Santos Ltd

GLNG Project Roma S3: Stage 2 Environmental Assessments

L1 and N1 (partial) Sub-branch Ecological Assessment Report

June 2014

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Acronyms

Acronym	Definition
CDZ	Construction Disturbance Zone
CWP	Construction Workpack
DEHP	(Queensland) Department of Environment and Heritage Protection
DOE	(Commonwealth) Department of Environment
EA	Environmental Authority
EPBC Act	(Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999*
ESA	Environmentally Sensitive Area
EVNT	Endangered, Vulnerable or Near Threatened
GTP	Gas Transmission Pipeline
NC Act	(Queensland) *Nature Conservation Act 1992*
RE	Regional Ecosystem
RoW	Right of Way
RRRMP	Remediation, Rehabilitation, Recovery and Monitoring Plan
SMP	Species Management Plan
SSMP	Significant Species Management Plan
TEC	Threatened Ecological Community
VAST	Vegetation Assets States and Transitions
VM Act	(Queensland) *Vegetation Management Act 1999*

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1. Introduction

1.1 Background

The L1 and N1 sub-branches are located in the southern extent of the Roma S3 (Phase 2) L1 and N1 Construction Workpacks (CWPs) of the GLNG Project. Power lines, gas and water pipeline right of ways (RoWs) and well pads are proposed for construction within this area.

Stage 2 Environmental Field Assessments were undertaken for selected infrastructure within the L1 and N1 investigation area. Construction footprints within the sub-branches relevant to the current scope of works are comprised of 15 Right of Ways (RoW) and nine proposed well pads (the 'investigation area') (refer Figure 1).

This report presents the results of an ecological assessment of the RoWs and proposed well pads within the L1 sub-branch and part of the N1 sub-branch for the purpose of informing permitting and approvals.

1.2 Report layout

Section 2 provides an overview of the methods used for this assessment.

Section 3 of this report provides, for each RoW or proposed well pad (refer 3.1 and 3.16), a summary of the following environmental features:

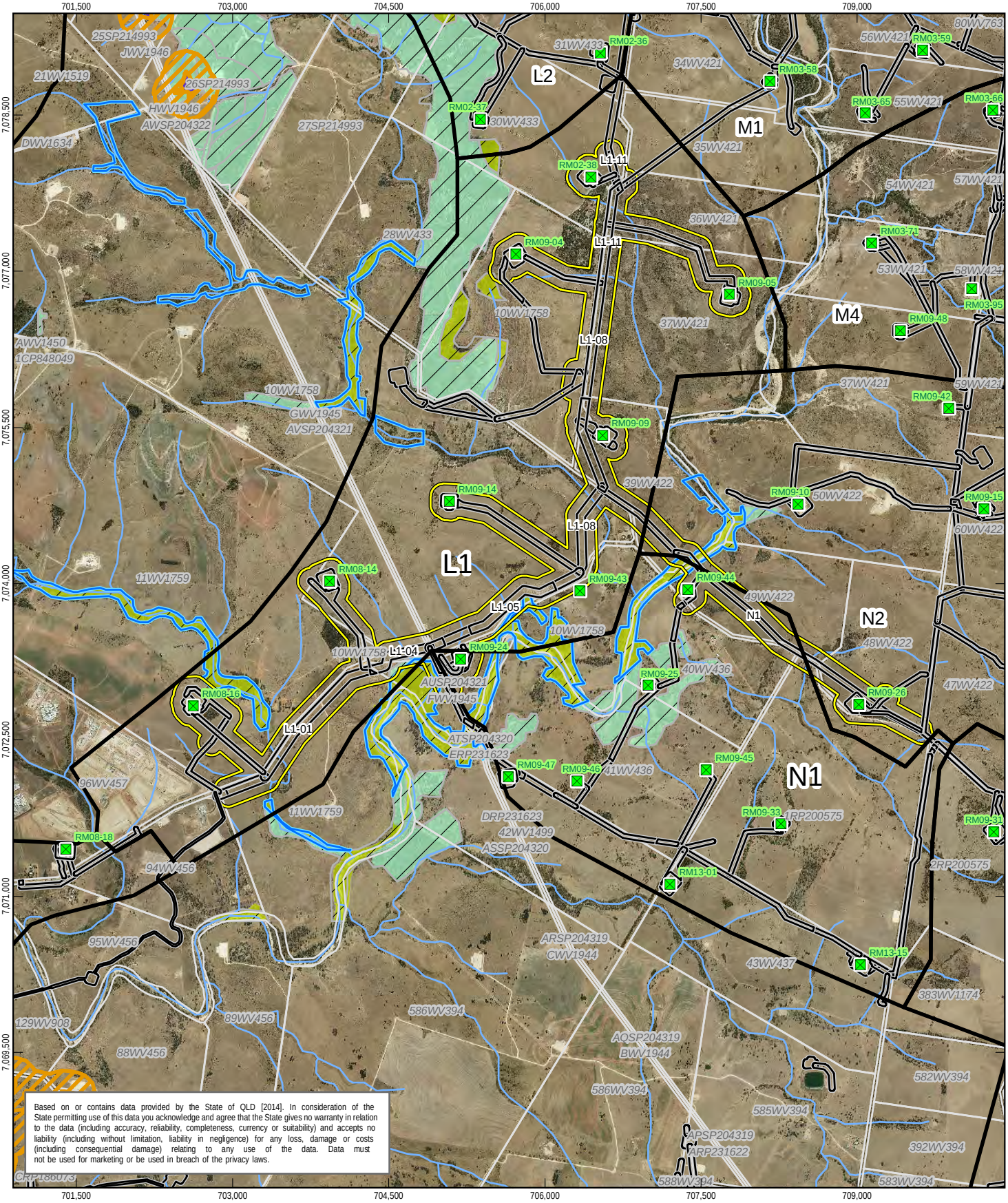
- Regional Ecosystems (REs)
- Threatened Ecological Communities (TECs)
- Vegetation community and habitat values
- Environmentally Sensitive Areas (ESAs)
- Essential habitat
- Threatened species
- Fauna habitat features
- Watercourses
- Wetlands, lakes and springs.

Section 4 provides information on threatened species relevant to the L1 and N1 sub-branches, including habitat mapping and habitat clearing calculations.

Further detail, including species lists and data sheets are provided in the appendices.

1.3 Limitations

Ecological field assessment and reporting is limited to the prescribed investigation area which includes RoWs and proposed well pad footprints, and appropriate assessment buffers. The area for assessment was determined during a workshop with Santos on 13/01/2014. Specifically, the investigation area encompassed a 30 m wide construction disturbance zone (CDZ) for all environmental values plus a 100 m buffer area around the CDZ for watercourses, wetlands, lakes and springs only. Ecological values within the L1 and N1 sub-branches that are outside of the investigation area were not assessed as part of this scope of works.



LEGEND

- Well Pad
- Watercourse
- Gathering Network Sub-branch
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Essential Habitat (BPA)
- Referable Wetlands
- Cadastre
- Regional Ecosystem (BD)
  - Endangered dominant
  - Of Concern dominant
  - Not of Concern
- Environmentally Sensitive Area
  - Category B - Primary

1:50,000 (@ A4)

0 500 1,000 1,500

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

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Santos GLNG Project

Santos GLNG
L1 and N1 Ecological Assessments

L1 and N1 Investigation Area Overview

Job Number	41-27312
Revision	0
Date	06 Jun 2014

Figure 1

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145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Regional Ecosystems, Essential Habitat, Imagery, ESA/Supplied October 2013, Well Pad, Construction Disturbance Zone, Referred Wetlands/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos)/2014. Created by: AF

2. Methodology

Desktop and field ecological assessments of RoWs, proposed well pads and associated assessment buffers were undertaken within the Roma S3 gas fields. Assessments were undertaken for infrastructure in accordance with the Santos Methodology. All desktop and field assessments were undertaken in accordance with the Santos GLNG Upstream Methodology for Undertaking Environmental Assessments (Santos document number: 6300-650-SPE-0002, Rev 1 dated 16/08/2013) (Santos Methodology). The field assessments were undertaken from 20 to 23 January 2014.

Ecological features assessed under the Santos Methodology and types of assessments undertaken within the sub-branch infrastructure included:

- Environmentally sensitive areas – assessed within RoW and well pad footprints by quaternary vegetation assessments (Neldner *et al*. 2012)
- Regional ecosystems – assessed within RoW and well pad footprints by quaternary vegetation assessments (Neldner *et al*. 2012) and the Vegetation Assets States and Transitions (VAST) methodology for assessing vegetation condition.
- Threatened Ecological Community assessments - assessed within RoW and well pad footprints by quaternary vegetation assessments (Neldner *et al*. 2012)
- Vegetation community assessments – assessed for infrastructure groups from criteria defined in the Roma Shallow Gas Project Area Environmental Authority (EPPG00898213), Schedule D – Land
- Mapped watercourses – assessed within 100 m of RoW and well pad footprints by the Works Within a Watercourse Assessment Checklist and Fluor/Santos Works Within a Watercourse Assessment and Approvals manual (document number: 6300-110-PRC-10104-FLR02-GENL Rev B)
- Wetlands, lakes and springs – assessed within 100 m of RoW and well pad footprints by the Wetland Rapid Assessment Checklist and the Procedure for Conducting Wetlands Assessments (document number: 3301-GLNG-4-1.3-0016) and Guideline for Conducting Wetlands Assessments (document number: 3301-GLNG-4-1.3-0017)
- General fauna habitat assessments – assessed within RoW and well pad footprints by habitat and condition assessments and by using the Santos Habitat Mapping Assessment Tool (Eyre *et al*. 2012)
- Essential habitat (mapped under the *Vegetation Management Act 1999*) – assessed within RoW and well pad footprints by targeted species searches
- Fauna habitat features and potential breeding places – type and location recorded within each RoW and well pad footprint

- Targeted threatened species searches – assessed within RoW and well pad footprints for flora and fauna species listed as endangered, vulnerable or near threatened (EVNT) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Nature Conservation Act 1992* (NC Act). Survey methods undertaken were appropriate for each targeted flora and fauna species as identified within relevant species survey guidelines published by the Department of the Environment (DOE) and/or the Department of Environment and Heritage Protection (DEHP). Survey techniques included:
  - Random meander transects (Cropper 1993) for threatened flora species
  - Diurnal active searches
  - Remote camera detection
  - Anabat deployment
  - Diurnal bird surveys
  - Spotlighting – driving and walking transects
  - Call playback
  - Incidental species observations
- Koala habitat assessments and surveys– presence/absence of koala habitat assessed within RoW and well pad footprints by collecting information on koala population and habitat information outlined in Interim koala referral advice for proponents (DSEWPaC 2012), including:
  - Koala habitat assessment: determining habitat critical to the survival of the koala including lists of primary and secondary food tree species.
  - Koala survey: undertaking koala surveys using the techniques outlined in Policy 4 (page 72) of the *Nature Conservation (Koala) Conservation Plan 2006 and Management Program 2006-2016* and for koala utilisation and frequency (faecal pellet surveys) using the spot assessment technique (Phillips & Callaghan 2011)

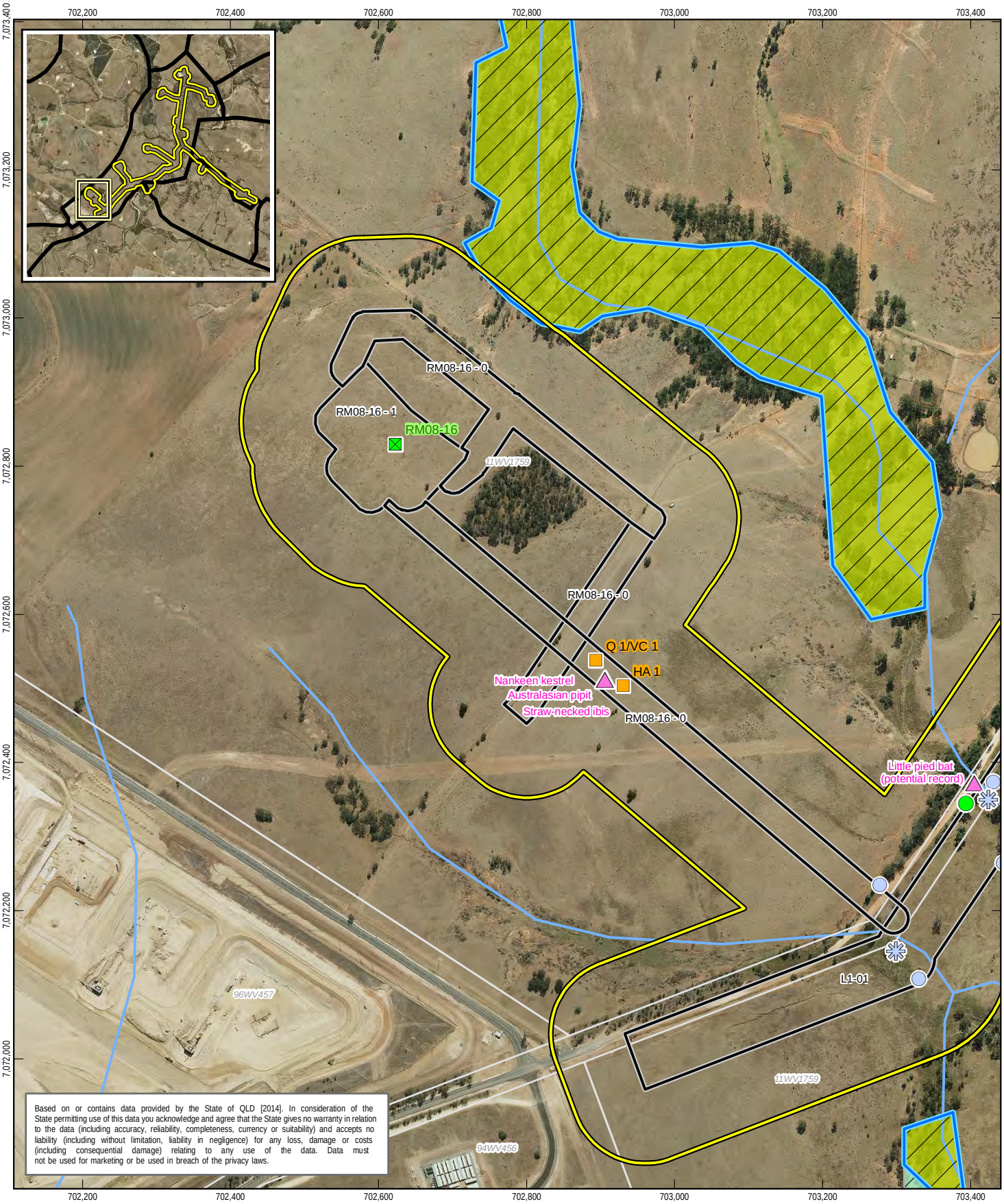
3. Ecological assessment results

3.1 L1 sub-branch overview

The result of the ecological assessment of the RoWs and proposed well pads within the L1 sub-branch has been presented for infrastructure in the following sections:

- Section 3.2 – RM 08-16 infrastructure area
- Section 3.3 – RM 08-14 infrastructure area
- Section 3.4 – RM 09-24 infrastructure area
- Section 3.5 – RM 09-43 infrastructure area
- Section 3.6 – RM 09-14 infrastructure area
- Section 3.7 – RM 09-09 infrastructure area
- Section 3.8 – RM 09-04 infrastructure area
- Section 3.9 – RM 09-05 infrastructure area
- Section 3.10 – RM 02-38 infrastructure area
- Section 3.11 – L1-01 sub-branch infrastructure area
- Section 3.12 – L1-04 sub-branch infrastructure area
- Section 3.13 – L1-05 sub-branch infrastructure area
- Section 3.14 – L1-08 sub-branch infrastructure area
- Section 3.15 – L1-11 sub-branch infrastructure area

Each of the above sections are preceded by a figure showing the location of the infrastructure, together with documented environmental features.



LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Notable Fauna Species
- Watercourse Assessment Site
- Type A Restricted Plant Site
- Brachychiton populneus
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Referable Wetlands
- Essential Habitat (BPA)
- Cadastre
- Regional Ecosystem (BD)
- Of Concern dominant
- Not of Concern

1:7,000 (@ A4)

0 50 100 150 200

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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L1 and N1 Ecological Assessments

Proposed RM 08-16
Infrastructure Area

Job Number	41-27312
Revision	0
Date	06 Jun 2014

Figure 2

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145 Ann St Brisbane QLD 4000 Australia **T** 61 7 3316 3000 **F** 61 7 3316 3333 **E** bnemail@ghd.com **W** www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Regional Ecosystems, Essential Habitat, Imagery, Referred Wetlands/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Notable Flora Species, Notable Fauna Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.2 Proposed RM 08-16 infrastructure area

3.2.1 Summary for the RM 08-16 infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Absent
ESAs	Present within 1 km	**Wetlands**	Absent
Essential habitat	Absent		

3.2.2 Regional ecosystems

No REs are mapped as present within the RM 08-16 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 2 (Q 1).

Approval requirement or further action

None

3.2.3 Threatened ecological communities

No TECs are mapped as present within the RM 08-16 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 2 (Q 1).

Approval requirement or further action

None

3.2.4 Vegetation communities and habitat values

The following vegetation community occurs within the RM 08-16 infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.2.11. Field validation points for vegetation communities and habitat values are shown on Figure 2 (VC 1, HA 1).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project Remediation, Rehabilitation, Recovery and Monitoring Plan, Coal Seam Gas Fields (Document number: 0020-GLNG-4.1.3-0012) (RRRMP) (RPS 2011).

3.2.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the RM 08-16 infrastructure area. However, two Category C ESAs and their primary protection areas are mapped within 1 km of the RM 08-16 infrastructure area, namely:

- An RE mixed polygon containing two of concern REs (RE 11.5.25/11.3.2)
- A referable wetland

Note that the primary protection zones of these Category C ESAs overlap with the disturbance footprint of the well pad.

The mapped Category C ESAs are located outside of the investigation area and were therefore not field validated as part of the current ecological assessment.

Approval requirement or further action

Only limited petroleum activities are permitted within the primary protection zone of Category C ESAs as per the Environmental Authority (EA) conditions. A number of conditions outlined in the EA (Schedule E15) must be met prior to carrying out limited petroleum activities.

3.2.6 Essential habitat

No essential habitat mapped under the *Vegetation Management Act 1999* (VM Act) is present within the RM 08-16 infrastructure area.

Approval requirement or further action

None

3.2.7 Threatened species

No threatened flora species were recorded within the RM 08-16 infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the RM 08-16 infrastructure area is presented in Table 15, Appendix A. The likelihood of occurrence assessment identified one threatened flora species that has the potential to occur within the infrastructure area.

No threatened fauna species were recorded from field assessments of the RM 08-16 infrastructure area.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.2.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the RM 08-16 infrastructure area (refer Section 3.2.11). Locations of these features are mapped on Figure 2 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.2.9 Watercourses

No watercourses are mapped or were confirmed present within the RM 08-18 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.2.10 Wetlands, lakes and springs

No wetlands are mapped or were confirmed present within the RM 08-16 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.2.11 RM 08-16: Vegetation community and habitat summary

Vegetation community description – Baseline data																							
Site:	Q 1/VC 1/HA 1	**Recorder:**	JN, PW LM	**Date:**	20/01/2014	**Time:**	0800																
Project:	L1 ecological field surveys			**Photos:**	N: 539 E: 536 S: 537 W: 538																		
Locality:	RM08-16			**Property (lot/plan):**	Tantatton (11WV1759)																		
Coordinates:	**Zone:**	5	5		7	0	2	8	9	4		7	0	7	2	5	3	7					
Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses.																							

Vegetation Structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1		-	
T2		-	
T3		-	
S1	2	1-3.5	V
S2		-	
G	0.7	0-0.8	D

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: G

Land form element (40 m radius): Gentle slope

Land form pattern (300 m radius): Low undulating hills

Soil and geology: Dark brown sandy loam

Slope and aspect: <10°, East

Vast: III

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
S1	d	*Atalaya hemiglauca*

Str.	Rel. dom.	Scientific Name
S1	d	*Acacia oswaldii*
G	d	*Cenchrus ciliaris**
G	a	*Chloris ventricosa*
G	a	*Melinis repens**
G	a	*Enneapogon nigricans*
G	a	*Sporobolus caroli*
G	a	*Portulaca oleracea**
G	a	*Sporobolus* sp.
G	a	*Digitaria ciliaris*
G	a	*Bothriochloa pertusa**
G	a	*Maireana microphylla*
G	a	*Pycnosorus globosus*
G	a	*Salsola kali*
G	a	*Aristida lignosa*
G	a	*Fimbristylis dichotoma*
G	a	*Sclerolaena tetracuspis*
G	a	*Verbena aristigera**
G	a	*Abutilon* sp.

**Denotes exotic species*

Ground cover and organic litter (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	12.8
Native herbs/forbs (non-grass)	0.4
Native shrubs (<1 m high))	0.0
Non-native grass	41.0
Non-native herbs and shrubs	0.6
Litter (woodies <10 cm diameter, dead annuals, etc)	6.0
Litter (logs >10 cm diameter)	0.0
Rock	19.2
Bare ground	20.0

Fauna habitat features (within 0.5 ha area)	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	0
Coarse leaf litter (>2 cm diameter)	0
Fine leaf litter (<2 cm diameter)	0
Bare ground	5
Grass	6
Soil cracks	1
Stones (20-60 cm)	2
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
E	n/a
T1	n/a
T2	n/a
S1	0.0
S2	n/a
G	n/a
Species	
None	

Vegetative density	
Strata	**Stem count (0.5 ha area)**
E	n/a
T1	n/a
T2	n/a
S1	20
S2	n/a
G	n/a
Species	
S1	
Acacia oswaldii	20

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Habitat features included a single hollow in tree
Potential habitat for EVNT fauna species (including essential habitat):

Koala habitat
Survey area not koala habitat due to non-remnant vegetation and absence of suitable koala food trees.

Disturbances (eg grazing, clearing, ploughing etc.)
Clearing and grazing
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.):
Survey area consists of large area of non-remnant vegetation with small patches of mature/ remnant vegetation. Small patches of remnant vegetation are present as isolated patches or narrow linear corridors within non-remnant landscape. Survey area represents low value habitat, with small patches of remnant vegetation representing higher habitat value within the landscape context.

Declared weeds and introduced species
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Velvety tree pear[1] (*Opuntia tomentosa*), R; buffel grass (*Cenchrus ciliaris*), C; Mayne's pest (*Verbena aristigera*), C; Indian bluegrass (*Bothriochloa pertusa*)
Total percentage weed cover: velvety tree pear[1]. 2%; buffel grass, 39%; Indian bluegrass, 2% Mayne's pest, 1%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
None present

Incidental fauna observations
apostlebird, Australasian pipit, Australian raven, Beccari's freetail bat, crested pigeon, eastern freetail bat, galah, Gould's wattled bat, little broad-nosed bat, magpie-lark, noisy miner, rabbit, red winged parrot red-necked wallaby, straw-necked ibis, sulphur-crested cockatoo, Torresian crow, wedge-tailed eagle weebill, western broad-nosed bat, whistling kite, white-striped freetail bat, yellow-bellied sheathtail-bat

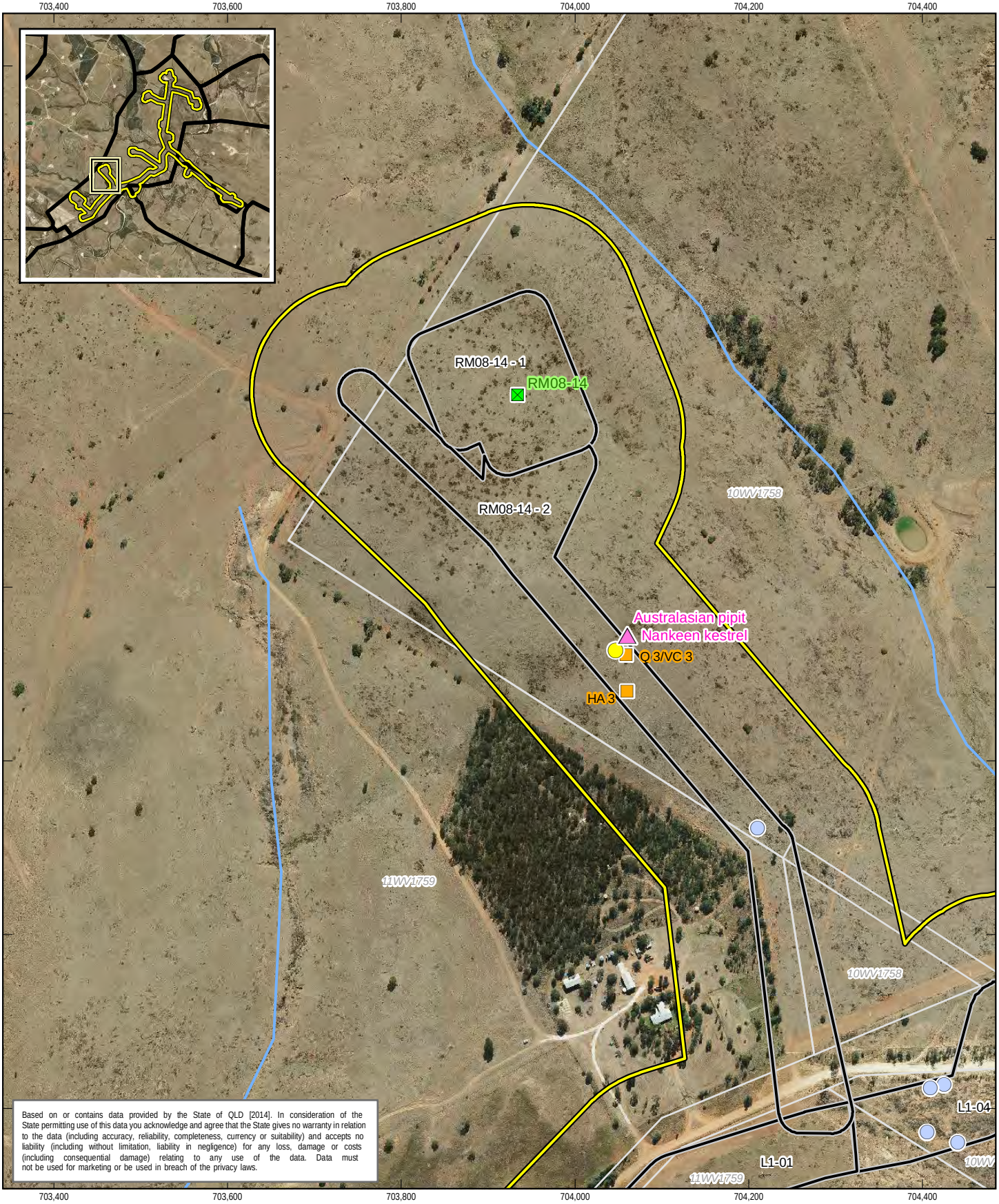
Representative photos for the RM 09-16 infrastructure area

North

East

South

West



LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Notable Fauna Species
- Type A Restricted Plant Site
- Brachychiton rupestris
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Cadastre

1:6,000 (@ A4)

0 50 100 150 200

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Santos GLNG
L1 and N1 Ecological Assessments

Proposed RM 08-14
Infrastructure Area

Job Number 41-27312
Revision 0
Date 06 Jun 2014

Figure 3

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145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Imagery/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Notable Flora Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.3 Proposed RM 08-14 infrastructure area

3.3.1 Summary for the RM 08-14 infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Absent
ESAs	Present within 1 km	**Wetlands**	Absent
Essential habitat	Absent		

3.3.2 Regional ecosystems

No remnant REs are mapped as present within the RM 08-14 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 3 (Q 3).

Approval requirement or further action

None

3.3.3 Threatened ecological communities

No TECs are mapped as present within the RM 08-14 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 3 (Q 3).

Approval requirement or further action

None

3.3.4 Vegetation communities and habitat values

The following vegetation community occurs within the RM 08-14 infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.3.11. Field validation points for vegetation communities and habitat values are shown on Figure 3 (VC 3, HA 3).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.3.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the RM 08-14 infrastructure area. However, two Category C ESAs and their primary protection areas are mapped within 1 km of the RM 08-14 infrastructure area, namely:

- An RE mixed polygon containing two of concern REs (RE 11.3.25/11.3.2)
- A referable wetland

Note that the primary protection zones of these Category C ESAs overlap with the disturbance footprint of the well pad.

The mapped Category C ESAs are located outside of the investigation area and were therefore not field validated as part of the current ecological assessments.

Approval requirement or further action

Only limited petroleum activities are permitted within the primary protection zone of Category C ESAs as per the EA conditions. A number of conditions outlined in the EA (Schedule E15) must be met prior to carrying out limited petroleum activities.

3.3.6 Essential habitat

No VM Act-mapped essential habitat is present within the RM 08-14 infrastructure area.

Approval requirement or further action

None

3.3.7 Threatened species

No threatened flora species were recorded within the RM 08-14 infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the RM 08-14 infrastructure area is presented in Table 15, Appendix A. The likelihood of occurrence assessment identified one threatened flora species that has the potential to occur within the infrastructure area.

No threatened fauna species were recorded from field assessments of the RM 08-14 infrastructure area.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.3.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the RM 08-16 infrastructure area (refer Section 3.3.11). Locations of these features are mapped on Figure 3 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.3.9 Watercourses

No watercourses are mapped or were confirmed present within the RM 08-14 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.3.10 Wetlands, lakes and springs

No wetlands are mapped or were confirmed present within the RM 08-14 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.3.11 RM 08-14: Vegetation community and habitat summary

Vegetation community description – Baseline data							
Site:	Q 3/VC 3/HA 3	**Recorder:**	JN, PW, LM	**Date:**	20/01/2014	**Time:**	0930
Project:	L1 ecological field surveys			**Photos:**	N: 592 E: 593 S: 594 W: 595		
Locality:	RM08-14			**Property (lot/plan):**	Dalmuir (10WV1758)		
Coordinates:	**Zone:** 5 5		7 0 4 0 5 9		7 0 7 3 7 2 2		

Vegetation community description: Open cleared pasture with very sparse shrubby regrowth vegetation, located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses.

Vegetation structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E	10	8-10	V
T1		-	
T2		-	
T3		-	
S1	1.5	0.8-1.5	V
S2		-	
G	0.7	0-0.8	D

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: G

Land form element# (40 m radius): Low hill crest

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Dark brown clay-loam

Slope and aspect: <10°, East

Vast: III

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
E	a	*Brachychiton rupestris*
S1	d	*Acacia harpophylla*
S1	a	*Atalaya hemiglauca*
S1	a	*Alstonia constricta*
S1	a	*Atalaya hemiglauca*
S1	a	*Alstonia constricta*
S1	a	*Eremophila mitchellii*
G	d	*Cenchrus ciliaris**
G	a	*Opuntia tomentosa**
G	a	*Arabidella eremigena*
G	a	*Verbena aristigera**
G	a	*Capparis lasiantha*
G	a	*Carissa ovata*
G	a	*Maireana microphylla*
G	a	*Enteropogon ramosus*
G	a	*Eragrostis lacunaria*
G	a	*Bothriochloa pertusa**
G	a	*Chloris ventricosa*
G	a	*Portulaca oleracea*
G	a	*Sporobolus caroli*
G	a	*Aristida lignosa*
G	a	*Abutilon oxycarpum*
G	a	*Paspalidium caespitosum*
G	a	*Ancistrachne uncinulata*
G	a	*Opuntia stricta**
G	a	*Enneapogon nigricans*

*Denotes exotic species

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	16.0
Native herbs/forbs (non-grass)	0.0
Native shrubs (<1 m high))	5.0
Non-native grass	17.6
Non-native herbs and shrubs	7.0
Litter (woodies <10 cm diameter, dead annuals, etc)	22.8
Litter (logs >10 cm diameter)	0.0
Rock	1.6
Bare ground	29.0

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	0
Coarse leaf litter (>2 cm diameter)	0
Fine leaf litter (<2 cm diameter)	0
Bare ground	7
Grass	7
Soil cracks	2
Stones (20-60 cm)	2
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
E	2.2
T1	n/a
T2	n/a
S1	0.0
S2	n/a
G	n/a
Species	
None	

Vegetative density	
Strata	**Stem count (1 ha area)**
E	2
T1	n/a
T2	n/a
S1	0
S2	n/a
G	n/a
Species	
E	
Brachychiton rupestris	2

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	0

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Habitat features included a single dead hollow log.
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern)

Koala habitat
Survey area not koala habitat due to non-remnant vegetation and absence of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Clearing, grazing
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Survey area consists of large area of non-remnant vegetation with limited habitat features. Ephemeral gullies and farms dams in non-remnant area would provide isolated water sources for fauna. Survey area provides generally low value habitat.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Velvety tree pear[1] (*Opuntia tomentosa*), U; prickly pear[1] (*Opuntia stricta*), R; buffel grass (*Cenchrus ciliaris*), C; Indian bluegrass (*Bothriochloa pertusa*), C
Total percentage weed cover: buffel grass, 39%; Indian bluegrass, 2%; velvety tree pear[1], 3%; prickly pear[1], 1%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
Narrow-leaved bottle tree (*Brachychiton rupestris*)

Incidental fauna observations
Australasian pipit, crested pigeon, eastern grey kangaroo, nankeen kestrel, noisy miner, red-necked wallaby, striated pardalote, Torresian crow, weebill whiptail wallaby, white-breasted woodswallow

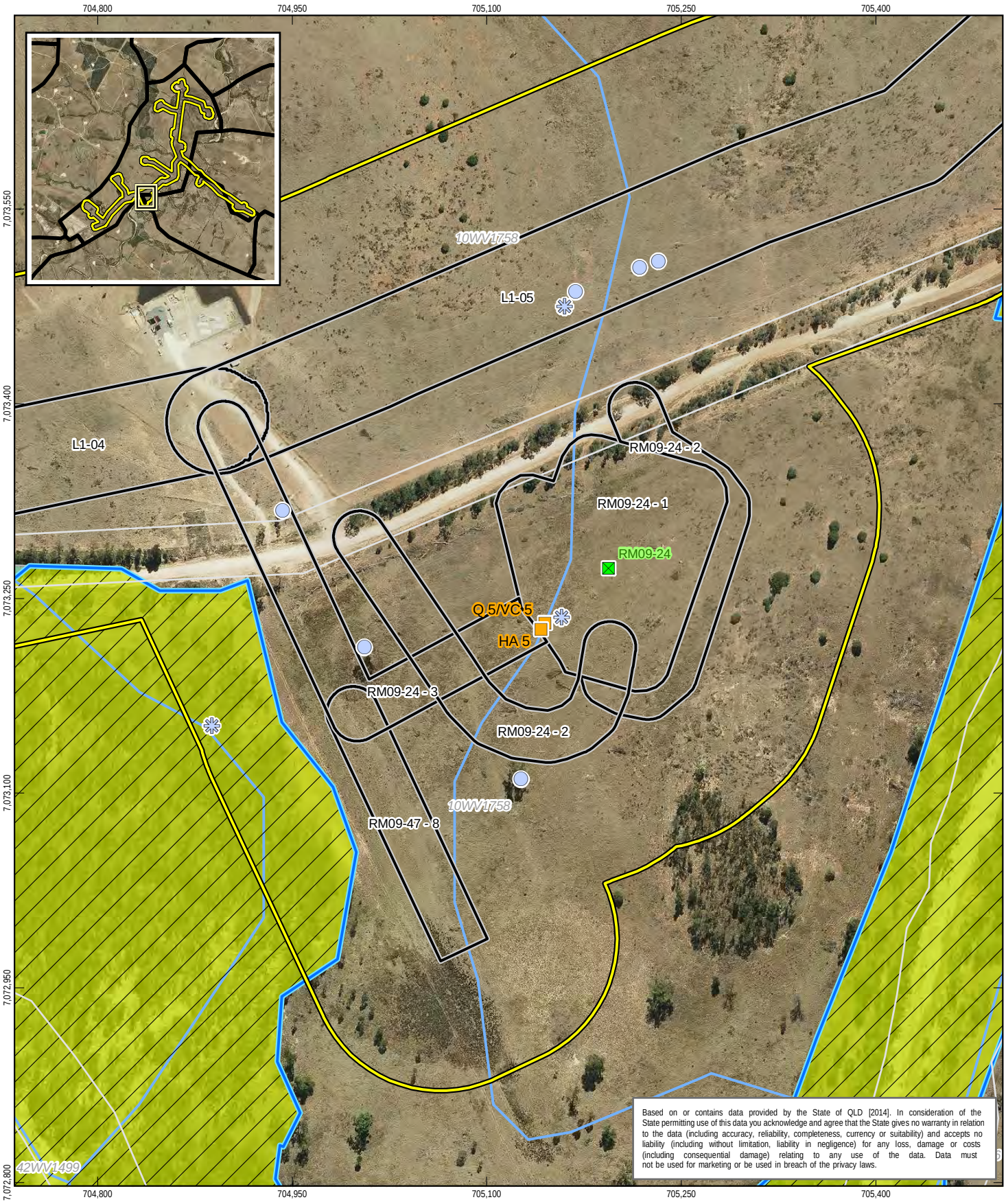
Representative photos for the RM 08-14 infrastructure area

North

East

South

West



LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Watercourse Assessment Site
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Essential Habitat (BPA)
- Referable Wetlands
- Cadastre
- Regional Ecosystem (BD)
- Of Concern dominant
- Not of Concern

1:4,000 (@ A4)

0 50 100 150

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Santos GLNG
L1 and N1 Ecological Assessments

Proposed RM 09-24
Infrastructure Area

Job Number	41-27312
Revision	0
Date	06 Jun 2014

Figure 4

G:\41\27312\GIS\Maps\MXD\41_27312_004_RM09-24_Rev0.mxd
145 Ann St Brisbane QLD 4000 Australia **T** 61 7 3316 3000 **F** 61 7 3316 3333 **E** bnemail@ghd.com **W** www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Regional Ecosystems, Essential Habitat, Imagery, Referred Wetlands/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.4 Proposed RM 09-24 infrastructure area

3.4.1 Summary for the RM 09-24 infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Present within 100 m
ESAs	Present within 1 km	**Wetlands**	Present within 100 m
Essential habitat	Absent		

3.4.2 Regional ecosystems

No remnant REs are mapped as present within the RM 09-24 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 3 (Q 5).

Approval requirement or further action

None

3.4.3 Threatened ecological communities

No TECs are mapped as present within the RM 09-24 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 4 (Q 5).

Approval requirement or further action

None

3.4.4 Vegetation communities and habitat values

The following vegetation community occurs within the RM 09-24 infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.4.11. Field validation points for vegetation communities and habitat values are shown on Figure 4 (VC 1, HA 1).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.4.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the RM 09-24 infrastructure area. However, two Category C ESAs and their primary protection areas are mapped within 1 km of the RM 09-24 infrastructure area, namely:

- An RE mixed polygon containing two of concern REs (RE 11.3.25/11.3.2)

- A referable wetland

Note that the primary protection zones of these Category C ESAs overlap with the disturbance footprint of the well pad.

The mapped Category C ESAs have been previously field validated and were thus not assessed during the current ecological assessment. The mapped referable wetland was validated as an ephemeral palustrine wetland and the mapped of concern mixed RE polygon was validated as containing of concern REs 11.3.2 and/or 11.3.25 (Boobook Ecological Consulting 2013).

Approval requirement or further action

Only limited petroleum activities are permitted within the primary protection zone of Category C ESAs as per the EA conditions. A number of conditions outlined in the EA (Schedule E15) must be met prior to carrying out limited petroleum activities.

3.4.6 Essential habitat

No VM Act-mapped essential habitat is present within the RM 09-24 infrastructure area.

Approval requirement or further action

None

3.4.7 Threatened species

No threatened flora species were recorded within the RM 09-24 infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the RM 09-24 infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the RM 09-24 infrastructure area.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.4.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the RM 09-24 infrastructure area (refer Section 3.4.11). Locations of these features are mapped on Figure 4 spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.4.9 Watercourses

A single mapped first order watercourses intersects the RM 09-24 infrastructure area. Additionally, a mapped first order watercourse is located within 100 m of the RM09-24 infrastructure area.

Field validation of the watercourses determined them to be drainage features under the *Water Act 2000*. The watercourse assessment locations are shown as sites WC 4 and WC 5 on Figure 4. A summary of results is presented in Table 1 and the watercourse assessments are presented in Appendix C.

Table 1 Watercourse assessments in RM 09-24 infrastructure area

Watercourse reference	Location (easting, northing)		Assessment outcome	Reason
WC 4	705145	7073231	Drainage feature (*Water Act 2000*)	No extended or permanent period of flow – only carries water flow for a short duration after a rainfall event Lacks sufficient flow adequacy to sustain basic ecological processes and support riverine species Lacks continuous and defined bed and banks and the presence of in-stream islands, benches or bars
WC 5	704886	7073151	Drainage feature (*Water Act 2000*)	No extended or permanent period of flow – only carries water flow for a short duration after a rainfall event Lacks sufficient flow adequacy to sustain basic ecological processes and support riverine species Lacks continuous and defined bed and banks and the presence of in-stream islands, benches or bars

Approval requirement or further action

None

3.4.10 Wetlands, lakes and springs

A referrable wetland and associated remnant vegetation (RE 11.3.25/11.3.2) is mapped along a first order watercourse within 100 m of the RM 09-24 infrastructure area. The wetland occurs within the 100 m investigation area for wetlands. However, the referable wetland has been

previously field validated as an ephemeral palustrine wetland (Boobook 2013), and thus was not assessed during the current ecological assessments.

Approval requirement or further action

As a wetland is present, construction must comply with the relevant EA requirements relating to wetlands (Schedule B5 to B16). All approvals must be lodged with the relevant agencies a minimum of ten business day prior to works.

3.4.11 RM 09-24: Vegetation community and habitat summary

Vegetation community description – Baseline data							
Site:	Q 5/VC 5/HA 5	**Recorder:**	JN, PW, LM, RF	**Date:**	21/01/2014	**Time:**	0700
Project:	L1 ecological field surveys			**Photos:**	N: 0310 E: 0313 S: 0312 W: 0311		
Locality:	RM09-24			**Property (lot/plan):**	Dalmuir (10WV1758)		
Coordinates:	**Zone:** 5 5	7 0 5 1 4 5		7 0 7 3 2 3 1			
Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses.							

Vegetation Structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	15	13-16	V
T2		-	
T3		-	
S1	1.5	1-5	V
S2		-	
G	0.6	0-1	M

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: G

Land form element[#] (40 m radius): Gentle slope

Land form pattern[#] (300 m radius): Low undulating hills

Soil and geology: Light brown sandy loam

Slope and aspect: 4°, East

Vast: III

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
T1	d	*Eucalyptus populnea*
S1	a	*Maireana microphylla*
S1	a	*Acacia excelsa*
G	a	*Austrostipa verticillata*
G	d	*Aristida lignosa*
G	a	*Ptilotus macrocephalus*
G	a	*Verbena aristigera**
G	a	*Enneapogon nigricans*
G	a	*Eragrostis lacunaria*
G	a	*Cirsium vulgare**
G	a	*Abutilon oxycarpum*
G	a	*Themeda triandra*
G	a	*Juncus usitatus*
G	a	*Arabidella eremigena*
G	s	*Cenchrus ciliaris**
G	a	*Maireana microphylla*

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	26.0
Native herbs/forbs (non-grass)	0.4
Native shrubs (<1 m high))	6.0
Non-native grass	27.0
Non-native herbs and shrubs	0.0
Litter (woodies <10 cm diameter, dead annuals, etc)	27.6
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	13.0

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	0
Coarse leaf litter (>2 cm diameter)	2
Fine leaf litter (<2 cm diameter)	0
Bare ground	6
Grass	7
Soil cracks	1
Stones (20-60 cm)	0
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	0.0
T2	n/a
S1	0.0
S2	n/a
G	n.a
Species	
None	

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	0
T2	n/a
S1	20
S2	n/a
G	n/a
Species	
S1	
Eucalyptus populnea	20

Fauna habitat value (within 1 ha area)	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	0

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Habitat features includes a dead hollow log and three nests in trees.
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern.

