REs are mapped as present in the Zone.

4.1.2 Regional Ecosystems Observed

Remnant REs were observed in the Zone at two locations. At survey site Q1/RM03-45 the Zone crosses Coxon Creek where remnant vegetation structurally and floristically equivalent (DSITIA

2012) to RE 11.3.25 (*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines: of concern) is present. Immediately south of and adjoining this vegetation is remnant vegetation equivalent to RE 11.3.2 (*Eucalyptus populnea* woodland on alluvial plains: Of Concern). The vegetation is mapped as a mixed polygon (50:50 ratio), shown in Figure 1b. At survey site Q2/RM03-45 the Zone crosses a linear remnant of vegetation structurally and floristically equivalent (DSITIA 2012) to RE 11.3.2 (Figure 1b). Location and details of the vegetation encountered at each site is given in Table 2. Representative images are shown at Figure 2.

Table 2: Floristics and Structure of Remnant Ecosystems at Survey Sites in Zone RM03-45

Site	Location	Vegetation Description		
Q1/RM03-45	55J 711117E 7081016N	<i>Angophora floribunda</i> woodland with associated <i>Eucalyptus</i> sp. (<i>E. camaldulensis</i> / <i>tereticornis</i>) and <i>E. populnea</i> ; mid-layer composed of <i>Callitris glaucophylla</i> , <i>Acacia deanei</i> and <i>Vachellia farnesiana</i> ; ground layer composed of <i>Imperata cylindrica</i> , <i>Aristida</i> sp., <i>Melinis repens</i> and <i>Heteropogon contortus</i> .		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	21	50	84	30
T2	10	20	160	8
S1	2	10	148	2
Site	Location	Vegetation Description		
Q2/RM03-45	55J 711016E 7081182N	<i>Eucalyptus populnea</i> woodland; mid-layer composed of canopy recruits, <i>Callitris glaucophylla</i> and <i>Geijera parviflora</i> ; grassy ground layer composed of <i>Aristida</i> sp. and <i>Chloris ventricosa</i> .		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	14	50	368	25
T2	9	2	176	10
S1	1.5	5	336	1

4.1.3 Threatened Ecological Communities Observed

No threatened ecological communities (TECs) were observed in the Zone.

4.1.4 Non-remnant Vegetation Observed

The Zone is vegetated by small areas of remnant (see above), areas of scattered regrowth/retained trees in previously cleared pasture and a shrubland of regrowth that has occurred after mechanical disturbance (pulling) of regrowth from earlier clearing event(s) (see Appendix A). The latter was sampled at the well site in the Zone (survey site Q3/RM03-45). The floristics and structure of the dominant species in each woody stratum at survey site Q3/RM03-45 are shown in Table 3. Representative images of the site are shown at Figure 3.

Table 3: Floristics and Structure of Vegetation at Survey Sites in Zone RM03-45

Site	Location	Vegetation Description		
Q3/RM03-45	55J 710400E 7081065N	Shrubland (regrowth) of <i>Callitris glaucophylla</i> (occasional large <i>Eucalyptus melanophloia</i> trees present): grassy ground layer dominated by <i>Aristida</i> sp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
S1	2	5	1072	3

4.2 Additional Observations

4.2.1 Additional Flora Species

Approximately 31 species of native flora were detected (Appendix B). In addition, 16 non-native species were recorded. Three of these, Tiger Pear (*Opuntia aurantiaca*), Common Pest Pear (*O. stricta*) and Velvety Tree Pear (*O. tomentosa*), are declared class 2 weeds scheduled under the *Land Protection (Pest and Stock Route Management) Regulation 2003* and Weeds of National Significance (WoNS).

4.2.2 Type A Restricted Plants

Six specimens of Kurrajong (*Brachychiton populneus*) were detected in or immediately adjacent to the Zone. Five individuals of Forest Grass Tree (*Xanthorrhoea johnsonii*) were detected within the well buffer area of the Zone. Details of these TAR plants are given in Table 4 and images shown at Figures 4a-k.

Table 4: TAR Plants recorded in Zone RM03-45

Waypoint	Location	Species	Height (m)	DBH (cm)	Management
BP1/RM03-45	55J 711131E 7081043N	<i>Brachychiton populneus</i>	15	30	Avoid
BP2/RM03-45	55J 711144E 7081036N	<i>Brachychiton populneus</i>	5	15	Translocation possible
BP3/RM03-45	55J 711161E 7081032N	<i>Brachychiton populneus</i>	10	25	Avoid
BP4/RM03-45	55J 710980E 7081280N	<i>Brachychiton populneus</i>	25	40	Avoid
BP5/RM03-45	55J 710785E 7081291N	<i>Brachychiton populneus</i>	0.2	n/a	Translocation possible
BP6/RM03-45	55J 710781E 7081290N	<i>Brachychiton populneus</i>	0.2	n/a	Translocation possible
XJ1/RM03-45	55J 710451E 7081056N	<i>Xanthorrhoea johnsonii</i>	Trunk absent	n/a	Translocation possible
XJ2/RM03-45	55J 710440E 7081059N	<i>Xanthorrhoea johnsonii</i>	Trunk absent	n/a	Translocation possible
XJ3/RM03-45	55J 710432E 7081048N	<i>Xanthorrhoea johnsonii</i>	Trunk absent	n/a	Translocation possible
XJ4/RM03-45	55J 710429E 7081039N	<i>Xanthorrhoea johnsonii</i>	Broken trunk with multiple heads	n/a	Translocation possible
XJ5/RM03-45	55J 710382E 7081009N	<i>Xanthorrhoea johnsonii</i>	Broken trunk with multiple heads	n/a	Translocation possible

4.2.3 Fauna Habitat Features

Nine hollow-bearing trees were detected within or immediately adjacent to the Zone. Location and details of these trees are shown in Table 5 and Figures 5a-i. No other significant fauna habitat features were observed in the Zone.

Table 5: Details of Fauna Habitat Features, Zone RM03-45

Waypoint	Location	Species	Alive/dead	DBH (cm)	Height (m)	Habitat features
HT1/RM03-45	55J 711217E 7080886N	unknown (<i>Eucalyptus</i> sp.)	Dead	49	10	3 hollows 10-30cm diam.
HT2/RM03-45	55J 711114E 7080964N	unknown (<i>Eucalyptus</i> sp.)	Dead	36	15	1 hollow <10cm diam.
HT3/RM03-45	55J 711154E 7081033N	unknown (<i>Eucalyptus</i> sp.)	Dead	72	15	3 hollows <10cm diam.; 2 hollows 10-30cm diam.
HT4/RM03-45	55J 710997E 7081166N	unknown (<i>Eucalyptus</i> sp.)	Dead	21	6	1 hollow <10cm diam.; 1 hollow 10-30cm diam.
HT5/RM03-45	55J 710810E 7081385N	unknown (<i>Eucalyptus</i> sp.)	Dead	25	12	3 hollows <10cm diam.
HT6/RM03-45	55J 710797E 7081372N	unknown (<i>Eucalyptus</i> sp.)	Dead	48	8	1 hollow 10-30cm diam.
HT7/RM03-45	55J 710796E 7081342N	Silver-leaved Ironbark (<i>Eucalyptus melanophloia</i>)	Alive	61	18	1 hollow 10-30cm diam.; 1 hollow >30cm diam.
HT8/RM03-45	55J 710798E 7081305N	Silver-leaved Ironbark (<i>Eucalyptus melanophloia</i>)	Dead	83	18	2 hollows <10cm diam.; 3 hollows 10-30cm diam.
HT9/RM03-45	55J 710780E 7081287N	Silver-leaved Ironbark (<i>Eucalyptus melanophloia</i>)	Alive	53	18	5 hollows <10cm diam.

4.2.4 Wetlands and Watercourses

One watercourse as defined by the *Water Act 2000* was observed at the Zone, this being Coxon Creek at waypoint W1/RM03-45 where riparian vegetation and defined bed and banks were present.

A drainage feature, a drainage line/depression at waypoint W2/RM03-45 was also seen. The lack of riparian vegetation and defined bed and banks indicates this is a drainage feature and not a watercourse (*Water Act 2000*). Additionally, this meets the definition of a drainage feature according to the Act because it is likely to be only capable of flowing during and immediately after rainfall, for a short period and does not have enough continual flow to maintain a riparian ecosystem.

Locations and descriptions are given in Table 6 and representative images are shown at Figures 6a, b. No other watercourses or drainage features as defined by the Act were observed at or within 100m of the Zone. No wetlands as defined by the Queensland Wetland Program (DERM 2011) as used in Santos Environmental Authority (Schedules C, M) were observed at or within 100m of the Zone.

Table 6: Wetlands and watercourses detected within Zone RM03-45

Waypoint	Location	Description
W1/RM03-45	55J 711119E 7081031N	Watercourse: Coxon Creek, traversing Zone east to west. Defined bed and banks with riparian vegetation present (RE 11.3.25)
W2/RM03-45	55J 710999E 7081155N	Drainage feature: drainage line/depression crossing Zone from north-east to south-west. Remnant vegetation, equivalent to RE 11.3.2 (not mapped). Wetland plants <i>Juncus usitatus</i> , <i>Paspalum distichum</i> and <i>Eleocharis plana</i> present.

5. References

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DERM (2011). *Queensland Wetland Definition and Delineation Guideline*. Queensland Government, Brisbane.

DSITIA (2012). *BioCondition Benchmarks for Regional Ecosystem Condition Assessment*.

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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, Brisbane.

Water Act 2000. (Queensland), viewed 14 February 2013,

<<http://www.legislation.qld.gov.au/legisltn/current/w/watera00.pdf>>

Figure 1a: Map of Zone RM03-45 (southwest portion) showing survey sites and other points of interest

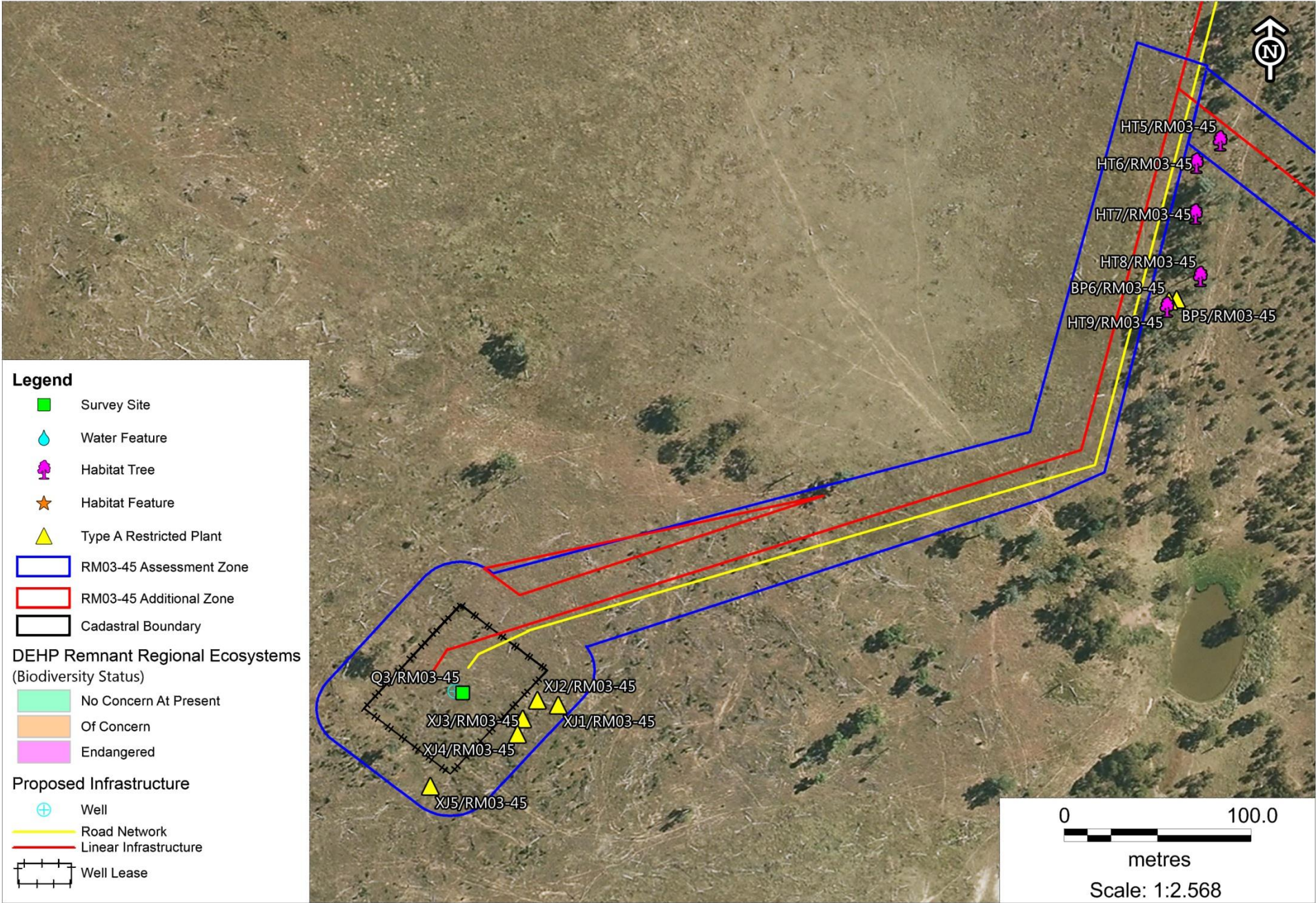


Figure 1b: Map of Zone RM03-45 (southeast portion) showing survey sites and other points of interest

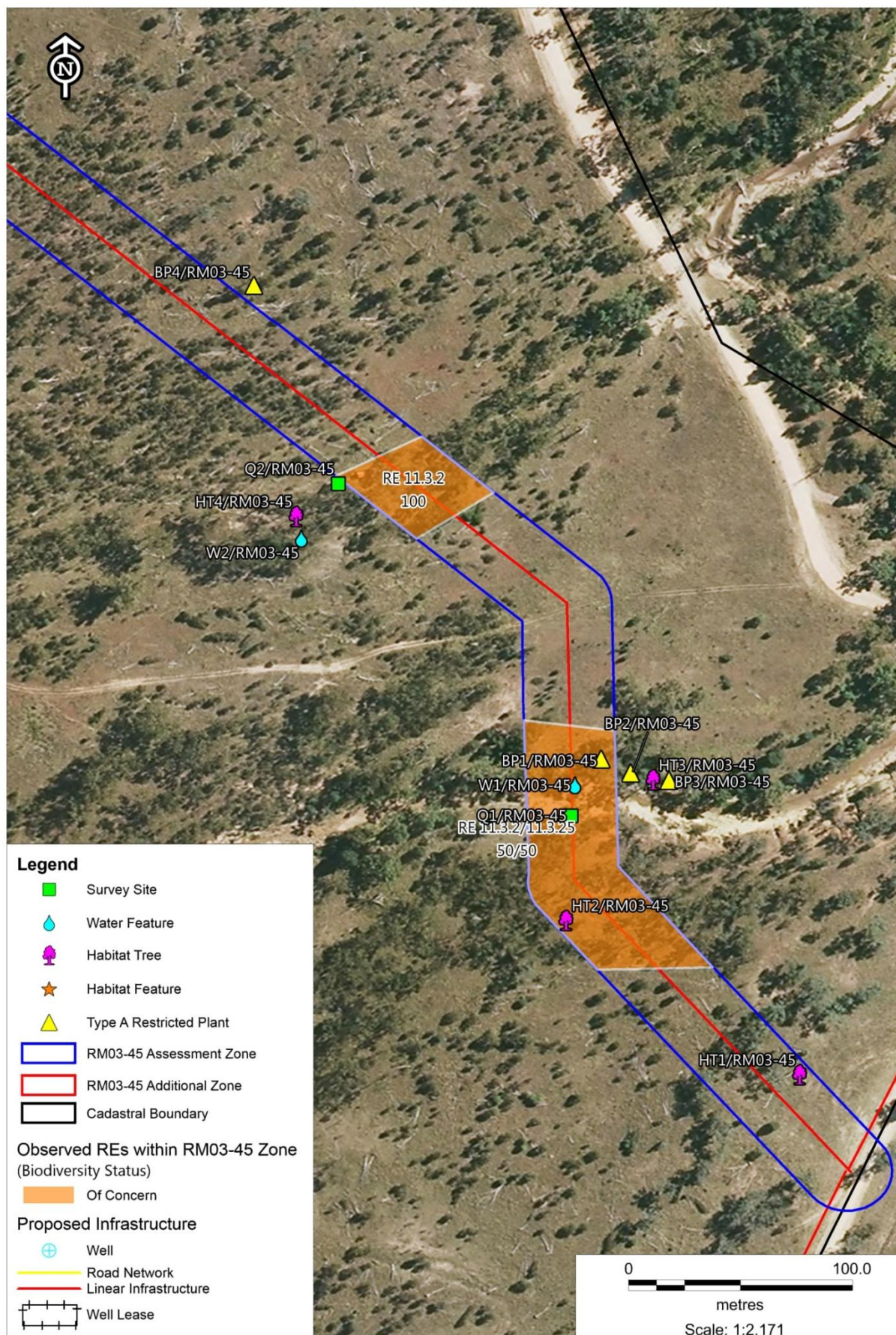




Figure 2: Riparian woodland fringing Coxon Creek (RE 11.3.25) at survey site Q1/RM03-45 (left); and a linear remnant of Poplar Box (*Eucalyptus populnea*) woodland (RE 11.3.2) at survey site Q2/RM03-45.



Figure 3: Shrubland (regrowth) of Cypress Pine (*Callitris glaucophylla*) with scattered retained Silver-leaved Ironbark (*Eucalyptus melanophloia*) at survey site Q3/RM03-45.



Figure 4a: A Kurrajong (*Brachychiton populneus*) tree at waypoint BP1/RM03-45 (left); **Figure 4b:** A small Kurrajong (*B. populneus*) tree at waypoint BP2/RM03-45 (right).



Figure 4c: A Kurrajong (*B. populneus*) tree at waypoint BP3/RM03-45.



Figure 4d: Mature Kurrajong (*B. populneus*) tree (left) and a Kurrajong (*B. populneus*) seedling near the base of the tree (right), at waypoint BP4/RM03-45.



Figure 4e: Kurrajong (*B. populneus*) sapling at waypoint BP5/RM03-45 (left); **Figure 4f:** Kurrajong (*B. populneus*) sapling at waypoint BP6/RM03-45 (right).



Figure 4g: Forest Grass Tree (*Xanthorrhoea johnsonii*) at waypoint XJ1/RM03-45 (left); **Figure 4h:** multiple Forest Grass Trees (*X. johnsonii*) at waypoint XJ2/RM03-45 (right).



Figure 4i, j: Forest Grass Trees (*X. johnsonii*) at waypoint XJ3/RM03-45 (left); and waypoint XJ4/RM03-45 (right).



Figure 4k: Forest Grass Tree (*X. johnsonii*) at waypoint XJ5/RM03-45.



Figure 5 a, b: Hollow-bearing dead trees at waypoint HT1/RM03-45 (left); and waypoint HT2/RM03-45 (right).



Figure 5 c, d: Hollow-bearing dead trees at waypoint HT3/RM03-45 (left); and waypoint HT4/RM03-45 (right).



Figure 5 e, f: Hollow-bearing dead trees at waypoint HT5/RM03-45 (left); and waypoint HT6/RM03-45 (right).



Figure 5g: A hollow-bearing live Silver-leaved Ironbark (*E.melanophloia*) at waypoint HT7/RM03-45 (left); **Figure 5h:** A hollow dead Silver-leaved Ironbark (*E. melanophloia*) at waypoint HT8/RM03-45 (right).



Figure 5i: A hollow-bearing live Silver-leaved Ironbark (*E. melanophloia*) at waypoint HT9/RM03-45.



Figure 6a: A watercourse, Coxon Creek, at waypoint W1/RM03-45 showing defined bed and banks, riparian woodland (left); **Figure 6b:** A drainage feature at waypoint W2/RM03-45.

Appendix A: Quaternary assessment results, Zone RM03-45

Site No. Q1/ RM03-45 Recorder: Rosamund Aisthorpe, Ashley Hoffmann Date 23/01/2013
Purpose Well Zone Assessments Time 08:30

Locality: (inc. distance/direction to nearest town) "Mt Hope", Coxon Creek @ RM03-45 linear infrastructure crossing

Zone: 55J 071117 E 7081016 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Angophora floribunda</i>
T1	21	19 - 25	M (50)	T1	A	<i>Eucalyptus sp. camaldulensis / tereticornis</i>
T2	10	8 - 12	S (20)	T2	D	<i>Callitris glaucophylla</i>
T3				S1	D	<i>Acacia deanei</i>
S1	2	1 - 3	S (10)	S1	A	<i>Vachellia farnesiana</i> Non-native
S2				G	D	<i>Imperata cylindrica</i>
S3				G	A	<i>Melinis repens</i> Non-native
G	0.4	0.1 - 0.6	M (50)	G	A	<i>Heteropogon contortus</i>
Structural formation: Woodland				T1	A	<i>Eucalyptus populnea</i>
Ecologically dominant layer: T1				G	S	<i>Aristida sp.</i>

Geology, landform, soils

Geology code and rock types: alluvium
Landform: watercourse (Coxon Creek)
Soils: pale brown sand
DERM Mapped RE Code: NR (PMAV category X)
Observed RE Code: 11.3.25 Landzone: 3

Vegetation Short Description

Angophora floribunda fringing woodland with associated *Eucalyptus sp. (camaldulensis / tereticornis)* and *E. populnea*; midlayer composed of *Callitris glaucophylla*, *Acacia deanei* and *Vachellia farnesiana*; ground layer composed of *Imperata cylindrica*, *Aristida sp.*, *Melinis repens* and *Heteropogon contortus*

Connectivity/Patch Characteristics

Riparian corridor adjoined by cleared paddock to north and south

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Vachellia farnesiana (U), *Melinis repens* (U), *Opuntia tomentosa* (R), *Dysphania ambrosioides* (R), *Xanthium occidentale* (R), *Conyza bonariensis* (C), *Glandularia aristigera* (C), *Cynodon dactylon* (U), *Verbena bonariensis* (U), *V. litoralis* (U), *Lepidium bonariense* (C), *Argemone ochroleuca* (R)

% Weed Cover: 10

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code:

Photo Nos. BBK5 4011-4013

Additional Flora:			
<i>Brachychiton populneus</i>			
<i>Dianella longifolia</i>			
<i>Acacia decora</i>			
<i>Vittadinia dissecta</i>			
<i>Cassinia laevis</i>			
<i>Euchiton sphaericus</i>			
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, dead litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)			
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%			
Rocks - embedded		Boulders	
Rocks - loose		Fallen bark	
		Shrub layer	
		Leaf litter	
		Ground cover	
		Bare ground	
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100			
Crevices/ledges		Large logs (>30cm diameter)	
Underhangs / overhangs / caves		Logs with hollows	
Small logs (<30cm diameter)		Hollow bearing trees	
		Trees / logs bearing loose bark	
		Termite mounds	
		Mistletoe	
Other			
Soil cracks			
Water	Coxon Creek at site however no water present (W1/RM03-45)		
Other (e.g. food trees):			
Disturbances			
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata	
		Str.	Stems/ha
		DBH (cm)	
Rainbow Bee-eater x 2 HE off site		T1	84
		T2	160
		S1	148
Additional Notes			

Site No. Q2/
RM03-45 **Recorder:** Rosamund Aisthorpe, Ashley Hoffmann **Date** 23/01/2013
Purpose Well Zone Assessments **Time** 10:10

Locality:
 (inc. distance/direction to nearest town) "Mt Hope" along RM03-45 linear infrastructure

Zone: 55J 0711016 E 7081182 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Eucalyptus populnea</i>
T1	14	13 - 15	M (50)	T2	D	<i>E. populnea</i>
T2	9	6 - 12	V (2)	G	D	<i>Aristida</i> sp.
T3				S1	A	<i>Geijera parviflora</i>
S1	1.5	1 - 2	V (5)	G	A	<i>Chloris ventricosa</i>
S2				T2	D	<i>Callitris glaucophylla</i>
S3						
G	0.4	0.1 - 0.5	D (80)			
Structural formation: Woodland						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types: alluvium
Landform: low undulating hills (gentle depression and alluvial plain)
Soils: pale brown loam
DERM Mapped RE Code: NR (PMAV category X)
Observed RE Code: 11.3.2 **Landzone:** 3

Vegetation Short Description

Eucalyptus populnea woodland; midlayer composed of canopy recruits, *Callitris glaucophylla* and *Geijera parviflora*; grassy ground layer composed of *Aristida* sp. and *Chloris ventricosa*

Connectivity/Patch Characteristics

Corridor following drainage depression; cleared paddock to north and south

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Opuntia aurantiaca (R), *Glandularia aristigera* (R), *Melinis repens* (R)

% Weed Cover: <5

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code:

Photo Nos. BBK5 4066-4068

Additional Flora:			
<i>Pterocaulon</i> sp. (infertile)			
<i>Einadia nutans</i>			
<i>Solanum nemophilum</i>			
<i>Eremophila mitchellii</i>			
<i>Juncus usitatus</i>			
<i>Acacia decora</i>			
<i>Jasminum dianthifolium</i>			
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, dead litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)			
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%			
Rocks - embedded		Boulders	
Rocks - loose		Fallen bark	
		Shrub layer	
		Leaf litter	
		Ground cover	
		Bare ground	
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100			
Crevices/ledges		Large logs (>30cm diameter)	
Underhangs /overhangs / caves		Logs with hollows	
Small logs (<30cm diameter.)		Hollow bearing trees	
		Trees / logs bearing loose bark	
		Termite mounds	
		Mistletoe	
Other			
Soil cracks			
Water	Corridor of trees follow gentle drainage depression (W2/RM03-45) towards dam in east		
Other (e.g. food trees):			
Disturbances			
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata	
		Str.	Stems/ha
		DBH (cm)	
Rainbow Bee-eater x 3 SE / HE on site		T1	368
		T2	176
		S1	336
Additional Notes			

Site No. Q3/ RM03-45 **Recorder:** Rosamund Aisthorpe, Ashley Hoffmann **Date** 23/01/2013
Purpose Well Zone Assessments **Time** 11:45

Locality: (inc. distance/direction to nearest town) "Mt Hope" @ RM03-45
Zone: 55J 0710400 E 7081065 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				S1	D	<i>Callitris glaucophylla</i>
T1				G	D	<i>Aristida sp.</i>
T2						
T3						
S1	2	1.5 - 2.5	S (30)			
S2						
S3						
G	0.5	0.1 - 0.6	M (60)			
Structural formation: Shrubland						
Ecologically dominant layer: S1						

Geology, landform, soils

Geology code and rock types: coarse-grained sedimentary rocks
Landform: low undulating hills (hill crest)
Soils: pale brown loamy sand
DERM Mapped RE Code: NR (PMAV category X)
Observed RE Code: NR (ex-11.10.9 or 11.10.11) **Landzone:** 10

Vegetation Short Description

Cleared paddock comprising regrowth *Callitris glaucophylla* (occasional large *Eucalyptus melanophloia* are present); grassy ground layer dominated by *Aristida* spp.

Connectivity/Patch Characteristics

Cleared paddock; riparian corridor (Coxon Creek) adjoins east and south

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Portulaca pilosa (C), *Lepidium bonariense* (C), *Cenchrus ciliaris* (R), *Glandularia aristigera* (U), *Opuntia stricta* (R), *Conyza bonariensis* (R)

% Weed Cover: 10

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code:

Photo Nos. BBK5 4124-4126

Appendix B: Plant species list, Zone RM03-45

Key: * indicates non-native plant species

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3
Asteraceae	<i>Cassinia laevis</i>	Cough Bush	LC		P		
Asteraceae	<i>Chrysocephalum apiculatum</i>	Yellow Buttons	LC				P
Asteraceae	<i>Conyza bonariensis</i> *	Fleabane	-		P		P
Asteraceae	<i>Euchiton sphaericus</i>	A Cudweed	LC		P		
Asteraceae	<i>Podolepis longipedata</i>	Tall Podolepis	LC				P
Asteraceae	<i>Pterocaulon</i> sp. (infertile)	A Fruit Salad Plant, Applebush	LC			P	
Asteraceae	<i>Vittadinia dissecta</i>	Common New Holland Daisy	LC		P		P
Asteraceae	<i>Xanthium occidentale</i> *	Noogoora Burr	-		P		
Brassicaceae	<i>Lepidium bonariense</i> *	Cut-leaf Peppergrass	-		P		P
Cactaceae	<i>Opuntia aurantiaca</i> *	Tiger Pear	-			P	
Cactaceae	<i>Opuntia stricta</i> *	Common Pest Pear	-				P
Cactaceae	<i>Opuntia tomentosa</i> *	Velvety Tree Pear	-		P		
Chenopodiaceae	<i>Dysphania ambrosioides</i> *	Mexican Tea	-		P		
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush	LC			P	
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC		P	P	P
Fabaceae	<i>Crotalaria mitchellii</i>	Rattlepod	LC				P
Hemerocallidaceae	<i>Dianella longifolia</i>	Smooth Flax Lily	LC		P		
Juncaceae	<i>Juncus usitatus</i>	Common Rush	LC			P	
Laxmanniaceae	<i>Lomandra leucocephala</i>	Woolly-headed Matrush	LC				P
Mimosaceae	<i>Acacia deanei</i>	Deane's Wattle	LC		P		
Mimosaceae	<i>Acacia decora</i>	Pretty Wattle	LC		P	P	
Mimosaceae	<i>Vachellia farnesiana</i> *	Mimosa Bush	-		P		
Myoporaceae	<i>Eremophila mitchellii</i>	False Sandalwood	LC			P	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	LC		P		
Myrtaceae	<i>Eucalyptus</i> sp. (<i>camaldulensis</i> / <i>tereticornis</i>)	River Red Gum or Queensland Blue Gum	LC		P		
Myrtaceae	<i>Eucalyptus chloroclada</i>	Baradine Red Gum	LC				P
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	LC				P
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		P	P	P
Nyctaginaceae	<i>Boerhavia dominii</i>	Tar Vine	LC				P
Oleaceae	<i>Jasminum dianthifolium</i>	A Jasmine	LC			P	
Papaveraceae	<i>Argemone ochroleuca</i> *	Mexican Poppy	-		P		
Poaceae	<i>Aristida</i> sp. (infertile)	A Wiregrass	LC		P	P	P
Poaceae	<i>Cenchrus ciliaris</i> *	Buffel Grass	-			P	P
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	LC			P	
Poaceae	<i>Cynodon dactylon</i> *	Couch Grass	-		P		
Poaceae	<i>Heteropogon contortus</i>	Black Speargrass	LC		P		
Poaceae	<i>Imperata cylindrica</i>	Blady Grass	LC		P		
Poaceae	<i>Melinis repens</i> *	Red Natal Grass	-		P	P	
Poaceae	<i>Perotis rara</i>	Comet Grass	LC				P
Portulacaceae	<i>Portulaca pilosa</i> *	Hairy Portulaca	-				P
Rutaceae	<i>Geijera parviflora</i>	Wilga	LC			P	
Solanaceae	<i>Solanum nemophilum</i>		LC			P	
Sterculiaceae	<i>Brachychiton populneus</i>	Kurrajong	LC/ TAR		P		
Verbenaceae	<i>Glandularia aristigera</i> *	Mayne's Pest	-		P	P	P
Verbenaceae	<i>Verbena bonariensis</i> *	Purple Top	-		P		
Verbenaceae	<i>Verbena litoralis</i> *	Common Verbena	-		P		
Xanthorrhoeaceae	<i>Xanthorrhoea johnsonii</i>	Forest Grass Tree	LC/ TAR				P

Well Lease Area/Infrastructure Zone Assessment Report: Mt Hope Zone RM03-67

Compiled by Boobook for Santos

Boobook
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

Revision	Date	Description	Author	Verifier	Approved
A	7/2/2013	Draft issued to client for review	RJ	CE	CE
B	15/5/2013	Incorporating client comment and amended zone	RJ & RA	CE	CE
0	4/6/2013	Final submitted to client	RA	CE	CE

1. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
TAR plant	Type A Restricted Plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report

2. Introduction

2.1 Purpose & Scope

Boobook was commissioned by Santos to undertake ecological assessments on a number of well leases and infrastructure zones (hereafter individually referred to as the Zone) located on the property 'Mt Hope', located about 40km north-east of Roma, south central Queensland. Boobook was requested to undertake the following:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation present within the Zone;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the assessment site;
- Comment on the nature and location of wetlands and watercourses within 100m of the Zone;
- Provide location and description of any plants of conservation concern listed in the NC Act or EPBC Act;
- Location and characteristics of any type A restricted (TAR) plants (NC Act) in the Zone; and
- Location and characteristics of habitat trees in the Zone, with reference to trees previously mapped by Santos.

An individual report was to be prepared for each Zone. This report refers to Zone RM03-67 located on Lot 57 on Plan WV421.

Changes to the boundaries of this Zone were made by Santos following completion of the ecological assessment described in this report for the Zone (Figure 1). Modifications of this infrastructure Zone were considered to be either minor in extent and/or involving areas where the ecological values were previously assessed on-site or nearby. Although the risk is acceptably small it is possible that some ecological values of the modified Zone may not have been documented. Based on professional judgement the modified zones are highly unlikely to contain populations of threatened flora or significant fauna habitat features, however, the presence of TAR plants, especially seedlings, cannot be ruled out.

2.2 Survey Team

The project supervisor (Craig Eddie) was approved by 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.

The field survey described by this report was undertaken by Boobook on 16th January 2013 and was conducted by Richard Johnson (senior ecologist) and Rosamund Aisthorpe (graduate botanist). The following report was compiled by Rosamund Aisthorpe and Richard Johnson. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie (Principal Ecologist and Project Supervisor). Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A comprehensive desktop search was not required by the client for the purposes of this report. However, a desktop search was undertaken for RE at the property scale using mapping version 6.1 (DEHP 2012). This dataset provides a baseline for subsequent field assessment.

The search was conducted using a 5km buffer around the coordinate -26.3558°S, 149.0847°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative site was selected for each regional ecosystem present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Figure 1. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2005).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all co-ordinates quoted within this report is GDA94. When referred to within this report the sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2005: Table 29);
4. RE type mapped;
5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;
9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;

11. presence of EVNT flora;
12. a list of all other flora encountered at the Site; and
13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2005) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

A search was made within the Zone for TAR plants: If found, the location was established with a hand-held GPS unit and the species, height, DBH and possible management options were recorded.

Where mapping supplied by Santos indicated the presence of habitat trees, a search was made for these. If found the location was established with a hand-held GPS unit and the species, height, DBH and habitat value(s) were recorded. In some instances unmapped habitat trees were located during the site survey and data was collected for these trees also.

The presence of any wetlands or watercourses within 100m of the Zone was recorded.

Representative photographs were taken at each quaternary survey site in the Zone, as well as at any wetlands or watercourses, habitat trees or TAR plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

No remnant REs are mapped as present in the Zone.

4.1.2 Regional Ecosystems Observed

No remnant REs were observed in the Zone. However, Poplar Box (*Eucalyptus populnea*) woodland on alluvium at survey site Q2/RM03-67 is structurally analogous to RE 11.3.2 (of concern). The small size and high levels of disturbance present - the area is used by cattle visiting an adjacent dam – would preclude classification as a remnant RE.

4.1.3 Threatened Ecological Communities Observed

No threatened ecological communities (TECs) were observed in the Zone.

4.1.4 Non-remnant Vegetation Observed

The Zone is almost entirely vegetated by a shrubland of regrowth that has occurred after mechanical disturbance (pulling) of regrowth from earlier clearing event(s) (see Appendix A). A relict stand of Poplar Box (*Eucalyptus populnea*) is present at a stock dam. The floristics and structure of the dominant species in each woody stratum at survey sites Q1/RM03-67 and Q3/RM03-67 are shown in Table 2. Representative images of the sites are shown at Figures 2a, 2b.

Table 2: Floristics and Structure of Vegetation at Survey Sites in Zone RM03-67

Site	Location	Vegetation Description		
Q1/RM03-67	55J 711571E 7078353N	Shrubland (regrowth) dominated by <i>Eucalyptus populnea</i> ; grassy understorey dominated by <i>Aristida</i> sp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
S1	1.0	10	200	0-2
Site	Location	Vegetation Description		
Q2/RM03-67	55J 711212E 7078076N	Woodland of <i>Eucalyptus populnea</i> . Sparse upper shrub layer of non-native <i>Lycium ferocissimum</i> and lower shrub layer of <i>Maireana microphylla</i> . Grassy understorey is dominated by non-native species.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	15	35	100	35
S1	1.8	5	80	0-1

4.2 Additional Observations

4.2.1 Additional Flora Species

Approximately 21 species of native flora were detected (Appendix B). In addition, 12 non-native species were recorded. The majority of these were recorded at survey site Q2/RM03-67, where non-native pasture species and weeds dominated the understorey. One species seen there, African Boxthorn (*Lycium ferocissimum*), is a declared class 2 weed scheduled under the *Land Protection (Pest and Stock Route Management) Regulation 2003* and Weed of National Significance (WoNS).

4.2.2 Type A Restricted Plants

No TAR plants were observed in the Zone.

4.2.3 Fauna Habitat Features

Several habitat trees were detected within the Zone. All were mature Poplar Box (*Eucalyptus populnea*) trees at or adjacent to survey site Q2/RM03-67. Details of the trees are given in Table 3 and representative images are shown at Figures 3a-e. Mapping provided by Santos indicated the presence of a tree of interest at approximately 55J 710343E 7077805N. A large Poplar Box (*E. populnea*) was seen here but it did not appear to have significant fauna habitat features. No other significant fauna habitat features were recorded in the Zone.

Table 3: Details of Habitat Trees, Zone RM03-67

Waypoint	Location	Species	Alive/dead	DBH (cm)	Height (m)	Habitat features
HT1/RM03-67	55J 711239E 7078073N	Poplar Box (<i>Eucalyptus populnea</i>)	Alive	n/a	15	2 hollows <10cm diam.; 1 hollow 10-30cm diam.; 1 hollow >30cm diam.
HT2/RM03-67	55J 711222E 7078051N	Poplar Box (<i>Eucalyptus populnea</i>)	Alive	37	12	2 hollows 10-30cm diam.
HT3/RM03-67	55J 711179E 7078066N	Poplar Box (<i>Eucalyptus populnea</i>)	Alive	36	15	Nest tree
HT4/RM03-67	55J 711169E 7078106N	Poplar Box (<i>Eucalyptus populnea</i>)	Alive	45	15	Nest tree
HT5/RM03-67	55J 711216E 7078071N	Poplar Box (<i>Eucalyptus populnea</i>)	Alive	43	12	1 hollow <10cm diam.; 1 hollow 10-30cm diam.

4.2.4 Wetlands and Watercourses

Survey site Q2/RM03-67 is located immediately upstream of a small stock dam fed by a poorly-defined drainage line which crosses the Zone at this point. This is considered to be a drainage feature and not a watercourse because there are no defined bed and banks and a lack of riparian vegetation (*Water Act 2000*). The drainage line feeds a creek which the Zone follows.

This creek may be a watercourse as defined by the Act due to the presence of a defined bed and banks. A representative site at waypoint W1/RM03-67 was selected to describe this watercourse. Details are given in Table 4 and representative images are shown in Figure 4.

No other watercourses or drainage features as defined by the Act were observed at or within 100m of the Zone. No wetlands as defined by the Queensland Wetland Program (DERM 2011) as used in Santos Environmental Authority (Schedules C, M) were detected in or within 100m of the Zone.

Table 4: Wetlands and watercourses detected within Zone RM03-67

Waypoint	Location	Description
Q2/RM03-67	55J 711212E 7078353N	Drainage feature: a drainage line crossing the Zone from north to south with stock dam <50m downstream. Relict stand of <i>Eucalyptus populnea</i> surrounded by cleared paddocks. No defined bed/banks. <i>Cynodon dactylon</i> present.

Waypoint	Location	Description
W1/RM03-67	55J 710910E 7078176N	Watercourse: a small ephemeral creek with advanced regrowth of <i>Eucalyptus chloroclada</i> , <i>E. populnea</i> and <i>Callitris glaucophylla</i> . Zone follows within 100m of this creek for about 650m.

5. References

Bostock, P.D. and Holland, A.E. (eds.) (2010). *Census of the Queensland Flora 2010*. Queensland Herbarium, Brisbane.

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DERM (2011). *Queensland Wetland Definition and Delineation Guideline*, Queensland Government, Brisbane.

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Neldner, V.J., Wilson, B. A., Thompson, E.J. and Dillewaard, H.A. (2005) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland. Version 3.1*. Queensland Herbarium, Environmental Protection Agency, Brisbane.

Water Act 2000. (Queensland), viewed 14 February 2013, <<http://www.legislation.qld.gov.au/legisltn/current/w/watera00.pdf>>

Figure 1: Map of Zone RM03-67 showing survey sites and other points of interest

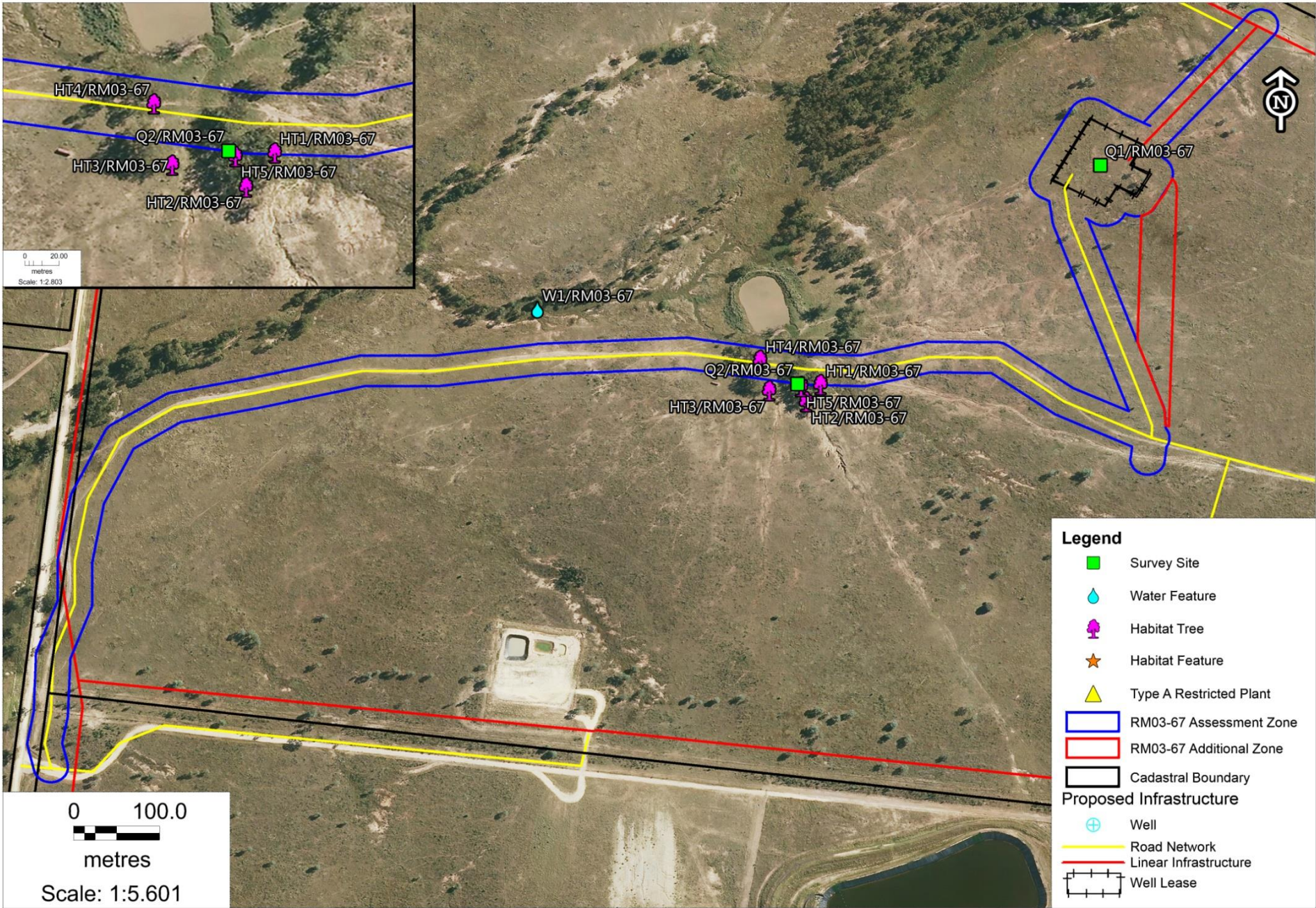




Figure 2a: Two views of shrubland (regrowth) dominated by Poplar Box (*Eucalyptus populnea*) at survey site Q1/RM03-67.



Figure 2b: A small relict patch of Poplar Box (*E. populnea*) at survey site Q2/RM03-67. Note the heavily-grazed understorey dominated by non-native species (right) and presence of a stock dam nearby (lower left).



Figure 3a: Hollow-bearing Poplar Box (*Eucalyptus populnea*) at waypoint HT1/RM03-67(left); detail of hollows shown (right).



Figure 3b: Hollow-bearing Poplar Box (*E. populnea*) at waypoint HT2/RM03-67 (left); detail of one hollow shown (right).



Figure 3c: Poplar Box (*E. populnea*) nest tree at waypoint HT3/RM03-67 (left); location of bird nest (right).



Figure 3d: Poplar Box (*Eucalyptus populnea*) nest tree at waypoint HT4/RM03-67 (left); location of bird nest (right).



Figure 3e: Hollow-bearing Poplar Box (*E. populnea*) at waypoint HT5/RM03-67 (left); detail of one hollow (right).



Figure 4: Representative site at waypoint W1/RM03-67 on a small creek to north of Zone, looking downstream to west (left) and upstream to east (right). Note regrowth in bed and on banks in an otherwise cleared landscape.

Appendix A: Quaternary assessment results, Zone RM03-67

Site No.	Q1/ RM03-67	Recorder:	Richard Johnson, Angela Bendall	Date	1/02/2013
Purpose	Well Zone Assessments			Time	09:40

Locality: "Mt Hope"
(inc. distance/direction to nearest town)

Zone: 55J 0711571 E 7078353 N Datum GDA94

Vegetation structure Median height of the EDL is to be measured				Plant species Record relative (numerical) dominance for each stratum; <i>d</i> – dominant; <i>c</i> – codominant; <i>s</i> - subdominant, <i>a</i> – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				S1	D	<i>Eucalyptus populnea</i>
T1				S1	S	<i>Acacia decora</i>
T2				G	D	<i>Aristida</i> sp.
T3						
S1	1.0	0.6 - 3.0	S (10)			
S2						
S3						
G	0.4	0.1 - 0.5	M (65)			
Structural formation: Shrubland						
Ecologically dominant layer: S1						

Geology, landform, soils

Geology code and rock types:	coarse-grained sedimentary		
Landform:	midslope; low undulating hills		
Soils:	brown sandy loam		
DERM Mapped RE Code:	NR		
Observed RE Code:	NR (ex-11.10.11)	Landzone:	10
Vegetation Short Description			
Shrubland (regrowth) dominated by <i>Eucalyptus populnea</i> ; grassy understory dominated by <i>Aristida</i> sp.			
Connectivity/Patch Characteristics			
Cleared paddock			
Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed) <i>Glandularia aristigera</i> (C), <i>Melinis repens</i> (R), <i>Gomphrena celosioides</i> (R)			
% Weed Cover:			
EVNT Flora Present:			
EVNT Flora Likely:			
Field Wpt Code:			
Photo Nos.	BBK5 4880-91		

Additional Flora:							
<i>Fimbristylis dichotoma</i>				<i>Sida corrugata</i>			
<i>Neptunia gracilis</i>				<i>Psydrax oleifolia</i>			
<i>Desmodium</i> sp.				<i>Callitris glaucophylla</i>			
<i>Eragrostis</i> sp.				<i>Goodenia glabra</i>			
<i>Bothriochloa decipiens</i>							
<i>Chrysocephalum apiculatum</i>							
<i>Cyperus gracilis</i>							
<i>Evolvulus alsinoides</i>							
<i>Maireana microphylla</i>							
<i>Brunoniella australis</i>							
<i>Glossocardia bidens</i>							
<i>Zornia muriculata</i>							
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.							
Rocks - embedded	0	Boulders	0	Shrub layer	1	Ground cover	3
Rocks - loose	0	Fallen bark	0	Leaf litter	1	Bare ground	2
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges	0	Large logs (>30cm diameter)	1	Trees / logs bearing loose bark	0		
Underhangs / overhangs / caves	0	Logs with hollows	0	Termite mounds	0		
Small logs (<30cm diameter.)	2	Hollow bearing trees	0	Mistletoe	0		
Other							
Soil cracks							
Water							
Other (e.g. food trees):							
Disturbances							
grazing; mechanical clearing							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)							
				Str.	Stems/ha	DBH (cm)	
					200	0 - 2	
Additional Notes							

Rev 0

Additional Flora:							
<i>Aristida</i> sp.							
<i>Cyperus gracilis</i>							
<i>Callitris glaucophylla</i>							
<i>Sclerolaena muricata</i>							
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.							
Rocks - embedded	0	Boulders	0	Shrub layer	1	Ground cover	4
Rocks - loose	0	Fallen bark	0	Leaf litter	1	Bare ground	1
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges	0	Large logs (>30cm diameter)	1	Trees / logs bearing loose bark	1		
Underhangs /overhangs / caves	0	Logs with hollows	1	Termite mounds	0		
Small logs (<30cm diameter.)	2	Hollow bearing trees	1	Mistletoe	0		
Other							
Soil cracks							
Water	Stock dam 50m downstream						
Other (e.g. food trees):	hollows, nest trees present						
Disturbances							
heavily modified understory; grazing, camping by cattle							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)							
				Str.	Stems/ha	DBH (cm)	
				T1	100	35	
				S1	80	0 - 1	
Additional Notes							

Appendix B: Plant species list, Zone RM03-67

Key: * indicates non-native plant species

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Other
Acanthaceae	<i>Brunoniella australis</i>	Blue Trumpet	LC		P		
Amaranthaceae	<i>Alternanthera pungens</i> *	Khaki Weed	-			P	
Amaranthaceae	<i>Gomphrena celosioides</i> *	Soft Khaki Weed	-		P		
Asteraceae	<i>Chryscephalum apiculatum</i>	Yellow Buttons	LC		P		
Asteraceae	<i>Glossocardia bidens</i>	Native Cobbler's Pegs	LC		P		
Brassicaceae	<i>Lepidium bonariense</i> *	Cut-leaf Peppergrass	-			P	
Chenopodiaceae	<i>Maireana microphylla</i>	Cotton Bush	LC		P	P	
Chenopodiaceae	<i>Sclerolaena muricata</i>	Black Roly Poly	LC			P	
Convolvulaceae	<i>Evolvulus alsinoides</i>	Tropical Speedwell	LC		P		
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC		P	P	P
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	LC		P	P	
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-sedge	LC		P		
Fabaceae	<i>Desmodium</i> sp.	A Tick-trefoil	LC		P		
Fabaceae	<i>Neptunia gracilis</i>	Native Sensitive Plant	LC		P		
Fabaceae	<i>Zornia muriculata</i>	A Zornia	LC		P		
Goodeniaceae	<i>Goodenia glabra</i>	Smooth Goodenia	LC		P		
Malvaceae	<i>Malvastrum coromandelianum</i> *	Prickly Malvastrum	-			P	
Malvaceae	<i>Sida corrugata</i>	Corrugated Sida	LC		P		
Malvaceae	<i>Sida rhombifolia</i> *	Paddy's Lucerne	-			P	
Mimosaceae	<i>Acacia decora</i>	Pretty Wattle	LC		P		
Myrtaceae	<i>Eucalyptus chloroclada</i>	Baradine Red Gum	LC				P
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		P	P	P
Poaceae	<i>Aristida</i> sp. (infertile)	A Wiregrass	LC		P	P	
Poaceae	<i>Bothriochloa decipiens</i>	Pitted Bluegrass	LC		P		
Poaceae	<i>Cenchrus ciliaris</i> *	Buffel Grass	-			P	
Poaceae	<i>Cynodon dactylon</i> *	Couch Grass	-			P	
Poaceae	<i>Eragrostis</i> sp. (infertile)	A Lovegrass	LC		P		
Poaceae	<i>Melinis repens</i> *	Red Natal Grass	-		P		
Poaceae	<i>Urochloa panicoides</i> *	Liverseed Grass	-			P	
Poaceae	<i>Urochloa mosambicensis</i> *	Sabi Grass	-			P	
Rubiaceae	<i>Psyrax oleifolia</i>	Myrtle Tree	LC		P		
Solanaceae	<i>Lycium ferocissimum</i> *	African Boxthorn	-			P	
Verbenaceae	<i>Glandularia aristigera</i> *	Mayne's Pest	-		P		

Well Lease Scouting – Environmental Adviser Assessment

Well name: RM03-16 Rev 1		PL: 309	EA: PEN101578910
Assessor: Vanessa Keogh, Field Environmental Adviser Drafted by: Angela Sherwin, Civil Works Ecologist , Vanessa Boettcher, Civil Works Ecologist Checked by:		Assessment date: 29.1.2013 Check Date:	
Zone: 55	Easting: 712280		Northing: 7083919
Versioning: There are no previous versions of this assessment			
Assessment Summary: - The proposed activity assessed in this report includes the well pad and access track indicated in Map 1. Although low impact drilling leases are the proposed activity, this assessment was conducted taking into consideration significant disturbance against the EA No: PEN101578910 and therefore is approved for low impact drilling leases and conventional pad construction. - The proposed activity is not situated in a category A, B or C Environmentally Sensitive Area (ESA) or the associated primary or secondary protection zones. - The proposed activity is not situated in, or within 200m, of a wetland, lake or spring - The proposed activity is not located within 100m of the high bank of a watercourse. - There is no mapping disputes regarding ESA's or wetlands identified during the ecological inspection. - There are no disputes regarding Regional Ecosystem mapping. - No species of conservation significance (ie listed as Near Threatened, Vulnerable, Endangered) under the provisions of the <i>Nature Conservation Act 1992</i> (NC Act) were detected. - No Type A restricted species under the provisions of the NC Act were observed in the development area. - No species or communities of conservation significance (ie listed as Critically Endangered, Endangered or Vulnerable) under the provisions of			

the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were detected within the proposed lease construction area.

- A habitat tree (Poplar Box – *Eucalyptus populnea*) was observed at 712201; 7083900. This tree will be avoided.

Well-Specific comments and final constraints (eg. European heritage, cultural heritage etc):

- Nil

Proposed Mitigation:

The following mitigation measures will be taken:

- **The habitat tree at 712201; 7083900 – Poplar Box (*Eucalyptus populnea*) must be avoided.**
- **A soil sample must be taken prior to any significant disturbance or activities taking place. Liaise with the Civil Works Ecologist (0408 290 919).**
- **Erosion and sediment control measures must be put in place to prevent sediment leaving the lease area.**
- **Compaction testing must be undertaken pre and post the conduct of the activities.**
- For the area of significant disturbance associated with cellar installation, ensure the top soil layer is removed, stockpiled to a maximum height of 1.5m and used in the rehabilitation process. In the event that the activity changes scope from a low impact lease to a standard lease layout, ensure the top layer of the soil profile is to be removed from the area of disturbance, stockpiled to a maximum height of 1.5m and used in the rehabilitation process..
- Landholder consent must be in place prior to clearing activities.
- Well lease installation is done in accordance with Santos Standards.
- Vehicle/machinery hygiene procedures to be adhered to at all times.
- Use existing infrastructure where practical.
- All clearing must be minimised to the area necessary for safe operations.
- In the event that the activity changes scope from a low impact lease to a standard lease layout, bunding is to be built around sump to prevent overland flow entering.
- Any vegetation cleared must be stockpiled in a manner that facilitates respreading or salvaging and will not impede vehicle, stock or wildlife movements.
- Any access tracks must not exceed 10 meters in width.
- A fauna spotter is not required.

Note: Santos currently holds an exemption under the NC Act for clearing species listed under the NC Act as 'Least Concern'. No other NC Act listed species are to be removed without a permit.

Maps	See Appendix 1. Maps Map 1. indicates the activity approved in this document. Map 2. indicates the area which had an assessment undertaken of the condition and type of vegetation, soils and habitat values.
EPBC Act Listed Communities	No species or communities of conservation significance (ie listed as Near Threatened, Vulnerable or Endangered) under the provisions of the Environment Protection and Biodiversity Conservation Act (EPBC Act) were detected within the proposed lease construction area.