Koala habitat
Survey area not koala habitat due to non-remnant vegetation and absence of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Mechanical clearing, grazing
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.):
Survey area consists of large area of non-remnant vegetation with scattered trees. Scattered trees act as isolated refuges for open grassland birds for nesting and foraging. Mapped remnant vegetation fringing Blyth Creek acts as vegetation corridor within landscape. Survey area represents low value habitat, with scattered trees representing marginally higher habitat value within the landscape context.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Buffel grass (*Cenchrus ciliaris*), C; Mayne's pest (*Verbena aristigera*), C; scotch thistle (*Cirsium vulgare*), U
Total percentage weed cover: buffel grass, 27%; scotch thistle, 3%; Mayne's pest, 10%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
None present

Incidental fauna observations
Australian raven, black-faced cuckoo-shrike, galah, grey butcherbird, nobbi dragon, noisy miner, sulphur-crested cockatoo, Torresian crow

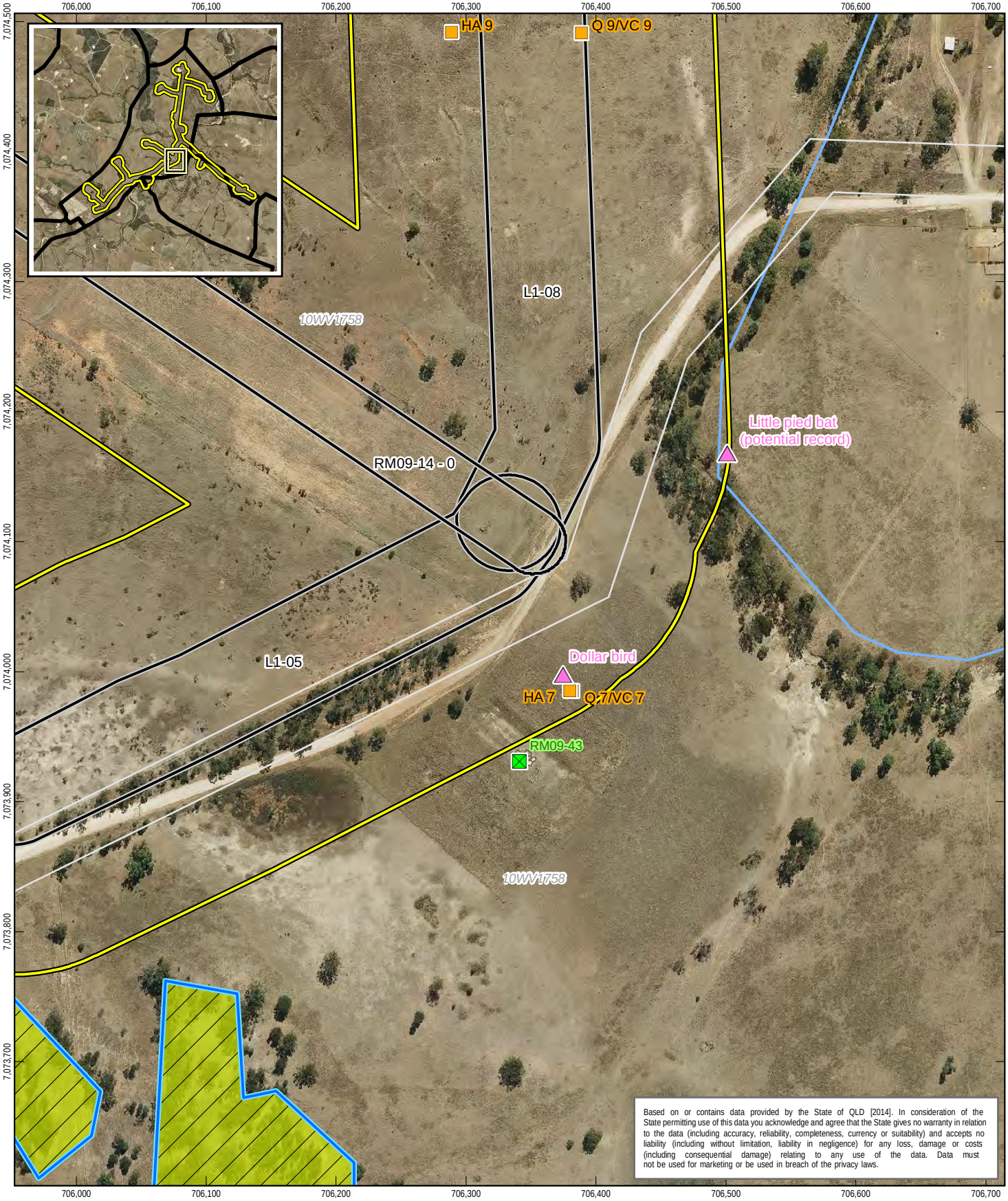
Representative photos for the RM 09-24 infrastructure area

North

East

South

West



LEGEND

- Well Pad
- Assessment Site
- Notable Fauna Species
- Watercourse
- CDZ Area (30m)
- Cadastre
- CSG Infrastructure Area (100m Investigation Area)
- Referable Wetlands
- Essential Habitat (BPA)
- Regional Ecosystem (BD)
- Of Concern dominant

1:4,000 (@ A4)

0 25 50 75 100

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Santos GLNG Project

Santos GLNG
L1 and N1 Ecological Assessments

Proposed RM 09-43
Infrastructure Area

Job Number	41-27312
Revision	0
Date	06 Jun 2014

Figure 5

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145 Ann St Brisbane QLD 4000 Australia **T** 61 7 3316 3000 **F** 61 7 3316 3333 **E** bnemail@ghd.com **W** www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Regional Ecosystems, Essential Habitat, Imagery, Referred Wetlands/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Notable Fauna Species, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.5 Proposed RM 09-43 infrastructure area

3.5.1 Summary for the RM 09-43 infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Absent
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Absent
ESAs	Present within 1 km	**Wetlands**	Absent
Essential habitat	Absent		

3.5.2 Regional ecosystems

No remnant REs are mapped as present within the RM 09-43 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 5 (Q 7).

Approval requirement or further action

None

3.5.3 Threatened ecological communities

No TECs are mapped as present within the RM 09-43 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 5 (Q 5).

Approval requirement or further action

None

3.5.4 Vegetation communities and habitat values

The following vegetation community occurs within the RM 09-43 infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.5.11. Field validation points for vegetation communities and habitat values are shown on Figure 5 (VC 7, HA 7).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.5.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the RM 09-43 infrastructure area. However, two Category C ESAs and their primary protection areas are mapped within 1 km of the RM 09-43 infrastructure area, namely:

- An RE mixed polygon containing two of concern REs (RE 11.3.25/11.3.2)

- A referable wetland

The mapped Category C ESAs have been previously field validated as consistent with the mapping. The mapped referable wetland was validated as an ephemeral palustrine wetland and the of concern mixed RE polygon was validated as containing of concern REs 11.3.2 and/or 11.3.25 (Boobook Ecological Consulting 2013).

Approval requirement or further action

None

3.5.6 Essential habitat

No VM Act-mapped essential habitat is present within the RM 09-43 infrastructure area.

Approval requirement or further action

None

3.5.7 Threatened species

No threatened flora species were recorded within the RM 09-43 infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the RM 09-43 infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the RM 09-43 infrastructure area.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.5.8 Fauna habitat features

No fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the RM 09-43 infrastructure area (refer Section 3.5.11).

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.5.9 Watercourses

No watercourses are mapped or were confirmed present within the RM 09-43 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.5.10 Wetlands, lakes and springs

No wetlands are mapped or were confirmed present within the RM 09-43 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.5.11 RM 09-43: Vegetation community and habitat summary

Vegetation community description – Baseline data						
Site:	Q 7/VC 7/HA 7	**Recorder:**	JN, PW, LM, RF	**Date:**	21/01/2014	**Time:** 0900
Project:	L1 ecological field surveys			**Photos:**	N: 628 E: 629 S: 630 W: 631	
Locality:	RM09-43			**Property (lot/plan):**	Dalmuir (10WV1758)	
Coordinates:	**Zone:** 5 5	7 0 6 3 8 2		7 0 7 3 9 8 5		
Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses.						

Vegetation Structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	11	10-14	V
T2		-	
T3		-	
S1	1	1-1.5	V
S2		-	
G	0.5	0-1	D

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: G

Land form element# (40 m radius): Gentle slope

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Grey-black cracking sandy clay

Slope and aspect: 4°, South

Vast: III

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
T1	d	*Eucalyptus populnea*
S1	a	*Vachellia farnesiana**
G	d	*Cenchrus ciliaris**
G	a	*Calotis lappulacea*
G	d	*Verbena aristigera**
G	a	*Rhynchosia minima*
G	a	*Vachellia farnesiana**
G	a	*Enneapogon nigricans*
G	a	*Sclerolaena tetracuspis*
G	a	*Bothriochloa pertusa**
G	a	*Aristida leptopoda*
G	a	*Cirsium vulgare**

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)

Type	% cover
Native grass	3.0
Native herbs/forbs (non-grass)	0.4
Native shrubs (<1 m high))	1.0
Non-native grass	52.0
Non-native herbs and shrubs	0.4
Litter (woodies <10 cm diameter, dead annuals, etc)	6.0
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	38.2

Fauna habitat features (within 1 ha area) – Baseline data

Characteristic	Abundance (0-7) ^
Decorticating bark	0
Coarse leaf litter (>2 cm diameter)	0
Fine leaf litter (<2 cm diameter)	0
Bare ground	7
Grass	7
Soil cracks	6
Stones (20-60 cm)	0
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0

^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	0.0
T2	n/a
S1	0.0
S2	n/a
G	n/a
Species	
None	

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	0
T2	n/a
S1	0
S2	n/a
G	n/a
Species	
None	

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	0

General habitat features and fauna breeding places present
None
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern)

Koala habitat
Survey area not koala habitat due to non-remnant vegetation and absence of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Grazing, clearing
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.):
Survey area consists of large area of non-remnant vegetation with limited habitat features. A thin corridor of mature trees is present adjacent to the survey area along a watercourse. This vegetation corridor may provide shelter and foraging habitat for birds. Survey area provides generally low value habitat.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Buffel grass (*Cenchrus ciliaris*), C; Mayne's pest (*Verbena aristigera*), C; scotch thistle (*Cirsium vulgare*), U; mimosa bush (*Vachellia farnesiana*), R; Indian bluegrass (*Bothriochloa pertusa*), C
Total percentage weed cover: buffel grass, 16%; scotch thistle, 2% Mayne's pest, 10%; mimosa bush, 8%; Indian bluegrass, 36%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
None present

Incidental fauna observations
blue-faced honeyeater, blue-winged kookaburra, dollarbird, noisy miner, pale-headed rosella, sulphur-crested cockatoo

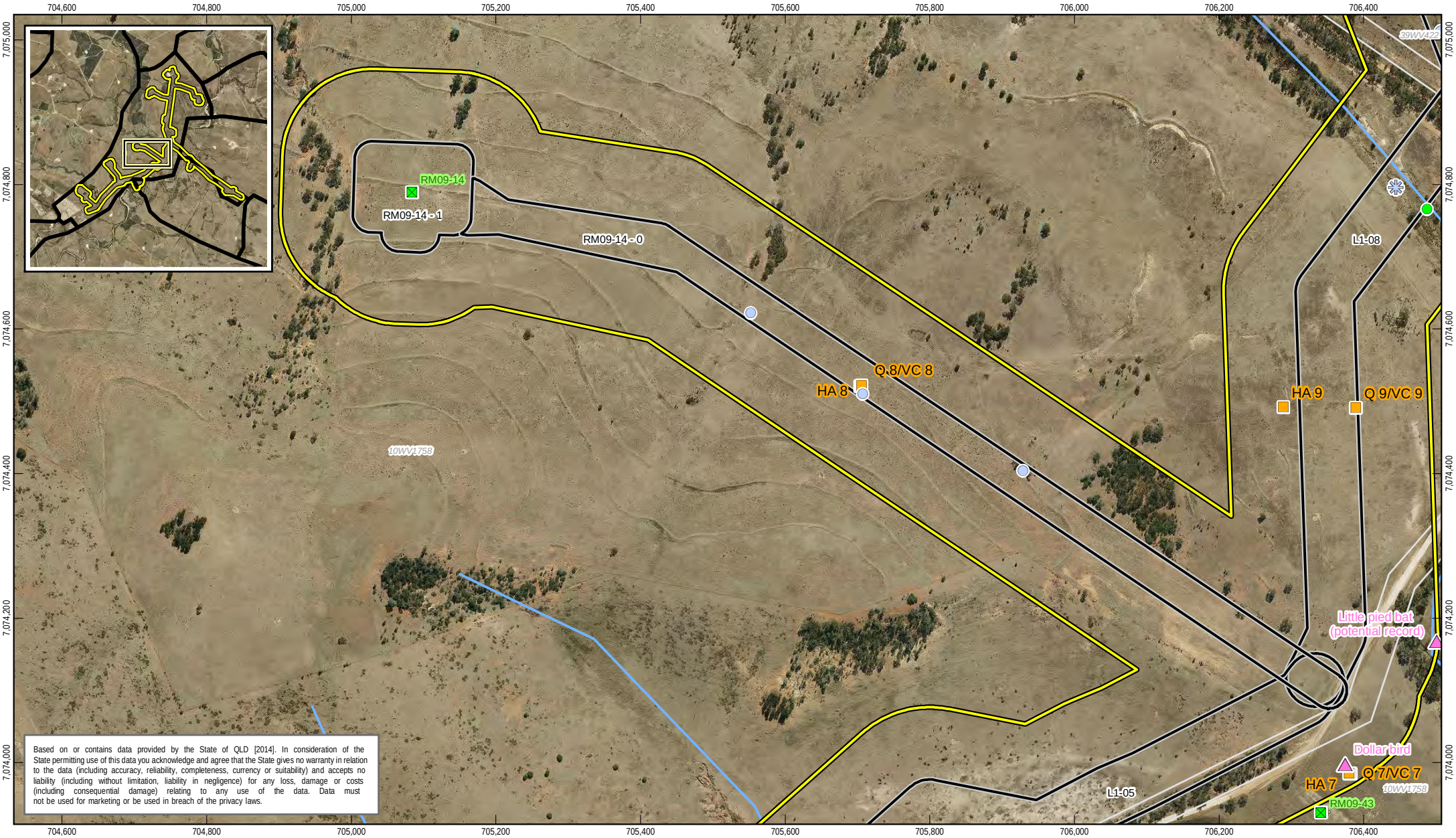
Representative photos for the RM 09-43 infrastructure area

North

East

South

West



1:7,000 (@ A4)

0 50 100 150 200

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Notable Fauna Species
- Watercourse Assessment Site
- Type A Restricted Plant Site
- Brachychiton populneus
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Cadastre

Santos GLNG
L1 and N1 Ecological Assessments

Job Number 41-27312
Revision 0
Date 06 Jun 2014

Proposed RM 09-14 Infrastructure Area

Figure 6

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145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Imagery/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Notable Fauna Species, Fauna Habitat, Fauna Habitat Assessment Site, Notable Flora Species, Flora Habitat Assessment Site/2014. Created by: AF

3.6 Proposed RM 09-14 infrastructure area

3.6.1 Summary for the RM 09-43 infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	present
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Absent
ESAs	Present within 1 km	**Wetlands**	Absent
Essential habitat	Absent		

3.6.2 Regional ecosystems

No remnant REs are mapped as present within the RM 09-14 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 6 (Q 8).

Approval requirement or further action

None

3.6.3 Threatened ecological communities

No TECs are mapped as present within the RM 09-14 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 6 (Q 8).

Approval requirement or further action

None

3.6.4 Vegetation communities and habitat values

The following vegetation community occurs within the RM 09-14 infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.6.11. Field validation points for vegetation communities and habitat values are shown on Figure 6 (VC 8, HA 8).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.6.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the RM 09-14 infrastructure area. However, two Category C ESAs and their primary protection areas are mapped within 1 km of the RM 09-14 infrastructure area, namely:

- An RE mixed polygon containing two of concern REs (RE 11.3.25/11.3.2)

- A referable wetland

The mapped Category C ESAs have been previously field validated as consistent with the mapping. The mapped referable wetland was validated as an ephemeral palustrine wetland and the of concern mixed RE polygon was validated as containing of concern REs 11.3.2 and/or 11.3.25 (Boobook Ecological Consulting 2013).

Approval requirement or further action

None

3.6.6 Essential habitat

No VM Act-mapped essential habitat is present within the RM 09-14 infrastructure area.

Approval requirement or further action

None

3.6.7 Threatened species

No threatened flora species were recorded within the RM 09-14 infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the RM 09-14 infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the RM 09-14 infrastructure area.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.6.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the RM 09-14 infrastructure area (refer Section

3.6.11). Locations of these features are mapped on Figure 6 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.6.9 Watercourses

No watercourses are mapped or were confirmed present within the RM 09-14 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.6.10 Wetlands, lakes and springs

No wetlands are mapped or were confirmed present within the RM 09-14 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.6.11 RM 09-14: Vegetation community and habitat summary

Vegetation community description – Baseline data							
Site:	Q 8/VC 8/HA 8	**Recorder:**	PW, LM	**Date:**	21/01/2014	**Time:**	1015
Project:	L1 ecological field surveys			**Photos:**	N: 632 E: 633 S: 634 W: 635		
Locality:	RM09-14			**Property (lot/plan):**	Dalmuir (10WV1758)		
Coordinates:	**Zone:** 5 5		7 0 5 7 0 4		7 0 7 4 5 2 1		
Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses.							

Vegetation Structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1		-	
T2		-	
T3		-	
S1	1.2	1-5	V
S2		-	
G	0.5	0-1	D

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: G

Land form element# (40 m radius): Hill crest

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Light brown sandy clay

Slope and aspect: <5°, North

Vast: III

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
S1	d	*Acacia excelsa*
G	d	*Cenchrus ciliaris**
G	a	*Melinis repens**
G	a	*Maireana microphylla*
G	a	*Enteropogon ramosus*
G	a	*Sporobolus creber*
G	a	*Eragrostis tenellula*
G	a	*Arabidella eremigena*
G	a	*Calotis lappulacea*
G	a	*Enneapogon nigricans*
G	a	*Bothriochloa pertusa**
G	a	*Abutilon oxycarpum*
G	a	*Hibiscus sturtii*
G	a	*Fimbristylis dichotoma*
G	a	*Aristida lignosa*
G	a	*Sclerolaena birchii*
G	a	*Austrostipa verticillata*
G	a	*Portulaca oleracea**
G	a	*Verbena aristigera**
G	a	*Digitaria ciliaris*
G	a	*Chrysocephalum apiculatum*

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	15.0
Native herbs/forbs (non-grass)	1.0
Native shrubs (<1 m high))	3.0
Non-native grass	29.0
Non-native herbs and shrubs	0.2
Litter (woodies <10 cm diameter, dead annuals, etc)	2.0
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	49.8

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	2
Coarse leaf litter (>2 cm diameter)	0
Fine leaf litter (<2 cm diameter)	4
Bare ground	5
Grass	7
Soil cracks	4
Stones (20-60 cm)	1
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	n/a
T2	n/a
S1	0.0
S2	n/a
G	n/a
Species	
None	

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	n/an
T2	n/a
S1	0
S2	n/a
G	n/a
Species	
None	

Fauna habitat value (within 1 ha area)	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	0

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included woody debris with peeling bark and a termite mound
Potential habitat for EVNT fauna species (including essential habitat): No potential habitat for EVNT fauna species present within the survey area.

Koala habitat
Survey area not koala habitat due to non-remnant vegetation and absence of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Mechanical clearing, soil alternations (berms), grazing
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.):
Survey area consists of large area of non-remnant vegetation with small, disturbed patches of mature trees. Small patches of remnant vegetation are present as isolated patches within non-remnant landscape. Survey area represents low value habitat, with small patches of disturbed remnant vegetation representing marginally higher habitat value within the landscape context.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Velvety tree pear[1] (*Opuntia tomentosa*), R; buffel grass (*Cenchrus ciliaris*), C; Mayne's pest (*Verbena aristigera*), C; Indian bluegrass (*Bothriochloa pertusa*), C
Total percentage weed cover: velvety tree pear, 2%; buffel grass, 29%; Mayne's pest, 1%; Indian bluegrass, 5%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
None present

Incidental fauna observations
buff-rumped thornbill, eastern grey kangaroo, laughing kookaburra, magpie-lark, noisy miner, pied butcherbird, red winged parrot, rufous whistler, Torresian crow, weebill, white-throated Gerygone, white-winged triller, willie wagtail

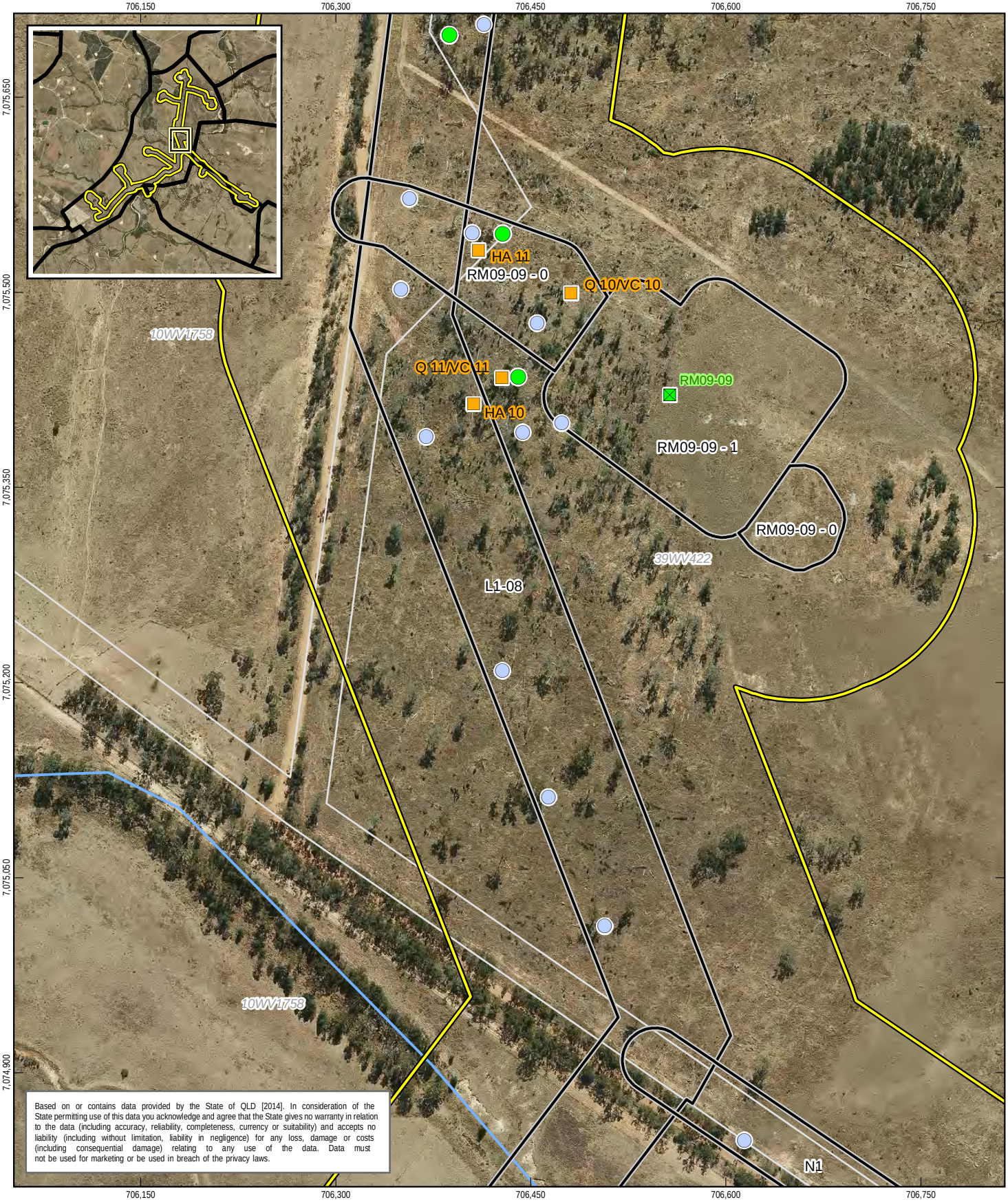
Representative photos for the RM 09-14 infrastructure area

North

East

South

West



Based on or contains data provided by the State of QLD [2014]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Type A Restricted Plant Site
- Brachychiton populneus
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Cadastre

1:4,000 (@ A4)

0 50 100 150

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Santos GLNG
L1 and N1 Ecological Assessments

Proposed RM 09-09 Infrastructure Area

Job Number	41-27312
Revision	0
Date	06 Jun 2014

Figure 7

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145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Imagery/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Notable Flora Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.7 Proposed RM 09-09 infrastructure area

3.7.1 Summary for the RM 09-43 infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	• Cleared open pasture • Regrowth Eucalypt woodland	**Watercourses**	Absent
ESAs	Present within 1 km	**Wetlands**	Absent
Essential habitat	Absent		

3.7.2 Regional ecosystems

No remnant REs are mapped as present within the RM 09-09 infrastructure area and none were identified during the ecological assessments. A small portion of the infrastructure intersects mapped high value regrowth vegetation that has a biodiversity status of no concern at present. This high value regrowth was confirmed present during field validation assessments. Field validation points for REs are shown on Figure 7 (Q 10, Q 11).

Approval requirement or further action

None

3.7.3 Threatened ecological communities

No TECs are mapped as present within the RM 09-09 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 7 (Q 10, Q 11).

Approval requirement or further action

None

3.7.4 Vegetation communities and habitat values

The following vegetation communities occur within the RM 09-09 infrastructure area:

- Cleared open pasture
- Regrowth eucalypt woodland

Descriptions of the two vegetation communities and habitat values are summarised in Section 3.7.11. Field validation points for vegetation communities and habitat values are shown on Figure 7 (VC 10, VC 11, HA 10, HA 11).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.7.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the RM 09-09 infrastructure area. However, two Category C ESAs and their primary protection areas are mapped within 1 km of the RM 09-09 infrastructure area, namely:

- An RE mixed polygon containing two of concern REs (RE 11.3.25/11.3.2)
- A referable wetland

The mapped Category C ESAs have been previously field validated as consistent with the mapping. The mapped referable wetland was validated as an ephemeral palustrine wetland and the of concern mixed RE polygon was validated as containing of concern REs 11.3.2 and/or 11.3.25 (Boobook Ecological Consulting 2013).

Approval requirement or further action

None

3.7.6 Essential habitat

No VM Act-mapped essential habitat is present within the RM 09-09 infrastructure area.

Approval requirement or further action

None

3.7.7 Threatened species

No threatened flora species were recorded within the RM 09-09 infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the RM 09-09 infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the RM 09-09 infrastructure area.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)

- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.7.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the RM 09-09 infrastructure area (refer Section 3.7.11). Locations of these features are mapped on Figure 7 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.7.9 Watercourses

No watercourses are mapped or were confirmed present within the RM 09-09 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.7.10 Wetlands, lakes and springs

No wetlands are mapped or were confirmed present within the RM 09-09 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.7.11 RM 09-09: Vegetation community and habitat summary

Vegetation community description – Baseline data							
Site:	Q 10/VC 10/HA 10	**Recorder:**	JN, PW, LM	**Date:**	21/01/2014	**Time:**	1315
Project:	L1 ecological field surveys			**Photos:**	N: 0330 E: 0331 S: 0332 W: 0333		
Locality:	RM09-09			**Property (lot/plan):**	South Leigh (39WV422)		
Coordinates:	**Zone:** 5 5	7 0 6 4 8 1		7 0 7 5 4 9 9			
Vegetation community description: Open cleared pasture with low regrowth shrubs, located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses. A small patch of high value regrowth is located adjacent to the site.							

Vegetation Structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	9	8-14	V
T2		-	
T3		-	
S1	7	5-8	S
S2	4	1-4	S
G	0.8	0-1.5	D

Structural formation (including height):

Open cleared pasture with shrubby regrowth

Ecologically dominant layer: T1

Land form element# (40 m radius): Hill crest

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Light brown loamy sand

Slope and aspect: 5°, North

Vast: III

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
T1	d	*Eucalyptus melanophloia*
S1	d	*Callitris glaucophylla*
S1	a	*Eucalyptus populnea*
S1	a	*Eucalyptus melanophloia*
S2	a	*Eucalyptus melanophloia*
S2	d	*Callitris glaucophylla*
S2	a	*Geijera parviflora*
S2	a	*Dodonaea viscosa*
S2	a	*Eucalyptus populnea*
G	a	*Calotis cuneifolia*
G	d	*Themeda triandra*
G	a	*Opuntia stricta**
G	a	*Enneapogon avenaceus*
G	s	*Cenchrus ciliaris**
G	a	*Fimbristylis dichotoma*
G	a	*Aristida caput-medusae*
G	a	*Opuntia tomentosa**
G	a	*Melinis repens**
G	a	*Sporobolus caroli*
G	a	*Themeda triandra*
G	a	*Heteropogon contortus*
G	a	*Cymbopogon refractus*
G	a	*Verbena aristigera**
G	a	*Chrysocephalum apiculatum*

*Denotes exotic species

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	33.0
Native herbs/forbs (non-grass)	1.6
Native shrubs (<1 m high))	2.0

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	4
Coarse leaf litter (>2 cm diameter)	4
Fine leaf litter (<2 cm diameter)	2

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Non-native grass	12.0
Non-native herbs and shrubs	1.0
Litter (woodies <10 cm diameter, dead annuals, etc)	32.4
Litter (logs >10 cm diameter)	5.0
Rock	0.0
Bare ground	13.0

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Bare ground	6
Grass	7
Soil cracks	4
Stones (20-60 cm)	4
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	4.0
T2	n/a
S1	0.0
S2	1.5
G	n/a
Species	
T1	
Eucalyptus melanophloia	2.5
Callitris glaucophylla	1.5
S2	
Callitris glaucophylla	1.0
Dodonaea viscosa	0.5

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	12
T2	n/a
S1	60
S2	540
G	n/a
Species	
T1	
Eucalyptus melanophloia	10
Brachychiton populneus	2
S1	
Eucalyptus melanophloia	40
Callitris glaucophylla	20
S2	
Dodonaea viscosa	60
Callitris glaucophylla	220
Eucalyptus populnea	100
Eucalyptus melanophloia	160

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	1
Total number of hollows in logs	2
Total length of fallen woody material (eg logs) >10 cm diameter	27 m

General fauna habitat and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included a stag with peeling bark and a dead hollow log.
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Koala, Large-eared pied bat, Little pied bat, South-eastern long-eared bat, squatter pigeon (southern) and Dunmall's snake

Koala habitat
Koala food tree present (*Eucalyptus melanophloia*); however, due to the lack of water and low soil moisture trees are unlikely to be koala habitat trees.

Disturbances (eg grazing, ploughing etc.)
Selective clearing
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.):
Mapped high value regrowth consisting of mature Eucalyptus melanophloia provides shelter and roosting habitat for woodland birds, shrubs provide habitat for small birds, woody debris provides habitat and potential breeding

sites for reptiles. Scattered trees are loosely connected to other narrow vegetation corridor within road reserve heading towards Blyth Creek. Survey area contains low to moderate value habitat.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Velvety tree pear[1] (*Opuntia tomentosa*), U; prickly pear[1] (*Opuntia stricta*), U; buffel grass (*Cenchrus ciliaris*), C; Mayne's pest (*Verbena aristigera*), C; red natal grass (*Melinis repens*), C; African box thorn[1] (*Lycium ferocissimum*), C
Total percentage weed cover: Velvety tree pear[1], 4%; prickly pear[1], 1%; buffel grass, 12%; Mayne's pest, 1%; red natal grass, 2%; African box thorn[1], 4%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
Kurrajong (*Brachychiton populneus*). Refer to Santos webGIS system for point locations.

Incidental fauna observations
black-faced cuckoo-shrike, Australian raven, Torresian crow, grey butcherbird, eastern grey kangaroo, noisy miner, weebill, red-necked wallaby

Representative photos for the RM 09-09 infrastructure area

North

East

South

West

Vegetation community description – Baseline data						
Site:	Q 11/VC 11/HA 11	**Recorder:**	JN, PW, LM	**Date:**	21/01/2014	**Time:** 1400
Project:	L1 ecological field surveys			**Photos:**	N: 0337 E: 0338 S: 0339 W: 0340	
Locality:	RM09-09			**Property (lot/plan):**	South Leigh (39WV422)	
Coordinates:	**Zone:** 5 5	7 0 6 4 2 8	7 0 7 5 4 3 4			

Vegetation community description: Regrowth eucalypt open woodland - Small (< 15 ha) polygon of regrowth *Eucalyptus melanophloia* open woodland with sparse shrub layer and dense ground cover.

Vegetation Structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	13	9-15	S
T2		-	
T3		-	
S1	2	1-7	M
S2		-	
G	0.4	0-1	M

Structural formation (including height):

Regrowth open woodland

Ecologically dominant layer: T1

Land form element[#] (40 m radius): Hill crest

Land form pattern[#] (300 m radius): Low undulating hills

Soil and geology: Light brown loamy sand

Slope and aspect: <5°, South

Vast: II

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
T1	d	*Eucalyptus melanophloia*
S1	a	*Brachychiton populneus*
S1	c	*Geijera parviflora*
S1	a	*Eucalyptus populnea*
S1	c	*Callitris glaucophylla*
S1	a	*Psydrax oleifolia*
S1	a	*Dodonaea viscosa*
S1	a	*Eucalyptus melanophloia*
S1	a	*Petalostigma pubescens*
S1	a	*Acacia excelsa*
G	d	*Aristida caput-medusae*
G	a	*Verbena aristigera**
G	s	*Cenchrus ciliaris**
G	a	*Melinis repens**
G	a	*Opuntia stricta**
G	a	*Opuntia tomentosa**
G	a	*Lomandra longifolia*
G	a	*Arabidella eremigena*
G	a	*Austrostipa verticillata*
G	a	*Enneapogon avenaceus*
G	a	*Heteropogon contortus*
G	a	*Solanum coactiliferum*

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	39.0
Native herbs/forbs (non-grass)	0.0
Native shrubs (<1 m high))	4.0
Non-native grass	2.0
Non-native herbs and shrubs	3.0
Litter (woodies <10 cm diameter, dead annuals, etc)	22.4
Litter (logs >10 cm diameter)	4.0
Rock	2.0
Bare ground	10.4

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	4
Coarse leaf litter (>2 cm diameter)	2
Fine leaf litter (<2 cm diameter)	0
Bare ground	6
Grass	7
Soil cracks	4
Stones (20-60 cm)	2
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	35.5
T2	n/a
S1	4.7
S2	n/a
G	n/a
Species	
T1	
Eucalyptus melanophloia	23.5
Eucalyptus populnea	12.0
S1	
Callitris glaucophylla	3.5
Geijera parviflora	1.2

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	50
T2	n/a
S1	380
S2	n/a
G	n/a
Species	
T1	
Eucalyptus melanophloia	46
Brachychiton populneus	2
Eucalyptus populnea	2
S1	
Callitris glaucophylla	160
Geijera parviflora	80
Dodonaea viscosa	20
Psydrax oleifolia	20
Eucalyptus populnea	80
Eucalyptus melanophloia	20

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	3
Total number of hollows in logs	6
Total length of fallen woody material (eg logs) >10 cm diameter	91

General fauna habitat and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included a log with peeling bark and a dead hollow log.
Potential habitat for EVNT fauna species (including essential habitat): Potential habitat for squatter pigeon (southern), brigalow scaly-foot, yakka skink

Koala habitat
Scattered koala habitat trees present (*Eucalyptus melanophloia*). However, survey area does not represent koala habitat due to low density of koala food trees within otherwise non-remnant cleared vegetation.

Disturbances (eg grazing, ploughing etc.)
Abundant logs and woody debris that have previously been clear felled, grazing.
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.):
Survey area consists of large area of non-remnant vegetation with scattered mature trees. Scattered mature trees provide refuge for birds utilising surrounding woodland environment. Limited connectivity between mature trees within non-remnant environment provides narrow corridor. Felled woody debris creates refuge for reptiles and small ground dwelling mammals. Survey area provides generally low value habitat.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Velvety tree pear[1] (*Opuntia tomentosa*), U; prickly pear[1] (*Opuntia stricta*), U; buffel grass (*Cenchrus ciliaris*), C; Mayne's pest (*Verbena aristigera*), C; red natal grass (*Melinis repens*), C
Total percentage weed cover: Velvety tree pear[1], 3%; prickly pear[1], 1%; buffel grass, 2%; Mayne's pest, 3%; red natal grass, 5%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
Kurrajong (*Brachychiton populneus*). Refer to Santos webGIS system for point locations.

Incidental fauna observations
black-faced cuckoo-shrike, Australian raven, Torresian crow, grey butcherbird, eastern grey kangaroo, noisy miner, weebill, red-necked wallaby

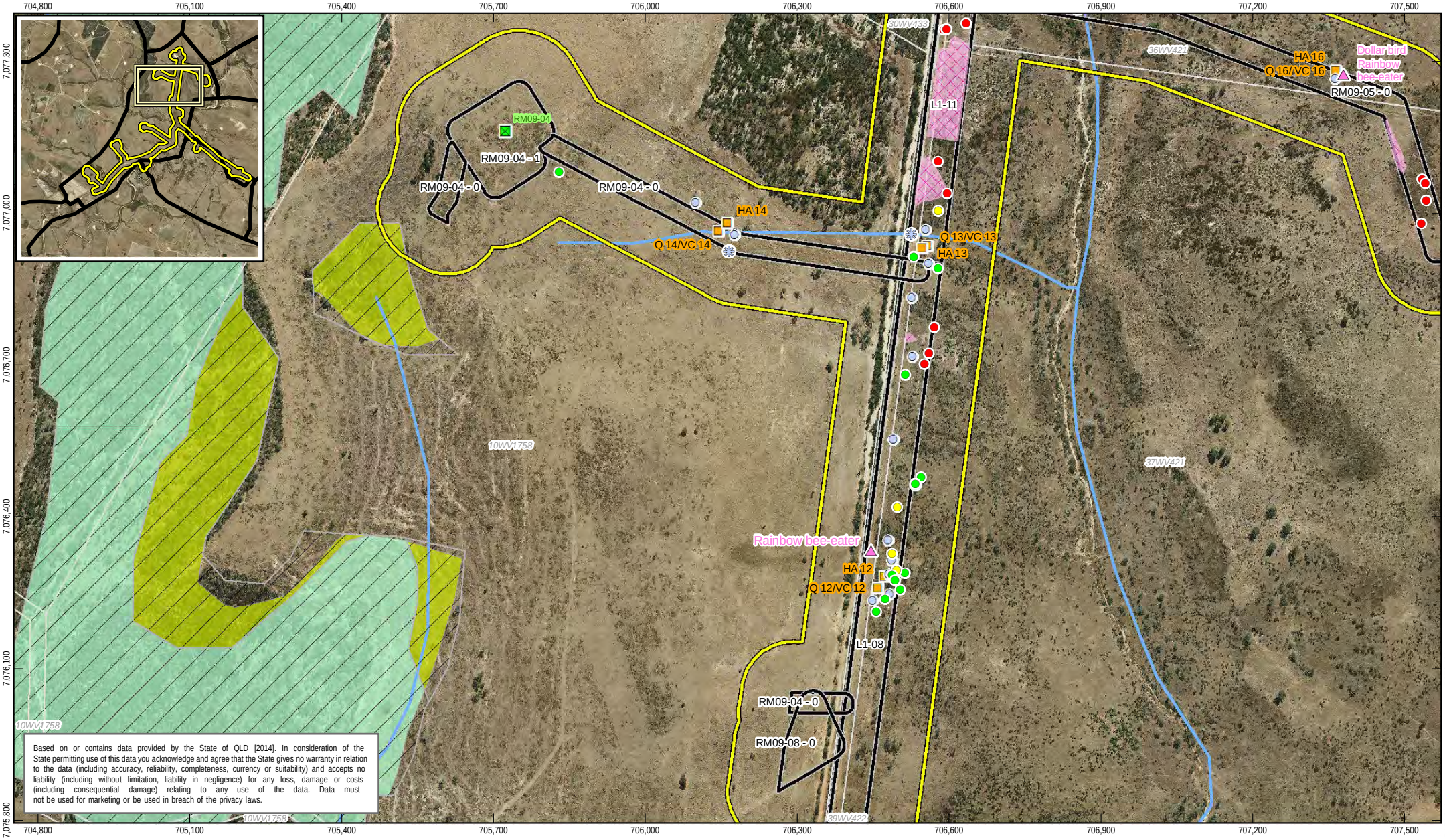
Representative photos for the RM 09-09 infrastructure area

North

East

South

West



1:10,000 (@ A4)

0 70 140 210 280

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Watercourse Assessment Site

Type A Restricted Plant Site
- Brachychiton populneus
- Brachychiton rupestris
- Xanthorrhoea johnsonii
- Xanthorrhoea johnsonii

- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Cadastre
- Essential Habitat (BPA)

Regional Ecosystem (BD)
- Of Concern dominant
- Not of Concern

GHD

Santos GLNG Project

Santos GLNG
L1 and N1 Ecological Assessments

Job Number 41-27312
Revision 0
Date 06 Jun 2014

Proposed RM 09-04 Infrastructure Area

Figure 8

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145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Imagery/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Notable Fauna Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.8 Proposed RM 09-04 infrastructure area

3.8.1 Summary for the RM 09-04 infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Present
ESAs	Present within 1 km	**Wetlands**	Absent
Essential habitat	Absent		

3.8.2 Regional ecosystems

No remnant REs are mapped as present within the RM 09-04 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 8 (Q 14).

Approval requirement or further action

None

3.8.3 Threatened ecological communities

No TECs are mapped as present within the RM 09-04 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 8 (Q 14).

Approval requirement or further action

None

3.8.4 Vegetation communities and habitat values

The following vegetation community occurs within the RM 09-04 infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.8.11. Field validation points for vegetation communities and habitat values are shown on Figure 8 (VC 14, HA 14).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.8.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the RM 09-04 infrastructure area. However, two Category C ESA polygons containing of concern RE: 11.9.7 and their primary protection area, are mapped within 1 km of the RM 09-04 infrastructure area.

The mapped Category C ESAs are located outside of the investigation area and were therefore not field validated as part of the current ecological assessments.

Approval requirement or further action

None

3.8.6 Essential habitat

No VM Act-mapped essential habitat is present within the RM 09-04 infrastructure area.

Approval requirement or further action

None

3.8.7 Threatened species

No threatened flora species were recorded within the RM 09-04 infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the RM 09-04 infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the RM 09-04 infrastructure area.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.8.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the RM 09-04 infrastructure area (refer Section 3.8.11). Locations of these features are mapped on Figure 8 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.8.9 Watercourses

A single mapped first order watercourse intersects the RM 09-04 infrastructure area.