Well names: RM03-16 Rev 1	PL: 309	EA: PEN100178208
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Schedule B – WATER

REF	Condition	Santos Assessment
Water courses, wetlands and springs		
C7	Unless otherwise authorised under this environmental authority, petroleum activity(ies) that require earthworks, vegetation clearing, placing fill and/or that will result in significant disturbance other than that associated with the construction and/or maintenance of linear infrastructure, is not permitted in or within : a) 200 meters from any wetland, lake or spring: or b) 100 meters of the high bank of any other water course	The proposed activities are within the condition B7 for water courses, wetlands and springs; a) More than 200m from a wetland, spring or lake b) More than 100m of the high bank of any other water course.
C8	All reasonable alternative locations must be considered prior to the construction of any linear infrastructure that will result in significant disturbance in or on the bed and banks of a watercourse or within the areas specified in (C7)(b).	N/A – the activity proposes not works in the bed or banks of a watercourse or within areas specified in (C7)(b).
C9	The construction and/or maintenance of linear infrastructure that will result in significant disturbance in or on the bed or banks of a watercourse or within the areas specified in (C7)(a) and (b) must be conducted in accordance with the following order of preference: (a) Conducting works in times when there is no water present (b) conducting work in times of no flow (c) conducting works in times of flow but in a way that does not impede low flow.	N/A
C10	The construction and/or maintenance of linear infrastructure that will result in significant disturbance in or on the bed and banks of a	N/A

REF	Condition	Santos Assessment
	watercourse or within the areas specified in (C7)(b) must not release from the site any contaminants to any waters that exceed the water quality limits specified in Error! Reference source not found.	
C11	Background water turbidity must be measured within 20 metres upstream of the construction and/or maintenance activities.	N/A
C12	Monitoring is undertaken at a reasonable frequency to ensure compliance with condition (C3).	N/A
C13	Written notification detailing the location (GPS coordinates) of any significant disturbance to be undertaken in or on the bed and banks of a watercourse, or within the areas specified in condition (C7)(b) must be provided to the administering authority at least 10 business days prior to the commencement of the significant disturbance.	N/A
Floodplains		
C14	Where the petroleum activity(ies) is carried out on floodplains, the holder of this environmental authority must ensure that the petroleum activity(ies) does not: (a) concentrate flood flows in a way that will or may cause or threaten an adverse environmental impact; or (b) divert flood flows from natural drainage paths and alter flow distribution; or (c) increase the local duration of floods; or (d) increase the risk of detaining flood flows; or (e) pose an unacceptable risk to the safety of persons from flooding; or	N/A – the activity is not located on a floodplain due to the following: The proposed construction site is on a higher area which would not be subject to inundation from time to time by floodwater overflowing from a watercourse. Does not confine floodwater to generally follow the path of a watercourse.

REF	Condition	Santos Assessment
	(f) pose an unacceptable risk of damage to property from flooding.	

Schedule D - LAND

Disturbance to Land – General		
E2	Prior to conducting petroleum activities that involve significant disturbance to land, an assessment must be undertaken of the condition and type and type of vegetation and soils in such areas where the activity is proposed to take place.	This assessment, including Appendix 1. Maps, Appendix 2. Desktop assessment and Appendix 3. Ecological Assessment constitutes the assessment required for condition E1.
E3	The assessment required by condition (E2) must be undertaken by a suitably qualified person and include the carrying out of field validation surveys, observations and mapping of any Category A, B or C Environmentally Sensitive Areas , wetlands and the presence of species classed as endangered, vulnerable, rare or near threatened under the <i>Nature Conservation Act 1992</i> .	Assessments of the area were carried by a suitably qualified person in line with condition (E2): • RM03-16 Rev 1 The assessments revealed and confirmed that the site is not in or near any Category A, B or C Environmentally Sensitive Areas. There were no wetlands observed at the site, or within 200m of the site. No species of conservation significance (ie listed as Near Threatened, Vulnerable or Endangered) under the provisions of the NC Act were detected.
E4	The assessment required by condition (D2) must include, but not necessarily be limited to: (a) Baseline soils quality data and maps for the soil units to be disturbed as provided for in the Soils Management Plan;	An assessment was conducted in accordance with condition E4 which included: (a) Baseline soils quality data and maps for the soil units to be disturbed as provided for in the Soils Management Plan – a soil sample will be taken from the well lease area prior to

	(b) Identification of the vegetation communities present (including species composition and regional ecosystem type 2 for native vegetation communities) within each area(s) to be disturbed; (c) data representing each vegetation community present within each area(s) to be rehabilitated including: (i) flora species richness and diversity; (ii) Structural data including woody stem count densities for dominant species within each stratum' and (iii) percent foliage cover (accounting for seasonal variation and excluding pests)	disturbance. This sample will be analysed by a NATA accredited laboratory and the results of the analysis will direct soil management in accordance with the Santos Soil Management Plan (b) Identification of the vegetation communities present (including species composition and regional ecosystem type for native vegetation communities) within each area(s) to be disturbed – the areas of disturbance is mapped as non-remnant vegetation which was confirmed to be correct during the field investigation. In addition, an external consultancy company Boobook conducted an assessment of the vegetation which occurs to the north west of the lease. (c) <i>Data representing each vegetation community present within each area(s) to rehabilitated including:</i> <i>i. Flora species richness and diversity;</i> <i>ii. Structural data including woody stem count densities for dominant species within each stratum; and</i> <i>iii. Percent foliage cover (accounting for seasonal variation and excluding pests)</i> See Appendix 3. Ecological Reports for detailed vegetation structure data collected during the inspection
E5	If the assessment required by conditions (E2) to (E4) indicates that an Environmentally Sensitive Area or wetland is incorrectly identified through state mapping, or is present and not identified by State mapping, the holder of this environmental authority must advise the administering authority in writing before any significant disturbance to land takes place.	There are no disputes regarding the mapping categorisations for ESAs or wetlands.

E6	Following the lodgement of the notification under condition (D5), significant disturbance to land within the relevant area is prohibited until the administering authority provides written advice that significant disturbance to land may proceed.	N/A
E7	If petroleum activities are authorised according to Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas in both the proposed ESA classification (as per condition (D5)) and the current ESA type/classification (as per State mapping), then those activities may proceed in accordance with Schedule D, Table 1 despite condition (D6)	N/A
E8	The holder of this environmental authority, when carrying out the petroleum activity(ies) must: (a) In order of preference, avoid, minimise or mitigate any impacts on areas of vegetation or other areas of ecological value; (b) minimise disturbance to land that may otherwise result in land degradation; (c) ensure that for land that is to be significantly disturbed by the petroleum activity(ies): i. the top layer of the soil profile is removed; ii. stockpiled in a manner that will preserve its biological and chemical properties; and iii. soils are for rehabilitation purposes; (d) avoid clearing mature trees; and (e) prior to carrying out field based petroleum activities, make all relevant staff, contractors or agents carrying out those activities, aware of the location of any category A, B or C Environmentally Sensitive Areas, wetlands and presence of species classes as endangered, vulnerable, rare or near threatened under the <i>Nature Conservation Act 1992</i> and the requirements of this environmental authority. <i>Note: This environmental authority does not authorise the taking of</i>	When carrying out the limited petroleum activity: a) Selection of the location of the proposed site aimed at avoiding and minimising impacts. The proposed site occurs in an area of existing disturbance with no remnant vegetation present. The proposed activity (low impact lease) has been specifically designed to minimise any impacts on vegetation and other areas of ecological value (including the ecological value of soil). The lease design has significantly reduced the area of disturbance required for undertaking the drilling activities. The design has also removed the need to disturb the soil profiles thereby minimising the impacts on the ecological value of the soil and enabling faster and more successful rehabilitation. b) The design of the proposed disturbance has minimised the risk of land degradation. The soil profiles will not be disturbed and as such the risk of soil erosion and degradation of soil quality is low. c) It is not expected that the activities will cause significant disturbance. Rehabilitation should not require human

	<i>protected plants, protected animals or the tampering with animal breeding place as defined under the Nature Conservation Act 1992 and Regulations and relevant approvals will need to be obtained.</i>	intervention as the soil will not be excavated and re-vegetation is expected to occur through natural regeneration. Various mitigation measures will be put in place to avoid soil compaction. Additionally, compaction testing will be undertaken pre and post the conduct of the activities to confirm there has been no significant disturbance through soil compaction that requires human intervention to remediate. d) clearing of mature trees has been avoided where practicable (see (a)); One mature habitat tree which is located near the lease will not be cleared. e) prior to carrying out field based petroleum activities, all relevant staff, contractors or agents carrying out those activities, will be made aware of the location of any category A, B or C Environmentally Sensitive Areas, wetlands and presence of species classes as endangered, vulnerable, rare or near threatened under the <i>Nature Conservation Act 1992</i> and the requirements of this environmental authority. Santos currently holds an exemption under the NC Act for clearing species listed under the NC Act as 'Not of Concern'. No other NC Act listed species will be removed without a permit.
E9	Despite condition (D8), significant disturbance to land caused by the carrying out of the petroleum activity(ies) must not involve clearing vegetation or placing fill: a) in a way which significantly isolates, fragments or dissects tracts of vegetation resulting in a reduction in the current level of ecosystem functioning, ecological connectivity (i.e. stepping stone or contiguous bioregional/local corridor networks) and/or results in an increase in threatening processes; b) on slopes greater than 10% for the petroleum activity(ies)	Clearing vegetation or placing fill will not be carried out in such way that is communicated in E9.

	other than pipelines and wells; or c) in discharge areas.	
E10	Clearing of remnant vegetation shall not exceed 10 metres in width for the purpose of establishing tracks or 20 metres in width for dual carriageway roads.	Clearing of remnant vegetation for the purpose of establishing access tracks will not exceed 10 meters.
E11	Cleared vegetation must be stockpiled in a manner that facilitates respreading or salvaging and does not impede vehicle, stock or wildlife movements.	There will be minimal vegetation cleared. Vegetation cleared will be stockpiled in a manner that facilitates respreading or salvaging and will not impede vehicle, stock or wildlife movements.
Disturbance to Land – Environmentally Sensitive Areas		
E12	Petroleum activities must not be carried out in accordance with Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas Petroleum activities in Environmentally Sensitive Areas.	There are no Environmentally Sensitive Areas within the area of disturbance.

Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas

ESA Category	Within the ESA	Primary Protection Zone of the ESA	Secondary protection zone of the ESA	Santos assessment
Category A ESAs	No petroleum activities permitted.	Only low impact petroleum activities permitted.	Only limited petroleum activities permitted. Subject to conditions (E14) and (E16).	Nil
Category B ESAs excluding 'Endangered' Regional Ecosystems.	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	Only limited petroleum activities permitted Subject to conditions (E14) and (E16).	Nil
Category B ESAs that are 'Endangered' Regional Ecosystems.	Only limited petroleum activities permitted Subject to conditions (E13) to (E17) inclusive.	Only limited petroleum activities permitted. Subject to conditions (E13) to (E17) inclusive.	Petroleum activities permitted Subject to conditions (E14) and (E18)	Nil
Category C ESAs excluding 'Of Concern' Regional Ecosystems, State Forests and Timber Reserves.	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	Only Limited petroleum activities permitted. Subject to conditions (E14) and (E18).	Nil
Category C ESAs that are State Forests, Timber Reserves and 'Of Concern' Regional Ecosystems.	Only limited petroleum activities permitted Subject to conditions (E13) to (E17) inclusive.	Only limited petroleum activities permitted Subject to conditions (E13) to (E17) inclusive.	Petroleum activities permitted.	Nil

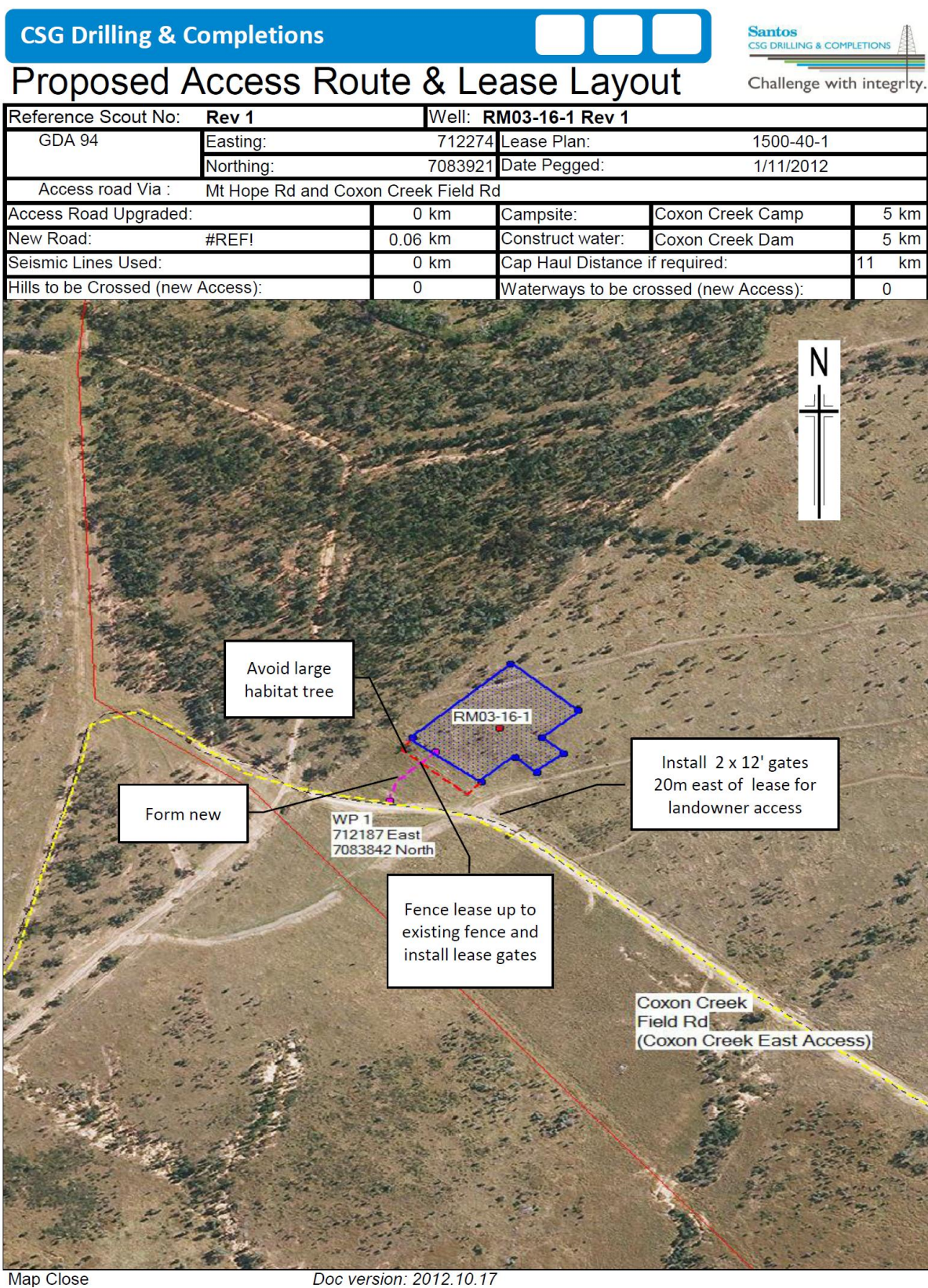
E13	Limited petroleum activities carried out within the secondary protection zone must be preferentially located in pre-existing areas of clearing or significant disturbance to the greatest practicable extent and must avoid the clearing of mature trees.	N/A
E14	Low impact or Limited petroleum activities carried out within an ESA, primary protection zone or secondary protection zone must not be conducted in those areas where there is overlap with another ESA or primary protection zone where low impact or limited petroleum activities are not authorised.	N/A
E15	Where limited petroleum activities are undertaken within the primary protection zone of, or within 'Endangered' or 'Of Concern' Regional Ecosystems, State Forests or Timber Reserves, the holder of this environmental authority must be able to demonstrate that no reasonable or practicable alternative exists and that disturbance to land only be located, and carried out in areas according to the following order of preference: (a) pre-existing cleared areas or significantly disturbed land within the primary protection zone of an 'Of Concern' Regional Ecosystem, State Forest or Timber Reserve'; (b) pre-existing cleared areas or significantly disturbed land within the primary protection zone of an 'Endangered' Regional Ecosystem; (c) undisturbed areas within the primary protection zone an 'Of Concern' Regional Ecosystem, State Forest or Timber Reserve; (d) undisturbed areas within the primary protection zone an 'Endangered' Regional Ecosystem; (e) pre-existing areas of significant disturbance within an 'Of Concern' Regional Ecosystem, State Forest or Timber Reserve' (e.g. areas where significant clearing or thinning has been	a) N/A b) N/A c) N/A d) N/A e) N/A f) N/A g) N/A h) N/A

	undertaken within a Regional Ecosystem, and/or areas containing high densities of weed or pest species which has inhibited re-colonisation of native regrowth); (f) pre-existing areas of significant disturbance within an 'Endangered' Regional Ecosystem (e.g. areas where significant clearing or thinning has been undertaken within a Regional Ecosystem, and / or areas containing high densities of weed or pest species which has inhibited re-colonisation of native regrowth); (g) areas where clearing of an 'Of Concern' Regional Ecosystem, State Forest or Timber Reserve is unavoidable; and (h) areas where clearing of an Endangered Regional Ecosystem is unavoidable.	
E16	Documentation demonstrating compliance with the requirements of the condition (E15) must be prepared by the holder of this environmental authority before any disturbance to land takes place.	N/A
E17	For limited petroleum activities undertaken within the primary protection zone of, or within 'Endangered' or 'Of Concern' Regional Ecosystems, State Forests or Timber Reserves, vegetation clearing must not exceed any of the following areas: (a) for the life of the project and before any activity commences, if the disturbance relates to an 'Endangered' or 'Of Concern' Regional Ecosystem, 10% of the remnant unit of 'Endangered' or 'Of Concern' Regional Ecosystem as ground truthed and mapped as per conditions (E2) to (E4) of this environmental authority; and (b) 6 metres in width for access tracks not associated with water or gas line; or (c) For linear infrastructure, including provision for a	N/A

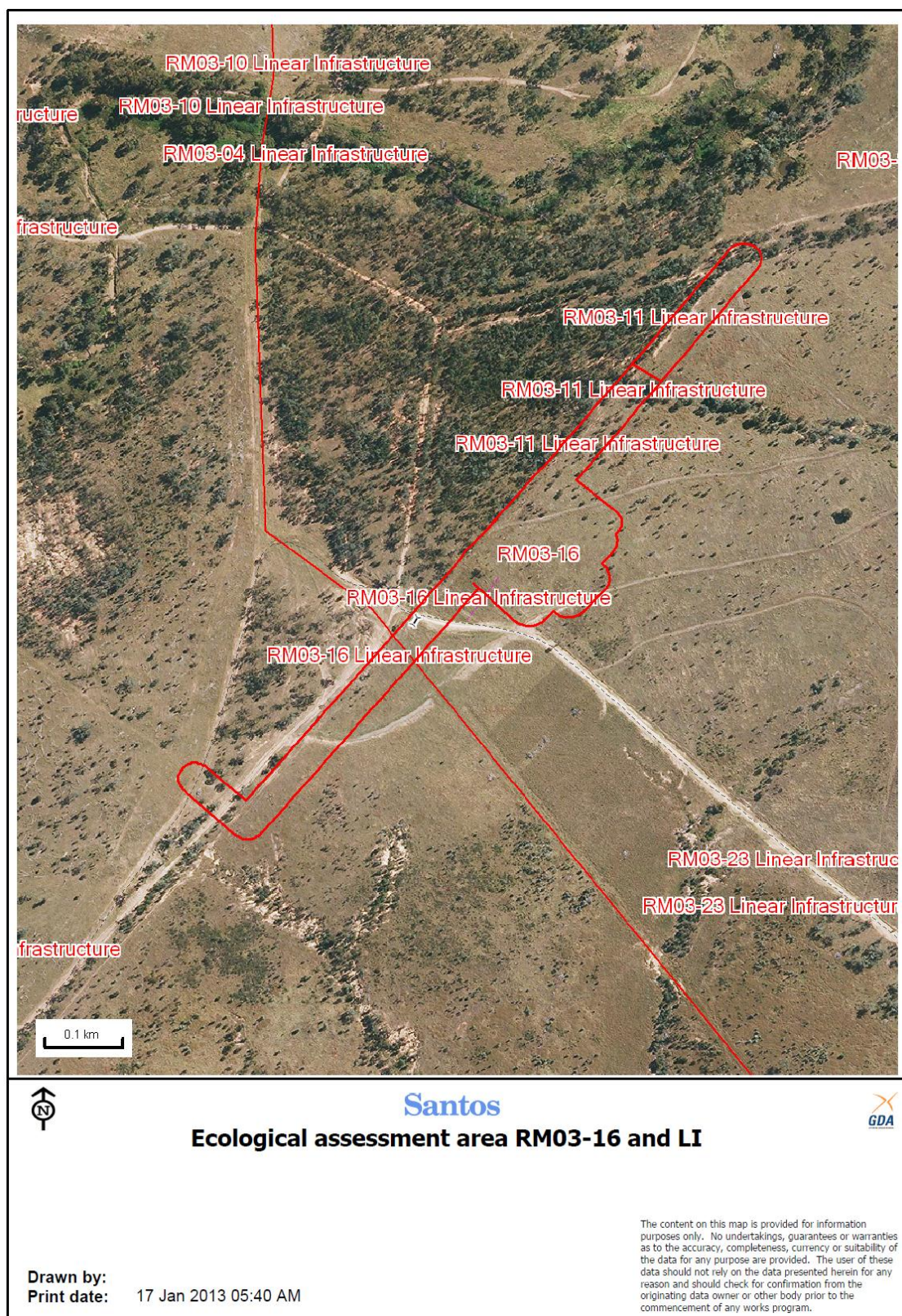
	utility corridor and access track; (i) 12 metres in width for flow pipeline construction purposes. (ii) 18 Metres width for a trench with one water gathering line and one parallel gas gathering pipeline; or (iii) 25 Metres width for multiple trenches where there are three parallel gas or water gathering lines; and (iv) Seven metres width for any additional trench for a water or gas line.	
E18	The record of the assessment required by conditions (E2) to (E4) and the extent of the significant disturbance to land in the following areas must be kept and submitted to the administering authority with each annual return: a) the primary protection zone of, or within an 'Endangered' or 'Of Concern' Regional Ecosystem, State Forest or Timber Reserve; and b) in the secondary protection zone of ESAs; and c) other remnant vegetation areas; and d) wetlands	Santos will keep and submit to the administering authority assessments required by conditions E2 – E4 for the proposed activity.

Environmental Approval	
Signed: Angela Sherwin, Civil Works Ecologist.	Date: 17 January 2013

Appendix 1. Maps



Map 1. Proposed activity approved in this document



Map 2. Ecological assessment area.

Appendix 2. Desktop assessment

CSG Drilling & Completions



EcoScout Report

Site Name	RM03-16			Landholder	TREVOR LEIGH KEHL, Armidale		
Coordinates	712274e, 7083921n	PL/ATP	PL309	Lot/Plan	Lot 79, WV759		

Mapped Constraints	Desktop Assessment					Groundtruthing			
	Assessor: Vanessa Keogh			Date: 13/08/2012		Assessor: VK		Date: 23/08/2012	
	Layer/Database	Mapped feature	Direct or PPZ?	Potential Issues?	Comments	Mapping Correct?	Direct or PPZ?	Potential Issues?	Comments
	Environmentally Sensitive Areas (ESAs)/Listed REs	Nil	N/A	No				No	
	Least Concern REs	RE11.10.11 in area	Vicinity	No				No	
	High Value Regrowth	HVR Least Concern	Vicinity	No				No	
	Watercourses	SO1 260m north and 350m SE	Vicinity	Maybe	Need to determine if constitutes a watercourse			No	Site >100m. Pipeline crosses. Veg clearing to be minimised.
	Wetlands, lakes, springs	Nil	N/A	No				No	

	EVNT Point	Nil	N/A	No	
	Ground Truthing ENV	Nil	N/A	No	
	EVNT Species	Nil	N/A	No	
	EBPC Fauna Habitat	Nil	N/A	No	
	Essential Habitat	Nil	N/A	No	
	Protected areas	Nil	N/A	No	
	GQAL	C1	N/A	No	
	SCL	Western Cropping	N/A	No	
	Bores	Nil	N/A	No	
Databases	EBPC Protected Matters Search	Not completed	N/A	Unknown	
	Wildlife Online	Not completed	N/A	Unknown	
	WildNet	Not completed	N/A	Unknown	
	HERBRECS	Not completed	N/A	Unknown	
General Comments/Outcome of desktop					

		No	
		No	
		No	
		No	
		No	
		No	
		No	
		No	
		No	
Feature		Easting	Northing
General Comments/Outcome of Scout			
Habitat Tree to be avoided - see scout lines			

Appendix 3. Ecological Reports

Santos

Quaternary Data Sheet

Site no: RM03-16 Rev 1	Date: 1.11.12 / 1340	Recorder: VJB
Locality/coordinates: 712274; 7083921		

Flora

Tree layer 1			
Cover: isolated trees only Av Height: 14m			
Species	Rel Dom	Species	Rel Dom
<i>Eucalyptus populnea</i> (Poplar Box)	D		
Tree layer 2			
Cover: isolated Av Height: 8m Height Range: 8-10m			
Species	Rel Dom	Species	Rel Dom
<i>Eucalyptus melanophloia</i> (Silver Leaved Ironbark)	C		
<i>Eucalyptus populnea</i> (Poplar Box)	C		
Shrub layer 1			
Cover: ~15% Av Height: 2m Height Range: 1-7m			
Species	Rel Dom	Species	Rel Dom
<i>Acacia decora</i> (Pretty Wattle)	A	<i>Eremophila mitchellii</i> (False Sandalwood)	A
<i>Acacia excelsa</i> (Ironwood)		<i>Eucalyptus melanophloia</i> (Silver Leaved Ironbark)	
<i>Alectryon diversifolius</i> (Scrub Boonaree)		<i>Eucalyptus populnea</i> (Poplar Box)	D
<i>Allocasuarina luehmannii</i> (Bulloak)		<i>Grevillea striata</i> (Beefwood)	
<i>Dodonaea viscosa</i> (Sticky Hop Bush)		<i>Opuntia stricta</i> (Prickly Pear)	
<i>Eremophila longifolia</i> (Dogwood)		<i>Psydrax oleifolius</i> (Myrtle Tree)	
Ground layer.			
Cover: 98% Av Height: 0.6 Height Range: 0-1m			
Species	Rel Dom	Species	Rel Dom
<i>Anagallis arvensis</i> (Blue Pimpernel)		<i>Pennisetum ciliare</i> (Buffel Grass)	
<i>Aristida</i> sp. (A Wiregrass – no fertile material)	A	<i>Plantago debilis</i> (Plantain)	
<i>Brachyscome dentata</i> (Lobe Seed Daisy)		<i>Podolepis jaceoides</i> (Showy Copper Wire Daisy)	
<i>Calotis lappulacea</i> (Yellow Burr Daisy)		<i>Pycnosorus globosus</i> (Billy Buttons)	
<i>Centaurea melitensis</i> (Maltese Cockspur)		<i>Rhynchosia minima</i> (Rhynchosia)	
<i>Chrysocephalum apiculatum</i> (Yellow Buttons)		<i>Schenkia australis</i> (Spike Centaury)	
<i>Cirsium vulgare</i> (Spear Thistle)		<i>Sclerolaena birchii</i> (Galvanised Burr)	
<i>Daucus glochidiatus</i> (Native Carrot)		<i>Sclerolaena muricata</i> (Roly Poly)	
<i>Dianella</i> sp. (Flax Lily)		<i>Themeda avenacea</i> (Wild Oats Grass)	
<i>Dichanthium sericeum</i> (Queensland Bluegrass)	D	<i>Themeda triandra</i> (Kangaroo Grass)	
<i>Dichondra repens</i> (Kidney Weed)		<i>Verbena officinalis</i> (Common Verbena)	
<i>Eragrostis brownii</i> (Browns Love Grass)		<i>Verbena tenuisecta</i> (Mayne's Curse)	
<i>Goodenia glabra</i> (Smooth Goodenia)		<i>Wahlenbergia communis</i> (Bluebell)	
<i>Juncus usitatus</i> (Juncus)		<i>Wahlenbergia gracilis</i> (Bluebell)	
Geology, landform, soils		Woody Stem counts (20x20)	

	representative plot)	
Geology code and rock types: sedimentary, lots of petrified wood	T1	0
Landform: Undulating low hills/plains	T2	0
Soils: Loamy clay	S1	11

Regional Ecosystems (RE) / Endangered Ecological Community (EEC)

Mapped RE: Non remnant	Landzone:
Corresponding EEC (mapped):	
Ground truthed RE: Non remnant	Landzone:
Corresponding EEC (ground truthed):	

Vegetation Short Description

Cleared area dominated by QLD bluegrass and with scattered eucalypt and acacia regrowth

Connectivity/Patch Characteristics

Low value

Weeds

Weeds Present. R=rare (<10 plants observed); U = uncommon (11-50 plants observed); C = common (>50 plants observed)

Maynes Pest = C, Buffel Grass = U (only on existing access edge), Spear Thistle = U

Total % Weed cover : <10%

EVNT/Type A Flora Present

Nil

EVNT/Type A Flora Likely

Nil

Fauna Habitat Features

Density scores: **0** = 0%; **1** = <25%; **2** = 26-50%; **3** = 51-75%; **4** = 75-99%; **5** = 100% abundance.

Rocks - embedded	0	Boulders	0	Shrub layer	1	Ground cover	4
Rocks - loose	1	Fallen Bark	1	Leaf litter	1	Bare ground	1

Abundance Scores: **0** = absent; **1** = 1-5; **2** = 6-20; **3** = 21-50; **4** = 51-75; **5** = 76-100; **6** = >100.

Crevices/ledges	0	Large logs (>30cm diameter)	0	Trees/logs bearing loose bark	1
Underhangs/overhangs/caves	0	Logs with hollows	0	Termite mounds	0
Small logs (<30cm diameter)	2	Hollow bearing /mature trees	1	Mistletoe	0

Disturbances (e.g. grazed, ploughed, flooded)

Grazed

Incidental Fauna Observations

Notes on watercourses, wetlands, lakes or springs

A small drainage feature was observed in the northern section of the area assessed.

Additional Notes

Habitat Tree – big half dead Poplar Box, already marked on scout lines.

Site Photos



Photo description

From well centre
facing north



Photo description

From well centre
facing south



**Photo
description**

From well centre
facing east



**Photo
description**

From well centre
looking west

Well Lease Area/ Infrastructure Zone Assessment Report: Mt Hope Zone RM03-15 Modified Zone

Compiled by Boobook for Santos

When comments back on Rev A, update
flora list: *Templetonia stenophylla*

Boobook
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

Revision	Date	Description	Author	Verifier	Approved
A	20/9/2013	Draft issued to client for review	R. Johnson	C. Eddie	C. Eddie
0	18/112013	Final version	R. Johnson		R. Johnson

1. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DSEWPac	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
TAR plant	Type A Restricted Plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

2. Introduction

2.1 Purpose & Scope

Boobook was commissioned by Santos to undertake ecological assessments on a number of well leases and infrastructure zones (hereafter individually referred to as the Zone) located on the property 'Mt Hope', located about 40km north-east of Roma, south central Queensland. Boobook was requested to undertake the following:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation present within the Zone;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the assessment site;
- Comment on the nature and location of wetlands and watercourses within 100m of the Zone;
- Provide location and description of any plants of conservation concern listed in the NC Act or EPBC Act;
- Location and characteristics of any type A restricted (TAR) plants (NC Act) in the Zone; and
- Location and characteristics of habitat trees in the Zone, with reference to trees previously mapped by Santos.

Subsequent to completion of this work (the report *BOOBOOK Mt Hope Infrastructure Zone RM03-15 Assessment Report RevO.pdf* was submitted to Santos on 21 June 2013), Santos advised that the location of the RM03-15 Zone was to be substantially modified (Figure 1a-c). Modifications of this Zone were considered to involve areas where the ecological values were not previously assessed on-site or nearby and required an additional field inspection. The results of this inspection have been included with the original findings, where still relevant, of this and other reports.

. Further, the scope of works was expanded to incorporate the following;

- Comment on the nature and location of watercourses within 100m and wetlands within 200m of the Zone;

Additionally, for the area outside the Zone but within a 200m buffer, Boobook was requested to undertake the following:

- Provide location and characteristics of any unmapped/incorrectly mapped Environmentally Sensitive Areas (ESA); and
- Provide location and characteristics of any unmapped/incorrectly mapped Threatened Ecological Communities (TEC) and other matters under the EPBC Act.

An individual report was to be prepared for each Zone. This report refers to the modified (September 2013) Zone RM03-15 located on Lot 80 on Plan WV763.

2.2 Survey Team

The project supervisor (Craig Eddie) was approved by 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.

The initial field survey described by this report was undertaken by Boobook on 23rd January 2013 and was conducted by Rosamund Aisthorpe (Graduate Botanist) and Ashley Hoffman (Field Assistant), with additional field survey conducted on 30th April 2013 by Rosamund Aisthorpe, Angela Bendall (Field Assistant) and David Chemello (Fauna Spotter/ Field Assistant). Following further revision of the Zone, re-inspection was carried out on 4th September 2013 by Richard Johnson (Senior Ecologist) and Jeroen Lurling (Intermediate Ecologist). The following report was compiled by Rosamund Aisthorpe and Richard Johnson.

All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie (Principal Ecologist and Project Supervisor). Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A comprehensive desktop search was not required by the client for the purposes of this report. However, a desktop search was undertaken for REs at the property scale using mapping version 6.1 (DEHP 2013a). This dataset provides a baseline for subsequent field assessment.

The search was conducted using a 5km buffer around the coordinate -26.3558°S, 149.0847°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative site was selected for each RE present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Figure 1a, 1b and 1c. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all GPS co-ordinates quoted within this report is GDA94. When referred to within this report the

sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2012: Table 29);
4. RE type mapped;
5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;
9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;
11. presence of EVNT flora;
12. a list of all other flora encountered at the Site; and
13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2012) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

A search was made within the Zone for TAR plants: If found, the location was established with a hand-held GPS unit and the species, height, DBH and possible management options were recorded.

Fauna habitat tree and other habitat features were searched for in the Zone. Where found the location was established with a hand-held GPS unit and the feature description was recorded.

The presence of any watercourses within 100m or wetlands within 200m of the Zone was recorded.

Representative photographs were taken at each quaternary survey site in the Zone, as well as at any wetlands or watercourses, habitat trees or TAR plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

A remnant RE is mapped as present at the western end of the Zone (Figure 1a and 1b). Details are shown in Table 2.

Table 2: Remnant REs mapped in Zone RM03-15

RE Code	Vegetation Management Class	Biodiversity Status	Short Description*
11.10.11	Not Of Concern	No Concern At Present	<i>Eucalyptus populnea</i> , <i>E. melanophloia</i> +/- <i>Callitris glaucophylla</i> woodland on coarse-grained sedimentary rocks

* Short description as per Regional Ecosystem Description Database (REDD), Department of Environment and Heritage Protection, Queensland Government (DEHP 2013b).

4.1.2 Regional Ecosystems Observed

The area mapped as remnant RE 11.10.11 (above) is sampled at survey site Q1/RM03-15. Structural and floristic characters of the vegetation here are considered to correspond to RE 11.10.9 (*Callitris glaucophylla* woodland on coarse-grained sedimentary rocks). This RE has a biodiversity status of no concern at present. The location and characteristics of woody vegetation strata are given in Table 3. Representative images are shown at Figure 2.

Note that woody vegetation within the modified part of the Zone corresponds to this remnant RE. Substantial disturbance is present, due to logging and clearing associated with construction of a now-derelict cattle yard (see additional data, Q1/RM03-15 in Appendix A).

Table 3: Floristics and Structure of Remnant Ecosystems at Survey Sites in Zone RM03-15

Site	Location	Vegetation Description		
Q1/RM03-15	55J 710932E 7084159N	<i>Callitris glaucophylla</i> woodland with associated <i>Eucalyptus populnea</i> and <i>E. chloroclada</i> ; mid-layer dominated by canopy recruits; grassy ground layer dominated by <i>Eragrostis</i> sp. and <i>Sporobolus</i> sp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	10	50	1392	20
T2	3	10	1184	3

4.1.3 Threatened Ecological Communities Observed

No threatened ecological communities (TECs) were observed in the Zone.

4.1.4 Non-remnant Vegetation Observed

The remainder of the Zone is vegetated by disturbed remnant and regrowth floristically resembling RE 11.10.11 and/or 11.10.9, with the exception of two locations where riparian vegetation associated with Appletree Creek is present (see 4.2.4). This vegetation was not further sampled.

4.2 Additional Observations

4.2.1 Additional Flora Species

Approximately 28 species of native flora were detected (Appendix B). In addition, six non-native species were recorded. Three of these, Tiger Pear (*Opuntia aurantiaca*), Common Pest Pear (*O. stricta*) and Velvety Tree Pear (*O. tomentosa*), are declared class 2 weeds scheduled under the *Land Protection (Pest and Stock Route Management) Regulation 2003* and Weeds of National Significance (WoNS).

4.2.2 Type A Restricted Plants

A number of Kurrajongs (*Brachychiton populneus*) and Black Orchids (*Cymbidiodon canaliculatum*) were recorded in or adjacent to the Zone. Details of these TAR plants are given in Table 4 and images are shown in Figures 3a-m.

Table 4: TAR Plants recorded in Zone RM03-15

Waypoint	Location	Species	Height (m)	DBH (cm)	Management
BP1/RM03-15	55J 710912E 7084177N	<i>Brachychiton populneus</i>	4	4	Translocation possible
BP2/RM03-15	55J 710962E 7084199N	<i>Brachychiton populneus</i>	12	20	Avoid
BP3/RM03-15	55J 711109E 7084321N	<i>Brachychiton populneus</i>	8, 12	25, 30	2 trees together: avoid
BP4/RM03-15	55J 711147E 7084360N	<i>Brachychiton populneus</i>	2	2	Translocation possible
BP5/RM03-15	55J 711156E 7084358N	<i>Brachychiton populneus</i>	0.4	2	Translocation possible
BP6/RM03-15	55J 711188E 7084388N	<i>Brachychiton populneus</i>	2.2	5	Translocation possible
BP7/RM03-15	55J 711711E 7084365N	<i>Brachychiton populneus</i>	2	1	Translocation possible
BP8/RM03-15	55J 711712E 7084362N	<i>Brachychiton populneus</i>	0.3, 0.3	0.5, 0.5	2 seedlings together: translocation possible
BP9/RM03-15	55J 711767E 7084357N	<i>Brachychiton populneus</i>	0.06 to 1.5	n/a	10 seedlings and saplings together: translocation possible
BP10-RM03-15	55J 710984E 7084250N	<i>Brachychiton populneus</i>	0.9	n/a	Sapling; translocation possible
CC1-RM03-15	55J 711007E 7084217N	<i>Cymbidiodon canaliculatum</i>	n/a	Base dimensions 10x20cm	On live <i>Callitris glaucophylla</i> ; translocatable
CC2-RM03-15	55J 711131E 7084288N	<i>Cymbidiodon canaliculatum</i>	n/a	Base dimensions 5x5cm	On fallen <i>C. glaucophylla</i> ; translocatable
CC3-RM03-15	55J 711122E 7084264N	<i>Cymbidiodon canaliculatum</i>	n/a	Base diameter 15cm	On <i>C. glaucophylla</i> stump; translocatable

4.2.3 Fauna Habitat Features

Twenty-seven hollow-bearing habitat trees were detected within the Zone during earlier surveys: a further 10 were detected in the modified Zone area. Additionally, a number of potential fauna habitat

features (logs and log piles) were recorded here. Location and details of these features are shown in Table 5 and Figures 4a-4ao. No other significant fauna habitat features were detected in the Zone.

Table 5: Details of Fauna Habitat Features, Zone RM03-15

Waypoint	Location	Species	Alive/ dead	DBH (cm)	Height (m)	Habitat features
HT1/RM03-15	55J 710895E 7084166 N	<i>Eucalyptus</i> sp.	dead	60	7.5	2 hollows 1-30cm diam.
HT2/RM03-15	55J 711221E 7084334 N	<i>Angophora floribunda</i>	dead	53	15	1 hollow <10cm diam.; 2 hollows 10-30cm diam.; 50% loose bark
HT3/RM03-15	55J 711515E 7084375N	<i>Eucalyptus populnea</i>	alive	27	10	1 hollow <10cm diam.
HT4/RM03-15	55J 711533E 7084350N	<i>Eucalyptus</i> sp.	dead	54	20	7 hollows <10cm diam.; 4 hollows 10-30cm diam.
HT5/RM03-15	55J 711708E 7084366 N	<i>Eucalyptus melanophloia</i>	alive	72	20	4 hollows <10cm diam.
HT6/RM03-15	55J 711707E 7084322 N	<i>Angophora floribunda</i>	dead	51	15	1 hollow <10cm diam.
HT7/RM03-15	55J 711716E 7084309 N	<i>Eucalyptus melanophloia</i>	alive	51	18	1 hollow 10-30cm diam.
HT8/RM03-15	55J 711774E 7084360 N	<i>Eucalyptus camaldulensis</i>	alive	51	18	3 hollows <10cm diam.; 5% loose bark
HT9/RM03-15	55J 711943E 7084358 N	<i>Eucalyptus populnea</i>	alive	25	12	1 hollow 10-30cm diam.
HT10/RM03-15	55 J 710901E 7084111N	<i>Eucalyptus populnea</i>	alive	40	16	2 hollows <10cm diam.; 1 hollow 10-30cm diam.; nil loose bark
HT11/RM03-15 (3 trees within 5m of each other)	55 J 710908E 7084119N	<i>Eucalyptus populnea</i>	alive	20	10	1 hollow <10cm diam.; 1 hollow 10-30cm diam.; nil loose bark
HT11/RM03-15	55 J 710908E 7084119N	<i>Eucalyptus populnea</i>	alive	20	12	1 hollow <10cm diam.; 1 hollow 10-30cm diam.; nil loose bark
HT11/RM03-15	55 J 710908E 7084119N	<i>Eucalyptus populnea</i>	alive	20	12	1 hollow <10cm diam.; nil loose bark
HT12/RM03-15	55 J 710896E 7084120N	<i>Eucalyptus populnea</i>	dead	60	14	2 hollows <10cm diam.; 2 hollows 10-30cm diam.; 1 hollow >30cm diam.; 10% loose bark
HT13/RM03-15	55 J 710868E 7084108N	<i>Eucalyptus melanophloia</i>	alive	15, 25 & 25	13	Multi-stemmed; 2 hollows 10- 30cm diam.; nil loose bark
HT14/RM03-15	55 J 710880E 7084102N	<i>Eucalyptus populnea</i>	alive	20	13	2 hollows <10cm diam.; nil loose bark

Waypoint	Location	Species	Alive/ dead	DBH (cm)	Height (m)	Habitat features
HT15/RM03-15	55 J 710870E 7084096N	<i>Eucalyptus populnea</i>	alive	30	15	1 hollow <10cm diam.; 2 hollows 10-30cm diam.; nil loose bark
HT16/RM03-15	55 J 710862E 7084103N	<i>Eucalyptus populnea</i>	alive	25	9	3 hollows <10cm diam.; nil loose bark
HT17/RM03-15	55 J 710869E 7084128N	<i>Eucalyptus populnea</i>	alive	25	18	3 hollows <10cm diam.; nil loose bark
HT18/RM03-15	55 J 710883E 7084126N	<i>Eucalyptus populnea</i>	alive	25	18	2 hollows <10cm diam.; nil loose bark
HT19/RM03-15	55 J 710854E 7084155N	<i>Eucalyptus chloroclada</i>	alive	20 & 30	10	Multi-stemmed; 4 hollows <10cm diam.; 5% loose bark
HT20/RM03-15	55 J 710843 7084156	<i>Eucalyptus chloroclada</i>	dead	30 & 20	7	Multi-stemmed; 3 hollows 10- 30cm diam.; nil loose bark
HT21/RM03-15	55 J 710838E 7084169N	<i>Eucalyptus chloroclada</i>	dead	20	8	1 hollow <10cm diam.; 2 hollows 10-30cm diam.; nil loose bark
HT22/RM03-15	55 J 710852E 7084196N	<i>Eucalyptus</i> sp.	dead	60	7	1 hollow 10-30cm diam.; 1 hollow >30cm diam.; nil loose bark
HT23/RM03-15	55 J 710860E 7084236N	<i>Eucalyptus</i> sp.	dead	100	20	2 hollows <10cm diam.; 4 hollows 10-30cm diam.; nil loose bark
HT24/RM03-15	55 J 710874E 7084223N	<i>Eucalyptus</i> sp.	dead	25	6	2 hollows 10-30cm diam.; nil loose bark
HT25/RM03-15	55 J 710865E 7084198N	<i>Eucalyptus</i> sp.	dead	40	12	2 hollows <10cm diam.; 1 hollow 10-30cm diam.; nil loose bark
HT26-RM03-15	55J 710974E 7084197N	<i>Eucalyptus chloroclada</i>	Dead	20	10	2 hollows <10cm diam., 5% loose bark
HT27-RM03-15	55J 710978E 7084198N	<i>Eucalyptus populnea</i>	Alive	32	12	1 hollow <10cm diam.
HT28-RM03-15	55J 710986E 7084227N	Myrtaceae sp.	Dead	30	12	Deeply cracked and split, loose plates of wood
HT29-RM03-15	55J 701984E 7084225N	Myrtaceae sp.	Dead	20	9	Deeply cracked and split, loose plates of wood
HT30-RM03-15	55J 711022E 7084227N	Myrtaceae sp.	Dead	20	11	1 hollow 10-30cm diam.
HT31-RM03-15	55J 711028E 7084239N	<i>Eucalyptus chloroclada</i>	dead	18, 30	13	Double-stemmed; 70% loose bark
HT32-RM03-15	55J 711029E 7084268N	<i>Eucalyptus chloroclada</i>	Alive	40	9	6 hollows <10cm diam.; 2 hollows 10-30cm diam.; 5% loose bark
HT33-RM03-15	55J 711147E 7084283N	<i>Eucalyptus populnea</i>	Alive	30	10	Double-stemmed; 2 hollows <10cm diam.; 1 hollow 10-30cm diam.

Waypoint	Location	Species	Alive/ dead	DBH (cm)	Height (m)	Habitat features
HT34-RM03-15	55J 711143E 7084376N	<i>Eucalyptus</i> sp.	Dead	45	14	4 hollows<10cm diam.; 2 hollows 10-30cm diam.
HT35-RM03-15	55J 711150E 7084384N	<i>Callitris glaucophylla</i>	Alive	70	15	Top fallen out of tree; 1 hollow >30cm diam.
HL1-RM03-15	55J 711023E 7084226E	Myrtaceae sp.	dead	To 40	4	Collapsed tree with stump
HL2-RM03-15	55J 711134E 7084273N	Myrtaceae sp.	dead	n/a	5	Collapsed large log
HL3-RM03-15	55J 711178E 7084319N	Mixed species	dead	To 20	To 3	Scatter of rotten logs and fragments
HL4-RM03-15	55J 711145E 7084358N	<i>Callitris glaucophylla</i>	dead	35	6	Large fallen fragment and stump
HL5-RM03-15	55J 711178E 7084360N	<i>Callitris glaucophylla</i> , Myrtaceae sp.	dead	To 45	To 5	Piled logs and debris
HL6-RM03-15	55J 711204E 7084419N	Mixed species	dead	To 15	To 3	Windrow of logs, debris, soil outside Zone.

4.2.4 Wetlands and Watercourses

One watercourse as defined by the *Water Act 2000* (Water Act) was observed in the Zone: it possesses well-defined banks and bed, is capable of retaining pools of water for an extended period following rain and supports fringing riparian vegetation analogous to RE 11.3.25. This watercourse, Appletree Creek, is sampled at waypoint W1/RM03-15 where it runs on the southern edge of the Zone for about 100m; and again at waypoint W2/RM03-15, where it crosses the Zone.

A minor drainage line crosses the Zone at W3/RM03-15. This is a drainage feature as defined by the Water Act, since it has no defined banks or bed, no riparian vegetation and is likely to be only capable of flowing during and immediately after rainfall, for a short period and does not have enough continual flow to maintain a riparian ecosystem. Location and details of the watercourses and drainage feature are detailed in Table 6; representative images are shown in Figures 5a-c.

No other drainage features or watercourses as defined by the Water Act were detected in or within 100m of the Zone. No wetlands as defined by the Queensland Wetland Program (DERM 2011) as used in Santos Environmental Authority (Schedules C, M) were detected in or within 200m of the Zone.

Table 6: Wetlands and watercourses detected within Zone RM03-15

Waypoint	Location	Description
W1/RM03-15	55J 711205E 7084254N	Watercourse: Appletree Creek. Defined bed and banks, some standing water in pools. Fringing riparian non-remnant vegetation floristically analogous to RE 11.3.25 present. Other wetland species present are <i>Juncus usitatus</i> , <i>Polygonum plebeium</i> .
W2/RM03-15	55J 711784E 7084336N	Watercourse: Appletree Creek. Defined bed and banks, some standing water in pools. Fringing riparian non-remnant vegetation floristically analogous to RE 11.3.25 present.

Waypoint	Location	Description
W3/RM03-15	55J 711554E 7084370N	Drainage feature: minor drainage line traverses Zone from north to south. Wetland species present include <i>Juncus usitatus</i> , <i>Cynodon dactylon</i> , <i>Leptochloa digitata</i> and <i>Lomandra longifolia</i> .

5. References

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Water Act 2000. (Queensland), viewed 14 February 2013,
 <<http://www.legislation.qld.gov.au/legisltn/current/w/watera00.pdf>>

Figure 1a: Map of Zone RM03-15 (western portion) showing survey sites and other points of interest

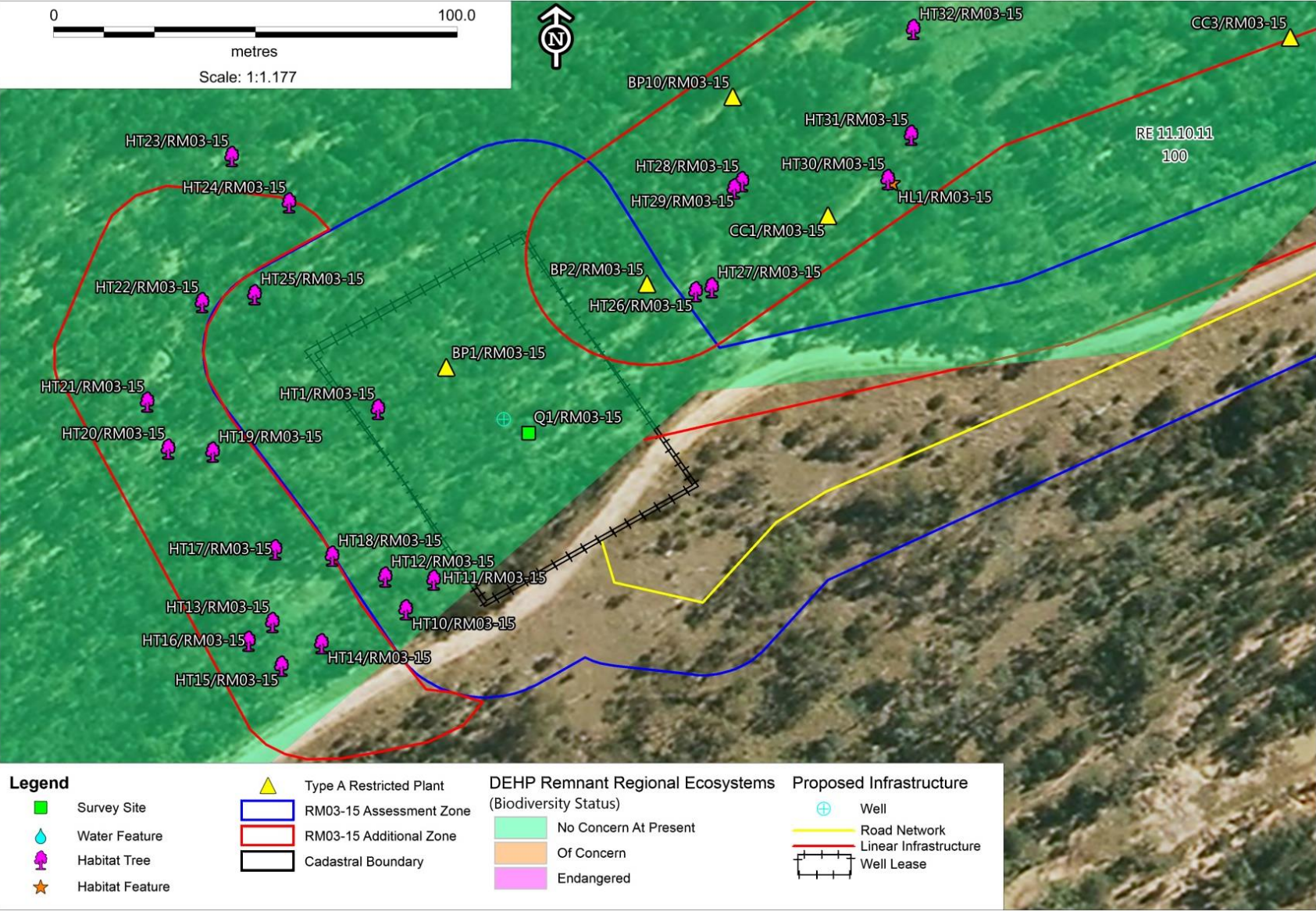


Figure 1b: Map of Zone RM03-15 (middle portion) showing survey sites and other points of interest

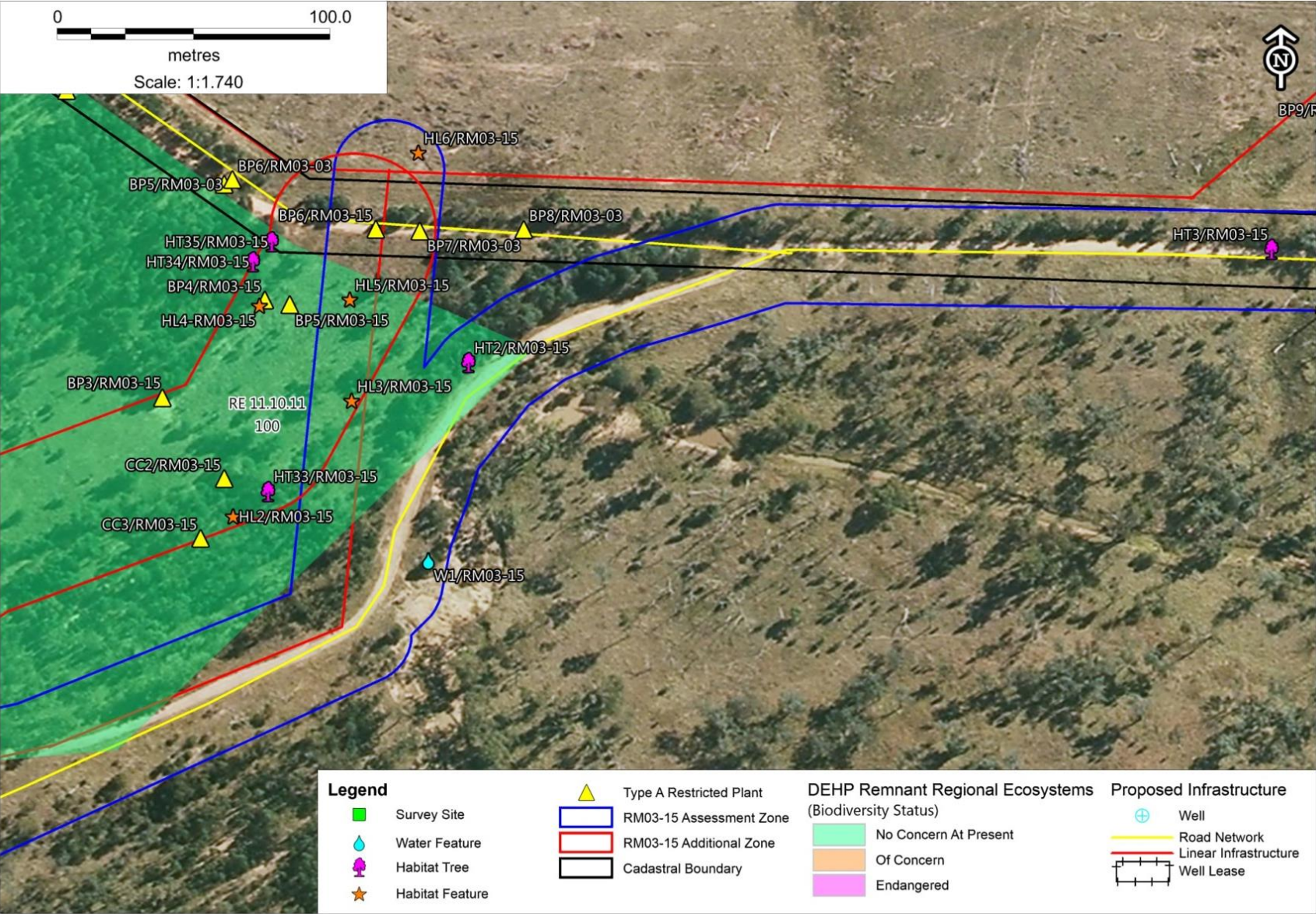


Figure 1c: Map of Zone RM03-15 (eastern portion) showing survey sites and other points of interest

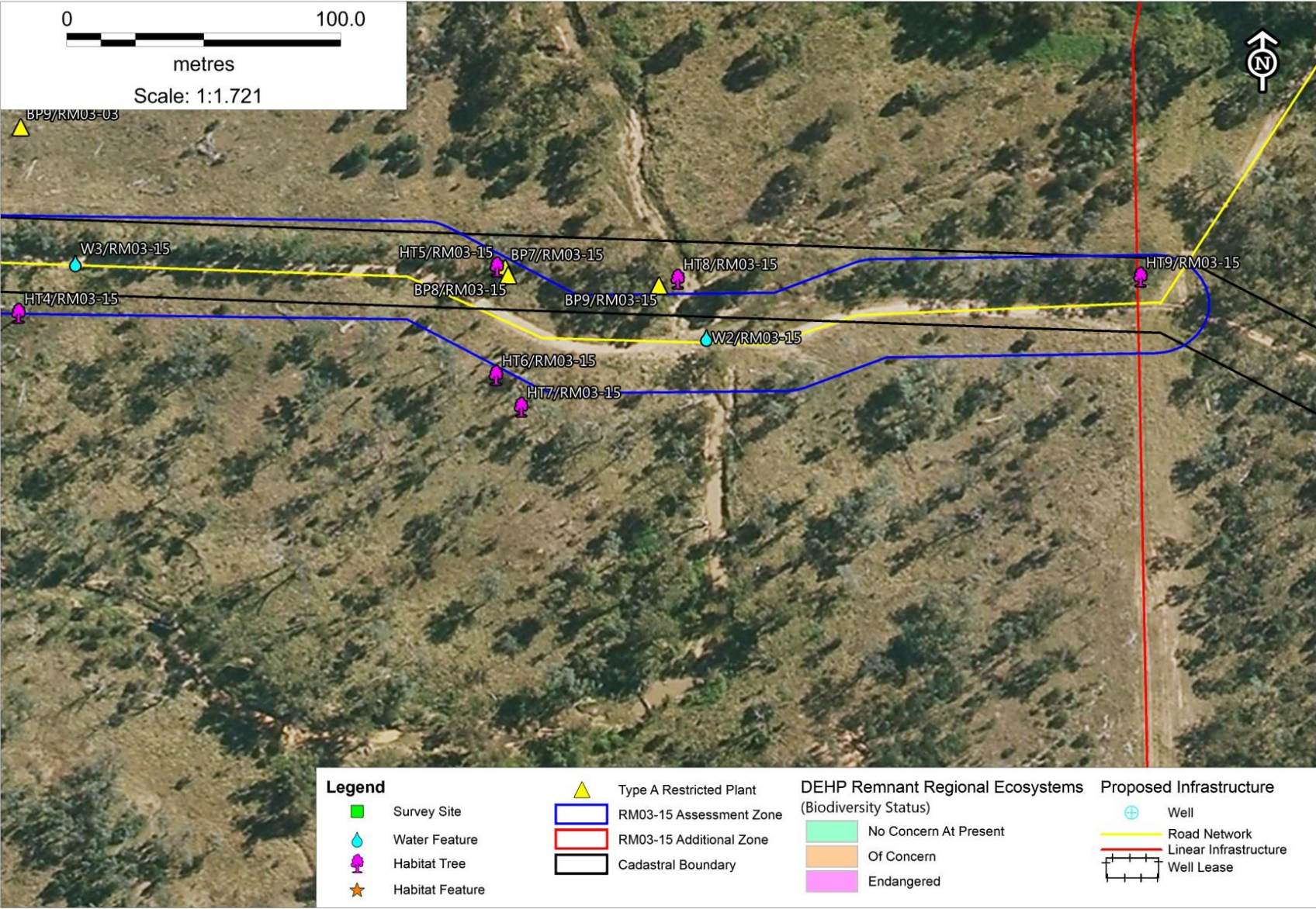




Figure 2: White Cypress Pine (*Callitris glaucophylla*) woodland corresponding to RE 11.10.9 at survey site Q1/RM03-15.



Figure 3a: A Kurrajong (*Brachychiton populneus*), a TAR plant, (centre foreground) at waypoint BP1/RM03-15 (left). **Figure 3b:** A Kurrajong (*B. populneus*) at waypoint BP2/RM03-15 (right).



Figure 3c: A Kurrajong (*B. populneus*) at waypoint BP3/RM03-15 (left). **Figure 3d:** A Kurrajong (*B. populneus*) sapling at waypoint BP4/RM03-15 (right).



Figure 3e: A Kurrajong (*Brachychiton populneus*) seedling at waypoint BP5/RM03-15 (left). **Figure 3f:** Kurrajong (*B. populneus*) sapling at waypoint BP6/RM03-15 (right).



Figure 3g: Kurrajong (*B. populneus*) sapling (in front of tree) at waypoint BP7/RM03-15 (left). **Figure 3h:** Two Kurrajong (*B. populneus*) seedlings at waypoint BP8/RM03-15 (right).



Figure 3i: A sapling Kurrajong (*B. populneus*) (left) and several seedlings (right) at waypoint BP9/RM03-15. These images do not show all of a cluster of 10 saplings or seedlings present at this location.



Figure 3j: A Kurrajong (*B. populneus*) sapling at waypoint BP10-RM03-15 (left). **Figure 3k:** Black Orchid (*Cymbidium canaliculatum*) at waypoint CC1-RM03-15 (right).



Figure 3l, m: Black Orchid (*Cymbidium canaliculatum*) plants at waypoints CC2-RM03-15 (left) and CC3-RM03-15 (right).



Figure 4a: A dead *Eucalyptus* sp. habitat tree at waypoint HT1/RM03-15 (left). **Figure 4b:** A dead Rough-barked Apple (*Angophora floribunda*) habitat tree at waypoint HT2/RM03-15 (right).



Figure 4c: A live Poplar Box (*Eucalyptus populnea*) habitat tree at waypoint HT3/RM03-15 (left).
Figure 4d: A dead *Eucalyptus* sp. habitat tree at waypoint HT4/RM03-15 (right).



Figure 4e: A live Silver-leaved Ironbark (*E. melanophloia*) habitat tree at waypoint HT5/RM03-15 (left). **Figure 4f:** A dead Rough-barked Apple (*A. floribunda*) habitat tree at waypoint HT6/RM03-15 (right).



Figure 4g: A live Silver-leaved Ironbark (*Eucalyptus melanophloia*) habitat tree at waypoint HT7/RM03-11 (left). **Figure 4h:** A live River Red Gum (*E. camaldulensis*) habitat tree at waypoint HT8/RM03-15 (right).



Figure 4i: A live Poplar Box (*E. populnea*) habitat tree at waypoint HT9/RM03-15 (left). **Figure 4j:** A live Poplar Box (*E. populnea*) habitat tree at waypoint HT10/RM03-15 (right).



Figure 4k: A group of three live Poplar Box (*E. populnea*) habitat trees at waypoint HT11/RM03-15 (left). **Figure 4l:** A dead Poplar Box (*E. populnea*) habitat tree at waypoint HT12/RM03-15 (right).



Figure 4m: A live Silver-leaved Ironbark (*Eucalyptus melanophloia*) habitat tree at waypoint HT13/RM03-11 (left). **Figure 4n:** A live Poplar Box (*E. populnea*) habitat tree at waypoint HT14/RM03-15 (right).



Figure 4o: A live Poplar Box (*E. populnea*) habitat tree at waypoint HT15/RM03-15 (left). **Figure 4p:** A live Poplar Box (*E. populnea*) habitat tree at waypoint HT16/RM03-15 (right).



Figure 4q: A live Poplar Box (*E. populnea*) habitat tree at waypoint HT17/RM03-15 (left). **Figure 4r:** A live Poplar Box (*E. populnea*) habitat tree at waypoint HT18/RM03-15 (right).



Figure 4s: A live Baradine Red Gum (*Eucalyptus chloroclada*) habitat tree at waypoint HT19/RM03-11 (left). **Figure 4t:** A dead Baradine Red Gum (*E. chloroclada*) habitat tree at waypoint HT20/RM03-15 (right).



Figure 4u: A dead Baradine Red Gum (*E. chloroclada*) habitat tree at waypoint HT21/RM03-15 (left). **Figure 4v:** A dead *Eucalyptus* sp. habitat tree at waypoint HT22/RM03-15 (right).

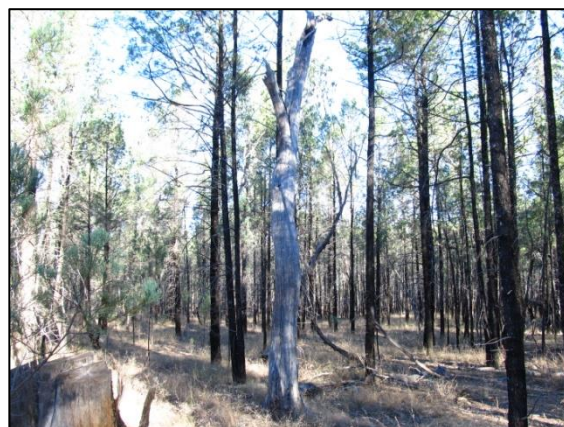


Figure 4w: A dead *Eucalyptus* sp. habitat tree at waypoint HT23/RM03-15 (left). **Figure 4x:** A dead *Eucalyptus* sp. habitat tree at waypoint HT24/RM03-15 (right).



Figure 4y: A dead *Eucalyptus* sp. habitat tree at waypoint HT25/RM03-11(left). **Figure 4z:** A dead Baradine Red Gum (*Eucalyptus chloroclada*) habitat tree at waypoint HT26-RM03-15 (right).



Figure 4aa: A live Poplar Box (*Eucalyptus populnea*) habitat tree at waypoint HT27-RM03-15 (left). **Figure 4ab:** A habitat tree (species unknown) at waypoint HT28-RM03-15 (right).



Figure 4ac: A habitat tree (species unknown) at waypoint HT29-RM03-15 (left). **Figure 4ad:** A habitat tree (species unknown) at waypoint HT30-RM03-15 (right).



Figure 4ae: A dead Baradine Red Gum (*Eucalyptus chloroclada*) habitat tree at waypoint HT31-RM03-15 (left). **Figure 4af:** A live Baradine Red Gum (*Eucalyptus chloroclada*) habitat tree at waypoint HT32-RM03-15 (right).



Figure 4ag: A live Poplar Box (*Eucalyptus populnea*) habitat tree at waypoint HT33-RM03-15 (left). **Figure 4ah:** A dead *Eucalyptus* sp. habitat tree at waypoint HT34-RM03-15 (right).



Figure 4ai: A live White Cypress Pine (*Callitris glaucophylla*) habitat tree at waypoint HT35-RM03-15 (left). **Figure 4aj:** A habitat log at waypoint HL1-RM03-15 (right).



Figure 4ak: A habitat log at waypoint HL2-RM03-15 (left). **Figure 4al:** A habitat log at waypoint HL3-RM03-15 (right).



Figure 4am: A linear pile of White Cypress Pine (*Callitris glaucophylla*) fallen tree (left), debris and stump (right) at waypoint HL4-RM03-15



Figure 4an: Piled logs and other woody debris at waypoint HL5-RM03-15 (left). **Figure 4ao:** A large windrow of woody debris and soil at waypoint HL6-RM03-15 (right).



Figure 5a: Appletree Creek at waypoint W1/RM03-15. Note exposed rock, high banks and fringing riparian vegetation.



Figure 5b: Appletree Creek at waypoint W2/RM03-15. Note high banks, riparian vegetation and pool of water.



Figure 5c: A drainage feature at waypoint W3/RM03-15. Note lack of defined banks and channel. The wetland plant Common Rush (*Juncus usitatus*) is prominent in places.

Appendix A: Quaternary assessment results, Zone RM03-15

Site No. Q1/ RM03-15 Recorder: Rosamund Aisthorpe, Ashley Hoffmann Date 23/01/2013
Purpose Well Zone Assessments Time 13:50

Locality: (inc. distance/direction to nearest town) "Mt Hope" @ RM03-15
Zone: 55J 0710932 E 7084159 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Callitris glaucophylla</i>
T1	10	8 - 12	M (50)	T1	A	<i>Eucalyptus populnea</i>
T2	3	2 - 4	S (10)	T1	A	<i>E. chloroclada</i>
T3				T2	D	<i>C. glaucophylla</i>
S1				T2	A	<i>E. chloroclada</i>
S2				G	D	<i>Eragrostis</i> sp.
S3				G	A	<i>Sporobolus</i> sp.
G	0.2	0.1 - 0.3	M (40)			
Structural formation: Woodland						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types:	coarse-grained sedimentary rocks		
Landform:	low undulating hills (gentle slope)		
Soils:	pale brown loamy sand		
DEHP Mapped RE Code:	11.10.11		
Observed RE Code:	11.10.9 ± regrowth 11.10.9	Landzone:	10
Vegetation Short Description			
<i>Callitris glaucophylla</i> woodland with associated <i>Eucalyptus populnea</i> and <i>E. chloroclada</i> ; midlayer dominated by canopy recruits; grassy ground layer dominated by <i>Eragrostis</i> sp. and <i>Sporobolus</i> sp.			
Connectivity/Patch Characteristics			
Part of remnant patch; clearing following vehicle track to south, clear to NE			
Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed) <i>Opuntia stricta</i> (R), <i>O. aurantiaca</i> (R), <i>O. tomentosa</i> (R), <i>Portulaca pilosa</i> (R)			
% Weed Cover:	<5		
EVNT Flora Present:	Nil		
EVNT Flora Likely:	Nil		
Field Wpt Code:			
Photo Nos.	BBK5 4130-4132		

Additional Flora:							
<i>Lomandra longifolia</i>				<i>Acacia leiocalyx</i>			
<i>Murdannia graminea</i>				<i>Brunonia australis</i>			
<i>Sida hackettiana</i>				<i>Tricoryne elatior</i>			
<i>Desmodium</i> sp.				<i>Cymbopogon refractus</i>			
<i>Parsonsia eucalyptophylla</i>				<i>Heteropogon contortus</i>			
<i>Alectryon oleifolius</i>				<i>Dianella caerulea</i>			
<i>Commelina</i> sp. (infertile)				<i>Dichondra repens</i>			
<i>Cyanthillium cinereum</i>							
aua Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.							
Rocks - embedded	0	Boulders	0	Shrub layer	1	Ground cover	2
Rocks - loose	0	Fallen bark	1	Leaf litter	1	Bare ground	2
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges	0	Large logs (>30cm diameter)	1	Trees / logs bearing loose bark	0		
Underhangs /overhangs / caves	0	Logs with hollows	1	Termite mounds	0		
Small logs (<30cm diameter.)	2	Hollow bearing trees	0	Mistletoe	0		
Other							
Soil cracks	nil						
Water	Nil						
Other (e.g. food trees):	nil						
Disturbances							
Grazing: moderate; current							
Logging: moderate; >10 yrs ago							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over, HAN=handled)				Structure of Woody Strata			
				Str.	Stems/ha	DBH (cm)	
White-eared Honeyeater 1 SE				T1	1392	20	
Grey Fantail 1 HE				T2	1184	3	
Weebill 1 HE							
Grey Butcherbird 1 HE							
Black-faced Cuckoo-shrike 1 HE				Black Kite 1 FO			
Inland Thornbill 3 SE				Brown Falcon 1 FO			
Torresian Crow 1 HE				Striated Pardalote 1 HE			
Noisy Miner 1 HE				Magpie-lark 1 HE			
Leaden Flycatcher 1 SE				<i>Carlia pectoralis</i> 1 HAN			
Rufous Whistler 1 SE				Meadow Argus 1 SE			
Sulphur-crested Cockatoo 2 SE							
Tawny Frogmouth 1 EV							
Additional Notes							

Appendix B: Plant species list, Zone RM03-15

Key: * indicates non-native plant species; LC = least concern; P = present; Q = quaternary survey site; # = identification confirmed by Queensland Herbarium

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Other
Apocynaceae	<i>Parsonsia eucalyptophylla</i>	Gargaloo	LC		P	
Asteraceae	<i>Centipeda minima</i>	Desert Sneezeweed	LC			P
Asteraceae	<i>Cyanthillium cinereum</i>	Vernonia	LC		P	
Cactaceae	<i>Opuntia aurantiaca</i> *	Tiger Pear	-		P	
Cactaceae	<i>Opuntia stricta</i> *	Common Pest Pear	-		P	
Cactaceae	<i>Opuntia tomentosa</i> *	Velvety Tree Pear	-		P	
Commelinaceae	<i>Commelina</i> sp. (infertile)	A Scurvy Weed	LC		P	
Commelinaceae	<i>Murdannia graminea</i>	Slugwort	LC		P	
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	LC		P	
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC		P	
Fabaceae	<i>Desmodium</i> sp. (indet.)	A Tick-trefoil	LC		P	
Fabaceae	<i>Templetonia stenophylla</i> [#]	A pea	LC		P	
Goodeniaceae	<i>Brunonia australis</i>	Blue Pincushions	LC		P	
Hemerocallidaceae	<i>Dianella caerulea</i>	Flax Lily	LC		P	
Johnsoniaceae	<i>Tricoryne elatior</i>	Yellow Rush-lily	LC		P	
Juncaceae	<i>Juncus usitatus</i>	Common Rush	LC			P
Laxmanniaceae	<i>Lomandra longifolia</i>	Long-leaved Matrush	LC		P	P
Malvaceae	<i>Sida hackettiana</i>	Spiked Sida	LC		P	
Mimosaceae	<i>Acacia leiocalyx</i>	Early-flowering Black Wattle	LC		P	

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Other
Molluginaceae	<i>Glinus lotoides</i>	Hairy Carpet-weed	LC			P
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	LC			P
Myrtaceae	<i>Eucalyptus chloroclada</i>	Baradine Red Gum	LC		P	
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	LC			P
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		P	
Myrtaceae	<i>Eucalyptus</i> sp. (<i>camaldulensis/ tereticornis</i>)	River Red Gum/ Queensland Blue Gum	LC			P
Poaceae	<i>Aristida</i> sp. (infertile)	A Wiregrass	LC			P
Poaceae	<i>Cymbopogon refractus</i>	Barbwire Grass	LC		P	
Poaceae	<i>Cynodon dactylon</i> *	Couch Grass	-			P
Poaceae	<i>Heteropogon contortus</i>	Black Speargrass	LC		P	
Poaceae	<i>Eragrostis</i> sp.	A Lovegrass	LC		P	
Poaceae	<i>Imperata cylindrica</i>	Blady Grass	LC			P
Poaceae	<i>Leptochloa digitata</i>	Umbrella Canegrass	LC			P
Poaceae	<i>Sporobolus</i> sp.	A Rat's Tail Grass	-		P	
Poaceae	<i>Urochloa panicoides</i> *	Liverseed Grass	-			P
Polygonaceae	<i>Polygonum plebeium</i>	Small Knotweed	LC			P
Portulacaceae	<i>Portulaca pilosa</i> *	Hairy Portulaca	-		P	
Sapindaceae	<i>Alectryon oleifolius</i>	Boonaree	LC		P	

Well Lease Scouting – Environmental Adviser Assessment

Well name: RM03-22-1 Rev 2		Lot/Plan: Lot 80 Plan WV763	PL: 309	EA: EPPG00898213
Approved by: Vanessa Keogh, Field Environmental Adviser.			Assessment date: 23.7.2013	
Drafted by: Angela Sherwin, Field Environmental Adviser.			Draft Date: 21.7.2013	
Zone: 55	Easting: 711552		Northing: 7083525	
Versioning: This approval has been issued in accordance with RSGPA EA conditions granted on 19.4.2013				
Assessment Summary: • This approval is for the RM03-22-1 Rev 2 minimal disturbance well lease and access track with lease layout 1500_40_69. • The proposed activity is not in a Category A, B or C Environmentally Sensitive Area or any protection zones. • The site is not located within 100m of the high bank of a watercourse, or 200m of a wetland, lake or spring. • There were no disputes regarding ESAs or wetlands identified in the ecological inspection. • No species classed as endangered, vulnerable or near threatened (EVNT) under the <i>Nature Conservation Act 1992</i> (NC Act) were detected during the ecological assessment. • The ecological assessment has confirmed that the area proposed for disturbance contains remnant vegetation with some regrowth of the same classification throughout. • No threatened species or threatened ecological communities listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth) (EPBC Act) were detected within the area where the activity is proposed to take place. Well-Specific comments and final constrains (eg. European heritage, cultural heritage etc): • N/A				

Proposed Mitigation:

The following mitigation measures will be taken:

- **A fauna spotter is required on site for clearing activities.**
- Access tracks must not exceed 10m in width.
- Landholder consent must be in place prior to clearing activities.
- Well Lease installation is done in accordance with Santos Standards.
- Vehicle/machinery hygiene procedures to be adhered to at all times.
- Ensure maximum root stock is left undisturbed where possible for topsoil retention.
- Drilling rig matting will be installed as per Minimal Disturbance Lease layout requirements (lease layout 1500_40_69_).
- **On removal of the Rig Matting (post drilling activities) the Erosion and Sediment Control Plan in Appendix 4 must be implemented.**
- All clearing must be minimised to the area necessary for safe operations. Woody vegetation is to be mulched and either:
 - Used to construct the grass filter/contour as per Appendix 4; or
 - Used as groundcover over the area of disturbance.
- Contaminants must not be released to waters or land.
- Prior to carrying out field based petroleum activities, all relevant staff, contractors or agents carrying out those activities, are to be made aware of the these conditions and the requirements of the environmental authority.

Note: Santos currently holds an exemption under the NC Act for clearing species listed under the NC Act as 'Least Concern'. No other NC Act listed species are to be removed without a permit.

Maps	Appendix 1. Maps	Map 1. Infrastructure map close Map 2. Infrastructure map far Map 3. RM03-22 Rev 2 Ecological assessment area
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Well names: RM03-22-1 Rev 2	Lot/Plan: Lot 80 Plan WV763	PL: 309	EA: EPPG00898213
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Schedule B – WATER

REF	Condition	Santos Assessment
Water courses, wetlands and springs		
C1	Contaminants must be directly or indirectly released to any waters except as permitted under this environmental authority.	Contaminants will not be released to waters or land.
C7	Unless otherwise authorised under this environmental authority, petroleum activity(ies) that require earthworks, vegetation clearing, placing fill and/or that will result in significant disturbance other than that associated with the construction and/or maintenance of linear infrastructure, is not permitted in or within : a) 200 meters from any wetland, lake or spring; or b) 100 meters of the high bank of any other water course	The proposed activities are within the condition C7 for water courses, wetlands and springs; a) More than 200m from a wetland, spring or lake b) More than 100m of the high bank of any other water course. N
C8	All reasonable alternative locations must be considered prior to the construction of any linear infrastructure that will result in significant disturbance in or on the bed and banks of a watercourse or within the areas specified in (C7)(b).	N/A
C9	The construction and/or maintenance of linear infrastructure that will result in significant disturbance in or on the bed or banks of a watercourse or within the areas specified in (C7)(a) and (b) must be conducted in accordance with the following order of preference: (a) Conducting works in times when there is no water present (b) conducting work in times of no flow (c) conducting works in times of flow but in a way that does not impede low flow.	N/A
C10	The construction and/or maintenance of linear infrastructure that will result in significant disturbance in or on the bed and banks of a	N/A

REF	Condition	Santos Assessment
	watercourse or within the areas specified in (C7)(b) must not release from the site any contaminants to any waters that exceed the water quality limits specified in <i>Schedule C, Table 1 – Release Limits to Waters</i>	

Schedule C, Table 1 – Release Limits to Waters

Water Quality Parameters	Units	Water Quality Limits
Turbidity	NTU	10% above background water turbidity measured within 20 meters downstream of the construction and/or maintenance activity.
Hydrocarbons	-	No visible sheen

C11	Background water turbidity must be measured within 20 metres upstream of the construction and/or maintenance activities.	N/A
C12	Monitoring is undertaken at a reasonable frequency to ensure compliance with condition (C3).	N/A
C13	Written notification detailing the location (GPS coordinates) of any significant disturbance to be undertaken in or on the bed and banks of a watercourse, or within the areas specified in condition (C7)(b) must be provided to the administering authority at least 10 business days prior to the commencement of the significant disturbance.	N/A
Floodplains		
C14	Where the petroleum activity(ies) is carried out on floodplains, the holder of this environmental authority must ensure that the	N/A – the activity is not located on a floodplain due to the following:

REF	Condition	Santos Assessment
	petroleum activity(ies) does not: (a) concentrate flood flows in a way that will or may cause or threaten an adverse environmental impact; or (b) divert flood flows from natural drainage paths and alter flow distribution; or (c) increase the local duration of floods; or (d) increase the risk of detaining flood flows; or (e) pose an unacceptable risk to the safety of persons from flooding; or (f) pose an unacceptable risk of damage to property from flooding.	The proposed construction site is on a higher area which would not be subject to inundation from time to time by floodwater overflowing from a watercourse. Additionally, the ecological assessment report did not detail any floodplains or structural components of floodplains.

Schedule E - LAND

Disturbance to Land – General		
E1	Contaminants must not be directly or indirectly released to land except as permitted under this environmental authority.	Santos will ensure that contaminants are not directly or indirectly released to land except as permitted under this environmental authority. The administering authority will be notified of any reportable release of contaminants.
E2	When petroleum activities are undertaken it must be ensured, that: (a) the top layer of the soil profile is removed and stockpiled in accordance with condition (E13) (b) any soils that are removed during the significant disturbance are retained for use for rehabilitation purposes (c) The clearing of mature trees has been preferentially avoided (d) Any clearing of vegetation or placing of fill does not significantly isolates, fragments or dissects tracts of vegetation resulting in a reduction in the current level of	When petroleum activities are undertaken it will be ensured, that: (a) Due to the activity being a minimal disturbance lease, the top layer of the soil profile will be treated in accordance with condition (E13) and actions taken for minimal disturbance leases. These will include leaving maximum root stock where possible and rilling material to the topside of the lease area to create a diversion for overland flow. The soil management plan will be followed to ensure the correct methods are implemented for the type of lease constructed. (b) any soils that are removed during the significant

	ecosystem functioning, ecological connectivity (i.e. stepping stone or contiguous bioregional/local corridor networks) and/or results in an increase in threatening processes ;	(c) disturbance are retained for use for rehabilitation purposes The clearing of mature trees has been preferentially avoided as much as practical. Despite efforts to remain out of the remnant vegetation, the lease could not be moved to the east due to the location of the nearby RM03-29 which was pushed east due to Coxon Creek being on its' eastern side. Significant efforts were made to avoid mature trees with habitat value in the area – only a small area of remnant vegetation will be impacted. (d) Any clearing of vegetation or placing of fill will not significantly isolate, fragment or dissect tracts of vegetation resulting in a reduction in the current level of ecosystem functioning, ecological connectivity (i.e. stepping stone or contiguous bioregional/local corridor networks) and/or results in an increase in threatening processes; As the clearing is on the edge of the remnant vegetation, the impacts are expected to be less than traversing through the area.
E3	Prior to conducting petroleum activities that involve significant disturbance to land, an assessment must be undertaken of the condition, type ecological value of soils and vegetation in such areas where the activity is proposed to take place.	Condition E3 is satisfied by Appendix 1. Maps, Appendix 2. Desktop assessment and Appendix 3. Ecologist report.
E4	The assessment required by condition (E3) must be undertaken by a suitably qualified person and include the carrying out of field validation surveys, observations and mapping of any Category A, B or C Environmentally Sensitive Areas , wetlands and the presence of species classed as endangered, vulnerable, rare or near threatened under the <i>Nature Conservation Act 1992</i> .	The assessments required by condition (E3) were carried out by suitably qualified people as per the meaning provided in the EA definitions. The assessments of RM03-22-1 Rev 2 revealed that the site is not within any Environmentally Sensitive Areas, wetlands or constraints classes. Ground truthing surveys conducted in and within 200m of the disturbance area confirmed this desktop assessment. No species classed EVNT under the NC Act were detected. A record of flora classed as Least Concern under the NC Act was recorded and can be seen in Appendix 3. Ecologist report.

E5	The assessment required by condition (E1) must also include, but not necessarily be limited to: (a) Baseline soils quality data and maps for the soil units to be disturbed as provided for in the Soils Management Plan; (b) Identification of the vegetation communities present (including species composition and regional ecosystem type for native vegetation communities) within each area(s) to be disturbed; (c) a map or series of maps of suitable scale displaying the distribution of vegetation communities; and (d) data on the level of ecosystem function of each vegetation community.	An assessment was conducted in accordance with condition E3 which included: (a) The soil management plan will be implemented in accordance with this proposed activit. (b) Identification of the vegetation communities present (including species composition and regional ecosystem type for native vegetation communities) within each area(s) to be disturbed have been assessed. Quaternary field survey was conducted in accordance with “<i>Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland</i>”, this assessment is represented by the ecological assessment report mentioned in the assessment summary and is available on request. (c) Data on the level of ecosystem functioning has been collected and is provided in Appendix 3. Ecologist Report.
E6	If there is a suitable analogue site for the area where the petroleum activity(ies) is proposed to take place is not able to be identified, then the assessment required by condition (E3) must also include, but not necessarily be limited to: (a) data representing each vegetation community present within each area(s) to be rehabilitated including: i) flora species richness and diversity ii) Structural data including woody stem count densities for dominant species within each stratum iii) percent foliage cover (accounting for seasonal variation and excluding pests) (b) data regarding habitat features, including but not necessarily limited to: (i) organic litter cover (%); and (ii) Trees with hollows $\geq 10\text{cm}$ diameter (Count and timber per hectare); (iii) hollow bearing logs (count and number per hectare); and (iv) fallen woody material (total length of logs $\geq 10\text{cm}$ diameter per	Due to uncertainty of additional and often unrelated infrastructure which may be planned for the area and have an impact on a chosen analogue site, the assessment required by condition (E1) has also included: (a) data representing each vegetation community present within each area(s) to be rehabilitated including: i) flora species richness and diversity ii) Structural data including woody stem count densities for dominant species within each stratum iii) percent foliage cover (accounting for seasonal variation and excluding pests) (b) data regarding habitat features, including but not necessarily limited to: (i) organic litter cover (%); and (ii) Trees with hollows $\geq 10\text{cm}$ diameter (Count and timber per hectare); (iii) hollow bearing logs (count and number per hectare); and

	hectare and number of logs ≥ 10 cm diameter per hectare).	(iv) fallen woody material (total length of logs ≥ 10 cm diameter per hectare and number of logs ≥ 10 cm diameter per hectare).
E7	If the assessment required by conditions (E3) to (E6) indicates that an Environmentally Sensitive Area or wetland is incorrectly identified through state mapping, or is present and not identified by State mapping, proposed activities may proceed in accordance with the conditions of the environmental authority and the field validated values.	An assessment was done in accordance with conditions E3 to E6. There are no disputes regarding the mapping categorisations for ESAs or wetlands within the area where the assessment was undertaken. As such, there is no requirement to notify the administering authority about incorrectly mapped ESAs or wetlands.
E8	In the instance where a proposed activity is authorised (in E5) under the environmental authority based upon the field validated value(s), but not the State mapped value(s), the environmental authority holder must notify the administering authority fir (5) business days prior to the activity commencing. The notification must be in writing, stipulate the precise location, and the nature of the proposed activity.	N/A
E9	The environmental authority holder must maintain for the life of the environmental authority all documentation survey information photographs, field data or any material associated with the field validation requirements in (E4) to demonstrate to the Administering Authority that surveys were conducted in a manner consistent with requirements contained in (E5).	Santos will maintain for the life of the environmental authority all documentation survey information photographs, field data and any other material associated with the field validation requirements in (E4) to demonstrate to the Administering Authority that surveys were conducted in a manner consistent with requirements contained in (E5).
Disturbance to Land – Environmentally Sensitive Areas		
E10	Activities must be conducted in accordance with Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas and any other relevant conditions of this environmental authority.	Activities will be conducted in accordance with Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas and all other relevant conditions of this environmental authority. See condition E8.

Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas

ESA Category	Within the ESA	Primary Protection Zone of the ESA	Secondary protection zone of the ESA	Santos assessment
Category A ESAs	No petroleum activities permitted.	Only low impact petroleum activities permitted.	Only limited petroleum activities permitted.	Desktop searches were conducted and no Category A ESAs are present within 1000m of the proposed disturbance area.
Category B ESAs excluding 'Endangered' Regional Ecosystems.	Only low impact petroleum activities permitted.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop and ground truthing surveys were conducted and no relevant Category B ESAs are present in within 200m of the proposed disturbance area.
Category C ESAs that are Nature Refuges, Koala Habitat and/or Declared Catchment areas	Only low impact petroleum activities permitted	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop surveys were conducted and no relevant Category C ESAs are present in or within 200m the proposed disturbance area.
Category B ESAs that are 'Endangered' Regional Ecosystems.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop and ground truthing surveys were conducted and no relevant Category B ESAs are present in or within 200m of the proposed disturbance area.
Category C ESAs that are Essential Habitat, Essential regrowth Habitat and/or 'Of Concern' Regional Ecosystems	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop and ground truthing surveys were conducted and no relevant Category C ESAs are present in or within 200m of the proposed disturbance area.
Category C ESAs that are Resource Reserves	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop surveys were conducted and no relevant Category C ESAs are present in or within 300m of the proposed disturbance area.
Category C ESAs that are State Forests, Timber Reserves	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	N/A	Desktop surveys were conducted and no relevant Category C ESAs are present in the proposed disturbance area.

E11	Prior to carrying out limited petroleum activities undertaken within environmentally sensitive areas in accordance with Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas It must be demonstrated, in the following order of preference that” 1. no reasonable or practicable alternative exists for carrying out the limited petroleum activities within the environmentally sensitive area; 2. the limited petroleum activities are preferentially located in pre-existing areas of clearing or significant disturbance; 3. vegetation clearing for the limited petroleum activities must not exceed any of the following areas: (a) 6 metres in width for access tracks not associated with a water, gas, power or communications line; or (b) for linear infrastructure, including provision of an access track; (i) 12 metres width for a single water, gas, power or communications line; or (ii) 7 metres width for any additional water or gas line.	No activities will be conducted within the ESAs mentioned in Schedule E, Table 1.
E12	If limited petroleum activity(ies) are located within a primary protection zone or secondary protection zone of an environmentally sensitive area, that the activity(ies) must not negatively affect the adjacent environmentally sensitive area.	

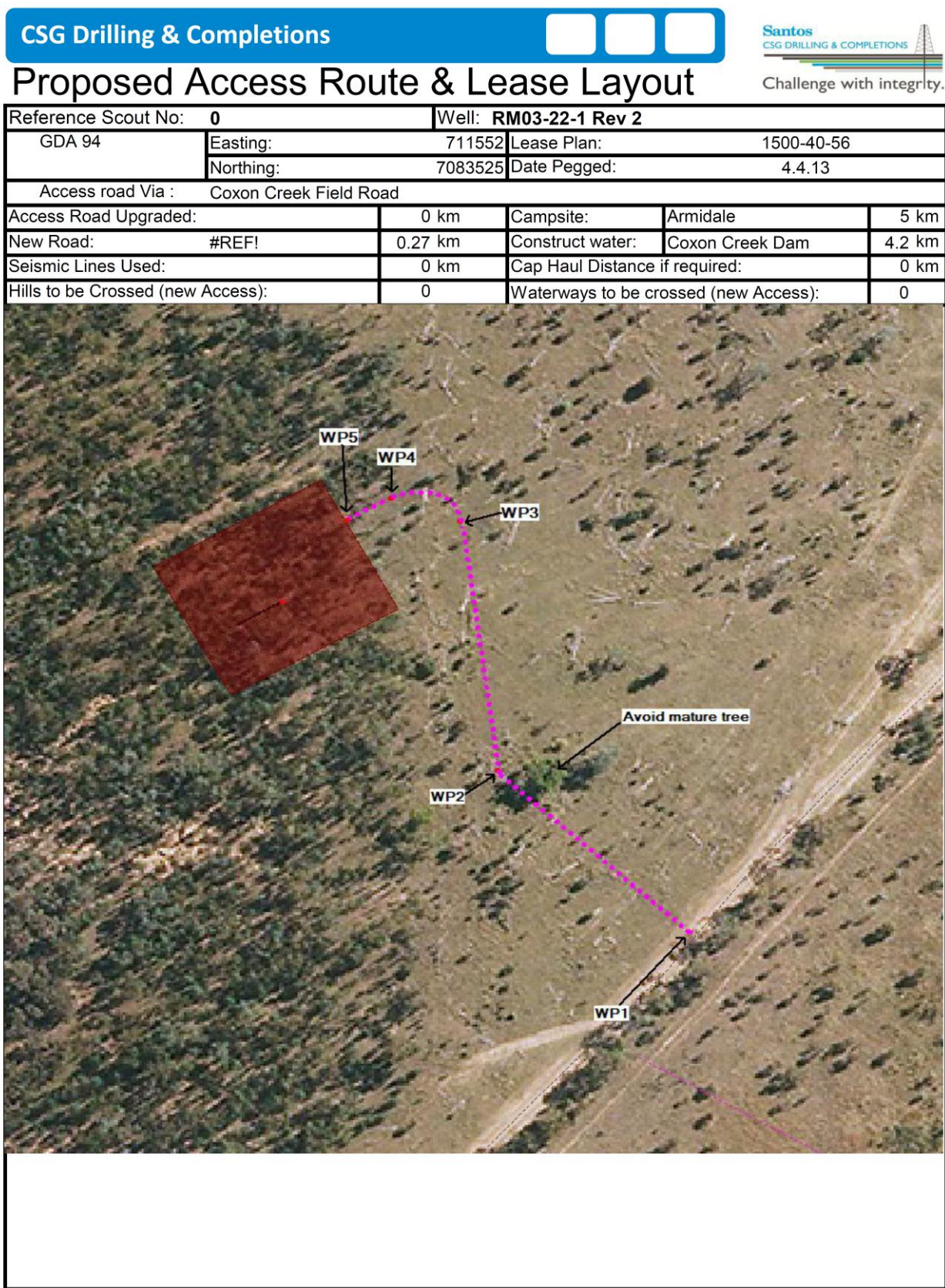
Schedule H - WASTE		
General		
Condition		Comment
H1	All general waste must only be removed from the site and sent to a recycling facility or a disposal facility licensed to accept the waste under the <i>Environmental Protection Act 1994</i> .	All general waste will be removed from the site and sent to a recycling facility or disposal facility licenced to accept the waste under the <i>Environmental Protection Act 1994</i> .
H2	All regulated waste removed only be removed from the site by a person who holds a current authority to transport such waste under the provisions of the <i>Environmental Protection Act 1994</i> and sent to a recycling facility or disposal facility licensed to accept the waste.	All regulated waste will be removed from the site by a person who holds a current authority to transport such waste under the provisions of the <i>Environmental Protection Act 1994</i> and sent to a recycling facility or disposal facility licenced to accept the waste

UPSTREAM GLNG PROTOCOLS	
Constraint Classes	The proposed activities are not within a Constraint Class and do not impact on any Matters of National Environmental Significance
EPBC Act Listed Communities	No species or communities of conservation significance (ie listed as Critically Endangered, Endangered or Vulnerable) under the provisions of the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) were detected within the proposed disturbance area.

GENERAL	
Water Bores	There were no water bores detected within 100m.

Environmental Approval	
Signed: Vanessa Keogh	Date: 23/7/2013

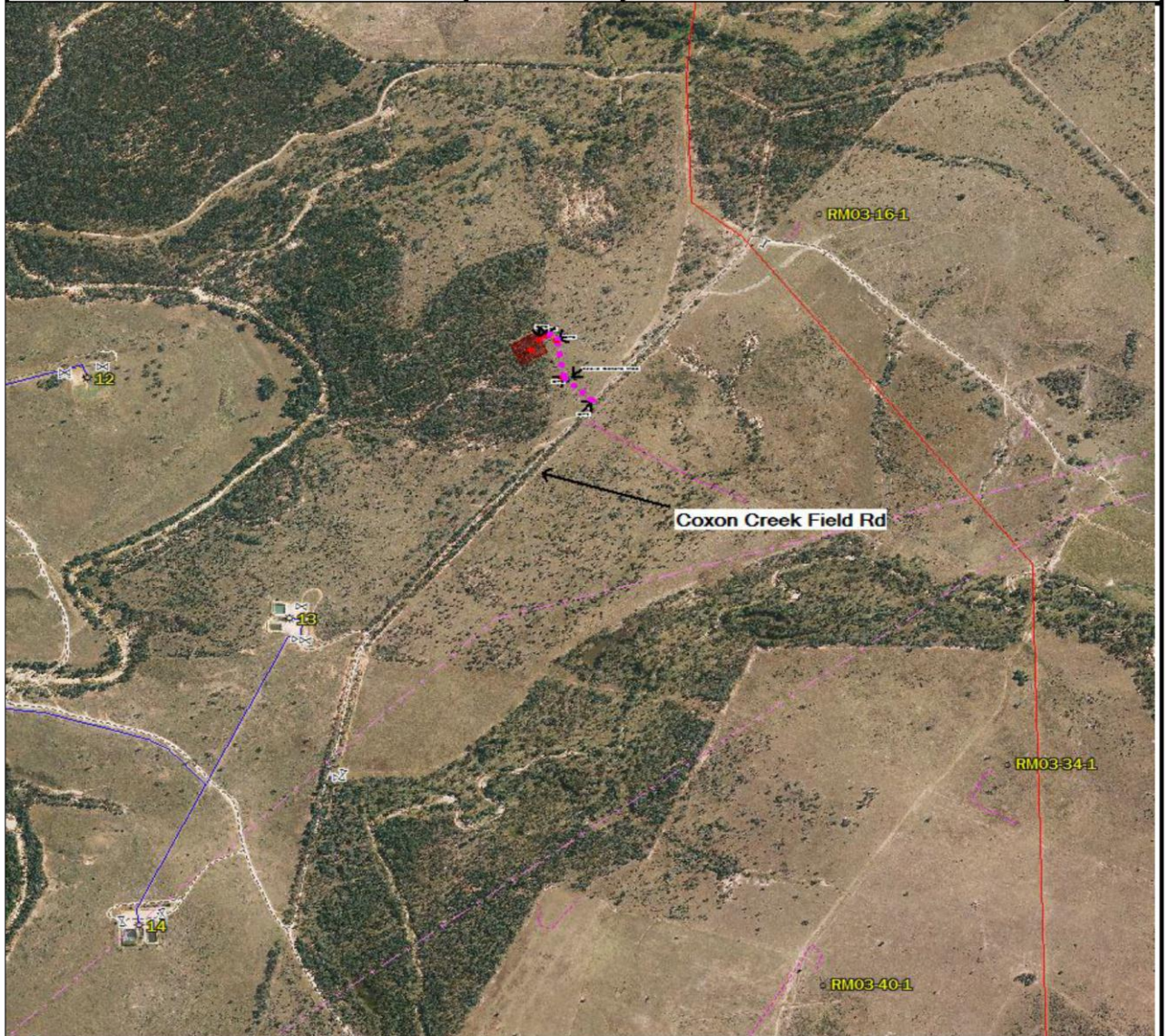
Appendix 1. Maps



Map 1. Infrastructure map close.

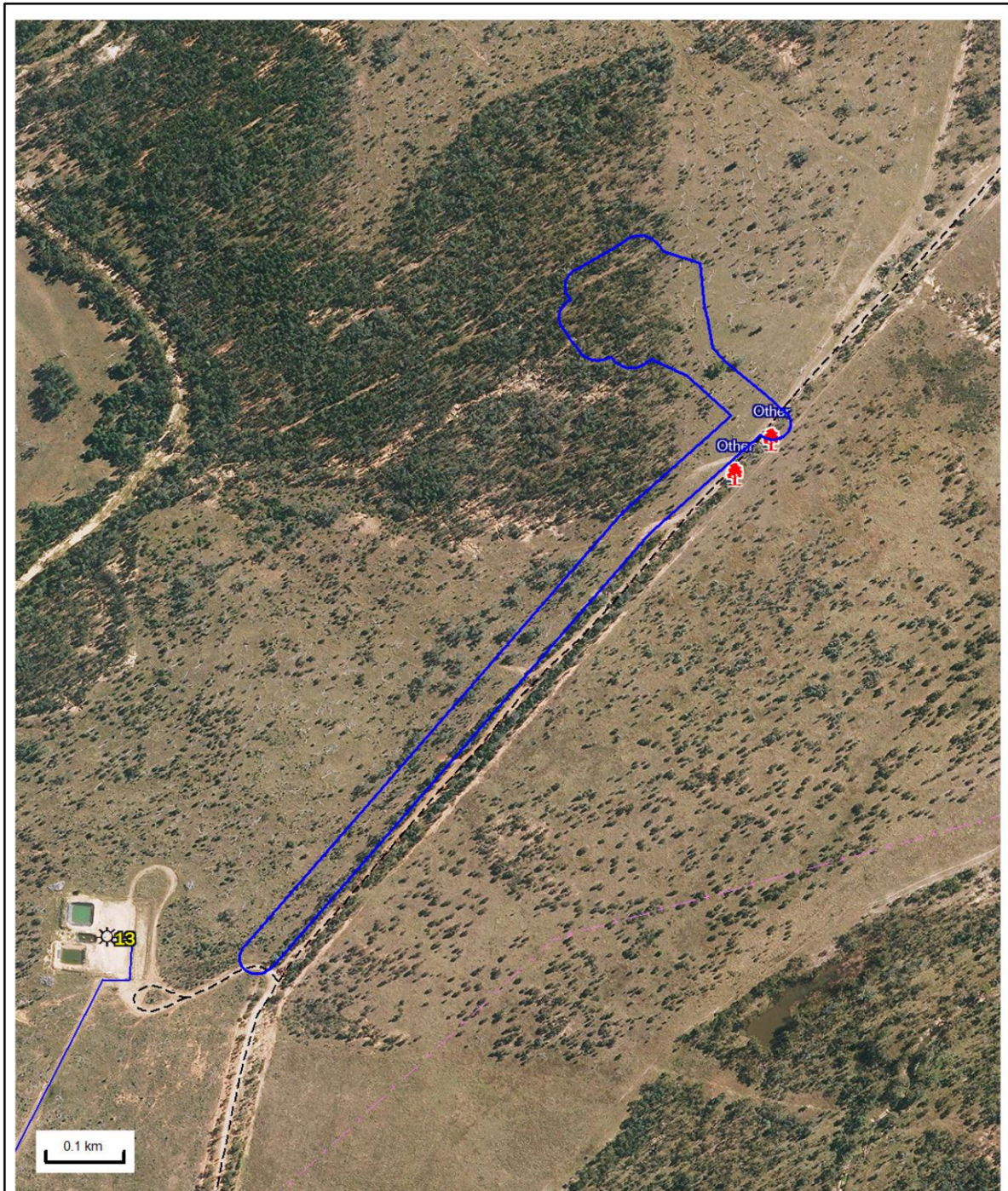
Proposed Access Route & Lease Layout

Reference Scout No: 0		Well: RM03-22-1 Rev 2			
GDA 94	Easting:	711552	Lease Plan:	1500-40-56	
	Northing:	7083525	Date Pegged:	4.4.13	
Access road Via :		Coxon Creek Field Road			
Access Road Upgraded:		0 km	Campsite:	Armidale	5 km
New Road: #REF!		0.27 km	Construct water:	Coxon Creek Dam	4.2 km
Seismic Lines Used:		0 km	Cap Haul Distance if required:		0 km
Hills to be Crossed (new Access):		0	Waterways to be crossed (new Access):		0



Map Far Doc version: 2012.11.20

Map 2. Infrastructure map far.



Santos



RM03-22 Rev 2 Ecological assessment area

Drawn by:
Print date: 21 Jul 2013 04:39 PM

The content on this map is provided for information purposes only. No undertakings, guarantees or warranties as to the accuracy, completeness, currency or suitability of the data for any purpose are provided. The user of these data should not rely on the data presented herein for any reason and should check for confirmation from the originating data owner or other body prior to the commencement of any works program.

Map 3. Ecological assessment area

Appendix 2. Desktop assessment

CSG Drilling & Completions



EcoScout Report

Site Name	RM03-22	PL/ATP	PL309	Coordinates	711501
Landholder	Leon Trevor Price			Coordinates	7083495

Mapped Constraints	Desktop Assessment					Groundtruthing	
	Assessor: Angela Sherwin		Date: 6/09/2012			Assessor: Vanessa Keogh	
	Layer/Database	Mapped feature	Direct or PPZ?	Potential Issues?	Comments	Comment	Potential Issues?
	Environmentally Sensitive Areas (ESAs)/Listed Res	Nil	N/A	No		Nil	
	Least Concern Res	The lease and 90m of its immediate access track/pipeline is in Least Concern 11.10.11 remnant vegetation.	Direct	Maybe		11.10.11 and non-remnant	
	High Value Regrowth	A significant portion of the pipelines are in NOC HVR	Direct	Maybe		No issues	

Data base s	Watercourses	Nothing near the lease. Access track in NW portion of area assessed will cross Appletree Creek, a SO3. A SO1 will also be crossed in three separate locations by the pipeline and access track. See maps	Direct	Maybe	most access tracks seem to be existing and may assist in minimising disturbance.	Nil within 100m	
	Wetlands, lakes, springs	Nil	N/A	No		No wetland features were detected in or within 200m of the proposed area of disturbance. This was based on an assessment of hydrology, soils, flora and fauna.	
	EVNT Point	Not available	N/A	N/A	Nil	Nil	
	Ground Truthing ENV	Not available	N/A	N/A	Nil	N/A	
	EVNT Species	Not available	N/A	N/A	Nil	Nil detected	
	EBPC Fauna Habitat	Nil	N/A	No	Nil	Potential habitat for Yakka skink, Squatter Pigeon, Dunmall's Snake, Brigalow Scaly Foot.	
	Essential Habitat	Nil	N/A	No	Nil	Nil	
	Protected areas	Nil	N/A	No	Nil	Nil	
	GQAL	C1	N/A	No	Nil		
	SCL	Nil	N/A	No	Nil		
	Bores	Nil	N/A	No	Nil		
	EBPC Protected Matters Search	Not yet completed	N/A	Unknown			

Appendix 3. Ecologist Report

Santos

Quaternary Data Sheet

Site no: RM03-22 Rev 2 and Linear infrastructure	Date: 30.11.12	Recorder: AS.
Locality/coordinates: 711552, 7083525		

Flora (representing species richness and diversity)

Tree layer 1 Cover: 36% Av Height: 20m			
Species	Rel Dom	Species	Rel Dom
<i>Eucalyptus melanophloia</i> (Silver Leaved Ironbark)	D	<i>Eucalyptus fibrosa</i> (Dusky Leaved ironbark)	C
<i>Eucalyptus populnea</i> (Poplar Box)	C		
<i>Owenia acidula</i> (Emu Apple)	C		
Tree layer 2 Cover: 13% Av Height: 3m			
Species	Rel Dom	Species	Rel Dom
<i>Eremophila mitchellii</i> (False Sandalwood)			
Shrub layer 1 Cover: 13% Av Height: 1.2m			
Species	Rel Dom	Species	Rel Dom
<i>Geijera parviflora</i> (Wilga)	D	<i>Acacia leiocalyx</i> (Early Flowering Black Wattle)	C
<i>Callitris glaucophylla</i> (White Cypress Pine)	C	<i>Dodonaea viscosa</i> (Sticky Hop Bush)	C
<i>Grevillea striata</i> (Beefwood)	C	<i>Acacia excelsa</i> (Ironwood)	C
Ground layer. Cover: 80% Av Height: 0.8m			
Species	Rel Dom	Species	Rel Dom
<i>Heteropogon contortus</i> (Black Spear Grass)	C	<i>Marsdenia sp</i>	C
<i>Acacia Decora</i> (Pretty Wattle)	C	<i>Sida cordifolia</i> (Flannel Weed)	C
<i>Aristida caput medusae</i> (Multi Headed Aristida)	D	<i>Sarcostemma viminalis</i> (Caustic Weed)	C
<i>Verbena tenuisecta</i> (Maynes Pest)	C	<i>Vittadinia dissecta</i>	C
<i>Themeda avenacea</i> (Wild Oats Grass)	C	<i>Neptunia gracilis</i> (Native Sensitive Plant)	C
<i>Cenchrus ciliaris</i> (Buffel Grass)	C	<i>Lepidium sagittulatum</i> (Peppercreess)	C
<i>Conyza bonariensis</i> (Fleabane)	C	<i>Onopordum acanthium</i> (Scotch Thistle)	C
<i>Apophyllum anomalum</i> (Warrior Bush)	C	<i>Eragrostis sp</i>	C
<i>Sida corrugata</i> (Corrugated Sida)	C	<i>Juncus sp</i>	C
<i>Eremophila debilis</i> (Winter Apple)	C	<i>Parsonsia lanceolata</i> (Monkey Rope)	C
<i>Carrisa ovata</i> (Currant Bush)	C	<i>Calocephalus platycephalus</i> (Billy Buttons)	C
<i>Capparis sp</i>	C		

Geology, landform, soils		Woody Stem Counts 10m X 10m	
Geology code and rock types: Some small rock present	T1	2	
Landform: Edge of hillside	T2	18	
Soils: Sandy, gravely loam	S1	5	

Regional Ecosystems (RE) / Threatened Ecological Community (TEC)

Mapped RE: 11.10.11 and non remnant	Landzone:
Corresponding EEC (mapped):	
Ground truthed RE: non remnant and 11.10.11	Landzone:
Corresponding EEC (ground truthed):	

Vegetation Short Description

E. populnea and *E. mitchellii* dominate with *E. melanophloia* throughout. *G. parviflora* occurs throughout the understory. Majority of the lease area is in remnant vegetation, the access track is in non remnant vegetation with some scattered mature woody vegetation.

Connectivity/Patch Characteristics

The entire area is remnant vegetation to the north, west and south of the proposed area. Throughout this area there are significant habitat values including hollow logs and hollow bearing trees.

Weeds

Weeds Present. R=rare (<10 plants observed); U = uncommon (11-50 plants observed); C = common (>50 plants observed)
Buffel Grass - C Maynes Curse – C Scotch Thistle – C
Total % Weed cover : <10%

EVR/Type A Flora Present

EVR/Type A Flora Likely

Nil observed	<i>Brachychiton</i> <i>Cymbidium</i>
--------------	---

Fauna Habitat Features

Density scores: **0** = 0%; **1** = <25%; **2** = 26-50%; **3** = 51-75%; **4** = 75-99%; **5** = 100% abundance.

Rocks - embedded	0	Boulders	0	Shrub layer	1	Ground cover	4
Rocks - loose	1	Fallen Bark	1	Leaf litter	2	Bare ground	1

Abundance Scores: **0** = absent; **1** = 1-5; **2** = 6-20; **3** = 21-50; **4** = 51-75; **5** = 76-100; **6** = >100. In a 1 ha area.

Crevices/ledges	0	Large logs (>30cm diameter)	6	Trees/logs bearing loose bark	2
Underhangs/overhangs/caves	0	Logs with hollows	16	Termite mounds	0
Small logs (<30cm diameter)	6	Hollow bearing /mature trees	4	Mistletoe	1

EVR Fauna Present

EVR Fauna Likely

Nil observed	Yakka skink, Squatter Pigeon, Dunmalls Snake, Brigalow Scaly Foot.
--------------	--

Disturbances (e.g. grazed, ploughed, flooded)

The area is grazed by cattle. Majority of the access track area has been mechanically pulled recently with only some

mature vegetation left standing.

Incidental Fauna Observations

Thornbills, Kookaburra.	
Pretty Faced Wallaby, diggings of an Echidna.	

Notes on watercourses, wetlands, lakes or springs

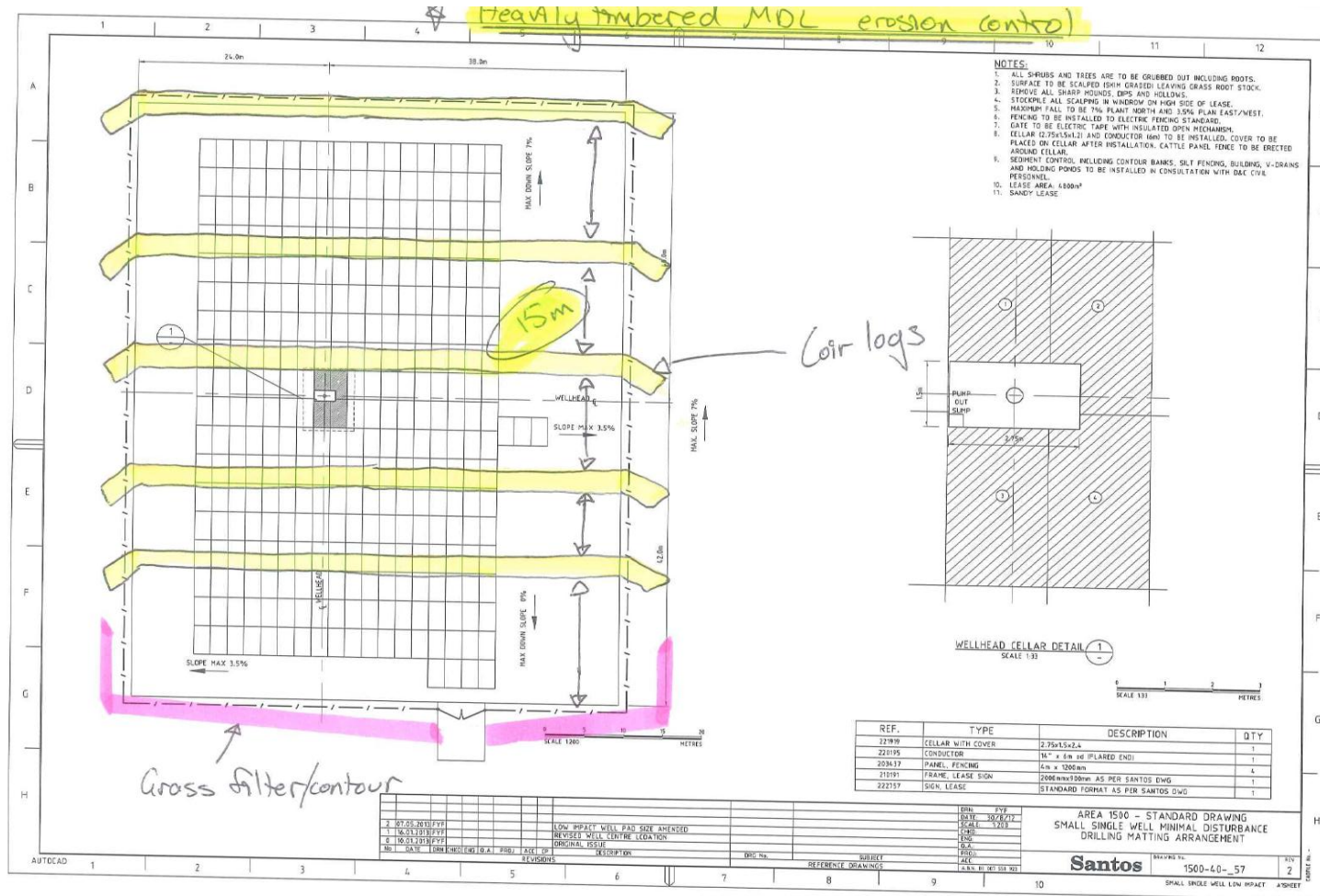
Nil observed.