Field validation of the watercourse determined it to be a drainage feature under the *Water Act 2000*. The watercourse assessment location is shown as site WC 10 on Figure 8. A summary of results is presented in Table 2 and the watercourse assessments are presented in Appendix C.

Table 2 Watercourse assessments in RM 09-04 infrastructure area

Watercourse reference	Location (easting, northing)		Assessment outcome	Reason
WC 10	706165	7076925	Drainage feature (*Water Act 2000*)	No extended or permanent period of flow – only carries water flow for a short duration after a rainfall event Lacks sufficient flow adequacy to sustain basic ecological processes and support riverine species Lacks continuous and defined bed and banks and the presence of in-stream islands, benches or bars

Approval requirement or further action

None

3.8.10 Wetlands, lakes and springs

No wetlands are mapped or were observed within the RM 09-04 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.8.11 RM 09-04: Vegetation community and habitat summary

Vegetation community description – Baseline data																			
Site:	Q 14/VC 14/HA 14		**Recorder:**	JN, PW			**Date:**	22/01/2014			**Time:**	1400						
Project:	L1 ecological field surveys						**Photos:**	N: 0341 E: 0342 S: 0343 W: 0344										
Locality:	RM09-04						**Property (lot/plan):**	Dalmuir (10WV1758)										
Coordinates:	**Zone:**	5	5	7	0	6	1	4	4	7	0	7	6	9	6	4		
Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses.																		

Vegetation structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	18	15-20	V
T2		-	
T3		-	
S1	2	1-4	S
S2		-	
G	0.7	0-1	M

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: S1

Land form element# (40 m radius): Gentle slope

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Light brown sandy-loam

Slope and aspect: <5°, East

Vast: III

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
T1	a	*Angophora leiocarpa*
T1	a	*Eucalyptus melanophloia*
T1	a	*Corymbia tessellaris*
S1	a	*Corymbia tessellaris*
S1	a	*Angophora leiocarpa*
S1	a	*Acacia leiocalyx*
S1	a	*Eucalyptus melanophloia*
S1	a	*Callitris glaucophylla*
S1	a	*Brachychiton populneus*
S1	a	*Petalostigma pubescens*
G	a	*Verbesina encelioides**
G	a	*Fimbristylis dichotoma*
G	a	*Themeda avenaceus*
G	a	*Aristida calycina*
G	c	*Austrostipa ramosissima*
G	a	*Cirsium vulgare**
G	c	*Cenchrus ciliaris**
G	a	*Aristida caput-medusae*
G	a	*Verbena aristigera**
G	a	*Calotis lappulacea*
G	a	*Cymbopogon refractus*
G	a	*Arabidella eremigena*
G	a	*Digitaria divaricatissima*
G	a	*Calotis cuneifolia*
G	a	*Alloteropsis semialata*

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	35.0
Native herbs/forbs (non-grass)	1.4
Native shrubs (<1 m high))	0.0
Non-native grass	31.0
Non-native herbs and shrubs	1.0
Litter (woodies <10 cm diameter, dead annuals, etc)	19.6
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	12.0

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	1
Coarse leaf litter (>2 cm diameter)	3
Fine leaf litter (<2 cm diameter)	5
Bare ground	4
Grass	7
Soil cracks	0
Stones (20-60 cm)	0
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	0.0
T2	n/a
S1	0.0
S2	n/a
G	n/a
Species	
None	

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	0
T2	n/a
S1	120
S2	n/a
G	n/a
Species	
S1	
Corymbia tessellaris	60
Acacia leiocalyx	40
Eucalyptus melanophloia	20

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	10 m

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included two hollows in trees.
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern).

Koala habitat
Survey area not koala habitat due to non-remnant vegetation and absence of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Clearing and grazing, as well as construction of infrastructure (well pad), resulting in soil alterations (berms)
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Survey area consists of large area of non-remnant vegetation with small, disturbed patches of mature trees. Small patches of remnant vegetation are present as isolated patches within non-remnant landscape. Survey area represents low value habitat, with small patches of disturbed remnant vegetation representing marginally higher habitat value within the landscape context.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Velvety tree pear[1] (*Opuntia tomentosa*), R; prickly pear[1] (*Opuntia stricta*), R; buffel grass (*Cenchrus ciliaris*), C; scotch thistle (*Cirsium vulgare*), U; red natal grass (*Melinis repens*), C; wild sunflower (*Verbesina encelioides*), C
Total percentage weed cover: Velvety tree pear[1], 2%; prickly pear[1], 1%; buffel grass, 30%; scotch thistle, 4%; red natal grass, 1%; wild sunflower, 5%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
Narrow-leaved bottle tree (*Brachychiton rupestris*). Refer to Santos webGIS system for point locations.

Incidental fauna observations
black-shouldered kite, red-backed fairy-wren, rufous whistler, red-necked wallaby

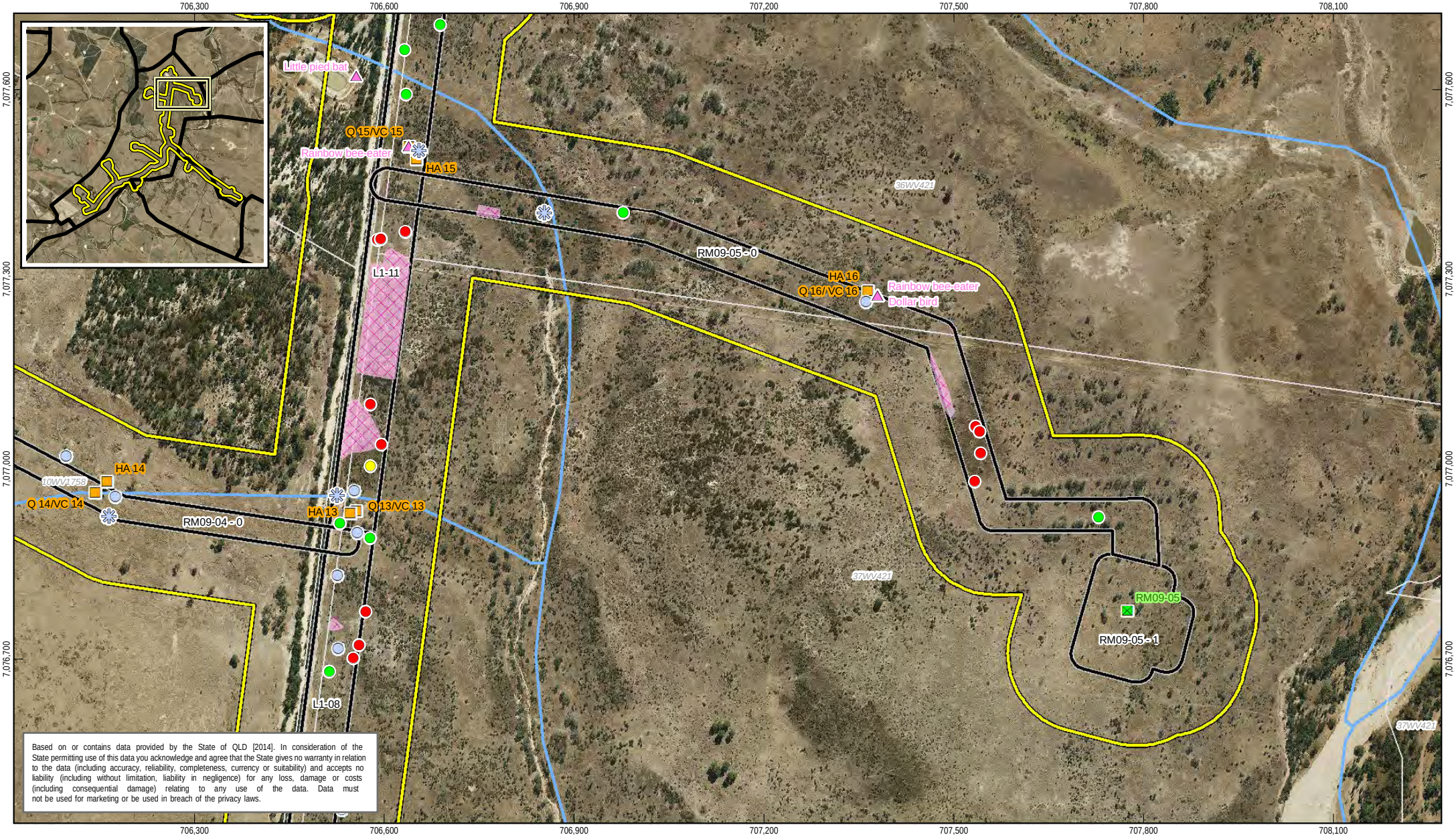
Representative photos for the RM 09-04 infrastructure area

North

East

South

West



1:8,000 (@ A4)

0 100 200 300

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Notable Fauna Species
- Watercourse Assessment Site
- Type A Restricted Plant Site
- Brachychiton populneus
- Brachychiton rupestris
- Xanthorrhoea johnsonii
- Xanthorrhoea johnsonii
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Cadastre

Santos GLNG
L1 and N1 Ecological Assessments

Job Number 41-27312
Revision 0
Date 06 Jun 2014

Proposed RM 09-05 Infrastructure Area

Figure 9

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145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Imagery/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Notable Flora Species, Notable Fauna Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.9 Proposed RM 09-05 infrastructure area

3.9.1 Summary for the RM 09-05 infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Present
ESAs	Absent	**Wetlands**	Absent
Essential habitat	Absent		

3.9.2 Regional ecosystems

No remnant REs are mapped as present within the RM 09-05 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 9 (Q 16).

Approval requirement or further action

None

3.9.3 Threatened ecological communities

No TECs are mapped as present within the RM 09-04 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 9 (Q 16).

Approval requirement or further action

None

3.9.4 Vegetation communities and habitat values

The following vegetation community occurs within the RM 09-05 infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.9.11. Field validation points for vegetation communities and habitat values are shown on Figure 9 (VC 16, HA 16).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.9.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the RM 09-05 infrastructure area, or within 1 km of this.

Approval requirement or further action

None

3.9.6 Essential habitat

No VM Act-mapped essential is present within the RM 09-05 infrastructure area.

Approval requirement or further action

None

3.9.7 Threatened species

No threatened flora species were recorded within the RM 09-05 infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the RM 09-05 infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the RM 09-05 infrastructure area. However, rainbow bee-eater, listed as migratory (JAMBA) and marine under the EPBC Act, was recorded during field assessments.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.9.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the RM 09-05 infrastructure area (refer Section 3.9.11). Locations of these features are mapped on Figure 9 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.9.9 Watercourses

A single mapped first order watercourse intersects the RM 09-05 infrastructure area.

Field validation of the watercourse determined it to be a drainage feature under the *Water Act 2000*. The watercourse assessment location is shown as site WC 12 on Figure 9. A summary of results is presented in Table 3 and the watercourse assessments are presented in Appendix C.

Table 3 Watercourse assessments in RM 09-05 infrastructure area

Watercourse reference	Location (easting, northing)		Assessment outcome	Reason
WC 12	706852	7077403	Drainage feature (*Water Act 2000*)	No extended or permanent period of flow – only carries water flow for a short duration after a rainfall event Lacks sufficient flow adequacy to sustain basic ecological processes and support riverine species Lacks continuous and defined bed and banks and the presence of in-stream islands, benches or bars

Approval requirement or further action

None

3.9.10 Wetlands, lakes and springs

No wetlands are mapped or were observed within the RM 09-05 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.9.11 RM 09-05: Vegetation community and habitat summary

Vegetation community description – Baseline data																			
Site:	Q 16/VC 16/HA 16		**Recorder:**	JN, PW, LM, RF			**Date:**	22/01/2014					**Time:**	1500				
Project:	L1 ecological field surveys						**Photos:**	N: 678 E: 679 S: 680 W: 681										
Locality:	RM09-05						**Property (lot/plan):**	Mount Hope (36WV421)										
Coordinates:	**Zone:**	5	5		7	0	7	3	6	4		7	0	7	7	2	8	2
Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses.																			

Vegetation structure
Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1		-	
T2		-	
T3		-	
S1	2.5	1-4	M
S2		-	
G	0.5	0-1	M

Structural formation (including height):

Low shrubby regrowth eucalypts

Ecologically dominant layer: S1

Land form element# (40 m radius): Gentle slope

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Light brown sand

Slope and aspect: <5°, North

Vast: III

Plant species
Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
S1	c	*Allocasuarina luehmannii*
S1	c	*Eucalyptus chloroclada*
S1	a	*Eucalyptus melanophloia*
S1	a	*Acacia leiocalyx*
G	a	*Heteropogon contortus*
G	a	*Cenchrus ciliaris**
G	a	*Aristida caput-medusae*
G	a	*Aristida calycina*
G	a	*Cymbopogon refractus*
G	a	*Chrysocephalum apiculatum*
G	a	*Lomandra leucocephala*
G	a	*Opuntia stricta**

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)

Type	% cover
Native grass	27.0
Native herbs/forbs (non-grass)	0.4
Native shrubs (<1 m high))	0.0
Non-native grass	8.0
Non-native herbs and shrubs	0.0
Litter (woodies <10 cm diameter, dead annuals, etc)	27.0
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	37.6

Fauna habitat features (within 1 ha area) – Baseline data

Characteristic	Abundance (0-7) ^
Decorticating bark	0
Coarse leaf litter (>2 cm diameter)	2
Fine leaf litter (<2 cm diameter)	2
Bare ground	6
Grass	7
Soil cracks	2
Stones (20-60 cm)	0
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0

^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	n/a
T2	n/a
S1	10.9
S2	n/a
G	n/a
Species	
S1	
Eucalyptus chloroclada	8.0
Allocasuarina luehmannii	2.9

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	n/a
T2	n/a
S1	1040
S2	n/a
G	n/a
Species	
S1	
Eucalyptus chloroclada	360
Acacia leiocalyx	20
Allocasuarina luehmannii	660

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	0

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included a termite a mound.
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern)

Koala habitat
Survey area not koala habitat due to non-remnant vegetation and absence of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Clearing and grazing, as well as construction of infrastructure (well pad and access road), resulting in soil alterations (berms)
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Survey area consists of large area of non-remnant vegetation with small, disturbed patches of mature trees. Small patches of remnant vegetation are present as isolated patches within non-remnant landscape. Survey area represents low value habitat, with small patches of disturbed remnant vegetation representing marginally higher habitat value within the landscape context.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Prickly pear[1] (*Opuntia stricta*), U; buffel grass (*Cenchrus ciliaris*), C
Total percentage weed cover: Prickly pear[1], 3%; buffel grass, 8%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
Numerous grass trees (*Xanthorrhoea johnsoni*). Refer to Santos webGIS system for point locations.

Incidental fauna observations
Australian magpie, Australian raven, brown falcon, eastern striped skink, noisy miner, pheasant coucal, rainbow bee-eater, red-necked wallaby, Torresian crow, variegated fairy-wren, weebill, white-throated gerygone

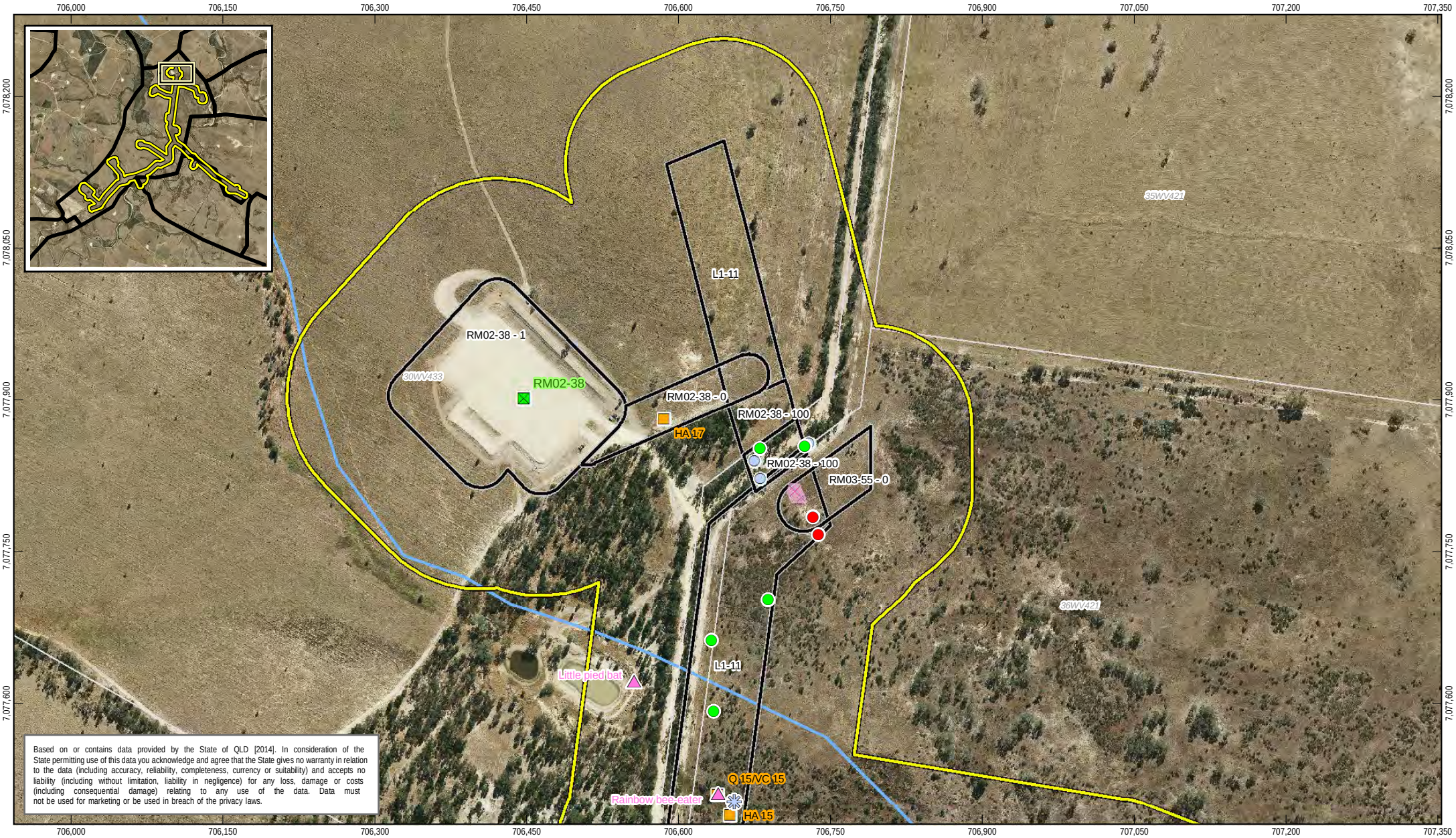
Representative photos for the RM 09-05 infrastructure area

North

East

South

West



1:5,000 (@ A4)

0 50 100 150

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Notable Fauna Species
- Watercourse Assessment Site
- Type A Restricted Plant Site
- Brachychiton populneus
- Xanthorrhoea johnsonii
- Xanthorrhoea johnsonii
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Cadastre

Santos GLNG
L1 and N1 Ecological Assessments

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Revision 0
Date 06 Jun 2014

Proposed RM 02-38 Infrastructure Area

Figure 10

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145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Imagery/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Notable Flora Species, Notable Fauna Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.10 Proposed RM 02-38 infrastructure area

3.10.1 Summary for the RM 02-38 infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Absent
ESAs	Present within 1 km	**Wetlands**	Absent
Essential habitat	Absent		

3.10.2 Regional ecosystems

No remnant REs are mapped as present within the RM 02-38 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 10 (Q 17).

Approval requirement or further action

None

3.10.3 Threatened ecological communities

No TECs are mapped as present within the RM 02-38 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 10 (Q 17).

Approval requirement or further action

None

3.10.4 Vegetation communities and habitat values

The following vegetation community occurs within the RM 02-38 infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.10.11. Field validation points for vegetation communities and habitat values are shown on Figure 10 (VC 17, HA 17).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.10.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the RM 02-38 infrastructure area. However, one Category C ESA, of concern RE 11.9.7, and its primary protection area is mapped within 1 km of the RM 02-38 infrastructure area.

The mapped Category C ESA is located outside of the investigation area and was therefore not field validated as part of the current ecological assessments.

Approval requirement or further action

None

3.10.6 Essential habitat

No VM Act-mapped essential habitat is present within the RM 02-38 infrastructure area.

Approval requirement or further action

None

3.10.7 Threatened species

No threatened flora species were recorded within the RM 02-38 infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the RM 02-38 infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the RM 02-38 infrastructure area.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.10.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the RM 02-38 infrastructure area (refer Section 3.10.11). Locations of these features are mapped on Figure 10 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.10.9 Watercourses

No watercourses are mapped or were confirmed present within the RM 02-38 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.10.10 Wetlands, lakes and springs

No wetlands are mapped or were confirmed present within the RM 02-38 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.10.11 RM 02-38: Vegetation community and habitat summary

Vegetation community description – Baseline data							
Site:	Q 17/VC 17/HA 17	**Recorder:**	JN, PW, LM	**Date:**	23/01/2014	**Time:**	0725
Project:	L1 ecological field surveys			**Photos:**	N: 696 E: 697 S: 698 W: 699		
Locality:	RM 02-38			**Property (lot/plan):**	30WV433		
Coordinates:	**Zone:** 5 5		7 0 5 6 0 0		7 0 7 3 7 5 1		

Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses. Some areas of low regrowth are scattered throughout the infrastructure area.

Vegetation structure
Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	13	9-15	V
T2		-	
T3		-	
S1	7	4-8	S
S2	1.5	1-3	V
G	0.4	0-1	D

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: T1

Land form element# (40 m radius): Gentle slope

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: White, sandy, hard and powdery

Slope and aspect: <5°, South

Vast: III

Plant species
Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
T1	d	*Eucalyptus melanophloia*
T1	a	*Angophora floribunda*
T1	a	*Angophora leiocarpa*
T1	a	*Eucalyptus populnea*
S1	a	*Eucalyptus melanophloia*
S1	a	*Corymbia tessellaris*
S1	a	*Geijera parviflora*
S1	d	*Callitris glaucophylla*
S1	a	*Allocasuarina luehmannii*
S2	a	*Opuntia tomentosa**
S2	a	*Acacia leiocalyx*
S2	a	*Carissa ovata*
S2	a	*Acacia deanei* subsp. *deanei*
S2	a	*Capparis lasiantha*
G	a	*Capparis lasiantha*
G	a	*Enteropogon ramosus*
G	a	*Aristida caput-medusae*
G	a	*Eragrostis lacunaria*
G	a	*Bothriochloa pertusa**
G	a	*Melinis repens**
G	d	*Cenchrus ciliaris**

*Denotes exotic species

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	0.0
Native herbs/forbs (non-grass)	0.0
Native shrubs (<1 m high))	0.0
Non-native grass	61.0
Non-native herbs and shrubs	0.0
Litter (woodies <10 cm diameter, dead annuals, etc)	13.0
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	26.0

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	2
Coarse leaf litter (>2 cm diameter)	4
Fine leaf litter (<2 cm diameter)	6
Bare ground	5
Grass	7
Soil cracks	1
Stones (20-60 cm)	0
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	0.0
T2	n/a
S1	0.0
S2	0.0
G	n/a
Species	
None	

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	0
T2	n/a
S1	60
S2	20
G	n/a
Species	
S1	
Eucalyptus melanophloia	40
Allocasuarina luehmannii	20
S2	
Acacia deanei	20

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	20.4

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included a dead hollow log and two hollows in trees
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern)

Koala habitat
Survey area not koala habitat due to non-remnant vegetation and absence of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Clearing and grazing
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Survey area consists of large area of non-remnant vegetation with scattered mature trees. Scattered mature trees provide refuge for birds utilising surrounding woodland environment. Vegetation corridor along road provides narrow corridor within the wider landscape. Isolated woody debris creates refuge for reptiles and small ground dwelling mammals. Survey area provides generally low value habitat.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Prickly pear[1] (*Opuntia tomentosa*), U; buffel grass (*Cenchrus ciliaris*), C; red natal grass (*Melinis repens*), C; Indian bluegrass (*Bothriochloa pertusa*), C
Total percentage weed cover: Prickly pear[1], 2%; buffel grass, 61%; red natal grass, 10%; Indian bluegrass, 5%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
Kurrajong (*Brachychiton populneus*). Refer to Santos webGIS system for point locations.

Incidental fauna observations
apostlebird, red-necked wallaby, whiptail wallaby

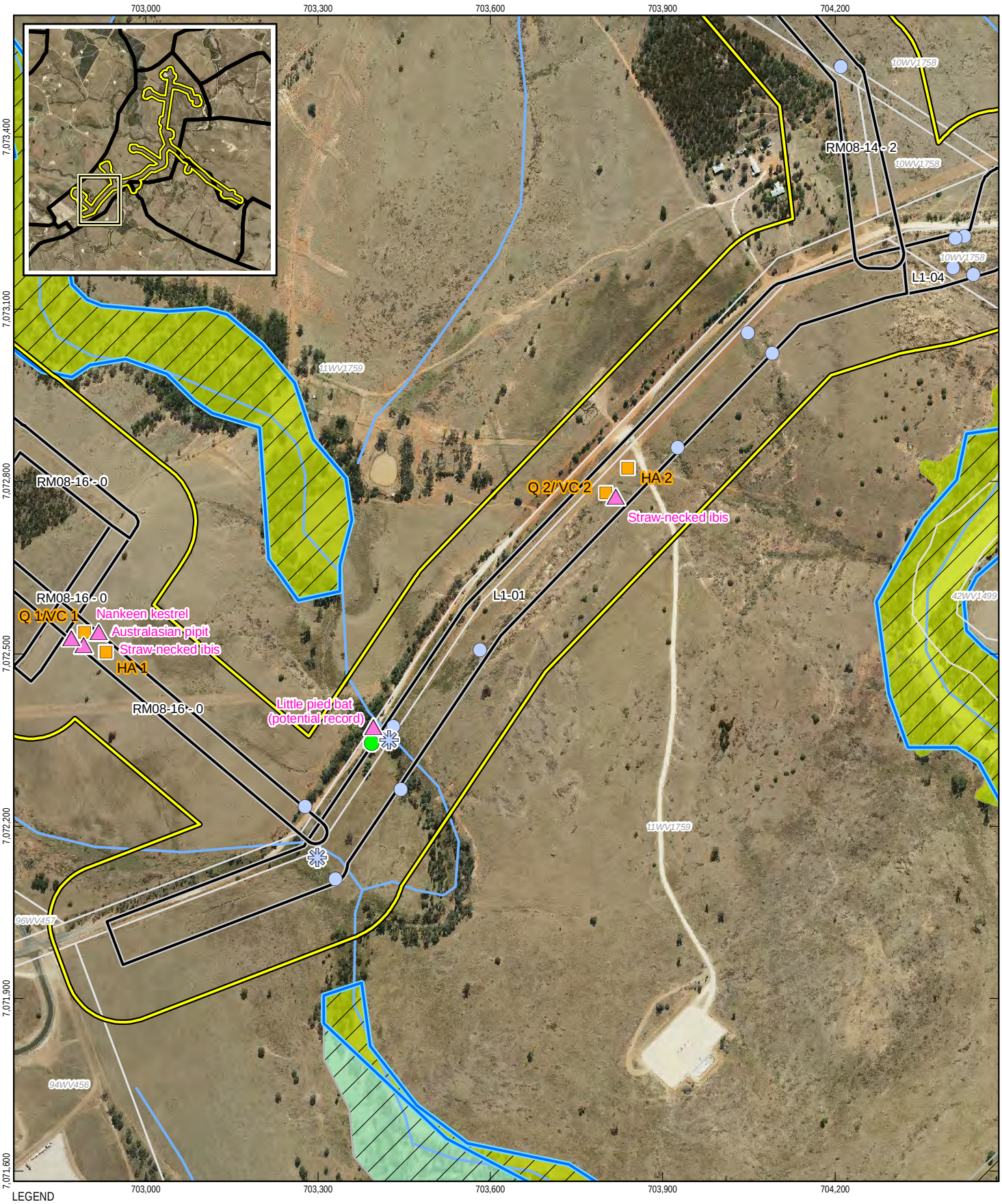
Representative photos for the RM 02-38 infrastructure area

North

East

South

West



LEGEND

- Assessment Site
- Fauna Habitat Feature
- Notable Fauna Species
- Watercourse Assessment Site

Type A Restricted Plant Site
- Brachychiton populneus
- Brachychiton rupestris
- Xanthorrhoea johnsonii
- Xanthorrhoea johnsonii

- Watercourse
- CDZ Area (30m)
- Essential Habitat (BPA)
- Referable Wetlands

- Cadastre

Regional Ecosystem (BD)
- Of Concern dominant
- Not of Concern

1:9,000 (@ A4)

0 100 200 300

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Santos GLNG
L1 and N1 Ecological Assessments

Job Number 41-27312
Revision 0
Date 06 Jun 2014

Proposed L1-01 Sub-branch Infrastructure Area

Figure 11

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145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Regional Ecosystems, Essential Habitat, Imagery, Referred Wetlands/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Notable Flora Species, Notable Fauna Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.11 Proposed L1-01 sub-branch infrastructure area

3.11.1 Summary for the L1-01 sub-branch infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Present
ESAs	Present within 1 km	**Wetlands**	Absent
Essential habitat	Absent		

3.11.2 Regional ecosystems

No remnant REs are mapped as present within the L1-01 sub-branch infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 11 (Q 2).

Approval requirement or further action

None

3.11.3 Threatened ecological communities

No TECs are mapped as present within the L1-01 sub-branch infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 11 (Q 2).

Approval requirement or further action

None

3.11.4 Vegetation communities and habitat values

The following vegetation community occurs within the L1-01 sub-branch infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.11.11. Field validation points for vegetation communities and habitat values are shown on Figure 11 (VC 2, HA 2).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.11.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the L1-01 sub-branch infrastructure area. However, two Category C ESAs and their primary protection areas are mapped within 1 km of the L1-01 sub-branch infrastructure area, namely:

- An RE mixed polygon containing two of concern REs (RE 11.3.25/11.3.2)

- A referable wetland

The mapped Category C ESAs have been previously field validated as consistent with the mapping. The mapped referable wetland was validated as an ephemeral palustrine wetland and the of concern mixed RE polygon was validated as containing of concern REs 11.3.2 and/or 11.3.25 (Boobook Ecological Consulting 2013).

Approval requirement or further action

None

3.11.6 Essential habitat

No VM-Act mapped essential habitat is present within the L1-01 sub-branch infrastructure area.

Approval requirement or further action

None

3.11.7 Threatened species

No threatened flora species were recorded within the L1-01 sub-branch infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the L1-01 sub-branch infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the L1-01 sub-branch infrastructure area. However, nankeen kestrel and straw-necked ibis, listed as marine under the EPBC Act, were recorded during field assessments. There was also an unconfirmed record of little-pied bat, listed as near threatened under the NC Act, recorded on the Anabat data. The unconfirmed records are a result of three species, including little pied bat, having very similar calls that are difficult to differentiate during analysis. The two species with similar calls to little pied bat, namely *Scotorepens greyii* and *Vespadelus baverstocki*, are not listed under either the EPBC Act or NC Act. Where calls were encountered that could not be resolved to species, all potential candidates are listed as possibly present. As conservative approach, where there were unconfirmed records of little pied bat it has been assumed that these species are present.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

Management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)

- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.11.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the L1-01 sub-branch infrastructure area (refer Section 3.11.11). Locations of these features are mapped on Figure 11 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.11.9 Watercourses

Two mapped watercourses intersect the L1-01 sub-branch infrastructure area. The watercourses are mapped as a first order watercourse and a third order watercourse.

Field validation of the watercourses determined them to be drainage features under the *Water Act 2000*. The watercourse assessment location is shown as site WC 1 and WC 2 on Figure 11. A summary of results is presented in Table 4 and the watercourse assessments are presented in Appendix C.

Table 4 Watercourse assessments in L1-01 sub-branch infrastructure area

Watercourse reference	Location (easting, northing)		Assessment outcome	Reason
WC 1	703300	7072145	Drainage feature (*Water Act 2000*)	No extended or permanent period of flow – only carries water flow for a short duration after a rainfall event Lacks sufficient flow adequacy to sustain basic ecological processes and support riverine species Lacks continuous and defined bed and banks and the presence of in-stream islands, benches or bars
WC 2	703424	7072350	Drainage feature (*Water Act 2000*)	No extended or permanent period of flow – only carries water flow for a short duration after a rainfall event Lacks sufficient flow adequacy to sustain basic ecological processes and support riverine species Lacks continuous and defined bed and banks and the presence of in-stream islands, benches or bars

Approval requirement or further action

None

3.11.10 Wetlands, lakes and springs

No wetlands are mapped or were confirmed present within the L1-01 sub-branch infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.11.11 L1-01 sub-branch: Vegetation community and habitat summary

Vegetation community description – Baseline data																					
Site:	Q 2/VC 2/HA 2		**Recorder:**	JN, PW, LM, RF		**Date:**	20/01/2014		**Time:**	0930											
Project:	L1 ecological field surveys					**Photos:**	N: 0309 E: 0306 S: 0307 W: 0308														
Locality:	L1-01 sub-branch					**Property (lot/plan):**	Tantatton (11WV1759)														
Coordinates:	**Zone:**	5	5		7	0	3	8	0	1		7	0	7	2	7	8	0			
Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses.																					

Vegetation structure
Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1		-	
T2		-	
T3		-	
S1	2	1-6	V
S2		-	
G	0.6	0-1	M

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: S1

Land form element# (40 m radius): Crest of low hill

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Light brown, clay-sands

Slope and aspect: <5°, West

Vast: III

Plant species
Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
S1	a	*Geijera parviflora*
S1	a	*Callitris glaucophylla*
S1	a	*Citrus glauca*

Str.	Rel. dom.	Scientific Name
S1	a	*Eremophila mitchellii*
S1	a	*Casuarina cristata*
G	a	*Eragrostis leptostachya*
G	a	*Chloris ventricosa*
G	d	*Cenchrus ciliaris**
G	a	*Enneapogon nigricans*
G	a	*Themeda triandra*
G	a	*Bothriochloa pertusa**
G	a	*Enteropogon ramosus*
G	a	*Sclerolaena birchii*
G	a	*Capparis lasiantha*
G	a	*Calotis lappulacea*
G	a	*Citrus glauca*
G	a	*Apophyllum anomalum*
G	a	*Sporobolus caroli*
G	a	*Arabidella eremigena*
G	a	*Maireana microphylla*
G	a	*Chrysocephalum apiculatum*
G	a	*Verbena aristigera**
G	a	*Austrostipa ramosissima*
G	a	*Rhynchosia minima*

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	5.0
Native herbs/forbs (non-grass)	1.6
Native shrubs (<1 m high))	0.4
Non-native grass	49.0
Non-native herbs and shrubs	1.6
Litter (woodies <10 cm diameter, dead annuals, etc)	6.0
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	36.4

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	0
Coarse leaf litter (>2 cm diameter)	0
Fine leaf litter (<2 cm diameter)	2
Bare ground	6
Grass	7
Soil cracks	2
Stones (20-60 cm)	0
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	n/a
T2	n/a
S1	0.4
S2	n/a
G	n/a
Species	
S1	
Geijera parviflora	0.4

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	n/a
T2	n/a -
S1	60
S2	n/a
G	n/a
Species	
S1	
Callitris glaucophylla	40
Geijera parviflora	20

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	21.0

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Habitat features included five dead hollow logs, a hollow in tree and a hollow stag.
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern), koala along ephemeral creeks where matures trees are present

Koala habitat
Potential koala habitat trees are present along road reserve and ephemeral creek lines. Survey area not koala habitat due to non-remnant vegetation and lack of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Clearing of shrubs, grazing, existing pipeline
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Survey area consists of large area of non-remnant vegetation. Thin corridor of mature trees along read reserve and ephemeral creek line provide vegetation corridor within non-remnant landscape. Mature trees provide shelter and food resources for birds and small mammals including wallabies. Survey area represents low value habitat, with small patches of remnant vegetation representing higher habitat value within the landscape context.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Prickly pear[1] (*Opuntia stricta*), R; buffel grass (*Cenchrus ciliaris*), C; Mayne's pest (*Verbena aristigera*), C; Indian bluegrass (*Bothriochloa pertusa*), C.
Total percentage weed cover: Prickly pear[1], 2%; buffel grass, 49%; Mayne's pest, 2%; Indian bluegrass, 2%.
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
Kurrajong (*Brachychiton populneus*). Refer to Santos webGIS system for point locations.

Incidental fauna observations
Australian magpie, Australian owlet-nightjar, Australian raven, barn owl, Beccari's freetail bat, blue bonnet, crested pigeon, eastern bentwing bat, eastern freetail bat, emu, galah, golden-headed cisticola, Gould's wattled bat, grey butcherbird, grey-crowned babbler, inland forest bat, little broad-nosed bat, little forest bat (unconfirmed), little pied bat (unconfirmed), magpie-lark, masked lapwing, masked owl, nankeen kestrel, noisy miner, rabbit, red winged parrot, red-necked wallaby, rufous bettong, straw-necked ibis, striated pardalote, sulphur-crested cockatoo, superb fairy-wren , tawny frogmouth Torresian crow, wedge-tailed eagle, weebill western broad-nosed bat, white-browed woodswallow white-striped freetail bat, willie wagtail, yellow-bellied sheathtail-bat, yellow-rumped thornbill, yellow-throated miner

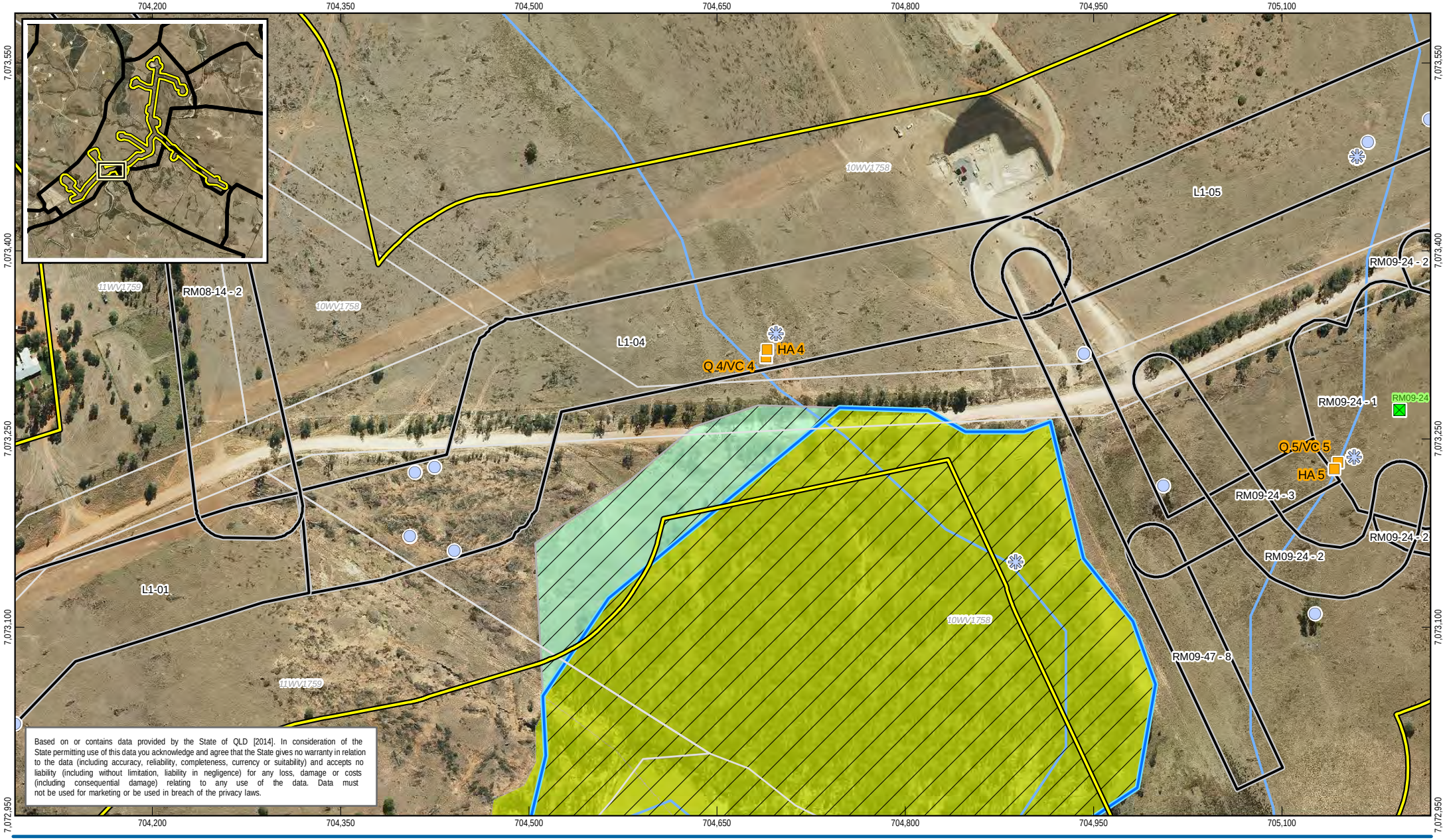
Representative photos for the L1-01 sub-branch infrastructure area

North

East

South

West



1:4,000 (@ A4)

0 50 100 150

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Watercourse Assessment Site
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Essential Habitat (BPA)
- Referable Wetlands
- Cadastre
- Regional Ecosystem (BD)
- Of Concern dominant
- Not of Concern

GHD

Santos GLNG Project

Santos GLNG
L1 and N1 Ecological Assessments

Job Number 41-27312
Revision 0
Date 06 Jun 2014

Proposed L1-04 Sub-branch Infrastructure Area

Figure 12

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145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Regional Ecosystems, Essential Habitat, Imagery, Referred Wetlands/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.12 Proposed L1-04 sub-branch infrastructure area

3.12.1 Summary for the L1-04 sub-branch infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Present
ESAs	Present within 100 m	**Wetlands**	Present within 100 m
Essential habitat	Absent		

3.12.2 Regional ecosystems

No remnant REs are mapped as present within the L1-04 sub-branch infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 12 (Q 4).

Approval requirement or further action

None

3.12.3 Threatened ecological communities

No TECs are mapped as present within the L1-04 sub-branch infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 12 (Q 4).

Approval requirement or further action

None

3.12.4 Vegetation communities and habitat values

The following vegetation community occurs within the L1-04 sub-branch infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.12.11. Field validation points for vegetation communities and habitat values are shown on Figure 12 (VC 4, HA 4).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.12.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the L1-04 sub-branch infrastructure area. However, two Category C ESAs and their primary protection areas are mapped within 100 m of the L1-04 sub-branch infrastructure area, namely:

- An RE mixed polygon containing two of concern REs (RE 11.3.25/11.3.2)

- A referable wetland

Note that the primary protection zones of these Category C ESAs overlap with the disturbance footprint of the well pad.

The mapped Category C ESAs have been previously field validated and were thus not assessed during the current ecological assessment. The mapped referable wetland was validated as an ephemeral palustrine wetland and the mapped of concern mixed RE polygon was validated as containing of concern REs 11.3.2 and/or 11.3.25 (Boobook Ecological Consulting 2013).

Approval requirement or further action

Only limited petroleum activities are permitted within the primary protection zone of Category C ESAs as per the Environmental Authority (EA) conditions. A number of conditions outlined in the EA (Schedule E15) must be met prior to carrying out limited petroleum activities.