Additional Notes Below

The area of the linear infrastructure to the south is littered with large piles of pulled/pushed timber. Due to it's location near a large patch of remnant vegetation, these may provide significant habitat for fauna. Fauna listed under the EPBC and NC act could also be seeking shelter in these piles of timber. Fauna spotter needed for lease area.
--

Appendix 4. Erosion and Sediment Control Plan for Timbered Sites

Prepared by Jed Farley, Drilling and Completions Civil Works Supervisor.



Site Photos



Photo description

From well centre facing north



Photo description

From well centre facing south

Well Lease Area/ Infrastructure Zone Assessment Report: Mt Hope Zone RM03-05

Compiled by Boobook for Santos

Boobook
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

Revision	Date	Description	Author	Verifier	Approved
A	01/03/2013	Draft issued to client for review	RJ	CE	CE
B	03/07/2013	Draft incorporating client comment and amended Zone	RJ	CE	CE
C	23/07/2013	Draft incorporating further client comment	RJ	CE	CE
0	13/11/2013	Final version	RJ		RJ

1. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
TAR plant	Type A Restricted Plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

2. Introduction

2.1 Purpose & Scope

Boobook was commissioned by Santos to undertake ecological assessments on a number of well leases and infrastructure zones (hereafter individually referred to as 'the Zone') located on the property 'Mt Hope', located about 40km north-east of Roma, south central Queensland. Boobook was requested to undertake the following:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation present within the Zone;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the assessment site;
- Comment on the nature and location of wetlands and watercourses within 100m of the Zone;
- Provide location and description of any plants of conservation concern listed in the NC Act or EPBC Act;
- Location and characteristics of any Type A Restricted (TAR) plants (NC Act) in the Zone; and
- Location and characteristics of habitat trees in the Zone, with reference to trees previously mapped by Santos.

An individual report was to be prepared for each Zone. This report refers to Zone RM03-05 located on Lot 71 on Plan WV758.

Changes to the boundaries of this Zone were made by Santos following completion of the ecological assessment described in this report for the Zone (Figure 1). Modifications of this infrastructure Zone were considered to be either minor in extent and/or involving areas where the ecological values were previously assessed on-site or nearby. Although the risk is acceptably small it is possible that some ecological values of the modified Zone may not have been documented. Based on professional judgment the modified zones are highly unlikely to contain populations of threatened flora or significant fauna habitat features. However, the presence of TAR plants, especially seedlings, cannot be ruled out.

2.2 Survey Team

The project supervisor (Craig Eddie) was approved by 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.

The field survey described by this report was undertaken by Boobook on 25th January 2013 and was conducted by Rosamund Aisthorpe (Botanist) and Ashley Hoffmann (Field Assistant). The following report was compiled by Rosamund Aisthorpe and Richard Johnson. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie (Principal Ecologist and Project Supervisor).

Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A comprehensive desktop search was not required by the client for the purposes of this report. However, a desktop search was undertaken for REs at the property scale using mapping version 6.1 (DEHP 2013). This dataset provides a baseline for subsequent field assessment.

The search was conducted using a 5km buffer around the coordinate -26.3558°S, 149.0847°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative site was selected for each RE present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Figures 1a-b. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all GPS co-ordinates quoted within this report is GDA94. When referred to within this report the sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2012: Table 29);
4. RE type mapped;

5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;
9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;
11. presence of endangered, vulnerable or near threatened flora;
12. a list of all other flora encountered at the Site; and
13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2012) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

A search was made within the Zone for TAR plants: If found, the location was established with a hand-held GPS unit and the species, height, DBH and possible management options were recorded.

Where mapping supplied by Santos indicated the presence of habitat trees, a search was made for these. If found the location was established with a hand-held GPS unit and the species, height, DBH and habitat value(s) were recorded. In some instances unmapped habitat trees were located during the site survey and data was collected for these trees also.

The presence of any wetlands or watercourses within 100m of the Zone was recorded.

Representative photographs were taken at each quaternary survey site in the Zone, as well as at any wetlands or watercourses, habitat trees or TAR plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

Remnant RE is mapped as present in the north-west of the Zone. This is described in Table 2 and mapped in Figure 1a.

Table 2: Remnant REs mapped in Zone RM03-05

RE Code	Vegetation Management Class	Biodiversity Status	Short Description*
11.10.11	Not Of Concern	No Concern At Present	<i>Eucalyptus populnea</i> , <i>E. melanophloia</i> +/- <i>Callitris glaucophylla</i> woodland on coarse-grained sedimentary rocks

* Short description as per Regional Ecosystem Description Database (REDD), Department of Environment and Heritage Protection, Queensland Government (DEHP 2013).

4.1.2 Regional Ecosystems Observed

The presence of the above remnant regional ecosystem was confirmed in the Zone. It was sampled at survey site Q1/RM03-05 (Appendix A). At this point, the remnant vegetation is outside the map polygon but it is contiguous with, and structurally and floristically analogous to, the mapped remnant RE 11.10.11.

The Zone crosses Appletree Creek at survey site Q2/RM03-05, where the remnant vegetation here (unmapped) is at an ecotone between RE 11.10.11 and the Of Concern riparian RE 11.3.25 (*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines) (Appendix A). At this point the majority of the RE 11.3.25 is present as a very narrow fringe on the creek banks while the RE 11.10.11 occurs immediately landward on slopes falling to the creek.

The location and details of floristics and structure at sites Q1/RM03-05 and Q2/RM03-05 are shown in Table 3 and illustrated in Figures 2a-b.

Table 3: Floristics and Structure of Remnant Ecosystems at Survey Sites in Zone RM03-05

Site	Location	Vegetation Description		
Q1/RM03-05	55J 713036E 7085238N	<i>Eucalyptus melanophloia</i> , <i>E. populnea</i> and <i>Callitris glaucophylla</i> woodland; mid-layer dominated by <i>C. glaucophylla</i> and <i>Acacia decora</i> ; grassy ground layer dominated by <i>Cymbopogon refractus</i> .		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	16	20	432	35
T2	6	50	2400	5
S1	2	5	288	2
Site	Location	Vegetation Description		
Q2/RM03-05	55J 713152E 7085067N	<i>Eucalyptus</i> sp. (<i>camaldulensis</i> / <i>tereticornis</i>) fringing a creek with adjoining <i>E. populnea</i> , <i>E. melanophloia</i> and <i>Callitris glaucophylla</i> woodland; mid-layer composed of <i>Vachellia farnesiana</i> and <i>Acacia</i>		

Site	Location	Vegetation Description		
		<i>deanei</i> ; ground layer composed of <i>Lomandra longifolia</i> , <i>Imperata cylindrica</i> , <i>Juncus usitatus</i> , <i>Arundinella nepalensis</i> and <i>Cynodon dactylon</i> .		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	16	15	320	30
T2	5	40	720	10
S1	2	10	350	3

4.1.3 Threatened Ecological Communities Observed

No threatened ecological communities (TECs) were observed in the Zone.

4.1.4 Non-remnant Vegetation Observed

The remainder of the Zone is vegetated by a grassland following mechanical disturbance (pulling and clearing) of regrowth from earlier clearing event(s) (see Appendix A). The floristics and structure of the dominant species at site Q3/RM03-05 are shown in Table 4. As no woody strata are present, no data is presented. Representative images of the site are shown at Figure 3.

Table 4: Floristics and Structure of Vegetation at Survey Sites in Zone RM03-05

Site	Location	Vegetation Description
Q3/RM03-05	55J 713178E 7085273N	Cleared paddock dominated by <i>Aristida</i> sp., <i>Conyza bonariensis</i> and <i>Aristida caput-medusae</i> .

4.2 Additional Observations

4.2.1 Additional Flora Species

Approximately 47 species of native flora were detected (Appendix B). In addition, 14 non-native species were recorded. Two of these, Common Pest Pear (*Opuntia stricta*) and Velvety Tree Pear (*O. tomentosa*), are declared Class 2 weeds and Weeds of National Significance (WoNS).

4.2.2 Type A Restricted Plants

A number of Kurrajongs (*Brachychiton populneus*), a TAR plant, were located in or adjacent to the Zone. Locations and characteristics are given in Table 5 and representative images shown in Figures 4a-i.

Table 5: TAR Plants recorded in Zone RM03-05

Waypoint	Location	Species	Height (m)	DBH (cm)	Management
BP1/RM03-05	55 J 713043E 7085235N	<i>Brachychiton populneus</i>	3.5	1.0	Translocation possible
BP2/RM03-05	55 J 713033E 7085202N	<i>Brachychiton populneus</i>	12	110	Avoid
BP3/RM03-05	55 J 713039E	<i>Brachychiton</i>	0.45	0.5	Translocation

Waypoint	Location	Species	Height (m)	DBH (cm)	Management
	7085214N	<i>populneus</i>			possible
BP4/RM03-05	55 J 713049E 7085200N	<i>Brachychiton populneus</i>	1.6	1.5	Translocation possible
BP5/RM03-05	55 J 713081E 7085220N	<i>Brachychiton populneus</i>	0.6	0.5	Translocation possible
BP6/RM03-05	55 J 713081E 7085221N	<i>Brachychiton populneus</i>	3.0	8.0	Translocation possible
BP7/RM03-05	55 J 713103E 7085269N	<i>Brachychiton populneus</i>	0.6	n/a	Translocation possible
BP8/RM03-05	55 J 713126E 7085272N	<i>Brachychiton populneus</i>	2.5	2.0	Translocation possible
BP9/RM03-05	55 J 713153E 7085070N	<i>Brachychiton populneus</i>	6.0	1.5	Translocation possible

4.2.3 Fauna Habitat Features

Three hollow-bearing trees were detected within the Zone. Location and details of these trees are shown in Table 6 and Figures 5a-c. No other significant fauna habitat features were detected in the Zone.

Table 6: Details of Fauna Habitat Features, Zone RM03-05

Waypoint	Location	Species	Alive/ dead	DBH (cm)	Height (m)	Habitat features
HT1/RM03-05	55 J 712775E 7084982N	<i>Eucalyptus populnea</i>	Alive	47	8	1 hollow >30cm diam.
HT2/RM03-05	55 J 713069E 7085221N	<i>Eucalyptus melanophloia</i>	Alive	63	15	2 hollows <10cm diam.; 1 hollow 10-30cm diam.
HT3/RM03-05	55 J 708287E 7080524N	<i>Eucalyptus</i> sp.	Dead	57	18	1 hollow 10-30cm diam.

4.2.4 Wetlands and Watercourses

One watercourse as defined by the *Water Act 2000* was observed in the Zone, this being Appletree Creek. It was sampled at waypoint W2/RM03-05. It meets the definition of a watercourse in that it possesses defined bed and banks and has riparian vegetation (RE 11.3.25: see 4.1.2 and Table 3) indicating sufficient flows to maintain a riverine environment. A drainage feature was also recorded at waypoint W1/RM03-05. The lack of riparian vegetation and defined bed and banks indicates this is a drainage feature and not a watercourse (*Water Act 2000*). Additionally, this meets the definition of a drainage feature according to the Act because it is likely to be only capable of flowing during and immediately after rainfall, for a short period and does not have enough continual flow to maintain a riparian ecosystem. Details are given in Table 7 and representative images are shown at Figures 6a-b.

No other drainage features or watercourses as defined by the *Water Act 2000* were detected in or within 100m of the Zone. No wetlands as defined by the Queensland Wetland Program

(DERM 2011) as used in Santos Environmental Authority (Schedules C, M) were detected in or within 100m of the Zone.

Table 7: Wetlands and watercourses detected in or within 100m of Zone RM03-05

Waypoint	Location	Description
W1/RM03-05	55J 713150E 7085003N	Drainage feature: minor drainage line dominated by <i>Aristida</i> sp., <i>Arundinella nepalensis</i> with scattered regrowth. No apparent vegetation change associated with watercourse. No wetland plant species recorded.
W2/RM03-05	55J 713150E 7085069N	Watercourse: Appletree Creek. Fringing riparian vegetation present. Wetland plant species present include <i>Juncus usitatus</i> , <i>Cynodon dactylon</i> , <i>Nymphoides crenata</i> and <i>Lomandra longifolia</i> .

5. References

Bostock, P.D. and Holland, A.E. (eds.) (2010). *Census of the Queensland Flora 2010*. Queensland Herbarium, Brisbane.

DEHP (2013). *Vegetation Management Act Regional Ecosystem and Remnant Map – Version 6.1*. Regional Ecosystem Maps/ Regrowth Vegetation Maps and PMAVs. Department of Environment and Heritage Protection, Queensland Government, Brisbane.
<http://www.ehp.qld.gov.au/ecosystems/biodiversity/regional-ecosystems/maps/index.php>

DERM (2011). *Queensland Wetland Definition and Delineation Guideline*. Queensland Government, Brisbane.

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, Brisbane.

Water Act 2000. (Queensland), viewed 14 February 2013,
<<http://www.legislation.qld.gov.au/legisln/current/w/watera00.pdf>>

Figure 1a: Map of Zone RM03-05 (northern) showing survey sites and other points of interest.

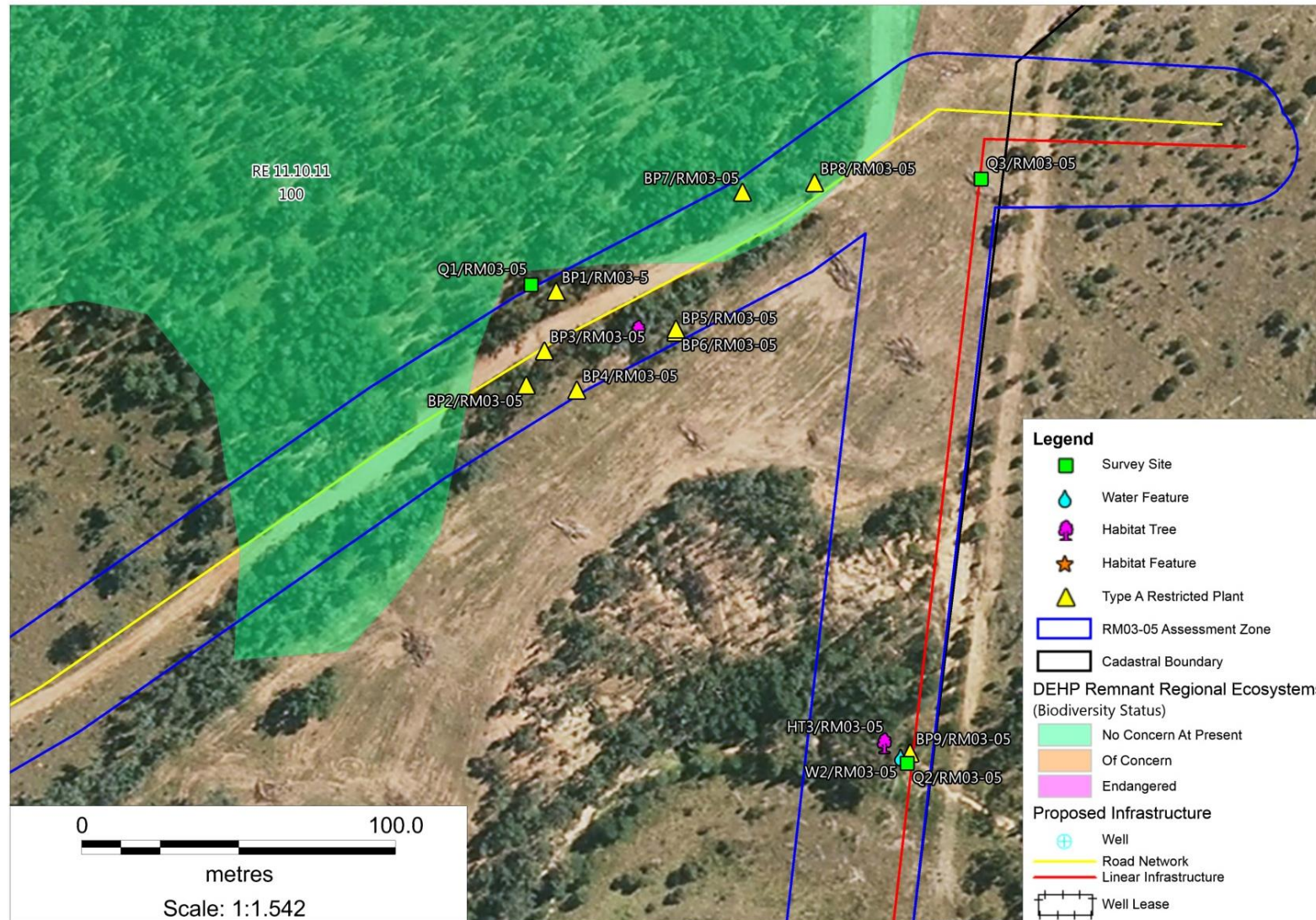


Figure 1b: Map of Zone RM03-05 (southern) showing survey sites and other points of interest.

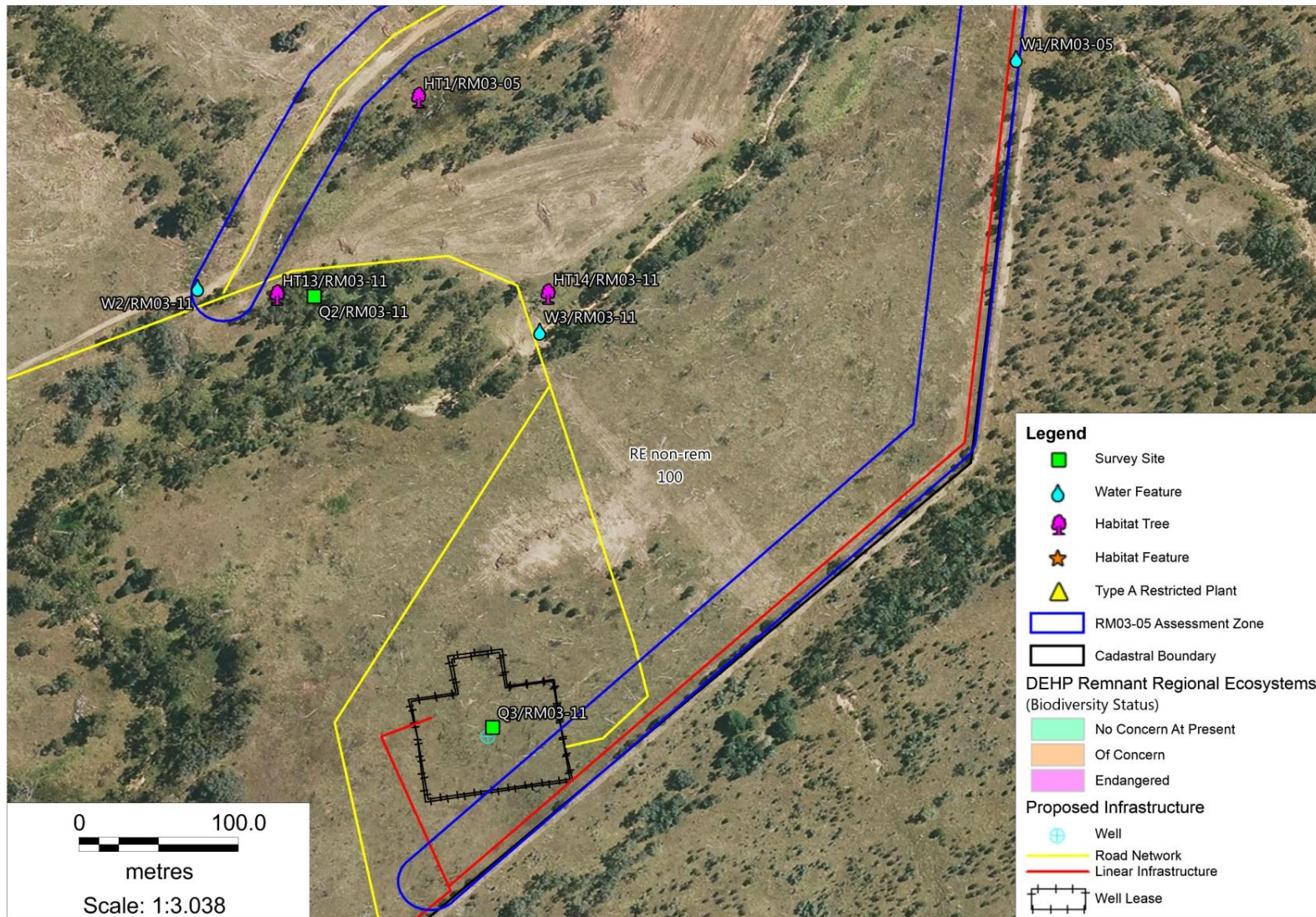




Figure 2a: Silver-leaved Ironbark (*Eucalyptus melanophloia*), Poplar Box (*E. populnea*), White Cypress Pine (*Callitris glaucophylla*) woodland at survey site Q1/RM03-05.



Figure 2b: River Red Gum or Queensland Blue Gum (*E. camaldulensis/ tereticornis*) woodland fringing Appletree Creek at survey site Q2/RM03-05.



Figure 3: Grassland in a cleared paddock at survey site Q3/RM03-05.



Figure 4a: A small Kurrajong (*Brachychiton populneus*) tree recorded at waypoint BP1/RM03-05 (left). **Figure 4b:** A Kurrajong tree recorded at waypoint BP2/RM03-05 (right).



Figure 4c: A Kurrajong sapling recorded at waypoint BP3/RM03-05 (left). **Figure 4d:** A small Kurrajong tree recorded at waypoint BP4/RM03-05 (right).



Figure 4e: A Kurrajong sapling recorded at waypoint BP5/RM03-05 (left). **Figure 4f:** A small Kurrajong tree recorded at waypoint BP6/RM03-05 (right).



Figure 4g: A Kurrajong sapling recorded at waypoint BP7/RM03-05 (left). **Figure 4h:** A small Kurrajong tree recorded at waypoint BP8/RM03-05 (right).



Figure 4i: A Kurrajong tree recorded at waypoint BP9/RM03-05.



Figure 5a: A hollow-bearing Poplar Box at waypoint HT1/RM03-05 (left); **Figure 5b:** A hollow-bearing Silver-leaved Ironbark at waypoint HT2/RM03-05 (right).



Figure 5c: A hollow-bearing dead eucalypt at waypoint HT3/RM03-05.



Figure 6a: A drainage feature at waypoint W1/RM03-05, looking upstream (left) and downstream (right). Note the lack of defined channel.



Figure 6b: Appletree Creek at waypoint W2/RM03-05, looking upstream (left) and downstream (right). Note the defined banks and bed and fringing riparian vegetation.

Appendix A: Quaternary assessment results, Zone RM03-05

Site No.	Q1/ RM03-05	Recorder:	Rosamund Aisthorpe, Ashley Hoffmann	Date	25/01/2013
Purpose	Well Zone Assessments			Time	09:15

Locality:
(inc. distance/direction to nearest town) "Mt Hope" along RM03-05 linear infras.

Zone:	55J	0713036 E	7085238 N	Datum	GDA94
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Vegetation structure	Plant species
Median height of the EDL is to be measured	Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated

Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)		Str.	Rel. dom.	Scientific Name
E					T1	D	<i>Eucalyptus melanophloia</i>
T1	16	14 – 20	S (20)		T1	S	<i>E. populnea</i>
T2	6	4 – 8	M (50)		T1	A	<i>Callitris glaucophylla</i>
T3					T2	D	<i>C. glaucophylla</i>
S1	2	1.5 – 2.5	V (5)		S1	D	<i>Acacia decora</i>
S2					G	D	<i>Cymbopogon refractus</i>
S3							
G	0.2	0.1 – 0.3	D (75)				
Structural formation: Woodland							
Ecologically dominant layer: T1							

Geology, landform, soils

Geology code and rock types:	coarse-grained sedimentary rocks		
Landform:	low undulating hills (upper hill slope)		
Soils:	reddish-brown loam		
DEHP Mapped RE Code:	NR (PMAV category X)		
Observed RE Code:	11.10.11	Landzone:	10

Vegetation Short Description

Eucalyptus melanophloia, *E. populnea* and *Callitris glaucophylla* woodland; midlayer dominated by *C. glaucophylla* and *Acacia decora*; grassy ground layer dominated by *Cymbopogon refractus*

Connectivity/Patch Characteristics

Remnant (or old regrowth) patch adjoined by cleared paddock to west

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Opuntia tomentosa (R), *Glandularia aristigera* (R)

% Weed Cover:	<5
EVNT Flora Present:	Nil
EVNT Flora Likely:	Nil
Field Wpt Code:	
Photo Nos.	BBK5 4394-4396

Additional Flora:									
<i>Dichondra repens</i>					<i>Brachyscome</i> sp.				
<i>Desmodium</i> sp.					<i>Acacia longispicata</i>				
<i>Cassinia laevis</i>					<i>Brachychiton populneus</i>				
<i>Carissa ovata</i>					<i>Corymbia tessellaris</i>				
<i>Dodonaea viscosa</i> subsp. <i>spatulata</i>									
<i>Eremophila debilis</i>									
<i>Cyperus gracilis</i>									
<i>Chrysocephalum apiculatum</i>									
<i>Dianella caerulea</i>									
<i>Heteropogon contortus</i>									
<i>Rostellularia adscendens</i>									
<i>Cyperus fulvus</i>									
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)									
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%									
Rocks - embedded				Boulders				Shrub layer	
Rocks - loose				Fallen bark				Leaf litter	
								Ground cover	
								Bare ground	
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100									
Crevices/ledges			Large logs (>30cm diameter)			Trees / logs bearing loose bark			
Underhangs / overhangs / caves			Logs with hollows			Termite mounds			
Small logs (<30cm diameter)			Hollow bearing trees			Mistletoe			
Other									
Soil cracks									
Water		Nil							
Other (e.g. food trees):									
Disturbances									
Vehicle track - well used									
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)									
					Str.	Stems/ha	DBH (cm)		
					T1	432	35		
					T2	2400	5		
					S1	288	2		
Additional Notes									

Site No. Q2/ RM03-05 **Recorder:** Rosamund Aisthorpe, Ashley Hoffmann **Date** 25/01/2013
Purpose Well Zone Assessments **Time** 11:10

Locality:
 (inc. distance/direction to nearest town) "Mt Hope" along RM03-05 linear infras.

Zone: 55J 0713152 E 7085067 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Eucalyptus</i> sp. (<i>camaldulensis</i> / <i>tereticornis</i>)
T1	16	14 - 20	S (15)	T1	A	<i>Callitris glaucophylla</i>
T2	5	4 - 7	M (40)	T1	S	<i>E. populnea</i>
T3				T1	S	<i>E. melanophloia</i>
S1	2	1.5 - 2.5	S (10)	T2	D	<i>C. glaucophylla</i>
S2				S1	D	<i>Vachellia farnesiana</i>
S3				S1	S	<i>Acacia deanei</i>
G	0.4	0.1 - 0.6	M (65)	G	D	<i>Lomandra longifolia</i>
Structural formation: Open woodland				G	A	<i>Juncus usitatus</i>
Ecologically dominant layer: T1				G	A	<i>Arundinella nepalensis</i>
				G	A	<i>Cynodon dactylon</i>
				G	S	<i>Imperata cylindrica</i>

Geology, landform, soils

Geology code and rock types: alluvium / coarse-grained sedimentary rocks
Landform: watercourse adjoined by hill slope
Soils: pale brown loamy sand
DEHP Mapped RE Code: NR (PMAV category X)
Observed RE Code: 11.3.25 / 11.10.11 **Landzone:** 3

Vegetation Short Description

Eucalyptus sp. (*camaldulensis* / *tereticornis*) fringing a gully / creek with adjoining *E. populnea*, *E. melanophloia* and *Callitris glaucophylla* open woodland; midlayer composed of *Vachellia farnesiana* and *Acacia deanei*; ground layer comprised of *Lomandra longifolia*, *Imperata cylindrica*, *Juncus usitatus*, *Arundinella nepalensis* and *Cynodon dactylon*

Connectivity/Patch Characteristics

Riparian corridor adjoined by clearings to south and north

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Conyza bonariensis (C), *Cynodon dactylon* (C), *Tagetes minuta* (U), *Xanthium occidentale* (R), *Opuntia stricta* (R), *Glandularia aristigera* (U), *Vachellia farnesiana* (U), *Solanum nigrum* (R), *Lepidium bonariense* (U), *O. tomentosa* (R), *Bidens pilosa* (C), *Sida rhombifolia* (U)

% Weed Cover: 25

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code:

Photo Nos.		BBK5 4453-4455	
Additional Flora:			
<i>Alternanthera denticulata</i>		<i>Brachychiton populneus</i>	
<i>Austrostipa verticillata</i>		<i>Chloris ventricosa</i>	
<i>Cassinia laevis</i>		<i>Nymphoides crenata</i>	
<i>Senna barclayana</i>			
<i>Jasminum dianthifolium</i>			
<i>Enneapogon</i> sp.			
<i>Sida</i> sp.			
<i>Maireana microphylla</i>			
<i>Dodonaea viscosa</i>			
<i>Acacia decora</i>			
<i>Acacia omalophylla</i> - 10 plants approx.			
<i>Indigofera linnaei</i>			
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)			
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%			
Rocks - embedded		Boulders	
Rocks - loose		Fallen bark	
		Shrub layer	
		Leaf litter	
		Ground cover	
		Bare ground	
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100			
Crevices/ledges		Large logs (>30cm diameter)	
Underhangs /overhangs / caves		Logs with hollows	
Small logs (<30cm diameter.)		Hollow bearing trees	
		Trees / logs bearing loose bark	
		Termite mounds	
		Mistletoe	
Other			
Soil cracks			
Water	Appletree Creek on site (W2/RM03-05)		
Other (e.g. food trees):			
Disturbances			
Erosion			
Clearing beside fence line - not drivable			
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)			
	Str.	Stems/ha	DBH (cm)
	T1	320	30
	T2	720	10
	S1	350	3
Additional Notes			

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Site No. Q3/
RM03-05 **Recorder:** Rosamund Aisthorpe, Ashley Hoffmann **Date** 25/01/2013
Purpose Well Zone Assessments **Time** 11:50

Locality:
 (inc. distance/direction to nearest town) "Mt Hope" along RM03-05 linear infras.
Zone: 55J 0713178 E 7085273 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				G	D	<i>Aristida</i> sp.
T1				G	A	<i>Conyza bonariensis</i>
T2				G	A	<i>Aristida caput-medusae</i>
T3						
S1						
S2						
S3						
G	0.2	0.1 - 0.4	M (70)			
Structural formation: Grassland						
Ecologically dominant layer: G						

Geology, landform, soils

Geology code and rock types: coarse-grained sedimentary rocks
Landform: low undulating hills (hill slope)
Soils: pale brown loam
DEHP Mapped RE Code: NR (PMAV category X)
Observed RE Code: NR (ex-11.10.11) **Landzone:** 10

Vegetation Short Description
 Cleared paddock dominated by *Aristida* sp., *Conyza bonariensis* and *Aristida caput-medusae*

Connectivity/Patch Characteristics
 Clearing adjoined by riparian corridor to south and remnant patch to north

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Conyza bonariensis (C), *Cirsium vulgare* (R), *Glandularia aristigera* (C), *Solanum nigrum* (R), *Cenchrus ciliaris* (R)

% Weed Cover: 20
EVNT Flora Present: Nil
EVNT Flora Likely: Nil
Field Wpt Code:
Photo Nos. BBK5 4462-4464

Appendix B: Plant species list, Zone RM03-05

Key: * indicates non-native plant species

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	Other
Acanthaceae	<i>Rostellularia adscendens</i>	Pink Tongues	LC		P			
Amaranthaceae	<i>Alternanthera denticulata</i>	Lesser Joyweed	LC			P		
Amaranthaceae	<i>Ptilotus macrocephalus</i>	Green Pusstail	LC				P	
Apocynaceae	<i>Carissa ovata</i>	Currant Bush	LC		P			
Asteraceae	<i>Bidens pilosa</i> *	Cobbler's Pegs	-			P		
Asteraceae	<i>Brachyscome</i> sp. (indet.)	A Daisy	LC		P			
Asteraceae	<i>Cassinia laevis</i>	Cough Bush	LC		P	P		
Asteraceae	<i>Chrysocephalum apiculatum</i>	Yellow Buttons	LC		P			
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	-				P	
Asteraceae	<i>Conyza bonariensis</i> *	Flaxleaf Fleabane	-			P	P	
Asteraceae	<i>Epaltes australis</i>	Spreading Nut-heads	LC				P	
Asteraceae	<i>Tagetes minuta</i> *	Stinking Roger	-			P		
Asteraceae	<i>Xanthium occidentale</i> *	Noogoora Burr	-			P		
Brassicaceae	<i>Lepidium bonariense</i> *	Cut-leaf Peppergrass	-			P		
Cactaceae	<i>Opuntia stricta</i> *	Common Pest Pear	-			P		
Cactaceae	<i>Opuntia tomentosa</i> *	Velvety Tree Pear	-		P	P		
Caesalpiniaceae	<i>Senna barclayana</i>	Pepper-leaved Senna	LC			P		
Chenopodiaceae	<i>Maireana microphylla</i>	Cotton Bush	LC			P	P	
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	LC		P			
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC		P	P		
Cyperaceae	<i>Cyperus fulvus</i>	Sticky Sedge	LC		P			
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge, Whisker Grass	LC		P			
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-rush	LC				P	
Fabaceae	<i>Desmodium</i> sp.	A Tick-trefoil	LC		P			
Fabaceae	<i>Indigofera linnaei</i>	Birdsville Indigo	LC			P		

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	Other
Hemerocallidaceae	<i>Dianella caerulea</i>	Flax Lily	LC		P			
Juncaceae	<i>Juncus usitatus</i>	Common Rush	LC			P	P	
Laxmanniaceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	LC			P		
Malvaceae	<i>Sida hackettiana</i>	High Sida	LC				P	
Malvaceae	<i>Sida rhombifolia</i> *	Paddy's Lucerne	-			P		
Malvaceae	<i>Sida</i> sp. (indet.)		LC			P		
Menyanthaceae	<i>Nymphoides crenata</i>	Yellow-fringed Waterflower	LC			P		
Mimosaceae	<i>Acacia decora</i>	Pretty Wattle	LC		P	P		
Mimosaceae	<i>Acacia deanei</i>	Deane's Wattle	LC			P		P
Mimosaceae	<i>Acacia longispicata</i>	A Wattle	LC		P			
Mimosaceae	<i>Acacia omalophylla</i>	Yarran	LC			P	P	
Mimosaceae	<i>Vachellia farnesiana</i> *	Mimosa Bush	-			P		
Myoporaceae	<i>Eremophila debilis</i>	Winter Apple	LC		P			
Myrtaceae	<i>Corymbia tessellaris</i>	Carbeen, Moreton Bay Ash	LC		P			
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	LC		P	P		
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		P	P	P	P
Myrtaceae	<i>Eucalyptus</i> sp. (<i>camaldulensis</i> / <i>tereticornis</i>)	A Gum	LC			P		P
Oleaceae	<i>Jasminum dianthifolium</i>	A Jasmine	LC			P		
Poaceae	<i>Aristida caput-medusae</i>	Many-headed Wiregrass	LC				P	
Poaceae	<i>Aristida</i> sp. (infertile)	A Wiregrass	LC				P	P
Poaceae	<i>Arundinella nepalensis</i>	Reedgrass	LC			P		P
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo Grass	LC			P	P	
Poaceae	<i>Cenchrus ciliaris</i> *	Buffel Grass	-				P	
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	LC			P		
Poaceae	<i>Cymbopogon refractus</i>	Barbed-wire Grass	LC		P			
Poaceae	<i>Cynodon dactylon</i> *	Couch Grass	-			P		
Poaceae	<i>Enneapogon</i> sp. (indet.)	A Bottle-washers Grass	LC			P		
Poaceae	<i>Eragrostis</i> sp. (indet.)	A Lovegrass	LC				P	
Poaceae	<i>Heteropogon contortus</i>	Black Speargrass	LC		P			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	Other
Poaceae	<i>Imperata cylindrica</i>	Blady Grass	LC			P		
Sapindaceae	<i>Dodonaea viscosa</i> subsp. <i>spatulata</i>	Sticky Hopbush	LC		P	P		
Solanaceae	<i>Nicotiana</i> sp. (indet.)		LC				P	
Solanaceae	<i>Solanum nigrum</i> *	Blackberry Nightshade	-			P	P	
Sterculiaceae	<i>Brachychiton populneus</i>	Kurrajong	LC/TAR		P	P		
Thymelaeaceae	<i>Pimelea trichostachya</i>	Annual Rice-flower	LC				P	
Verbenaceae	<i>Glandularia aristigera</i> *	Mayne's Pest	-		P	P	P	

Well Lease Scouting – Environmental Adviser Assessment

Well name: RM03-04-1 Rev 1A		Lot/Plan: Lot 71 WV758	PL: 309	EA: EPPG00898213
Drafted by: Angela Sherwin, Field Environmental Advisor			Assessment date: 13.5.2013	
Checked by: Erik Kadri, Senior Environmental Advisor			Check Date: 15.5.2013	
Zone: 55	Easting: 712133		Northing: 7085312	
Versioning: This approval has been issued in accordance with RSGPA EA conditions granted on 19.4.2013				
Assessment Summary: - This approval is for the RM03-04-1 Rev 1A minimal disturbance well lease and access track only. - According to State mapping, the proposed activity is not in any Environmentally Sensitive Areas or associated protection zones. - Assessment of vegetation was only undertaken within the area where the activities are proposed to take place (lease & access track). Field validation surveys were not undertaken to ground-truth adjacent vegetation within 200m of the proposed disturbance to confirm whether the proposed activity is within the primary protection zone of an ESA. As such, all activities will be undertaken as limited petroleum activities to ensure compliance with condition (E10). - The lease site is not located within 100m of the high bank of a watercourse, or 200m of a wetland, lake or spring. - The access track crosses a watercourse at 712000, 7084442. The administering authority must be notified 10 business days prior to disturbance taken place. Notification was submitted on 14.05.2013 and disturbance for the access can commence after 27.05.2013. - The ecological assessment has confirmed that the area proposed for disturbance does not contain remnant vegetation. - There were no disputes regarding ESAs or wetlands identified in the ecological inspection. - No species classed as endangered, vulnerable or near threatened (EVNT) under the <i>Nature Conservation Act 1992</i> (NC Act) were detected during the ecological assessment. - No threatened species or threatened ecological communities listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth) (EPBC Act) were detected within the area where the activity is proposed to take place.				

Well-Specific comments and final constrains (e.g. European heritage, cultural heritage etc.): N/A

Proposed Mitigation:

The following mitigation measures will be taken:

- **Watercourse disturbance in Appletree Creek can commence after 27.05.2013.**
- An assessment of the watercourse crossings flow must be made prior to disturbance. The following order of preference must be followed:
 1. Conducting works in times when there is no water present.
 2. Conducting work in times of no flow.
 3. Conducting works in times of flow but in a way that does not impede low flow.
- If there is water present during the watercourse crossing construction activities, background water turbidity must be measured within 20 metres upstream of the construction and/or maintenance activities. **Please contact Field Environmental adviser to undertake the assessment.**
- Only limited petroleum activities are permitted due to the possibility of ESA present within 200m of proposed disturbance that have not been identified by the State mapping:
 - Single well pad will not exceed 1 ha;
 - Clearing for the access tracks will not exceed 6m in width.
- A black Orchid is in the southern side of the lease at (712146, 7085278). This plant will be moved from the location to the side of the lease where it will not be disturbed. **Ensure a basis of decision worksheet and record of clearing activities are provided to the Civil works team prior to commencement of disturbance to this plant.**
- **Avoid the large mature trees on either side of the road easement to the south of the gateway located at: (712021, 7084439) and (712026, 7084464).**
- Landholder consent is in place prior to clearing activities including QPWS for works within the State Forest area.
- Well Lease installation is done in accordance with Santos standards.
- Use existing infrastructure where practical.
- Vehicle/machinery hygiene procedures to be adhered to at all times.
- Avoid unnecessary earthworks within areas containing Prickly Pear.
- Ensure maximum root stock is left undisturbed where possible for topsoil retention.
- Drilling rig matting will be installed as per Minimal Disturbance Lease layout requirements.

- All clearing will be minimised to the area necessary for safe operations.
- Where required timber that is cleared is to be pushed aside and used for habitat and the excess timber is not to be burned.
- Erosion control and silt fences will be implemented as per the individual lease layout requirements.
- Fauna spotter is not required on site for clearing activities
- Any vegetation cleared will be stockpiled in a manner that facilitates resspreading or salvaging and will not impede vehicle, stock or wildlife movements.
- Prior to carrying out field based petroleum activities, all relevant staff, contractors or agents carrying out those activities, are to be made aware of the these conditions and the requirements of the environmental authority.
- Contaminants must not be released to waters or land.

Note: Santos currently holds an exemption under the NC Act for clearing species listed under the NC Act as 'Least Concern'. No other NC Act listed species are to be removed without a permit.

Maps	Appendix 1. Maps	Map 1. Infrastructure map close Map 2. Infrastructure map far Map 3. Ecological assessment area
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Well names: RM03-04-1 Rev 1A	Lot/Plan: Lot 71 WV758	PL: 309	EA: EPPG00898213
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Schedule B – WATER

REF	Condition	Santos Assessment
Water courses, wetlands and springs		
C1	Contaminants must be directly or indirectly released to any waters except as permitted under this environmental authority.	Contaminants will not be released to waters or land.

REF	Condition	Santos Assessment
C7	Unless otherwise authorised under this environmental authority, petroleum activity(ies) that require earthworks, vegetation clearing, placing fill and/or that will result in significant disturbance other than that associated with the construction and/or maintenance of linear infrastructure, is not permitted in or within : a) 200 meters from any wetland, lake or spring: or b) 100 meters of the high bank of any other watercourse	The proposed activities are within the condition C7 for water courses, wetlands and springs; a) More than 200m from a wetland, spring or lake b) More than 100m of the high bank of any other watercourse. The proposed access track will cross a watercourse at 712000, 7084442. The location was chosen due to existing infrastructure and has been kept to the same alignment to reduce the amount of disturbance.
C8	All reasonable alternative locations must be considered prior to the construction of any linear infrastructure that will result in significant disturbance in or on the bed and banks of a watercourse or within the areas specified in (C7)(b).	Due to existing infrastructure, all reasonable locations for the proposed infrastructure were considered during the planning phase of the proposed infrastructure. It is considered that the current access track alignment is the most suitable location for the infrastructure, which also causes the least environmental harm.
C9	The construction and/or maintenance of linear infrastructure that will result in significant disturbance in or on the bed or banks of a watercourse or within the areas specified in (C7)(a) and (b) must be conducted in accordance with the following order of preference: a) Conducting works in times when there is no water present b) Conducting work in times of no flow c) Conducting works in times of flow but in a way that does not impede low flow.	The construction and or maintenance of linear infrastructure that will result in the significant disturbance in or on the bed and banks of a watercourse or within the areas specified in (C7)(b) will be conducted in the following order of preference: a) Conducting works in times when there is no water present b) Conducting work in times of no flow c) Conducting works in times of flow but in a way that does not impede low flow. An assessment of the watercourse will be conducted prior to construction.
C10	The construction and/or maintenance of linear infrastructure that will result in significant disturbance in or on the bed and banks of a watercourse or within the areas specified in (C7)(b) must not release from the site any contaminants to any waters that exceed the water quality limits specified in Schedule C Table 1 – <i>Release Limits to Waters</i>.	Construction works will not release from the site any contaminants to any waters that exceed the limits specified in Schedule C Table 1 – Release Limits to Waters.

REF	Condition	Santos Assessment
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Schedule C, Table 1 – Release Limits to Waters

Water Quality Parameters	Units	Water Quality Limits
Turbidity	NTU	10% above background water turbidity measured within 20 meters downstream of the construction and/or maintenance activity.
Hydrocarbons	-	No visible sheen

C11	Background water turbidity must be measured within 20 metres upstream of the construction and/or maintenance activities.	Background water turbidity will be measured within 20 metres upstream of the construction and/or maintenance activities.
C12	Monitoring is undertaken at a reasonable frequency to ensure compliance with condition (C9).	Monitoring will be undertaken at a reasonable frequency to ensure compliance with condition (C3).
C13	Written notification detailing the location (GPS coordinates) of any significant disturbance to be undertaken in or on the bed and banks of a watercourse, or within the areas specified in condition (C7)(b) must be provided to the administering authority at least 10 business days prior to the commencement of the significant disturbance.	Written notification detailing the location, including a GPS coordinate of the significant disturbance to be undertaken in or on the bed and banks of the watercourse will be provided to the administering authority at least 10 business days prior to the commencement of the significant disturbance.
Floodplains		
C14	Where the petroleum activity(ies) is carried out on floodplains, the holder of this environmental authority must ensure that the petroleum activity(ies) does not: (a) concentrate flood flows in a way that will or may cause or threaten an adverse environmental impact; or	N/A – the activity is not located on a floodplain due to the following: The proposed construction site is on a higher area which would not be subject to inundation from time to time by floodwater overflowing from a watercourse. Additionally, the ecological assessment report did not detail any floodplains or

REF	Condition	Santos Assessment
	(b) divert flood flows from natural drainage paths and alter flow distribution; or (c) increase the local duration of floods; or (d) increase the risk of detaining flood flows; or (e) pose an unacceptable risk to the safety of persons from flooding; or (f) pose an unacceptable risk of damage to property from flooding.	structural components of floodplains.

Schedule E - LAND

Disturbance to Land – General		
E1	Contaminants must not be directly or indirectly released to land except as permitted under this environmental authority.	Santos will ensure that contaminants are not directly or indirectly released to land except as permitted under this environmental authority. The administering authority will be notified of any reportable release of contaminants.
E2	When petroleum activities are undertaken it must be ensured, that: (a) the top layer of the soil profile is removed and stockpiled in accordance with condition (E13); (b) any soils that are removed during the significant disturbance are retained for use for rehabilitation purposes (c) The clearing of mature trees has been preferentially avoided (d) Any clearing of vegetation or placing of fill does not significantly isolates, fragments or dissects tracts of vegetation resulting in a reduction in the current level of ecosystem functioning, ecological connectivity (i.e. stepping stone or contiguous bioregional/local corridor networks) and/or results in an increase in threatening processes;	When petroleum activities are undertaken it will be ensured, that: (a) Due to the activity being a minimal disturbance lease, the top layer of the soil profile will be treated in accordance with condition (E13) and actions taken for minimal disturbance leases. These will include leaving maximum root stock where possible and rilling material to the topside of the lease area to create a diversion for overland flow. The soil management plan will be followed to ensure the correct methods are implemented for the type of lease constructed. (b) any soils that are removed during the significant disturbance are retained for use for rehabilitation purposes (c) The clearing of mature trees has been preferentially avoided. Significant efforts were made to avoid remnant vegetation and mature trees in the area. (d) Any clearing of vegetation or placing of fill will not significantly isolate, fragment or dissect tracts of vegetation resulting in a reduction in the current level of ecosystem functioning, ecological connectivity (i.e.

		stepping stone or contiguous bioregional/local corridor networks) and/or results in an increase in threatening processes .
E3	Prior to conducting petroleum activities that involve significant disturbance to land, an assessment must be undertaken of the condition, type ecological value of soils and vegetation in such areas where the activity is proposed to take place.	Condition E3 is satisfied by Appendix 1. Maps, Appendix 2. Desktop assessment and Appendix 3. Ecologist reports.
E4	The assessment required by condition (E3) must be undertaken by a suitably qualified person and include the carrying out of field validation surveys, observations and mapping of any Category A, B or C Environmentally Sensitive Areas , wetlands and the presence of species classed as endangered, vulnerable, rare or near threatened under the <i>Nature Conservation Act 1992</i> .	The assessments required by condition (E3) were carried out by suitably qualified people as per the meaning provided in the EA definitions. The assessments of RM03-04-1 Rev 1A revealed that the site is not in any ESA, wetlands or constraints classes. Ground truthing surveys conducted within the disturbance area confirmed the desktop assessment. No species classed EVNT under the NC Act were detected. A record of flora classed as Least Concern under the NC Act was recorded.
E5	The assessment required by condition (E3) must also include, but not necessarily be limited to: (a) Baseline soils quality data and maps for the soil units to be disturbed as provided for in the Soils Management Plan; (b) Identification of the vegetation communities present (including species composition and regional ecosystem type for native vegetation communities) within each area(s) to be disturbed; (c) a map or series of maps of suitable scale displaying the distribution of vegetation communities; and (d) data on the level of ecosystem function of each vegetation community.	An assessment was conducted in accordance with condition E3 which included: (a) <i>Baseline soils quality data and maps for the soil units to be disturbed as provided for in the Soils Management Procedure Coal Seam Gas Fields Santos Ltd</i> – a soil sample <u>will</u> be taken from the well lease area prior to disturbance. This sample will be analysed by a NATA accredited laboratory and the results of the analysis will direct soil management in accordance with the Santos Soil Management Plan. (b) Identification of the vegetation communities present (including species composition and regional ecosystem type for native vegetation communities) within each area(s) to be disturbed have been assessed. Quaternary field survey was conducted in accordance with “<i>Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland</i>”, this assessment is represented by the ecological assessment report mentioned in the assessment summary and is available on request. (c) Maps are provided in Appendix 1 (d) Data on the level of ecosystem functioning has been collected and is

		provided in Appendix 3. Ecological assessment report.
E6	If there is a suitable analogue site for the area where the petroleum activity(ies) is proposed to take place is not able to be identified, then the assessment required by condition (E3) must also include, but not necessarily be limited to: (a) data representing each vegetation community present within each area(s) to be rehabilitated including: i) flora species richness and diversity ii) Structural data including woody stem count densities for dominant species within each stratum iii) percent foliage cover (accounting for seasonal variation and excluding pests) (b) data regarding habitat features, including but not necessarily limited to: (i) organic litter cover (%); and (ii) Trees with hollows $\geq 10\text{cm}$ diameter (Count and timber per hectare); (iii) hollow bearing logs (count and number per hectare); and (iv) fallen woody material (total length of logs $\geq 10\text{cm}$ diameter per hectare and number of logs $\geq 10\text{cm}$ diameter per hectare).	Due to uncertainty of additional and often unrelated infrastructure which may be planned for the area and have an impact on a chosen analogue site, the assessment required by condition (E1) has also included: (a) data representing each vegetation community present within each area(s) to be rehabilitated including: i) flora species richness and diversity ii) Structural data including woody stem count densities for dominant species within each stratum iii) percent foliage cover (accounting for seasonal variation and excluding pests). (b) data regarding habitat features, including but not necessarily limited to: (i) organic litter cover (%); and (ii) Trees with hollows $\geq 10\text{cm}$ diameter (Count and timber per hectare); (iii) hollow bearing logs (count and number per hectare); and (iv) fallen woody material (total length of logs $\geq 10\text{cm}$ diameter per hectare and number of logs $\geq 10\text{cm}$ diameter per hectare).
E7	If the assessment required by conditions (E3) to (E6) indicates that an Environmentally Sensitive Area or wetland is incorrectly identified through state mapping, or is present and not identified by State mapping, proposed activities may proceed in accordance with the conditions of the environmental authority and the field validated values.	An assessment was done in accordance with conditions E3 to E6. There are no disputes regarding the mapping categorisations for ESAs or wetlands within the area where the assessment was undertaken. As such, there is no requirement to notify the administering authority about incorrectly mapped ESAs or wetlands.
E8	In the instance where a proposed activity is authorised (in E5) under the environmental authority based upon the field validated value(s), but not the State mapped value(s), the environmental authority holder must notify the administering authority five (5) business days prior to the activity commencing. The notification must be in writing, stipulate the precise location, and the nature of the proposed activity.	N/A

E9	The environmental authority holder must maintain for the life of the environmental authority all documentation survey information photographs, field data or any material associated with the field validation requirements in (E4) to demonstrate to the Administering Authority that surveys were conducted in a manner consistent with requirements contained in (E5).	Santos will maintain for the life of the environmental authority all documentation survey information photographs, field data and any other material associated with the field validation requirements in (E4) to demonstrate to the Administering Authority that surveys were conducted in a manner consistent with requirements contained in (E5).
Disturbance to Land – Environmentally Sensitive Areas		
E10	Activities must be conducted in accordance with Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas and any other relevant conditions of this environmental authority.	The landholder did not authorise land access to the property outside the area of proposed disturbance (lease and access track). As such, ecological assessments and ground truthing surveys were not conducted outside the infrastructure area. An assessment by Boobook Consulting for RM03-11 access track revealed the vegetation fringing Appletree Creek is of the floristic and structure analogous of RE 11.3.25 (Of Concern) and a patch of 2ha north of the Creek is analogous with RE 11.3.2 (Of Concern). These areas were not assessed by Santos due to land access restrictions and therefore taken into consideration to undertake the proposed activity for RM03-04 as a limited petroleum activity to remain compliant with condition E10.

Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas

ESA Category	Within the ESA	Primary Protection Zone of the ESA	Secondary protection zone of the ESA	Santos assessment
Category A ESAs	No petroleum activities permitted.	Only low impact petroleum activities permitted.	Only limited petroleum activities permitted.	Desktop searches were conducted and no Category A ESAs are present within 300m of the proposed disturbance area.
Category B ESAs excluding 'Endangered' Regional Ecosystems.	Only low impact petroleum activities permitted.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop and ground truthing surveys were conducted and no relevant Category B ESAs are present within the proposed disturbance area.
Category C ESAs that are Nature Refuges, Koala Habitat and/or Declared Catchment areas	Only low impact petroleum activities permitted	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop surveys were conducted and no relevant Category C ESAs are present within the proposed disturbance area.
Category B ESAs that are 'Endangered' Regional Ecosystems.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop and ground truthing surveys were conducted within the proposed area of disturbance and no relevant Category B ESAs are present within the proposed disturbance area. As field validation surveys were not undertaken with within 200m, there is the possibility that the proposed activities are within the PPZ of a Category B ESA.
Category C ESAs that are Essential Habitat, Essential regrowth Habitat and/or 'Of Concern' Regional Ecosystems	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop and ground truthing surveys were conducted within the proposed area of disturbance and no relevant Category C ESAs are present within the proposed disturbance area. As field validation surveys were not undertaken with within 200m, there is the possibility that the proposed activities are within the PPZ of a Category C ESA.
Category C ESAs that are Resource Reserves	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop surveys were conducted and no relevant Category C ESAs are present in or within 300m of the proposed disturbance area.
Category C ESAs that are State Forests, Timber Reserves	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	N/A	Desktop surveys were conducted and no relevant Category C ESAs are present in the proposed disturbance area.