3.12.6 Essential habitat

No VM Act-mapped essential habitat is present within the L1-04 sub-branch infrastructure area.

Approval requirement or further action

None

3.12.7 Threatened species

No threatened flora species were recorded within the L1-04 sub-branch infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the L1-04 sub-branch infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the L1-04 sub-branch infrastructure area.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.12.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the L1-04 sub-branch infrastructure area (refer Section 3.12.11). Locations of these features are mapped on Figure 12 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.12.9 Watercourses

A single mapped first order watercourse intersects the L1-04 sub-branch infrastructure area.

Field validation of the watercourse determined it to be a drainage feature under the *Water Act 2000*. The watercourse assessment location is shown as site WC 3 on Figure 12. A summary of results is presented in Table 5 and the watercourse assessments are presented in Appendix C.

Table 5 Watercourse assessments in L1-04 sub-branch infrastructure area

Watercourse reference	Location (easting, northing)		Assessment outcome	Reason
WC 3	704697	7073334	Drainage feature (*Water Act 2000*)	No extended or permanent period of flow – only carries water flow for a short duration after a rainfall event Lacks sufficient flow adequacy to sustain basic ecological processes and support riverine species Lacks continuous and defined bed and banks and the presence of in-stream islands, benches or bars

Approval requirement or further action

None

3.12.10 Wetlands, lakes and springs

A referrable wetland associated with remnant vegetation (RE 11.3.25/11.3.2) along a first order watercourse is mapped within 100 m of the L1-04 sub-branch infrastructure area. This referable wetland, has been previously field validated as an ephemeral palustrine wetland (Boobook Ecological Consulting, 2013) and thus was not assessed during the current ecological assessments.

Approval requirement or further action

As the feature has been assessed as a wetland, construction must comply with the EA requirements (Schedule B5 to B16). All approvals must be lodged with the relevant agencies a minimum of ten business day prior to works.

3.12.11 L1-04 sub-branch: Vegetation community and habitat summary

Vegetation community description – Baseline data					
Site: Q 4/VC 4/HA 4	**Recorder:** JN, PW, LM, RF	**Date:** 20/01/2014	**Time:** 1130		
Project: L1 ecological field surveys		**Photos:** N: 596 E: 597 S: 598 W: 599			
Locality: L1-04 sub-branch		**Property (lot/plan):** Dalmuir (10WV1758)			
Coordinates:	**Zone:** 55	704690	7073321		
Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses.					

Vegetation structure
Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1		-	
T2		-	
T3		-	
S1	1.2	0.8-1.5	V
S2		-	
G	0.6	0-1	D

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: G

Land form element# (40 m radius): Gentle slope

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Light brown, clay-sands

Slope and aspect: 5°, North

Vast: III

Plant species
Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
S1	d	*Eucalyptus populnea*
G	c	*Cenchrus ciliaris**
G	c	*Austrostipa ramosissima*
G	a	*Urochloa mosambicensis**
G	a	*Maireana microphylla*
G	a	*Chrysocephalum apiculatum*
G	d	*Themeda triandra*
G	a	*Fimbristylis dichotoma*
G	a	*Aristida lignosa*
G	a	*Eragrostis lacunaria*
G	a	*Verbena aristigera**
G	a	*Wahlenbergia gracilis*
G	a	*Cirsium vulgare**
G	a	*Podolepis longipedata*
G	a	*Sporobolus creber*
G	a	*Chrysopogon fallax*
G	a	*Cymbopogon refractus*
G	a	*Digitaria ciliaris*
G	a	*Panicum effusum*
G	a	*Arabidella eremigena*
G	a	*Malvastrum americanum**

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	17.0
Native herbs/forbs (non-grass)	0.4
Native shrubs (<1 m high))	0.0
Non-native grass	15.0
Non-native herbs and shrubs	4.0
Litter (woodies <10 cm diameter, dead annuals, etc)	14.0
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	41.0

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	0
Coarse leaf litter (>2 cm diameter)	0
Fine leaf litter (<2 cm diameter)	0
Bare ground	6
Grass	7
Soil cracks	1
Stones (20-60 cm)	0
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	n/a
T2	n/a
S1	0.0
S2	n/a
G	n/a
Species	
None	

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	n/a
T2	n/a
S1	0
S2	n/a
G	n/a
Species	
None	20

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	0.0

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Habitat features included four dead hollow logs.
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern)

Koala habitat
Survey area not koala habitat due to non-remnant vegetation and absence of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Grazing, mechanical clearing
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Survey area consists of large area of non-remnant vegetation with limited habitat features. A thin corridor of mature trees is present adjacent to the survey area within the road reserve. This vegetation corridor may provide shelter and foraging habitat for birds. Survey area provides generally low value habitat.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Buffel grass (*Cenchrus ciliaris*), C; Mayne's pest (*Verbena aristigera*), C; *Urochloa mosambicensis*, C; spear thistle (*Cirsium vulgare*), U; *Malvastrum americanum*, U
Total percentage weed cover: Buffel grass, 20%; Mayne's pest, 2% *Urochloa mosambicensis*, 4%; spear thistle, 3%; *Malvastrum americanum*, 4%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
None present.

Incidental fauna observations
galah,masked owl, noisy miner, pied butcherbird, red-necked wallaby, rufous bettong, striated pardalote, tawny frogmouth, Torresian crow, weebill, white-throated gerygone

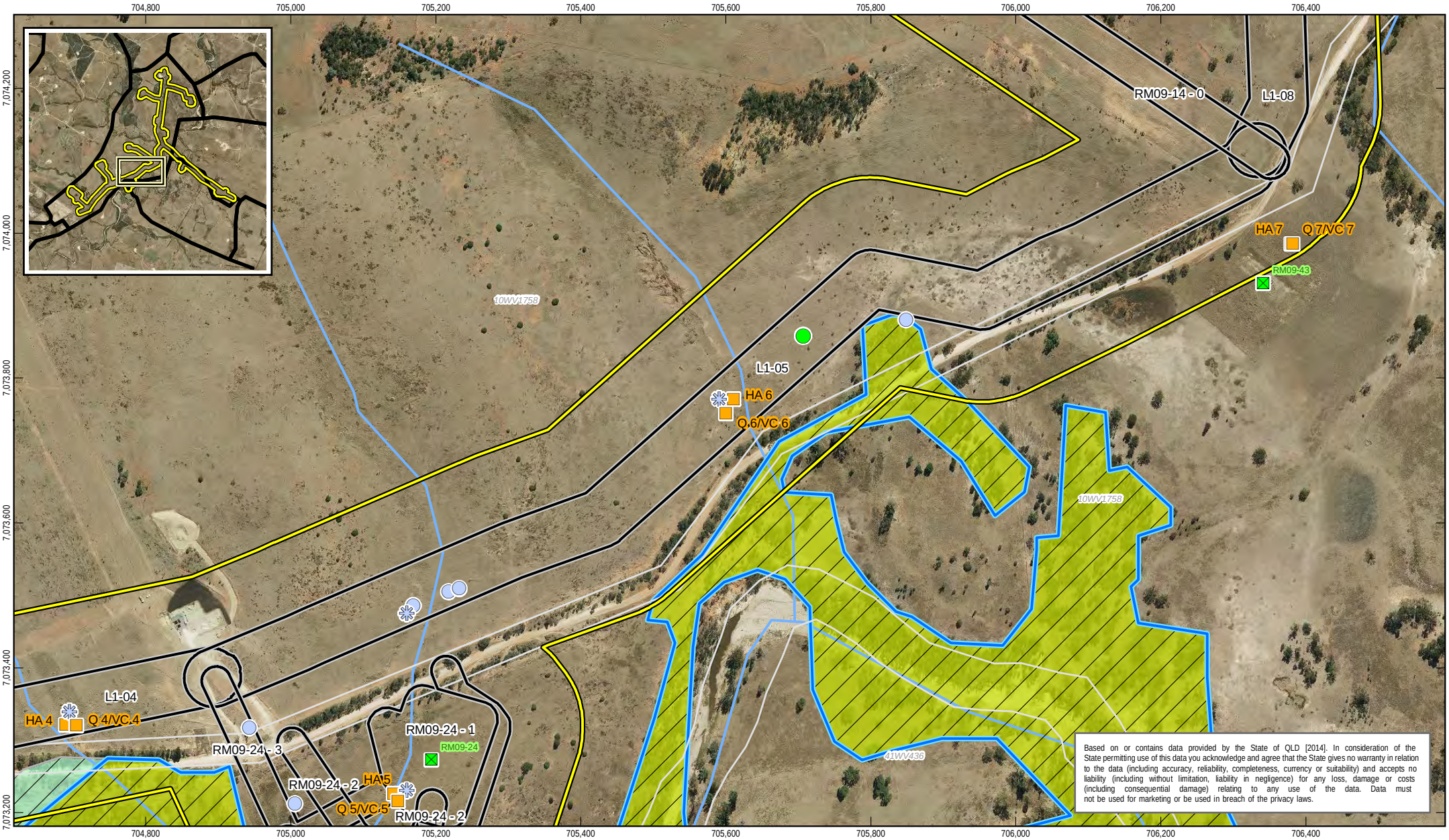
Representative photos for the L1-04 sub-branch infrastructure area

North

East

South

West



1:7,000 (@ A4)

0 50 100 150 200

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Well Pad
- Fauna Habitat Feature
- Assessment Site
- Watercourse Assessment Site
- Type A Restricted Plant Site
- Brachychiton populneus
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Cadastre
- Referable Wetlands
- Essential Habitat (BPA)
- Regional Ecosystem (BD)
- Of Concern dominant
- Not of Concern

Santos GLNG
L1 and N1 Ecological Assessments

Job Number	41-27312
Revision	0
Date	06 Jun 2014

Proposed L1-05 Sub-branch Infrastructure Area

Figure 13

G:\41\27312\GIS\Maps\MXD\41_27312_013_L1-05_Rev0.mxd

145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Regional Ecosystems, Essential Habitat, Imagery, Referred Wetlands/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Notable Flora Species, Notable Fauna Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.13 Proposed L1-05 sub-branch infrastructure area

3.13.1 Summary for the L1-05 sub-branch infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Present
ESAs	Present within 100 m	**Wetlands**	Present within 100 m
Essential habitat	Absent		

3.13.2 Regional ecosystems

No remnant REs are mapped as present within the L1-05 sub-branch infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 13 (Q 6).

Approval requirement or further action

None

3.13.3 Threatened ecological communities

No TECs are mapped as present within the L1-05 sub-branch infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 13 (Q 6).

Approval requirement or further action

None

3.13.4 Vegetation communities and habitat values

The following vegetation community occurs within the L1-05 sub-branch infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.13.11. Field validation points for vegetation communities and habitat values are shown on Figure 13 (VC 6, HA 6).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.13.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the L1-05 sub-branch infrastructure area. However, two Category C ESAs and their primary protection areas are mapped within 100 m of the L1-05 sub-branch infrastructure area, namely:

- An RE mixed polygon containing two of concern REs (RE 11.3.25/11.3.2)

- A referable wetland

Note that the primary protection zones of these Category C ESAs overlap with the disturbance footprint of the well pad.

The mapped Category C ESAs have been previously field validated and were thus not assessed during the current ecological assessment. The mapped referable wetland was validated as an ephemeral palustrine wetland and the mapped of concern mixed RE polygon was validated as containing of concern REs 11.3.2 and/or 11.3.25 (Boobook Ecological Consulting 2013).

Approval requirement or further action

Only limited petroleum activities are permitted within the primary protection zone of Category C ESAs as per the Environmental Authority (EA) conditions. A number of conditions outlined in the EA (Schedule E15) must be met prior to carrying out limited petroleum activities.

3.13.6 Essential habitat

No VM Act-mapped essential habitat is present within the L1-05 infrastructure area.

Approval requirement or further action

None

3.13.7 Threatened species

No threatened flora species were recorded within the L1-05 sub-branch infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the L1-05 sub-branch infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the L1-05 sub-branch infrastructure area.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.13.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the L1-04 sub-branch infrastructure area (refer Section 3.13.11). Locations of these features are mapped on Figure 13 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.13.9 Watercourses

Two mapped first order watercourses intersect the L1-05 sub-branch infrastructure area.

Field validation of the watercourses determined them to be drainage features under the *Water Act 2000*. The watercourse assessment location is shown as site WC 6 and WC 7 on Figure 13. A summary of results is presented in Table 6 and the watercourse assessments are presented in Appendix C.

Table 6 Watercourse assessments in L1-05 sub-branch infrastructure area

Watercourse reference	Location (easting, northing)		Assessment outcome	Reason
WC 6	705160	707334	Drainage feature (*Water Act 2000*)	No extended or permanent period of flow – only carries water flow for a short duration after a rainfall event Lacks sufficient flow adequacy to sustain basic ecological processes and support riverine species Lacks continuous and defined bed and banks and the presence of in-stream islands, benches or bars
WC 7	705610	7073769	Drainage feature (*Water Act 2000*)	No extended or permanent period of flow – only carries water flow for a short duration after a rainfall event Lacks sufficient flow adequacy to sustain basic ecological processes and support riverine species Lacks continuous and defined bed and banks and the presence of in-stream islands, benches or bars

Approval requirement or further action

None

3.13.10 Wetlands, lakes and springs

A DEHP mapped referrable wetland associated with remnant vegetation (11.3.25/11.3.2) along a first order watercourse is mapped within 100 m of the L1-05 sub-branch infrastructure area. This referable wetland, has been previously field validated as an ephemeral palustrine wetland (Boobook Ecological Consulting, 2013) and thus was not assessed during the current ecological assessments.

Approval requirement or further action

As the feature has been assessed as a wetland, construction must comply with the EA requirements (Schedule B5 to B16). All approvals must be lodged with the relevant agencies a minimum of ten business day prior to works.

3.13.11 L1-05 sub-branch: Vegetation community and habitat summary

Vegetation community description – Baseline data							
Site:	Q 6/VC 6/HA 6	**Recorder:**	JN, PW, LM, RF	**Date:**	21/01/2014	**Time:**	0800
Project:	L1 ecological field surveys			**Photos:**	N: 0320 E: 0317 S: 0318 W: 0319		
Locality:	L1-05 sub-branch			**Property (lot/plan):**	Dalmuir (10WV1758)		
Coordinates:	**Zone:** 5 5	7 0 5 6 1 0	7 0 7 3 7 7 1				

Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses.

Vegetation structure
Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1		-	
T2		-	
T3		-	
S1	1.5	1-4	V
S2		-	
G	0.5	0-1	M

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: S1

Land form element# (40 m radius): Gentle slope

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Brown, sandy-loam

Slope and aspect: 5°, East

Vast: III

Plant species
Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated

Str.	Rel. dom.	Scientific Name
S1	d	*Acacia oswaldii*
S1	a	*Eucalyptus populnea*
S1	a	*Acacia excelsa*
G	a	*Chrysocephalum apiculatum*
G	a	*Sporobolus caroli*
G	a	*Opuntia stricta**
G	a	*Aristida lignosa*
G	a	*Themeda triandra*
G	a	*Verbena aristigera**
G	a	*Eragrostis lacunaria*
G	a	*Cirsium vulgare**
G	a	*Juncus usitatus*
G	a	*Maireana microphylla*
G	a	*Cenchrus ciliaris**
G	a	*Aristida caput-medusae*
G	a	*Fimbristylis dichotoma*

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	14.0
Native herbs/forbs (non-grass)	6.0
Native shrubs (<1 m high))	0.0
Non-native grass	25.0
Non-native herbs and shrubs	12.0
Litter (woodies <10 cm diameter, dead annuals, etc)	8.6
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	34.4

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	0
Coarse leaf litter (>2 cm diameter)	0
Fine leaf litter (<2 cm diameter)	0
Bare ground	6
Grass	7
Soil cracks	2
Stones (20-60 cm)	2
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	n/a
T2	n/a
S1	0.0
S2	n/a
G	n/a
Species	
None	

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	n/a
T2	n/a
S1	220
S2	n/a
G	n/a
Species	
Acacia oswaldii	80
Casuarina cristata	80
Eucalyptus populnea	20
Acacia excelsa	40

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	0.0

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included a hollow in tree, woody debris and a burrow.
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern)

Koala habitat
Survey area not koala habitat due to non-remnant vegetation and absence of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Grazing, mechanical clearing
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Survey area consists of large area of non-remnant vegetation with limited habitat features. Mature remanet vegetation is present within non-remnant surrounding landscape either in isolated patches of narrow linear corridors within the road reserve. Survey area represents low value habitat.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Prickly pear[1] (*Opuntia stricta*), U ;buffel grass (*Cenchrus ciliaris*), C; Mayne's pest (*Verbena aristigera*), C; spear thistle (*Cirsium vulgare*), C
Total percentage weed cover: Prickly pear[1], 2% ;buffel grass, 23%; Mayne's pest, 12%; spear thistle, 4%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
None present.

Incidental fauna observations
Australian raven, eastern grey kangaroo, masked owl, red-necked wallaby, rufous bettong, sulphur-crested cockatoo, tawny frogmouth, Torresian crow, wedge-tailed eagle

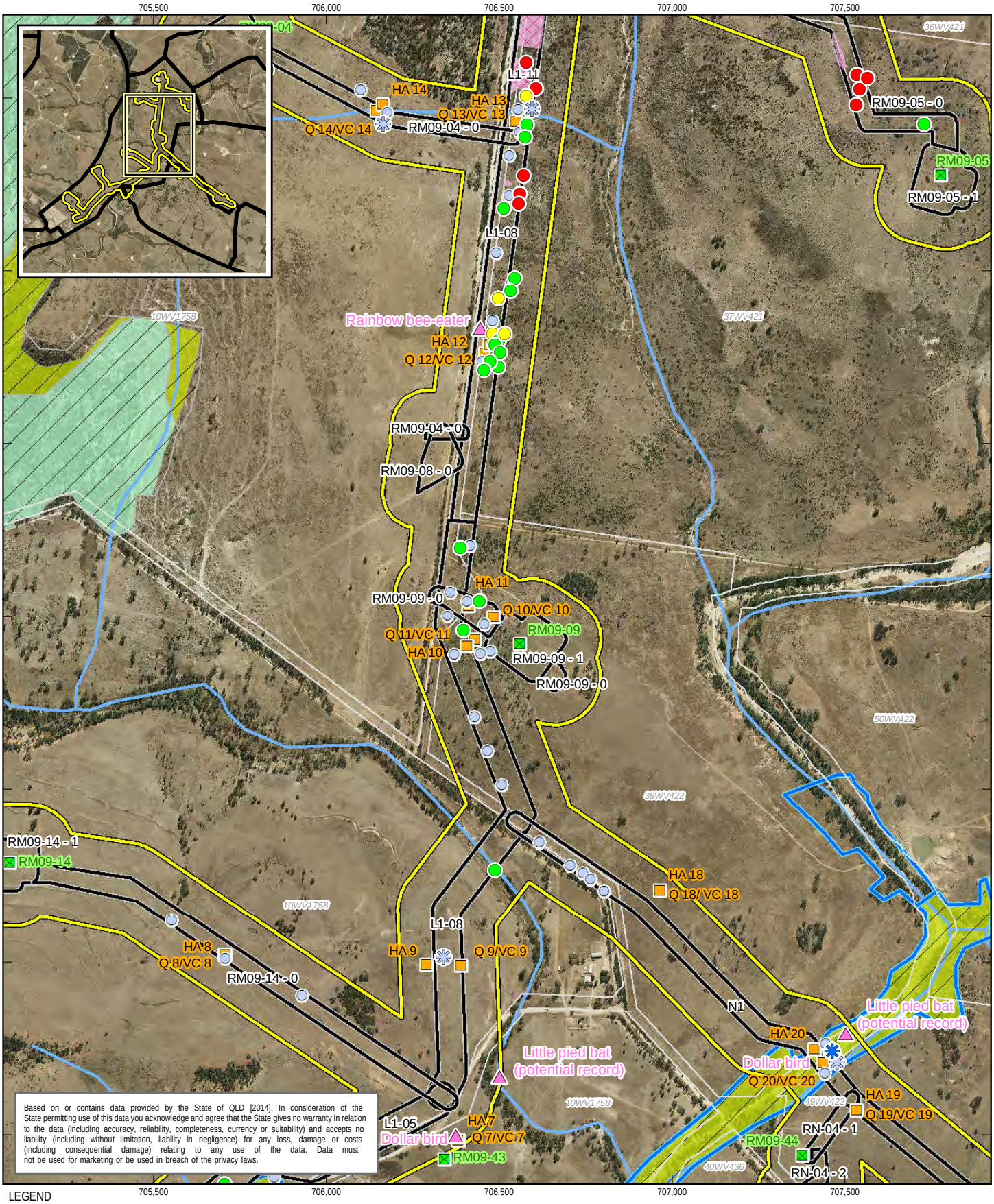
Representative photos for the L1-05 sub-branch infrastructure area

North

East

South

West



Based on or contains data provided by the State of QLD [2014]. In consideration of the State permitting use of this data you acknowledge and agree that the State gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data. Data must not be used for marketing or be used in breach of the privacy laws.

LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Notable Fauna Species
- Watercourse Assessment Site
- Wetland Assessment Site
- Type A Restricted Plant Site
- Brachychiton populneus
- Brachychiton rupestris
- Xanthorrhoea johnsonii
- Xanthorrhoea johnsonii
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Essential Habitat (BPA)
- Referable Wetlands
- Cadastre
- Regional Ecosystem (BD)
- Of Concern dominant
- Not of Concern

1:15,000 (@ A4)

0 100 200 300 400 500

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

Santos GLNG
L1 and N1 Ecological Assessments

Proposed L1-08 Sub-branch Infrastructure Area

Job Number 41-27312
Revision 0
Date 06 Jun 2014

Figure 14

G:\41\27312\GIS\Maps\MXD\41_27312_014_L1-08_Rev0.mxd

145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Regional Ecosystems, Essential Habitat, Imagery, Referred Wetlands/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Notable Flora Species, Notable Fauna Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.14 Proposed L1-08 sub-branch infrastructure area

3.14.1 Summary for the L1-08 sub-branch infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	• Cleared open pasture • Regrowth Eucalypt open-woodland	**Watercourses**	Present
ESAs	Present within 1 km	**Wetlands**	Absent
Essential habitat	Absent		

3.14.2 Regional ecosystems

No remnant REs are mapped as present within the L1-08 sub-branch infrastructure area and none were identified during the ecological assessments. A small portion of the infrastructure intersects mapped high value regrowth vegetation that is no concern at present. This was confirmed present during field validation assessments. Field validation points for REs are shown on Figure 14 (Q 9, Q 11, Q12).

Approval requirement or further action

None

3.14.3 Threatened ecological communities

No TECs are mapped as present within the L1-08 sub-branch infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 14 (Q 9, Q 11, Q12).

Approval requirement or further action

None

3.14.4 Vegetation communities and habitat values

The following vegetation community occurs within the L1-08 sub-branch infrastructure area:

- Cleared open pasture
- Regrowth eucalypt open-woodland

Descriptions of this vegetation community and habitat values are summarised in Section 3.14.11. Field validation points for vegetation communities and habitat values are shown on Figure 14 (VC 9, VC 11, VC 12, HA 9, HA 11, HA 12).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.14.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the L1-08 sub-branch infrastructure area. However, two Category C ESAs and their primary protection areas are mapped within 1 km of the L1-08 sub-branch infrastructure area, namely:

- An RE mixed polygon containing two of concern REs (RE 11.3.25/11.3.2)
- A referable wetland

The mapped Category C ESAs have been previously field validated and were thus not assessed during the current ecological assessment. The mapped referable wetland was validated as an ephemeral palustrine wetland and the mapped of concern mixed RE polygon was validated as containing of concern REs 11.3.2 and/or 11.3.25 (Boobook Ecological Consulting 2013).

Approval requirement or further action

None

3.14.6 Essential habitat

No VM Act-mapped essential habitat is present within the L1-08 sub-branch infrastructure area.

Approval requirement or further action

None

3.14.7 Threatened species

No threatened flora species were recorded within the L1-08 sub-branch infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the L1-08 sub-branch infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the L1-08 sub-branch infrastructure area. There was an unconfirmed record of little-pied bat, listed as near threatened under the NC Act, recorded on Anabat.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

Management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)

- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.14.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the L1-08 sub-branch infrastructure area (refer Section 3.14.11). Locations of these features are mapped on Figure 14 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.14.9 Watercourses

A single mapped fourth order watercourse intersects the L1-08 sub-branch infrastructure area.

Field validation of the watercourses confirmed it as a watercourse under the *Water Act 2000*. The watercourse assessment location is shown as site WC 8 on Figure 14. A summary of results is presented in Table 7 and the watercourse assessments are presented in Appendix C.

Table 7 Watercourse assessments in L1-08 sub-branch infrastructure area

Watercourse reference	Location (easting, northing)		Assessment outcome	Reason
WC 8	706289	7074492	Watercourse (*Water Act 2000*)	No extended or permanent period of flow – only carries water flow for a short duration after a rainfall event Lacks sufficient flow adequacy to sustain basic ecological processes and support riverine species Features a continuous and defined bed and banks and the presence of in-stream islands, benches or bars

Approval requirement or further action

As the feature constitutes a waterway under the *Water Act 2000*, construction must comply with relevant self-assessable codes under the Water Act and the relevant EA requirements relating to watercourses (Schedule B5 to B16). All approvals must be lodged with the relevant agencies a minimum of ten business day prior to works.

3.14.10 Wetlands, lakes and springs

No wetlands are mapped or were confirmed present within the L1-08 sub-branch infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.14.11 L1-08 sub-branch: Vegetation community and habitat summary

Vegetation community description – Baseline data							
Site:	Q11/12 / VC11/12 /HA 11/12	**Recorder:**	JN, PW, LM	**Date:**	22/01/2014	**Time:**	0800
Project:	L1 ecological field surveys			**Photos:**	N: 0337 E: 0338 S: 0339 W: 0340		
Locality:	L1-08 sub-branch			**Property (lot/plan):**	South Leigh (39WV422)		
Coords (11):	**Zone:** 55	706428		7075434			
Coords (12)	**Zone:** 55	706459		7076261			
Vegetation community description: Regrowth eucalypt open-woodland – Small (< 15 ha) polygon of regrowth *Eucalyptus melanophloia* open woodland with sparse shrub layer and dense ground cover.							

Vegetation structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	13	8-15	S
T2		-	
T3		-	
S1	2.5	1-7	M
S2		-	
G	0.5	0-1	M

Structural formation (including height):

Regrowth open woodland

Ecologically dominant layer: T1

Land form element# (40 m radius): Hill crest

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Light brown loamy- sand

Slope and aspect: <5°, South

Vast: II

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
T1	d	*Eucalyptus melanophloia*
T1	s	*Eucalyptus populnea*
S1	a	*Brachychiton populneus*
S1	a	*Geijera parviflora*
S1	a	*Atalaya hemiglauca*
S1	a	*Acacia leiocalyx*
S1	a	*Corymbia trachyphloia*
S1	d	*Eucalyptus melanophloia*
S1	c	*Acacia excelsa*
S1	a	*Psydrax oleifolia*
S1	a	*Dodonaea viscosa*
S1	s	*Eucalyptus populnea*
S1	a	*Petalostigma pubescens*
G	a	*Bothriochloa pertusa**
G	a	*Enteropogon ramosus*
G	c	*Themeda avenaceus*
G	a	*Cymbopogon refractus*
G	a	*Chrysopogon fallax*
G	a	*Melinis repens**
G	a	*Opuntia stricta**
G	a	*Opuntia tomentosa**
G	a	*Lomandra longifolia*
G	a	*Arabidella eremigena*
G	s	*Austrostipa verticillata*
G	a	*Enneapogon avenaceus*
G	a	*Heteropogon contortus*
G	a	*Solanum coactiliferum*
G	c	*Aristida caput-medusae*
G	a	*Verbena aristigera**
G	a	*Cenchrus ciliaris**
G	a	*Cirsium vulgare**
G	a	*Evolvulus alsinoides*
G	a	*Calotis cuneifolia*
G	a	*Themeda triandra*

S1	c	*Callitris glaucophylla*	G	a	*Arundinella nepalensis*
			**Denotes exotic species*		

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	40.0
Native herbs/forbs (non-grass)	0.5
Native shrubs (<1 m high))	4.0
Non-native grass	11.0
Non-native herbs and shrubs	3.0
Litter (woodies <10 cm diameter, dead annuals, etc)	26.4
Litter (logs >10 cm diameter)	4.0
Rock	1.0
Bare ground	5.4

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	2
Coarse leaf litter (>2 cm diameter)	2
Fine leaf litter (<2 cm diameter)	0
Bare ground	7
Grass	7
Soil cracks	3
Stones (20-60 cm)	2
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	35.5
T2	n/a
S1	4.7
S2	n/a
G	n/a
Species	
T1	
Eucalyptus melanophloia	23.5
Eucalyptus populnea	12.0
S1	
Callitris glaucophylla	3.5
Geijera parviflora	1.2

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	50
T2	n/a
S1	380
S2	n/a
G	n/a
Species	
T1	
Eucalyptus melanophloia	46
Brachychiton populneus	2
Eucalyptus populnea	2
S1	
Callitris glaucophylla	160
Geijera parviflora	80
Dodonaea viscosa	20
Psydrax oleifolia	20
Eucalyptus populnea	80
Eucalyptus melanophloia	20

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	3
Total number of hollows in logs	6
Total length of fallen woody material (eg logs) >10 cm diameter	91.0 m

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included two dead hollow logs.
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake, squatter pigeon (southern), koala, large-eared pied bat, south-eastern long-eared bat and little pied bat.

Koala habitat
Scattered koala habitat trees present (*Eucalyptus melanophloia*). However, survey area does not represent koala habitat due to low density of koala food trees within otherwise non-remnant cleared vegetation.

Disturbances (eg grazing, ploughing etc.)
Abundant logs and woody debris that have previously been clear felled, grazing.
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Survey area consists of large area of non-remnant vegetation with scattered mature trees. Scattered mature trees provide refuge for birds utilising surrounding woodland environment. Limited connectivity between mature trees within non-remnant environment provides narrow corridor. Felled woody debris creates refuge for reptiles and small ground dwelling mammals. Survey area provides generally low value habitat.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Velvety tree pear[1] (*Opuntia tomentosa*), U; prickly pear[1] (*Opuntia stricta*), U; buffel grass (*Cenchrus ciliaris*), C; Mayne's pest (*Verbena aristigera*), C; red natal grass (*Melinis repens*), C; Indian bluegrass (*Bothriochloa pertusa*), C; spear thistle (*Cirsium vulgare*), U
Total percentage weed cover: Velvety tree pear[1], 3%; prickly pear[1], 1%; buffel grass, 2%; Mayne's pest, 3%; red natal grass, 5%; Indian bluegrass, 5%; spear thistle, 3%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
Kurrajong (*Brachychiton populneus*). Refer to Santos webGIS system for point locations.

Incidental fauna observations
Australian magpie, Australian raven, Beccari's freetail bat, black-shouldered kite, buff-rumped thornbill Bynoe's gecko, eastern bentwing bat (unconfirmed), eastern freetail bat, eastern grey kangaroo, eastern, striped skink, galah, Gould's wattled bat, grey-crowned babbler, inland forest bat, laughing kookaburra, little broad-nosed bat, little forest bat (unconfirmed), little pied bat (unconfirmed), masked lapwing, noisy miner, pied butcherbird, pied currawong, rabbit, red-backed fairy-wren, red-necked wallaby, spotted pardalote, striated pardalote sulphur-crested cockatoo, superb fairy-wren, tawny frogmouth, Torresian crow, weebill, western broad-nosed bat, white-striped freetail bat, willie wagtail, yellow-bellied sheathtail-bat, yellow-rumped thornbill

NOTE: The results of the vegetation and habitat assessments have been averaged from two sites representative of this community, sites Q/VC/HA 11 and Q/VC/HA 12.

Representative photos for the RM 09-44 infrastructure area

North

East

South

West

Vegetation community description – Baseline data																					
Site:	Q 9/VC 9/HA 9			**Recorder:**	JN, PW, LM					**Date:**	21/01/2014							**Time:**	1020		
Project:	L1 ecological field surveys									**Photos:**	N: 0322 E: 0323 S: 0339 W: 0340										
Locality:	L1-08 sub-branch									**Property (lot/plan):**	Mt Hope/ (27WV421)										
Coords):	**Zone:**	5	5		7	0	6	3	8	9		7	0	7	4	4	9	1			
Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses. Some low regrowth shrubs present in isolated clusters.																					

Vegetation structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1		-	
T2		-	
T3		-	
S1	3	1-4	V
S2		-	
G	0.6	0-1	M

Structural formation (including height):

Cleared open pasture

Ecologically dominant layer: G

Land form element# (40 m radius): Gentle lower slope

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Brown sandy-loam

Slope and aspect: <5°, North

Vast: III

.

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
S1	a	*Eucalyptus populnea*
S1	a	*Callitris glaucophylla*
S1	a	*Vachellia farnesiana**
G	a	*Lomandra longifolia*
G	a	*Themeda triandra*
G	a	*Arabidella eremigena*
G	a	*Fimbristylis dichotoma*
G	a	*Chrysocephalum apiculatum*
G	a	*Verbena aristigera**
G	a	*Opuntia stricta**
G	a	*Melinis repens**
G	a	*Cirsium vulgare**
G	a	*Ptilotus macrocephala*
G	a	*Maireana microphylla*
G	d	*Austrostipa verticillata*
G	s	*Cenchrus ciliaris**

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	14.0
Native herbs/forbs (non-grass)	0.0
Native shrubs (<1 m high))	0.0
Non-native grass	22.0
Non-native herbs and shrubs	0.0
Litter (woodies <10 cm diameter, dead annuals, etc)	27.0
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	39.0

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	2
Coarse leaf litter (>2 cm diameter)	4
Fine leaf litter (<2 cm diameter)	2
Bare ground	6
Grass	6
Soil cracks	2
Stones (20-60 cm)	4
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	n/a
T2	n/a
S1	0.0
S2	n/a
G	n/a
Species	
None	

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	n/a
T2	n/a
S1	0
S2	n/a
G	n/a
Species	
None	

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	14 m

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included six dead hollow logs, a stag with hollows, three nests in trees and five termite mounds.
Potential habitat for EVNT fauna species (including essential habitat): Squatter pigeon (southern)

Koala habitat
Survey area not koala habitat due to non-remnant vegetation, the few isolated koala food trees present are not connected to a vegetation corridor and the soil moisture level is low.

Disturbances (eg grazing, ploughing etc.)
Grazing, clearing.
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Investigation area consists of large area of non-remnant vegetation surrounding watercourse with limited riparian vegetation. Few mature trees scattered within surveys area. Fragmented, narrow corridor of remnant vegetation across the landscape surrounding infrastructure. Survey area represents low value habitat.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Velvety tree pear* (*Opuntia tomentosa*), U; prickly pear* (*Opuntia stricta*), R; buffel grass (*Cenchrus ciliaris*), C; Mayne's pest (*Verbena aristigera*), C; red natal grass (*Melinis repens*), C; mimosa bush (*Vachellia farnesiana*), R; spear thistle (*Cirsium vulgare*), C
Total percentage weed cover: Velvety tree pear*, 4%; prickly pear*, 2%; buffel grass, 21%; Mayne's pest, 10%; red natal grass, 3%; mimosa bush, 5%; spear thistle, 5%
*Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
Kurrajong (*Brachychiton populneus*) and numerous grass trees (*Xanthorrhoea johnsonii*). Refer to Santos webGIS system for point locations.

Incidental fauna observations
Australian magpie, Australian raven, Beccari's freetail bat, black-shouldered kite, buff-rumped thornbill Bynoe's gecko, eastern bentwing bat (unconfirmed), eastern freetail bat, eastern grey kangaroo, eastern, striped skink, galah, Gould's wattled bat, grey-crowned babbler, inland forest bat, laughing kookaburra, little broad-nosed bat, little forest bat (unconfirmed), little pied bat (unconfirmed), masked lapwing, noisy miner, pied butcherbird, pied currawong, rabbit, red-backed fairy-wren, red-necked wallaby, spotted pardalote, striated pardalote sulphur-crested cockatoo, superb fairy-wren, tawny frogmouth, Torresian crow, weebill, western broad-nosed bat, white-striped freetail bat, willie wagtail, yellow-bellied sheathtail-bat, yellow-rumped thornbill

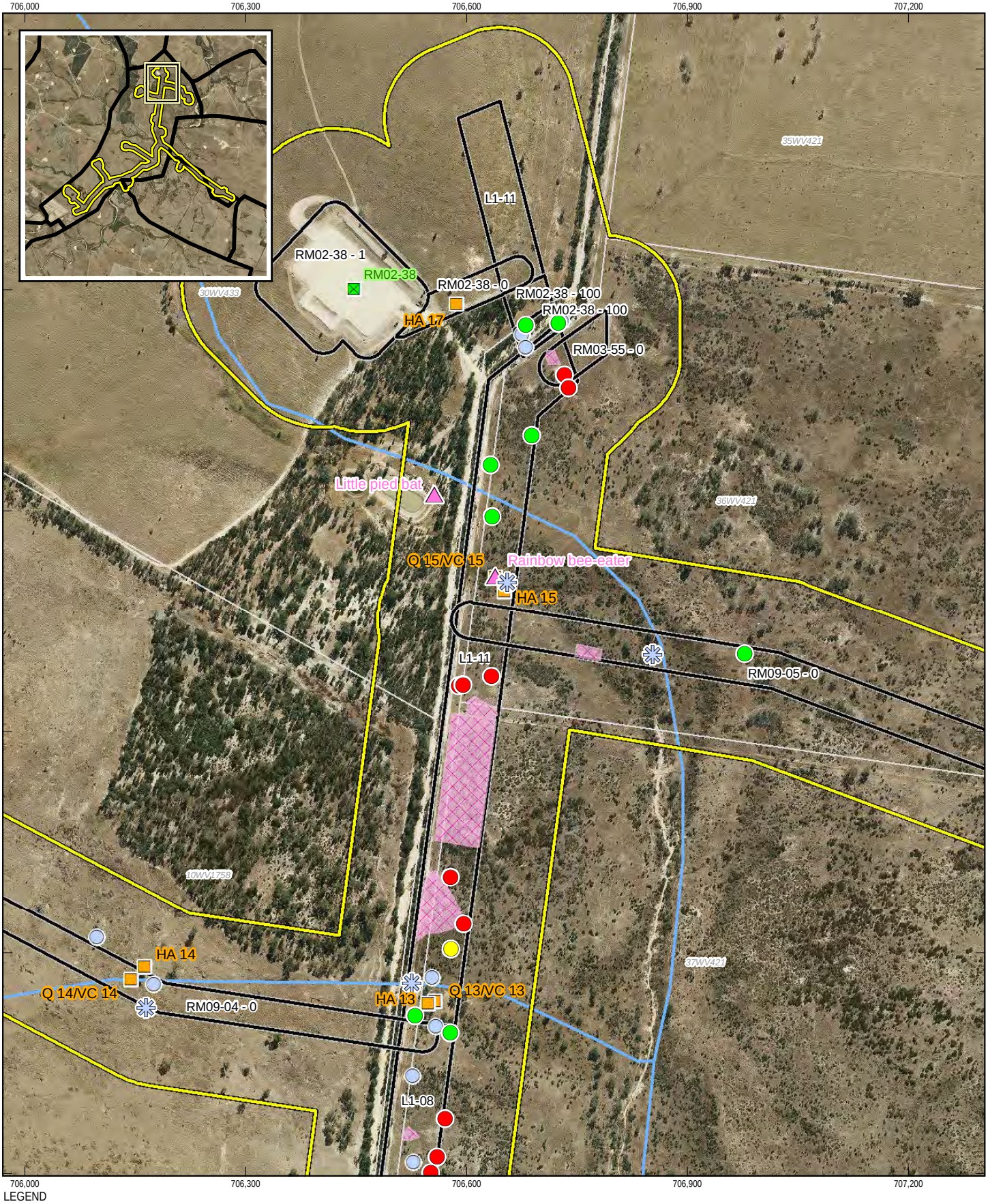
Representative photos for the RM 09-44 infrastructure area

North

East

South

West



LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Notable Fauna Species
- Watercourse Assessment Site
- Type A Restricted Plant Site
- Brachychiton populneus
- Brachychiton rupestris
- Xanthorrhoea johnsonii
- Xanthorrhoea johnsonii
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Cadastre

1:7,000 (@ A4)

0 100 200 300

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Santos GLNG
L1 and N1 Ecological Assessments

Job Number 41-27312
Revision 0
Date 06 Jun 2014

Proposed L1-11 Sub-branch Infrastructure Area

Figure 15

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145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Regional Ecosystems, Essential Habitat, Imagery, Referred Wetlands/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Notable Flora Species, Notable Fauna Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.15 Proposed L1-11 sub-branch infrastructure area

3.15.1 Summary for the L1-11 sub-branch infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Present
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Present
ESAs	Absent	**Wetlands**	Absent
Essential habitat	Absent		

3.15.2 Regional ecosystems

No remnant REs are mapped as present within the L1-11 sub-branch infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 15 (Q 13, Q 15).

Approval requirement or further action

None

3.15.3 Threatened ecological communities

No TECs are mapped as present within the L1-11 sub-branch infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 17 (Q 13, Q 15).

Approval requirement or further action

None

3.15.4 Vegetation communities and habitat values

The following vegetation community occurs within the L1-11 sub-branch infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.15.11. Field validation points for vegetation communities and habitat values are shown on Figure 17 (VC 6, HA 6).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.15.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the L1-11 sub-branch infrastructure area or within 1 km of this.

Approval requirement or further action

None

3.15.6 Essential habitat

No VM Act-mapped essential is present within the L1-11 sub-branch infrastructure area.

Approval requirement or further action

None

3.15.7 Threatened species

No threatened flora species were recorded within the L1-11 sub-branch infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the L1-11 sub-branch infrastructure area is presented in Table 15, Appendix A.

One threatened fauna species was recorded from field assessments of the L1-11 sub-branch infrastructure area:

- Little pied bat (near threatened under the NC Act)

Additionally, rainbow bee-eater, listed as migratory (JAMBA) and marine under the EPBC Act, and dollarbird, listed as marine under the EPBC Act, were recorded during field assessments.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

Management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.15.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the L1-11 sub-branch infrastructure area (refer Section 3.15.11). Locations of these features are mapped on Figure 17 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.15.9 Watercourses

Two mapped first order watercourses intersect the L1-11 sub-branch infrastructure area.

Field validation of the watercourses determined them to be drainage features under the *Water Act 2000*. The watercourse assessment location is shown as site WC 9 and WC11 on Figure 17. A summary of results is presented in Table 8 and the watercourse assessments are presented in Appendix C.

Table 8 Watercourse assessments in L1-11 sub-branch infrastructure area

Watercourse reference	Location (easting, northing)		Assessment outcome	Reason
WC 9	706551	7076944	Drainage feature (*Water Act 2000*)	No extended or permanent period of flow – only carries water flow for a short duration after a rainfall event Lacks sufficient flow adequacy to sustain basic ecological processes and support riverine species Lacks continuous and defined bed and banks and the presence of in-stream islands, benches or bars
WC 11	706656	7077530	Drainage feature (*Water Act 2000*)	No extended or permanent period of flow – only carries water flow for a short duration after a rainfall event Lacks sufficient flow adequacy to sustain basic ecological processes and support riverine species Lacks continuous and defined bed and banks and the presence of in-stream islands, benches or bars

Approval requirement or further action

None

3.15.10 Wetlands, lakes and springs

No wetlands are mapped or were confirmed present within the L1-08 sub-branch infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.15.11 L1-11 sub-branch: Vegetation community and habitat summary

Vegetation community description – Baseline data							
Site:	Q13/15 / VC13/15 /HA 13/15	**Recorder:**	JN, PW, LM	**Date:**	22/01/2014	**Time:**	0800
Project:	L1 ecological field surveys			**Photos:**	N: 674 E: 675 S: 676 W: 677		
Locality:	L1-11 sub-branch			**Property (lot/plan):**	South Leigh (39WV422)		
Coords (13):	**Zone:** 55	706556		7076935			
Coords (15)	**Zone:** 55	706639		7077511			
Vegetation community description: Low and dense, but patchy, regrowth eucalypt open-woodland polygon of regrowth dominated by *Eucalyptus melanophloia* and *Eucalyptus chloroclada* open woodland							

Vegetation structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	11	8-14	S
T2		-	
T3		-	
S1	2.5	1-7	M
S2		-	
G	0.5	0-1	D

Structural formation (including height):

Regrowth open woodland

Ecologically dominant layer: S1

Land form element# (40 m radius): Gentle slope

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Light brown clayey- sand with some cracking clay

Slope and aspect: <5°, South-east

Vast: III

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
T1	d	*Eucalyptus melanophloia*
T1	a	*Callitris glaucophylla*
S1	c	*Eucalyptus melanophloia*
S1	a	*Acacia excelsa*
S1	a	*Brachychiton populneus*
S1	c	*Eucalyptus chloroclada*
S1	a	*Acacia deanei*
S1	a	*Acacia leiocalyx*
S1	a	*Angophora leiocarpa*
S1	a	*Callitris glaucophylla*
S1	a	*Eucalyptus populnea*
G	a	*Lomandra leucocephala*
G	a	*Digitaria ciliaris*
G	c	*Themeda avenaceus*
G	a	*Opuntia tomentosa**
G	c	*Cenchrus ciliaris**
G	a	*Aristida caput-medusae*
G	a	*Psydrax oleifolia*
G	a	*Lomandra longifolia*
G	a	*Cymbopogon refractus*
G	s	*Melinis repens**
G	a	*Fimbristylis dichotoma*
G	a	*Eragrostis setifolia*
G	a	*Solanum ellipticum*
G	c	*Aristida calycina*
G	a	*Juncus usitatus*
G	a	*Ptilotus rara*
G	a	*Aristida jerichoensis*

**Denotes exotic speces*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	21.0
Native herbs/forbs (non-grass)	10.4
Native shrubs (<1 m high))	3.0
Non-native grass	11.8
Non-native herbs and shrubs	1.8
Litter (woodies <10 cm diameter, dead annuals, etc)	31.0
Litter (logs >10 cm diameter)	2.0
Rock	0.0
Bare ground	19.0

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	1
Coarse leaf litter (>2 cm diameter)	3
Fine leaf litter (<2 cm diameter)	2
Bare ground	6
Grass	6
Soil cracks	1
Stones (20-60 cm)	0
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	13.3
T2	n/a
S1	14.8
S2	n/a
G	n/a
Species	
T1	
Eucalyptus melanophloia	13.3
S1	
Callitris glaucophylla	2.8
Acacia leiocalyx	0.5
Eucalyptus chloroclada	7.5
Angophora leiocarpa	1.3
Acacia deanei	1.5
Eucalyptus melanophloia	1.2

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	24
T2	n/a
S1	1110
S2	n/a
G	n/a
Species	
T1	
Eucalyptus melanophloia	23
Eucalyptus populnea	1
S1	
Eucalyptus melanophloia	300
Callitris glaucophylla	20
Eucalyptus chloroclada	610
Acacia leiocalyx	90
Angophora leiocarpa	60
Acacia deanei	20
Eucalyptus populnea	10

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	2
Total number of hollows in logs	4
Total length of fallen woody material (eg logs) >10 cm diameter	33.0 m

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included a single dead hollow log.
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern)

Koala habitat
Survey area not koala habitat due to non-remnant vegetation, the few isolated koala food trees present are not connected to a vegetation corridor and low soil moisture.

Disturbances (eg grazing, ploughing etc.)
Grazing, mechanical clearing, existing pipeline infrastructure.
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Survey area consists of large area of non-remnant vegetation with scattered mature *Eucalyptus melanophloia* and *Eucalyptus populnea* trees. Scattered mature trees provide some shelter resources for woodland and grassland birds. Mature trees within survey area are generally isolated and do not have any connectivity values in the landscape. A minor narrow vegetation corridor is present within the road reserve. Survey area represents low value habitat, with mature trees representing higher habitat value within the landscape context.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Velvety tree pear[1] (*Opuntia tomentosa*), U; buffel grass (*Cenchrus ciliaris*), C; red natal grass (*Melinis repens*), C
Total percentage weed cover: Velvety tree pear[1], 3%; buffel grass, 10%; red natal grass, 3.6%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
Kurrajong (*Brachychiton populneus*) and numerous grass trees (*Xanthorrhoea johnsonii*). Refer to Santos webGIS system for point locations.

Incidental fauna observations
Apostlebird, Australian magpie, Beccari's freetail bat Bynoe's gecko, desert tree frog, dollarbird, double-barred finch, eastern freetail bat, eastern striped skink, galah, Gould's wattled bat, grey-crowned babbler, inland forest bat, laughing kookaburra, little broad-nosed bat, little pied bat, magpie-lark, masked lapwing, *Mormopterus* sp., noisy miner, pale-headed rosella, pheasant coucal, pied butcherbird, rabbit, rainbow bee-eater, red-backed fairy-wren, red-necked wallaby, striated pardalote, superb fairy-wren tawny frogmouth, Torresian crow, weebill, western broad-nosed bat, white-striped freetail bat, willie wagtail, yellow-bellied sheathtail-bat, yellow-rumped thornbill

NOTE: The results of the vegetation and habitat assessments have been averaged from two sites representative of this community, sites Q/VC/HA 13 and Q/VC/HA 15.

Representative photos for the RM 09-44 infrastructure area

North

East

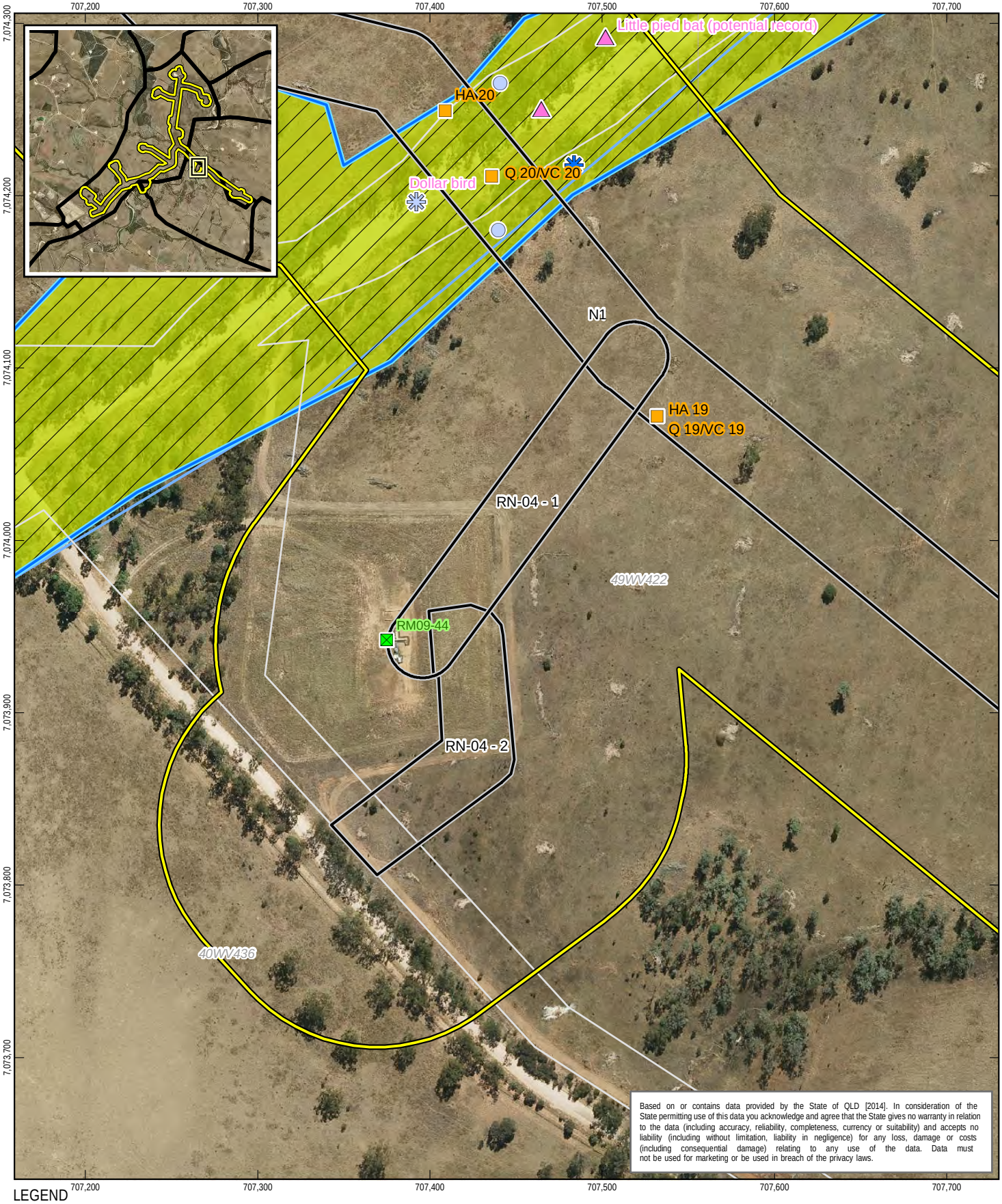
South

West

3.16 N1 sub-branch overview

The result of the ecological assessments of RoWs and proposed well pads within the N1 sub-branch has been presented for infrastructure in the following sections:

- Section 3.17 - RM 09-44 infrastructure area
- Section 3.18 – RM 09-26 infrastructure area
- Section 3.19 – N1 sub-branch infrastructure area



LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Notable Fauna Species
- Watercourse Assessment Site
- Wetland Assessment Site
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Essential Habitat (BPA)
- Referable Wetlands
- Cadastre
- Regional Ecosystem (BD)
- Of Concern dominant

1:3,000 (@ A4)

0 25 50 75 100

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

Santos GLNG
L1 and N1 Ecological Assessments

Proposed RM 09-44
Infrastructure Area

Job Number 41-27312
Revision 0
Date 06 Jun 2014

Figure 16

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145 Ann St Brisbane QLD 4000 Australia **T** 61 7 3316 3000 **F** 61 7 3316 3333 **E** bnemail@ghd.com **W** www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Regional Ecosystems, Essential Habitat, Imagery, Referred Wetlands/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Notable Flora Species, Notable Fauna Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.17 Proposed RM 09-44 infrastructure area

3.17.1 Summary for the RM 09-44 infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Absent
Vegetation community/ habitat values	Open cleared pasture	**Watercourses**	Present within 100 m
ESAs	Present within 100 m	**Wetlands**	Present within 100 m
Essential habitat	Absent		

3.17.2 Regional ecosystems

No remnant REs are mapped as present within the RM 09-44 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 16 (Q 19).

Approval requirement or further action

None

3.17.3 Threatened ecological communities

No TECs are mapped as present within the RM 09-44 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 16 (Q 19).

Approval requirement or further action

None

3.17.4 Vegetation communities and habitat values

The following vegetation community occurs within the RM 09-44 infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.17.11. Field validation points for vegetation communities and habitat values are shown on Figure 16 (VC 19, HA 19).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.17.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the L1-05 sub-branch infrastructure area. However, two Category C ESAs and their primary protection areas are mapped within 100 m of the L1-05 sub-branch infrastructure area, namely:

- An RE mixed polygon containing two of concern REs (RE 11.3.25/11.3.2)

- A referable wetland

Note that the primary protection zones of these Category C ESAs overlap with the disturbance footprint of the well pad.

The mapped Category C ESAs have been previously field validated and were thus not assessed during the current ecological assessment. The mapped referable wetland was validated as an ephemeral palustrine wetland and the mapped of concern mixed RE polygon was validated as containing of concern REs 11.3.2 and/or 11.3.25 (Boobook Ecological Consulting 2013).

Approval requirement or further action

Only limited petroleum activities are permitted within the primary protection zone of Category C ESAs as per the EA conditions. A number of conditions outlined in the EA (Schedule E15) must be met prior to carrying out limited petroleum activities.

3.17.6 Essential habitat

No VM Act-mapped essential habitat is present within the RM 09-44 infrastructure area.

Approval requirement or further action

None

3.17.7 Threatened species

No threatened flora species were recorded within the RM 09-44 infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the RM 09-44 infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the RM 09-44 infrastructure area.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.17.8 Fauna habitat features

No fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the RM 02-38 infrastructure area.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.17.9 Watercourses

A single fifth order watercourse is mapped and was confirmed present within 100 m of the RM 09-44 infrastructure area. The watercourse was determined to be a watercourse under the *Water Act 2000*. The watercourse assessment location is shown as site WC 13 on Figure 16. A summary of results is presented in Table 9 and the watercourse assessments are presented in Appendix C.

Table 9 Watercourse assessments in RM 09-44 infrastructure area

Watercourse reference	Location (easting, northing)		Assessment outcome	Reason
WC 13	707433	70774221	Watercourse (*Water Act 2000*) Waterway (*Fisheries Act 1994*)	Features an extended or permanent period of flow Features sufficient flow adequacy to sustain basic ecological processes and support riverine species Features continuous and defined bed and banks and the presence of in-stream islands, benches or bars

Approval requirement or further action

As the feature has been assessed as a watercourse under the *Water Act 2000* and a waterway under the *Fisheries Act 1994*, construction must comply with the EA requirements, relevant self-assessable codes under the Water Act and the Fisheries Act. Approvals under the Water Act and EA Requirements (Schedule B5 to B16) must be lodged a minimum of ten business day prior to works. In addition to this, applications for a Development Approval and Riverine Protection Permit must be lodged with the relevant agency a minimum of six months prior to works.

3.17.10 Wetlands, lakes and springs

A DEHP mapped referable wetland is mapped within100 m of the N1 sub-branch infrastructure area at Blyth Creek. Field validation identified that this mapped area was a non-wetland feature and constituted the area between the outer banks of a watercourse.

Approval requirement or further action

None

3.17.11 RM 09-44: Vegetation community and habitat summary

Vegetation community description – Baseline data																			
Site:	Q 19/VC 19/HA 19	**Recorder:**	JN, PW, LM	**Date:**	23/01/2014	**Time:**	0930												
Project:	L1 ecological field surveys			**Photos:**	N: 710 E: 711 S: 712 W: 713														
Locality:	RM 09-44			**Property (lot/plan):**	30WV433														
Coordinates:	**Zone:**	5	5	7	0	7	5	3	2	7	0	7	4	0	7	2			
Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses. Site located adjacent to remnant vegetation fringing a watercourse.																			

Vegetation structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	15	12-16	V
T2		-	
T3		-	
S1	1	1-2	V
S2		-	
G	0.4	0-1	M

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: G

Land form element# (40 m radius): Gentle slope

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Brown sand

Slope and aspect: <5°, West

Vast: III

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
T1	d	*Eucalyptus populnea*
T1	a	*Geijera parviflora*
S1	a	*Lycium ferocissimum**
S1	d	*Alstonia constricta*
G	a	*Opuntia tomentosa**
G	a	*Wahlenbergia gracilis*
G	a	*Melinis repens**
G	a	*Calotis cuneifolia*
G	a	*Argemone ochroleuca* subsp. *ochroleuca**
G	a	*Salsola kali*
G	a	*Podolepis longipedata*
G	a	*Boerhavia dominii*
G	a	*Digitaria ciliaris*
G	a	*Calotis lappulacea*
G	a	*Lomandra leucocephala*
G	a	*Fimbristylis dichotoma*
G	s	*Chrysocephalum apiculatum*
G	c	*Cenchrus ciliaris**
G	c	*Aristida calycina*

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	15.0
Native herbs/forbs (non-grass)	6.2
Native shrubs (<1 m high))	0.0
Non-native grass	19.0
Non-native herbs and shrubs	0.0
Litter (woodies <10 cm diameter, dead annuals, etc)	8.0
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	51.8

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	0
Coarse leaf litter (>2 cm diameter)	1
Fine leaf litter (<2 cm diameter)	3
Bare ground	5
Grass	6
Soil cracks	0
Stones (20-60 cm)	0
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	0.0
T2	n/a
S1	0.0
S2	n/a
G	n/a
Species	
None	

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	0
T2	n/a
S1	120
S2	n/a
G	n/a
Species	
S1	
Alstonia constricta	120

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	
Number of hollow bearing logs (hollows >10 cm diameter)	
Total number of hollows in logs	
Total length of fallen woody material (eg logs) >10 cm diameter	

General habitat features and fauna breeding places present
None
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern)

Koala habitat
Survey area not koala habitat due to non-remnant vegetation and absence of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Clearing and grazing
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Survey area consists of large area of non-remnant vegetation with scattered mature trees. Scattered mature trees provide refuge for birds utilising surrounding woodland environment. Vegetation corridor along a nearby watercourse and road provides narrow corridor within the wider landscape. Isolated woody debris creates refuge for reptiles and small ground dwelling mammals. Survey area provides generally low value habitat.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Prickly pear[1] (*Opuntia tomentosa*), U; buffel grass (*Cenchrus ciliaris*), C; red natal grass (*Melinis repens*), C; African box thorn[1] (*Lycium ferocissimum*), R; Mexican poppy (*Argemone ochroleuca*), U
Total percentage weed cover: Prickly pear[1], 5%; buffel grass, 19%; red natal grass, 5%; African box thorn[1], 2%; Mexican poppy, 4%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
None present

Incidental fauna observations
apostlebird, Australian magpie, Australian raven, noisy miner, pale-headed rosella

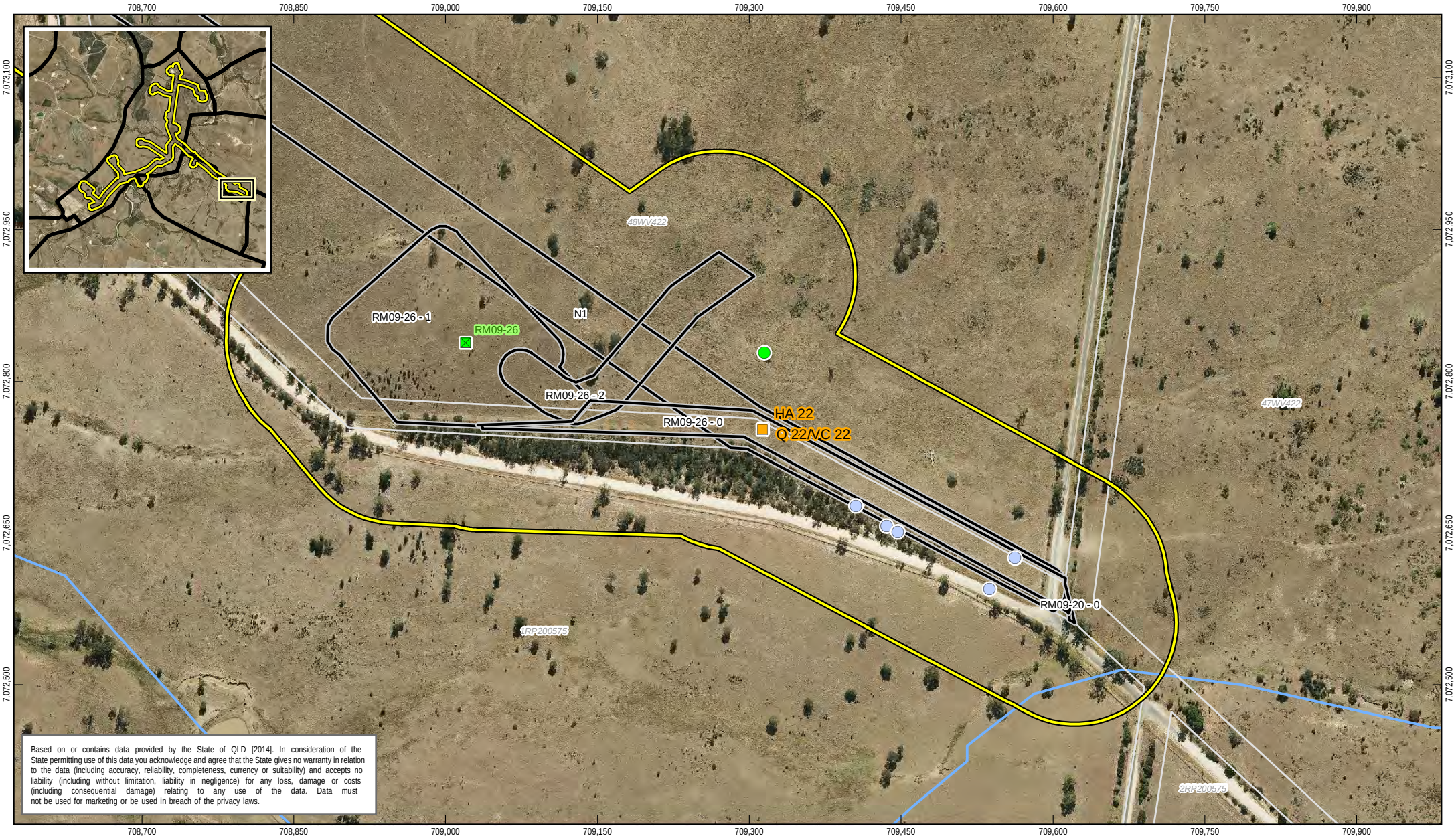
Representative photos for the RM 09-44 infrastructure area

North

East

South

West



1:5,000 (@ A4)

0 50 100 150

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Type A Restricted Plant Site
- Brachychiton populneus
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Cadastre

Santos GLNG
L1 and N1 Ecological Assessments

Job Number 41-27312
Revision 0
Date 06 Jun 2014

Proposed RM 09-26 Infrastructure Area

Figure 17

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145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Imagery/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Notable Flora Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.18 Proposed RM 09-26 infrastructure area

3.18.1 Summary for the RM 09-26 infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Absent	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Present
Vegetation community/ habitat values	Cleared open pasture	**Watercourses**	Absent
ESAs	Absent	**Wetlands**	Absent
Essential habitat	Absent		

3.18.2 Regional ecosystems

No remnant REs are mapped as present within the RM 09-26 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 17 (Q 22).

Approval requirement or further action

None

3.18.3 Threatened ecological communities

No TECs are mapped as present within the RM 09-26 infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 17 (Q 22).

Approval requirement or further action

None

3.18.4 Vegetation communities and habitat values

The following vegetation community occurs within the RM 09-26 infrastructure area:

- Cleared open pasture

Descriptions of this vegetation community and habitat values are summarised in Section 3.18.11. Field validation points for vegetation communities and habitat values are shown on Figure 17 (VC 22, HA 22).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.18.5 Environmentally sensitive areas

No ESAs are mapped or were observed to occur within the RM 09-26 infrastructure area, or within 1 km of this.

Approval requirement or further action

None

3.18.6 Essential habitat

No VM Act-mapped essential habitat is present within the RM 09-26 infrastructure area.

Approval requirement or further action

None

3.18.7 Threatened species

No threatened flora species were recorded within the RM 09-26 infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the RM 09-26 infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the RM 09-26 infrastructure area.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

No further action currently required. Should a threatened species be encountered, management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.18.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the RM 09-26 infrastructure area (refer Section 3.18.11). Locations of these features are mapped on Figure 17 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.18.9 Watercourses

No watercourses are mapped or were confirmed present within the RM 02-26 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.18.10 Wetlands, lakes and springs

No wetlands are mapped or were confirmed present within the RM 09-26 infrastructure area, or within 100 m of this.

Approval requirement or further action

None

3.18.11 RM 09-26: Vegetation community and habitat summary

Vegetation community description – Baseline data							
Site:	Q 22/VC 22/HA 22	**Recorder:**	JN, PW, LM	**Date:**	23/01/2014	**Time:**	1300
Project:	L1 ecological field surveys			**Photos:**	N: 759 E: 760 S: 761 W: 762		
Locality:	RM 09-26			**Property (lot/plan):**	South Leigh(48WV422)		
Coordinates:	**Zone:** 5 5		7 0 9 3 1 4		7 0 7 2 7 5 3		
Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses.							

Vegetation structure
Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	8	6-11	V
T2		-	
T3		-	
S1	1.5	1-3	V
S2		-	
G	0.5	0-1	M

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: G

Land form element# (40 m radius): Gentle slope

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Dark brown loamy-sand

Slope and aspect: <5°, West

Vast: III

Plant species
Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
T1	a	*Acacia harpophylla*
S1	a	*Eucalyptus populnea*
S1	a	*Citrus glauca*
G	d	*Cenchrus ciliaris**
G	a	*Exocarpos cupressiformis*
G	a	*Enteropogon ramosus*
G	a	*Cirsium vulgare**
G	a	*Austrostipa ramosissima*
G	a	*Juncus usitatus*
G	a	*Enneapogon avenaceus*
G	a	*Verbena aristigera**
G	a	*Eragrostis lacunaria*
G	a	*Arabidella eremigena*
G	a	*Capparis lasiantha*
G	a	*Boerhavia dominii*
G	a	*Einadia hastata*
G	a	*Chrysocephalum apiculatum*
G	a	*Bothriochloa pertusa**
G	a	*Opuntia tomentosa**
G	a	*Opuntia stricta**

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	18.0
Native herbs/forbs (non-grass)	1.4
Native shrubs (<1 m high))	0.0
Non-native grass	25.0
Non-native herbs and shrubs	0.8
Litter (woodies <10 cm diameter, dead annuals, etc)	7.0
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	43.8

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	0
Coarse leaf litter (>2 cm diameter)	0
Fine leaf litter (<2 cm diameter)	0
Bare ground	7
Grass	7
Soil cracks	3
Stones (20-60 cm)	0
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	0.0
T2	n/a
S1	0.0
S2	n/a
G	n/a
Species	
None	

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	0
T2	n/a
S1	60
S2	n/a
G	n/a
Species	
S1	
Eucalyptus populnea	20
Citrus glauca	40

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	18 m

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included two dead hollow logs, two hollows in trees and a stag with hollows.
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern)**.**

Koala habitat
Potential koala habitat trees are present along road reserve. Survey area not koala habitat due to non-remnant vegetation and lack of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Mechanical clearing, grazing, well pad construction
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Survey area consists of large area of non-remnant vegetation. Thin corridor of mature trees along read reserve provide vegetation corridor within non-remnant landscape. Mature trees provide shelter and food resources for birds, small mammals and reptiles. Survey area represents low value habitat. Vegetation corridor within road reserve represents higher habitat value within the landscape context.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Velvety tree pear[1] (*Opuntia tomentosa*), U; Prickly pear[1] (*Opuntia tomentosa*), U; buffel grass (*Cenchrus ciliaris*), C; Indian bluegrass (*Bothriochloa pertusa*), C; scotch thistle (*Cirsium vulgare*), U; Mayne's pest (*Verbena aristigera*), C
Total percentage weed cover: Velvety tree pear[1], 3%; Prickly pear[1], 2%; buffel grass, 14%; Indian bluegrass, 11%; scotch thistle, 1%; Mayne's pest, 1%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
None present

Incidental fauna observations
Australian raven, noisy miner

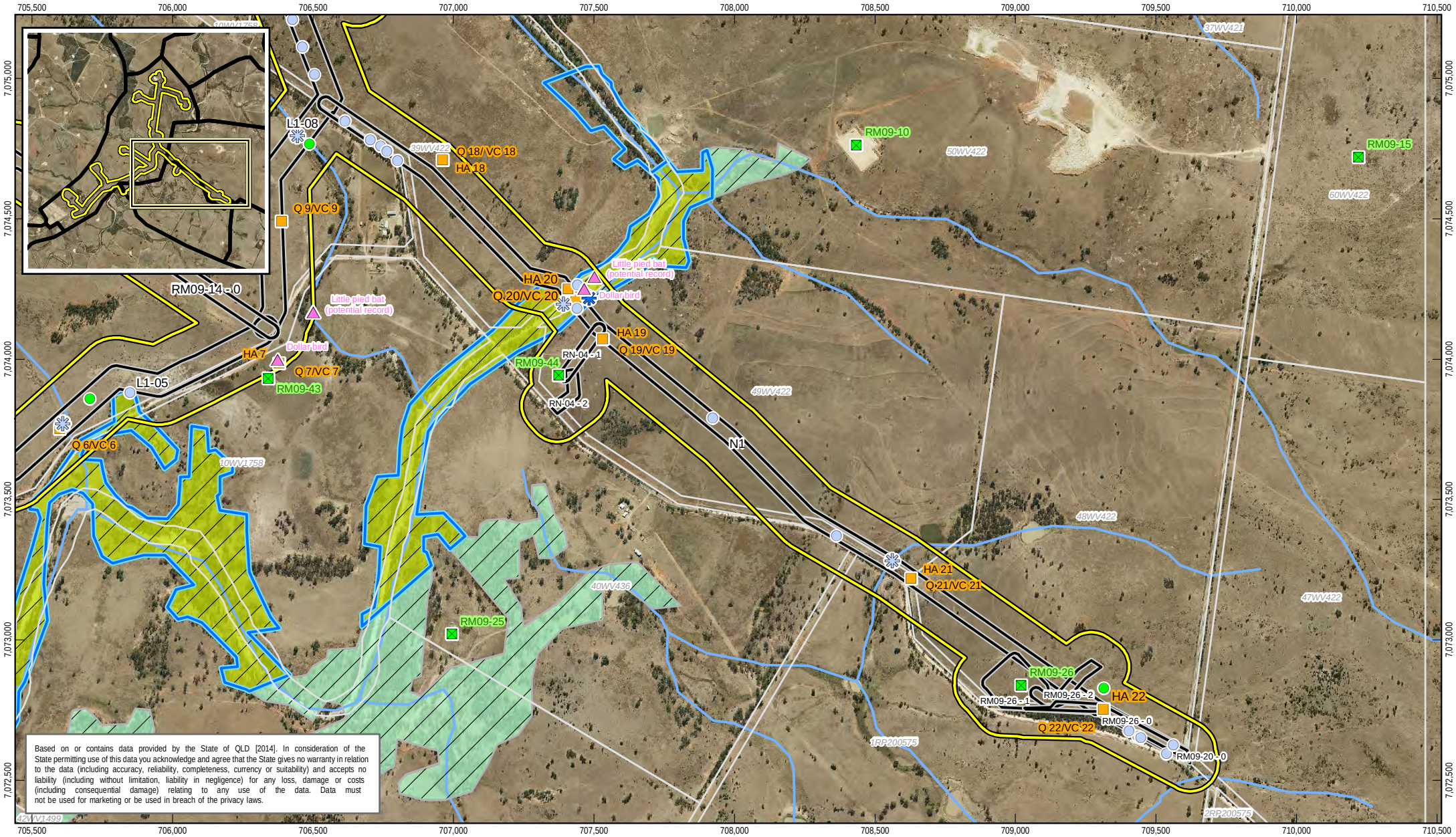
Representative photos for the RM 09-26 infrastructure area

North

East

South

West



1:18,000 (@ A4)

0 100 200 300 400 500

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

LEGEND

- Well Pad
- Assessment Site
- Fauna Habitat Feature
- Notable Fauna Species
- Type A Restricted Plant Site
- Brachychiton populneus
- Wetland Assessment Site
- Watercourse
- CDZ Area (30m)
- CSG Infrastructure Area (100m Investigation Area)
- Essential Habitat (BPA)
- Referable Wetlands
- Cadastre
- Regional Ecosystem (BD)
- Of Concern dominant
- Not of Concern

GHD

Santos GLNG Project

Santos GLNG
L1 and N1 Ecological Assessments

Job Number 41-27312
Revision A
Date 06 Jun 2014

Proposed N1 Sub-branch Infrastructure Area

Figure 18

145 Ann St Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

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Data source: DNRM: Ordered Drainage/2011; Santos GLNG: Cadastre, Regional Ecosystems, Essential Habitat, Imagery, Referred Wetlands/Supplied October 2013, Well Pad, Construction Disturbance Zone/Supplied February 2014; GHD: CSG Infrastructure Area (produced in conjunction with Santos), Gathering Network Sub-branch (digitised from document provided by Santos), Watercourse Assessment Site, Notable Flora Species, Notable Fauna Species, Fauna Habitat, Fauna Habitat Assessment Site, Flora Habitat Assessment Site/2014. Created by: AF

3.19 Proposed N1 sub-branch infrastructure area

3.19.1 Approvals and actions summary for the N1 sub-branch infrastructure area

Item	Present/Absent	Item	Present/Absent
REs	Present	**Threatened species**	Absent
TECs	Absent	**Fauna habitat features**	Presnet
Vegetation community/ habitat values	• Cleared open pasture • Eucalypt woodland	**Watercourses**	Absent
ESAs	Yes	**Wetlands**	Absent
Essential habitat	No		

3.19.2 Regional ecosystems

The majority of the N1 sub-branch infrastructure area overlaps with non-remnant vegetation. However, the trunkline crosses a narrow section of remnant vegetation, containing of concern RE 11.3.25/11.3.2, at Blyth Creek. Field validation of this RE was undertaken which confirmed the RE mapping to be correct. Field validation points for REs are shown on Figure 18 (Q 20).

Approval requirement or further action

The of concern RE constitutes a Category C ESA. Only limited petroleum activities are permitted within the primary protection zone of Category C ESAs as per the EA conditions.

3.19.3 Threatened ecological communities

No TECs are mapped as present within the N1 sub-branch infrastructure area and none were identified during the ecological assessments. Field validation points for REs are shown on Figure 18 (Q 20).

Approval requirement or further action

None

3.19.4 Vegetation communities and habitat values

The following vegetation communities occur within the N1 sub-branch infrastructure area:

- Eucalypt woodland fringing a watercourse
- Cleared open pasture

Descriptions of the two vegetation communities and habitat values are summarised in Section 3.19.11. Field validation points for vegetation communities and habitat values are shown on Figure 18 (VC 20, HA 20).

Approval requirement or further action

None, however, rehabilitation activities are to be undertaken post-operation in accordance with the GLNG Project RRRMP (RPS 2011).

3.19.5 Environmentally sensitive areas

Field validation of the mapped ESA confirmed the presence of the of concern RE and the wetland which constitute the Category C ESA.

Two category C ESAs are mapped within the N1 sub-branch infrastructure area, namely:

- An RE mixed polygon containing two of concern REs (RE 11.3.25/11.3.2)
- A referable wetland

The mapped Category C ESAs were field validated during ecological surveys. The mapped of concern REs were confirmed present; however, the referrable wetland was confirmed as a non-wetland feature and constituted the area between the outer banks of a watercourse.

Approval requirement or further action

Only limited petroleum activities are permitted within the Category C ESA and its primary protection zone as per the EA conditions. A number of conditions outlined in the EA (Schedule E15) must be met prior to carrying out limited petroleum activities.

3.19.6 Essential habitat

No VM Act-mapped essential habitat is present within the N1 sub-branch infrastructure area.

Low value essential habitat mapped under the BPA mapping occurs within the N1 sub-branch infrastructure area along Blyth Creek. This mapping is associated with the mapped RE polygons 11.3.25/11.3.2 discussed in Section 3.19.2.

Approval requirement or further action

None

3.19.7 Threatened species

No threatened flora species were recorded within the N1 sub-branch infrastructure area during ecological assessments. A likelihood of occurrence assessment for flora species identified in desktop searches as having the potential to occur within the N1 sub-branch infrastructure area is presented in Table 15, Appendix A.

No threatened fauna species were recorded from field assessments of the N1 sub-branch infrastructure area. However, dollarbird, listed as marine under the EPBC Act, was recorded during field assessments. . There was also an unconfirmed record of little-pied bat, listed as near threatened under the NC Act, recorded on the Anabat data. The unconfirmed records are a result of three species, including little pied bat, having very similar calls that are difficult to differentiate during analysis. The two species with similar calls to little pied bat, namely *Scotorepens greyii* and *Vespadelus baverstocki*, are not listed under either the EPBC Act or NC Act. Where calls were encountered that could not be resolved to species, all potential candidates are listed as possibly present. As conservative approach, where there were unconfirmed records of little pied bat it has been assumed that these species are present.

Further information relating to the threatened species records is contained within Section 4.

Lists of all flora and fauna species recorded from field assessments are contained within Appendix B.

Threatened species habitat mapping

Potential habitat for fauna species listed under the EPBC Act and the NC Act has been mapped over the infrastructure area (refer Section 4). Calculations of the extent of species habitat within the L1 and N1 investigation area are presented in Section 4.1.

Approval requirement or further action

Management actions listed within the following approved GLNG Project documents are to be followed during pre-construction, construction and operation:

- GLNG Project CSG Fields Significant Species Management Plan (RPS 2012) (document number: 0020-GLNG-4-1.3-0003) (SSMP)
- Roma, Arcadia and Fairview CSG Fields Species Management Plan (Aurecon 2012) (document number: STO-FL-T2GS-L-32)1(SMP)
- GLNG Gas Transmission Pipeline Species Management Plan (document number: 3380-GLNG-3-1.3-0036) (GTP SMP)

It is recommended that all management plans are checked for validity prior to implementation on this project.

3.19.8 Fauna habitat features

Fauna habitat features that have potential to be fauna breeding places for least concern and threatened fauna species were recorded within the N1 sub-branch infrastructure area (refer Section 3.19.11). Locations of these features are mapped on Figure 18 and spatial data have been provided to Santos for incorporation into their webGIS system.

Approval requirement or further action

Management actions listed within the SSMP, SMP and GTP SMP documents are to be followed during pre-construction, construction and operation.

3.19.9 Watercourses

A single fifth order watercourse is mapped and was confirmed present within the N1 sub-branch infrastructure area. The watercourse was determined to be a watercourse under the *Water Act 2000*. The watercourse assessment location is shown as site WC 13 on Figure 18. A summary of results is presented in Table 10 and the watercourse assessments are presented in Appendix C.

Table 10 Watercourse assessments in N1 sub-branch infrastructure area

Watercourse reference	Location (easting, northing)		Assessment outcome	Reason
WC 13	707433	70774221	Watercourse (*Water Act 2000*) Waterway (*Fisheries Act 1994*)	Features an extended or permanent period of flow Features sufficient flow adequacy to sustain basic ecological processes and support riverine species Features continuous and defined bed and banks and the presence of in-stream islands, benches or bars

Approval requirement or further action

As the feature has been assessed as a waterway under the *Water Act 2000* and a watercourse under the *Fisheries Act 1994*, construction must comply with the EA requirements (Schedule B5 to B16), relevant self-assessable codes under the Water Act and the Fisheries Act. Approvals under the Water Act and EA Requirements must be lodged a minimum of ten business day prior to works. In addition to this, applications for a Development Approval and Riverine Protection Permit must be lodged with the relevant agency a minimum of six months prior to works.

3.19.10 Wetlands, lakes and springs

A DEHP mapped referable wetland crosses the N1 sub-branch infrastructure area at Blyth Creek. Field validation identified that this mapped area was a non-wetland feature and constituted the area between the outer banks of a watercourse.

Approval requirement or further action

None

3.19.11 N1 sub-branch: Vegetation community and habitat summary

Vegetation community description – Baseline data							
Site:	Q 22/VC 22/HA 22	**Recorder:**	JN, PW, LM, RF	**Date:**	23/01/2014	**Time:**	1300
Project:	L1 ecological field surveys			**Photos:**	N: 723 E: 724 S: 725 W: 726		
Locality:	N1 Trunkline			**Property (lot/plan):**	South Leigh(49WV422)		
Coordinates:	**Zone:** 5 5	7 0 7 4 2 3	7 0 7 4 2 1 1				

Vegetation community description: Eucalypt woodland fringing watercourse - Woodland dominated by *Eucalyptus tereticornis* fringing a watercourse. Shrub and ground layers are moderately-dense to dense.

Vegetation structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1	16	12-18	S
T2	9	7-10	M
T3		-	
S1	2	1-6	S
S2		-	
G	0.8	0-1	M-D

Structural formation (including height):

Woodland fringing watercourse

Ecologically dominant layer: T1

Land form element# (40 m radius): Gully/watercourse

Land form pattern# (300 m radius): Gently undulating plain

Soil and geology: Light brown sand with some small rocks

Slope and aspect: 20°, East and West

Vast: II

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
T1	d	*Eucalyptus tereticornis*
T1	s	*Angophora floribunda*
T1	a	*Eucalyptus populnea*
T2	d	*Eucalyptus melanophloia*
T2	a	*Eucalyptus populnea*
T2	a	*Angophora floribunda*
T2	a	*Brachychiton populneus*
T2	a	*Callitris glaucophylla*
S1	a	*Atalaya hemiglauca*
S1	a	*Callitris glaucophylla*
S1	a	*Geijera parviflora*
S1	a	*Acacia deanei*
S1	a	*Carissa ovata*
S1	a	*Acacia macradenia*
S1	a	*Opuntia tomentosa**
S1	a	*Vachellia farnesiana**
S1	a	*Santalum lanceolatum*
G	d	*Themeda avenaceus*
G	a	*Lomandra longifolia*
G	a	*Chrysopogon fallax*
G	a	*Heteropogon contortus*
G	a	*Imperata cylindrica*
G	a	*Opuntia tomentosa**
G	a	*Cenchrus ciliaris**
G	a	*Themeda triandra*
G	a	*Verbena aristigera**
G	a	*Aristida calycina*
G	a	*Ancistrachne uncinulata*
G	a	*Melinis repens**
G	a	*Arundinella nepalensis*

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	37.0
Native herbs/forbs (non-grass)	0.0
Native shrubs (<1 m high))	0.0
Non-native grass	0.0
Non-native herbs and shrubs	0.0
Litter (woodies <10 cm diameter, dead annuals, etc)	34.0
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	29.0

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	4
Coarse leaf litter (>2 cm diameter)	6
Fine leaf litter (<2 cm diameter)	2
Bare ground	6
Grass	7
Soil cracks	0
Stones (20-60 cm)	0
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	21.5
T2	19.5
S1	1.5
S2	n/a
G	n/a
Species	
T1	
Angophora floribunda	1.5
Eucalyptus tereticornis	12.0
Eucalyptus melanophloia	8.0
T2	
Callitris glaucophylla	4.5
Eucalyptus tereticornis	14.5
Acacia macradenia	0.5
S1	
Santalum lanceolatum	1.5

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	84
T2	8
S1	600
S2	n/a
G	n/a
Species	
T1	
Eucalyptus melanophloia	76
Eucalyptus tereticornis	4
Angophora floribunda	4
T2	
Eucalyptus tereticornis	4
Callitris glaucophylla	4
S1	
Acacia macradenia	160
Acacia deanei	40
Eucalyptus melanophloia	80
Callitris glaucophylla	160
Atalaya hemiglauca	40
Santalum lanceolatum	80
Carissa ovata	40

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 5 4
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	45 m

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included one dead hollow logs and one hollows in tree.
Potential habitat for EVNT fauna species (including essential habitat): Koala, Large-eared pied bat, Little pied bat, South-eastern long-eared bat, squatter pigeon (southern), brigalow scaly foot and Dunmall's snake Mature trees in riparian corridor not tall enough for red goshawk habitat

Koala habitat
Riparian vegetation within survey area is koala habitat. Koala food trees are present and riparian corridor provides connectivity to vegetation in wider landscape.