E11	Prior to carrying out limited petroleum activities undertaken within environmentally sensitive areas in accordance with Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas It must be demonstrated, in the following order of preference that” 1. no reasonable or practicable alternative exists for carrying out the limited petroleum activities within the environmentally sensitive area; 2. the limited petroleum activities are preferentially located in pre-existing areas of clearing or significant disturbance; 3. vegetation clearing for the limited petroleum activities must not exceed any of the following areas: (a) 6 metres in width for access tracks not associated with a water, gas, power or communications line; or (b) for linear infrastructure, including provision of an access track; (i) 12 metres width for a single water, gas, power or communications line; or (ii) 7 metres width for any additional water or gas line.	No activities will be conducted within the ESAs mentioned in Schedule E, Table 1. Santos ground truthing survey could not confirm the presence of Category B or Category C ESAs that have not been identified in the State mapping due to land access restrictions to area of proposed disturbance for RM03-04 Rev1A. Therefore, this assessment will be conducted as though it is constrained to limited petroleum activities due to its' occurrence within possible primary protection zones of the Environmentally Sensitive Areas previously mentioned and identified in Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas.
E12	If limited petroleum activity (ies) are located within a primary protection zone or secondary protection zone of an environmentally sensitive area, that the activity (ies) must not negatively affect the adjacent environmentally sensitive area.	The activity will be: 1. A minimal disturbance lease therefore reducing the amount of disturbed land, retaining topsoil, vegetation and root stock to minimise erosion. 2. Conducted in the shortest amount of time possible – including civil construction and drilling activities. 3. Be fenced to exclude fauna

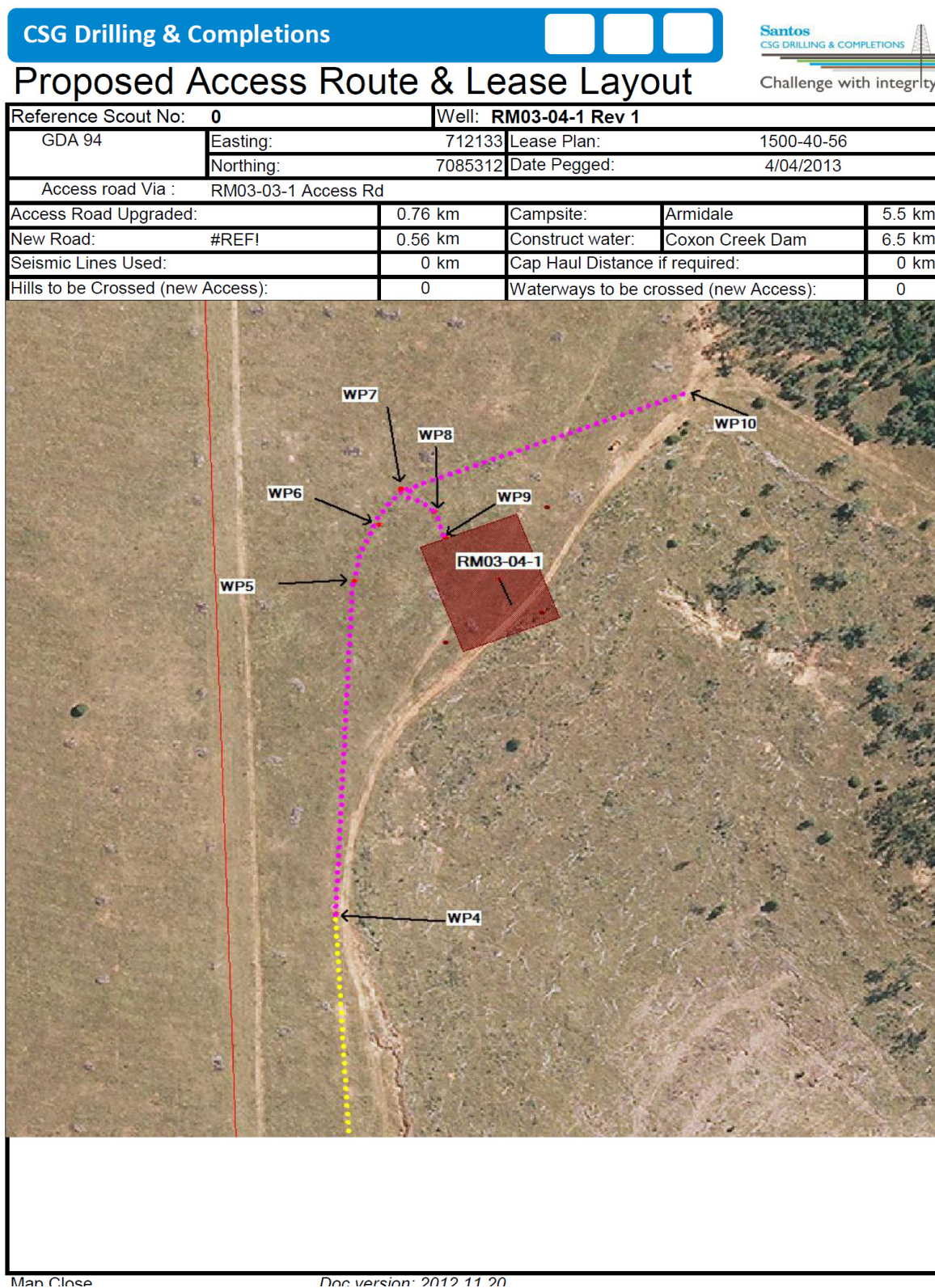
Schedule H - WASTE

General		
H1	All general waste must only be removed from the site and sent to a recycling facility or a disposal facility licensed to accept the waste under the <i>Environmental Protection Act 1994</i> .	All general waste will be removed from the site and sent to a recycling facility or disposal facility licenced to accept the waste under the <i>Environmental Protection Act 1994</i> .
H2	All regulated waste removed only be removed from the site by a person who holds a current authority to transport such waste under the provisions of the <i>Environmental Protection Act 1994</i> and sent to a recycling facility or disposal facility licensed to accept the waste.	All regulated waste will be removed from the site by a person who holds a current authority to transport such waste under the provisions of the Environmental Protection Act 1994 and sent to a recycling facility or disposal facility licenced to accept the waste

UPSTREAM GLNG PROTOCOLS	
Constraint Classes	The proposed activities are not within a Constraint Class and do not impact on any Matters of National Environmental Significance
EPBC Act Listed Communities	No threatened species or threatened ecological communities listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth) (EPBC Act) were detected within the area where the activity is proposed to take place.

GENERAL	
Water Bores	There were no water bores detected within 100m.
Environmental Approval	
Signed: Erik Kadri	Date: 15.5.2013

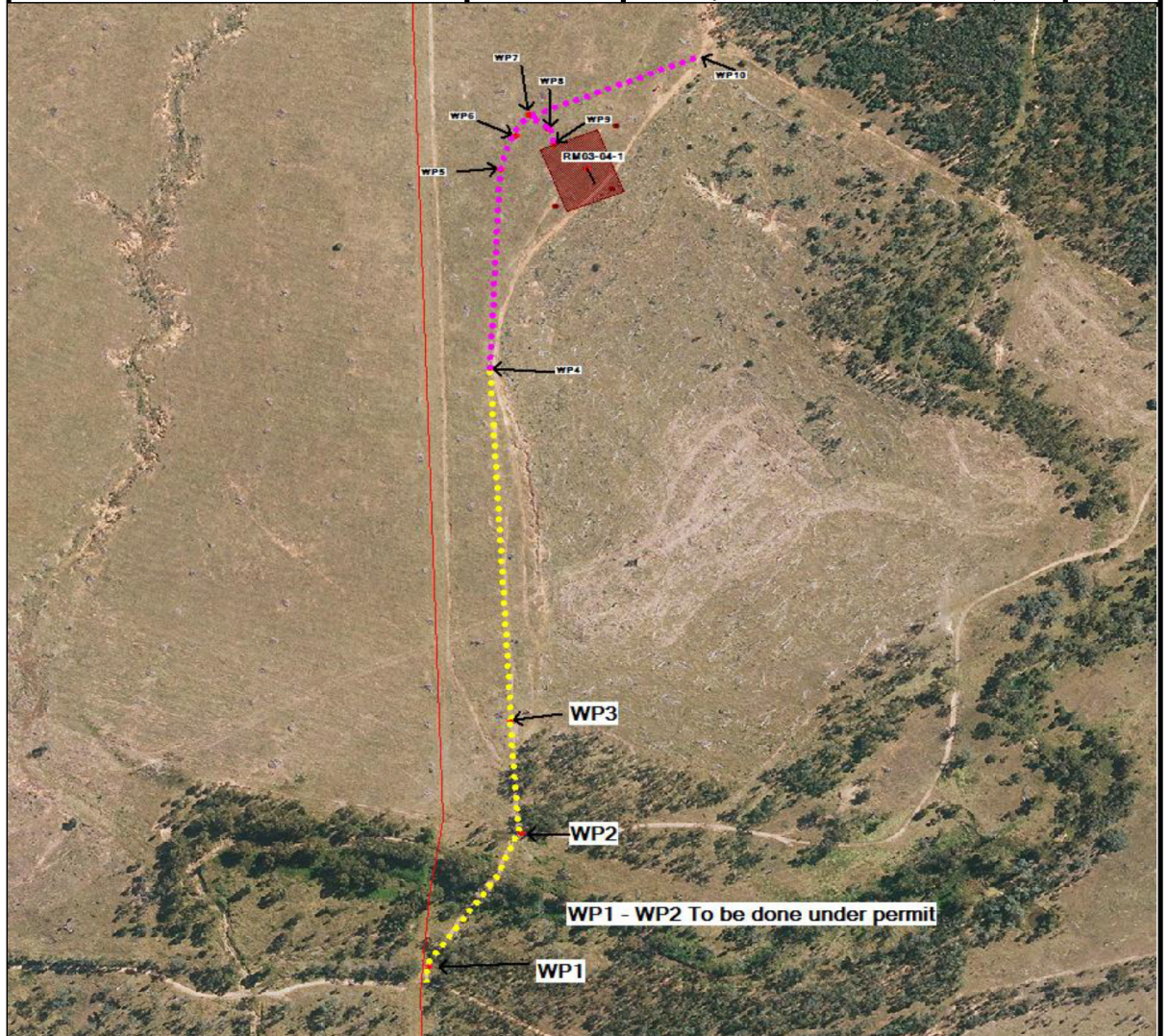
Appendix 1. Maps



Map 1. Infrastructure map close.

Proposed Access Route & Lease Layout

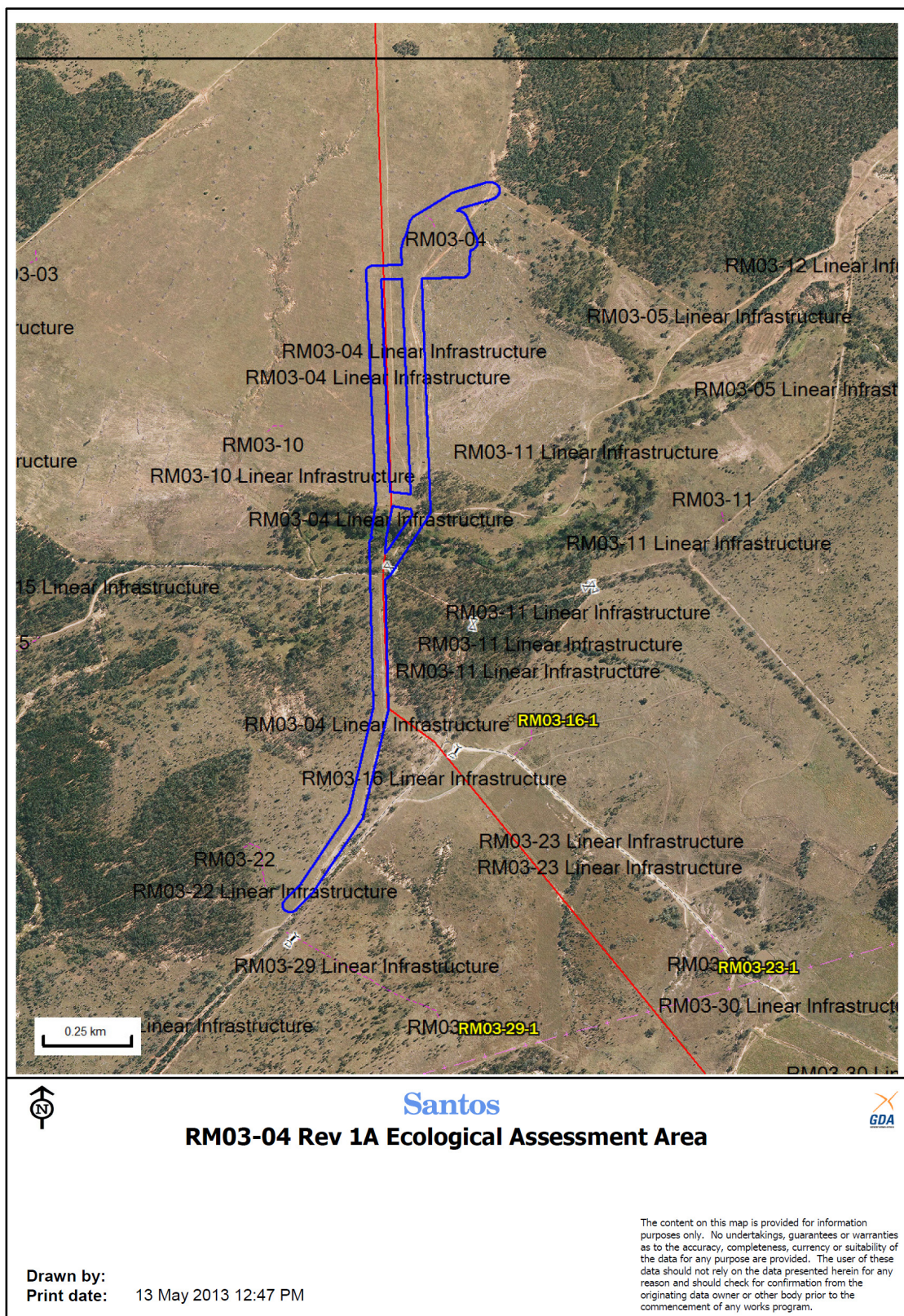
Reference Scout No: 0	Well: RM03-04-1 Rev 1		
GDA 94	Easting: 712133	Lease Plan: 1500-40-56	
	Northing: 7085312	Date Pegged: 4/04/2013	
Access road Via : RM03-03-1 Access Rd			
Access Road Upgraded:	0.76 km	Campsite:	Armidale 5.5 km
New Road: #REF!	0.56 km	Construct water:	Coxon Creek Dam 6.5 km
Seismic Lines Used:	0 km	Cap Haul Distance if required:	0 km
Hills to be Crossed (new Access):	0	Waterways to be crossed (new Access):	0



Map Far

Doc version: 2012.11.20

Map 2. Infrastructure map far.



Map 3. Ecological assessment area

Appendix 2. Desktop assessment

CSG Drilling & Completions



EcoScout Report

Site Name	RM03-04	PL/ATP	PL309	Coordinates	712134
Landholder	Leon Trevor Price			Coordinates	7085311

Desktop Assessment						Groundtruthing	
Assessor: Angela Sherwin Date: 6/09/2012						Assessor:	Date:
Mapped Constraints	Layer/Database	Mapped feature	Direct or PPZ?	Potential Issues?	Comments	Comment	Potential Issues?
	Environmentally Sensitive Areas (ESAs)/Listed Res	Nil	N/A	No			
	Least Concern Res	11.10.11 occurs to the NE of the well centre	Vicinity	No	will not be impacted for this area assessed		
	High Value Regrowth	The southern portion of the access track is in NOC HVR.	Direct	Maybe	track appears to be existing, maybe no veg clearing?		
	Watercourses	Access crosses the SO3. Access is existing. A SO3 occurs 400m east of well centre.	Vicinity	Maybe			

Appendix 3. Ecologist Report

Santos

Quaternary Data Sheet

Site no: RM03-04-1 Rev 1A	Date: 10.12.2012	Recorder: Angela Sherwin
Locality/coordinates: 712133, 7085312		

Flora (Representing species richness and diversity)

Tree layer 1			
Cover: isolated trees only		Av Height: 25m	
Species	Rel Dom	Species	Rel Dom
Eucalyptus populnea (Poplar Box)	C	Eucalyptus melanophloia (Silver Leaved Ironbark)	D
Tree layer 2			
Cover: isolated		Av Height: 8m Height Range: 8-10m	
Species	Rel Dom	Species	Rel Dom
Geijera parviflora (Wilga)			
Acacia decora (Pretty Wattle)			
Shrub layer 1			
Cover: ~15%		Av Height: 2m Height Range: 1-7m	
Species	Rel Dom	Species	Rel Dom
Callitris glaucophylla (White Cypress Pine)		Eremophila mitchellii (False Sandalwood)	
Acacia excelsa (Ironwood)		Maireana microphylla (Cotton bush)	
Acacia deanii (Deans Wattle)		Eucalyptus populnea (Poplar Box)	D
Cassinia laevis (Cough Bush)		Grevillea striata (Beefwood)	
Dodonaea viscosa (Sticky Hop Bush)		Opuntia stricta (Prickly Pear)	
Acacia farnesiana (Mimosa)		Psydrax oleifolius (Myrtle Tree)	
Owenia acidula (Emu Apple)			
Ground layer.			
Cover: 80%		Av Height: 0.4 Height Range: 0-1m	
Species	Rel Dom	Species	Rel Dom
Sida subspicata (Queensland Hemp)		Pennisetum ciliare (Buffel Grass)	
Aristida holathera (Tall Wiregrass)		Austrostipa verticillata (Slender Bamboo Grass)	
Heteropogon contortus (Black Spear Grass)		Podolepis jaceoides (Showy Copper Wire Daisy)	
Calotis lappulacea (Yellow Burr Daisy)		Rhodanthe polyphylla (Rhodanthe)	
Centaurea melitensis (Maltese Cockspur)		Rhynchosia minima (Rhynchosia)	
Chrysocephalum apiculatum (Yellow Buttons)		Pratia sp	
Cirsium vulgare (Spear Thistle)		Sclerolaena birchii (Galvanised Burr)	
Daucus glochidiatus (Native Carrot)		Sclerolaena muricata (Roly Poly)	
Tagetes minuta (Stinking Rodger)		Lichen	
Dichanthium sericeum (Queensland Bluegrass)		Themeda triandra (Kangaroo Grass)	
Dichondra repens (Kidney Weed)		Verbena officinalis (Common Verbena)	
Evolvulus alsinoides (Speedwell)		Verbena tenuisecta (Mayne's Curse)	
Goodenia glabra (Smooth Goodenia)		Bidens bipinnata (Native Copplers Pegs)	
Lepidium sagittulatum (Peppercress)		Wahlenbergia gracilis (Bluebell)	

<i>Sida acuta</i> (Spiny Sida)		<i>Alectryon oleifolius</i> (Boonaree)	
<i>Xanthium occidentale</i> (Noogoora Burr)		<i>Ptilotus exaltatus</i> var. <i>semilantus</i> (Pussy Tails)	
<i>Lomandra longifolia</i> (Lomandra)		<i>Capparis loranthifolia</i> (Wait a While)	
<i>Eragrostis dielsii</i>		<i>Conyza bonariensis</i> (Fleabane)	
<i>Melinis repens</i> (Red Natal)		<i>Cynodon dactylon</i> (Green Couch)	
<i>Gomphrena celosioides</i> (Gomphrons weed)		<i>Capillipedium spicigerum</i> (Scented Browntop)	
<i>Eremophila longifolia</i> (Emu Bush)		<i>Jasminum suavissimum</i> (Jasmin)	
<i>Neptunia gracilis</i> (Native Sensitive Plant)		<i>Eremophila debilis</i> (Winter Apple)	
<i>Portulaca pilosa</i> (Hairy Pig Weed)		<i>Eremophila detersi</i> (Ellangowan Poison Bush)	
<i>Lomandra leucocephala</i> (Woolly Headed Matt Rush)		<i>Cissus opaca</i> (Native Grape)	
<i>Senecio laevis</i> (Fireweed)		<i>Aristida</i> sp	
<i>Cyperus rotundus</i> (Nut Grass)		<i>Einadia nutans</i> (Climbing Saltbush)	
<i>Pimelea trichostachya</i> (Spiked riceflower)		<i>Aristida caput medusae</i> (Multi Headed Aristida)	
<i>Sida corrugata</i> (Corrugated Sida)		<i>Solanum nigrum</i> (Blackberry nightshade)	

Geology, landform, soils

Woody Stem counts (20x20 representative plot)

Geology code and rock types: some rock and petrified wood	T1	0
Landform: Undulating hills to creek	T2	2
Soils: Sandy loam running to alluvial	S1	6

Regional Ecosystems (RE) / Threatened Ecological Community (TEC)

Mapped RE: Non remnant	Landzone:
Corresponding TEC (mapped):	
Ground truthed RE: Non remnant and High Value regrowth	Landzone:
Corresponding TEC (ground truthed):	

Vegetation Short Description

Cleared grazing land in the southern section with some mature and scattered *E. melanophloia* and *E. populnea* along edge the area assessed. Pipeline and access runs through an area of regrowth analogous with RE 11.3.2. This area is fragmented due to the existing pipeline, fences, firebreaks and roads.

Connectivity/Patch Characteristics

The area to the south has fragmented stands of *Eucalyptus* sp with some *G. parviflora* and *E. mitchellii*. The area through the regrowth is quite connected with many mature trees still throughout the vegetation. Hollows in mature trees and hollow logs are abundant in the vegetation surrounding the area assessed.

Weeds

Weeds Present. R=rare (<10 plants observed); U = uncommon (11-50 plants observed); C = common (>50 plants observed)

Maynes Pest = C, Buffel Grass = U, Spear Thistle = U, Mexican Poppy = C, Prickly Pear = U, Wild Cotton = C.

Total % Weed cover : <10%

EVNT/Type A Flora Present

C. canaliculatum at 712146, 7085278, this is located in the sump of the lease assessed. This plant will be moved from the location prior to disturbance.

EVNT/Type A Flora Likely

Brachychitons and Cymbidiums.

Fauna Habitat Features

Density scores: **0** = 0%; **1** = <25%; **2** = 26-50%; **3** = 51-75%; **4** = 75-99%; **5** = 100% abundance.

Rocks - embedded	1	Boulders	0	Shrub layer	1	Ground cover	4
Rocks - loose	1	Fallen Bark	2	Leaf litter	1	Bare ground	1

Abundance Scores: **0** = absent; **1** = 1-5; **2** = 6-20; **3** = 21-50; **4** = 51-75; **5** = 76-100; **6** = >100.

Crevices/ledges	0	Large logs (>30cm diameter)	3	Trees/logs bearing loose bark	1
Underhangs/overhangs/caves	0	Logs with hollows	3	Termite mounds	1
Small logs (<30cm diameter)	6	Hollow bearing /mature trees	1	Mistletoe	0

Disturbances (e.g. grazed, ploughed, flooded)

The area is grazed heavily and has been broad scale cleared. Some of the area has recently been re-pulled with suckers laying over. The majority of the area assessed is adjacent to an existing pipeline easement.

Incidental Fauna Observations

Magpie, Laughing Kookaburra, Willy Wag Tail, Forrest Kingfisher, Galahs, Sulphur Crested Cockatoo.	
A monitor was seen in the area prior to the assessment.	

Notes on watercourses, wetlands, lakes or springs

Nil present. No watercourses were observed in or within 200m of the area assessed.

Additional Notes

The overall area, including the lease area is of medium to low ecological value due to the lack of cover and habitat. There are some existing large piles of dead vegetation which has been pushed together, these may provide habitat for fauna in a landscape otherwise void of sheltering areas.

Site no: Watercourse crossing for the linear infrastructure and the access track for RM03-04-1 Rev 1A.	Date: 10.12.2012	Recorder: Angela Sherwin
Locality/coordinates: 711939 and 7084479		

Flora (Representing species richness and diversity)

Tree layer 1			
Cover:	40%	isolated trees	Av Height: 25m
Species	Rel Dom	Species	Rel Dom
<i>Eucalyptus populnea</i> (Poplar Box)		<i>Eucalyptus melanophloia</i> (Silver Leaved Ironbark)	D
<i>Eucalyptus camaldulensis</i> (River Red Gum)		<i>Angophora floribunda</i> (Rough Barked Apple)	
Tree layer 2			
Cover:	10%	Av Height: 8m	Height Range: 8-10m
Species	Rel Dom	Species	Rel Dom
<i>Callitris glaucophylla</i> (White Cypress Pine)	C		
Shrub layer 1			
Cover:	~15%	Av Height: 2m	Height Range: 1-7m
Species	Rel Dom	Species	Rel Dom
<i>Acacia farnesiana</i> (Mimosa)			
Ground layer.			
Cover:	98%	Av Height: 0.6	Height Range: 0-1m
Species	Rel Dom	Species	Rel Dom
<i>Sida subspicata</i> (Queensland Hemp)		<i>Pennisetum ciliare</i> (Buffel Grass)	
<i>Aristida holathera</i> (Tall Wiregrass)		<i>Austrostipa verticillata</i> (Slender Bamboo Grass)	
<i>Lomandra longifolia</i> (Lomandra)		Lichen	
<i>Schoenoplectus calidus</i> (River Clubbrush)		<i>Aristida caput medusae</i> (Multi Headed Aristida)	
<i>Lepidium sagittulatum</i> (Peppercress)		<i>Conyza bonariensis</i> (Fleabane)	
<i>Dichondra repens</i> (Kidney Weed)		<i>Bidens bipinnata</i> (Native Copplers Pegs)	
<i>Dichanthium sericeum</i> (Queensland Bluegrass)		<i>Verbena tenuisecta</i> (Mayne's Curse)	
<i>Daucus glochidiatus</i> (Native Carrot)		<i>Verbena officinalis</i> (Common Verbena)	
<i>Tagetes minuta</i> (Stinking Rodger)		<i>Urochloa panicoides</i> (Liverseed Grass)	
<i>Dianella sp</i>			

Geology, landform, soils

Woody Stem counts (20x20 representative plot)

Geology code and rock types: No rock present	T1	1
Landform: Creek flat	T2	1
Soils: Alluvial	S1	0

Regional Ecosystems (RE) / Threatened Ecological Community (TEC)

Mapped RE: Non remnant	Landzone:
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Corresponding TEC (mapped):	
Ground truthed RE: Non remnant with regrowth of 11.3.2	Landzone:
Corresponding TEC (ground truthed):	

Vegetation Short Description

Scattered *A. floribunda*, *E. camaldulensis*, and *C. glaucophylla* throughout the area assessed.

Connectivity/Patch Characteristics

Area is relatively connected however has historically been selectively cleared and some fencelines/pipelines exist. A linear strip of vegetation along the watercourse exists and although fragmented and thin, the frequency of habitat trees would provide habitat values.

Weeds

Weeds Present. R=rare (<10 plants observed); U = uncommon (11-50 plants observed); C = common (>50 plants observed)

Maynes Pest = C, Buffel Grass = U, Spear Thistle = U, Wild Cotton = C.

Total % Weed cover : <10%

EVNT/Type A Flora Present

None were observed in the area assessed

EVNT/Type A Flora Likely

Brachychitons and *Cymbidiums*.

Fauna Habitat Features

Density scores: **0** = 0%; **1** = <25%; **2** = 26-50%; **3** = 51-75%; **4** = 75-99%; **5** = 100% abundance.

Rocks - embedded	0	Boulders	0	Shrub layer	0	Ground cover	4
Rocks - loose	0	Fallen Bark	1	Leaf litter	1	Bare ground	1

Abundance Scores: **0** = absent; **1** = 1-5; **2** = 6-20; **3** = 21-50; **4** = 51-75; **5** = 76-100; **6** = >100.

Crevices/ledges	0	Large logs (>30cm diameter)	1	Trees/logs bearing loose bark	1
Underhangs/overhangs/caves	0	Logs with hollows	0	Termite mounds	0
Small logs (<30cm diameter)	1	Hollow bearing /mature trees	1	Mistletoe	0

Disturbances (e.g. grazed, ploughed, flooded)

The area is grazed heavily by cattle as there is a water trough nearby. There are existing fencelines and pipelines in the area which fragment the connectivity of the vegetation.

Incidental Fauna Observations

Magpie, Laughing Kookaburra, Willy Wag Tail, Forrest Kingfisher, Galahs, Sulphur Crested Cockatoo.

Notes on watercourses, wetlands, lakes or springs

The area crosses through a Stream order 3. Both the proposed pipeline and access track to the lease cross this watercourse.

Additional Notes

Existing disturbance is prevalent with two fence lines, a pipeline and an existing access track.

Site Photos



Photo description

From well centre facing
north



Photo description

From well centre facing
south

Well Lease Area/ Infrastructure Zone Assessment Report: Mt Hope Zone RM03-11

Compiled by Boobook for Santos

Boobook
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

Revision	Date	Description	Author	Verifier	Approved
A	22/2/2013	Draft issued to client for review	RJ	CE	CE
B	13/6/2013	Draft incorporating client comment	RJ	CE	CE
C	28/6/2013	Draft incorporating revised mapping (Fig. 1a, b)	RJ		RJ
0	3/7/2013	Final version	RJ		RJ

1. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DSEWPac	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
TAR plant	Type A Restricted Plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

2. Introduction

2.1 Purpose & Scope

Boobook was commissioned by Santos to undertake ecological assessments on a number of well leases and infrastructure zones (hereafter individually referred to as 'the Zone') located on the property 'Mt Hope', located about 40km north-east of Roma, south central Queensland. Boobook was requested to undertake the following:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation present within the Zone;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the assessment site;
- Comment on the nature and location of wetlands and watercourses within 100m of the Zone;
- Provide location and description of any plants of conservation concern listed in the NC Act or EPBC Act;
- Location and characteristics of any Type A Restricted (TAR) plants (NC Act) in the Zone; and
- Location and characteristics of habitat trees in the Zone, with reference to trees previously mapped by Santos.

An individual report was to be prepared for each Zone. This report refers to Zone RM03-11 located on Lot 71 on Plan WV758.

2.2 Survey Team

The project supervisor (Craig Eddie) was approved by 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.

The field survey described by this report was undertaken by Boobook on 24th January 2013 and was conducted by Rosamund Aisthorpe (Graduate Botanist) and Ashley Hoffman (Field Assistant). The following report was compiled by Rosamund Aisthorpe and Richard Johnson. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie (Principal Ecologist and Project Supervisor).

Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A comprehensive desktop search was not required by the client for the purposes of this report. However, a desktop search was undertaken for REs at the property scale using

mapping version 6.1 (DEHP 2013). This dataset provides a baseline for subsequent field assessment.

The search was conducted using a 5km buffer around the coordinate -26.3558°S, 149.0847°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative site was selected for each RE present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Figures 1a and 1b. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all GPS co-ordinates quoted within this report is GDA94. When referred to within this report the sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2012: Table 29);
4. RE type mapped;
5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;
9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;
11. presence of endangered, vulnerable or near threatened flora;
12. a list of all other flora encountered at the Site; and

13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2012) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

A search was made within the Zone for TAR plants: If found, the location was established with a hand-held GPS unit and the species, height, DBH and possible management options were recorded.

Where mapping supplied by Santos indicated the presence of habitat trees, a search was made for these. If found the location was established with a hand-held GPS unit and the species, height, DBH and habitat value(s) were recorded. In some instances unmapped habitat trees were located during the site survey and data was collected for these trees also.

The presence of any wetlands or watercourses within 100m of the Zone was recorded.

Representative photographs were taken at each quaternary survey site in the Zone, as well as at any wetlands or watercourses, habitat trees or TAR plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

No remnant regional ecosystems are mapped as present in the Zone.

4.1.2 Regional Ecosystems Observed

An area of vegetation about 2ha in extent at the western end of the Zone is floristically and structurally analogous to RE 11.3.2 (of concern). It is sampled at Q1/RM03-11. Appletree Creek crosses the Zone (and is largely within 100m of the Zone for most of the Zone's extent): remnant vegetation fringing the creek is RE 11.3.25 (of concern) and is sampled at Q2/RM03-11. The floristics and structure of the dominant species in each woody stratum at

the two sites are detailed in Table 2. Representative images are shown in Figures 2a-b. The extent of the two RE within the Zone is shown in Figures 1a and 1b.

Table 2: Floristics and Structure of Remnant Ecosystems at Survey Sites in Zone RM03-11

Site	Location	Vegetation Description		
Q1/RM03-11	55J 712143E 7084545N	<i>Eucalyptus populnea</i> woodland; very sparse mid-layer of <i>E. populnea</i> saplings and <i>Geijera parviflora</i> ; grassy ground layer dominated by native perennial spp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	16	40	260	25
S1	2	5	220	5
Site	Location	Vegetation Description		
Q2/RM03-11	55J 712706E 7084845N	<i>Eucalyptus</i> sp. (<i>camaldulensis</i> / <i>tereticornis</i>) woodland with associated <i>Angophora floribunda</i> ; sparse mid-layer dominated by <i>Callitris glaucophylla</i> and <i>Vachellia farnesiana</i> ; grassy ground layer of <i>Austrostipa verticillata</i> , <i>Eragrostis</i> sp., <i>Aristida</i> sp. and <i>Lomandra longifolia</i>		
Stratum	Median height (m)	5 foliage cover	Stems/ha	DBH (cm)
T1	22	25	140	30
T2	8	20	100	10
S1	1.5	5	40	1

4.1.3 Threatened Ecological Communities Observed

NO TEC were observed in the Zone.

4.1.4 Non-remnant Vegetation Observed

The remainder of the Zone is vegetated by non-remnant (disturbed) woodland or by regrowth that has occurred after mechanical disturbance (pulling) of regrowth from earlier clearing event(s) (see Appendix A). The latter was sampled at Q3/RM03-11 within the well area. The floristics and structure of the dominant species in each woody stratum at this site are shown in Table 3. Representative images of the site are shown at Figure 3.

Table 3: Floristics and Structure of Vegetation at Survey Sites in Zone RM03-11

Site	Location	Vegetation Description		
Q3/RM03-11	55J 712814E 7084543N	Cleared , with scattered <i>Eucalyptus populnea</i> suckers and log stacks; dominated by <i>Aristida</i> sp., <i>Conyza bonariensis</i> , <i>Glandularia aristigera</i> , <i>Xerochrysum bracteatum</i> , <i>Chrysocephalum apiculatum</i> .		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
G	0.3	n/a	n/a	n/a

4.2 Additional Observations

4.2.1 Additional Flora Species

Approximately 46 species of native flora were detected (Appendix B). In addition, 11 non-native species were recorded. Two of these, Tiger Pear (*Opuntia aurantiaca*) and Velvety Tree Pear (*O. tomentosa*), are declared Class 2 weeds scheduled under the *Land Protection (Pest and Stock Route Management) Act 2002* and Weeds of National Significance (WoNS). A number of wetland-dependent species were recorded: these are detailed at 4.2.4 below.

4.2.2 Type A Restricted Plants

No TAR plants were detected within the Zone.

4.2.3 Fauna Habitat Features

A number of fauna habitat trees were observed at various locations in or adjacent to the Zone. Location and details of these trees are shown in Table 4 and Figures 4a-n. No other significant fauna habitat features were detected in the Zone.

Table 4: Details of Fauna Habitat Features, Zone RM03-11

Waypoint	Location	Species	Alive/ dead	DBH (cm)	Height (m)	Habitat features
HT1/RM03-11	55J 712213E 7084520N	unknown (<i>Eucalyptus</i> sp.)	dead	38	8	1 hollow <10cm diam.
HT2/RM03-11	55J 712212E 7084489N	Poplar Box (<i>Eucalyptus populnea</i>)	alive	57	8	2 hollows <10cm; 1 hollow 10-30cm; 1 hollow >30cm diam.
HT3/RM03-11	55J 712224E 7084485N	Poplar Box (<i>Eucalyptus populnea</i>)	dead	38	15	1 hollow 10-30cm diam.; 30% loose bark
HT4/RM03-11	55J 712234E 7084490N	Poplar Box (<i>Eucalyptus populnea</i>)	Alive	48	17	1 hollow <10cm; 2 hollows 10-30cm diam.
HT5/RM03-11	55J 712235E 7084509N	Poplar Box (<i>Eucalyptus populnea</i>)	Alive	48	15	1 hollow <10cm; 1 hollow 10-30cm diam.
HT6/RM03-11	55J 712245E 7084486N	Poplar Box (<i>Eucalyptus populnea</i>)	Alive	62	12	2 hollows 10-30cm diam.
HT7/RM03-11	55J 712285E 7084562N	Silver-leaved Ironbark (<i>Eucalyptus melanophloia</i>)	Dead	80	20	1 hollow <10cm; 2 hollows 10-30cm; 2 hollows >30cm diam.
HT8/RM03-11	55J 712288E 7084546N	Poplar Box (<i>Eucalyptus populnea</i>)	Alive	52	16	4 hollows <10cm diam.
HT9/RM03-11	55J 712460E 7084505N	Rough-barked Apple (<i>Angophora</i>)	Dead	67	17	1 hollow >30cm diam.; 5% loose bark

Waypoint	Location	Species	Alive/ dead	DBH (cm)	Height (m)	Habitat features
		<i>floribunda</i>)				
HT10/RM03-11	55J 712408E 7084530N	Rough-barked Apple (<i>Angophora floribunda</i>)	Dead	70	17	40% loose bark
HT11/RM03-11	55J 712496E 7084642N	Silver-leaved Ironbark (<i>Eucalyptus melanophloia</i>)	Alive	64	17	1 hollow 10-30cm diam.
HT12/RM03-11	55J 712486E 7084689N	River Red Gum (<i>Eucalyptus camaldulensis</i>)	Alive	57	20	1 hollow <10cm diam.
HT13/RM03-11	55J 712684E 7084846N	Unknown (<i>Eucalyptus</i> sp.)	Dead	29	8	7 hollows <10cm diam.
HT14/RM03-11	55J 712854E 7084844N	Rough-barked Apple (<i>Angophora floribunda</i>)	Dead	80	15	4 hollows <10cm; 2 hollows 10-30cm diam.; 10% loose bark

4.2.4 Wetlands and Watercourses

One watercourse as defined by the *Water Act 2000*, possessing well-defined banks and bed and distinct riparian vegetation (RE 11.3.25), was observed at the Zone. This is the named Appletree Creek; it was sampled at waypoint W3/RM03-11 where the Zone crosses the creek. Note that for much of the length of the Zone, the creek is within 100m. Two drainage features, small drainage lines running into the creek, were also present. The lack of riparian vegetation and defined bed and banks indicates they are drainage features and not watercourses (*Water Act 2000*). Additionally, they meet the definition of a drainage feature according to the Act because they are likely to be only capable of flowing during and immediately after rainfall, for a short period and do not have enough continual flow to maintain a riparian ecosystem. These are sampled at waypoints W1/RM03-11 and W2/RM03-11. Locations and characteristics are given in Table 5. Representative images are shown at Figures 5a-c.

Table 5: Wetlands and watercourses detected within Zone RM03-11

Waypoint	Location	Description
W1/RM03-11	55J 712274E 7084526N	Drainage feature: drainage line crossing the Zone from north to south. Poorly-defined banks. Wetland species present include <i>Eucalyptus camaldulensis/tereticornis</i> , <i>Juncus usitatus</i> , <i>Cynodon dactylon</i> , <i>Nymphoides crenata</i> , <i>Persicaria prostrata</i> .
W2/RM03-11	55J 712634E 7084852N	Drainage feature: gully crossing Zone from north to south. Poorly-defined banks. Wetland species present include <i>Eucalyptus camaldulensis/tereticornis</i> , <i>Juncus usitatus</i> and <i>Lomandra longifolia</i> .
W3/RM03-11	55J 712848E 7084818N	Watercourse: beds and banks defined, some water present. Riparian vegetation present: <i>Eucalyptus camaldulensis</i> / <i>tereticornis</i> woodland

		(RE 11.3.25). Wetland plants include <i>Juncus usitatus</i> , <i>Cynodon dactylon</i> , <i>Leptochloa digitata</i> , <i>Lomandra longifolia</i> .
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5. References

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<http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/L/LandPRPSRMR03.pdf>

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 3.1*. Department of Science, Information technology, Innovation and the Arts , Brisbane.

Water Act 2000. (Queensland), viewed 14 February 2013,
<http://www.legislation.qld.gov.au/legisltn/current/w/watera00.pdf>

Figure 1a: Map of Zone RM03-11 showing survey sites and other points of interest (western end)

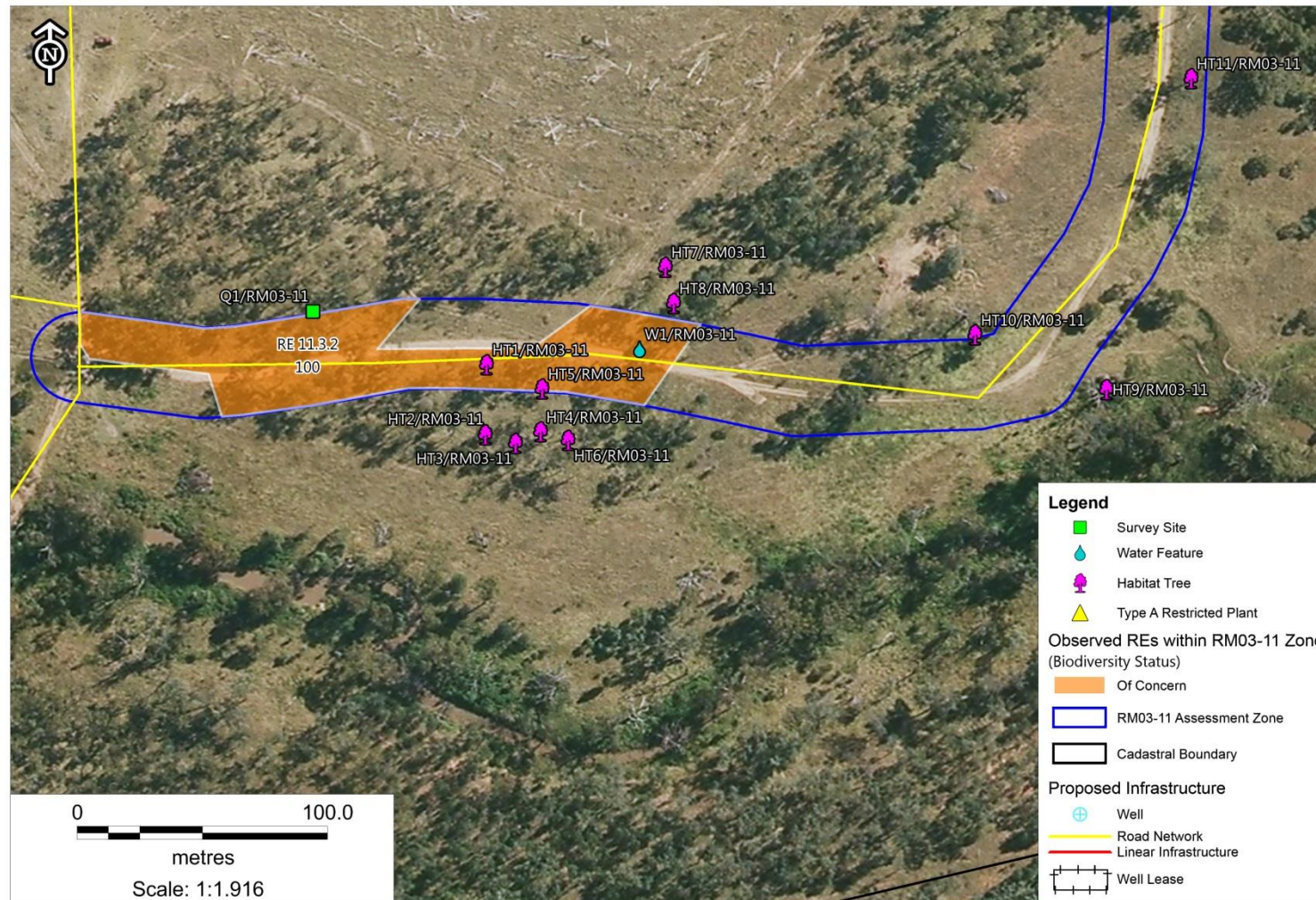


Figure 1b: Map of Zone RM03-11 showing survey sites and other points of interest (eastern end)

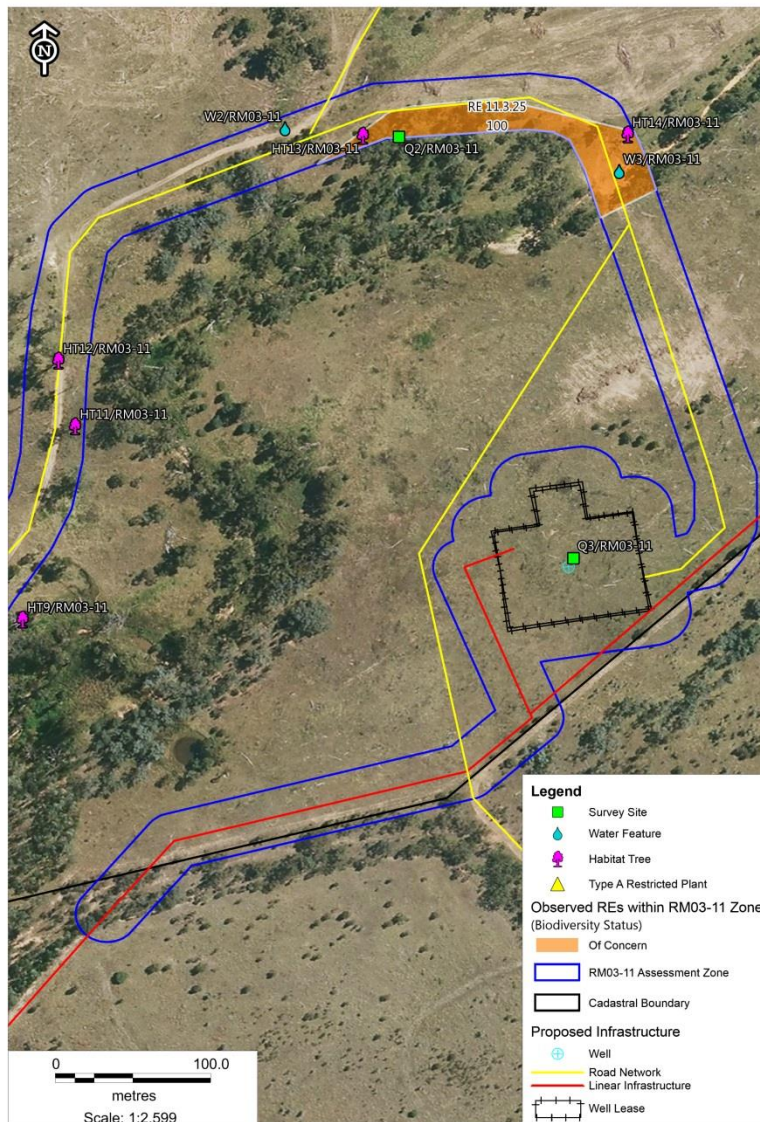




Figure 2a: Woodland of Poplar Box *Eucalyptus populnea* analogous to RE 11.3.2 at site Q1/RM03-11.



Figure 2b: River Red Gum/ Queensland Blue Gum *Eucalyptus camaldulensis* / *tereticornis* woodland, RE 11.3.25, at Site Q2/RM03-11 (left, right).



Figure 3: Cleared pasture at site Q3/RM03-11. Very sparse regrowth of Poplar Box suckers is present but the area is dominated by grasses and forbs.



Figure 4a (left): A habitat tree (dead eucalypt) at waypoint HT1/RM03-11; **Figure 4b** (right): Poplar Box habitat tree at waypoint HT2/RM03-11.



Figure 4c (left): A habitat tree (dead Poplar Box) at waypoint HT3/RM03-11; **Figure 4d** (right): Poplar Box habitat tree at waypoint HT4/RM03-11.



Figure 4e (left): Poplar Box habitat tree at waypoint HT5/RM03-11; **Figure 4f** (right): Poplar Box habitat tree at waypoint HT6/RM03-11.



Figure 4g (left): A habitat tree (dead Silver-leaved Ironbark) at waypoint HT7/RM03-11; **Figure 4h** (right): Poplar Box habitat tree at waypoint HT8/RM03-11.



Figure 4i (left): A habitat tree (dead Rough-barked Apple) at waypoint HT9/RM03-11; **Figure 4j** (right): A habitat tree (dead Rough-barked Apple) at waypoint HT10/RM03-11.



Figure 4k (left): A silver-leaved ironbark habitat tree at waypoint HT11/RM03-11; **Figure 4l** (right): A River Red Gum habitat tree at waypoint HT12/RM03-11.



Figure 4m (left): A habitat tree (dead eucalypt) at waypoint HT13/RM03-11; **Figure 4n** (right): A habitat tree (dead Rough-barked Apple) at waypoint HT14/RM03-11.



Figure 5a (left): A drainage feature at waypoint W1/RM03-11; **Figure 5b** (right): A drainage feature at waypoint W2/RM03-11.



Figure 5c: A watercourse, Appletree Creek, at waypoint W3/RM03-11. Note the pooled water (left) and variable width of bed (right).

Appendix A: Quaternary assessment results, Zone RM03-11

Site No.	Q1/ RM03-11	Recorder:	Rosamund Aisthorpe, Ashley Hoffmann	Date	24/01/2013
Purpose	Well Zone Assessments			Time	06:20

Locality: (inc. distance/direction to nearest town)	"Mt Hope" along RM03-11 linear infrastructure				
Zone:	55J	0712143 E	7084545 N	Datum	GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Eucalyptus populnea</i>
T1	16	14 - 18	M (40)	S1	D	<i>E. populnea</i>
T2				S1	A	<i>Geijera parviflora</i>
T3				G	C	<i>Aristida</i> spp.
S1	2	1 - 4	V (5)	G	C	<i>Panicum effusum</i>
S2				G	C	<i>Fimbristylis dichotoma</i>
S3						
G	0.3	0.1 - 0.4	D (80)			
Structural formation: Woodland						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types:	alluvium
Landform:	alluvial plain (adjoins watercourse to south)
Soils:	pale brown clay loam
DERM Mapped RE Code:	NR (PMAV category X)
Observed RE Code: 11.3.2	Landzone: 3
Vegetation Short Description	
<i>Eucalyptus populnea</i> woodland; very sparse midlayer composed of <i>E. populnea</i> saplings and <i>Geijera parviflora</i> ; grassy ground layer dominated by native perennial spp.	
Connectivity/Patch Characteristics	
Remnant patch adjoined by cleared paddock to north; riparian corridor to south	
Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed) <i>Opuntia aurantiaca</i> (R), <i>Conyza bonariensis</i> (U), <i>Glandularia aristigera</i> (U), <i>O. tomentosa</i> (R)	
% Weed Cover:	<5
EVNT Flora Present:	Nil
EVNT Flora Likely:	Nil
Field Wpt Code:	
Photo Nos.	BBK5 4219-4221

Additional Flora:							
<i>Eremophila debilis</i>				<i>Einadia nutans</i>			
<i>Commelina</i> sp.				<i>Chloris ventricosa</i>			
<i>Xerochrysum bracteatum</i>				<i>Paspalidium</i> sp.			
<i>Nymphoides crenata</i>				<i>Tricoryne elatior</i>			
<i>Grevillea striata</i>				<i>Dianella longifolia</i>			
<i>Digitaria ammophila</i>							
<i>Sporobolus</i> sp.							
<i>Bothriochloa decipiens</i>							
<i>Dichanthium sericeum</i>							
<i>Chrysocephalum apiculatum</i>							
<i>Cymbopogon refractus</i>							
<i>Cyperus fulvus</i>							
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, dead litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)							
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%							
Rocks - embedded				Boulders			
Rocks - loose				Fallen bark			
				Shrub layer		Ground cover	
				Leaf litter		Bare ground	
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100							
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark			
Underhangs / overhangs / caves		Logs with hollows		Termite mounds			
Small logs (<30cm diameter)		Hollow bearing trees		Mistletoe			
Other							
Soil cracks							
Water		Nil					
Other (e.g. food trees):							
Disturbances							
Vehicle track - well used							
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)				Structure of Woody Strata			
				Str.	Stems/ha	DBH (cm)	
				T1	260	25	
				S1	220	5	
Additional Notes							

Site No.	Q2/ RM03-11	Recorder:	Rosamund Aisthorpe, Ashley Hoffmann	Date	24/01/2013
Purpose	Well Zone Assessments			Time	09:15

Locality: (inc. distance/direction to nearest town) "Mt Hope" along RM03-11 linear infrastructure

Zone: 55J 0712706 E 7084845 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Eucalyptus</i> sp. (<i>camaldulensis</i> / <i>tereticornis</i>)
T1	22	20 – 25	S (25)	T1	A	<i>Angophora floribunda</i>
T2	8	7 – 9	S (20)	T2	D	<i>Callitris glaucophylla</i>
T3				G	D	<i>Austrostipa verticillata</i>
S1	1.5	1 – 2	V (5)	G	A	<i>Aristida</i> sp.
S2				G	A	<i>Lomandra longifolia</i>
S3				G	S	<i>Eragrostis</i> sp.
G	0.4	0.1 – 1.2	D (75)	S1	D	<i>Vachellia farnesiana</i>
Structural formation: Woodland				T1	A	<i>Eucalyptus populnea</i>
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types:	alluvium
Landform:	alluvial plain / creek flat
Soils:	brown clay loam (high organic material content)
DERM Mapped RE Code:	NR (PMAV category X)
Observed RE Code:	11.3.25
Landzone:	3
Vegetation Short Description	
<i>Eucalyptus</i> sp. (<i>camaldulensis</i> / <i>tereticornis</i>) woodland with associated <i>E. populnea</i> , <i>Angophora floribunda</i> ; sparse midlayer dominated by <i>Callitris glaucophylla</i> and <i>Vachellia farnesiana</i> ; grassy ground layer composed of <i>Austrostipa verticillata</i> , <i>Eragrostis</i> sp., <i>Aristida</i> sp. and <i>Lomandra longifolia</i> .	
Connectivity/Patch Characteristics	
Part of riparian corridor; cleared paddock adjoins north.	
Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed) <i>Bidens pilosa</i> (C), <i>Conyza bonariensis</i> (C), <i>Glandularia aristigera</i> (U), <i>Vachellia farnesiana</i> (U), <i>Lepidium bonariense</i> (C), <i>Xanthium occidentale</i> (R)	
% Weed Cover:	10
EVNT Flora Present:	Nil
EVNT Flora Likely:	Nil
Field Wpt Code:-	
Photo Nos.	BBK5 4276-4284

Additional Flora:			
<i>Ajuga australis</i>			
<i>Cyperus</i> sp.			
<i>Juncus usitatus</i>			
<i>Cyperus gracilis</i>			
<i>Daucus glochidiatus</i>			
<i>Einadia nutans</i>			
<i>Rhodanthe</i> sp.			
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, dead litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)			
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%			
Rocks - embedded		Boulders	
Rocks - loose		Fallen bark	
		Shrub layer	
		Leaf litter	
		Ground cover	
		Bare ground	
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100			
Crevices/ledges		Large logs (>30cm diameter)	
Underhangs /overhangs / caves		Logs with hollows	
Small logs (<30cm diameter)		Hollow bearing trees	
		Trees / logs bearing loose bark	
		Termite mounds	
		Mistletoe	
Other			
Soil cracks			
Water	Adjoins creek to south (off well zone)		
Other (e.g. food trees):			
Disturbances			
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata	
		Str.	Stems/ha
		DBH (cm)	
		T1	140
		T2	100
		S1	40
Additional Notes			

Site No. Q3/
RM03-11 **Recorder:** Rosamund Aisthorpe, Ashley Hoffmann **Date** 24/01/2013
Purpose Well Zone Assessments **Time** 10:30

Locality:
 (inc. distance/direction to nearest town) "Mt Hope" @ RM03-11
Zone: 55J 0712814 E 7084543 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				G	D	<i>Aristida</i> sp.
T1				G	S	<i>Conyza bonariensis</i> non-native
T2				G	S	<i>Glandularia aristigera</i> non-native
T3				G	A	<i>Xerochrysum bracteatum</i>
S1	0.6	0.5 - 0.7	V (5)	G	A	<i>Chrysocephalum apiculatum</i>
S2				S1	D	<i>Eucalyptus populnea</i>
S3						
G	0.3	0.1 - 0.4	D (80)			
Structural formation: Grassland						
Ecologically dominant layer: G						

Geology, landform, soils

Geology code and rock types: coarse-grained sedimentary rocks
Landform: low undulating hills (hill slope)
Soils: pale brown sandy loam
DERM Mapped RE Code: NR (PMAV category X)
Observed RE Code: NR (ex-11.10.11) **Landzone:** 10

Vegetation Short Description

Cleared paddock with scattered *Eucalyptus populnea* suckers and log stacks; dominated by *Aristida* sp., *Conyza bonariensis*, *Glandularia aristigera*, *Xerochrysum bracteatum* and *Chrysocephalum apiculatum*.

Connectivity/Patch Characteristics

Cleared paddock adjoined by riparian corridor to north and remnant corridor to south

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Conyza bonariensis (C), *Glandularia aristigera* (C), *Lepidium bonariense* (C), *Cirsium vulgare* (U)

% Weed Cover: ~20

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code:

Photo Nos. BBK5 4313-4316

Additional Flora:			
<i>Juncus usitatus</i>	<i>Bothriochloa decipiens</i>		
<i>Dichondra repens</i>	<i>Digitaria ammophila</i>		
<i>Cymbopogon refractus</i>	<i>Eremophila debilis</i>		
<i>Sida hackettiana</i>	<i>Sporobolus</i> sp.		
<i>Maireana microphylla</i>			
<i>Eragrostis</i> sp.			
<i>Glycine tabacina</i>			
<i>Acacia decora</i>			
<i>Sida</i> sp.			
<i>Cyperus fulvus</i>			
<i>Daucus glochidiatus</i>			
<i>Dichanthium sericeum</i>			
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, dead litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)			
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%			
Rocks - embedded		Boulders	
Rocks - loose		Fallen bark	
		Shrub layer	
		Leaf litter	
		Ground cover	
		Bare ground	
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100			
Crevices/ledges		Large logs (>30cm diameter)	
Underhangs / overhangs / caves		Logs with hollows	
Small logs (<30cm diameter)		Hollow bearing trees	
		Trees / logs bearing loose bark	
		Termite mounds	
		Mistletoe	
Other			
Soil cracks			
Water	Nil		
Other (e.g. food trees):			
Disturbances			
Mechanical clearing <1 year			
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata	
		Str.	Stems/ha
		DBH (cm)	
		Non-woody	n/a
Additional Notes			

Appendix B: Plant species list, Zone RM03-11

Key: * indicates non-native plant species

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	other
Apiaceae	<i>Daucus glochidiatus</i>	Australian Carrot	LC			P	P	
Asteraceae	<i>Bidens pilosa</i> *	Cobbler's Pegs	-			P		
Asteraceae	<i>Centipeda minima</i>	Desert Sneezeweed	LC					P
Asteraceae	<i>Chrysocephalum apiculatum</i>	Yellow Buttons	LC		P		P	
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	-				P	
Asteraceae	<i>Conyza bonariensis</i> *	Fleabane	-		P	P	P	
Asteraceae	<i>Rhodanthe</i> sp.		LC			P		
Asteraceae	<i>Xanthium occidentale</i> *	Noogoora Burr	-			P		
Asteraceae	<i>Xerochrysum bracteatum</i>	Golden Everlasting Daisy	LC		P		P	
Brassicaceae	<i>Lepidium bonariense</i> *	Cut-leaf Peppergrass	-			P	P	
Cactaceae	<i>Opuntia aurantiaca</i> *	Tiger Pear	-		P			
Cactaceae	<i>Opuntia tomentosa</i> *	Velvety Tree Pear	-		P			
Chenopodiaceae	<i>Einadia nutans</i>	Climbing Saltbush	LC		P	P		
Chenopodiaceae	<i>Maireana microphylla</i>	Cotton Bush	LC				P	
Commelinaceae	<i>Commelina</i> sp. (infertile)		LC		P			
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	LC				P	
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC			P		
Cyperaceae	<i>Cyperus fulvus</i>	Sticky Sedge	LC		P		P	
Cyperaceae	<i>Cyperus gracilis</i>	Slender Flat-sedge	LC			P		
Cyperaceae	<i>Cyperus</i> sp.		LC			P		
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-sedge	LC		P			
Fabaceae	<i>Glycine tabacina</i>	Glycine	LC				P	
Hemerocallidaceae	<i>Dianella longifolia</i>	Long-leaved Flax Lily	LC		P			
Johnsoniaceae	<i>Tricoryne elatior</i>	Yellow Rush-lily	LC		P			
Juncaceae	<i>Juncus usitatus</i>	Common Rush	LC			P	P	P
Lamiaceae	<i>Ajuga australis</i>	Austral Bugle	LC			P		
Laxmanniaceae	<i>Lomandra longifolia</i>	Long-leaved Matrush	LC			P		P
Malvaceae	<i>Sida</i> sp.		LC				P	
Malvaceae	<i>Sida hackettiana</i>	Spiked Sida	LC		P		P	
Menyanthaceae	<i>Nymphoides crenata</i>	Yellow-fringed Waterflower	LC		P			P
Mimosaceae	<i>Acacia decora</i>	Pretty Wattle	LC				P	
Mimosaceae	<i>Vachellia farnesiana</i> *	Mimosa Bush	-			P		P
Myoporaceae	<i>Eremophila debilis</i>	Winter Apple	LC		P		P	
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	LC			P		P
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		P	P	P	
Myrtaceae	<i>Eucalyptus</i> sp. (<i>E. camaldulensis</i> / <i>tereticornis</i>)	River Red Gum or Queensland Blue Gum	LC			P		P
Poaceae	<i>Aristida</i> sp. (infertile)	A Speargrass	LC		P	P	P	
Poaceae	<i>Austrostipa verticillata</i>	Stout Bamboo Grass	LC			P		
Poaceae	<i>Bothriochloa bladhii</i>	Forest Bluegrass	LC					P
Poaceae	<i>Bothriochloa decipiens</i>	Pitted Bluegrass	LC		P		P	
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	LC		P			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	other
Poaceae	<i>Cymbopogon refractus</i>	Barbwire Grass	LC		P		P	
Poaceae	<i>Cynodon dactylon</i> *	Couch Grass	-					P
Poaceae	<i>Dichanthium sericeum</i>	Queensland Bluegrass	LC		P		P	P
Poaceae	<i>Digitaria ammophila</i>	Silky Umbrella Grass	LC		P		P	
Poaceae	<i>Echinochloa colona</i> *	Awnless Barnyard Grass	-					P
Poaceae	<i>Eragrostis</i> sp.	A Lovegrass	LC			P	P	
Poaceae	<i>Imperata cylindrica</i>	Blady Grass	LC					P
Poaceae	<i>Leptochloa digitata</i>	Umbrella Canegrass	LC					P
Poaceae	<i>Panicum effusum</i>	Hairy Panic	LC			P		
Poaceae	<i>Paspalidium</i> sp.	A Grass	LC		P			
Poaceae	<i>Sporobolus</i> sp.	A Grass	LC		P		P	
Polygonaceae	<i>Persicaria prostrata</i>	Creeping Knotweed	LC					P
Proteaceae	<i>Grevillea striata</i>	Beefwood	LC		P			
Rutaceae	<i>Geijera parviflora</i>	Wilga	LC		P			
Verbenaceae	<i>Glandularia aristigera</i> *	Mayne's Pest	-		P	P	P	P
Verbenaceae	<i>Verbena bonariensis</i> *	Purple Top	-					P

Well Lease Scouting – Environmental Adviser Assessment

Well name: RM03-54		Lot: Lot 76 Plan WV759	PL: 309	EA: EPPG00898213
Assessor: Lincoln Smith, Ecologist Checked by: Angela Sherwin, Field Environmental Advisor			Assessment date: 7/4/13 Check Date: 17/9/13	
Zone: 55	Easting: 715695		Northing: 7080355	
Versioning: This approval has been issued in accordance with RSGPA EA conditions granted on 11.07.2013				
Assessment Summary: • This approval is for the RM03-54-1 Rev 0 lease and access track only. • The ecological assessment has revealed that the area proposed for disturbance contains remnant vegetation with a classification of 11.10.11 contrary to the state mapped regional ecosystems which indicates the area is non remnant. No notification to the administering authority is required. • The site is not within 200m of any mapped Category A, B or C Environmentally Sensitive Areas. Due to the location of the nearby drainage feature and remnant vegetation, there may be Of Concern Regional Ecosystems within 200m of the lease area. As such, the lease and access track must be limited to a limited petroleum activity. • The site is not located within 100m of the high bank of a watercourse, or 200m of a wetland, lake or spring. • There were no State mapping disputes regarding ESAs or wetlands identified in the proposed disturbance area. • No species classed as endangered, vulnerable or near threatened (EVNT) under the <i>Nature Conservation Act 1992</i> (NC Act) were detected during the ecological assessment. • No threatened species or threatened ecological communities listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth) (EPBC Act) were detected within the area where the activity is proposed to take place.				
Well-Specific comments and final constrains (e.g. European heritage, cultural heritage etc.):				

N/A

Proposed Mitigation:

The following mitigation measures will be taken:

- **The proposed project is permitted within the area indicated in Appendix 1. Map only and with lease layout 1500_40_69.**
- Only limited petroleum activities are permitted.
 - Single well is not to exceed 1 ha.
 - Vegetation clearing is not to exceed 6m in width for the purposes of establishing access tracks.
- **A soil sample (Baseline soils quality data) must be taken prior to any significant disturbance or activities taking place. Liaise with the Civil Works Ecologist (0408 290 919).**
- **Fauna spotter is required on site for clearing activities as site contains high value habitat features including trees with hollows and hollow logs.**
- Where required timber that is cleared is to be pushed aside and used for habitat or batter mulch and is not to be burned.
- Ensure top soil layer is removed, stockpiled (max 1.5m high) in a manner which will preserve its' biological properties and is used in the rehabilitation process.
- Landholder consent is in place prior to clearing activities.
- Well Lease installation is done in accordance with Santos Standards.
- Vehicle/machinery hygiene procedures to be adhered to at all times. Avoid unnecessary earthworks within areas containing Velvety Tree Pear.
- Use existing infrastructure where practical.
- All clearing will be minimised to the area necessary for safe operations.
- Erosion control incorporating mulch and coir logs will be implemented as per the individual lease layout requirements.
- Any vegetation cleared will be stockpiled in a manner that facilitates respreading or salvaging and will not impede vehicle, stock or wildlife movements.
- Prior to carrying out field based petroleum activities, all relevant staff, contractors or agents carrying out those activities, are to be made aware of the these conditions and the requirements of the environmental authority.
- Contaminants must not be released to waters or land.

Note: Santos currently holds an exemption under the NC Act for clearing species listed under the NC Act as 'Least Concern'. No other NC Act listed species are to be removed without a permit.

Maps	Appendix 1. Map	Map 1. Ecological assessment area
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Well names: RM03-54-1	Lot/Plan: Lot 76, WV759	PL: 309	EA: EPPG00898213
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Schedule C – WATER

REF	Condition	Santos Assessment
Water courses, wetlands and springs		
C1	Contaminants must be directly or indirectly released to any waters except as permitted under this environmental authority.	Contaminants will not be released to waters or land.
C7	Unless otherwise authorised under this environmental authority, petroleum activity(ies) that require earthworks, vegetation clearing, placing fill and/or that will result in significant disturbance other than that associated with the construction and/or maintenance of linear infrastructure, is not permitted in or within : a) 200 meters from any wetland, lake or spring; or b) 100 meters of the high bank of any other water course	The proposed activities are within the condition C7 for water courses, wetlands and springs; a) More than 200m from a wetland, spring or lake b) More than 100m of the high bank of any other water course. The area to the east of the lease mapped as a stream order 1 was observed in the field to be a drainage feature.
C8	All reasonable alternative locations must be considered prior to the construction of any linear infrastructure that will result in significant disturbance in or on the bed and banks of a watercourse or within the areas specified in (C7)(b).	N/A
C9	The construction and/or maintenance of linear infrastructure that will result in significant disturbance in or on the bed or banks of a watercourse or within the areas specified in (C7)(a) and (b) must be conducted in accordance with the following order of preference: (a) Conducting works in times when there is no water present (b) conducting work in times of no flow (c) conducting works in times of flow but in a way that	N/A

REF	Condition	Santos Assessment
	does not impede low flow.	
C10	The construction and/or maintenance of linear infrastructure that will result in significant disturbance in or on the bed and banks of a watercourse or within the areas specified in (C7)(b) must not release from the site any contaminants to any waters that exceed the water quality limits specified in <i>Schedule C, Table 1 – Release Limits to Waters</i>	N/A

Schedule C, Table 1 – Release Limits to Waters

Water Quality Parameters	Units	Water Quality Limits
Turbidity	NTU	10% above background water turbidity measured within 20 meters downstream of the construction and/or maintenance activity.
Hydrocarbons	-	No visible sheen

C11	Background water turbidity must be measured within 20 metres upstream of the construction and/or maintenance activities.	N/A
C12	Monitoring is undertaken at a reasonable frequency to ensure compliance with condition (C3).	N/A

REF	Condition	Santos Assessment
C13	Written notification detailing the location (GPS coordinates) of any significant disturbance to be undertaken in or on the bed and banks of a watercourse, or within the areas specified in condition (C7)(b) must be provided to the administering authority at least 10 business days prior to the commencement of the significant disturbance.	N/A
Floodplains		
C14	Where the petroleum activity(ies) is carried out on floodplains, the holder of this environmental authority must ensure that the petroleum activity(ies) does not: (a) concentrate flood flows in a way that will or may cause or threaten an adverse environmental impact; or (b) divert flood flows from natural drainage paths and alter flow distribution; or (c) increase the local duration of floods; or (d) increase the risk of detaining flood flows; or (e) pose an unacceptable risk to the safety of persons from flooding; or (f) pose an unacceptable risk of damage to property from flooding.	N/A – the activity is not located on a floodplain due to the following: The proposed construction site is on a higher area which would not be subject to inundation from time to time by floodwater overflowing from a watercourse. Additionally, the ecological assessment report did not detail any floodplains or structural components of floodplains.

Schedule E - LAND
Disturbance to Land – General

E1	Contaminants must not be directly or indirectly released to land except as permitted under this environmental authority.	Santos will ensure that contaminants are not directly or indirectly released to land except as permitted under this environmental authority. The administering authority will be notified of any reportable release of contaminants.
E2	When petroleum activities are undertaken it must be ensured, that: (a) the top layer of the soil profile is removed and stockpiled in accordance with condition (E13) (b) any soils that are removed during the significant disturbance are retained for use for rehabilitation purposes (c) The clearing of mature trees has been preferentially avoided (d) Any clearing of vegetation or placing of fill does not significantly isolates, fragments or dissects tracts of vegetation resulting in a reduction in the current level of ecosystem functioning, ecological connectivity (i.e. stepping stone or contiguous bioregional/local corridor networks) and/or results in an increase in threatening processes;	When petroleum activities are undertaken it will be ensured, that: (a) the top layer of the soil profile is removed and stockpiled in accordance with condition (E13) (b) any soils that are removed during the significant disturbance are retained for use for rehabilitation purposes (c) The clearing of mature trees has been preferentially avoided however the location of the subsurface target did not allow the well pad to be sited outside the area of remnant vegetation. Significant efforts were made to avoid trees with habitat values in the area. (d) Any clearing of vegetation or placing of fill will not significantly isolate, fragment or dissect tracts of vegetation resulting in a reduction in the current level of ecosystem functioning, ecological connectivity (i.e. stepping stone or contiguous bioregional/local corridor networks) and/or results in an increase in threatening processes;
E3	Prior to conducting petroleum activities that involve significant disturbance to land, an assessment must be undertaken of the condition, type ecological value of soils and vegetation in such areas where the activity is proposed to take place.	Condition E3 is satisfied by Appendix 1. Map, Appendix 2. Desktop assessment and Error! Not a valid result for table..

E4	The assessment required by condition (E3) must be undertaken by a suitably qualified person and include the carrying out of field validation surveys, observations and mapping of any Category A, B or C Environmentally Sensitive Areas, wetlands and the presence of species classed as endangered, vulnerable, rare or near threatened under the <i>Nature Conservation Act 1992</i>.	The assessment required by condition (E3) was carried out by a suitably qualified person as per the meaning provided in the EA definitions. The assessments of RM03-54 revealed that: There were no wetlands observed in or within 200m of the lease site or within the linear infrastructure disturbance area. This area can be seen in Map 1 Ecological assessment area. The site is not in any mapped Category A, B or C Environmentally Sensitive Areas. Due to the location of the nearby drainage feature and remnant vegetation, there may be Of Concern Regional Ecosystems within 200m of the lease area. As such, the lease and access track will be limited to a limited petroleum activity. No species classed EVNT under the NC Act were detected. A record of flora classed as Least Concern under the NC Act was recorded. A comprehensive record of flora classed as Least Concern under the NC Act was recorded, refer to Appendix 3 – Ecologist report.
E5	The assessment required by condition (E1) must also include, but not necessarily be limited to: (a) Baseline soils quality data and maps for the soil units to be disturbed as provided for in the Soils Management Plan; (b) Identification of the vegetation communities present (including species composition and regional ecosystem type for native vegetation communities) within each area(s) to be disturbed; (c) a map or series of maps of suitable scale displaying the distribution of vegetation communities; and (d) data on the level of ecosystem function of each vegetation community.	An assessment was conducted in accordance with condition E3 which included: (a) <i>Baseline soils quality data and maps for the soil units to be disturbed as provided for in the Soils Management Procedure Coal Seam Gas Fields Santos Ltd</i> – a soil sample <u>will</u> be taken from the well lease area prior to disturbance. This sample will be analysed by a NATA accredited laboratory and the results of the analysis will direct soil management in accordance with the Santos Soil Management Plan. (b) Identification of the vegetation communities present (including species composition and regional ecosystem type for native vegetation communities) within each area(s) to be disturbed have been assessed. Quaternary field survey was

		conducted in accordance with “<i>Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland</i>”, this assessment is represented by the ecological assessment report mentioned in the assessment summary and is available on request. (c) A map is provided in Appendix 1 and descriptions of vegetation communities observed provided for in the ecological assessment report. (d) Data on the level of ecosystem functioning has been collected and is provided in Appendix 3 - Ecologist report.
E6	If there is a suitable analogue site for the area where the petroleum activity(ies) is proposed to take place is not able to be identified, then the assessment required by condition (E3) must also include, but not necessarily be limited to: (a) data representing each vegetation community present within each area(s) to be rehabilitated including: i) flora species richness and diversity ii) Structural data including woody stem count densities for dominant species within each stratum iii) percent foliage cover (accounting for seasonal variation and excluding pests) (b) data regarding habitat features, including but not necessarily limited to: (i) organic litter cover (%); and (ii) Trees with hollows $\geq 10\text{cm}$ diameter (Count and timber per hectare); (iii) hollow bearing logs (count and number per hectare); and (iv) fallen woody material (total length of logs $\geq 10\text{cm}$ diameter per hectare and number of logs $\geq 10\text{cm}$ diameter per hectare).	Due to uncertainty of additional and often unrelated infrastructure which may be planned for the area and have an impact on a chosen analogue site, the assessment required by condition (E1) has also included: (a) data representing each vegetation community present within each area(s) to be rehabilitated including: i) flora species richness and diversity ii) Structural data including woody stem count densities for dominant species within each stratum iii) percentage foliage cover (accounting for seasonal variation and excluding pests) (b) data regarding habitat features, including but not necessarily limited to: (i) organic litter cover (%); and (ii) Trees with hollows $\geq 10\text{cm}$ diameter (Count and timber per hectare); (iii) hollow bearing logs (count and number per hectare); and (iv) fallen woody material (total length of logs $\geq 10\text{cm}$ diameter per hectare and number of logs $\geq 10\text{cm}$ diameter per hectare).
E7	If the assessment required by conditions (E3) to (E6) indicates that an Environmentally Sensitive Area or wetland is incorrectly identified through state mapping, or is present and not identified by State mapping, proposed activities may proceed in accordance with	An assessment was done in accordance with conditions E3 to E6. There are no disputes regarding the mapping categorisations for ESAs or wetlands within the area where the assessment was

	the conditions of the environmental authority and the field validated values.	undertaken. As such, there is no requirement to notify the administering authority about incorrectly mapped ESAs or wetlands
E8	In the instance where a proposed activity is authorised (in E5) under the environmental authority based upon the field validated value(s), but not the State mapped value(s), the environmental authority holder must notify the administering authority for (5) business days prior to the activity commencing. The notification must be in writing, stipulate the precise location, and the nature of the proposed activity.	N/A
E9	The environmental authority holder must maintain for the life of the environmental authority all documentation survey information photographs, field data or any material associated with the field validation requirements in (E4) to demonstrate to the Administering Authority that surveys were conducted in a manner consistent with requirements contained in (E5).	Santos will maintain for the life of the environmental authority all documentation survey information photographs, field data and any other material associated with the field validation requirements in (E4) to demonstrate to the Administering Authority that surveys were conducted in a manner consistent with requirements contained in (E5).
Disturbance to Land – Environmentally Sensitive Areas		
E10	Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas and any other relevant conditions of this environmental authority.	N/A

Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas

ESA Category	Within the ESA	Primary Protection Zone of the ESA	Secondary protection zone of the ESA	Santos assessment
Category A ESAs	No petroleum activities permitted.	Only low impact petroleum activities permitted.	Only limited petroleum activities permitted.	Desktop searches were conducted and no Category A ESAs are present within an area <300m of the proposed disturbance area.
Category B ESAs excluding 'Endangered' Regional Ecosystems.	Only low impact petroleum activities permitted.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop and ground truthing surveys were conducted and no relevant Category B ESAs are present within an area <200m of the proposed disturbance area.
Category C ESAs that are Nature Refuges, Koala Habitat and/or Declared Catchment areas	Only low impact petroleum activities permitted	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop surveys were conducted and no relevant Category C ESAs are present within an area <200m of the proposed disturbance area.
Category B ESAs that are 'Endangered' Regional Ecosystems.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop and ground truthing surveys were conducted and no relevant Category B ESAs are present within an area <200m of the proposed disturbance area.
Category C ESAs that are Essential Habitat, Essential regrowth Habitat and/or 'Of Concern' Regional Ecosystems	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop surveys were conducted and no relevant Category C ESAs are present within an area <200m of the proposed disturbance area. Vegetation which may be Of Concern is located within 200m of the lease area adjacent to the drainage feature – only limited petroleum activities apply.
Category C ESAs that are Resource Reserves	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	Desktop surveys were conducted and no relevant Category C ESAs are present within an area <300m of the proposed disturbance area.
Category C ESAs that are State Forests, Timber Reserves	Only limited petroleum activities permitted. Subject to conditions (E11) and (E12) inclusive.	N/A	N/A	Desktop surveys were conducted and no relevant Category C ESAs are present within the proposed disturbance area.

E11	Prior to carrying out limited petroleum activities undertaken within environmentally sensitive areas in accordance with Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas It must be demonstrated, in the following order of preference that: 1. no reasonable or practicable alternative exists for carrying out the limited petroleum activities within the environmentally sensitive area; 2. the limited petroleum activities are preferentially located in pre-existing areas of clearing or significant disturbance; 3. vegetation clearing for the limited petroleum activities must not exceed any of the following areas: (a) 6 metres in width for access tracks not associated with a water, gas, power or communications line; or (b) for linear infrastructure, including provision of an access track; (i) 12 metres width for a single water, gas, power or communications line; or (ii) 7 metres width for any additional water or gas line.	Prior to carrying out limited petroleum activities the following order of preference has been taken: 1. no reasonable or practicable alternative exists for carrying out the limited petroleum activities within the possible environmentally sensitive area due to the limitations of subsurface targets and the shallow coal seam target; 2. the entire area which is proposed for disturbance and it's surrounding areas was of a similar vegetation and habitat composition 3. vegetation clearing for the limited petroleum activities must not exceed any of the following areas: (a) 6 metres in width for access tracks not associated with a water, gas, power or communications line; or (b) for linear infrastructure, including provision of an access track; (i) 12 metres width for a single water, gas, power or communications line; or (ii) 7 metres width for any additional water or gas line.
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E12	If limited petroleum activity(ies) are located within a primary protection zone or secondary protection zone of an environmentally sensitive area, that the activity(ies) must not negatively affect the adjacent environmentally sensitive area.	It is not anticipated that the activity will negatively affect the adjacent environmentally sensitive area due to the following: - Civil works activities will be minor due to the design of minimal disturbance leases. - Minimal disturbance methodology will ensure vegetation, root stock and topsoil are kept onsite with as little disturbance as possible - Drilling rig matting will cover the ground to protect biological and chemical composition - Drilling activities will be kept to approximately 3 days, therefore limiting noise, dust, the potential for spills and traffic.
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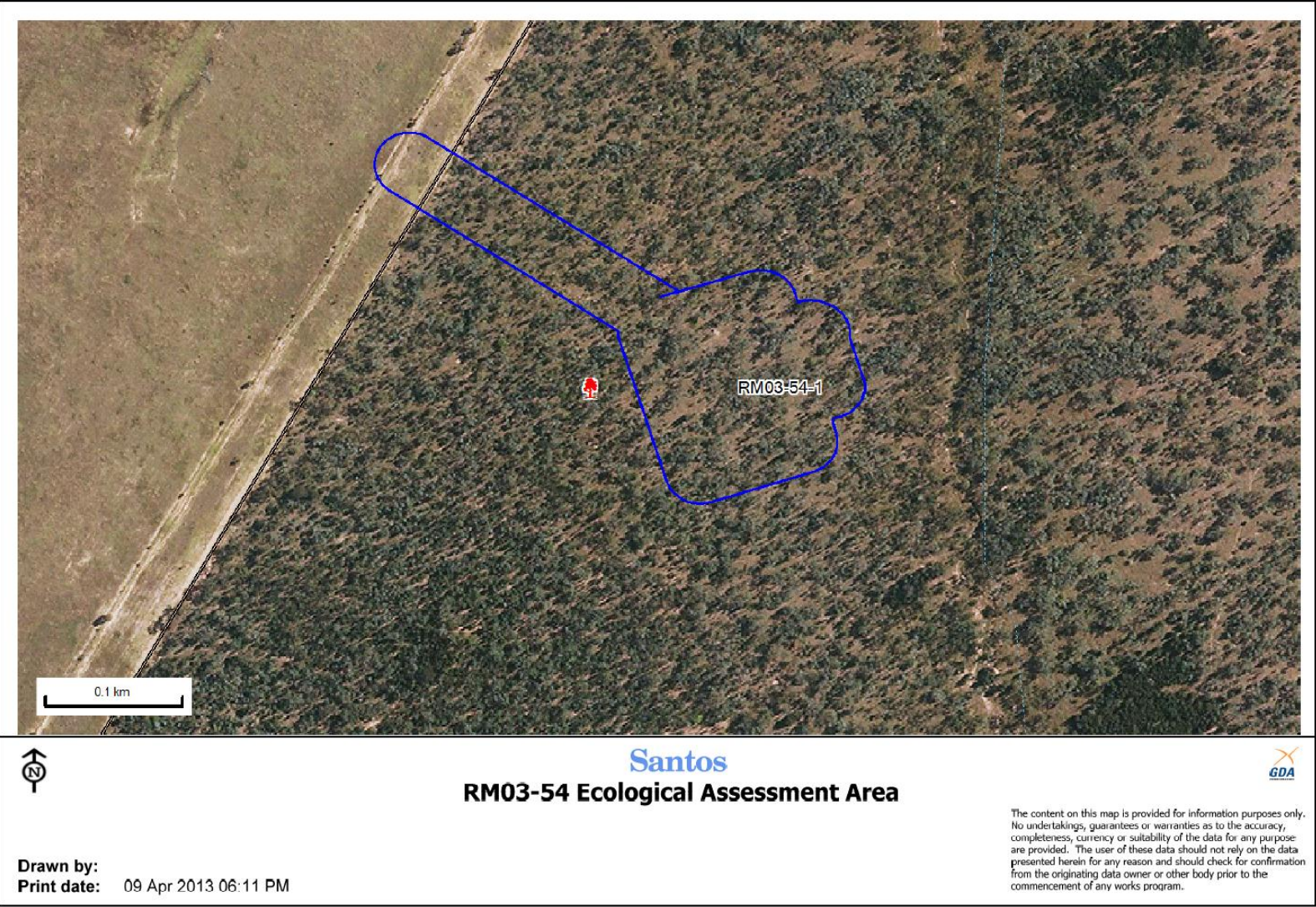
Schedule H - WASTE		
General		
Condition		Comment
H1	All general waste must only be removed from the site and sent to a recycling facility or a disposal facility licensed to accept the waste under the <i>Environmental Protection Act 1994</i> .	All general waste will be removed from the site and sent to a recycling facility or disposal facility licenced to accept the waste under the <i>Environmental Protection Act 1994</i> .
H2	All regulated waste removed only be removed from the site by a person who holds a current authority to transport such waste under the provisions of the <i>Environmental Protection Act 1994</i> and sent to a recycling facility or disposal facility licensed to accept the waste.	All regulated waste will be removed from the site by a person who holds a current authority to transport such waste under the provisions of the <i>Environmental Protection Act 1994</i> and sent to a recycling facility or disposal facility licenced to accept the waste.

UPSTREAM GLNG PROTOCOLS

Constraint Classes	The proposed activities are not within a Constraint Class and do not impact on any Matters of National Environmental Significance
EPBC Act Listed Communities	No species or communities of conservation significance (ie listed as Critically Endangered, Endangered or Vulnerable) under the provisions of the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) were detected within the proposed disturbance area.

GENERAL	
Water Bores	There were no water bores detected within 100m.
Environmental Approval	
Signed: Angela Sherwin	Date: 17/9/2013

Appendix 1. Map



Map 3. RM03-54 Ecological assessment area.

Appendix 2. Desktop assessment

CSG Drilling & Completions



EcoScout Report

Site Name	RM03-54			Landholder	"RAYMOUNT", RAYMOND K SMITH		
Coordinates	TBA	PL/ATP	PL309	Lot/Plan	Lot 76, WV759	Scouted site moved from desktop locn?	

Mapped Constraints		Desktop Assessment				Groundtruthing				
		Assessor: Vanessa Keogh				Date: 16/08/2012				
		Assessor:				Date:				
		Layer/Database	Mapped feature	Direct or PPZ?	Potential Issues?	Comments	Mapping Correct?	Direct or PPZ?	Potential Issues?	Comments
		Environmentally Sensitive Areas (ESAs)/Listed REs	Nil	N/A	No					
		Least Concern REs	Nil	N/A	No					
High Value Regrowth	Least Concern HVR in vicinity	Direct	No	Min disturbance						
Watercourses	Stream order 1: 150m EAST.	Vicinity	Maybe	Determine if constitutes a watercourse on site				No wetlands were observed within 200m of the area assessed, this was determined by an assessment of flora, fauna, soils and hydrology.		

	Wetlands, lakes, springs	Nil	N/A	No				
	EVNT Point	Nil	N/A	No				
	Ground Truthing ENV	Nil	N/A	No				
	EVNT Species	Nil	N/A	No				
	EBPC Fauna Habitat	Nil	N/A	No				
	Essential Habitat	Nil	N/A	No				
	Protected areas	Nil	N/A	No				
	GQAL	C1	N/A	Unknown				
	SCL	Western Cropping	Direct	No				
	Bores	Nil	N/A	No				
Databases	EBPC Protected Matters Search							
	Wildlife Online							
	WildNet							
	HERBRECS							

Appendix 3. Ecologist Reports

Santos

Quaternary Data Sheet

Site no: RM03-54	Date: 07/04/13	Recorder: Lincoln Smith
Locality/coordinates: 715695, 7080355		

Flora (representing species richness and diversity)

Tree layer 1 Percentage Foliage Cover : 10% Av Height: 23m Height range: 19 – 29m			
Species	Rel Dom	Species	Rel Dom
Eucalyptus melanophloia (Silver Leaved Ironbark)	CD	Eucalyptus populnea (Poplar Box)	CD
Tree layer 2 Cover: 25% Av Height: 16m Height range: 9-19m			
Species	Rel Dom	Species	Rel Dom
Eucalyptus melanophloia (Silver Leaved Ironbark)	CD	Callitris glaucophylla (White Cypress Pine)	
Eucalyptus populnea (Poplar Box)	CD	Casuarina cristata (Belah)	
Shrub layer 1 2-10m Cover: 15% Av Height: 6m Height range: 2-8m			
Species	Rel Dom	Species	Rel Dom
Eremophila mitchellii (False Sandalwood)	CD	Grevillea striata (Beefwood)	
Acacia aneura (Wilga)		Ventilago viminalis (Vine Tree)	
Eucalyptus melanophloia (Silver Leaved Ironbark)	CD	Acacia decora (Pretty Wattle)	
Eucalyptus populnea (Poplar Box)	CD	Geijera parviflora (Wilga)	
Callitris glaucophylla (White Cypress Pine)		Carissa ovata (Currant Bush)	
Casuarina cristata (Belah)		Owenia acidula (Emu Apple)	
Alstonia constricta (Bitter Bark)			
Ground layer. Cover: 80% Av Height: 0.2m			
Species	Rel Dom	Species	Rel Dom
Themeda triandra (Kangaroo Grass)		Enteropogon acicularis (Curly Windmill Grass)	
Dichanthium sericeum (Queensland Blue Grass)		Verbena tenuisecta (Mayne's Curse)	
Sporobolus creber (Western Rats Tail Grass)		Chrysocephalum apiculatum (Yellow Buttons)	
Cymbopogon refractus (Barbwire Grass)		Chloris divaricate (Windmill Chloris)	
Opuntia tomentosa (Velvety Tree Pear)		Cyperus sp. (Sedge)	
Bothriochloa bladhii (Forest Blue Grass)		Heteropogon contortus (Black Spear Grass)	
Aristida caput medusa (Curly Head Wire Grass)		Enneapogon avenaceus (Bottle Washer)	
Sida cordifolia (Flannel weed)		Glycine clandestine (Twining Glycine)	

Urochloa sp. (Liverseed)		Cenchrus ciliaris (Buffel Grass)	
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Geology, landform, soils	Woody Stem Counts 10m X 10m	
Geology code and rock types:	T1	1
Landform: Gentle sloping	T2	3
Soils: Light brown loam	S1	2

Regional Ecosystems (RE) / Threatened Ecological Community (TEC)

Mapped RE: Non remnant	Landzone
Corresponding TEC (mapped):	
Ground truthed RE: 11.10.11	Landzone: 10
Corresponding TEC (ground truthed):	

Vegetation Short Description

Sparsely scattered trees in upper tree layer; moderate lower tree layer and shrub layer; dense ground layer coverage primarily of native perennials with exotics.

Connectivity/Patch Characteristics

Woody regrowth immediately surrounds the site separating the site from open paddocks (Refer to aerial imagery)

Weeds

Weeds Present. R=rare (<10 plants observed); U = uncommon (11-50 plants observed); C = common (>50 plants observed)
Sida cordifolia = U, Verbena tenuisecta = C, Cenchrus ciliaris = C
Classed weeds present R=rare (<10 plants observed); U = uncommon (11-50 plants observed); C = common (>50 plants observed)
Opuntia tomentosa (Class 2) = U
Total % Weed cover : 15%

EVR/Type A Flora Present

EVR/Type A Flora Likely

Nil	
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Fauna Habitat Features

Density scores: **0** = 0%; **1** = <25%; **2** = 26-50%; **3** = 51-75%; **4** = 75-99%; **5** = 100% abundance.

Rocks - embedded	1	Boulders	0	Shrub layer	2	Ground cover	4
Rocks - loose	1	Fallen Bark	1	Leaf litter	3	Bare ground	1

Abundance Scores: **0** = absent; **1** = 1-5; **2** = 6-20; **3** = 21-50; **4** = 51-75; **5** = 76-100; **6** = >100. In a 1 ha area.

Crevice/ledges	0	Large logs (>30cm diameter)	3	Trees/logs bearing loose bark	2
Underhangs/overhangs/caves	0	Logs with hollows	2	Termite mounds	0
Small logs (<30cm diameter)	3			Mistletoe	1
Trees with hollows ≥ 10cm diameter number	2	Fallen woody material ≥ 10cm diameter			4

EVR Fauna Present

EVR Fauna Likely

Nil	
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Disturbances (e.g. grazed, ploughed, flooded)

Grazed, Historical clearing, Weeds

Incidental Fauna Observations

Macropod scats, Crows, Mickey Birds	

Notes on watercourses, wetlands, lakes or springs

Stream order 1 mapped to the east was observed a drainage line. Rapid wetland assessment did not identify any wetlands within the 200m buffer zone of the non-linear infrastructure disturbance area and within the linear infrastructure disturbance area.

Additional Notes

A fauna spotter is required due to trees with hollows, hollow logs and trees with loose bark.

Site Photos



7/04/2013 11:09 AM E. Australia Standard Time

Photo description

From well centre looking north



7/04/2013 11:09 AM E. Australia Standard Time

Photo description

From well centre looking south



Photo description

From well centre looking east



Photo description

From well centre looking west

Well Lease Scouting – Environmental Adviser Assessment

Well name: RM03-30 Rev 1		PL: 314	EA: PEN101578910
Assessor: Angela Sherwin, Civil Works Ecologist Drafted by: Angela Sherwin, Civil Works Ecologist Checked by: Angela Sherwin, Civil Works Ecologist		Assessment date: 3.2.2013 Check Date: 3.2.2013	
Zone: 55	Easting: 713543	Northing: 7082967	
Versioning: This assessment supersedes any assessments undertaken under the pre December 2012 Environmental Authority.			
Assessment Summary: - The proposed activity assessed in this report includes the well pad and access track indicated in Map 1. Although low impact drilling leases are the proposed activity, this assessment was conducted taking into consideration significant disturbance against the EA No: PEN101578910 and therefore is approved for low impact drilling leases and conventional pad construction. - The proposed activity is not situated in a category A or B Environmentally Sensitive Area (ESA) or the associated primary or secondary protection zones. The lease is in the Secondary Protection Zone of an area which should be categorised as a Category C ESA due to its classification meeting Of Concern status. - The proposed activity is not situated in, or within 200m, of a wetland, lake or spring - The proposed activity is not located within 100m of the high bank of a watercourse. - There is no mapping disputes regarding wetlands identified during the ecological inspection. - There is a dispute regarding the Regional Ecosystem mapping within the ecological assessment area which is required in Condition E2. The area mapped as Least Concern RE 11.10.11 surrounding Coxon Creek was verified during inspections to be a heterogeneous polygon of RE 11.3.2/11.3.25, of which both have a classification of Of Concern (biodiversity status). Therefore this area is a Category C ESA as mentioned above. - No species of conservation significance (ie listed as Near Threatened, Vulnerable, Endangered) under the provisions of the <i>Nature Conservation Act 1992</i> (NC Act) were detected.			

- No Type A restricted species under the provisions of the NC Act were observed in the development area.
- No species or communities of conservation significance (ie listed as Critically Endangered, Endangered or Vulnerable) under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were detected within the proposed lease construction area.

Well-Specific comments and final constrains (eg. European heritage, cultural heritage ect):

- Nil.

Proposed Mitigation:

The following mitigation measures will be taken:

- **A soil sample must be taken prior to any significant disturbance or activities taking place. Liaise with the Civil Works Ecologist (0408 290 919).**
- **Erosion and sediment control measures must be put in place to prevent sediment leaving the lease area.**
- **Compaction testing must be undertaken pre and post the conduct of the activities.**
- For the area of significant disturbance associated with cellar installation, ensure the top soil layer is removed, stockpiled to a maximum height of 1.5m and used in the rehabilitation process. In the event that the activity changes scope from a low impact lease to a standard lease layout, ensure the top layer of the soil profile is to be removed from the area of disturbance, stockpiled to a maximum height of 1.5m and used in the rehabilitation process.
- Landholder consent is in place prior to clearing activities including DERM for works within the State Forest area.
- Well Lease installation is done in accordance with Santos Standards.
- Vehicle/machinery hygiene procedures to be adhered to at all times.
- Use existing infrastructure where practical.
- All clearing will be minimised to the area necessary for safe operations.
- Where required timber that is cleared is to be pushed aside and used for habitat and the excess timber is not to be burned.
- Erosion control and silt fences will be implemented as per the individual lease layout requirements.
- Bunding is to be built around sump to prevent overland flow entering.
- Any vegetation cleared will be stockpiled in a manner that facilitates respreading or salvaging and will not impede vehicle, stock or wildlife

movements. • Prior to carrying out field based petroleum activities, all relevant staff, contractors or agents carrying out those activities, are to be made aware of the location of the category C Environmentally Sensitive Area and the requirements of the environmental authority. • Any access tracks will not exceed 10 meters in width. • Fauna spotter is not required on site for clearing activities Note: Santos currently holds an exemption under the NC Act for clearing species listed under the NC Act as 'Least Concern'. No other NC Act listed species are to be removed without a permit.		
Maps	Appendix 1. Maps	
EPBC Act Listed Communities	No species or communities of conservation significance (ie listed as Near Threatened, Vulnerable or Endangered) under the provisions of the Environment Protection and Biodiversity Conservation Act (EPBC Act) were detected within the proposed lease construction area.	

Well names: RM03-30 Rev 1	PL: 314	EA: PEN101578910
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Schedule B – WATER

REF	Condition	Santos Assessment
Water courses, wetlands and springs		
C7	Unless otherwise authorised under this environmental authority, petroleum activity(ies) that require earthworks, vegetation clearing, placing fill and/or that will result in significant disturbance other than that associated with the construction and/or maintenance of linear infrastructure, is not permitted in or within : a) 200 meters from any wetland, lake or spring: or b) 100 meters of the high bank of any other water course	The proposed activities are within the condition C7 for water courses, wetlands and springs; a) More than 200m from a wetland, spring or lake b) More than 100m of the high bank of any other water course.
C8	All reasonable alternative locations must be considered prior to the construction of any linear infrastructure that will result in significant disturbance in or on the bed and banks of a watercourse or within the areas specified in (C7)(b).	N/A
C9	The construction and/or maintenance of linear infrastructure that will result in significant disturbance in or on the bed or banks of a watercourse or within the areas specified in (C7)(a) and (b) must be conducted in accordance with the following order of preference: (a) Conducting works in times when there is no water present (b) conducting work in times of no flow (c) conducting works in times of flow but in a way that does not impede low flow.	N/A
C10	The construction and/or maintenance of linear infrastructure that will result in significant disturbance in or on the bed and banks of a	N/A

REF	Condition	Santos Assessment
	watercourse or within the areas specified in (C7)(b) must not release from the site any contaminants to any waters that exceed the water quality limits specified in <i>Schedule B, Table 1 – Release Limits to Waters</i>	

Schedule B, Table 1 – Release Limits to Waters

Water Quality Parameters	Units	Water Quality Limits
Turbidity	NTU	10% above background water turbidity measured within 20 meters downstream of the construction and/or maintenance activity.
Hydrocarbons	-	No visible sheen

C11	Background water turbidity must be measured within 20 metres upstream of the construction and/or maintenance activities.	N/A
C12	Monitoring is undertaken at a reasonable frequency to ensure compliance with condition (C3).	N/A
C13	Written notification detailing the location (GPS coordinates) of any significant disturbance to be undertaken in or on the bed and banks of a watercourse, or within the areas specified in condition (C7)(b) must be provided to the administering authority at least 10 business days prior to the commencement of the significant	N/A

REF	Condition	Santos Assessment
	disturbance.	
Floodplains		
C14	Where the petroleum activity(ies) is carried out on floodplains, the holder of this environmental authority must ensure that the petroleum activity(ies) does not: (a) concentrate flood flows in a way that will or may cause or threaten an adverse environmental impact; or (b) divert flood flows from natural drainage paths and alter flow distribution; or (c) increase the local duration of floods; or (d) increase the risk of detaining flood flows; or (e) pose an unacceptable risk to the safety of persons from flooding; or (f) pose an unacceptable risk of damage to property from flooding.	N/A – the activity is not located on a floodplain due to the following: The proposed construction site is on a higher area which would not be subject to inundation from time to time by floodwater overflowing from a watercourse. Does not confine floodwater to generally follow the path of a watercourse.

Schedule D - LAND

Disturbance to Land – General		
E2	Prior to conducting petroleum activities that involve significant disturbance to land, an assessment must be undertaken of the condition and type and type of vegetation and soils in such areas where the activity is proposed to take place.	This assessment, including Appendix 1. Maps, Appendix 2. Desktop assessment and Error! Not a valid result for table. constitutes the assessment required for condition E2.

E3	The assessment required by condition (E2) must be undertaken by a suitably qualified person and include the carrying out of field validation surveys, observations and mapping of any Category A, B or C Environmentally Sensitive Areas, wetlands and the presence of species classed as endangered, vulnerable, rare or near threatened under the <i>Nature Conservation Act 1992</i>.	Assessments of the area were carried by a suitably qualified person in line with condition (E2): • RM03-30 Rev 1 The assessments revealed that the site is within 400 m of an area which is incorrectly mapped by state mapping. There is an area adjacent to the lease site (>400m) which is mapped as Not Of Concern, however is actually Of Concern. Activities will be conducted in accordance with Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas. There were no wetlands observed at the site, or within 200m of the site – see comments in C7. No species of conservation significance (ie listed as Near Threatened, Vulnerable or Endangered) under the provisions of the NC Act were detected.
E4	The assessment required by condition (D2) must include, but not necessarily be limited to: (a) Baseline soils quality data and maps for the soil units to be disturbed as provided for in the Soils Management Plan; (b) Identification of the vegetation communities present (including species composition and regional ecosystem type 2 for native vegetation communities) within each area(s) to be disturbed; (c) data representing each vegetation community present within each area(s) to be rehabilitated including: (i) flora species richness and diversity; (ii) Structural data including woody stem count densities for dominant species within each stratum' and (iii) percent foliage cover (accounting for seasonal variation and	The assessment includes: (a) Baseline soils quality data and maps for the soil units to be disturbed as provided for in the Soils Management Plan - a soil sample will be taken from the well lease area prior to disturbance. This sample will be analysed by a NATA accredited laboratory and the results of the analysis will direct soil management in accordance with the Santos Soil Management Plan; (b) Identification of the vegetation communities present (including species composition and regional ecosystem type 2 for native vegetation communities) within each area(s) to be disturbed; (c) data representing each vegetation community present within each area(s) to be rehabilitated including: (i) flora species richness and diversity; (ii) Structural data including woody stem count densities for

	excluding pests)	dominant species within each stratum' and (iii) percent foliage cover (accounting for seasonal variation and excluding pests)
E5	If the assessment required by conditions (E2) to (E4) indicates that an Environmentally Sensitive Area or wetland is incorrectly identified through state mapping, or is present and not identified by State mapping, the holder of this environmental authority must advise the administering authority in writing before any significant disturbance to land takes place.	There are no disputes regarding the mapping categorisations for ESAs or wetlands within the area assessed.
E6	Following the lodgement of the notification under condition (D5), significant disturbance to land within the relevant area is prohibited until the administering authority provides written advice that significant disturbance to land may proceed.	N/A
E7	If petroleum activities are authorised according to Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas in both the proposed ESA classification (as per condition (D5)) and the current ESA type/classification (as per State mapping), then those activities may proceed in accordance with Schedule D, Table 1 despite condition (D6)	N/A
E8	The holder of this environmental authority, when carrying out the petroleum activity(ies) must: (a) In order of preference, avoid, minimise or mitigate any impacts on areas of vegetation or other areas of ecological value; (b) minimise disturbance to land that may otherwise result in land degradation; (c) ensure that for land that is to be significantly disturbed by the petroleum activity(ies): i. the top layer of the soil profile is removed; ii. stockpiled in a manner that will preserve its biological and chemical properties; and	When carrying out the limited petroleum activity: a) Selection of the location of the proposed site aimed at avoiding and minimising impacts. The proposed site occurs in an area of existing disturbance with no remnant vegetation present. The proposed activity (low impact lease) has been specifically designed to minimise any impacts on vegetation and other areas of ecological value (including the ecological value of soil). The lease design has significantly reduced the area of disturbance required for undertaking the drilling activities. The design has also removed the need to disturb the soil profiles thereby minimising the impacts on the

	iii. soils are for rehabilitation purposes; (d) avoid clearing mature trees; and (e) prior to carrying out field based petroleum activities, make all relevant staff, contractors or agents carrying out those activities, aware of the location of any category A, B or C Environmentally Sensitive Areas, wetlands and presence of species classes as endangered, vulnerable, rare or near threatened under the <i>Nature Conservation Act 1992</i> and the requirements of this environmental authority. <i>Note: This environmental authority does not authorise the taking of protected plants, protected animals or the tampering with animal breeding place as defined under the Nature Conservation Act 1992 and Regulations and relevant approvals will need to be obtained.</i>	ecological value of the soil and enabling faster and more successful rehabilitation. b) The design of the proposed disturbance has minimised the risk of land degradation. The soil profiles will not be disturbed and as such the risk of soil erosion and degradation of soil quality is low. c) It is not expected that the activities will cause significant disturbance. Rehabilitation should not require human intervention as the soil will not be excavated and re-vegetation is expected to occur through natural regeneration. Various mitigation measures will be put in place to avoid soil compaction. Additionally, compaction testing will be undertaken pre and post the conduct of the activities to confirm there has been no significant disturbance through soil compaction that requires human intervention to remediate. d) clearing of mature trees has been avoided where practicable (see (a)); One mature habitat tree which is located near the lease will not be cleared. e) prior to carrying out field based petroleum activities, all relevant staff, contractors or agents carrying out those activities, will be made aware of the location of any category A, B or C Environmentally Sensitive Areas, wetlands and presence of species classes as endangered, vulnerable, rare or near threatened under the <i>Nature Conservation Act 1992</i> and the requirements of this environmental authority. Santos currently holds an exemption under the NC Act for clearing species listed under the NC Act as 'Not of Concern'. No other NC Act listed species will be removed without a permit.
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E9	Despite condition (D8), significant disturbance to land caused by the carrying out of the petroleum activity(ies) must not involve clearing vegetation or placing fill: a) in a way which significantly isolates, fragments or dissects tracts of vegetation resulting in a reduction in the current level of ecosystem functioning, ecological connectivity (i.e. stepping stone or contiguous bioregional/local corridor networks) and/or results in an increase in threatening processes; b) on slopes greater than 10% for the petroleum activity(ies) other than pipelines and wells; or c) in discharge areas.	Clearing vegetation or placing fill will not be carried out in such way that is communicated in E7.
E10	Clearing of vegetation shall not exceed 10 metres in width for the purpose of establishing tracks or 20 metres in width for dual carriageway roads.	Clearing of vegetation for the purpose of establishing access tracks will not exceed 10 meters.
E11	Cleared vegetation must be stockpiled in a manner that facilitates respreading or salvaging and does not impede vehicle, stock or wildlife movements.	There will be minimal vegetation cleared. Vegetation cleared will be stockpiled in a manner that facilitates respreading or salvaging and will not impede vehicle, stock or wildlife movements.
Disturbance to Land – Environmentally Sensitive Areas		
E12	Petroleum activities must not be carried out in accordance with Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas Petroleum activities in Environmentally Sensitive Areas.	See Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas

Schedule E, Table 1 – Petroleum Activities in Environmentally Sensitive Areas

ESA Category	Within the ESA	Primary Protection Zone of the ESA	Secondary protection zone of the ESA	Santos assessment
Category A ESAs	No petroleum activities permitted.	Only low impact petroleum activities permitted.	Only limited petroleum activities permitted. Subject to conditions (E14) and (E16).	
Category B ESAs excluding 'Endangered' Regional Ecosystems.	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	Only limited petroleum activities permitted Subject to conditions (E14) and (E16).	
Category B ESAs that are 'Endangered' Regional Ecosystems.	Only limited petroleum activities permitted Subject to conditions (E13) to (E17) inclusive.	Only limited petroleum activities permitted. Subject to conditions (E13) to (E17) inclusive.	Petroleum activities permitted Subject to conditions (E14) and (E18)	
Category C ESAs excluding 'Of Concern' Regional Ecosystems, State Forests and Timber Reserves.	Only low impact petroleum activities permitted.	Only low impact petroleum activities permitted.	Only Limited petroleum activities permitted. Subject to conditions (E14) and (E18).	
Category C ESAs that are State Forests, Timber Reserves and 'Of Concern' Regional Ecosystems.	Only limited petroleum activities permitted Subject to conditions (E13) to (E17) inclusive.	Only limited petroleum activities permitted Subject to conditions (E13) to (E17) inclusive.	Petroleum activities permitted.	The ecological assessment of the area revealed an Of Concern Regional Ecosystem >400m south of the lease site. There are no implications.

E13	Limited petroleum activities carried out within the secondary protection zone must be preferentially located in pre-existing areas of clearing or significant disturbance to the greatest practicable extent and must avoid the clearing of mature trees. .	N/A
E14	Low impact or Limited petroleum activities carried out within an ESA, primary protection zone or secondary protection zone must not be conducted in those areas where there is overlap with another ESA or primary protection zone where low impact or limited petroleum activities are not authorised.	N/A
E15	Where limited petroleum activities are undertaken within the primary protection zone of, or within 'Endangered' or 'Of Concern' Regional Ecosystems, State Forests or Timber Reserves, the holder of this environmental authority must be able to demonstrate that no reasonable or practicable alternative exists and that disturbance to land only be located, and carried out in areas according to the following order of preference: (a) pre-existing cleared areas or significantly disturbed land within the primary protection zone of an 'Of Concern' Regional Ecosystem, State Forest or Timber Reserve'; (b) pre-existing cleared areas or significantly disturbed land within the primary protection zone of an 'Endangered' Regional Ecosystem; (c) undisturbed areas within the primary protection zone an 'Of Concern' Regional Ecosystem, State Forest or Timber Reserve; (d) undisturbed areas within the primary protection zone an 'Endangered' Regional Ecosystem; (e) pre-existing areas of significant disturbance within an 'Of Concern' Regional Ecosystem, State Forest or Timber Reserve' (e.g. areas where significant clearing or thinning has been	a) N/A b) N/A c) N/A d) N/A e) N/A f) N/A g) N/A h) N/A

	undertaken within a Regional Ecosystem, and/or areas containing high densities of weed or pest species which has inhibited re-colonisation of native regrowth); (f) pre-existing areas of significant disturbance within an 'Endangered' Regional Ecosystem (e.g. areas where significant clearing or thinning has been undertaken within a Regional Ecosystem, and / or areas containing high densities of weed or pest species which has inhibited re-colonisation of native regrowth); (g) areas where clearing of an 'Of Concern' Regional Ecosystem, State Forest or Timber Reserve is unavoidable; and (h) areas where clearing of an Endangered Regional Ecosystem is unavoidable.	
E16	Documentation demonstrating compliance with the requirements of the condition (E15) must be prepared by the holder of this environmental authority before any disturbance to land takes place.	This assessment, including Appendices constitutes the documentation.
E17	For limited petroleum activities undertaken within the primary protection zone of, or within 'Endangered' or 'Of Concern' Regional Ecosystems, State Forests or Timber Reserves, vegetation clearing must not exceed any of the following areas: (a) for the life of the project and before any activity commences, if the disturbance relates to an 'Endangered' or 'Of Concern' Regional Ecosystem, 10% of the remnant unit of 'Endangered' or 'Of Concern' Regional Ecosystem as ground truthed and mapped as per conditions (E2) to (E4) of this environmental authority; and (b) 6 metres in width for access tracks not associated with water or gas line; or (c) For linear infrastructure, including provision for a	N/A

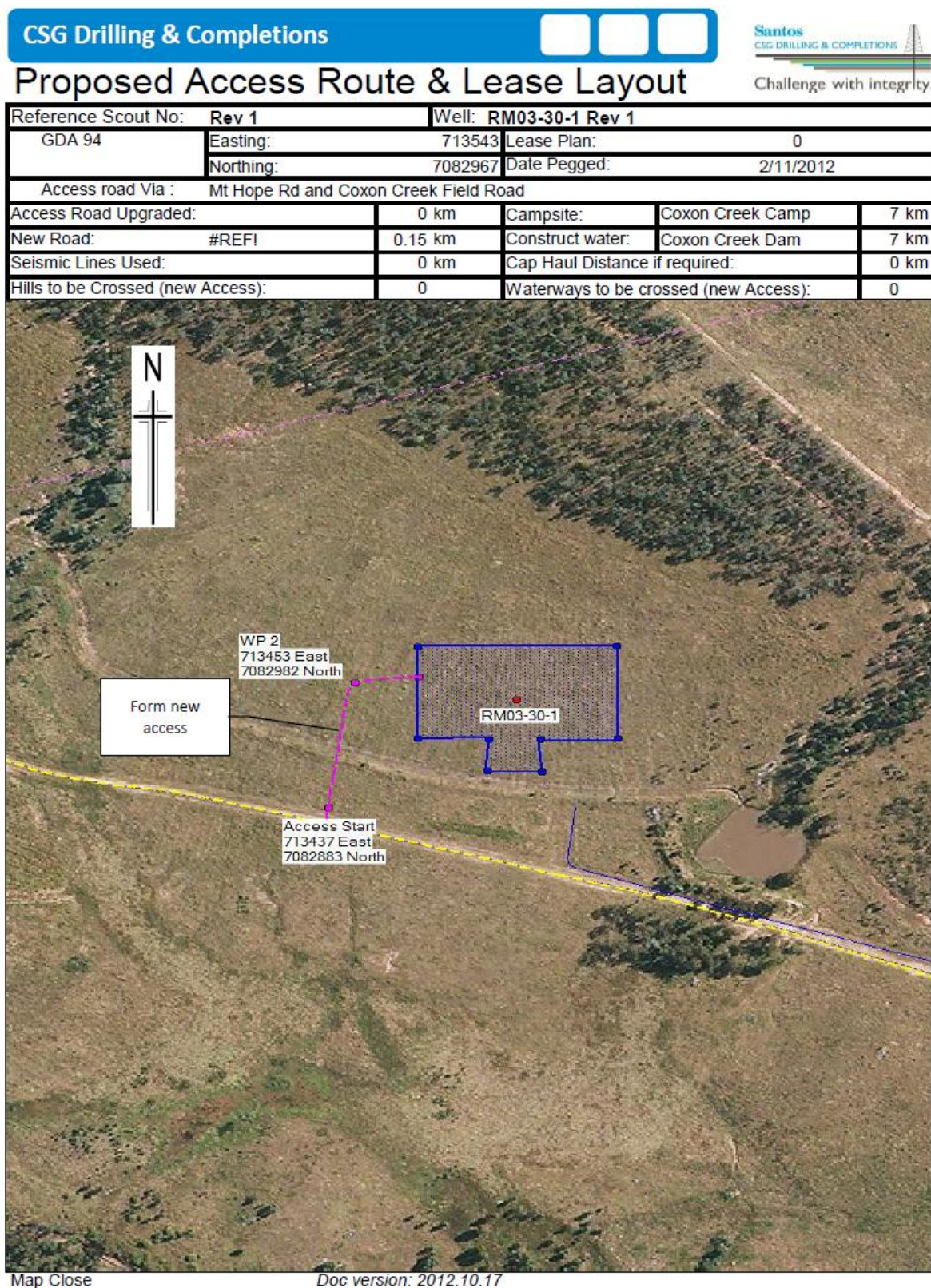
	utility corridor and access track; (i) 12 metres in width for flow pipeline construction purposes. (ii) 18 Metres width for a trench with one water gathering line and one parallel gas gathering pipeline; or (iii) 25 Metres width for multiple trenches where there are three parallel gas or water gathering lines; and (iv) Seven metres width for any additional trench for a water or gas line.	
E18	The record of the assessment required by conditions (E2) to (E4) and the extent of the significant disturbance to land in the following areas must be kept and submitted to the administering authority with each annual return: a) the primary protection zone of, or within an 'Endangered' or 'Of Concern' Regional Ecosystem, State Forest or Timber Reserve; and b) in the secondary protection zone of ESAs; and c) other remnant vegetation areas; and d) wetlands	Santos will keep and submit to the administering authority assessments required by conditions E2 – E4 for the following areas : a) the primary protection zone of, or within an 'Endangered' or 'Of Concern' Regional Ecosystem, State Forest or Timber Reserve; and b) in the secondary protection zone of ESAs; and c) other remnant vegetation areas; and d) wetlands

Environmental Approval

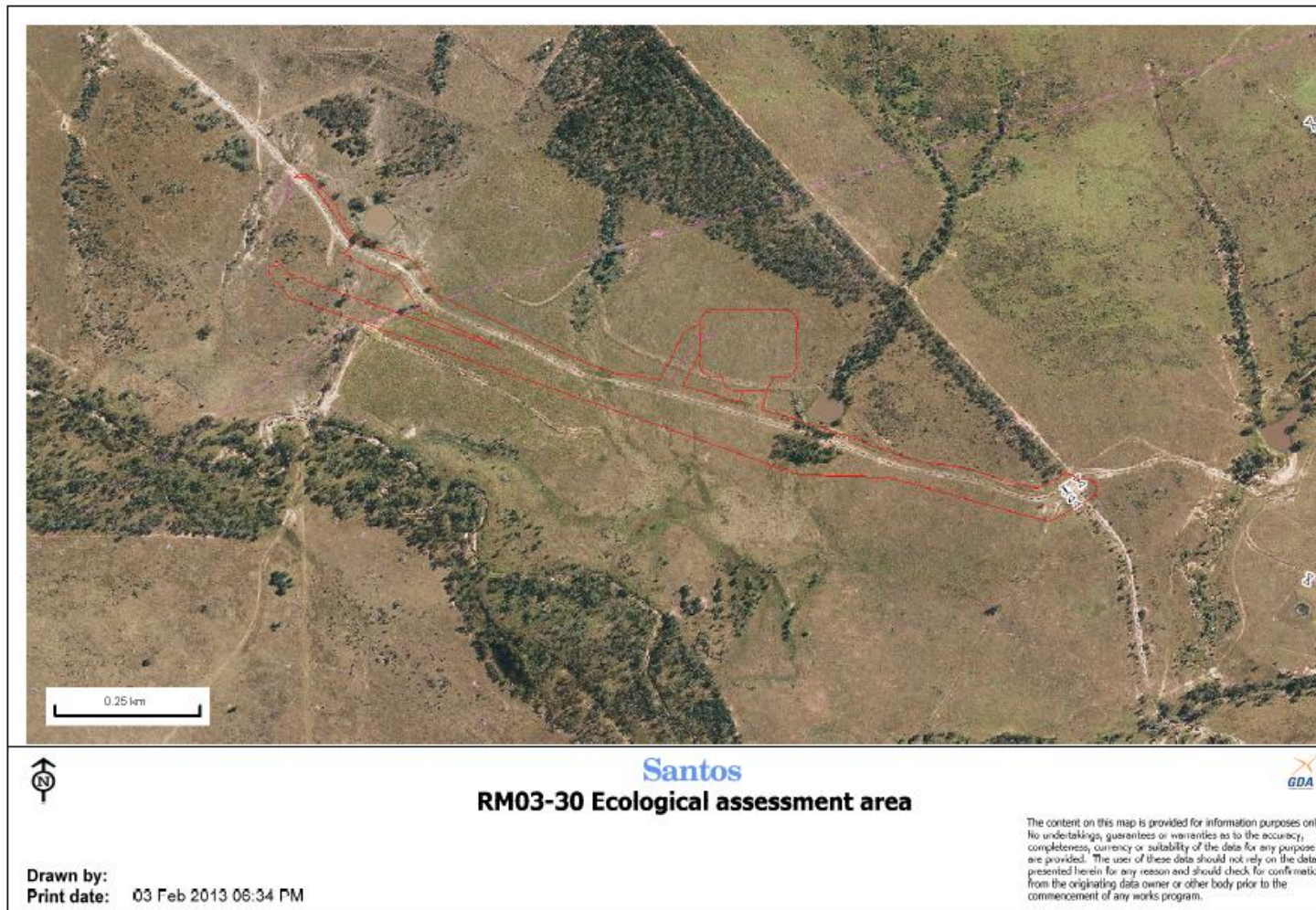
Signed: Angela Sherwin, Civil Works Ecologist

Date: 3.2.2012

Appendix 1. Maps



Lease and access track location.