Disturbances (eg grazing, ploughing etc.)
Erosion in creek channel, grazing, cleared paddocks surrounding creeks
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.):
Riparian corridor around Blyth Creek with mature eucalypts and *Callitris glaucophylla* provides connectivity in the landscape for fauna. Creek also provides a major water flow path after rain. Narrow riparian corridor surrounded by non-remnant paddock. Tree hollows in mature trees and hollow logs provide habitat features including roosting habitat, shelter and hollows for breeding habitat. Survey area represents relatively high value habitat, particularly in relation to vegetation within the landscape.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Velvety tree pear[1] (*Opuntia tomentosa*), C; buffel grass (*Cenchrus ciliaris*), C; Mayne's pest (*Verbena aristigera*), C; mimosa bush (*Vachellia farnesiana*), R; red natal grass (*Melinis repens*), C
Total percentage weed cover: Velvety tree pear[1], 1%; buffel grass, 10%; Mayne's pest, 5%; mimosa bush, 4%; red natal grass, 5%
[1]Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
Kurrajong (*Brachychiton populneus*). Refer to Santos webGIS system for point locations.

Incidental fauna observations
apostlebird, Australian magpie, Australian owlet-nightjar, Australian raven, barn owl, Beccari's freetail bat, common brushtail possum, crested pigeon, dollarbird, eastern bentwing bat (unconfirmed) eastern brown snake, eastern freetail bat, eastern grey kangaroo, eastern striped skink, fairy martin, galah, Gould's wattled bat, grey-crowned babbler, inland forest bat (unconfirmed), little broad-nosed bat, little forest bat (unconfirmed), little friarbird, little pied bat (unconfirmed), noisy miner, pale-headed rosella, pied butcherbird, red-necked wallaby, restless flycatcher, sacred kingfisher, spiny-cheeked honeyeater, striated pardalote, sulphur-crested cockatoo, Torresian crow, wedge-tailed eagle, weebill, western broad-nosed bat, white-striped freetail bat, willie wagtail, yellow-bellied sheathtail-bat, yellow-rumped thornbill

Representative photos for the N1 sub-branch infrastructure area

North

East

South

West

Vegetation community description – Baseline data							
Site:	Q/VC/HA18 / Q/VC/HA21	**Recorder:**	JN, PW, LM	**Date:**	23/01/2014	**Time:**	0800-1100
Project:	L1 ecological field surveys			**Photos:**	N: 759 E: 760 S: 761 W: 762		
Locality:	N1 trunkline			**Property (lot/plan):**	South Leigh(48WV422)		
Coords (18):	**Zone:** 55	706962		7074709			
Coords (21)	**Zone:** 55	7086306		7073220			
Vegetation community description: Open cleared pasture with very sparse shrubs and trees located within a highly fragmented landscape with remnant vegetation restricted to roadsides and watercourses.							

Vegetation structure

Median height of EDL is to be measured and cover density estimated: D, touching-overlap<0; M, touching-slight separation 0-0/25; S, clearly separated 0.25-1, V, well separated 1-20

Stratum	Median height	Height interval	Est. cover density (D,M,S,V)
E		-	
T1		-	
T2		-	
T3		-	
S1	1.5	1-5	S
S2		-	
G	0.5	0-1	M

Structural formation (including height):

Open cleared pasture

Ecologically dominant layer: S1

Land form element# (40 m radius): Gentle slope

Land form pattern# (300 m radius): Low undulating hills

Soil and geology: Brown sandy clay

Slope and aspect: <5°, South-east

Vast: III

Plant species

Relative (numerical) dominance for each stratum: d, dominant; c, codominant; s, subdominant; a, associated.

Str.	Rel. dom.	Scientific Name
S1	a	*Eucalyptus populnea*
S1	a	*Maireana microphylla*
S1	a	*Callitris glaucophylla*
S1	a	*Eucalyptus chloroclada*
S1	a	*Allocasuarina luehmannii*
S1	a	*Eucalyptus melanophloia*
S1	a	*Capparis lasiantha*
S1	a	*Citrus glauca*
S1	a	*Dodonaea viscosa* subsp. *spatulata*
S1	a	*Eremophila mitchellii*
S1	a	*Acacia excelsa*
G	a	*Verbena aristigera**
G	a	*Chloris ventricosa*
G	a	*Austrostipa ramosissima*
G	a	*Salsola kali*
G	a	*Bothriochloa pertusa**
G	a	*Maireana microphylla*
G	a	*Cenchrus ciliaris**
G	a	*Cirsium vulgare**
G	a	*Citrus glauca*
G	a	*Enteropogon ramosus*
G	a	*Aristida personata*
G	a	*Heteropogon contortus*
G	a	*Wahlenbergia gracilis*
G	a	*Cymbopogon refractus*
G	a	*Enneapogon avenaceus*
G	a	*Eragrostis lacunaria*
G	a	*Chrysocephalum apiculatum*
G	a	*Melinis repens**
G	a	*Aristida caput-medusae*
G	a	*Alloteropsis semialata*
G	a	*Aristida calycina*

**Denotes exotic species*

Ground cover (%) (average from five 1 m x 1 m quadrats)	
Type	**% cover**
Native grass	26.5
Native herbs/forbs (non-grass)	8.5
Native shrubs (<1 m high))	1.0
Non-native grass	18.0
Non-native herbs and shrubs	3.0
Litter (woodies <10 cm diameter, dead annuals, etc)	22.0
Litter (logs >10 cm diameter)	0.0
Rock	0.0
Bare ground	21.0

Fauna habitat features (within 1 ha area) – Baseline data	
Characteristic	**Abundance (0-7) ^**
Decorticating bark	0
Coarse leaf litter (>2 cm diameter)	0.5
Fine leaf litter (<2 cm diameter)	2
Bare ground	3.5
Grass	6.5
Soil cracks	2
Stones (20-60 cm)	1
Boulders (61 cm – 2 m)	0
Larger boulders (>2 m)	0
Rock crevices	0
Exfoliating rock	0
^ 0, nil; **1**, rare; **2,** rare to occasional; **3,** occasional; **4**, Occasional to common; **5**, common; **6**, common to abundant; **7**, abundant	

Vegetative cover	
Strata	**Cover (100 m line intercept)**
T1	n/a
T2	n/a
S1	0.0
S2	n/a
G	n/a
Species	
None	

Vegetative density	
Strata	**Stem count (1 ha area)**
T1	n/a
T2	n/a
S1	130
S2	n/a
G	n/a
Species	
S1	
Eremophila mitchellii	10
Capparis lasiantha	10
Acacia excelsa	10
Callitris glaucophylla	30
Dodonaea viscosa	10
Eucalyptus populnea	40
Allocasuarina luehmannii	10
Eucalyptus melanophloia	10

Fauna habitat value (within 1 ha area) – Baseline data	
Characteristic	**Value**
Number of trees with hollows: - Hollow size <10 cm diameter - Hollow size >10 cm diameter	 0 0
Number of hollow bearing logs (hollows >10 cm diameter)	0
Total number of hollows in logs	0
Total length of fallen woody material (eg logs) >10 cm diameter	18 m

General habitat features and fauna breeding places present
General habitat features and potential fauna breeding places have been recorded in the Santos webGIS system. Refer to Santos webGIS for more information on these features. Fauna habitat features included one dead hollow logs and six hollows in trees
Potential habitat for EVNT fauna species (including essential habitat): General habitat for Dunmall's snake and squatter pigeon (southern)

Koala habitat
Survey area not koala habitat due to non-remnant vegetation and absence of suitable koala food trees.

Disturbances (eg grazing, ploughing etc.)
Grazing, clearing, farm dam earthworks
Ecosystem functioning (eg. Extent of remnant vegetation in the landscape, connectivity, etc.)
Survey area consists of a large area of non-remnant vegetation with little ecosystem functioning due to the absence of habitat features. Adjacent farm dam provides a water source in the area. Narrow corridor of mature vegetation is present within a road reserve outside of the investigation area, which provides some connectivity within the landscape and sheltering habitat for birds, mammals and reptiles. The investigation are represents low value habitat.

Weeds
Weeds present: R, rare (<10 plants observed); U, uncommon (11-50 plants observed); C, common (>50 plants observed)
Velvety tree pear* (*Opuntia tomentosa*), U; Prickly pear* (*Opuntia tomentosa*), U; buffel grass (*Cenchrus ciliaris*), C; Indian bluegrass (*Bothriochloa pertusa*), C; scotch thistle (*Cirsium vulgare*), U; Mayne's pest (*Verbena aristigera*), C; red natal grass (*Melinis repens*), C
Total percentage weed cover: Velvety tree pear*, 5%; Prickly pear*, 3%; buffel grass, 18%; Indian bluegrass, 3%; scotch thistle, 1%; Mayne's pest, 5%; red natal grass, 5%
*Class 2 declared weed under the *Land Protection (Pest and Stock Route) Act 2002*

EVNT/Type A flora present
Kurrajong (*Brachychiton populneus*). Refer to Santos webGIS system for point locations.

Incidental fauna observations
apostlebird, Australian magpie, Australian owlet-nightjar, Australian raven, barn owl, Beccari's freetail bat, common brushtail possum, crested pigeon, dollarbird, eastern bentwing bat (unconfirmed) eastern brown snake, eastern freetail bat, eastern grey kangaroo, eastern striped skink, fairy martin, galah, Gould's wattled bat, grey-crowned babbler, inland forest bat (unconfirmed), little broad-nosed bat, little forest bat (unconfirmed), little friarbird, little pied bat (unconfirmed), noisy miner, pale-headed rosella, pied butcherbird, red-necked wallaby, restless flycatcher, sacred kingfisher, spiny-cheeked honeyeater, striated pardalote, sulphur-crested cockatoo, Torresian crow, wedge-tailed eagle, weebill, western broad-nosed bat, white-striped freetail bat, willie wagtail, yellow-bellied sheathtail-bat, yellow-rumped thornbill

NOTE: Results of ecological assessments – baseline data – have been averaged for two assessment sites, Q/VC/HA 18 and Q/VC/HA 21

Representative photos for the N1 sub-branch infrastructure area

North

East

South

West

4. Threatened species

4.1 Threatened fauna species habitat clearing extents

Table 11 contains the areas of potential habitat for threatened fauna species of relevance to the Santos GLNG Project, as listed under the EPBC Act and/or the NC Act, which will be cleared for the construction of RoWs within the L1 and N1 investigation area. Further detail regarding threatened species habitat mapping for the investigation area is provided in Section 4.2.

Table 11 Threatened fauna species habitat and TEC clearing extents

Species	EPBC Act / NC Act status	Habitat within L1 to be cleared for construction (ha)*	Habitat within N1 to be cleared for construction (ha)*
Brigalow scaly-foot (*Paradelma orientalis*)	not listed / vulnerable	0	0.3
Collared delma (*Delma torquata*)	vulnerable / vulnerable	0.0	0.0
Dunmall's snake (*Furina dunmalli*)	vulnerable / vulnerable	54.7	12.3
Fitzroy River turtle (*Rheodytes leukops*)	vulnerable / vulnerable	0.0	0.0
Ornamental snake (*Denisonia maculata*)	vulnerable / vulnerable	0.0	0.0
Yakka skink (*Egernia rugosa*)	vulnerable / vulnerable	0.0	0.0
Koala (*Phascolarctos cinereus*)	vulnerable / special least concern	1.2	0.3
Large-eared pied bat (*Chalinolobus dwyeri*)	vulnerable / vulnerable	1.8	0.3
Northern quoll (*Dasyurus hallucatus*)	vulnerable / least concern	0.0	0.0
South-eastern long-eared bat (*Nyctophilus corbeni*)	vulnerable / vulnerable	1.8	0.3
Australian painted snipe (*Rostratula australis*)	vulnerable, migratory / vulnerable	0.0	0.0
Black-breasted button quail (*Turnix melanogaster*)	vulnerable / vulnerable	0.0	0.0
Red goshawk (*Erythrotriorchis radiatus*)	vulnerable / endangered	0.0	0.0
Squatter pigeon (*Geophaps scripta scripta*)	vulnerable / vulnerable	54.7	12.3
Murray cod (*Maccullochella peelii)*	vulnerable	0.0	0.0
Boggomoss snail (*Adclarkia dawsonensis*)	critically endangered	0.0	0.0
Little pied bat (*Chalinolobus picatus*)	not listed / vulnerable	1.2	0.3

*Where habitat calculations are 0 ha, no suitable habitat for the species has been identified within the L1 or N1 RoWs.

4.2 Threatened fauna species habitat mapping

The quality of habitat to a number of fauna species of relevance to the Santos GLNG Project, was assessed using the Santos Fauna Habitat Assessment Tool. Using this tool, potential habitat for seven threatened fauna species has been identified within the L1 and N1 investigation area. The habitat assessment results have been provided with the spatial data, which include the habitat polygons. Table 12 identifies potential habitat within the investigation area for threatened fauna species using the habitat hierarchy described in the Santos Methodology. Threatened fauna species survey effort and results from field assessments within the investigation area are presented in Appendix A.

Potential habitat mapping for threatened flora species is not a requirement of the Santos Methodology; therefore, threatened flora species of relevance to the investigation area are not included further in this section. A brief discussion on threatened flora potential habitat within the investigation area and results of the field survey is contained within Appendix A.

Table 12 Threatened fauna species habitat descriptions within the L1 and N1 investigation area

Species	Likelihood of occurrence*	Potential habitat within the L1 and N1 investigation area
Brigalow scaly-foot (*Paradelma orientalis*)	Potential to occur	**General habitat:** Only a small portion of the L1 and N1 investigation area contains RE and regrowth vegetation that might be suitable for the species. Within these habitat areas there are suitable microhabitat features, as determined from field surveys. Areas containing suitable microhabitat features have been mapped as general habitat for the species, including: • Eucalypt woodlands with a mixed shrub layer and *Callitris* sp. that may exude tree sap • Microhabitat features to shelter under during the day, including rock slabs, logs, peeling bark **Unlikely habitat:** Other areas within the L1 and N1 investigation area are mapped within cleared pastures that are suitable for the species and do not display suitable microhabitat features that the species might use as shelter. Habitats within these areas were generally lacking any rock slabs, logs or woody/leafy debris and have sparse to absent shrub layers.
Dunmall's snake (*Furina dunmalli*)	Potential to occur	**General habitat:** Areas of remnant, regrowth or modified communities, including non-remnant areas within 3 km of mapped watercourses or water bodies. **Unlikely habitat:** Areas greater than 3 km from watercourses or water bodies
Koala (*Phascolarctos cinereus*)	Potential to occur	**General habitat:** Areas of eucalypt dominated remnant and regrowth vegetation within the L1 and N1 investigation corridor. Within these areas, suitable habitat for koala was determined from field survey. Vegetation within areas mapped as general habitat for koala include: • Remnant *Eucalyptus* spp. woodland fringing drainage features • Regrowth vegetation with *Eucalyptus* spp. present **Unlikely habitat:** Areas within the L1 and N1 investigation area that contain modified communities including non-remnant vegetation. These areas were generally lacking in habitat features suitable for koala, including koala habitat trees and food trees.
Large-eared pied bat (*Chalinolobus dwyeri*)	Potential to occur	**General habitat:** Areas of remnant and regrowth vegetation within the L1 and N1 investigation corridor. Within these areas, suitable habitat for large-eared pied bat was determined based on areas of suitable microhabitat features from field survey. Areas mapped as general habitat for large-eared pied bat included areas with the following habitat features: • Remnant eucalypt dominated woodlands and regrowth vegetation with suitable microhabitat features to shelter including stag trees, logs with hollows and peeling bark **Unlikely habitat:** Areas within the L1 and N1 investigation area that contain modified communities including non-remnant vegetation. These areas were generally lacking in habitat features suitable microhabitat features for large-eared pied bat.

Species	Likelihood of occurrence*	Potential habitat within the L1 and N1 investigation area
South-eastern long-eared bat (*Nyctophilus corbeni*)	Potential to occur	**General habitat:** Areas of remnant and regrowth vegetation within the L1 and N1 investigation corridor. Within these areas, suitable habitat for south-eastern long-eared bat was determined based on areas of suitable microhabitat features from field survey. The species may forage for a few kilometres along watercourses and linear remnants of vegetation leading away from roosting sites. Areas mapped as general habitat for south-eastern long-eared bat included areas with the following habitat features: • Remnant eucalypt dominated woodlands and regrowth vegetation with suitable microhabitat features to shelter including stag trees, logs with hollows and peeling bark **Unlikely habitat:** Areas within the L1 and N1 investigation area that contain modified communities including non-remnant vegetation. These areas were generally lacking in habitat features suitable microhabitat features for south-eastern long-eared bat.
Squatter pigeon (*Geophaps scripta scripta*)	Potential to occur	**General habitat:** Areas of remnant, regrowth or modified communities, including non-remnant areas within 3 km of mapped watercourses or water bodies. **Unlikely habitat:** Areas greater than 3 km from watercourses or water bodies. None present within investigation area.
Little pied bat (*Chalinolobus picatus)*	Confirmed present	**General habitat:** Areas of remnant and regrowth vegetation within the L1 and N1 investigation corridor. Within these areas, suitable habitat for little pied bat was determined based on areas of suitable microhabitat features from field survey. Areas mapped as general habitat for little pied bat included areas with the following habitat features: • Remnant eucalypt dominated woodlands and regrowth vegetation with suitable microhabitat features to shelter including stag trees, logs with hollows and peeling bark Although little-pied bat echolocations were recorded on Anabat on site during field assessments, there is a general lack of existing records for the species within the L1 and N1 investigation corridor from previous ecological studies or database results. Little pied bat is reported as scare in highly fragmented landscapes but persists in vegetated corridors and well-connected patches of remnant vegetation (DSITIA 2012). Areas within the L1 and N1 investigation corridor are considered to provide general habitat for this species based on field survey, but were not considered to represent core or essential habitat areas for the species. **Unlikely habitat:** Areas within the L1 and N1 investigation area that contain modified communities including non-remnant vegetation. These areas were generally lacking in habitat features suitable microhabitat features for little pied bat.

*Likelihood of occurrence criteria:

Confirmed present – species was recorded during field surveys of the L1 and N1 investigation area undertaken in January 2014

Potential to occur – suitable habitat requirements are present within L1 and N1 investigation area, even if the species has not been recorded from field surveys

Unlikely to occur – habitat requirements for the species are not present within L1 and N1 investigation area

4.3 Threatened flora species

No threatened flora species listed under the NC Act or EBPC Act were identified during the field surveys. A likelihood of occurrence assessment has been undertaken for listed flora species identified as having the potential to occur within the investigation area. The results are presented in Table 15, Appendix A.

5. References

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Appendices

Appendix A – Threatened species survey results

Targeted threatened species survey effort

During the January 2014 field surveys of the L1 and N1 investigation area, threatened species searches were undertaken targeting the 14 threatened fauna species listed under the EPBC Act or NC Act with potential to occur. Additionally, four listed threatened flora species identified as having the potential to occur were targeted during surveys of investigation area. Survey methods undertaken were appropriate for each species as identified within relevant species survey guidelines published by DOE and/or DEHP. These methods are listed in Section 2. Table 13 outlines the survey effort undertaken for each targeted method employed during field surveys.

Table 13 Survey effort

Survey method/technique	Survey effort
Active search, bird surveys, targeted fauna surveys	43.5 person hours
Spotlighting (walking and driving transects)	12 person hours
Call playback	1 person hour
Attended anabat survey - walking transects	2 person hours
Unattended anabat survey - overnight	6 nights

L1 and N1 threatened species field survey results

Field surveys undertaken in the investigation area during January 2014 recorded the following species, which are protected under the EPBC Act and/or NC Act:

- Little pied bat – not listed EPBC Act, near threatened NC Act
- Rainbow bee-eater – migratory (JAMBA), special least concern NC Act
- Straw-necked ibis – marine, EPBC Act; not listed, NC Act
- Nankeen kestrel– marine, EPBC Act; not listed, NC Act
- Australasian pipit– marine, EPBC Act; not listed, NC Act
- Dollar bird– marine, EPBC Act; not listed, NC Act

Threatened fauna species recorded from field surveys are detailed in Table 15.

No threatened flora species were recorded during field surveys. A likelihood of occurrence assessment for threatened flora species identified during the desktop assessment process is presented in Table 15.

Table 14 Threatened fauna species records

Species name	Location (easting, northing)		Date, Time	Number	Activity	Habitat type
Little pied bat (potential record)	702778	702699	20/01/2014, no time data	Multiple	Echolocation calls recorded on anabat device adjacent to RM 08-16	Small brigalow open-forest
Little pied bat (potential record)	706501	7074168	21/01/2014, no time data	Multiple	Echolocation calls recorded on anabat device adjacent to RM 09-09	High value regrowth *Eucalyptus melanophloia* open-woodand
Little pied bat (potential record)	707502	7074292	22/01/2014, no time data	Multiple	Echolocation calls recorded on anabat device within N1 sub-branch	Eucalypt woodland fringing watercourse
Little pied bat (potential record)	703397	7072355	20/01/2014, no time data	Multiple	Echolocation calls recorded on anabat device adjacent to L1-01 sub-branch	Cleared paddock with mature eucalypts along a creek line
Little pied bat	706556	7077622	22/01/2014, no time data	Multiple	Echolocation calls recorded on anabat device adjacent to L1-11 sub-branch	Farm dam
Rainbow bee-eater	707364	7077282	23/01/2014 7:00 am	Multiple	Observed flying near RM09-05	Shrubby low regrowth eucalyptus and cleared pasture
Rainbow bee-eater	706459	7076261	22/01/2014 12:30	Multiple	Observed perched in tree along L1-11	Regrowth eucalypt woodland and shrubby regrowth
Rainbow bee-eater	706639	7077511	22/01/2014 8:00 am	Multiple	Observed flying near L1-08	Open cleared pasture with very sparse trees and shrubs
Straw-necked ibis	702894	7072537	20/01/2014 9:30 am	Multiple	Large flock observed flying overhead near RM 08-16	Open cleared pasture with very sparse trees and shrubs
Straw-necked ibis	703801	7072780	20/01/2014 7:00 am	Multiple	Seen flying along L1-01	Open cleared pasture with very sparse trees and shrubs
Nankeen kestrel	704059	7073722	20/01/2014 11:30 am	1	Observed flying near RM 08-14	Open cleared pasture with very sparse trees and shrubs
Nankeen kestrel	702894	7072537	20/01/2014 7:00 am	1	Observed flying near L1-01	Open cleared pasture with very sparse trees and shrubs
Australasian pipit	704059	7073722	20/01/2014 11:30 am	1	Observed flying near RM 08-14	Open cleared pasture with very sparse trees and shrubs
Australasian pipit	702894	7072537	20/01/2014 9:00 am	1	Observed flying near RM 08-16	Open cleared pasture with very sparse trees and shrubs
Dollar bird	707364	7077282	22/01/2014 1:30 pm	Multiple	Heard calling near RM 09-05	Shrubby low regrowth eucalyptus and cleared pasture
Dollar bird	707436	7074211	23/01/2014 9:00	1	Observed perched in a shrub within N1 sub-branch	Eucalypt woodland fringing watercourse
Dollar bird	706382	7073985	23/01/2014 12:00 pm	1	Observed perched in tree near RM 09-43	Open cleared pasture with very sparse trees and shrubs

Table 15 Threatened flora likelihood of occurrence assessment

Species	EPBC Act/NC Act status	Records*	Habitat requirements	Habitat available in the Yorkaringa project area and likelihood of occurrence[1]
				Eucalypt open woodland
Cadellia pentastylis ooline	vulnerable/ vulnerable	PMST	Occurs in a range of vegetation types including semi-evergreen vine thicket, brigalow-belah, poplar box and bendee communities. Often occurs on the edges of sandstone and basalt escarpments.	No suitable habitat was observed within and adjacent to the infrastructure within the Yorkaringa project area **Unlikely to occur**
Homopholis belsonii Belson's panic	Endangered/ endangered	PMST	This species occurs within dry woodland habitats on poor soils (often basalt derived), mostly in rocky hills supporting white box (*Eucalyptus albens*) and wilga woodland, or alluvial areas supporting belah and poplar box woodland.	No suitable habitat in remnant vegetation on preferred soils of the species exists within the investigation area. **Unlikely to occur**
Swainsona murrayana slender Darling-pea	Vulnerable/ vulnerable	PMST	This species grows in heavy grey/brown clay, loam or cracking clays and is found in grassland and open woodland. It may be disturbance mediated. It is often associated with low chenopod shrubs (*Maireana* spp.), wallaby-grass (*Austrodanthonia* spp.), and spear grass (*Austrostipa* spp.).	Potential habitat exists in non-remnant vegetation where cracking clays exist; although, these soils were seen in only minor areas within the investigation area. Flora species that have been known to be associated with the slender darling pea were recorded on site (e.g. *Maireana* sp. and *Austrostipa* spp.) **Potential to occur**
Tylophora linearis	not listed/near threatened	PMST	Grows in dry scrub and open-forest. Found in low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa*, *E. sideroxylon*, *E. albens*, *Callitris glaucophylla* and *Allocasuarina luehmannii*.	No suitable habitat was observed within and adjacent to the infrastructure within the Yorkaringa project area **Unlikely to occur**

*Desktop search sources: WO, Wildlife Online; PMST, Protected Matters Search Tool; EH, essential habitat and species location occurs for the species within the search area

[1]Likelihood of occurrence criteria:

Confirmed present – species was recorded during field surveys of the L1 and N1 investigation area undertaken in January 2014

Potential to occur – suitable habitat requirements are present within the L1 and N1 investigation area, even if the species has not been recorded from field surveys

Unlikely to occur – habitat requirements for the species are not present within the L1 and N1 investigation area

Appendix B – Flora and fauna species lists

- Flora species list
- Fauna species list

Flora species list

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	LP Act Status	Survey sites
Amaranthaceae	*Ptilotus macrocephalus*	green pussytail	LC			Q5, Q9
Apocynaceae	*Alstonia constricta*	bitter bark	LC			Q3, Q19
Apocynaceae	*Carissa ovata*	currant bush	LC			Q3, Q17, Q20
Asteraceae	*Calotis cuneifolia*	purple burr-daisy	LC			Q10, Q12, Q14, Q19
Asteraceae	*Calotis lappulacea*	yellow burr-daisy	LC			Q7, Q8, Q14, Q19
Asteraceae	*Chrysocephalum apiculatum*	billy-buttons	LC			Q2, Q4, Q6, Q8, Q9, Q10, Q16, Q18, Q19, Q22
Asteraceae	*Cirsium vulgare*	scotch thistle	I			Q4, Q5, Q6, Q7, Q9, Q12, Q14, Q21, Q22
Asteraceae	*Podolepis longipedtata*		LC			Q4, Q19
Asteraceae	*Pycnosorus globosus*	drumsticks	LC			Q1
Asteraceae	*Verbesina encelioides*	wild sunflower	I			Q14
Brassicaceae	*Arabidella eremigena*	priddiwalkatji	LC			Q2, Q3, Q4, Q5, Q8, Q9, Q11, Q14, Q22
Cactaceae	*Opuntia stricta*	prickly pear	I		Class 2	Q2, Q3, Q6, Q9, Q10, Q11, Q22
Cactaceae	*Opuntia tomentosa*	velvety tree pear	I		Class 2	Q3, Q10, Q11, Q13, Q17, Q19, Q20, Q22
Campanulaceae	*Wahlenbergia gracilis*	bluebell	LC			Q4, Q19, Q21
Capparaceae	*Apophyllum anomalum*	warrior bush	LC			Q2
Capparaceae	*Capparis lasiantha*	wait-a-while	LC			Q2, Q3, Q17, Q21, Q22
Casuarinaceae	*Allocasuarina leuhmannii*	buloak	LC			Q16, Q17, Q18
Casuarinaceae	*Casuarina glaucophylla*	white cypress pine	LC			Q2
Chenopodiaceae	*Einadia hastata*		LC			Q22
Chenopodiaceae	*Maireana microphylla*	cotton bush	LC			Q1, Q2, Q3, Q4, Q5, Q6, Q8, Q9, Q18, Q21
Chenopodiaceae	*Salsola kali*	soft roly-poly	LC			Q1, Q19, Q21
Chenopodiaceae	*Sclerolaena birchii*	galvanised burr	LC			Q2, Q8
Chenopodiaceae	*Sclerolaena tetracuspis*	dog burr	LC			Q1, Q7
Convolvulaceae	*Evolvulus alsinoides*	tropical speedwell	LC			Q12
Cupressaceae	*Callitris glaucophylla*	white cypress pine	LC			Q2, Q9, Q10, Q11, Q13, Q14, Q15, Q17, Q18, Q20, Q21, Q22

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	LP Act Status	Survey sites
Cyperaceae	*Fimbristylis dichotoma*	common finger rush	LC			Q1, Q4, Q6, Q8, Q9, Q10, Q13, Q14, Q19
Fabaceae	*Rhynchosia minima*	rhynchosia	LC			Q2, Q7
Juncaceae	*Juncus usitatus*		LC			Q5, Q6, Q13, Q15, Q22
Laxmanniaceae	*Lomandra leucocephala* subsp. *leucocephala*	wooly-headed matrush	LC			Q13, Q15, Q16, Q19
Laxmanniaceae	*Lomandra longifolia*	long-leaved matrush	LC			Q9, Q11, Q12, Q13, Q15, Q20
Malvaceae	*Abutilon oxycarpum*	flannel flower	LC			Q3, Q5, Q8
Malvaceae	*Abutilon sp.*		LC			Q1
Malvaceae	*Hibiscus sturtii* var. *sturtii*	hill hibiscus	LC			Q8
Malvaceae	*Malvastrum americanum*	malvastrum	I			Q4
Mimosaceae	*Acacia deanei subsp. deanei*	Dean's wattle	LC			Q15, Q17, Q20
Mimosaceae	*Acacia excelsa* subsp. *excelsa*	ironwood	LC			Q5, Q6, Q8, Q11, Q13, Q21
Mimosaceae	*Acacia harpophylla*	brigalow	LC			Q3, Q22
Mimosaceae	*Acacia leiocalyx*	early black wattle	LC			Q12, Q13, Q14, Q15, Q16, Q17
Mimosaceae	*Acacia macradenia*	zig-zag wattle	LC			Q20
Mimosaceae	*Acacia oswaldii*	miljee	LC			Q1, Q6
Mimosaceae	*Vachellia farnesiana*	mimosa bush	I			Q7, Q9, Q20
Myoporaceae	*Eremophila mitchellii*	false sandalwood	LC			Q2, Q3, Q21
Myrtaceae	*Angophora floribunda*	rough barked apple	LC			Q17, Q20
Myrtaceae	*Angophora leiocarpa*	smooth apple	LC			Q13, Q14, Q15, Q17
Myrtaceae	*Corymbia tessellaris*	Moreton Bay ash	LC			Q14, Q17
Myrtaceae	*Corymbia trachyphloia*	brown bloodwood	LC			Q12
Myrtaceae	*Eucalyptus chloroclada*	Baradine gum	LC			Q13, Q15, Q16, Q18
Myrtaceae	*Eucalyptus melanophloia*	silver-leaved ironbark	LC			Q10, Q11, Q12, Q13, Q14, Q15, Q16, Q17, Q18, Q20
Myrtaceae	*Eucalyptus populnea*	poplar box	LC			Q4, Q5, Q6, Q7, Q9, Q10, Q11, Q12, Q13, Q17, Q18, Q19, Q20, Q21, Q22
Myrtaceae	*Eucalyptus tereticornis*	forest red gum	LC			Q20
Nyctaginaceae	*Boerhavia dominii*	tar vine	LC			Q19, Q22

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	LP Act Status	Survey sites
Papaveraceae	*Argemone ochroleuca subsp. ochroleuca*	Mexican poppy	I			Q19
Picrodendraceae	*Petalostigma pubescens*	quinine berry tree	LC			Q11, Q14
Poaceae	*Alloteropsis semialata*	cockatoo grass	LC			Q14, Q18
Poaceae	*Ancistrachne uncinulata*	hooky grass	LC			Q3, Q20
Poaceae	*Aristida calycina*	dark wiregrass	LC			Q12, Q13, Q14, Q15, Q16, Q18, Q19, Q20
Poaceae	*Aristida caput-medusae*	many-headed wiregrass	LC			Q6, Q10, Q11, Q12, Q13, Q14, Q15, Q16, Q17, Q18
Poaceae	*Aristida jerichoensis*	Jericho wiregrass				Q15
Poaceae	*Aristida leptopoda*	white spear grass	LC			Q7
Poaceae	*Aristida lignosa*		LC			Q1, Q3, Q4, Q5, Q6, Q8
Poaceae	*Aristida personata*	purple wiregrass	LC			Q21
Poaceae	*Arundinella nepalensis*	reed grass	LC			Q12, Q20
Poaceae	*Austrostipa ramosissima*	stout bamboo grass	LC			Q2, Q4, Q9, Q14, Q18, Q22
Poaceae	*Austrostipa verticillata*	slender bamboo grass	LC			Q5, Q8, Q9, Q11
Poaceae	*Bothriochloa pertusa*	Indian bluegrass	I			Q1, Q2, Q3, Q7, Q8, Q12, Q17, Q21, Q22
Poaceae	*Cenchrus ciliaris*	buffel grass	I			Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14, Q15, Q16, Q17, Q18, Q19, Q20, Q21, Q22
Poaceae	*Chloris ventricosa*	tall chloris	LC			Q1, Q2, Q3, Q18
Poaceae	*Chrysopogon fallax*	golden beard	LC			Q4, Q12, Q20
Poaceae	*Cymbopogon refractus*	barbed wire grass	LC			Q4, Q10, Q12, Q13, Q14, Q15, Q16, Q18, Q21
Poaceae	*Digitaria ciliaris*		I			Q1, Q4, Q8, Q13
Poaceae	*Digitaria divaricatissima*	spreading umbrella grass	LC			Q14, Q19
Poaceae	*Enneapogon avenaceus*	ridge grass	LC			Q10, Q11, Q12, Q21, Q22
Poaceae	*Enneapogon nigricans*	bottle washers	LC			Q1, Q2, Q3, Q5, Q7, Q8
Poaceae	*Enteropogon ramosus*	twirly windmill grass	LC			Q2, Q3, Q8, Q12, Q17, Q21, Q22
Poaceae	*Eragrostis lacunaria*	purple lovegrass	LC			Q3, Q4, Q5, Q6, Q17, Q21, Q22
Poaceae	*Eragrostis leptostachya*	paddock lovegrass	LC			Q2

Family	Scientific Name	Common Name	NC Act Status	EPBC Act Status	LP Act Status	Survey sites
Poaceae	*Eragrostis setifolia*	neverfail grass	LC			Q13, Q15
Poaceae	*Eragrostis tenellula*	delicate lovegrass	LC			Q8
Poaceae	*Heteropogon contortus*	black spear grass	LC			Q10, Q11, Q16, Q18, Q20, Q21
Poaceae	*Imperata cylindrida*	blady grass	LC			Q20
Poaceae	*Melinis repens*	red natal grass	I			Q1, Q8, Q9, Q10, Q11, Q13, Q15, Q17, Q18, Q19, Q20
Poaceae	*Panicum effusum*	hairy panic	LC			Q4
Poaceae	*Paspalidium caespitosum*	brigalow grass	LC			Q3
Poaceae	*Perotis rara*	comet grass	LC			Q13
Poaceae	*Sporobolus caroli*	fairy grass	LC			Q1, Q2, Q3, Q6, Q10
Poaceae	*Sporobolus creber*	western rat's tail grass	LC			Q4, Q8
Poaceae	*Sporobolus sp.*		LC			Q1
Poaceae	*Themeda avenacea*	oat kangaroo grass	LC			Q10, Q12, Q13, Q14, Q15, Q20
Poaceae	*Themeda triandra*	kangaroo grass	LC			Q2, Q4, Q5, Q6, Q9, Q10, Q20
Poaceae	*Urochloa mosambicensis*		I			Q4
Portulacaceae	*Portulaca oleracea*	common pigweed	I			Q1, Q3, Q8
Rubiaceae	*Psydrax oleifolia*	myrtle tree	LC			Q11, Q13
Rutaceae	*Citrus glauca*	wild lime	LC			Q2
Rutaceae	*Geijera parviflora*	wilga	LC			Q2, Q10, Q11, Q17, Q19, Q20
Santalaceae	*Exocarpos cupressiformis*	wild cherry	LC			Q22
Santalaceae	*Santalum lanceolatum*	sandalwood	LC			Q20
Sapindaceae	*Atalaya hemiglauca*	cattle bush	LC			Q1, Q3, Q12, Q20
Sapindaceae	*Dodonaea viscosa* subsp. *spatulata*	sticky hopbush	LC			Q10, Q11, Q12, Q21
Solanaceae	*Lycium ferocissimum*	African box thorn	I		Class 2	Q19
Solanaceae	*Solanum coactiliferum*	felted nightshade	LC			Q11, Q12
Solanaceae	*Solanum ellipticum*	potato bush	LC			Q13
Sterculiaceae	*Brachychiton populneus*	kurrajong	Type A			Q11, Q12, Q13, Q14, Q20
Sterculiaceae	*Brachychiton rupestris*	narrow-leaved bottletree	Type A			Q3
Verbenaceae	*Verbena aristigera*	Mayne's pest	I			Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q14, Q18, Q20, Q22

Fauna survey results

Group	Scientific name	Common name	EPBC Act status	NC Act Status	Infrastructure ID
Amphibians	*Litoria latopalmata*	broad-palmed frog	-	Least concern	RM08-16 (spotlighting)
Amphibians	*Litoria rubella*	desert tree frog	-	Least concern	L1-11
Birds	*Acanthagenys rufogularis*	spiny-cheeked honeyeater	-	Least concern	Branch N1
Birds	*Acanthiza chrysorrhoa*	yellow-rumped thornbill	-	Least concern	L1-01, L1-08, L1-11, Branch N1
Birds	*Acanthiza reguloides*	buff-rumped thornbill	-	Least concern	RM09-14, L1-08
Birds	*Aegotheles cristatus*	Australian owlet-nightjar	-	Least concern	L1-01 (spotlighting), Branch N1 (spotlighting)
Birds	*Anthus novaeseelandiae*	Australasian pipit	Marine	Least concern	RM08-16, RM08-14
Birds	*Aprosmictus erythropterus*	red winged parrot	-	Least concern	L1-01, RM08-16, RM09-14
Birds	*Aquila audax*	wedge-tailed eagle	-	Least concern	RM08-16, L1-01, L1-05, Branch N1
Birds	*Artamus leucorynchus*	white-breasted woodswallow	-	Least concern	RM08-14
Birds	*Artamus superciliosus*	white-browed woodswallow	-	Least concern	L1-01
Birds	*Cacatua galerita*	sulphur-crested cockatoo	-	Least concern	L1-01, RM08-16, RM09-24, L1-05, RM09-43, L1-08, Branch N1
Birds	*Centropus phasianinus*	pheasant coucal	-	Least concern	L1-11, RM09-05
Birds	*Cisticola exilis*	golden-headed cisticola	-	Least concern	L1-01
Birds	*Coracina novaehollandiae*	black-faced cuckoo-shrike	-	Least concern	RM09-24, RM09-09
Birds	*Corvus coronoides*	Australian raven	-	Least concern	L1-01, RM08-16, RM09-24, L1-05, RM09-09, L1-08,

Group	Scientific name	Common name	EPBC Act status	NC Act Status	Infrastructure ID
					RM09-05, Branch N1, RM09-44
Birds	*Corvus orru*	Torresian crow	-	Least concern	L1-01, RM08-16, RM08-14, L1-04, RM09-24, L1-05, RM09-14, L1-08, RM09-09, L1-08, L1-11, RM09-05, Branch N1
Birds	*Cracticus nigrogularis*	pied butcherbird	-	Least concern	L1-04, RM09-14, L1-08, L1-11, Branch N1
Birds	*Cracticus tibicen*	Australian magpie	-	Least concern	L1-01, L1-08, RM09-05, L1-11, Branch N1, RM09-44
Birds	*Cracticus torquatus*	grey butcherbird	-	Least concern	L1-01, RM09-24, RM09-09
Birds	*Dacelo leachii*	blue-winged kookaburra	-	Least concern	RM09-43
Birds	*Dacelo novaeguineae*	laughing kookaburra	-	Least concern	RM09-14, L1-08, L1-11
Birds	*Dromaius novaehollandiae*	emu	-	Least concern	L1-01
Birds	*Elanus axillaris*	black-shouldered kite	-	Least concern	L1-08, RM09-04
Birds	*Entomyzon cyanotis*	blue-faced honeyeater	-	Least concern	RN09-43
Birds	*Eolophus roseicapilla*	galah	-	Least concern	RM08-16, L1-01, RM09-24, L1-04, L1-08, L1-11, Branch N1
Birds	*Eurystomus orientalis*	dollarbird	Marine	Least concern	RM09-43, L1-11, Branch N1
Birds	*Falco berigora*	brown falcon	-	Least concern	RM09-05
Birds	*Falco cenchroides*	nankeen kestrel	Marine	Least concern	L1-01, RM08-14
Birds	*Gerygone albogularis*	white-throated gerygone	-	Least concern	L1-04, RM09-14, RM09-05
Birds	*Grallina cyanoleuca*	magpie-lark	-	Least concern	L1-01, RM08-16, RM09-14, L1-11,
Birds	*Haliastur sphenurus*	whistling kite	-	Least concern	RM08-16
Birds	*Lalage tricolor*	white-winged triller	-	Least concern	RM09-14

Group	Scientific name	Common name	EPBC Act status	NC Act Status	Infrastructure ID
Birds	*Malurus cyaneus*	superb fairy-wren	-	Least concern	L1-01, L1-08, L1-11
Birds	*Malurus lamberti*	variegated fairy-wren	-	Least concern	RM09-05
Birds	*Malurus melanocephalus*	red-backed fairy-wren	-	Least concern	L1-08, RM09-04, L1-11
Birds	*Manorina flavigula*	yellow-throated miner	-	Least concern	L1-01
Birds	*Manorina melanocephala*	noisy miner	-	Least concern	L1-01, RM08-16, RM08-14, L1-04, RM09-43, RM09-24, RM09-14, RM09-09, L1-08, L1-11, RM09-05, RM09-44, Branch N1
Birds	*Merops ornatus*	rainbow bee-eater	Migratory (JAMBA), Marine	Least concern	L1-11, RM09-05
Birds	*Myiagra inquieta*	restless flycatcher	-	Least concern	Branch N1
Birds	*Northiella haematogaster*	blue bonnet	-	Least concern	L1-01
Birds	*Ocyphaps lophotes*	crested pigeon	-	Least concern	L1-01, RM08-16, RM08-14, Branch N1
Birds	*Pachycephala rufiventris*	rufous whistler	-	Least concern	RM09-14, RM09-04
Birds	*Pardalotus punctatus*	spotted pardalote	-	Least concern	L1-08
Birds	*Pardalotus striatus*	striated pardalote	-	Least concern	L1-01, RM08-14, L1-04, L1-08, L1-11, Branch N1
Birds	*Petrochelidon ariel*	fairy martin	-	Least concern	Branch N1
Birds	*Philemon citreogularis*	little friarbird	-	Least concern	Branch N1
Birds	*Platycercus adscitus*	pale-headed rosella	-	Least concern	RM09-43, L1-11, Branch N1, RM09-44
Birds	*Podargus strigoides*	tawny frogmouth	-	Least concern	L1-01, L1-04, L1-05, L1-08, L1-11
Birds	*Pomatostomus temporalis*	grey-crowned babbler	-	Least concern	L1-01, L1-08, L1-11, Branch N1
Birds	*Rhipidura*	willie wagtail	-	Least concern	L1-01, RM09-14, L1-08, L1-11, Branch N1