Ecological assessment area.

Appendix 2. Desktop assessment

CSG Drilling & Completions



EcoScout Report

Site Name	RM03-30			Landholder	TREVOR LEIGH KEHL, Armidale		
Coordinates	712840E, 7083315N	PL/ATP	PL309	Lot/Plan	Lot 79, WV759		

Mapped Constraints	Desktop Assessment					Groundtruthing			
	Assessor: Vanessa Keogh		Date: 13/08/2012			Assessor: VK		Date: 23/08/2012	
	Layer/Database	Mapped feature	Direct or PPZ?	Potential Issues?	Comments	Mapping Correct?	Direct or PPZ?	Potential Issues?	Comments
	Environmentally Sensitive Areas (ESAs)/Listed REs	Nil	N/A	No				No	
	Least Concern REs	RE11.10.11 (120m north)	Vicinity	No				No	
	High Value Regrowth	Nil	N/A	No				No	
	Watercourses	SO1 140m east. Coxon Ck (SO4): 520m south.	Vicinity	Maybe	Need to assess SO1 on site			No	SO1 = Drainage line. >100m from Coxon Ck.
	Wetlands, lakes, springs	Nil	N/A	No				No	

	EVNT Point	Nil	N/A	No	
	Ground Truthing ENV	Nil	N/A	No	
	EVNT Species	Nil	N/A	No	
	EBPC Fauna Habitat	Nil	N/A	No	
	Essential Habitat	Nil	N/A	No	
	Protected areas	Nil	N/A	No	
	GQAL	C1	N/A	No	
	SCL	Western Cropping	N/A	No	
	Bores	Nil	N/A	No	

		No	
		No	
		No	
		No	
		No	
		No	
		No	
		No	
		No	

Appendix 3. Ecologist Reports

Santos

Quaternary Data Sheet

Site no: RM03-30 Rev 1	Date: 2-11-12 / 0725 hrs	Recorder: VJB
Locality/coordinates: 713543; 7082967		

Flora

Tree layer 1			
Cover:	Av Height:	Height Range:	
Species	Rel Dom	Species	Rel Dom
Absent in assessment area			
Tree layer 2			
Cover:	Av Height:	Height Range:	
Species	Rel Dom	Species	Rel Dom
Absent in assessment area			
Shrub layer 1			
Cover:	~10%	Av Height:1m	Height Range: 1-3m
Species	Rel Dom	Species	Rel Dom
<i>Acacia decora</i> (Pretty Wattle)	D	<i>Eucalyptus populnea</i> (Poplar box)	A
<i>Acacia farnesiana</i> (Mimosa Bush)	A	<i>Maireana microphylla</i> (Small Leaved Bluebush)	
<i>Callitris glaucophylla</i> (White Cypress Pine)		<i>Tagetes minuta</i> (Stinking Rodger)	
<i>Eucalyptus melanophloia</i> (Silver Leaved Ironbark)			
Ground layer.			
Cover:	95%	Av Height: 0.7m	Height Range: 0-1m
Species	Rel Dom	Species	Rel Dom
<i>Anagallis arvensis</i> (Blue Pimpernel)		<i>Schenkia australis</i> (Spike Centaury)	
<i>Aristida</i> sp. (A Wiregrass – no fertile material)	C	<i>Sclerolaena muricata</i> (Roly Poly)	
<i>Bothriochloa bladhii</i> (Forest Bluegrass)		<i>Senecio lautus</i> (Fireweed)	
<i>Centaurea melitensis</i> (Maltese Cockspur)		<i>Sporobolus creber</i> (Western Rats Tail Grass)	
<i>Chamaesyce drummondii</i> (Caustic Weed)		<i>Themeda triandra</i> (Kangaroo Grass)	
<i>Cirsium vulgare</i> (Spear Thistle)		<i>Verbena officinalis</i> (Common Verbena)	
<i>Cyclospermum leptophyllum</i> (Slender Celery)		<i>Verbena tenuisecta</i> (Mayne's Curse)	
<i>Daucus glochidiatus</i> (Native Carrot)		<i>Wahlenbergia gracilis</i> (Bluebell)	
<i>Dichanthium sericeum</i> (Queensland Bluegrass)	C		
<i>Evolvulus alsinoides</i> (Tropical Speedwell)			
<i>Heteropogon contortus</i> (Black Speargrass)			
<i>Neptunia gracilis</i> (Native Sensitive Plant)			
<i>Panicum effusum</i> (Hairy Panic)			
<i>Plantago debilis</i> (Plantain)			
<i>Pycnosorus globosus</i> (Billy Buttons)			
<i>Rhynchosia minima</i> (Rhynchosia)			

Geology, landform, soils

Woody Stem counts (20x20m plot)

Geology code and rock types: sedimentary	T1	0
Landform: Undulating - gently sloping here ~4%	T2	0
Soils: brown loamy clay	S1	14

Regional Ecosystems (RE) / Endangered Ecological Community (EEC)

Mapped RE: Non remnant	Landzone:
Corresponding EEC (mapped):	
Ground truthed RE: Non remnant	Landzone:
Corresponding EEC (ground truthed):	

Vegetation Short Description

Non remnant with very scattered eucalypt and acacia regrowth. Dominated by native grasses

Connectivity/Patch Characteristics

Low value

Weeds

Weeds Present. R=rare (<10 plants observed); U = uncommon (11-50 plants observed); C = common (>50 plants observed)
Maynes Pest = C, Spear Thistle = U,
Total % Weed cover : <20%

EVNT/Type A Flora Present

EVNT/Type A Flora Likely

Nil	Nil
-----	-----

Fauna Habitat Features

Density scores: **0** = 0%; **1** = <25%; **2** = 26-50%; **3** = 51-75%; **4** = 75-99%; **5** = 100% abundance.

Rocks - embedded	0	Boulders	0	Shrub layer	1	Ground cover	4
Rocks - loose	1	Fallen Bark	0	Leaf litter	1	Bare ground	1

Abundance Scores: **0** = absent; **1** = 1-5; **2** = 6-20; **3** = 21-50; **4** = 51-75; **5** = 76-100; **6** = >100.

Crevices/ledges	0	Large logs (>30cm diameter)	0	Trees/logs bearing loose bark	0
Underhangs/overhangs/caves	0	Logs with hollows	0	Termite mounds	0
Small logs (<30cm diameter)	1	Hollow bearing /mature trees	0	Mistletoe	0

Disturbances (e.g. grazed, ploughed, flooded)

Grazed

Incidental Fauna Observations

Crow (<i>Corvus orru</i>) – heard	
Australian Pipit (<i>Anthus novaeseelandiae</i>)	

Notes on watercourses, wetlands, lakes or springs

Nil within 100m

Additional Notes

Patch of remnant Least Concern 11.10.11 to the north of the well is correctly mapped.

Site Photos

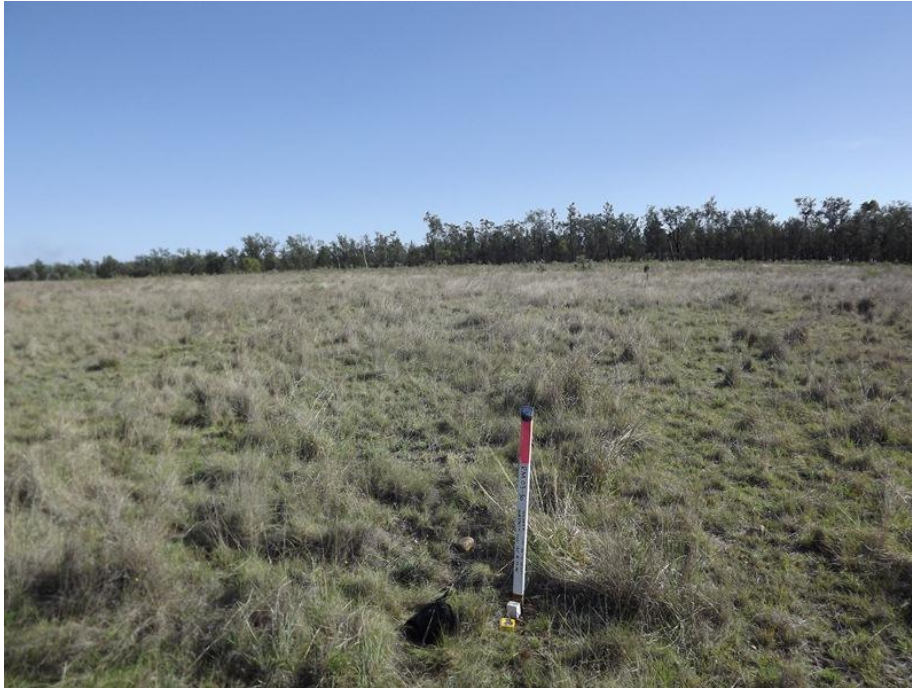


Photo description

From well centre facing north



Photo description

From well centre facing south

Well Lease Area/ Infrastructure Zone Assessment Report: Mt Hope Zone RM03-09

Compiled by Boobook for Santos

Boobook
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

Revision	Date	Description	Author	Verifier	Approved
A	27/2/2013	Draft issued to client for review	RA	CE	CE
B	13/6/2013	Draft incorporating amended zone	RA, RJ	CE	CE
0	3/7/2013	Final version	RJ		RJ

1. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DSEWPac	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
HVR	High Value Regrowth
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
TAR plant	Type A Restricted Plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

2. Introduction

2.1 Purpose & Scope

Boobook was commissioned by Santos to undertake ecological assessments on a number of well leases and infrastructure zones (hereafter individually referred to as the Zone) located on the property 'Mt Hope', located about 40km north-east of Roma, south central Queensland. Boobook was requested to undertake the following:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation present within the Zone;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the assessment site;
- Comment on the nature and location of wetlands and watercourses within 100m of the Zone;
- Provide location and description of any plants of conservation concern listed in the NC Act or EPBC Act;
- Location and characteristics of any type A restricted (TAR) plants (NC Act) in the Zone; and
- Location and characteristics of habitat trees in the Zone, with reference to trees previously mapped by Santos.

An individual report was to be prepared for each Zone. This report refers to Zone RM03-09 located on Lot 83 on Plan WV763.

Changes to the boundaries of this Zone were made by Santos following completion of the ecological assessment described in this report for the Zone (Figure 1). Modifications of this infrastructure Zone were considered to involve areas where the ecological values were not previously assessed on-site or nearby and required an additional field inspection. The results of this inspection have been included with the original findings of this report.

2.2 Survey Team

The project supervisor (Craig Eddie) was approved by 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.

The field survey described by this report was undertaken by Boobook on 17th January 2013 and was conducted by Richard Johnson (Senior Ecologist) and Rosamund Aisthorpe (Botanist). The additional field survey was conducted on the 30th April 2013 by Rosamund Aisthorpe, Angela Bendall (Field Assistant) and David Chemello (Fauna Spotter/ Field Assistant). The following report was compiled by Rosamund Aisthorpe and Richard Johnson. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie (Principal Ecologist and Project Supervisor). Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A comprehensive desktop search was not required by the client for the purposes of this report. However, a desktop search was undertaken for REs at the property scale using mapping version 6.1 (DEHP 2013). This dataset provides a baseline for subsequent field assessment.

The search was conducted using a 5km buffer around the coordinate -26.3558°S, 149.0847°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative site was selected for each RE present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Figure 1. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all GPS co-ordinates quoted within this report is GDA94. When referred to within this report the sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2012: Table 29);
4. RE type mapped;
5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;
9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;

11. presence of EVNT flora;
12. a list of all other flora encountered at the Site; and
13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2012) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

A search was made within the Zone for TAR plants: If found, the location was established with a hand-held GPS unit and the species, height, DBH and possible management options were recorded.

Where mapping supplied by Santos indicated the presence of habitat trees, a search was made for these. If found the location was established with a hand-held GPS unit and the species, height, DBH and habitat value(s) were recorded. In some instances unmapped habitat trees were located during the site survey and data was collected for these trees also.

The presence of any wetlands or watercourses within 100m of the Zone was recorded.

Representative photographs were taken at each quaternary survey site in the Zone, as well as at any wetlands or watercourses, habitat trees or TAR plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

The eastern end of the Zone occurs within a mapped RE. This is described in Table 2 and mapped in Figure 1. For discussion of mapped high value regrowth (HVR) see section 4.1.2.

Table 2: Remnant REs mapped in Zone RM03-09

RE Code	Vegetation Management Class	Biodiversity Status	Short Description*
11.10.11	Not Of Concern	No Concern At Present	<i>Eucalyptus populnea</i> , <i>E. melanophloia</i> +/- <i>Callitris glaucophylla</i> woodland on coarse-grained sedimentary rocks

* Short description as per Regional Ecosystem Description Database (REDD), Department of Environment and Heritage Protection, Queensland Government (DEHP 2013).

4.1.2 Regional Ecosystems Observed

White Cypress Pine (*Callitris glaucophylla*) woodland with subdominant Poplar Box (*Eucalyptus populnea*) was observed in the Zone at survey site Q2/RM03-09 (see Appendix A). This vegetation is part of a patch surrounding the proposed RM03-09 well which is currently mapped as RE 11.10.11. However, field results indicate it equates to RE 11.10.9 (no concern at present): White Cypress Pine (*Callitris glaucophylla*) woodland on coarse-grained sedimentary rocks.

The Zone traverses a small area of advanced regrowth Poplar Box (*Eucalyptus populnea*) with an upper shrub layer of Yarran (*Acacia omalophylla*) that was observed at survey site Q3/RM03-09. This vegetation is part of a mapped polygon of high value regrowth (HVR) containing endangered RE. Field observations indicate the vegetation at the survey site equates to RE 11.9.7 (of concern): Poplar Box (*E. populnea*), False Sandalwood (*Eremophila mitchellii*) shrubby woodland on fine-grained sedimentary rocks. This vegetation resembled old regrowth approaching remnant status. Draft technical description data supplied by the Qld Herbarium (Queensland Herbarium unpub.) confirms the field findings: canopy (T1) median height of 12m and cover of 15% (Table 3) meet or exceed remnant thresholds of 75% canopy height and 50% canopy cover when compared to the relevant figures given in the RE technical description (16m and 14.67% respectively).

Four narrow fringes of remnant vegetation were observed within the Zone (Figure 2) which are the edges of larger patches extending beyond the Zone. These fringes are mapped as part of the endangered HVR polygon at the Zone however, field observations indicate they are all remnant REs. The polygon at the western end of the Zone in Figure 2 is part of a large remnant patch extending north. This displayed similarities to RE 11.10.9 vegetation recorded at survey site Q3/RM03-02 (approximately 400m north) that was inspected as part of the RM03-02 Zone assessment. Field observations of the other three narrow polygons suggest they are equivalent to RE 11.10.11 due to the dominance of Poplar Box (*E. populnea*) and Silver-leaved Ironbark (*E. melanophloia*).

The floristics and structure of the dominant species in each woody stratum of these survey sites are given in Table 3. Mapping of observed REs is provided in Figure 2. Representative site photos are given in Figures 3a and 3b.

Table 3: Floristics and Structure of Remnant Ecosystems at Survey Sites in Zone RM03-09

Site	Location	Vegetation Description		
Q2/RM03-09	55J 710230E 7084737N	Woodland of <i>Callitris glaucophylla</i> with subdominant <i>Eucalyptus populnea</i> ; a sparse shrub layer dominated by <i>C. glaucophylla</i> recruits; and grassy layer dominated by <i>Cymbopogon refractus</i> .		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	15	25	375	30
S1	2.5	10	192	2.5
Site	Location	Vegetation Description		
Q3/RM03-09	55J 710097E 7084842N	Woodland (advanced regrowth) of <i>Eucalyptus populnea</i> with upper shrub layer dominated by <i>Acacia omalophylla</i> and lower shrub layer dominated by <i>Eremophila mitchellii</i> ; grassy ground layer dominated by <i>Aristida</i> sp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	12	15	160	25
S1	8	20	640	12
S2	2.5	15	1500	2.5

4.1.3 Threatened Ecological Communities Observed

No threatened ecological communities (TECs) were observed in the Zone.

4.1.4 Non-remnant Vegetation Observed

The remainder of the Zone is vegetated by pasture with patches of shrubland that has occurred after mechanical disturbance (pulling) of regrowth from earlier clearing event(s), including an existing cleared corridor within the mapped endangered HVR polygon. The floristics and structure of the dominant species in each woody stratum at survey site Q1/RM03-09 are shown in Table 4 (see Appendix A for further detail). Representative images of the survey site are shown at Figure 4.

Table 4: Floristics and Structure of Vegetation at Survey Sites in Zone RM03-09

Site	Location	Vegetation Description		
Q1/RM03-09	55J 709777E 7084932N	Shrubland (regrowth) of <i>Eucalyptus populnea</i> and <i>Callitris glaucophylla</i> ; mid-dense grassy layer dominated by <i>Aristida</i> sp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
S1	2	10	800	0.5

4.2 Additional Observations

4.2.1 Additional Flora Species

Approximately 44 species of native flora were detected (Appendix B). In addition, seven non-native species were recorded. Three of these, Common Pest Pear (*Opuntia stricta*), Tiger Pear (*O. aurantiaca*) and Velvety Tree Pear (*O. tomentosa*), are declared class 2 weed scheduled under the *Land Protection (Pest and Stock Route Management) Regulation 2003* and Weed of National Significance (WoNS).

4.2.2 Type A Restricted Plants

One species of Type A restricted (TAR) plant was detected within the Zone, this being Kurrajong (*Brachychiton populneus*). Details are given in Table 5 and images are shown in Figures 5a - 5c.

Table 5: TAR Plants recorded in Zone RM03-09

Waypoint	Location	Species	Height (m)	DBH (cm)	Management
BP1/RM03-09	55J 710035E 7084894N	<i>Brachychiton populneus</i>	7.0	0.45	Avoid disturbance
BP2/RM03-09	55J 710229E 7084754N	<i>Brachychiton populneus</i>	1.6	0.8	Translocation possible
BP3/RM03-09	55J 710148E 7084804N	<i>Brachychiton populneus</i>	1.4	0.5	Translocation possible

4.2.3 Fauna Habitat Features

Six hollow-bearing trees were detected within the Zone. Location and details of these trees are shown in Table 6 and Figures 6a – 6f. Note that habitat tree HT5/RM03-09 is located about 15m north of the Zone boundary but is highlighted as it is of potential management concern. No other significant fauna habitat features were detected in the Zone.

Table 6: Details of Fauna Habitat Features, Zone RM03-09

Waypoint	Location	Species	Alive/ dead	DBH (cm)	Height (m)	Habitat features
HT1/RM03-09	55J 710174E 7084743N	<i>Eucalyptus populnea</i>	Dead	105	8	2 hollows <10cm diam.; 3 hollows 10- 30cm diam.; 10% loose bark
HT2/RM03-09	55J 710202E 7084704 N	<i>Eucalyptus populnea</i>	Alive	90	28	2 hollows <10cm diam.; 1 hollow 10-30cm diam.
HT3/RM03-09	55J 710223E 7084718 N	<i>Eucalyptus populnea</i>	Alive	117	20	6 hollows <10cm diam.; 2 hollows 10-30cm diam.
HT4/RM03-09	55J 710158E 7084842 N	<i>Eucalyptus populnea</i>	Alive	68	15	1 hollow >30cm diam.; 4 hollows 10-30cm diam.
HT5/RM03-09	55J 709371E 7084921 N	<i>Eucalyptus populnea</i>	Alive	95	20	1 hollow <10cm diam.; 5 hollows 10-30cm diam.
HT6/RM03-09	55J 710157E 7084804N	<i>Eucalyptus melanophloia</i>	Alive	50	20	1 hollow <10cm diam.; nil loose bark

4.2.4 Wetlands and Watercourses

One drainage feature, a gully, crosses the Zone at waypoint W1/RM03-09. Despite the presence of defined banks and beds, it is considered to be a drainage feature due to a lack of riparian vegetation (*Water Act 2000*). Additionally, this meets the definition of a drainage feature according to the Act because it is likely to be only capable of flowing during and immediately after rainfall, for a short period and does not have enough continual flow to maintain a riparian ecosystem.

Location and characteristics are shown in Table 7. Images are shown in Figure 7. No other drainage features or watercourses as defined by the Act were detected in or within 100m of the Zone. No wetlands as defined by the Queensland Wetland Program (DERM 2011) as used in Santos Environmental Authority (Schedules C, M) were observed at the Zone.

Table 7: Wetlands and watercourses detected within Zone RM03-09

Waypoint	Location	Description
W1/RM03-09	55J 709599E 7084903N	Drainage feature (gully) crossing the Zone from south to north. Surrounded by cleared paddock, with fringing remnant woodland downstream of Zone. No apparent vegetation change associated with watercourse. No wetland plant species recorded.

5. References

Bostock, P.D. and Holland, A.E. (eds.) (2010). *Census of the Queensland Flora 2010*. Queensland Herbarium, Brisbane.

DEHP (2013). *Vegetation Management Act Regional Ecosystem and Remnant Map – Version 6.1*. Regional Ecosystem Maps/ Regrowth Vegetation Maps and PMAVs. Department of Environment and Heritage Protection, Queensland Government, Brisbane.

<http://www.ehp.qld.gov.au/ecosystems/biodiversity/regional-ecosystems/maps/index.php>

DERM (2011). *Queensland Wetland Definition and Delineation Guideline*. Queensland Government, Brisbane.

Queensland Herbarium (2013) *RE 11.9.7 Draft Technical Description*. Unpublished data. Department of Science, Information Technology, Innovation and the Arts, Brisbane.

Land Protection (Pest and Stock Route Management) Regulation 2003. (Queensland), viewed 13 May 2013, <<http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/L/LandPRPSRMR03.pdf>>

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, Brisbane.

Water Act 2000. (Queensland), viewed 14 February 2013, <<http://www.legislation.qld.gov.au/legisltn/current/w/watera00.pdf>>

Figure 1: Map of Zone RM03-09 showing survey sites and other points of interest

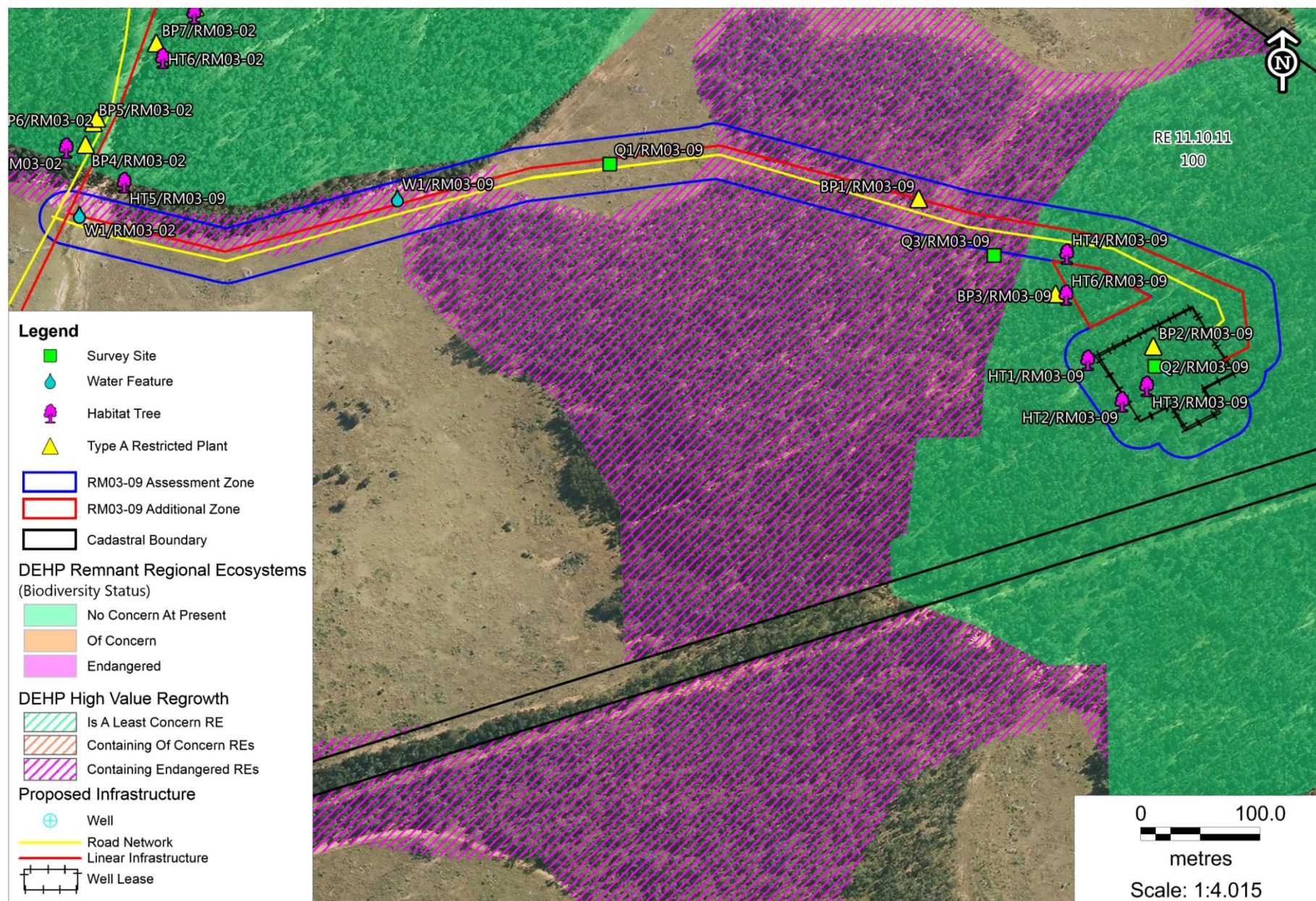


Figure 2: Map of amended RE polygons for Zone RM03-09

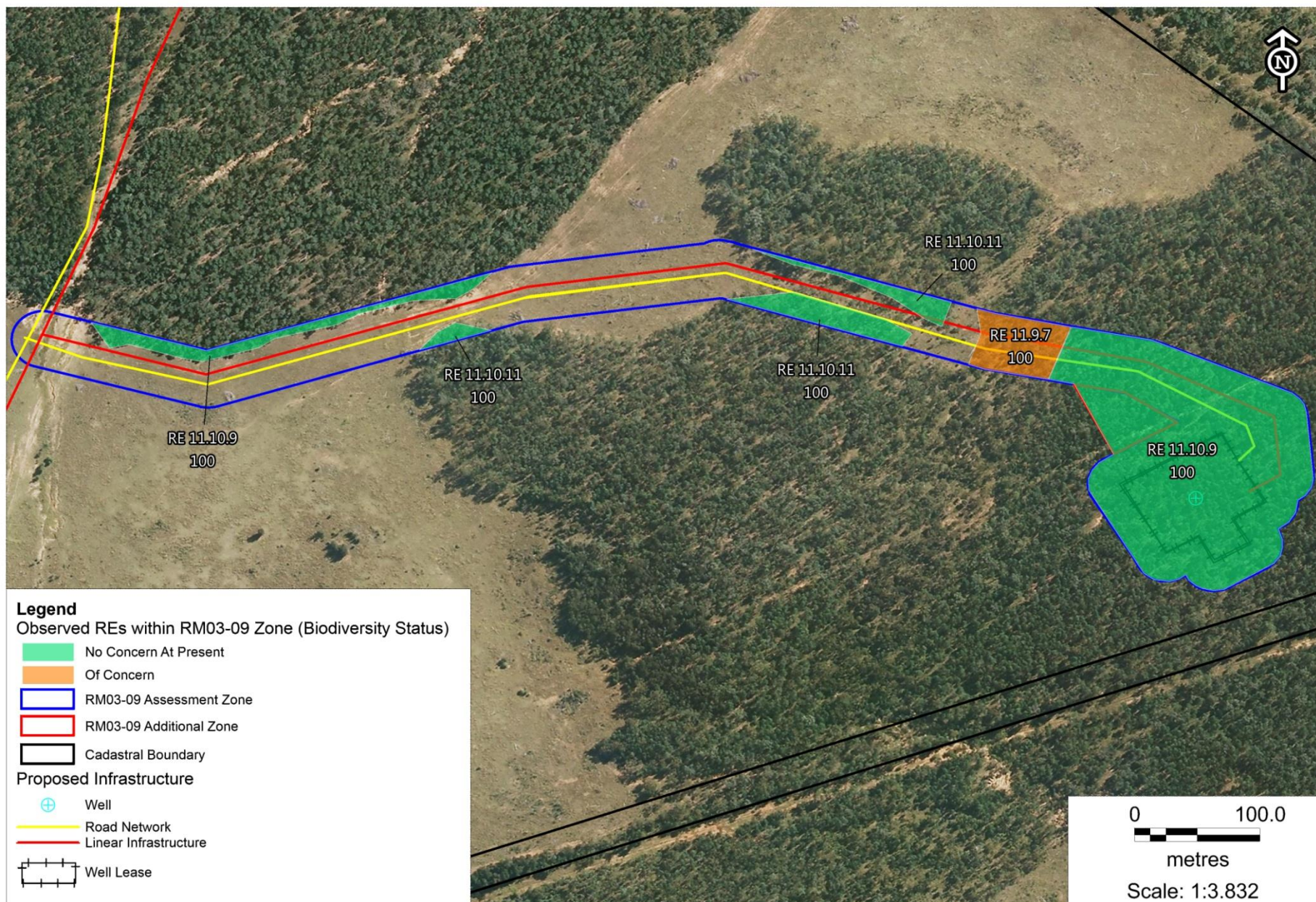




Figure 3a: White Cypress Pine (*Callitris glaucophylla*) woodland with subdominant Poplar Box (*Eucalyptus populnea*) at survey site Q2/RM03-09 looking southwest (left) and east (right).



Figure 3b: Advanced regrowth Poplar Box (*E. populnea*) with an upper shrub layer of Yarran (*Acacia omalophylla*) at survey site Q3/RM03-09 looking southwest (left) and northeast (right). This vegetation is attributable to RE 11.9.7.



Figure 4: Poplar Box (*E. populnea*) and White Cypress Pine (*C. glaucophylla*) shrubland at survey site Q1/RM03-09. Similar vegetation extends east (left) and west (right). Note adjoining vegetation adjoining northeast, southeast (left) and south (right) of the survey site.



Figure 5a: A Kurrajong (*Brachychiton populneus*) at waypoint BP1/RM03-09 (left). **Figure 5b:** A Kurrajong (*B. populneus*) sapling recorded at waypoint BP2/RM03-09 (right).



Figure 5c: A Kurrajong (*B. populneus*) sapling recorded at waypoint BP3/RM03-09.



Figure 6a: A dead hollow-bearing Poplar Box (*Eucalyptus populnea*) recorded at waypoint HT1/RM03-09 (left). **Figure 6b:** A hollow-bearing Poplar Box (*E. populnea*) recorded at waypoint HT2/RM03-09 (right).



Figure 6c: A multi-stemmed, hollow-bearing Poplar Box (*Eucalyptus populnea*) recorded at waypoint HT3/RM03-09 (left). **Figure 6d:** A hollow-bearing Poplar Box (*E. populnea*) recorded at waypoint HT4/RM03-09 (right).



Figure 7: Small drainage feature (gully) at W1/RM03-09 looking downstream (left) and upstream (right).

Appendix A: Quaternary assessment results, Zone RM03-09

Site No. Q1/RM03-09 **Recorder:** Rosamund Aisthorpe, Richard Johnson **Date** 17/01/2013
Purpose Well Zone Assessments **Time** 13:40

Locality: (inc. distance/direction to nearest town) "Mt Hope"
Zone: 55J 0709777 E 7084932 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				S1	C	<i>Eucalyptus populnea</i>
T1				S1	C	<i>Callitris glaucophylla</i>
T2				S1	A	<i>Acacia omalophylla</i>
T3				S1	A	<i>Eremophila mitchellii</i>
S1	2.0	1.5-2.5	S (10)	G	D	<i>Aristida</i> sp.
S2						
S3						
G	0.4	0.8 - 0.6	M (60)			
Structural formation: Shrubland						
Ecologically dominant layer: S1						

Geology, landform, soils

Geology code and rock types: coarse-grained sediments
Landform: hill slope
Soils: light brown loam
DEHP Mapped RE Code: NR
Observed RE Code: NR (ex-11.10.11) **Landzone:** 10

Vegetation Short Description

Shrubland (regrowth) of *Eucalyptus populnea* and *Callitris glaucophylla*; mid-dense grassy layer dominated by *Aristida* sp.

Connectivity/Patch Characteristics

cleared

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Glandularia aristigera (R), *Conyza bonariensis* (R), *Cirsium vulgare* (R), *Opuntia stricta* (R)

% Weed Cover: <5

EVNT Flora Present: Nil

EVNT Flora Likely:

Field Wpt Code:

Photo Nos. BBK 3343-3351

Additional Flora:				
<i>Epaltes australis</i>				
<i>Sida hackettiana</i>				
<i>Juncus usitatus</i>				
<i>Casuarina cristata</i>				
<i>Psydrax oleifolia</i>				
<i>Solanum ellipticum</i>				
<i>Eremophila debilis</i>				
<i>Podolepis longipedata</i>				
<i>Glossocardia bidens</i>				
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)				
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.				
Rocks - embedded		Boulders		Shrub layer
Rocks - loose		Fallen bark		Leaf litter
				Ground cover
				Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100				
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark
Underhangs / overhangs / caves		Logs with hollows		Termite mounds
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe
Other				
Soil cracks				
Water				
Other (e.g. food trees):				
Disturbances				
grazing; treated regrowth (chain-pulled)				
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata		
		Str.	Stems/ha	DBH (cm)
NOT RECORDED		S1	800	0.5
Additional Notes				

Site No. Q2/ RM03-09 Recorder: Rosamund Aisthorpe, Richard Johnson Date 17/01/2013
Purpose Well Zone Assessments Time 14:30

Locality: (inc. distance/direction to nearest town) "Mt Hope"
Zone: 55J 0710230 E 7084737 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Callitris glaucophylla</i>
T1	15	12 - 18	S (25)	T1	S	<i>Eucalyptus populnea</i>
T2				S1	D	<i>Callitris glaucophylla</i>
T3				S1	S	<i>Acacia leiocalyx</i>
S1	2.5	1.5 - 4.0	S (10)	G	D	<i>Cymbopogon refractus</i>
S2						
S3						
G	0.3	0.1 - 0.4	D (80)			
Structural formation: Woodland						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types: coarse-grained sediments
Landform: gentle slope
Soils: pale brown sandy loam
DEHP Mapped RE Code: ?
Observed RE Code: 11.10.9 Landzone: 10

Vegetation Short Description

Woodland of *Callitris glaucophylla* with subdominant *Eucalyptus populnea*; a sparse shrub layer dominated by *C. glaucophylla* recruits; and grassy layer dominated by *Cymbopogon refractus*.

Connectivity/Patch Characteristics

large remnant patch

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Opuntia tomentosa (R); *Opuntia aurantiaca* (R)

% Weed Cover: <5

EVNT Flora Present: Nil

EVNT Flora Likely:

Field Wpt Code:

Photo Nos. BBK 15965-70

Additional Flora:				
<i>Vittadinia dissecta</i>		<i>Calotis cuneifolia</i>		
<i>Carissa ovata</i>		<i>Jasminum didymum</i>		
<i>Aristida caput-medusae</i>		<i>Jasminum simplicifolium</i>		
<i>Dianella longifolia</i>		<i>Maytenus cunninghamii</i>		
<i>Geijera parviflora</i>		<i>Wedelia spilanthis</i>		
<i>Ancistrachne uncinulata</i>		<i>Eremophila mitchellii</i>		
<i>Eucalyptus chloroclada</i>		<i>Parsonsia eucalyptophylla</i>		
<i>Arundinella nepalensis</i>		<i>Petalostigma pubescens</i>		
<i>Plectranthus parviflorus</i>		<i>Spartothamnella juncea</i>		
<i>Notelaea microcarpa</i>				
<i>Laxmannia compacta</i>				
<i>Cyanthillium cinereum</i>				
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)				
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.				
Rocks - embedded		Boulders		Shrub layer
Rocks - loose		Fallen bark		Leaf litter
				Ground cover
				Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100				
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark
Underhangs / overhangs / caves		Logs with hollows		Termite mounds
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe
Other				
Soil cracks				
Water				
Other (e.g. food trees):				
Disturbances				
previous selective logging (<i>Callitris</i>)				
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata		
		Str.	Stems/ha	DBH (cm)
		T1	375	30
		S1	192	2.5
Additional Notes				

Site No.	Q3/ RM03-09	Recorder:	Rosamund Aisthorpe, Richard Johnson	Date	17/01/2013
Purpose	Well Zone Assessments			Time	15:30

Locality:
(inc. distance/direction to nearest town) "Mt Hope"

Zone: 55J 0710097 E 7084842 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Eucalyptus populnea</i>
T1	12	10 – 15	(S) (15)	S1	D	<i>Acacia omalophylla</i>
T2				S1	SD	<i>Eucalyptus populnea</i>
T3				S2	D	<i>Eremophila mitchellii</i>
S1	8	6 – 9	S (20)	S2	S	<i>Acacia omalophylla</i>
S2	2.5	1.8 – 4	S (15)	S2	A	<i>Callitris glaucophylla</i>
S3				G	D	<i>Aristida</i> sp.
G	0.4	0.1 – 0.6	M (60)	G	S	<i>Chloris ventricosa</i>
Structural formation: Woodland						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types:	
Landform:	
Soils:	brown loam with some surface gravel, stones
DEHP Mapped RE Code:	11.10.11
Observed RE Code:	11.9.7
Landzone:	9
Vegetation Short Description	
Woodland (advanced regrowth) of <i>Eucalyptus populnea</i> with upper shrubby layer dominated by <i>Acacia omalophylla</i> and lower shrubby layer dominated by <i>Eremophila mitchellii</i> ; grassy ground layer dominated by <i>Aristida</i> sp.	
Connectivity/Patch Characteristics	
remnant / regrowth patch, contiguous with larger remnant area	
Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed) <i>Cenchrus ciliaris</i> (R), <i>Opuntia tomentosa</i> (R)	
% Weed Cover:	<5
EVNT Flora Present:	Nil
EVNT Flora Likely:	
Field Wpt Code:	
Photo Nos.	

Additional Flora:				
<i>Casuarina cristata</i>				
<i>Owenia acidula</i>				
<i>Alstonia constricta</i>				
<i>Jasminum didymum</i>				
<i>Capparis lasiantha</i>				
<i>Ancistrachne uncinulata</i>				
<i>Cymbopogon refractus</i>				
<i>Senna artemisioides</i> subsp. <i>zygophylla</i>				
<i>Maytenus cunninghamii</i>				
<i>Maireana microphylla</i>				
<i>Sida hackettiana</i>				
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)				
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.				
Rocks - embedded		Boulders		Shrub layer
Rocks - loose		Fallen bark		Leaf litter
				Ground cover
				Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100				
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark
Underhangs / overhangs / caves		Logs with hollows		Termite mounds
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe
Other				
Soil cracks				
Water				
Other (e.g. food trees):				
Disturbances				
previously pulled - timber on ground (>10 years)				
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata		
		Str.	Stems/ha	DBH (cm)
NOT RECORDED		T1	160	25
		S1	640	12
		S2	1500	2.5
Additional Notes				

Appendix B: Plant species list, Zone RM03-09

Key: * indicates non-native plant species

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	Other
Apocynaceae	<i>Alstonia constricta</i>	Bitterbark	LC				P	
Apocynaceae	<i>Carissa ovata</i>	Currant Bush	LC			P		
Apocynaceae	<i>Parsonsia eucalyptophylla</i>	Gargaloo	LC			P		
Asteraceae	<i>Calotis cuneifolia</i>	Purple Burr-daisy	LC			P		
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	-		P			
Asteraceae	<i>Conyza bonariensis</i> *	Flaxleaf Fleabane	-		P			
Asteraceae	<i>Cyanthillium cinereum</i>	Vernonia	LC			P		
Asteraceae	<i>Epaltes australis</i>	Spreading Nut-heads	LC		P			
Asteraceae	<i>Glossocardia bidens</i>	Native Cobbler's Pegs	LC		P			
Asteraceae	<i>Podolepis longipedata</i>	Tall Copper-wire Daisy	LC		P			
Asteraceae	<i>Vittadinia dissecta</i>	Dissected New Holland Daisy	LC			P		
Asteraceae	<i>Wedelia spilanthis</i>	A Daisy	LC			P		
Cactaceae	<i>Opuntia aurantiaca</i> *	Tiger Pear	-			P		
Cactaceae	<i>Opuntia stricta</i> *	Common Pest Pear	-		P			
Cactaceae	<i>Opuntia tomentosa</i> *	Velvety Tree Pear	-			P	P	
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>zygophylla</i>	Butter Bush	LC				P	
Capparaceae	<i>Capparis lasiantha</i>	Wait-A-While	LC				P	
Casuarinaceae	<i>Casuarina cristata</i>	Belah	LC		P		P	
Celastraceae	<i>Maytenus cunninghamii</i>	Yellow-berry Bush	LC			P	P	
Chenopodiaceae	<i>Maireana microphylla</i>	Cotton Bush	LC				P	
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC		P	P	P	
Hemerocallidaceae	<i>Dianella longifolia</i>	Smooth Flax Lily	LC			P		
Juncaceae	<i>Juncus usitatus</i>	Common Rush	LC		P			
Lamiaceae	<i>Plectranthus parviflorus</i>	Cockspur Flower	LC			P		
Lamiaceae	<i>Spartothamnella juncea</i>	Bead Bush	LC			P		

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	Other
Laxmanniaceae	<i>Laxmannia compacta</i>	Pink Wire Lily	LC			P		
Malvaceae	<i>Sida hackettiana</i>	High Sida	LC		P		P	
Meliaceae	<i>Owenia acidula</i>	Emu Apple	LC				P	
Mimosaceae	<i>Acacia leiocalyx</i>	Early Flowering Black Wattle	LC			P		
Mimosaceae	<i>Acacia omalophylla</i>	Yarran	LC		P		P	
Myoporaceae	<i>Eremophila debilis</i>	Winter Apple	LC		P			
Myoporaceae	<i>Eremophila mitchellii</i>	False Sandalwood	LC		P	P	P	
Myrtaceae	<i>Eucalyptus chloroclada</i>	Baradine Red Gum	LC			P		
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	LC					P
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		P	P	P	
Oleaceae	<i>Jasminum didymum</i>	Native Jasmine	LC			P	P	
Oleaceae	<i>Jasminum simplicifolium</i> subsp. <i>australiense</i>	Stiff Jasmine	LC			P		
Oleaceae	<i>Notelaea microcarpa</i>	Native Olive	LC			P		
Picrodendraceae	<i>Petalostigma pubescens</i>	Quinine Tree	LC			P		
Poaceae	<i>Ancistrachne uncinulata</i>	Hooky Grass	LC			P	P	
Poaceae	<i>Aristida caput-medusae</i>	Many-headed Wiregrass	LC			P		
Poaceae	<i>Aristida</i> sp. (infertile)	A Wiregrass	LC		P		P	
Poaceae	<i>Arundinella nepalensis</i>	Reedgrass	LC			P		
Poaceae	<i>Cenchrus ciliaris</i> *	Buffel Grass	-				P	
Poaceae	<i>Chloris ventricosa</i>	Tall Chloris	LC				P	
Poaceae	<i>Cymbopogon refractus</i>	Barbed-wire Grass	LC			P	P	
Rubiaceae	<i>Psydrax oleifolia</i>	Myrtle Tree	LC		P			
Rutaceae	<i>Geijera parviflora</i>	Wilga	LC			P		
Solanaceae	<i>Solanum ellipticum</i>	Potato Bush	LC		P			
Sterculiaceae	<i>Brachychiton populneus</i>	Kurrajong	LC/TAR					P
Verbenaceae	<i>Glandularia aristigera</i> *	Mayne's Pest	-		P			

Well Lease Area/ Infrastructure Zone Assessment Report: Mt Hope Zone RM03-02

Compiled by Boobook for Santos

Boobook
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

Revision	Date	Description	Author	Verifier	Approved
A	27/2/2013	Draft issued to client for review	RJ	CE	CE
B	24/5/2013	Draft incorporating client comment and amended zone	RA	RJ	CE
C	8/7/2013	Draft incorporating client comment	RJ	CE	CE
0	23/7/2013	Final version	RJ		RJ

1. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DSEWPac	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
TAR plant	Type A Restricted Plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

2. Introduction

2.1 Purpose & Scope

Boobook was commissioned by Santos to undertake ecological assessments on a number of well leases and infrastructure zones (hereafter individually referred to as the Zone) located on the property 'Mt Hope', located about 40km north-east of Roma, south central Queensland. Boobook was requested to undertake the following:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation present within the Zone;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the assessment site;
- Comment on the nature and location of wetlands and watercourses within 100m of the Zone;
- Provide location and description of any plants of conservation concern listed in the NC Act or EPBC Act;
- Location and characteristics of any type A restricted (TAR) plants (NC Act) in the Zone; and
- Location and characteristics of habitat trees in the Zone, with reference to trees previously mapped by Santos.

An individual report was to be prepared for each Zone. This report refers to Zone RM03-02 located on Lot 83 on Plan WV763.

Changes to the boundaries of this Zone were made by Santos following completion of the ecological assessment described in this report for the Zone (Figure 1). Modifications of this infrastructure Zone were considered to be either minor in extent and/or involving areas where the ecological values were previously assessed on-site or nearby. Although the risk is acceptably small it is possible that some ecological values of the modified Zone may not have been documented. Based on professional judgement the modified zones are highly unlikely to contain populations of threatened flora or significant fauna habitat features. However, the presence of TAR plants, especially seedlings, cannot be ruled out.

2.2 Survey Team

The project supervisor (Craig Eddie) was approved by 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.

The field survey described by this report was undertaken by Boobook on 17th January 2013 and was conducted by Richard Johnson (Senior Ecologist) and Rosamund Aisthorpe (Botanist). The following report was compiled by Rosamund Aisthorpe and Richard Johnson. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie (Principal Ecologist and Project Supervisor). Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A comprehensive desktop search was not required by the client for the purposes of this report. However, a desktop search was undertaken for REs at the property scale using mapping version 6.1 (DEHP 2013a). This dataset provides a baseline for subsequent field assessment.

The search was conducted using a 5km buffer around the coordinate -26.3558°S, 149.0847°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative site was selected for each RE present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Figure 1a and 1b. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all GPS co-ordinates quoted within this report is GDA94. When referred to within this report the sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2012: Table 29);
4. RE type mapped;
5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;
9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;

11. presence of EVNT flora;
12. a list of all other flora encountered at the Site; and
13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2012) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

A search was made within the Zone for TAR plants: If found, the location was established with a hand-held GPS unit and the species, height, DBH and possible management options were recorded. Where mapping supplied by Santos indicated the presence of habitat trees, a search was made for these. If found the location was established with a hand-held GPS unit and the species, height, DBH and habitat value(s) were recorded. In some instances unmapped habitat trees were located during the site survey and data was collected for these trees also.

The presence of any wetlands or watercourses within 100m of the Zone was recorded.

Representative photographs were taken at each quaternary survey site in the Zone, as well as at any wetlands or watercourses, habitat trees or TAR plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

The Zone intersects mapped REs at the southern and northern ends of the Zone (Figure 1). The RE mapped as present is described in Table 2.

Table 2: Remnant REs mapped in Zone RM03-02

RE Code	Vegetation Management Class	Biodiversity Status	Short Description*
11.10.11	Not Of Concern	No Concern At Present	<i>Eucalyptus populnea</i> , <i>E. melanophloia</i> +/- <i>Callitris glaucophylla</i> woodland on coarse-grained sedimentary rocks

* Short description as per Regional Ecosystem Description Database (REDD), Department of Environment and Heritage Protection, Queensland Government (DEHP 2013b).

4.1.2 Regional Ecosystems Observed

Remnant REs were sampled at survey sites Q1/RM03-02 and Q3/RM03-02 (see Appendix A). At the former, the vegetation corresponded to the DEHP RE mapping as described above. At the latter site, the structure and floristics of the vegetation are analogous to RE 11.10.9, described as *Callitris glaucophylla* woodland on coarse-grained sedimentary rocks. This RE has a biodiversity status of no concern at present. Details of floristics and structure at the two sites are provided in Table 3. Representative images are shown at Figures 2a-b.

Table 3: Floristics and Structure of Remnant Ecosystems at Survey Sites in Zone RM03-02

Site	Location	Vegetation Description		
Q1/RM03-02	55J 709048E 7084285N	<i>Eucalyptus melanophloia</i> , <i>Callitris glaucophylla</i> and <i>E. populnea</i> woodland; mid-layer dominated by <i>Eremophila mitchellii</i> , <i>C. glaucophylla</i> saplings, <i>Acacia deanei</i> and <i>Geijera parviflora</i> ; grassy ground layer dominated by <i>Aristida</i> sp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	12	45	176	30
T2	5.5	20	656	15
S1	1.5	5	512	3
Site	Location	Vegetation Description		
Q3/RM03-02	55J 709502E 7085296N	Woodland of <i>Callitris glaucophylla</i> with scattered <i>Eucalyptus chloroclada</i> ; sparse shrub layer dominated by <i>C. glaucophylla</i> recruits; grassy ground layer dominated by <i>Cymbopogon refractus</i> .		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	22	15	384	32
T2	15	30	352	15
S1	2.5	15	800	2

4.1.3 Threatened Ecological Communities Observed

No threatened ecological communities (TECs) were observed in the Zone.

4.1.4 Non-remnant Vegetation Observed

The remainder of the Zone is vegetated by a sparse grassy shrubland of regrowth that has occurred after mechanical disturbance (pulling) of regrowth from earlier clearing event(s). This was sampled at survey site Q2/RM03-02 (see Appendix A). The floristics and structure of the dominant species in each woody stratum at the site are shown in Table 4. Representative images of the site are shown at Figure 3.

Table 4: Floristics and Structure of Vegetation at Survey Sites in Zone RM03-02

Site	Location	Vegetation Description		
Q1/RM03-02	55J 709231E 7084693N	Grassland of <i>Aristida</i> sp., <i>Bothriochloa decipiens</i> with scattered shrubs (regrowth) of <i>Casuarina cristata</i> , <i>Geijera parviflora</i> , <i>Eucalyptus populnea</i> .		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
S1	1.5	<5	80	n/a

4.2 Additional Observations

4.2.1 Additional Flora Species

Approximately 38 species of native flora were detected (Appendix B). In addition, three non-native species were recorded. One of these, Velvety Tree Pear (*Opuntia tomentosa*), is a declared class 2 weed scheduled under the *Land Protection (Pest and Stock Route Management) Regulation 2003* and Weed of National Significance (WoNS). The wetland plants *Juncus usitatus* and *Cynodon dactylon* were recorded at waypoints W1/RM03-02 and W2/RM03-02.

4.2.2 Type A Restricted Plants

Seventeen Kurrajong (*Brachychiton populneus*) plants, a TAR plant, were detected within or adjacent to the Zone. Details of locations and characteristics of the plants are presented in Table 5 and representative images are shown at Figure 4a-q.

Table 5: TAR Plants recorded in Zone RM03-02

Waypoint	Location	Species	Height (m)	DBH (cm)	Management
BP1/RM03-02	55J 709064E 7084239N	<i>Brachychiton populneus</i>	8.0	25	Translocation unlikely
BP2/RM03-02	55J 709023E 7084302N	<i>Brachychiton populneus</i>	12.0	35	Avoid
BP3/RM03-02	55J 709054E 7084463N	<i>Brachychiton populneus</i>	12.0	57	Avoid
BP4/RM03-02	55J 709339E 7084956N	<i>Brachychiton populneus</i>	6.0	10	Translocation possible
BP4/RM03-02	55J 709339E 7084956N	<i>Brachychiton populneus</i>	0.5	n/a	Translocation possible
BP4/RM03-02	55J 709339E 7084956N	<i>Brachychiton populneus</i>	0.5	n/a	Translocation possible
BP5/RM03-02	55J 709346E 7084976N	<i>Brachychiton populneus</i>	7.0	10	Translocation possible
BP5/RM03-02	55J 709346E 7084976N	<i>Brachychiton populneus</i>	0.7	n/a	Translocation possible
BP6/RM03-02	55J 709349E 7084980N	<i>Brachychiton populneus</i>	1.0	n/a	Translocation possible
BP7/RM03-02	55J 709400E 7085049N	<i>Brachychiton populneus</i>	0.8	n/a	Translocation possible
BP8/RM03-02	55J 709433E 7085082N	<i>Brachychiton populneus</i>		15	Avoid
BP9/RM03-02	55J 709514E 7085278N	<i>Brachychiton populneus</i>	1.5	n/a	Translocation possible
BP9/RM03-02	55J 709514E 7085278N	<i>Brachychiton populneus</i>	0.9	n/a	Translocation possible
BP10/RM03-02	55J 709542E 7085298N	<i>Brachychiton populneus</i>	0.9	n/a	Translocation possible
BP10/RM03-02	55J 709542E 7085298N	<i>Brachychiton populneus</i>	1.0	n/a	Translocation possible
BP11/RM03-02	55J 709560E 7085297N	<i>Brachychiton populneus</i>	1.0	n/a	Translocation possible
BP12/RM03-02	55J 709547E 7085279N	<i>Brachychiton populneus</i>	4.0	40	Translocation possible

Waypoint	Location	Species	Height (m)	DBH (cm)	Management
BP12/RM03-02	55J 709547E 7085279N	<i>Brachychiton populneus</i>	0.9	n/a	Translocation possible
BP12/RM03-02	55J 709547E 7085279N	<i>Brachychiton populneus</i>	1.0	n/a	Translocation possible
BP12/RM03-02	55J 709547E 7085279N	<i>Brachychiton populneus</i>	0.3	n/a	Translocation possible
BP13/RM03-02	55 J 709568E 7085275N	<i>Brachychiton populneus</i>	1.2	n/a	Translocation possible
BP14/RM03-02	55 J 709572E 7085273N	<i>Brachychiton populneus</i>	0.6	n/a	Translocation possible
BP14/RM03-02	55 J 709572E 7085273N	<i>Brachychiton populneus</i>	0.55	n/a	Translocation possible
BP14/RM03-02	55 J 709572E 7085273N	<i>Brachychiton populneus</i>	0.6	n/a	Translocation possible
BP15/RM03-02	55 J 709509E 7085296N	<i>Brachychiton populneus</i>	0.5	n/a	Translocation possible
BP16/RM03-02	55 J 709498E 7085348N	<i>Brachychiton populneus</i>	8.0	20	Avoid
BP17/RM03-02	55 J 709499E 7085345N	<i>Brachychiton populneus</i>	0.6	n/a	Translocation possible

4.2.3 Fauna Habitat Features

A number of potential fauna habitat trees were detected within the Zone. Location and details of these trees are shown in Table 6 and Figures 5a-i. No other significant fauna habitat features were detected in the Zone.

Table 6: Details of Fauna Habitat Features, Zone RM03-02

Waypoint	Location	Species	Alive/ dead	DBH (cm)	Height (m)	Habitat features
HT1/RM03-02	55 J 709039E 7084251N	<i>Eucalyptus melanophloia</i>	Alive	62	25	1 hollow <10cm diam. 5% loose bark
HT2/RM03-02	55 J 709025E 7084287N	<i>Eucalyptus melanophloia</i>	Alive	43	14	2 hollows <10cm diam. 5% loose bark
HT3/RM03-02	55 J 709013E 7084287N	<i>Eucalyptus populnea</i>	Alive	81	12	3 hollows <10cm diam.; 1 hollow 10-30cm diam.
HT4/RM03-02	55 J 709035E 7084294N	<i>Eucalyptus melanophloia</i>	Dead	53	14	30% loose bark.
HT5/RM03-02	55 J 709323E 7084954N	<i>Eucalyptus</i> sp.	Dead	73	12	2 hollows >30cm diam.; 5 hollows 10-30cm diam.
HT6/RM03-02	55 J 709405E 7085036N	<i>Eucalyptus</i> sp.	Dead	68	15	1 hollow > 30cm diam.; 5 hollows 10-30cm diam.
HT7/RM03-02	55 J 709427E 7085108N	<i>Eucalyptus chloroclada</i>	Alive	19	10	5% loose bark; nest tree
HT8/RM03-02	55 J 709432E 7085077N	<i>Eucalyptus</i> sp.	Dead	38	20	4 hollows <10cm diam.; 2 hollows 10-30cm diam.

Waypoint	Location	Species	Alive/ dead	DBH (cm)	Height (m)	Habitat features
HT9/RM03-02	55 J 709455E 7085247N	<i>Eucalyptus chloroclada</i>	Alive	28	18	Nest tree 1 stick nest

4.2.4 Wetlands and Watercourses

A mapped first-order stream, apparently un-named, is within 100m of the northern end of the Zone. This is sampled at waypoint W2/RM03-02. Defined banks and bed are present but there is no development of a riparian vegetation community. It appears that flows are insufficient to maintain a riverine environment; hence the stream is a drainage feature as defined by the *Water Act 2000*.

A drainage feature is present at W1/RM03-02. The lack of riparian vegetation and defined bed and banks indicates this is a drainage feature and not a watercourse (*Water Act 2000*). Additionally, this meets the definition of a drainage feature according to the Act because it is likely to be only capable of flowing during and immediately after rainfall, for a short period and does not have enough continual flow to maintain a riparian ecosystem.

Location and details of these features are given in Table 7 and images shown in Figures 6a-b. No other watercourses or drainage features as defined by the *Water Act 2000* were observed at or within 100m of the Zone. No wetlands as defined by the Queensland Wetland Program (DERM 2011) as used in Santos Environmental Authority (Schedules C, M) were observed at or within 100m of the Zone.

Table 4: Wetlands and watercourses detected within Zone RM03-02

Waypoint	Location	Description
W1/RM03-02	55J 709333E 7084892N	Drainage feature: gully crossing the Zone from south to north. Surrounded by regrowth with remnant 11.10.9 to north. Wetland plant species <i>Juncus usitatus</i> , <i>Cynodon dactylon</i> were recorded.
W2/RM03-02	55J 709561E 7085454N	Drainage feature: a first-order stream to the north of the Zone. Steep, eroded banks. No distinct riparian vegetation: surrounding remnant vegetation equivalent to RE11.3.39. <i>Juncus usitatus</i> present in bed.

5. References

Bostock, P.D. and Holland, A.E. (eds.) (2010). *Census of the Queensland Flora 2010*. Queensland Herbarium, Brisbane.

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Water Act 2000. (Queensland), viewed 14 February 2013, <<http://www.legislation.qld.gov.au/legisltn/current/w/watera00.pdf>>

Figure 1a: Map of Zone RM03-02 (northern portion) showing survey sites and other points of interest

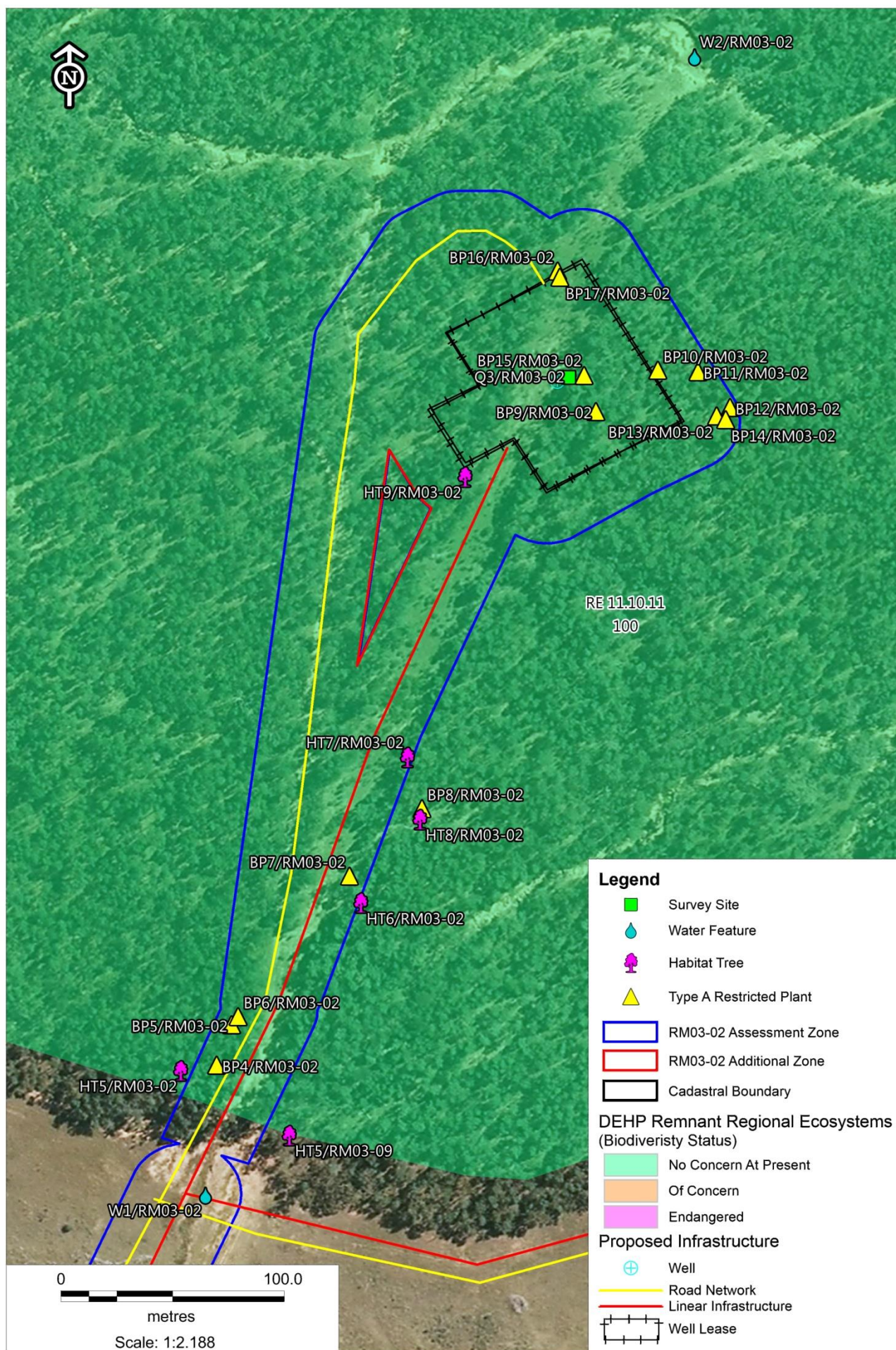


Figure 1b: Map of Zone RM03-02 (southern portion) showing survey sites and other points of interest

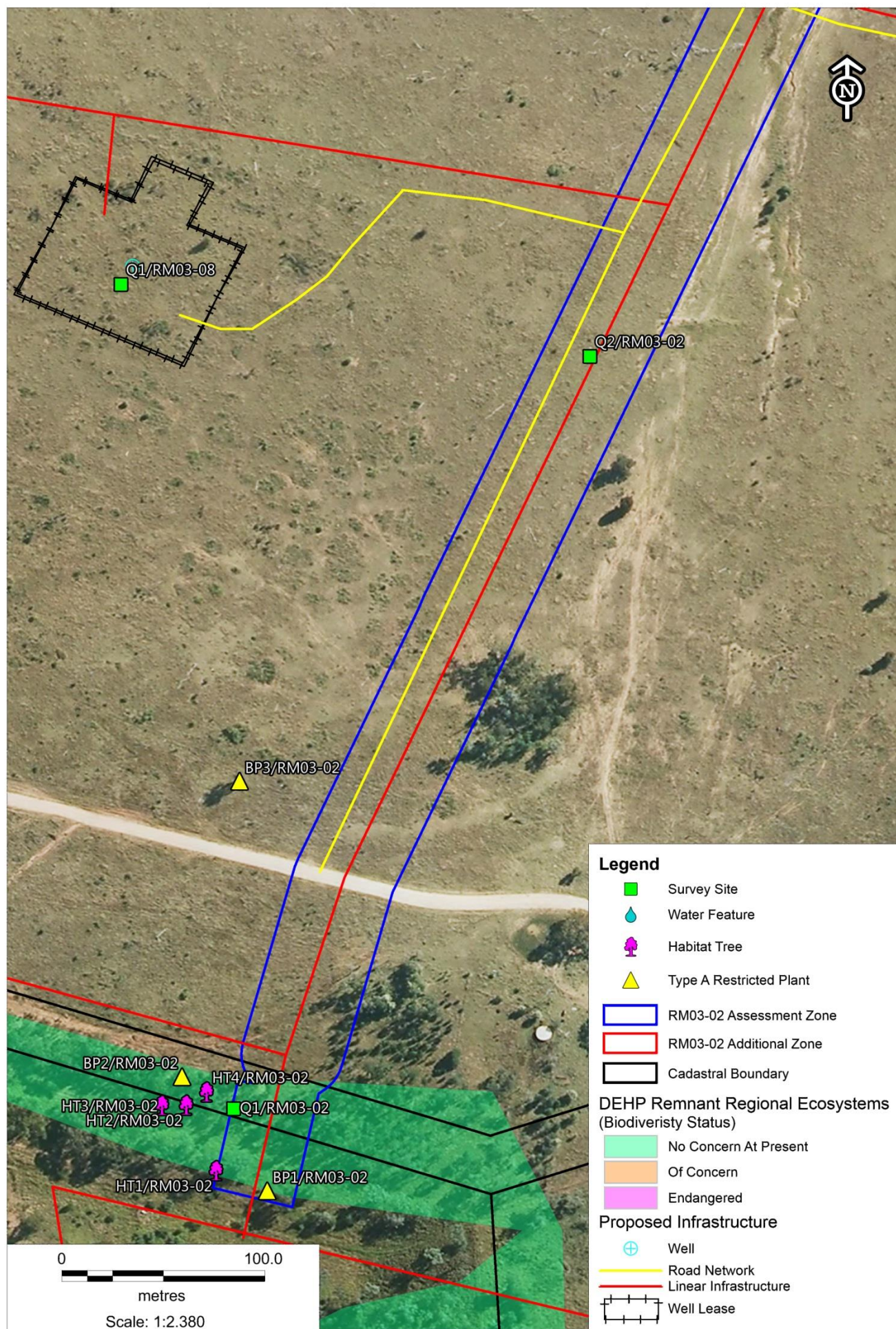




Figure 2a: Two views of Silver-leaved Ironbark (*Eucalyptus melanophloia*), White Cypress Pine (*Callitris glaucophylla*) and Poplar Box (*E. populnea*) woodland at survey site Q1/RM03-02.



Figure 2b: Two views of woodland of White Cypress Pine (*C. glaucophylla*) with scattered eucalypts at survey site Q3/RM03-02.



Figure 3: Grassland with scattered shrubs (regrowth) at survey site Q2/RM03-02 looking east (left) and west (right).



Figures 4a, 4b: Kurrajong (*Brachychiton populneus*) trees recorded at waypoint BP1/RM03-02 (left) and at waypoint BP2/RM03-02 (right).



Figure 4c: A Kurrajong (*B. populneus*) recorded at waypoint BP3/RM03-02.



Figure 4d: A Kurrajong (*B. populneus*) tree (left) and a sapling immediately adjacent (right) recorded at waypoint BP4/RM03-02.



Figure 4e: A Kurrajong (*B. populneus*) tree (left) and a sapling immediately adjacent (right) recorded at waypoint BP5/RM03-02.



Figures 4f, 4g: A sapling Kurrajong (*B. populneus*) at waypoint BP6/RM03-02 (left) and at waypoint BP7/RM03-02 (right).



Figures 4h, 4i: A small Kurrajong (*B. populneus*) at waypoint BP8/RM03-02 (left) and a cluster of Kurrajong (*B. populneus*) saplings at waypoint BP9/RM03-02 (right).



Figures 4j, 4k: A group of Kurrajong (*B. populneus*) saplings recorded at waypoint BP10/RM03-02 (left) and a Kurrajong (*B. populneus*) sapling at waypoint BP11/RM03-02 (right).



Figures 4l, 4m: A small Kurrajong (*B. populneus*) tree recorded at waypoint BP12/RM03-02 (left) and a Kurrajong (*B. populneus*) sapling at waypoint BP13/RM03-02.



Figures 4n, 4o: Groups of Kurrajong (*B. populneus*) saplings recorded at waypoint BP14/RM03-02 (left) and at waypoint BP15/RM03-02 (right).



Figures 4p, 4q: A Kurrajong (*B. populneus*) tree at waypoint BP16/RM03-02 (left) and a sapling at waypoint BP17/RM03-02 (right).



Figure 5a: A hollow-bearing live Silver-leaved Ironbark (*Eucalyptus melanophloia*) at waypoint HT1/RM03-02 (left); **Figure 5b:** A hollow-bearing live Silver-leaved Ironbark (*E. melanophloia*) at waypoint HT2/RM03-02 (right).



Figure 5c: A hollow-bearing live Poplar Box (*E. populnea*) at waypoint HT3/RM03-02 (left); **Figure 5d:** A dead Silver-leaved Ironbark (*E. melanophloia*) with 30% loose bark at waypoint HT4/RM03-02 (right).



Figures 5e, 5f: Hollow-bearing dead eucalypt trees recorded at waypoint HT5/RM03-02 (left) and at waypoint HT6/RM03-02 (right).



Figure 5g: A live Baradine Red Gum (*Eucalyptus chloroclada*) containing a bird nest at waypoint HT7/RM03-02 (left); **Figure 5h:** A hollow-bearing dead tree at waypoint HT8/RM03-02 (right).



Figure 5i: A live Baradine Red Gum (*E. chloroclada*) containing a bird nest at waypoint HT9/RM03-02 (left), with closer detail of nest location (right).



Figure 6a: Two views of a drainage feature at waypoint W1/RM03-02, looking upstream to cleared pasture (left) and downstream to remnant RE 11.10.11 (right).



Figure 6b: Two views of an un-named watercourse at waypoint W2/RM03-02, looking upstream (left) and downstream (right).

Appendix A: Quaternary assessment results, Zone RM03-02

Site No. Q1/ RM03-02 Recorder: Rosamund Aisthorpe Date 17/01/2013
 Purpose Well Zone Assessments Time 07:50

Locality: (inc. distance/direction to nearest town) "Mt Hope"
 Zone: 55J 0709048 E 7084285 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	C	<i>Eucalyptus melanophloia</i>
T1	12	10 - 14	M (45)	T1	C	<i>Callitris glaucophylla</i>
T2	5.5	5 - 6	S (20)	T1	C	<i>E. populnea</i>
T3				T2	S	<i>Eremophila mitchellii</i>
S1	1.5	1 - 2	V (5)	T2	D	<i>C. glaucophylla</i>
S2				S1	D	<i>C. glaucophylla</i>
S3				S1	S	<i>Acacia deanei</i>
G	0.3	0.1 - 0.4	M (65)	S1	A	<i>Geijera parviflora</i>
Structural formation: Woodland				G	D	<i>Aristida</i> sp.
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types: coarse-grained sedimentary rocks
 Landform: undulating low hills
 Soils: pale brown sandy loam
 DEHP Mapped RE Code:
 Observed RE Code: 11.10.11 Landzone: 10

Vegetation Short Description

Eucalyptus melanophloia, *Callitris glaucophylla* and *E. populnea* woodland; midlayer dominated by *Eremophila mitchellii*, *C. glaucophylla* saplings, *Acacia deanei* and *Geijera parviflora*; grassy ground layer dominated by *Aristida* sp.

Connectivity/Patch Characteristics

Narrow corridor (road reserve) adjoined by mostly cleared paddock with regrowth to north; fence line runs along centre of corridor.

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Opuntia tomentosa (R)

% Weed Cover: <5

EVNT Flora Present: Nil

EVNT Flora Likely: Nil

Field Wpt Code:

Photo Nos. BBK5 3223-3231

Additional Flora:				
<i>Hakea lorea</i>				
<i>Grevillea striata</i>				
<i>Allocasuarina luehmannii</i>				
<i>Acacia excelsa</i>				
<i>Atalaya hemiglauca</i>				
<i>Psyrdrax johnsonii</i>				
<i>Alectryon oleifolius</i>				
<i>Brachychiton populneus</i>				
<i>Carissa ovata</i>				
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)				
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.				
Rocks - embedded		Boulders		Shrub layer
Rocks - loose		Fallen bark		Leaf litter
				Ground cover
				Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100				
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark
Underhangs / overhangs / caves		Logs with hollows		Termite mounds
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe
Other				
Soil cracks				
Water				
Other (e.g. food trees):				
Disturbances				
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata		
		Str.	Stems/ha	DBH (cm)
		T1	116	30
		T2	656	15
		S1	512	3
Additional Notes				

Site No. Q2/ RM03-02 **Recorder:** Rosamund Aisthorpe, Richard Johnson **Date** 17/01/2013
Purpose Well Zone Assessments **Time** 09:45

Locality: (inc. distance/direction to nearest town) "Mt Hope"
Zone: 55J 0709231 E 7084693 N **Datum** GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				S1	CD	<i>Casuarina cristata</i>
T1					C	<i>Geijera parviflora</i>
T2					C	<i>Eucalyptus populnea</i>
T3				G	D	<i>Aristida</i> sp.
S1	1.5	1.2 - 2.0	V S (<5)	G	S	<i>Bothriochloa decipiens</i>
S2						
S3						
G	0.4	0.1 - 0.6	D (80)			
Structural formation: Grassland						
Ecologically dominant layer: G						

Geology, landform, soils

Geology code and rock types: fine-grained sediments
Landform: hill slope
Soils: light brown loam
DEHP Mapped RE Code: NR
Observed RE Code: NR (ex-11.9.5 or 11.9.10) Landzone: 9
Vegetation Short Description
Grassland of <i>Aristida</i> sp. <i>Bothriochloa decipiens</i> with scattered shrubs (regrowth) of <i>Casuarina cristata</i> , <i>Geijera parviflora</i> , <i>Eucalyptus populnea</i>
Connectivity/Patch Characteristics
cleared
Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed) <i>Cirsium vulgare</i> (R)
% Weed Cover:
EVNT Flora Present:
EVNT Flora Likely:
Field Wpt Code:
Photo Nos. BBK5 3257-3265

Additional Flora:				
<i>Maireana microphylla</i>				
<i>Sclerolaena birchii</i>				
<i>Sida hackettiana</i>				
<i>Capparis lasiantha</i>				
<i>Epaltes australis</i>				
<i>Senna artemisioides</i> subsp. <i>zygophylla</i>				
<i>Pterocaulon redolens</i>				
<i>Psydrax oleifolia</i>				
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)				
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.				
Rocks - embedded		Boulders		Shrub layer
Rocks - loose		Fallen bark		Leaf litter
				Ground cover
				Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100				
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark
Underhangs / overhangs / caves		Logs with hollows		Termite mounds
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe
Other				
Soil cracks				
Water				
Other (e.g. food trees):				
Disturbances				
grazing				
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata		
		Str.	Stems/ha	DBH (cm)
		S1	80	N/A
Additional Notes				

Site No. Q3/ RM03-02 Recorder: Rosamund Aisthorpe, Richard Johnson Date 17/01/2013
 Purpose Well Zone Assessments Time 11:19

Locality: (inc. distance/direction to nearest town) "Mt Hope"
 Zone: 55J 0709502 E 7085296 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Callitris glaucophylla</i>
T1	22	20 – 24	S (15)	T1	A	<i>Eucalyptus chloroclada</i>
T2	15	10 – 18	S (30)	T2	D	<i>Callitris glaucophylla</i>
T3				T2	S	<i>Eucalyptus chloroclada</i>
S1	2.5	1.5 – 4.0	S (15)	S1	D	<i>Callitris glaucophylla</i>
S2				S1	A	<i>Indigofera australis</i>
S3				S1	A	<i>Eucalyptus populnea</i>
G	0.4	0.1 – 0.6	D (70)	G	D	<i>Cymbopogon refractus</i>
Structural formation: Woodland						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types: coarse-grained sediments
 Landform: gentle slope
 Soils: deep pale brown loamy sand
 DEHP Mapped RE Code: 11.10.11
 Observed RE Code: 11.10.9 Landzone: 10

Vegetation Short Description

Woodland of *Callitris glaucophylla* with scattered *Eucalyptus chloroclada*; sparse shrub layer dominated by recruit *Callitris*; dense grassy layer dominated by *Cymbopogon refractus*.

Connectivity/Patch Characteristics

large remnant patch

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Opuntia tomentosa (R)

% Weed Cover: <5

EVNT Flora Present:

EVNT Flora Likely:

Field Wpt Code:

Photo Nos.

Additional Flora:					
<i>Corymbia tessellaris</i>					
<i>Acacia leiocalyx</i>					
<i>Brachychiton populneus</i>					
<i>Acacia deanei</i>					
<i>Corymbia clarksoniana</i>					
<i>Aristida caput-medusae</i>					
<i>Lomandra longifolia</i>					
<i>Carissa ovata</i>					
<i>Allocasuarina luehmannii</i>					
<i>Lomandra leucocephala</i>					
<i>Arundinella nepalensis</i>					
<i>Vittadinia dissecta</i>					
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)					
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.					
Rocks - embedded		Boulders		Shrub layer	Ground cover
Rocks - loose		Fallen bark		Leaf litter	Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100					
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark	
Underhangs / overhangs / caves		Logs with hollows		Termite mounds	
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe	
Other					
Soil cracks					
Water					
Other (e.g. food trees):					
Disturbances					
grazing, previous selective logging (<i>Callitris</i>)					
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)			Structure of Woody Strata		
			Str.	Stems/ha	DBH (cm)
NOT RECORDED			T1	384	32
			T2	352	15
			S1	800	0.5 - 3
Additional Notes					

Appendix B: Plant species list, Zone RM03-02

Key: * indicates non-native plant species

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	Other
Apocynaceae	<i>Carissa ovata</i>	Currant Bush	LC		P		P	
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	-			P		
Asteraceae	<i>Epaltes australis</i>	Spreading Nutheads	LC			P		
Asteraceae	<i>Pterocaulon redolens</i>	Fruit Salad Plant	LC			P		
Asteraceae	<i>Vittadinia dissecta</i>	Dissected New Holland Daisy	LC				P	
Cactaceae	<i>Opuntia tomentosa</i> *	Velvety Tree Pear	-		P		P	
Caesalpiniaceae	<i>Senna artemisioides</i> subsp. <i>zygophylla</i>	Butter Bush	LC			P		
Capparaceae	<i>Capparis lasiantha</i>	Nipan	LC			P		
Casuarinaceae	<i>Allocasuarina luehmanna</i>	Bulloak	LC		P		P	
Casuarinaceae	<i>Casuarina cristata</i>	Belah	LC			P		
Chenopodiaceae	<i>Maireana microphylla</i>	Cotton Bush	LC			P		
Chenopodiaceae	<i>Sclerolaena birchii</i>	Galvanised Burr	LC			P		
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC		P		P	
Fabaceae	<i>Indigofera australis</i>	Austral Indigo	LC				P	
Juncaceae	<i>Juncus usitatus</i>	Common Rush	LC					P
Laxmanniaceae	<i>Lomandra leucocephala</i>	Woolly-headed Mat-rush	LC				P	
Laxmanniaceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	LC				P	
Malvaceae	<i>Sida hackettiana</i>	Spiked Sida	LC			P		
Mimosaceae	<i>Acacia deanei</i>	Deane's Wattle	LC		P		P	
Mimosaceae	<i>Acacia excelsa</i>	Ironwood	LC		P			
Mimosaceae	<i>Acacia leiocalyx</i>	Early Flowering Black Wattle	LC				P	
Myoporaceae	<i>Eremophila mitchellii</i>	False Sandalwood	LC		P			
Myrtaceae	<i>Corymbia clarksoniana</i>	Clarkson's Bloodwood	LC				P	
Myrtaceae	<i>Corymbia tessellaris</i>	Carbeen, Moreton Bay Ash	LC				P	
Myrtaceae	<i>Eucalyptus chloroclada</i>	Baradine Red Gum	LC				P	
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	LC		P			
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		P	P	P	
Poaceae	<i>Aristida caput-medusae</i>	Many-headed Wiregrass	LC				P	
Poaceae	<i>Aristida</i> sp. (infertile)	A Wiregrass	LC		P	P		
Poaceae	<i>Arundinella nepalensis</i>	Reedgrass	LC				P	
Poaceae	<i>Bothriochloa decipiens</i>	Pitted Bluegrass	LC			P		
Poaceae	<i>Cymbopogon refractus</i>	Barbed-wire Grass	LC				P	
Poaceae	<i>Cynodon dactylon</i> *	Couch Grass	-					P
Proteaceae	<i>Grevillea striata</i>	Beefwood	LC		P			
Proteaceae	<i>Hakea lorea</i>	Bootlace Oak	LC		P			
Rubiaceae	<i>Psydrax johnsonii</i>	Brigalow Canthium	LC		P			

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Q3	Other
Rubiaceae	<i>Psidium oleifolia</i>	Myrtle Tree	LC			P		
Rutaceae	<i>Geijera parviflora</i>	Wilga	LC		P	P		
Sapindaceae	<i>Alectryon oleifolius</i>	Boonaree, Rosewood	LC		P			
Sapindaceae	<i>Atalaya hemiglauca</i>	Whitewood	LC		P			
Sterculiaceae	<i>Brachychiton populneus</i>	Kurrajong	LC/TAR		P		P	

Well Lease Area/Infrastructure Zone Assessment Report: Mt Hope Zone RM02-05

Compiled by Boobook for Santos

Boobook
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

Revision	Date	Description	Author	Verifier	Approved
A	6/2/2013	Draft issued to client for review	RJ	CE	CE
B	23/5/2013	Incorporating client comment and amended zone	RJ & RA	CE	CE
0	4/6/2013	Final submitted to client	RJ	CE	CE

1. Abbreviations

Table 1: Abbreviations

Abbreviation	Description
DBH	Diameter at breast height
DEHP	Department of Environment and Heritage Protection
DSEWPac	Department of Sustainability, Environment, Water, Population and Communities
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EVNT	Endangered, Vulnerable or Near Threatened
GLNG	Gladstone Liquefied Natural Gas
NC Act	<i>Nature Conservation Act 1992</i>
RE	Regional Ecosystem
TAR plant	Type A Restricted Plant
TEC	Threatened Ecological Community
VM Act	<i>Vegetation Management Act 1999</i>
WoNS	Weeds of National Significance

Conclusions drawn in this report are based on available information at the time of writing. Any additional information may alter such conclusions and the author reserves the right to do so if such information becomes available. This report has been made as at the date of the report and is not to be used after six (6) months and not if there are any material changes meanwhile. In either event it should be referred back for review. To the extent permitted by law BOOBOOK does not accept liability for any loss or damage which any person may suffer arising from any negligence or breach of contract on its part. This report was prepared for the benefit of the party to whom it is directed only and for the purpose identified within. BOOBOOK does not accept responsibility to any other person for the contents of the report.

2. Introduction

2.1 Purpose & Scope

Boobook was commissioned by Santos to undertake ecological assessments on a number of well leases and infrastructure zones (hereafter individually referred to as the Zone) located on the property 'Mt Hope' located about 40km north-east of Roma, south central Queensland. Boobook was requested to undertake the following:

- Perform a quaternary vegetation assessment for each regional ecosystem (RE) and non-remnant vegetation present within the Zone;
- Estimate stem density and percentage foliage cover of the dominant species in each woody stratum present in the assessment site;
- Comment on the nature and location of wetlands and watercourses within 100m of the Zone;
- Provide location and description of any plants of conservation concern listed in the NC Act or EPBC Act;
- Location and characteristics of any type A restricted (TAR) plants (NC Act) in the Zone; and
- Location and characteristics of habitat trees in the Zone, with reference to trees previously mapped by Santos.

An individual report was to be prepared for each Zone. This report refers to Zone RM02-05 located on Lot 83 on Plan WV763.

Changes to the boundaries of this Zone were made by Santos following completion of the ecological assessment described in this report for the Zone (Figure 1). Modifications of this infrastructure Zone were considered to be either minor in extent and/or involving areas where the ecological values were previously assessed on-site or nearby. Although the risk is acceptably small it is possible that some ecological values of the modified Zone may not have been documented. Based on professional judgement the modified zones are highly unlikely to contain populations of threatened flora or significant fauna habitat features. However, the presence of TAR plants, especially seedlings, cannot be ruled out.

2.2 Survey Team

The project supervisor (Craig Eddie) was approved by 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.

The field survey described by this report was undertaken by Boobook on 16th January 2013 and was conducted by Richard Johnson (Senior Ecologist) and Rosamund Aisthorpe (Graduate Botanist). The following report was compiled by Richard Johnson and Rosamund Aisthorpe. All aspects of the project including field survey and reporting were conducted under the supervision of Craig Eddie (Principal Ecologist and Project Supervisor).

Any collections of endangered, vulnerable, near threatened (EVNT) and least concern flora protected under the NC Act were conducted in accordance with Scientific Purposes Permit

WISP11669312 issued to Craig Eddie as the representative for Boobook Enterprises Pty. Ltd. This permit is valid from 13 August 2012 to 12 August 2017.

3. Methodology

3.1 Desktop & Literature Review

A comprehensive desktop search was not required by the client for the purposes of this report. However, a desktop search was undertaken for RE at the property scale using mapping version 6.1 (DEHP 2013). This dataset provides a baseline for subsequent field assessment.

The search was conducted using a 5km buffer around the coordinate -26.3558°S, 149.0847°E (datum GDA94) which corresponds to the approximate centre point of the property.

3.2 Field Survey

Vegetation structure and species composition was assessed during a walking traverse of the Zone. Detailed descriptions of vegetation were compiled at representative assessment locations within the mapped Zone. A representative site was selected for each regional ecosystem present. In the case of non-remnant vegetation, a site considered representative of non-remnant vegetation structure within the Zone was selected. Because non-remnant areas in the Zone may vary in plant species composition (for example, where these areas would have formerly supported more than one regional ecosystem) species present in the Zone but not recorded at the survey site(s) were noted and included in a cumulative plant list for the Zone.

Locations of each survey site are shown in Figure 1. All of these assessments were consistent with the quaternary level of detail as per Neldner *et al.* (2012).

Quaternary assessments are those sites where all location, environmental (landform, substrate) and overall vegetation structure and species composition was recorded. Abundance of all dominant species in each layer was recorded. A list of additional species present at each site was also obtained (i.e. species that were not dominant were also recorded as being present but their abundance was not rated). Species names for flora follow Bostock and Holland (2010). The location of each survey site was determined using a handheld GPS unit (Garmin GPSmap 78S). The datum for all GPS co-ordinates quoted within this report is GDA94. When referred to within this report the sites are identified alphanumerically using a prefix Q, e.g. Q1. At each quaternary site the following was recorded:

1. height (median and maximum/minimum) of each stratum of vegetation (i.e. ground, shrub, tree and emergent layers);
2. dominant flora in each stratum of vegetation;
3. structural formation type codes (Neldner *et al.* 2012: Table 29);
4. RE type mapped;
5. RE type observed;
6. broad geology type;
7. landform type;
8. broad soil type;
9. connectivity/patch characteristics (i.e. whether the isolated or degree of connectivity to surrounding vegetation);
10. presence and abundance of weeds (declared and non-declared species) as well as estimated % coverage of the site;

11. presence of EVNT flora;
12. a list of all other flora encountered at the Site; and
13. disturbance types (e.g. clearing, grazing, fire history, pest animal diggings): categories as per Neldner *et al.* (2012) with some minor modification to suit local variables.

Quaternary assessment report sheets are presented in Appendix A. The assessment descriptions provide a snapshot of the species present during the inspection, but do not represent a complete inventory of the native flora and weeds present at the location. Subsequent visits would be necessary over a range of seasons to compile a more detailed inventory of species present. Despite these limitations, sufficient information was collected to assess the status, condition and composition of vegetation communities within the study area.

Additionally, for the dominant species in each woody stratum (trees, shrubs) present at the survey site an estimate was made of stem density and mean diameter at breast height (DBH). Stem density is expressed as the number of stems per hectare and is derived by extrapolation of counts from one or more 20m x 50m or 25m x 25m quadrats within the site. DBH was measured or estimated and is given as a median value except in the case where the dominant plants formed a low shrub stratum in which some stems in the stratum failed to reach breast height. In this case a minimum-maximum range with a zero minimum value is used.

A search was made within the Zone for TAR plants: If found, the location was established with a hand-held GPS unit and the species, height, DBH and possible management options were recorded.

Where mapping supplied by Santos indicated the presence of habitat trees, a search was made for these. If found the location was established with a hand-held GPS unit and the species, height, DBH and habitat value(s) were recorded. In some instances unmapped habitat trees were located during the site survey and data was collected for these trees also.

The presence of any wetlands or watercourses within 100m of the Zone was recorded.

Representative photographs were taken at each quaternary survey site in the Zone, as well as at any wetlands or watercourses, habitat trees or TAR plants.

4. Results & Discussion

4.1 Vegetation Assessment

4.1.1 DEHP Regional Ecosystem Mapping

No remnant REs are mapped as present in the Zone.

4.1.2 Regional Ecosystems Observed

No remnant REs were observed in the Zone.

4.1.3 Threatened Ecological Communities Observed

No threatened ecological communities (TECs) were observed in the Zone.

4.1.4 Non-remnant Vegetation Observed

The Zone is almost entirely vegetated by a shrubland of regrowth that has occurred after mechanical disturbance (pulling) of regrowth from earlier clearing event(s) (see Appendix A: Q1/RM02-05). The floristics and structure of the dominant species in each stratum at survey site Q1/RM02-05 is shown in Table 2. Representative images of the sites are shown at Figures 2a, 2b.

Additionally, a very small patch of Brigalow (*Acacia harpophylla*)-dominated vegetation is present in the Zone (see Q2/RM02-05: Appendix A); this is illustrated at Figure 2b. The patch is floristically and structurally equivalent to RE 11.9.5 (*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks) (endangered). However, the patch area is about 400m²: this is less than both the remnant vegetation threshold for DEHP RE mapping at 1:100,000 scale (Neldner *et al.* 2012) and the minimum area for TEC status under the EPBC Act (DSEWPC 2013). It is included in Table 2 to flag its presence, should it be considered desirable to manage impacts on the patch.

Table 2: Floristics and Structure of Vegetation at Survey Sites in Zone RM02-05

Site	Location	Vegetation Description		
Q1/RM02-05	55J 706179E 7085410N	Shrubland (regrowth) of <i>Eucalyptus melanophloia</i> , <i>E. populnea</i> , <i>Eremophila mitchellii</i> , <i>Acacia deanei</i> ; dense ground layer of native perennial grasses dominated by <i>Aristida</i> sp.		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	8	1	16	18
S1	1.6	15	3000	0-2
Site	Location	Vegetation Description		
Q2/RM02-05	55J 706475E 7085165N	<i>Acacia harpophylla</i> open forest; a shrub layer dominated by <i>Geijera parviflora</i> ; grassy layer of several native perennials dominated by <i>Ancistrachne uncinulata</i>		
Stratum	Median height (m)	% foliage cover	Stems/ha	DBH (cm)
T1	11	50	875	20
S1	2.5	30	750	4

4.2 Additional Observations

4.2.1 EVNT and Additional Flora Species

No EVNT flora was encountered in the Zone. Flora species additional to those encountered at the two survey sites (see Appendix A) included an individual Kurrajong (*Brachychiton populneus*), a TAR plant (see below). Three wetland-associated species were also recorded in small watercourses: Common Rush (*Juncus usitatus*), Couch Grass (*Cynodon dactylon*) and Long-leaved Matrush (*Lomandra longifolia*). Approximately 39 species of native flora were detected (Appendix B). In addition, six non-native species were recorded. Two of these, Velvety Tree Pear (*Opuntia tomentosa*) and Common Pest Pear (*O. stricta*), are declared class 2 weeds scheduled under the *Land Protection (Pest and Stock Route Management) Regulation 2003* and Weeds of National Significance (WoNS).

4.2.2 Type A Restricted Plants

Table 3 shows the location, species and characteristics of TAR plants detected within the Zone. Images of the plants are shown in Figure 3.

Table 3: TAR Plants recorded in Zone RM02-05

Waypoint	Location	Species	Height (m)	DBH (cm)	Management
BP1/RM02-05	55J 706447E 7085214N	<i>Brachychiton populneus</i>	0.5	n/a	Translocation possible
BR1/RM02-05	55J 706492E 7085163N	<i>Brachychiton rupestris</i>	0.9	n/a	Translocation possible
BR1/RM02-05	55J 706492E 7085163N	<i>Brachychiton rupestris</i>	1.0	n/a	Translocation possible

4.2.3 Fauna Habitat Features

No habitat trees or significant fauna habitat features were detected within the Zone.

4.2.4 Wetlands and Watercourses

Two gullies are present in the Zone. These are considered to be drainage features, because the lack of riparian vegetation and defined bed and banks indicates they are not watercourses (*Water Act 2000*). Additionally, they meet the definition of a drainage feature according to the Act because they are likely to be only capable of flowing during and immediately after rainfall, for a short period and do not have enough continual flow to maintain a riparian ecosystem.

Location and characteristics are shown in Table 4. Images are shown in Figures 4a, 4b. No other drainage features or watercourses as defined by the Act were detected in or within 100m of the Zone. No wetlands as defined by the Queensland Wetland Program (DERM 2011) as used in Santos Environmental Authority (Schedules C, M) were detected in or within 100m of the Zone.

Table 4: Wetlands and watercourses detected within Zone RM02-05

Waypoint	Location	Description
W1/RM02-05	55J 706273E 7085346N	Drainage feature: gully crossing the Zone from north to south. Surrounded by regrowth. No apparent vegetation change associated with watercourse. No wetland plant species recorded.

Waypoint	Location	Description
W2/RM02-05	55J 706556E 7085133N	Drainage feature: gully crossing Zone from north to south. To north of Zone gully supports remnant vegetation, possibly equivalent to RE 11.3.39 but not mapped. Cleared across Zone. <i>Juncus usitatus</i> , <i>Cynodon dactylon</i> and <i>Lomandra longifolia</i> present.

5. References

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DSEWPC (2013). Brigalow (*Acacia harpophylla* dominant and co-dominant) in Community and Species Profile and Threats Database, Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available from: <http://www.environment.gov.au/sprat>. Accessed 2013-03-04T10:47:02EST.

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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*. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts, Brisbane.

Water Act 2000. (Queensland), viewed 14 February 2013, <<http://www.legislation.qld.gov.au/legisltn/current/w/watera00.pdf>>

Legend

- Survey Site
- Water Feature
- Habitat Tree
- Type A Restricted Plant
- RM02-05 Assessment Zone
- RM02-05 Additional Zone
- Cadastral Boundary
- Proposed Infrastructure
- Well
- Road Network
- Linear Infrastructure
- Well Lease

Scale: 1:2.920

0 100.0 metres

North Arrow

Q1/RM02-05

W1/RM02-05

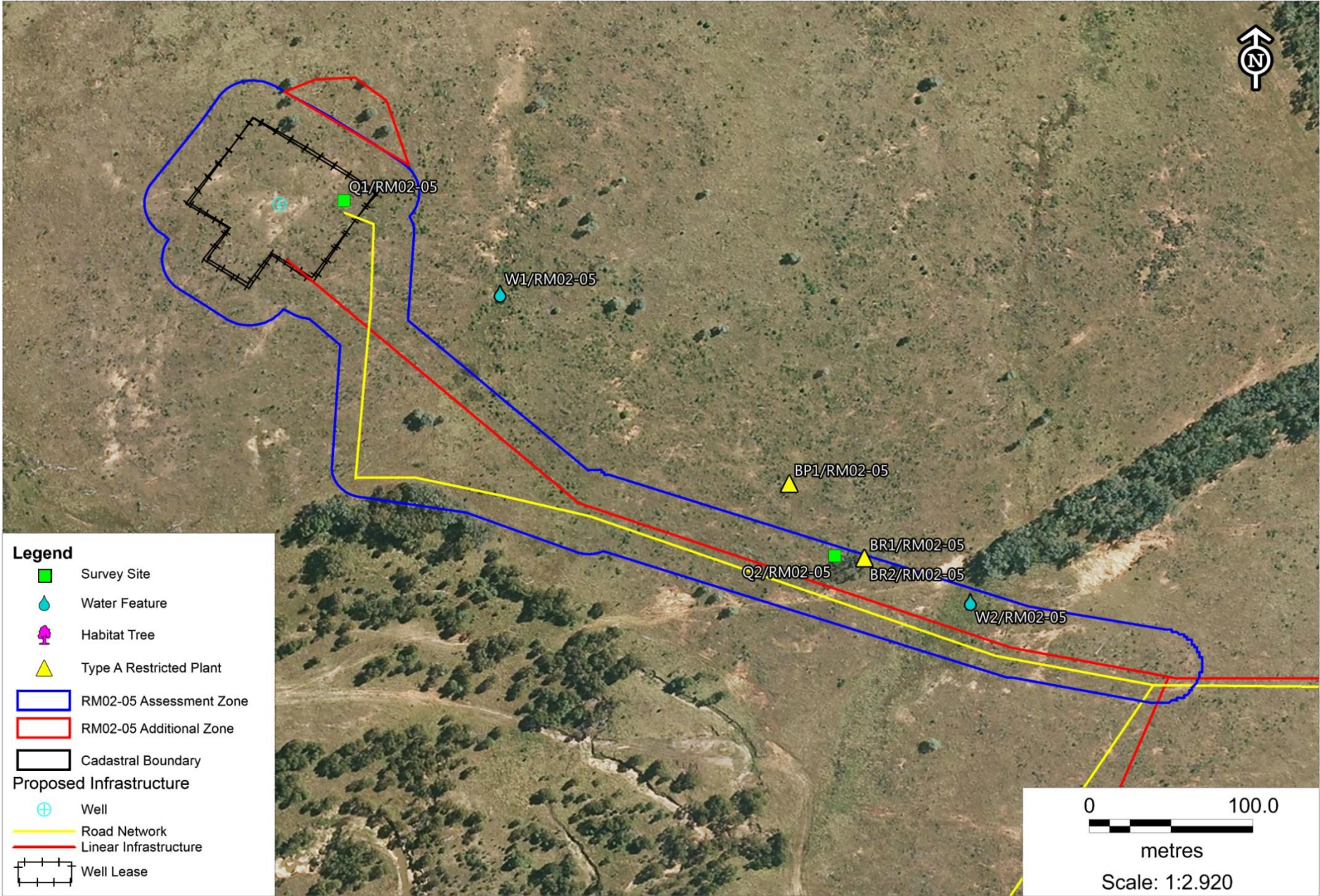
BP1/RM02-05

Q2/RM02-05

BR1/RM02-05

BR2/RM02-05

W2/RM02-05



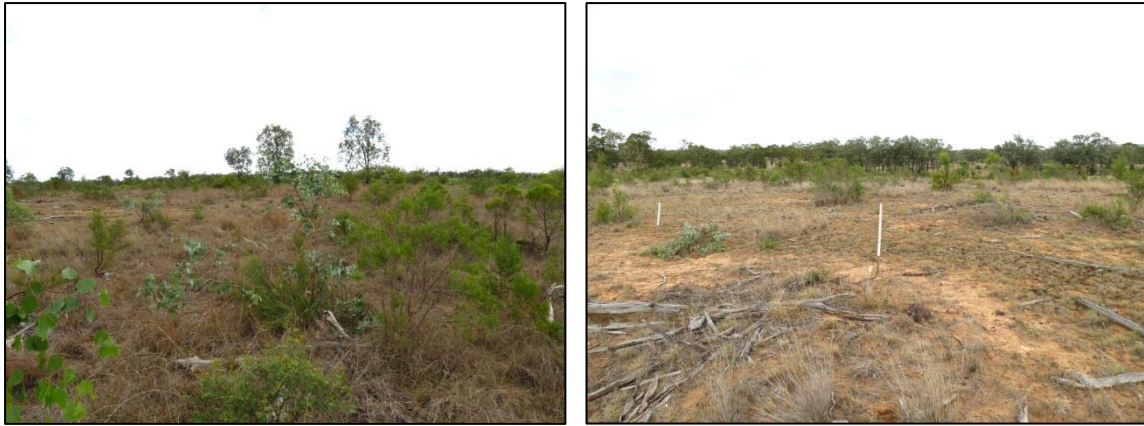


Figure 2a: Shrubland (regrowth) of Silver-leaved Ironbark (*Eucalyptus melanophloia*), Poplar Box (*E. populnea*) and False Sandalwood (*Eremophila mitchellii*) at survey site Q1/RM02-05. Note presence of scattered small Silver-leaved Ironbark trees (left). Some woody debris from earlier clearing is still present (right).



Figure 2b: A small patch of remnant Brigalow (*Acacia harpophylla*) at survey site Q2/RM02-05 (left). Surrounding shrubland (regrowth) includes regenerating Brigalow (right).



Figure 3: Sapling Kurrajong (*Brachychiton populneus*), a TAR plant, in regrowth at location BP1/RM02-05 (left); two Narrow-leaved Bottle Tree (*B. rupestris*) saplings (TAR plants) growing at the base of a dead tree at survey site Q2/RM02-05 (right).



Figure 4a: Drainage line encountered at waypoint W1/RM02-05. Banks of the gully are low and no discernable vegetation change is apparent. Images captured looking upstream (left) and downstream (right).



Figure 4b: Gully encountered at waypoint W2/RM02-05. Upstream and just outside the Zone, a narrow band of remnant vegetation probably attributable to RE 11.3.39 is present (left); downstream, the gully and surrounds are cleared. Note presence of Common Rush (*Juncus usitatus*) and Long-leaved Mat-rush (*Lomandra longifolia*) (right).

Appendix A: Quaternary assessment results, Zone RM02-05

Site No. Q1/ RM02-05 Recorder: Rosamund Aisthorpe, Richard Johnson Date 16/01/2013
 Purpose Well Zone Assessments Time 08:00

Locality: (inc. distance/direction to nearest town) "Mt Hope"

Zone: 55J 0706179 E 7085410 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Eucalyptus melanophloia</i>
T1	8	7 - 9	V (1)	S1	C	<i>E. melanophloia</i>
T2				S1	C	<i>E. populnea</i>
T3				S1	C	<i>Eremophila mitchellii</i>
S1	1.6	0.9 - 2.5	S (15)	S1	C	<i>Acacia deanei</i>
S2				S1	C	<i>Allocasuarina luehmannii</i>
S3				G	D	<i>Aristida</i> sp.
G	0.4	0.1 - 0.8	D (70)	G	S	<i>Themeda triandra</i>
Structural formation: Shrubland				G	S	<i>Enteropogon</i> sp.
Ecologically dominant layer: S1						

Geology, landform, soils

Geology code and rock types: coarse-grained sediments
 Landform: low hill slope
 Soils: light brown sandy loam, rare surface stones and gravel
 DERM Mapped RE Code: NR
 Observed RE Code: NR (ex- 11.10.11) Landzone: 10

Vegetation Short Description

Non-remnant : shrubland (regrowth) of *Eucalyptus melanophloia*, *E. populnea*, *Eremophila mitchellii*, *Acacia deanei*; dense layer of native perennial grasses dominated by *Aristida* sp.

Connectivity/Patch Characteristics

cleared

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Glandularia aristigera (U); *Cirsium vulgare* (R), *Opuntia tomentosa* (R), *Lepidium africanum* (R)

% Weed Cover: <5

EVNT Flora Present:

EVNT Flora Likely:

Field Wpt Code:

Photo Nos. BBK5 3060-3071

Additional Flora:				
<i>Geijera parviflora</i>		<i>Wedelia spilanthoides</i>		
<i>Boerhavia dominii</i>		<i>Acacia decora</i>		
<i>Dianella longifolia</i>		<i>Callitris glaucophylla</i>		
<i>Hakea lorea</i>		<i>Grevillea striata</i>		
<i>Podolepis longipedata</i>				
<i>Pterocaulon redolens</i>				
<i>Jasminum didymum</i>				
<i>Scaevola spinescens</i>				
<i>Hovea longipes</i>				
<i>Carissa ovata</i>				
<i>Maytenus cunninghamii</i>				
<i>Fimbristylis dichotoma</i>				
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)				
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.				
Rocks - embedded		Boulders		Shrub layer
Rocks - loose		Fallen bark		Leaf litter
				Ground cover
				Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100				
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark
Underhangs / overhangs / caves		Logs with hollows		Termite mounds
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe
Other				
Soil cracks				
Water				
Other (e.g. food trees):				
Disturbances				
Treated regrowth (chain-pulled); grazing				
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata		
		Str.	Stems/ha	DBH (cm)
		T1	16	18
		S1	3000	0 - 2
Additional Notes				

Site No. Q2/ RM02-05 Recorder: Rosamund Aisthorpe, Richard Johnson Date 16/01/2013
Purpose Well Zone Assessments Time

Locality: (inc. distance/direction to nearest town) "Mt Hope"
Zone: 55J 0706475 E 7085165 N Datum GDA94

Vegetation structure				Plant species		
Median height of the EDL is to be measured				Record relative (numerical) dominance for each stratum; d – dominant; c – codominant; s - subdominant, a – associated		
Stratum	Median height	Height interval	Est. cover density (D,M,S,V) (%)	Str.	Rel. dom.	Scientific Name
E				T1	D	<i>Acacia harpophylla</i>
T1	11	9 - 12	M (50)	T1	A	<i>Eucalyptus populnea</i>
T2	2.5	1.8 - 3.0	M (30)	S1	S	<i>Eremophila mitchellii</i>
T3				S1	D	<i>Geijera parviflora</i>
S1				S1	S	<i>Carissa ovata</i>
S2				S1	C	<i>A. harpophylla</i> (suckers)
S3				G1	D	<i>Ancistrachne uncinulata</i>
G	0.8	0.1 - 1.0	D (85)	G1	S	<i>Paspalidium</i> sp.
Structural formation: Open forest						
Ecologically dominant layer: T1						

Geology, landform, soils

Geology code and rock types: fine-grained sediments
Landform: low hill slope
Soils: light brown sandy loam
DERM Mapped RE Code: NR (patch size not mappable at 1:100,000 scale)
Observed RE Code: 11.9.5 (surrounded by NR regrowth) Landzone: 9

Vegetation Short Description

Acacia harpophylla open forest : shrub layer dominated by *Geijera parviflora*; grassy layer of several native perennials, dominated by *Ancistrachne uncinulata*

Connectivity/Patch Characteristics

small patch <0.5ha in cleared paddock

Weeds: R = rare (<10 plants observed); U = uncommon (11 – 50 plants observed); C = common = (>50 plants observed)
Opuntia tomentosa (R), *Opuntia stricta* (R)

% Weed Cover: <5

EVNT Flora Present:

EVNT Flora Likely:

Field Wpt Code:

Photo Nos. BBK 3084-89

Additional Flora:				
<i>Maireana microphylla</i>		<i>Marsdenia viridiflora</i>		
<i>Jasminum didymum</i>				
<i>Solanum parvifolium</i>				
<i>Nyssanthus erecta</i>				
<i>Notelaea microcarpa</i>				
<i>Enteropogon ramosus</i>				
<i>Brachychiton rupestris</i>				
<i>Alectryon oleifolius</i>				
<i>Plectranthus parviflorus</i>				
<i>Eremophila debilis</i>				
<i>Dianella</i> sp.				
<i>Austrostipa verticillata</i>				
Fauna Habitat Features – (note coarse/fine woody debris, rocks/boulders, mistletoe, termite mounds, hollows, leaf litter, burrows, shrubs, food trees, loose bark, soil cracks, caves/crevices)				
Density Scores: 0 = 0%; 1 = <25%; 2 = 26-50%; 3 = 51-75%; 4 = 75-99%; 5 = 100%.				
Rocks - embedded		Boulders		Shrub layer
Rocks - loose		Fallen bark		Leaf litter
				Ground cover
				Bare ground
Abundance Scores: 0 = absent; 1 = 1-5; 2 = 6-20; 3 = 21-50; 4 = 51-75; 5 = 76-100; 6 = >100				
Crevices/ledges		Large logs (>30cm diameter)		Trees / logs bearing loose bark
Underhangs / overhangs / caves		Logs with hollows		Termite mounds
Small logs (<30cm diameter.)		Hollow bearing trees		Mistletoe
Other				
Soil cracks				
Water				
Other (e.g. food trees):				
Disturbances				
grazing				
Incidental Fauna Observations (HE= heard, SE= seen, EV= evidence, FO= flying over)		Structure of Woody Strata		
		Str.	Stems/ha	DBH (cm)
		T1	875	20
		S1	750	4
Additional Notes				

Appendix B: Plant species list, Zone RM02-05

Key: * indicates non-native plant species

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Other
Amaranthaceae	<i>Nyssanthes erecta</i>	Barbwire Weed	LC			P	
Apocynaceae	<i>Carissa ovata</i>	Currant Bush	LC			P	
Apocynaceae	<i>Marsdenia viridiflora</i>	Native Pear	LC		P		
Asteraceae	<i>Cirsium vulgare</i> *	Spear Thistle	-		P		
Asteraceae	<i>Podolepis longipedata</i>	Long Podolepis	LC		P		
Asteraceae	<i>Pterocaulon redolens</i>	Applebush, Fruit Salad Plant	LC		P		
Asteraceae	<i>Wedelia spilanthoides</i>	A Daisy	LC		P		
Brassicaceae	<i>Lepidium africanum</i> *	Common Peppercross	-		P		
Cactaceae	<i>Opuntia stricta</i> *	Common Pest Pear	-			P	
Cactaceae	<i>Opuntia tomentosa</i> *	Velvety Tree Pear	-		P	P	
Casuarinaceae	<i>Allocasuarina luehmannii</i>	Bulloak	LC		P		
Celastraceae	<i>Maytenus cunninghamii</i>	Yellowberry Bush	LC		P		
Chenopodiaceae	<i>Maireana microphylla</i>	Cotton Bush	LC				
Cupressaceae	<i>Callitris glaucophylla</i>	White Cypress Pine	LC		P		
Cyperaceae	<i>Fimbristylis dichotoma</i>	Common Fringe-rush	LC		P		
Fabaceae	<i>Hovea longipes</i>	Purple Bush-pea	LC		P		
Goodeniaceae	<i>Scaevola spinescens</i>	Spiny Fan-flower	LC				
Hemerocallidaceae	<i>Dianella longifolia</i>	Smooth Flax-lily	LC		P		
Hemerocallidaceae	<i>Dianella</i> sp. (indet.)	A Flax-lily	LC			P	
Juncaceae	<i>Juncus usitatus</i>	Common Rush	LC				P
Lamiaceae	<i>Plectranthus parvifolius</i>	Cockspur Flower	LC			P	
Laxmanniaceae	<i>Lomandra longifolia</i>	Long-leaved Matrush	LC				P
Mimosaceae	<i>Acacia deanei</i>	Deane's Wattle	LC		P		
Mimosaceae	<i>Acacia decora</i>	Pretty Wattle	LC		P		
Mimosaceae	<i>Acacia harpophylla</i>	Brigalow	LC		P		
Myoporaceae	<i>Eremophila debilis</i>	Winter Apple	LC			P	
Myoporaceae	<i>Eremophila mitchellii</i>	False Sandalwood	LC		P	P	
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver-leaved Ironbark	LC		P		
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	LC		P	P	
Nyctaginaceae	<i>Boerhavia dominii</i>	Tar vine, Hogweed	LC		P		
Oleaceae	<i>Jasminum didymum</i>	A Jasmine	LC		P		
Oleaceae	<i>Notelaea microcarpa</i>	Small-fruited Mock Olive	LC			P	
Poaceae	<i>Ancistrachne uncinulata</i>	Hooky Grass	LC			P	
Poaceae	<i>Aristida</i> sp. (indet.)	A Wiregrass	LC		P		
Poaceae	<i>Austrostipa verticillata</i>	Slender Bamboo Grass	LC			P	
Poaceae	<i>Cynodon dactylon</i> *	Couchgrass	-				P

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	Q1	Q2	Other
Poaceae	<i>Enteropogon ramosus</i>	Twirly Windmill Grass	LC			P	
Poaceae	<i>Enteropogon</i> sp. (infertile)	A Windmill Grass	LC		P		
Poaceae	<i>Paspalidium</i> sp. (indet.)	A Grass	LC			P	
Poaceae	<i>Themeda triandra</i>	Kangaroo Grass	LC		P		
Proteaceae	<i>Grevillea striata</i>	Beefwood	LC		P		
Proteaceae	<i>Hakea lorea</i>	Corkwood Oak	LC		P		
Rutaceae	<i>Geijera parviflora</i>	Wilga	LC		P	P	
Sapindaceae	<i>Alectryon oleifolius</i>	Rosewood	LC			P	
Solanaceae	<i>Solanum parvifolium</i>	Small-leaved Nightshade	LC			P	
Sterculiaceae	<i>Brachychiton populneus</i>	Kurrajong	LC/TAR				P
Sterculiaceae	<i>Brachychiton rupestris</i>	Narrow-leaved Bottle Tree	LC/TAR			P	
Verbenaceae	<i>Glandularia aristigera</i> *	Mayne's Pest	-		P		