Group	Scientific name	Common name	EPBC Act status	NC Act Status	Infrastructure ID
	leucophrys				
Birds	*Smicrornis brevirostris*	weebill	-	Least concern	L1-01, RM08-16, RM08-14, L1-04, RM09-14, L1-08, RM09-09, L1-08, L1-11, RM09-05, Branch N1
Birds	*Strepera graculina*	pied currawong	-	Least concern	L1-08
Birds	*Struthidea cinerea*	apostlebird	-	Least concern	RM08-16, L1-11, RM02-38, Branch N1, RM09-44
Birds	*Taeniopygia bichenovii*	double-barred finch	-	Least concern	L1-11
Birds	*Threskiornis spinicollis*	straw-necked ibis	Marine	Least concern	RM08-16, L1-01
Birds	*Todiramphus sanctus*	sacred kingfisher	-	Least concern	Branch N1
Birds	*Tyto alba*	barn owl	-	Least concern	L1-01 (spotlighting), Branch N1 (spotlighting)
Birds	*Tyto novaehollandiae*	masked owl	-	Least concern	L1-01 (spotlighting), L1-04 (spotlighting), L1-05 (spotlighting)
Birds	*Vanellus miles*	masked lapwing	-	Least concern	L1-01, L1-08, L1-11 (spotlighting)
Mammals	*Aepyprymnus rufescens*	rufous bettong	-	Least concern	L1-01 (spotlighting), L1-04 (spotlighting), L1-05 (spotlighting)
Mammals	*Chalinolobus gouldii*	Gould's wattled bat	-	Least concern	L1-11, L1-08, L1-01, RM08-16, Branch N1
Mammals	*Chalinolobus picatus*	little pied bat	-	Near threatened	RM08-16 (unconfirmed), L1-08 (unconfirmed), Branch N1 (unconfirmed), L1-01 (unconfirmed), L1-11
Mammals	*Macropus giganteus*	eastern grey kangaroo	-	Least concern	RM09-14, RM09-09, RM08-14, L1-05, L1-08, Branch N1
Mammals	*Macropus parryi*	whiptail wallaby	-	Least concern	RM08-14, RM02-38
Mammals	*Macropus rufogriseus*	red-necked wallaby	-	Least concern	L1-01 (spotlighting), RM08-16, RM08-14, L1-04 (spotlighting), L1-05, RM09-09, L1-08, RM09-04, L1-11, RM09-05, L1-08, L1-11, RM02-38, Branch N1 (spotlighting)
Mammals	*Oryctolagus cuniculus*	rabbit	-	Introduced	L1-01 (spotlighting), RM08-16, L1-08, L1-11

Group	Scientific name	Common name	EPBC Act status	NC Act Status	Infrastructure ID
Mammals	*Scrotorepens balstoni*	western broad-nosed bat	-	Least concern	L1-11, L1-08, L1-01, RM08-16, Branch N1
Mammals	*Scrotorepens greyii*	little broad-nosed bat	-	Least concern	L1-11, L1-08, L1-01, RM08-16, Branch N1
Mammals	*Trichosurus vulpecula*	common brushtail possum	-	Least concern	Branch N1 (spotlighting)
Mammals	*Vespadelus baverstocki*	inland forest bat	-	Least concern	RM08-16 (unconfirmed), L1-08 (unconfirmed), Branch N1 (unconfirmed), L1-01, L1-11 (unconfirmed)
Mammals	*Vespadelus vulturnus*	little forest bat	-	Least concern	RM08-16 (unconfirmed), L1-08 (unconfirmed), Branch N1 (unconfirmed), L1-01 (unconfirmed)
Mammals	*Miniopterus orianaen oceanensis*	eastern bentwing bat	-	Least concern	RM08-16 (unconfirmed), L1-08 (unconfirmed), Branch N1 (unconfirmed), L1-01 (unconfirmed)
Mammals	*Austronomus australis*	white-striped freetail bat	-	Least concern	RM08-16, L1-08, Branch N1, L1-01, L1-11
Mammals	*Mormopterus beccarii*	Beccari's freetail bat	-	Least concern	RM08-16, L1-08, Branch N1, L1-01, L1-11
Mammals	*Mormopterus ridei*	eastern freetail bat	-	Least concern	RM08-16, L1-08, Branch N1, L1-01, L1-11
Mammals	*Mormopterus sp.*		-	Least concern	L1-01, L1-11
Mammals	*Saccolaimus flaviventris*	yellow-bellied sheathtail-bat	-	Least concern	RM08-16, L1-08, Branch N1, L1-01, L1-11
Reptiles	*Amphibolurus Nobbi*	nobbi dragon	-	Least concern	RM09-24
Reptiles	*Ctenotus robustus*	eastern striped skink	-	Least concern	RM09-05, L1-08 (spotlighting), L1-11, Branch N1
Reptiles	*Heteronotia binoei*	Bynoe's gecko	-	Least concern	L1-08 (spotlighting), L1-11 (spotlighting)
Reptiles	*Pseudonaja textilis*	eastern brown snake	-	Least concern	Branch N1 (spotlighting)

Appendix C – Field data sheets

- Koala habitat assessments
- Watercourse assessments
- Wetland assessments
- Microbat call identification report

Koala Habitat Assessment and Faecal Pellet Survey

Project: L1 and N1 (partial) Ecological Assessment **Site name/number:** KH 1 (HA 10)

Date and recorder: 21/01/2014 RF **Photos:** refer HA 10

Easting: 706407 **Northing:** 7075414

General habitat description: Eucalypt open woodland dominated by *E. melanophloia*, sparse shrubs and mid dense to dense ground cover of native and exotic grasses

Canopy tree species composition

Tree species	**% canopy cover of species** What proportion of canopy is represented by this species	**Primary food tree species in LGA –** refer AKF *National Koala Tree Protection List 2012* [a] – trees in bold	**Food tree species in LGA –** refer AKF *National Koala Tree Protection List 2012* [a] – trees not in bold	**Koala habitat tree* as defined in SEQ Koala SPP [b] –** *any other Eucalyptus sp., and trees in genera Corymbia, Melaleuca, Lophostemon, Angophora*	**Not a koala habitat tree**
		Tick one for each tree species			
Eucalyptus melanophloia	100	n	y	y	

***** non-juvenile koala habitat tree > 4 m in height OR trunk circumference > 31.5 cm at height of 1.3 m

Other habitat information [c]	**Comments**
Vegetative ground cover (% of ground area)	50
Leaf litter cover (% of ground area)	5
Area of surface water (% of ground area)	0
Distance to surface water (approximate)	1-3 km
Evidence of dogs in area	no

Habitat critical to the survival of the koala [c]	**Yes / No**
Primary koala food tree species comprise at least 30% of the overstorey trees	n
Primary koala food tree species comprise less than 30% of the overstorey trees, but together with secondary food tree species comprise at least 50% of the overstorey trees (secondary food trees in this instance are those identified for LGA that are not primary food trees (AKF, 2012))	n
Primary food tree species are absent but secondary food tree species alone comprise at least 50% of the overstorey trees	y
The above qualities are absent in a forest or woodland, but other essential habitat features are present and adjacent to areas exhibiting the above qualities	n
A relatively high density of koalas is supported, regardless of the presence of food tree species	n
Any form of landscape corridor which is essential for the dispersal of koalas between forest of woodland habitats	n

Other site notes

Site context: patch of high value regrowth veg within predominately non-remnant landscape, Blyth Creek and farm dams located within 3km.

Condition and disturbance: few weeds , existing tracks and gas infrastructure

Koala faecal pellet survey - overview

Method based on Spot Assessment Technique (Phillips and Callaghan, 2011 [d])

Note: If a more detailed koala survey is required (i.e. density estimates), refer to Policy 4 of the Queensland Government's Nature Conservation (Koala) Conservation Plan 2006-2016 [e] and Dique *et al*. 2003 [f]. This may be required where preliminary surveys (i.e. faecal pellet searches) reveal the presence of the koala at a site, for the purposes of informing impact assessment and Commonwealth referral.

Faecal pellet survey data

Survey date and time; survey team: as per koala habitat assessment

Survey location details (site name / number): as per koala habitat assessment

Survey location (transect start) Easting and Northing: as per koala habitat assessment

Survey location (transect end) Easting and Northing: as per koala habitat assessment

	Search area 1	**Search area 2**	**Search area 3**
Pellet visibility (Poor, Medium, Good)*	good		
Number of trees searched	30		
Koala faecal pellets observed (Y/N)	n		
Arboreal mammal scratches observed (Y/N)	n		
Koala(s) observed (Y/N – if yes, details)	n		

*Poor: Thick layer of leaf liter, grasses, weeds, shed bark / Medium: Limited amount of leaf litter, grasses, weeds, shed bark / Good: little or no leaf litter, grasses, weeds, shed bark

Key references:

a Australian Koala Foundation's National Koala Tree Protection List; Recommended Tree Species for Protection and Planting of Koala Habitat (Mitchell, 2012): https://www.savethekoala.com/sites/default/files/Australian%20Koala%20Foundation_National%20Koala%20Tree%20Protection%20List.pdf

b State Planning Policy 2/10 Koala Conservation in South East Queensland (DERM, 2010): http://www.ehp.qld.gov.au/wildlife/koalas/strategy/pdf/koala-spp.pdf

c Required habitat information and definition of 'habitat critical to the survival of the species' sourced from Interim koala referral advice for proponents (DSEWPaC, 2012): http://www.environment.gov.au/epbc/publications/pubs/bio240-0612-interim-koala-referral-advice.pdf

d The Spot Assessment Technique (Phillips and Callaghan, 2011): http://www.biolink.com.au/sites/www.biolink.com.au/files/publications/Phillips%20%26%20Callaghan.pdf

e Nature Conservation (Koala) Conservation Plan 2006-2016: http://www.ehp.qld.gov.au/wildlife/koalas/legislation/pdf/conservation-plan-06-16.pdf

f Dique *et al*. (2003). Evaluation of line transect sampling for estimating koala abundance in the Pine Rivers Shire, south east Queensland. Wildlife Research, 30, 127-133.

Site photos

Koala Habitat Assessment and Faecal Pellet Survey

Project: L1 and N1 (partial) Ecological Assessment **Site name/number:** KH 2 (HA 20)

Date and recorder: 23/01/2014 RF **Photos:** refer HA 20

Easting: 707416 **Northing:** 7074249

General habitat description: Narrow riparian corridor fringing Blyth Creek composed of mature eucalypts , scattered shrubs and dense ground layer on banks of native and exotic grasses.

Canopy tree species composition

Tree species	**% canopy cover of species** What proportion of canopy is represented by this species	**Primary food tree species in LGA –** refer AKF *National Koala Tree Protection List 2012* [a] – trees in bold	**Food tree species in LGA –** refer AKF *National Koala Tree Protection List 2012* [a] – trees not in bold	**Koala habitat tree* as defined in SEQ Koala SPP [b] –** *any other Eucalyptus sp., and trees in genera Corymbia, Melaleuca, Lophostemon, Angophora*	**Not a koala habitat tree**
		Tick one for each tree species			
Eucalyptus tereticornis	30	y	y	y	
Angophora floribunda	20	n	n	y	
Eucalyptus populnea	15	n	y	y	
Eucalyptus melanophloia	20	n	y	y	
Brachychiton. populneus	5	n	n	n	y
Callitris glaucophylla	10	n	n	n	y

***** non-juvenile koala habitat tree > 4 m in height OR trunk circumference > 31.5 cm at height of 1.3 m

Other habitat information [c]	**Comments**
Vegetative ground cover (% of ground area)	70
Leaf litter cover (% of ground area)	5
Area of surface water (% of ground area)	0
Distance to surface water (approximate)	0 m to Blyth Creek (ephemeral), 1-3 km to permanent water
Evidence of dogs in area	no

Habitat critical to the survival of the koala [c]	**Yes / No**
Primary koala food tree species comprise at least 30% of the overstorey trees	y
Primary koala food tree species comprise less than 30% of the overstorey trees, but together with secondary food tree species comprise at least 50% of the overstorey trees (secondary food trees in this instance are those identified for LGA that are not primary food trees (AKF, 2012))	n
Primary food tree species are absent but secondary food tree species alone comprise at least 50% of the overstorey trees	n
The above qualities are absent in a forest or woodland, but other essential habitat features are present and adjacent to areas exhibiting the above qualities	n
A relatively high density of koalas is supported, regardless of the presence of food tree species	n
Any form of landscape corridor which is essential for the dispersal of koalas between forest of woodland habitats	y

Other site notes

Site context: Riparian corridor of remnant vegetation along Blyth Creek

Condition and disturbance: few weeds, non-remnant cleared pasture outside of riparian corridor

Koala faecal pellet survey - overview

Method based on Spot Assessment Technique (Phillips and Callaghan, 2011 [d])

Note: If a more detailed koala survey is required (i.e. density estimates), refer to Policy 4 of the Queensland Government's Nature Conservation (Koala) Conservation Plan 2006-2016 [e] and Dique *et al*. 2003 [f]. This may be required where preliminary surveys (i.e. faecal pellet searches) reveal the presence of the koala at a site, for the purposes of informing impact assessment and Commonwealth referral.

Faecal pellet survey data

Survey date and time; survey team: as per koala habitat assessment

Survey location details (site name / number): as per koala habitat assessment

Survey location (transect start) Easting and Northing: as per koala habitat assessment

Survey location (transect end) Easting and Northing: as per koala habitat assessment

	Search area 1	**Search area 2**	**Search area 3**
Pellet visibility (Poor, Medium, Good)*	Medium		
Number of trees searched	30		
Koala faecal pellets observed (Y/N)	n		
Arboreal mammal scratches observed (Y/N)	y		
Koala(s) observed (Y/N – if yes, details)	n		

*Poor: Thick layer of leaf liter, grasses, weeds, shed bark / Medium: Limited amount of leaf litter, grasses, weeds, shed bark / Good: little or no leaf litter, grasses, weeds, shed bark

Key references:

a Australian Koala Foundation's National Koala Tree Protection List; Recommended Tree Species for Protection and Planting of Koala Habitat (Mitchell, 2012): https://www.savethekoala.com/sites/default/files/Australian%20Koala%20Foundation_National%20Koala%20Tree%20Protection%20List.pdf

b State Planning Policy 2/10 Koala Conservation in South East Queensland (DERM, 2010): http://www.ehp.qld.gov.au/wildlife/koalas/strategy/pdf/koala-spp.pdf

c Required habitat information and definition of 'habitat critical to the survival of the species' sourced from Interim koala referral advice for proponents (DSEWPaC, 2012): http://www.environment.gov.au/epbc/publications/pubs/bio240-0612-interim-koala-referral-advice.pdf

d The Spot Assessment Technique (Phillips and Callaghan, 2011): http://www.biolink.com.au/sites/www.biolink.com.au/files/publications/Phillips%20%26%20Callaghan.pdf

e Nature Conservation (Koala) Conservation Plan 2006-2016: http://www.ehp.qld.gov.au/wildlife/koalas/legislation/pdf/conservation-plan-06-16.pdf

f Dique *et al*. (2003). Evaluation of line transect sampling for estimating koala abundance in the Pine Rivers Shire, south east Queensland. Wildlife Research, 30, 127-133.

Site photos

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Roisin Feeney	GHD	**Inspected Date:**	20/01/2014
Company:			**Time:**	7:30 am

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – L1
Watercourse ID	WC 1	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 11 on WV1759	**Location Reference**	Tantatton
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	Freehold / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☒ New crossing in previously disturbed area: ☐ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Cultural Heritage Approval to undertake assessment:	Yes ☐ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☒ Hot (>35◦C) ☐	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐

CROSSING LOCATION (REFER SECTION 8.2)					
GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94					
Latitude (E)	703300	**Longitude (S)**	7072145		
Bankfull Width (m)	No defined banks	**Bank Width (m):**	Left Bank: 2 m Right Bank: NA		
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	NA		
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 0.2 m/ NA Downstream Right Bank 0 m/ NA	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	**Location**	**Latitude (E)**	**Longitude (S)**
			A	NA	NA
			B	NA	NA
			C	NA	NA
			D	NA	NA
			E	NA	NA
Water Present:	Yes ☐ No ☒				
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒				
Sample Site Length: 50 m		Water Surface Depth to Bed: NA			

CHANNEL DETERMINATION (REFER TO SECTION 8.3)			
Stream Order: 1☒ 2☐ 3☐ 4☐ 4+☐	Functional Zone Type - Sediment	Supply☐ Transfer☒ Storage☐	
Identify Channel Type:	Mildly sinuous		
Channel Modifications:	None		
Bed Sediment Character:	Tight ☐ Packed ☐ Moderate ☐ Low 1 ☐ Low 2 ☒		
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 0 % Pebble 0 % Gravel 0 % Sand Fines 100 %		
Bed Material Angularity:	Very Angular☐ Angular ☐ Sub-angular ☐ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☒		
Bank Predominant Shape:	Concave ☒ Convex ☐ Stepped ☐ Wide lower bench ☐ Undercut ☐		
Bank Slope Downstream Right:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☒		
Bank Slope Downstream Left:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☒ Low 10-30° ☐ Flat<10°☐		
Channel Shape:	Flat U shape		
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☐ Bed Stable ☒ Moderate Deposition ☐ Severe Deposition ☐		
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒		
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐		

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)		
Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed** **<0.25 ha**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If yes, reference Report No:

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SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).

Notes:

non remnant pasture grasses outside of channel

Eucalyptus spp along road

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SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)

no defined bed or banks.

looking downstream.

Notes:

WC 01 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

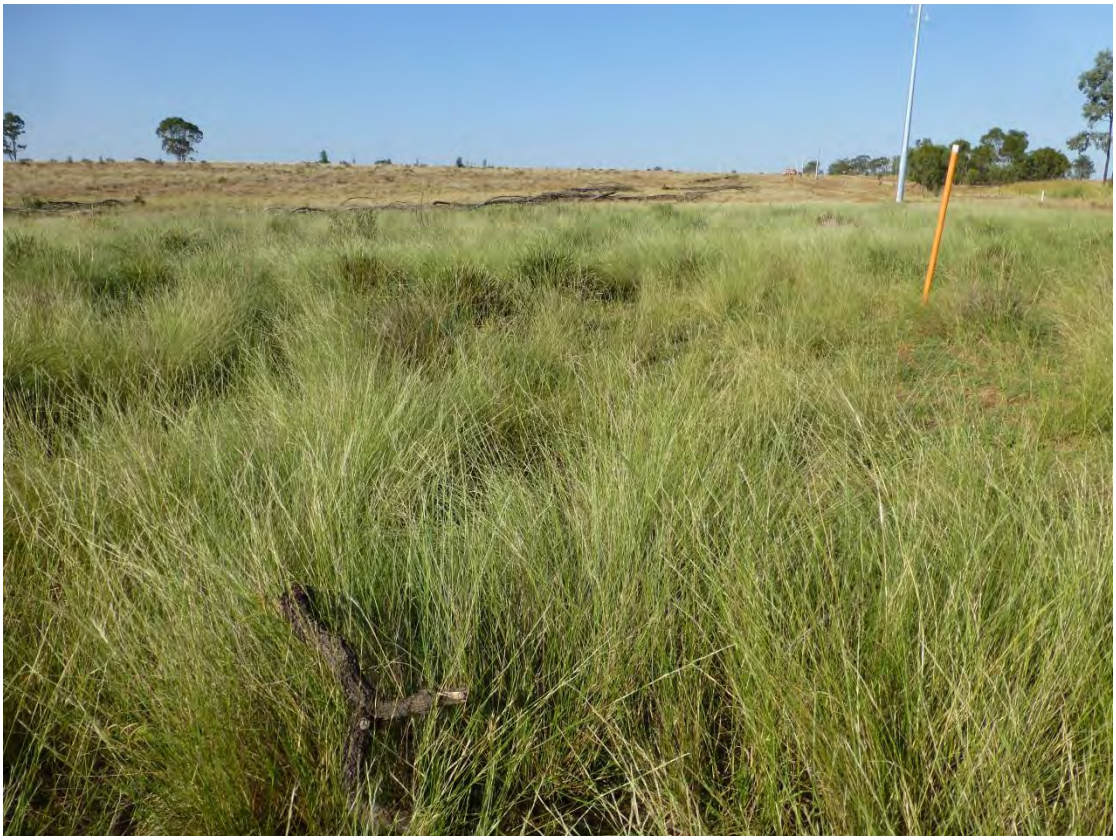

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

Has a pre-disturbance assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If no, a pre-disturbance assessment may be required
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable: Non remnant vegetation
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail ESA category:
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☐ No ☒	If no, Check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required.
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☐	If Yes, detail site:
General Vegetation Community description: (including a list of dominant flora species within each stratum)	*Non remnant vegetation with a sparse shrub layer and ground layer of native and exotic grasses*.	

Are there any declared weeds within the area of the crossing?	Yes☒ No ☐	If yes, describe flag on the ground and GPS and provide on map. Opuntia sp.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☐ No ☒	
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	0 % 0 % 2 % 80 %	
Riparian vegetation patchiness:	None	
Describe the riparian vegetation condition:	VAST 4 – Replaced- Adventive	

Native woody vegetation regeneration:	Abundant ☐ Present ☒ Limited ☐	
SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements. **No evidence of aquatic life. Vegetation consistent with areas surrounding (outside of area of influence**	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream islands, benches or bars?	☒yes ☐no ☒yes ☐no ☒yes ☐no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** **X YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. **☐ NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** **☐ YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. **X NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☐yes ☒no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	<0.25 ha of vegetation will require clearing Majority of the crossing location has already been cleared Potential species to be cleared include:
Can the water crossing be located in a previously disturbed area?	☒yes ☐no	If No, why not?	
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

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Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☐yes ☒no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior to works commencing.	☐ **YES** **(APPROVAL REQUIRED)** ☒ **NO** **(NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)**
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ **YES** **(APPROVAL REQUIRED)** ☒ **NO** **(NO LODGEMENT REQUIRED)**
Is a development approval required (i.e. the self assessable code can not be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Peter Wagner	GHD	**Inspected Date:**	20/01/2014
Company:			**Time:**	9:10 am

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – L1
Watercourse ID	WC 2	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 11 on WV1759	**Location Reference**	Tantatton
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	**Freehold** / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☐ New crossing in previously disturbed area: ☒ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	14-01-08 16:37 [Multiple Sites - Ecol assessment]
Cultural Heritage Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☒ Hot (>35◦C) ☐	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐

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CROSSING LOCATION (REFER SECTION 8.2)

GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94

Latitude (E)	703424	**Longitude (S)**	7072350
Bankfull Width (m)	11 m	**Bank Width (m):**	Left Bank: 5.8 m Right Bank: 4 m
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	1.2 m
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 1 m Downstream Right Bank 1 m	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	

Location	Latitude (E)	Longitude (S)
A	703424	7072350
B	703424	7072350
C	703424	7072350
D		
E		

Water Present:	Yes ☐ No ☒
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒
Sample Site Length: 100 m	Water Surface Depth to Bed: NA

CHANNEL DETERMINATION (REFER TO SECTION 8.3)

Stream Order: 1☐ 2☐ 3☒ 4☐ 4+☐	Functional Zone Type - Sediment	Supply☐ Transfer☒ Storage☐	
Identify Channel Type:	Irregular meanders		
Channel Modifications:	Natural		
Bed Sediment Character:	Tight ☐ Packed ☒ Moderate ☐ Low 1 ☐ Low 2 ☐		
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 10 % Pebble 10 % Gravel 20 % Sand Fines 60 %		
Bed Material Angularity:	Very Angular☐ Angular ☒ Sub-angular ☐ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☐		
Bank Predominant Shape:	Concave ☐ Convex ☐ Stepped ☒ Wide lower bench ☐ Undercut ☐		
Bank Slope Downstream Right:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☒		
Bank Slope Downstream Left:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☒		
Channel Shape:	Widened or infilled		
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☐ Bed Stable ☐ Moderate Deposition ☒ Severe Deposition ☐		
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒		
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐		

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)

Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☐ No ☒	If yes, reference Report No:
Has a pre-disturbance assessment been undertaken previously that encompasses the	Yes ☐ No ☒	If no, a pre-disturbance assessment may be required

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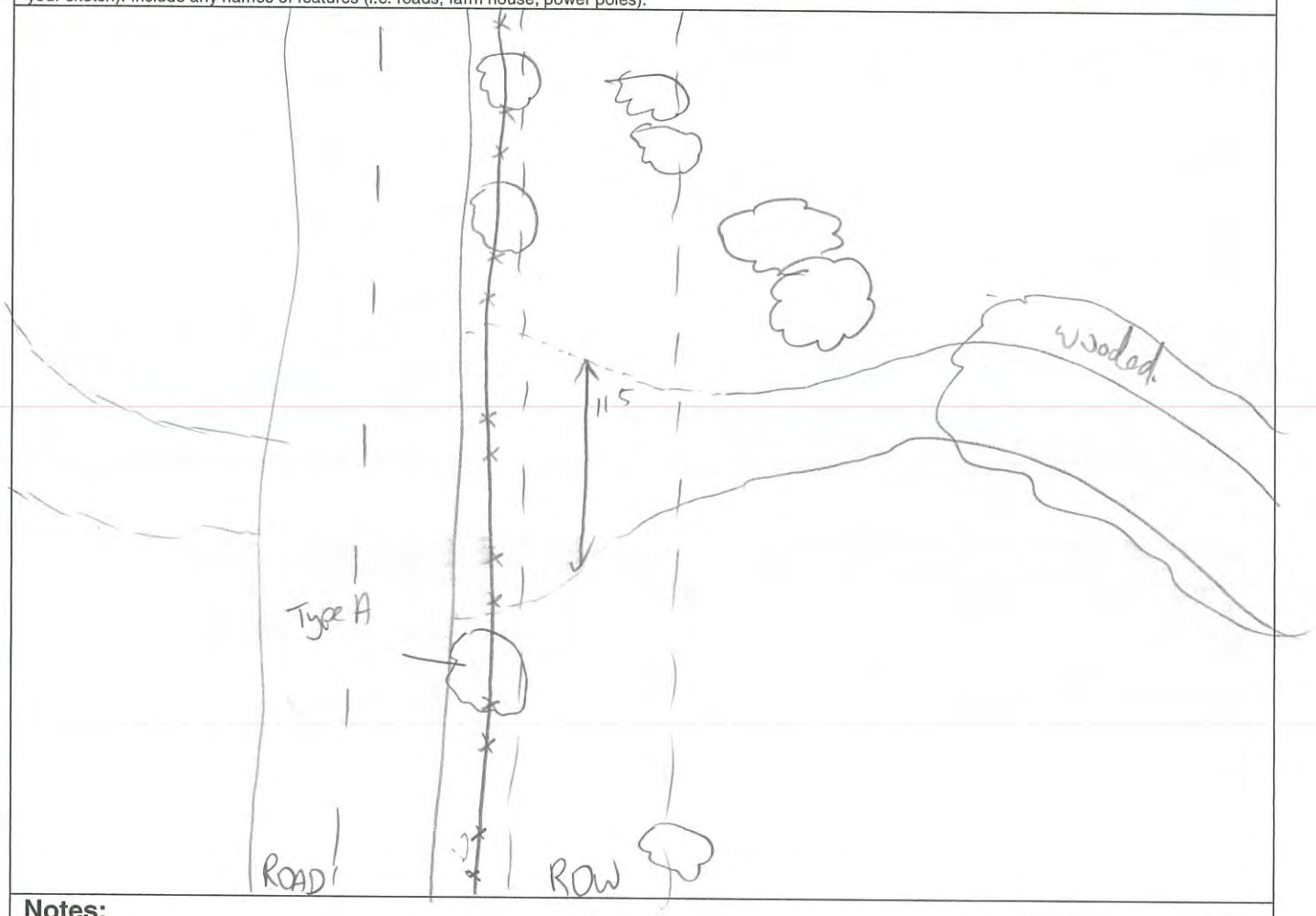
SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).



Notes:

- WC flares after road crossing

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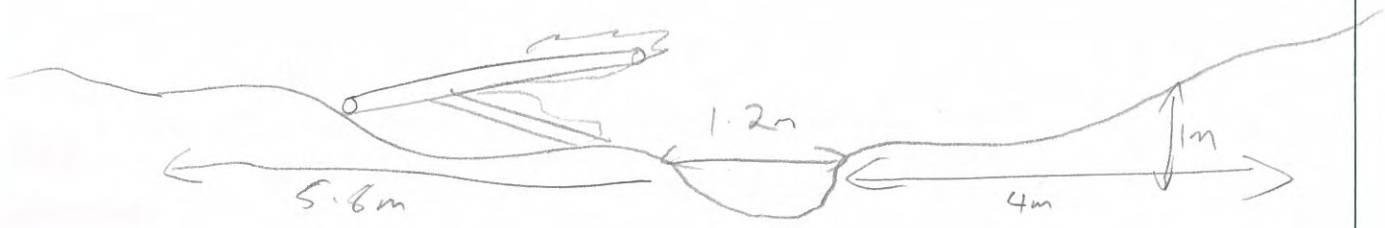
SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)



Notes: Woody debris ~~crossing~~ within causeway - fallen trees

WC 2 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

watercourse crossing point (both for flora and fauna characteristics).		
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable:
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail ESA category: Category B Primary Buffer (Endangered Regional Ecosystems)
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☒ No ☐	If no, check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail site: Unsure if Cultural Heritage assessment has been conducted for the R.O.W.
General Vegetation Community description: (including a list of dominant flora species within each stratum)	Narrow, non-remnant, riparian woodland: T1 = *Angophora floribunda* (d) and *Eucalyptus chloroclada* (a) T2 = *A. floribunda* G = Austrostipa ramosissima, *Themeda avenacea, Cirsium vulgare, Bothriochloa pertusa, Enteropogon ramosus, Verbena aristigera, Urochloa mosambicensis* and *Lomandra longifolia.*	

Are there any declared weeds within the area of the crossing?	Yes☐ No ☒	If yes, describe flag on the ground and GPS and provide on map.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☒ No ☐	Type A – *Brachychiton populneus* nearby (E 703228; N 7072131)
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	10 % 5 % 5 % 90 %	
Riparian vegetation patchiness:	Isolated/scattered	
Describe the riparian vegetation condition:	Type III	
Native woody vegetation regeneration:	Abundant ☐ Present ☒ Limited ☐	

SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☒yes ☐no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	NA
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	NA

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	NA

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream	☒yes ☐no ☒yes ☐no ☒yes ☐no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** ☒ **YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. ☐ **NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. ☒ **NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	Construction to place during dry conditions and comply with self-assessable guidelines (WAM/2008/3500)

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☒yes ☐no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	Refer to previous vegetation description
Can the water crossing be located in a previously disturbed area?	☐yes ☒no	If No, why not?	Occurs in existing non-remnant vegetation
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

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Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☐yes ☒no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED)
Is a development approval required (i.e. the self-assessable code cannot be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Roisin Feeney	GHD	**Inspected Date:**	20/01/2014
Company:			**Time:**	12:00 pm

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – L1
Watercourse ID	WC 3	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 10 WV1758	**Location Reference**	Tantatton
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	Freehold / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☒ New crossing in previously disturbed area: ☐ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Cultural Heritage Approval to undertake assessment:	Yes ☐ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☐ Hot (>35◦C) ☒	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐

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CROSSING LOCATION (REFER SECTION 8.2)

GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94

Latitude (E)	704697	**Longitude (S)**	7073334
Bankfull Width (m)	4 m	**Bank Width (m):**	Left Bank: 1 m Right Bank: 1 m
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	2 m
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 0.3 m/ NA Downstream Right Bank 0.3 m/ NA	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	

Location	Latitude (E)	Longitude (S)
A	NA	NA
B	NA	NA
C	NA	NA
D	NA	NA
E	NA	NA

Water Present:	Yes ☐ No ☒
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒
Sample Site Length: 50 m	Water Surface Depth to Bed: NA

CHANNEL DETERMINATION (REFER TO SECTION 8.3)

Stream Order: 1☒ 2☐ 3☐ 4☐ 4+☐	Functional Zone Type - Sediment	Supply☒ Transfer☐ Storage☐	
Identify Channel Type:	Mildly sinuous		
Channel Modifications:	None		
Bed Sediment Character:	Tight ☐ Packed ☐ Moderate ☐ Low 1 ☐ Low 2 ☒		
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 0 % Pebble 0 % Gravel 0 % Sand Fines 100 %		
Bed Material Angularity:	Very Angular☐ Angular ☐ Sub-angular ☐ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☒		
Bank Predominant Shape:	Concave ☒ Convex ☐ Stepped ☐ Wide lower bench ☐ Undercut ☐		
Bank Slope Downstream Right:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☒ Low 10-30° ☐ Flat<10°☐		
Bank Slope Downstream Left:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☒ Flat<10°☐		
Channel Shape:	Flat U shape		
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☒ Bed Stable ☐ Moderate Deposition ☐ Severe Deposition ☐		
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒		
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐		

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)

Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed** **<0.25 ha**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If yes, reference Report No:

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SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).

Notes: grass in channel

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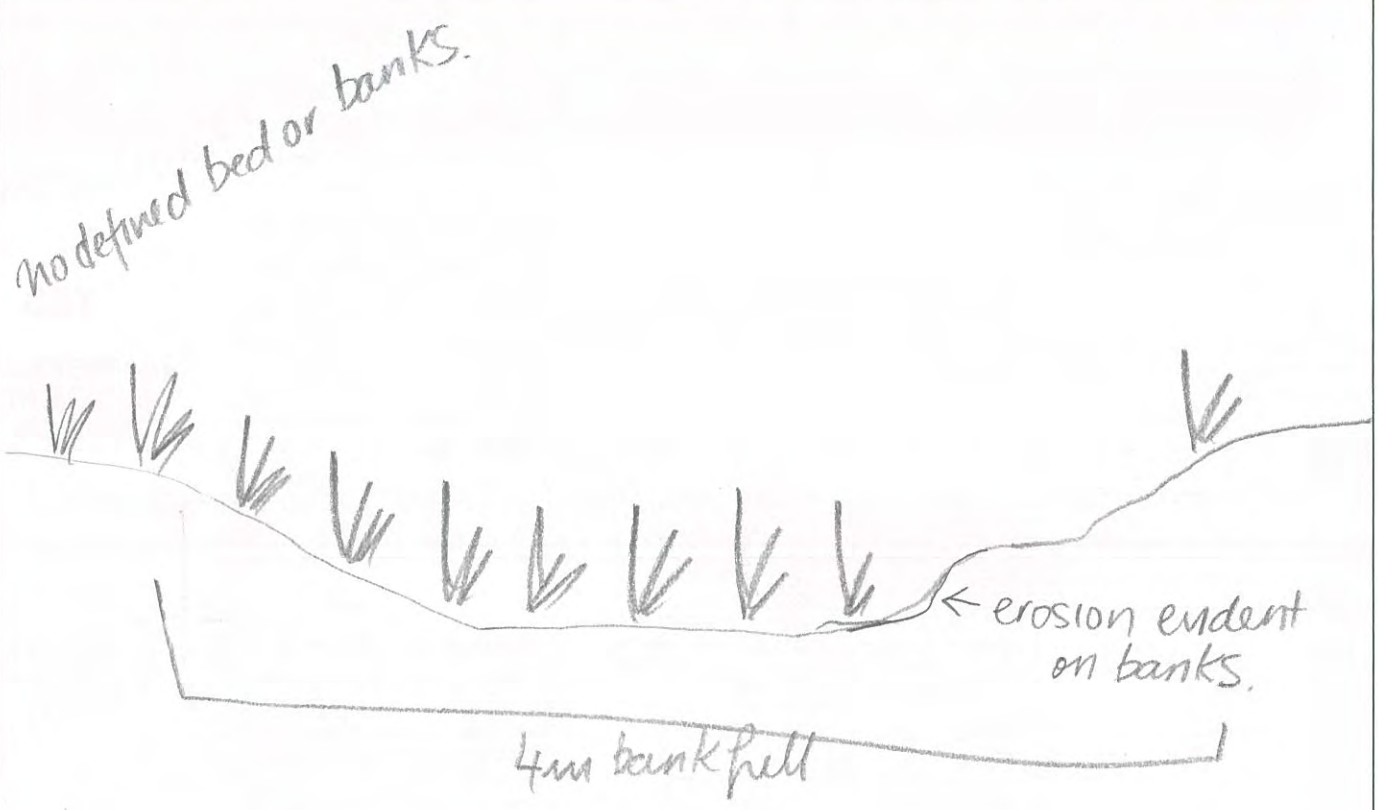
SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)



Notes:

WC 03 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

Has a pre-disturbance assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If no, a pre-disturbance assessment may be required
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable: Non remnant vegetation
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☒ No ☐	If Yes, detail ESA category: Category C Primary Buffer (Of Concern RE)
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☒ No ☐	If no, Check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required.
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☐	If Yes, detail site:
General Vegetation Community description: (including a list of dominant flora species within each stratum)	*Non remnant vegetation with a sparse shrub layer and ground layer of native and exotic grasses*.	

Are there any declared weeds within the area of the crossing?	Yes☒ No ☐	If yes, describe flag on the ground and GPS and provide on map. Opuntia sp.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☐ No ☒	
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	0 % 0 % 5 % 80 %	
Riparian vegetation patchiness:	None	
Describe the riparian vegetation condition:	VAST 4 – Replaced- Adventive	

Native woody vegetation regeneration:	Abundant ☐ Present ☒ Limited ☐	
SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☒yes ☐no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements. **No evidence of aquatic life. Vegetation consistent with areas surrounding (outside of area of influence**	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream islands, benches or bars?	☒yes ☐no ☒yes ☐no ☒yes ☐no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** ☒ **YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. ☐ **NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. ☒ **NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☐yes ☒no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	<0.25 ha of vegetation will require clearing Majority of the crossing location has already been cleared Potential species to be cleared include:
Can the water crossing be located in a previously disturbed area?	☒yes ☐no	If No, why not?	
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

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Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☐yes ☒no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior to works commencing.	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED)
Is a development approval required (i.e. the self assessable code can not be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Peter Wagner	GHD	**Inspected Date:**	21/01/2014
Company:			**Time:**	7:00 am

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – L1
Watercourse ID	WC 4	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 10 on WV1758	**Location Reference**	Dalmuir
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	**Freehold** / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☐ New crossing in previously disturbed area: ☒ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	14-01-08 16:37 [Multiple Sites - Ecol assessment]
Cultural Heritage Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☒ Hot (>35◦C) ☐	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐

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CROSSING LOCATION (REFER SECTION 8.2)

GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94

Latitude (E)	705145	**Longitude (S)**	7073231
Bankfull Width (m)	No defined banks	**Bank Width (m):**	Left Bank: 0 m Right Bank: 0 m
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	0 m
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 0 m Downstream Right Bank 0 m	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	

Location	Latitude (E)	Longitude (S)
A	705145	7073231
B	705145	7073231
C	705145	7073231
D		
E		

Water Present:	Yes ☐ No ☒
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒
Sample Site Length: 100 m	Water Surface Depth to Bed: NA

CHANNEL DETERMINATION (REFER TO SECTION 8.3)

Stream Order: 1☒ 2☐ 3☐ 4☐ 4+☐	Functional Zone Type - Sediment	Supply☒ Transfer☐ Storage☐
Identify Channel Type:	No defined channel	
Channel Modifications:	NA	
Bed Sediment Character:	Tight ☐ Packed ☒ Moderate ☐ Low 1 ☐ Low 2 ☐	
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 0 % Pebble 0 % Gravel 10 % Sand Fines 90 %	
Bed Material Angularity:	Very Angular☐ Angular ☒ Sub-angular ☐ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☐	
Bank Predominant Shape:	Concave ☐ Convex ☐ Stepped ☐ Wide lower bench ☐ Undercut ☐	
Bank Slope Downstream Right:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☐	
Bank Slope Downstream Left:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☐	
Channel Shape:	NA	
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☐ Bed Stable ☐ Moderate Deposition ☒ Severe Deposition ☐	
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒	
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐	

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)

Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☐ No ☒	If yes, reference Report No:
Has a pre-disturbance assessment been undertaken previously that encompasses the	Yes ☐ No ☒	If no, a pre-disturbance assessment may be required

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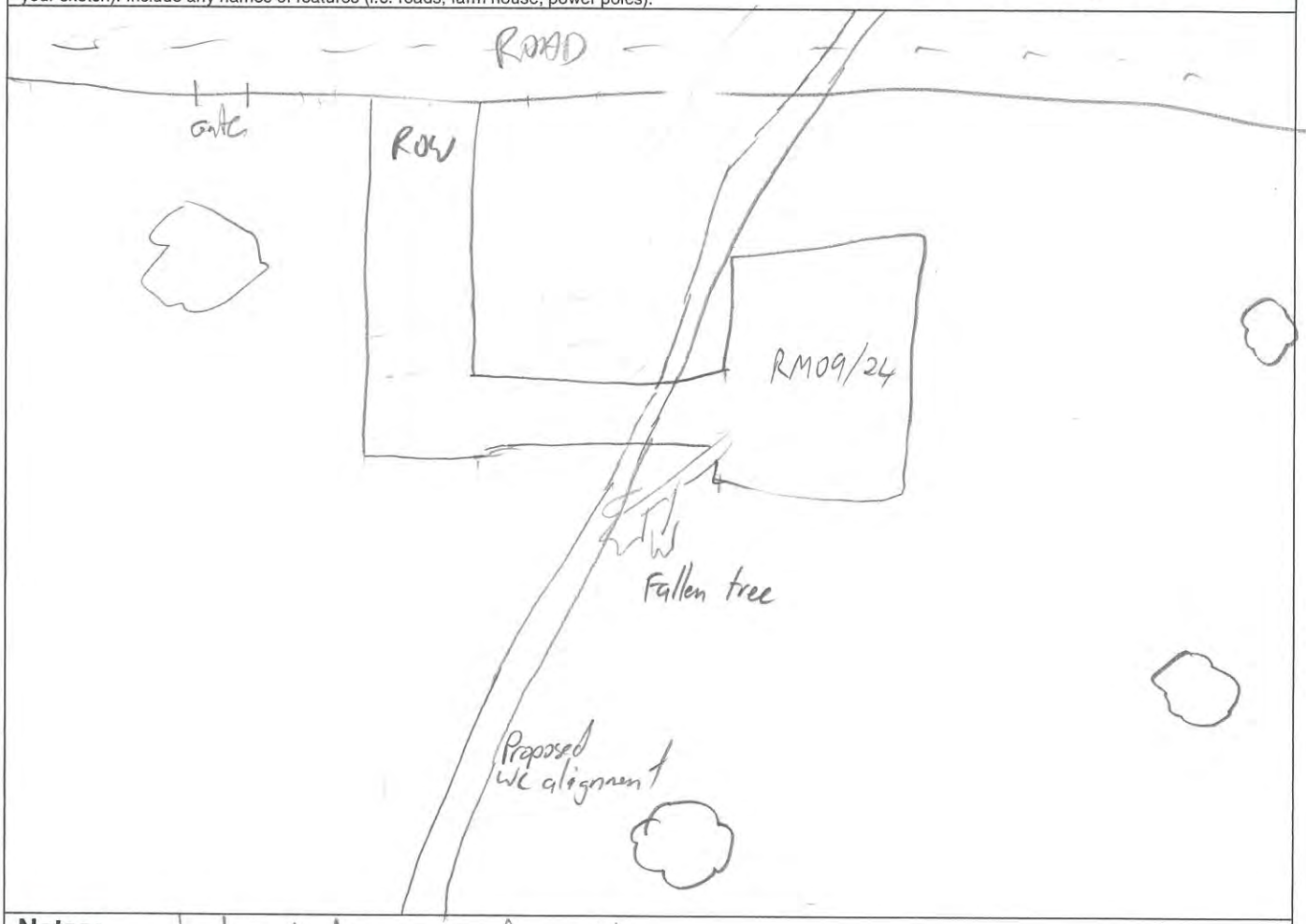
SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).



Notes: Check before submitting
- No WC present

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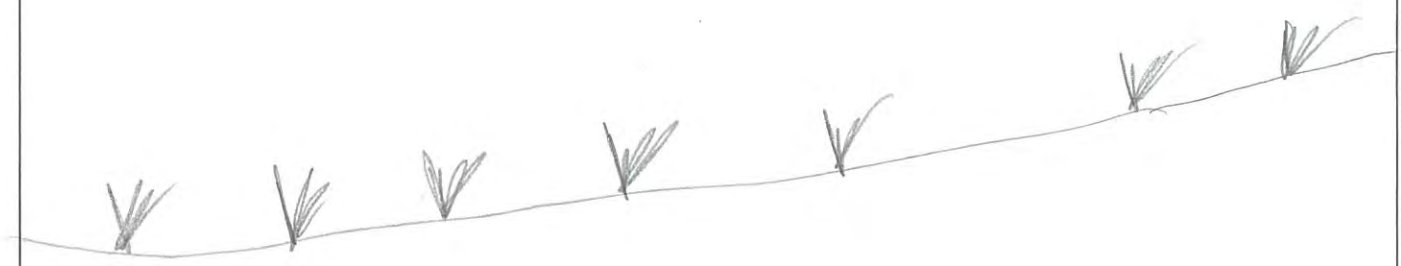
SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)



Notes: Southerly slope – lower hillslope
No defined Bed + Banks

WC 4 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

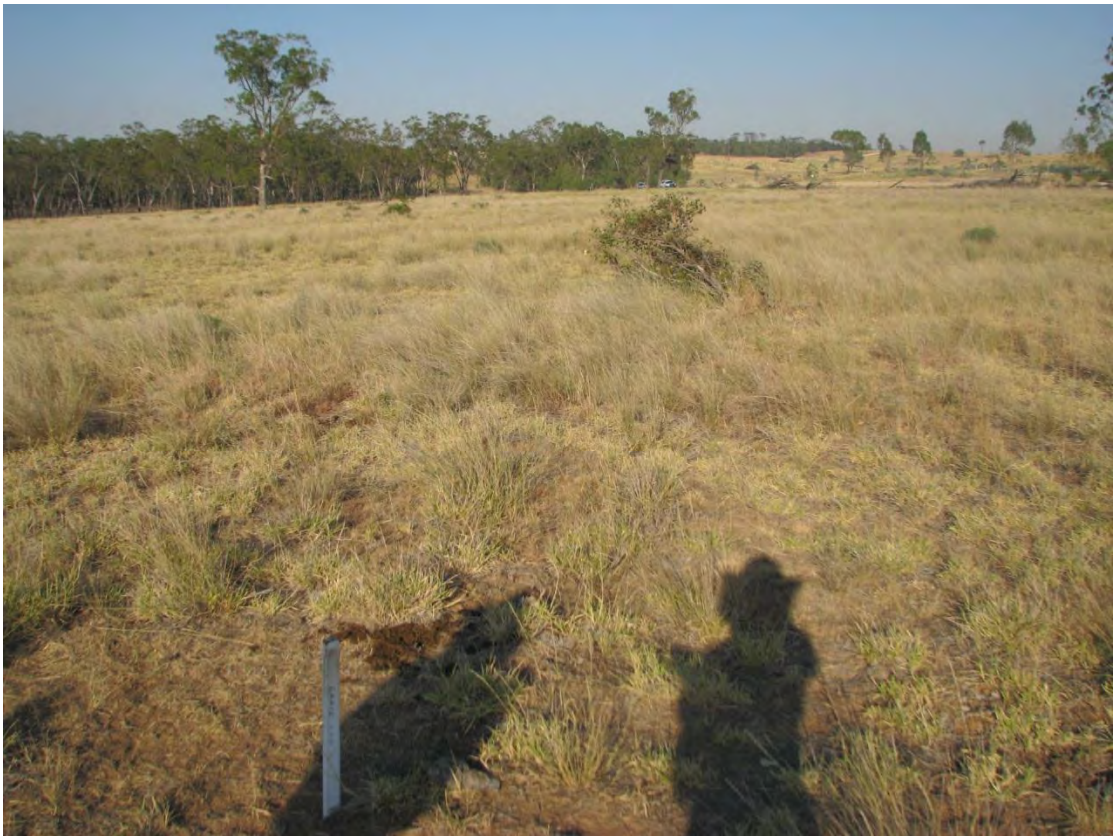


Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

watercourse crossing point (both for flora and fauna characteristics).		
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable:
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☒ No ☐	If Yes, detail ESA category: Category B Primary Buffer (Endangered Regional Ecosystems) Category C Primary Buffer (Of Concern RE)
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☒ No ☐	If no, check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail site: Unsure if Cultural Heritage assessment has been conducted for the R.O.W.
General Vegetation Community description: (including a list of dominant flora species within each stratum)	Non-remnant pasture: E = *Eucalyptus populnea* (d) S = *Acacia excelsa* G = *Aristida personata*, *Cenchrus ciliaris**, *Maireana microphylla.*	
Are there any declared weeds within the area of the crossing?	Yes☒ No ☐	If yes, describe flag on the ground and GPS and provide on map.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☐ No ☒	*Opuntia tomentosa* scattered throughout
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	5 % 5 % 5 % 85 %	
Riparian vegetation patchiness:	Isolated/scattered	
Describe the riparian vegetation condition:	Type III	
Native woody vegetation regeneration:	Abundant ☐ Present ☒ Limited ☐	
SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	NA
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	NA

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	NA

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream	☒yes ☐no ☒yes ☐no ☒yes ☐no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** [X] **YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. [ ] **NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** [ ] **YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. [X] **NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	Construction to place during dry conditions and comply with self-assessable guidelines (WAM/2008/3500)

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☒yes ☐no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	Refer to previous vegetation description
Can the water crossing be located in a previously disturbed area?	☐yes ☒no	If No, why not?	Occurs in existing non-remnant vegetation
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

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Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☐yes ☒no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED)
Is a development approval required (i.e. the self-assessable code cannot be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Roisin Feeney	GHD	**Inspected Date:**	21/01/2014
Company:			**Time:**	7:15 am

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – L1
Watercourse ID	WC 5	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 10 on WV1758	**Location Reference**	Dalmuir
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	Freehold / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☐ New crossing in previously disturbed area: ☒ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Cultural Heritage Approval to undertake assessment:	Yes ☐ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☒ Hot (>35◦C) ☐	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐

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CROSSING LOCATION (REFER SECTION 8.2)

GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94

Latitude (E)	704886	**Longitude (S)**	7073151
Bankfull Width (m)	No defined banks	**Bank Width (m):**	Left Bank: 0 m Right Bank: 0 m
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	0 m
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 0 m/ NA Downstream Right Bank 0 m/ NA	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	

Location	Latitude (E)	Longitude (S)
A	NA	NA
B	NA	NA
C	NA	NA
D	NA	NA
E	NA	NA

Water Present:	Yes ☐ No ☒
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒
Sample Site Length: 50 m	Water Surface Depth to Bed: NA

CHANNEL DETERMINATION (REFER TO SECTION 8.3)

Stream Order: 1☒ 2☐ 3☐ 4☐ 4+☐	Functional Zone Type - Sediment	Supply☐ Transfer☒ Storage☐	
Identify Channel Type:	No defined channel		
Channel Modifications:	None		
Bed Sediment Character:	Tight ☐ Packed ☐ Moderate ☐ Low 1 ☐ Low 2 ☒		
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 0 % Pebble 0 % Gravel 0 % Sand Fines 100 %		
Bed Material Angularity:	Very Angular☐ Angular ☐ Sub-angular ☐ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☒		
Bank Predominant Shape:	Concave ☐ Convex ☐ Stepped ☐ Wide lower bench ☐ Undercut ☐		
Bank Slope Downstream Right:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☒		
Bank Slope Downstream Left:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☒		
Channel Shape:	Flat		
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☐ Bed Stable ☒ Moderate Deposition ☐ Severe Deposition ☐		
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒		
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐		

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)

Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed** **<0.25 ha**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If yes, reference Report No:

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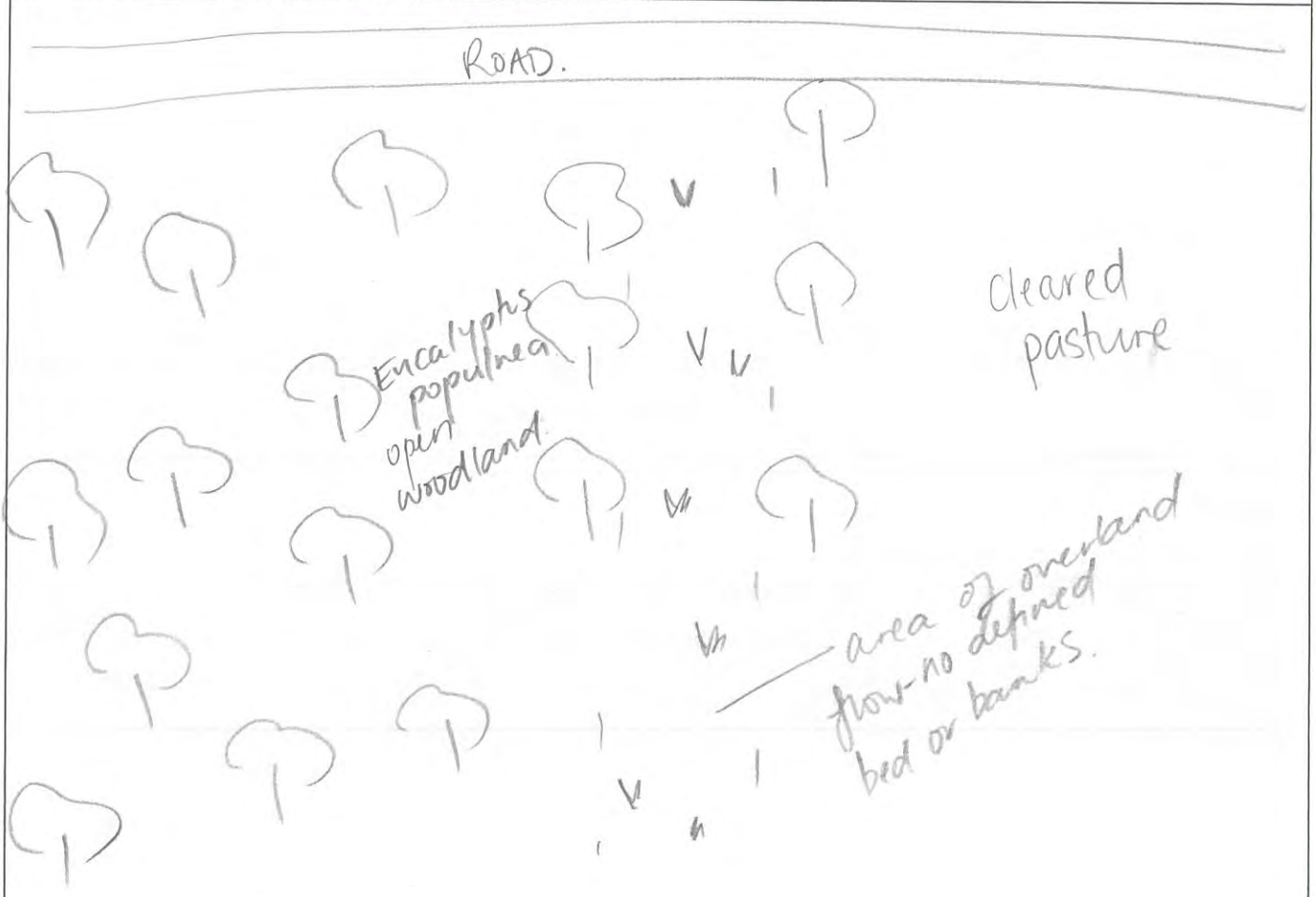
SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).



Notes:

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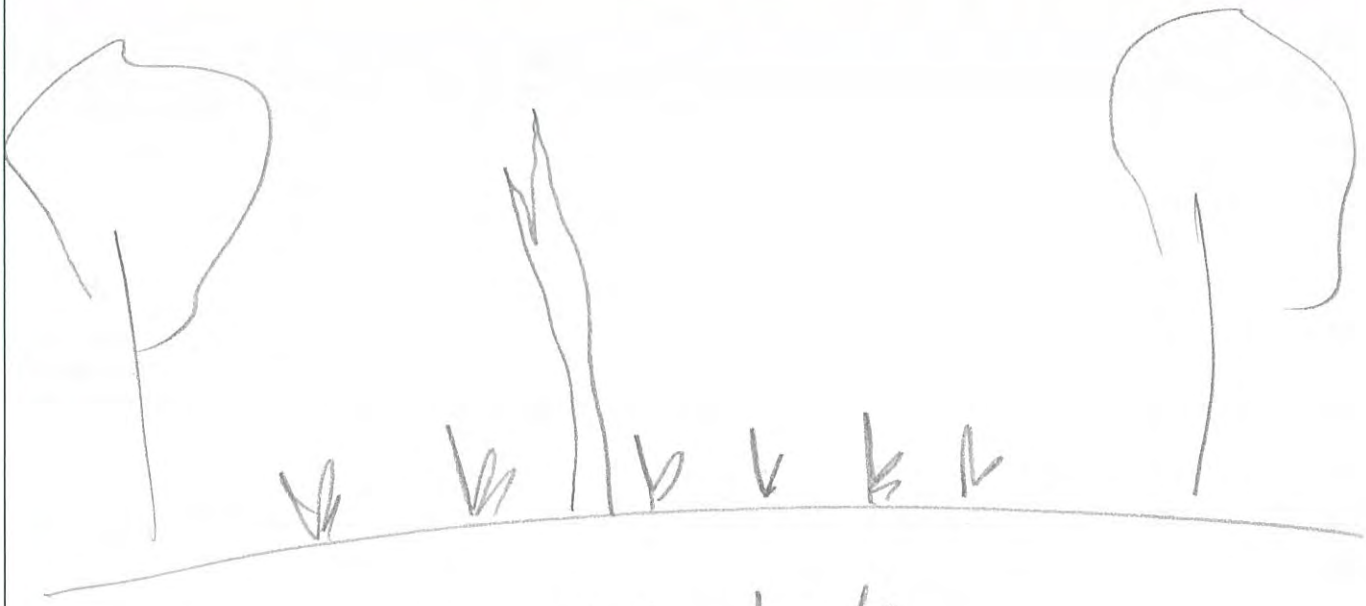
SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)



Notes:

WC 05 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

Has a pre-disturbance assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If no, a pre-disturbance assessment may be required
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☒ No ☐	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable: Non remnant vegetation RE 11.3.25/ 11.3.2
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☒ No ☐	If Yes, detail ESA category: Category C ESA (Of Concern RE)
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☒ No ☐	If no, Check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required. On ground vegetation community consistent with RE 11.3.2
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☐	If Yes, detail site:
General Vegetation Community description: (including a list of dominant flora species within each stratum)	*Eucalyptus populnea open woodland with sparse shrub layer and mid dense ground layer of native and exotic grass species.*	

Are there any declared weeds within the area of the crossing?	Yes☒ No ☐	If yes, describe flag on the ground and GPS and provide on map. Opuntia sp.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☐ No ☒	
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	1 % 40 % 1 % 70 %	
Riparian vegetation patchiness:	Semi continuous	
Describe the riparian vegetation condition:	VAST 2 – Modified	
Native woody vegetation regeneration:	Abundant ☐ Present ☒ Limited ☐	

SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements. **No evidence of aquatic life. Vegetation consistent with areas surrounding (outside of area of influence**	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream islands, benches or bars?	☒yes ☐no ☒yes ☐no ☒yes ☐no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** **X YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. **☐ NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** **☐ YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. **X NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☒yes ☐no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	<0.25 ha of vegetation will require clearing Majority of the crossing location has already been cleared Potential species to be cleared include: Eucalyptus populnea Opuntia sp.
Can the water crossing be located in a previously disturbed area?	☒yes ☐no	If No, why not?	
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

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Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☐yes ☒no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior to works commencing.	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED)
Is a development approval required (i.e. the self assessable code can not be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Peter Wagner	GHD	**Inspected Date:**	21/01/2014
Company:			**Time:**	8:00 am

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – L1
Watercourse ID	WC 6	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 10 on WV1758	**Location Reference**	Dalmuir
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	**Freehold** / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☐ New crossing in previously disturbed area: ☒ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	14-01-08 16:37 [Multiple Sites - Ecol assessment]
Cultural Heritage Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☒ Hot (>35◦C) ☐	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☒ Humid ☐ Rain (Steady) ☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☒ Humid ☐ Rain (Steady) ☐ Rain (Heavy) ☐

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CROSSING LOCATION (REFER SECTION 8.2)

GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94

Latitude (E)	705160	**Longitude (S)**	7073475
Bankfull Width (m)	6 m	**Bank Width (m):**	Left Bank: 2 m Right Bank: 3 m
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	1 m
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 0.4 m Downstream Right Bank 0.4 m	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	

Location	Latitude (E)	Longitude (S)
A	705160	7073475
B	705160	7073475
C	705160	7073475
D		
E		

Water Present:	Yes ☐ No ☒
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒
Sample Site Length: 100 m	Water Surface Depth to Bed: NA

CHANNEL DETERMINATION (REFER TO SECTION 8.3)

Stream Order: 1☒ 2☐ 3☐ 4☐ 4+☐	Functional Zone Type - Sediment	Supply☒ Transfer☐ Storage☐
Identify Channel Type:	Irregular	
Channel Modifications:	Natural	
Bed Sediment Character:	Tight ☐ Packed ☒ Moderate ☐ Low 1 ☐ Low 2 ☐	
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 0 % Pebble 0 % Gravel 10 % Sand Fines 90 %	
Bed Material Angularity:	Very Angular☐ Angular ☒ Sub-angular ☐ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☐	
Bank Predominant Shape:	Concave ☐ Convex ☐ Stepped ☐ Wide lower bench ☒ Undercut ☐	
Bank Slope Downstream Right:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☒	
Bank Slope Downstream Left:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☒	
Channel Shape:	Widened or infilled	
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☒ Bed Stable ☐ Moderate Deposition ☐ Severe Deposition ☐	
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒	
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐	

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)

Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☐ No ☒	If yes, reference Report No:
Has a pre-disturbance assessment been undertaken previously that encompasses the	Yes ☐ No ☒	If no, a pre-disturbance assessment may be required

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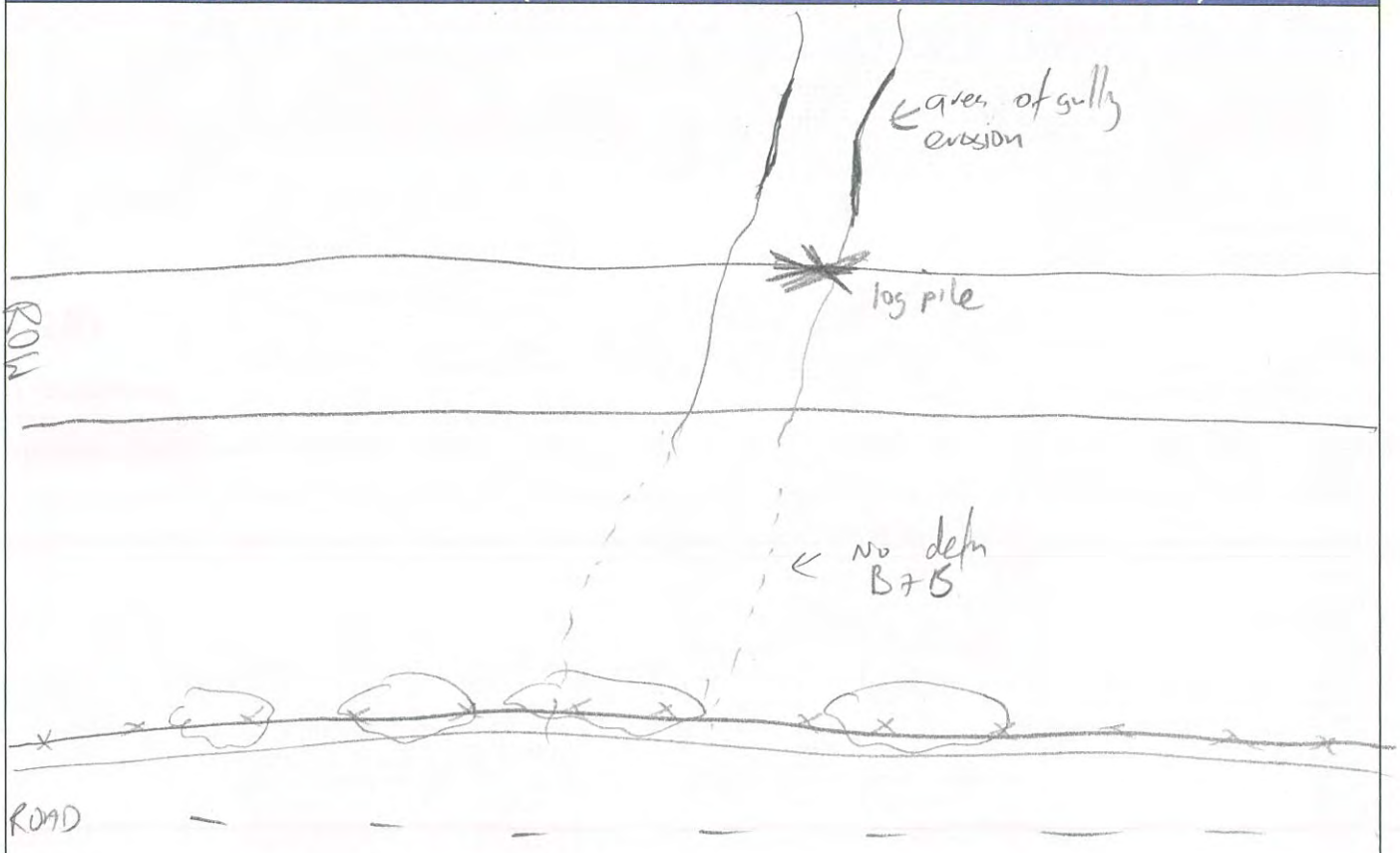
SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)



Notes: No defined bed + banks

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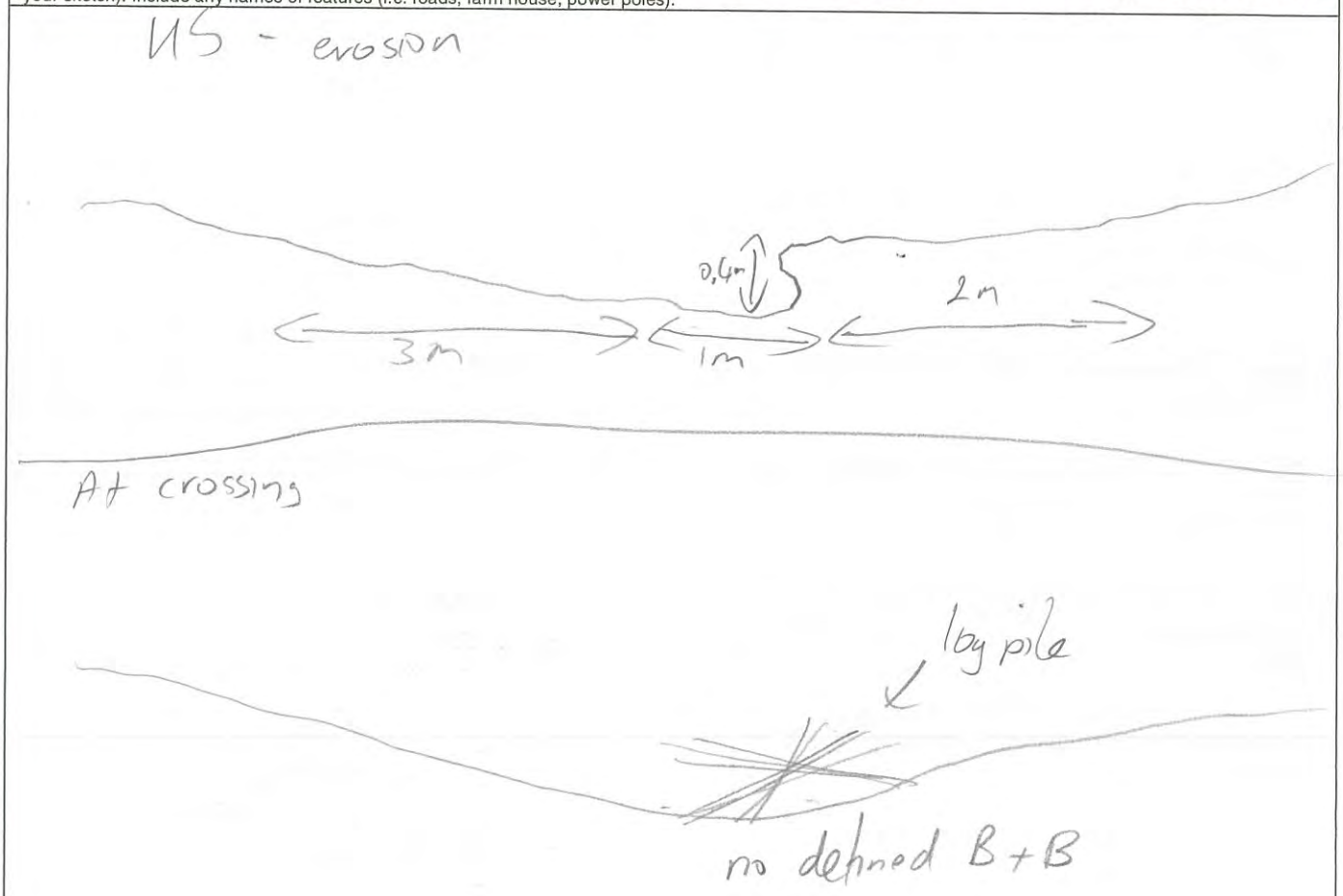
SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).



Notes:

WC 6 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

watercourse crossing point (both for flora and fauna characteristics).		
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable:
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail ESA category: Category B Primary Buffer (Endangered Regional Ecosystems)
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☒ No ☐	If no, check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail site: Unsure if Cultural Heritage assessment has been conducted for the R.O.W.
General Vegetation Community description: (including a list of dominant flora species within each stratum)	Non-remnant pasture: S = Eucalyptus populnea (saplings) G = *Aristida personata*, *Cenchrus ciliaris**, *Maireana microphylla, Themeda triandra, Verbena aristigera and Austrostipa verticillata*	
Are there any declared weeds within the area of the crossing?	Yes☐ No ☒	If yes, describe flag on the ground and GPS and provide on map.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☐ No ☒	
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	0 % 0 % 5 % 95 %	
Riparian vegetation patchiness:	Isolated/scattered	
Describe the riparian vegetation condition:	Type III	
Native woody vegetation regeneration:	Abundant ☐ Present ☒ Limited ☐	
SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	NA
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	NA

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	NA

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream	☒yes ☐no ☒yes ☐no ☒yes ☐no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** ☒ **YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. ☐ **NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. ☒ **NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	Construction to place during dry conditions and comply with self-assessable guidelines (WAM/2008/3500)

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☒yes ☐no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	Refer to previous vegetation description
Can the water crossing be located in a previously disturbed area?	☐yes ☒no	If No, why not?	Occurs in existing non-remnant vegetation
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

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Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☐yes ☒no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED)
Is a development approval required (i.e. the self-assessable code cannot be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Roisin Feeney	GHD	**Inspected Date:**	21/01/2014
Company:			**Time:**	8:15 am

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – L1
Watercourse ID	WC 7	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 10 on WV1758	**Location Reference**	Dalmuir
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	Freehold / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☐ New crossing in previously disturbed area: ☒ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Cultural Heritage Approval to undertake assessment:	Yes ☐ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☒ Hot (>35◦C) ☐	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☒ Humid ☐ Rain (Steady) ☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☒ Humid ☐ Rain (Steady) ☐ Rain (Heavy) ☐

CROSSING LOCATION (REFER SECTION 8.2)					
GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94					
Latitude (E)	705610	**Longitude (S)**	7073769		
Bankfull Width (m)	No defined banks	**Bank Width (m):**	Left Bank: 0 m Right Bank: 0 m		
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	0 m		
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 0 m/ NA Downstream Right Bank 0 m/ NA	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	**Location**	**Latitude (E)**	**Longitude (S)**
			A	NA	NA
			B	NA	NA
			C	NA	NA
			D	NA	NA
			E	NA	NA
Water Present:	Yes ☐ No ☒				
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒				
Sample Site Length: 50 m		Water Surface Depth to Bed: NA			

CHANNEL DETERMINATION (REFER TO SECTION 8.3)			
Stream Order: 1☒ 2☐ 3☐ 4☐ 4+☐		Functional Zone Type - Sediment	Supply☐ Transfer☒ Storage☐
Identify Channel Type:	No defined channel		
Channel Modifications:	None		
Bed Sediment Character:	Tight ☐ Packed ☐ Moderate ☐ Low 1 ☐ Low 2 ☒		
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 0 % Pebble 0 % Gravel 0 % Sand Fines 100 %		
Bed Material Angularity:	Very Angular☐ Angular ☐ Sub-angular ☐ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☒		
Bank Predominant Shape:	Concave ☐ Convex ☐ Stepped ☐ Wide lower bench ☐ Undercut ☐		
Bank Slope Downstream Right:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☒		
Bank Slope Downstream Left:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☒		
Channel Shape:	Flat		
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☐ Bed Stable ☒ Moderate Deposition ☐ Severe Deposition ☐		
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒		
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐		

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)		
Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed** **<0.25 ha**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If yes, reference Report No:

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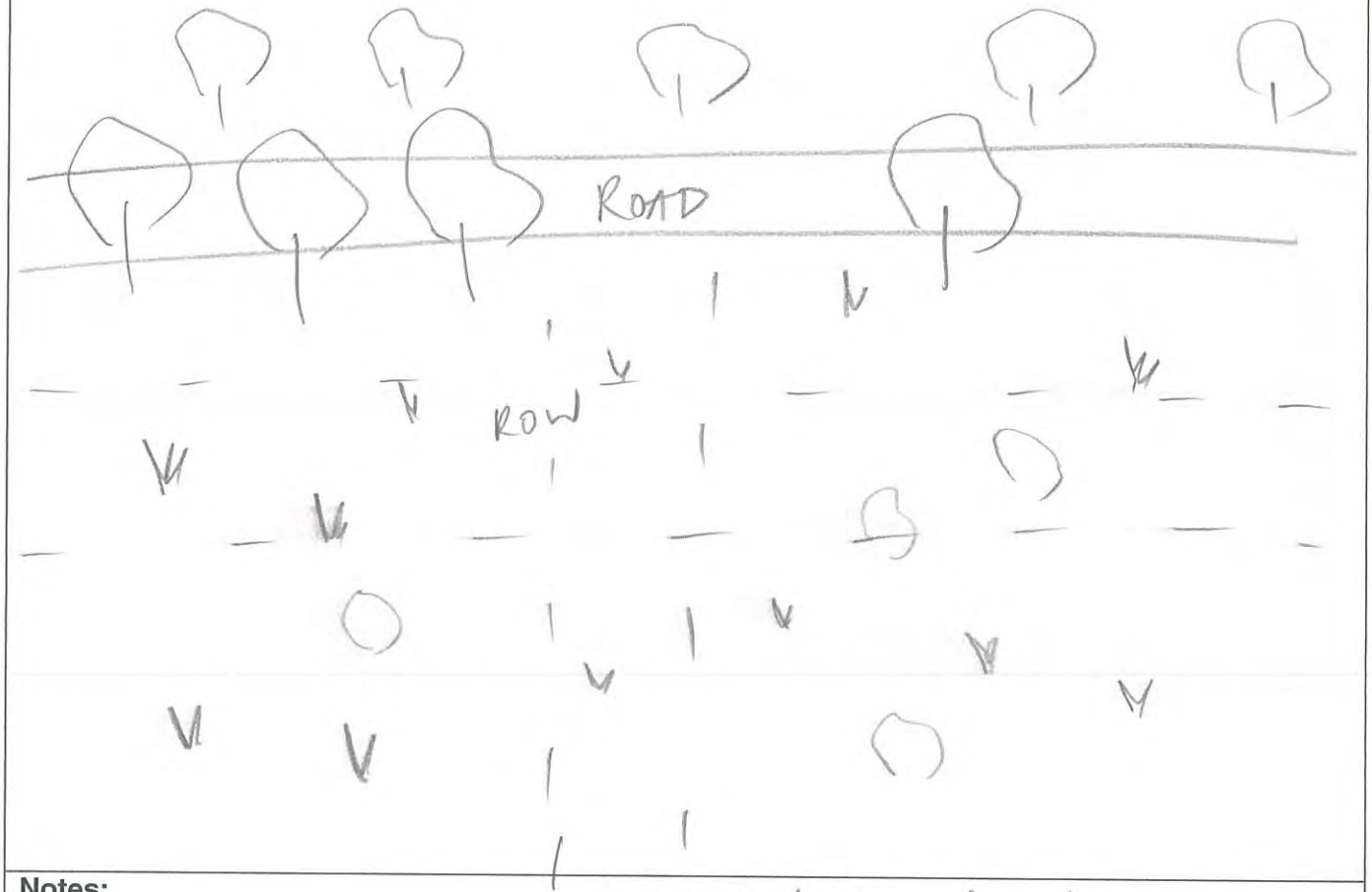
SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).



Notes:

no defined bed or banks
area of overland flow

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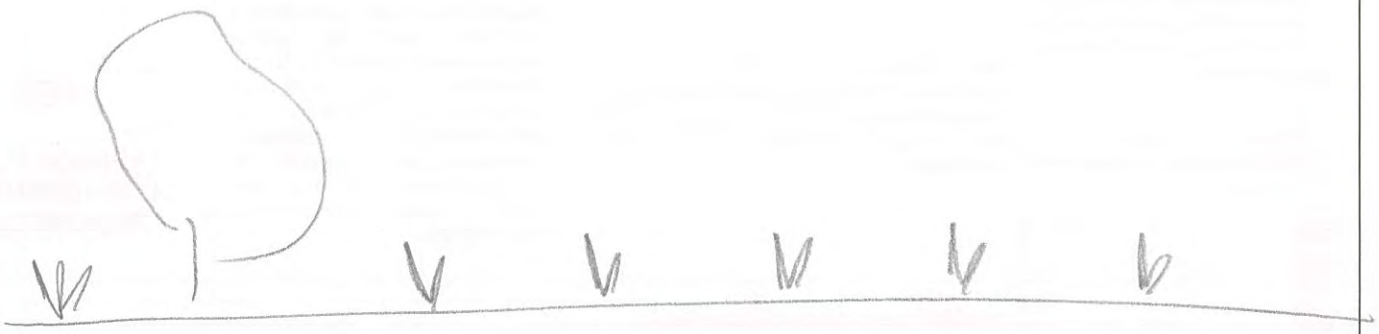
SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)



no defined bed or banks
area of overland flow

Notes:

WC 07 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

Has a pre-disturbance assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If no, a pre-disturbance assessment may be required
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable: Non remnant vegetation
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☒ No ☐	If Yes, detail ESA category: Category C Primary Buffer (Of Concern RE)
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☐ No ☐	If no, Check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required.
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☐	If Yes, detail site:
General Vegetation Community description: (including a list of dominant flora species within each stratum)	*Non remnant vegetation with sparse shrub layer including Acacia oswaldii and Acacia decora and native and exotic grass species*.	

Are there any declared weeds within the area of the crossing?	Yes☐ No ☒	If yes, describe flag on the ground and GPS and provide on map. Opuntia sp.in wider area
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☐ No ☒	
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	0 % 0 % 5 % 80 %	
Riparian vegetation patchiness:	Isolated/ scattered	
Describe the riparian vegetation condition:	VAST 4 – Replaced- Adventive	

Native woody vegetation regeneration:	Abundant ☐	Present ☒	Limited ☐

SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements. **No evidence of aquatic life. Vegetation consistent with areas surrounding (outside of area of influence**	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream islands, benches or bars?	☒yes ☐no ☒yes ☐no ☒yes ☐no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** **X YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. **☐ NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** **☐ YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. **X NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☒yes ☐no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	<0.25 ha of vegetation will require clearing Majority of the crossing location has already been cleared Potential species to be cleared include: Acacia decora Acacia oswaldii Eucalyptus populnea Onopordum acanthium
Can the water crossing be located in a previously disturbed area?	☒yes ☐no	If No, why not?	
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

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Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☐yes ☒no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior to works commencing.	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED)
Is a development approval required (i.e. the self assessable code can not be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Roisin Feeney	GHD	**Inspected Date:**	21/01/2014
Company:			**Time:**	10:30 am

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – L1
Watercourse ID	WC 8	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 10 on WV1758	**Location Reference**	Dalmuir
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	Freehold / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☐ New crossing in previously disturbed area: ☒ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Cultural Heritage Approval to undertake assessment:	Yes ☐ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☐ Hot (>35◦C) ☒	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐

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CROSSING LOCATION (REFER SECTION 8.2)

GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94

Latitude (E)	706289	**Longitude (S)**	7074492
Bankfull Width (m)	18 m	**Bank Width (m):**	Left Bank: 8 m Right Bank: 5 m
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	5 m
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 1.5 m/ NA Downstream Right Bank 2 m/ NA	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	

Location	Latitude (E)	Longitude (S)
A	NA	NA
B	NA	NA
C	NA	NA
D	NA	NA
E	NA	NA

Water Present:	Yes ☐ No ☒
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒
Sample Site Length: 50 m	Water Surface Depth to Bed: NA

CHANNEL DETERMINATION (REFER TO SECTION 8.3)

Stream Order: 1☐ 2☐ 3☐ 4☒ 4+☐	Functional Zone Type - Sediment	Supply☐ Transfer☒ Storage☐	
Identify Channel Type:	Mildly sinuous		
Channel Modifications:	None		
Bed Sediment Character:	Tight ☐ Packed ☐ Moderate ☐ Low 1 ☐ Low 2 ☒		
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 0 % Pebble 0 % Gravel 0 % Sand Fines 100 %		
Bed Material Angularity:	Very Angular☐ Angular ☐ Sub-angular ☐ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☒		
Bank Predominant Shape:	Concave ☒ Convex ☐ Stepped ☐ Wide lower bench ☐ Undercut ☐		
Bank Slope Downstream Right:	Vertical 80-90° ☐ Steep 60-80° ☒ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☐		
Bank Slope Downstream Left:	Vertical 80-90° ☐ Steep 60-80° ☒ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☐		
Channel Shape:	U Shape		
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☒ Bed Stable ☐ Moderate Deposition ☐ Severe Deposition ☐		
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒		
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐		

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)

Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed** **<0.25 ha**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If yes, reference Report No:

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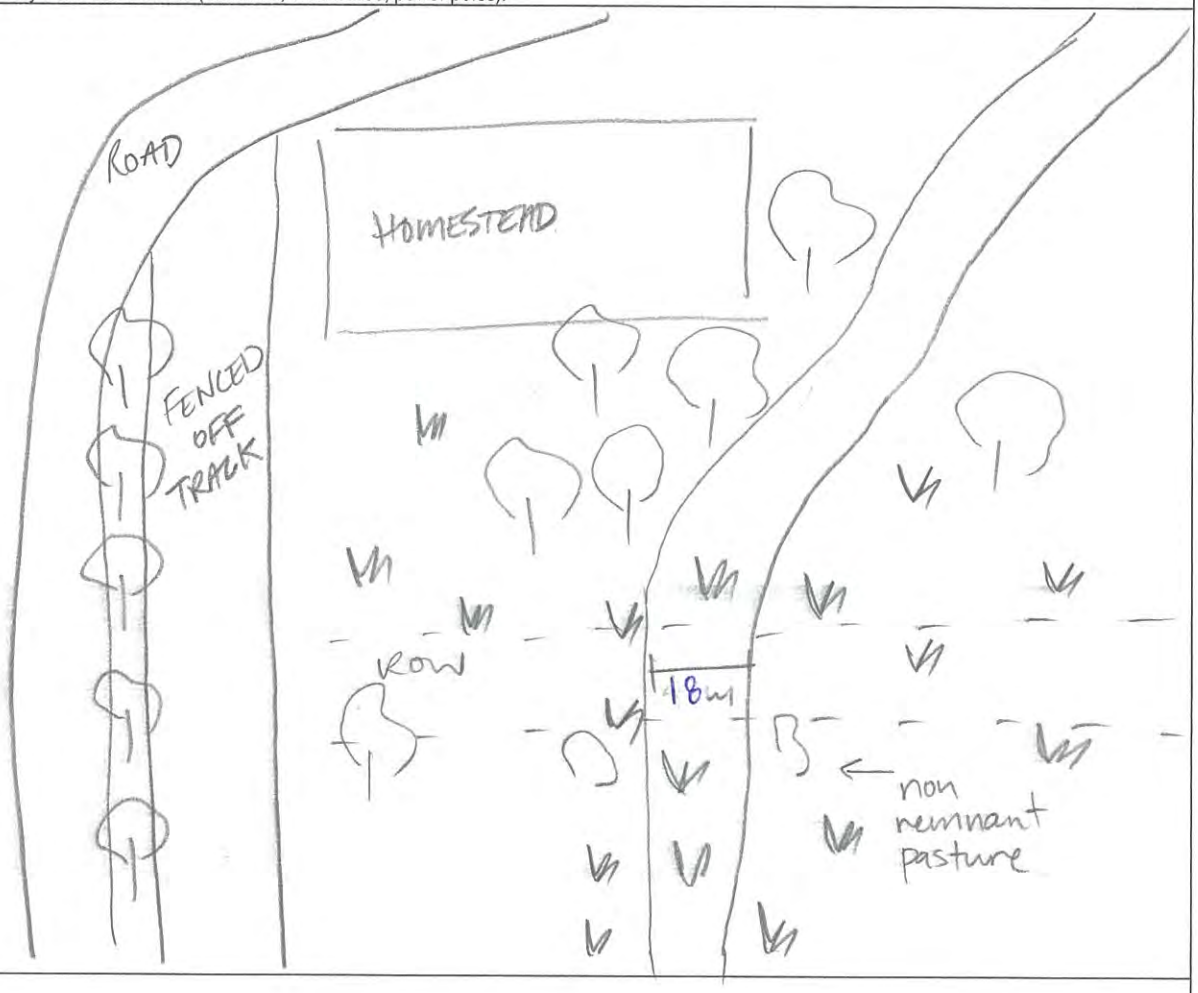
SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).



Notes:

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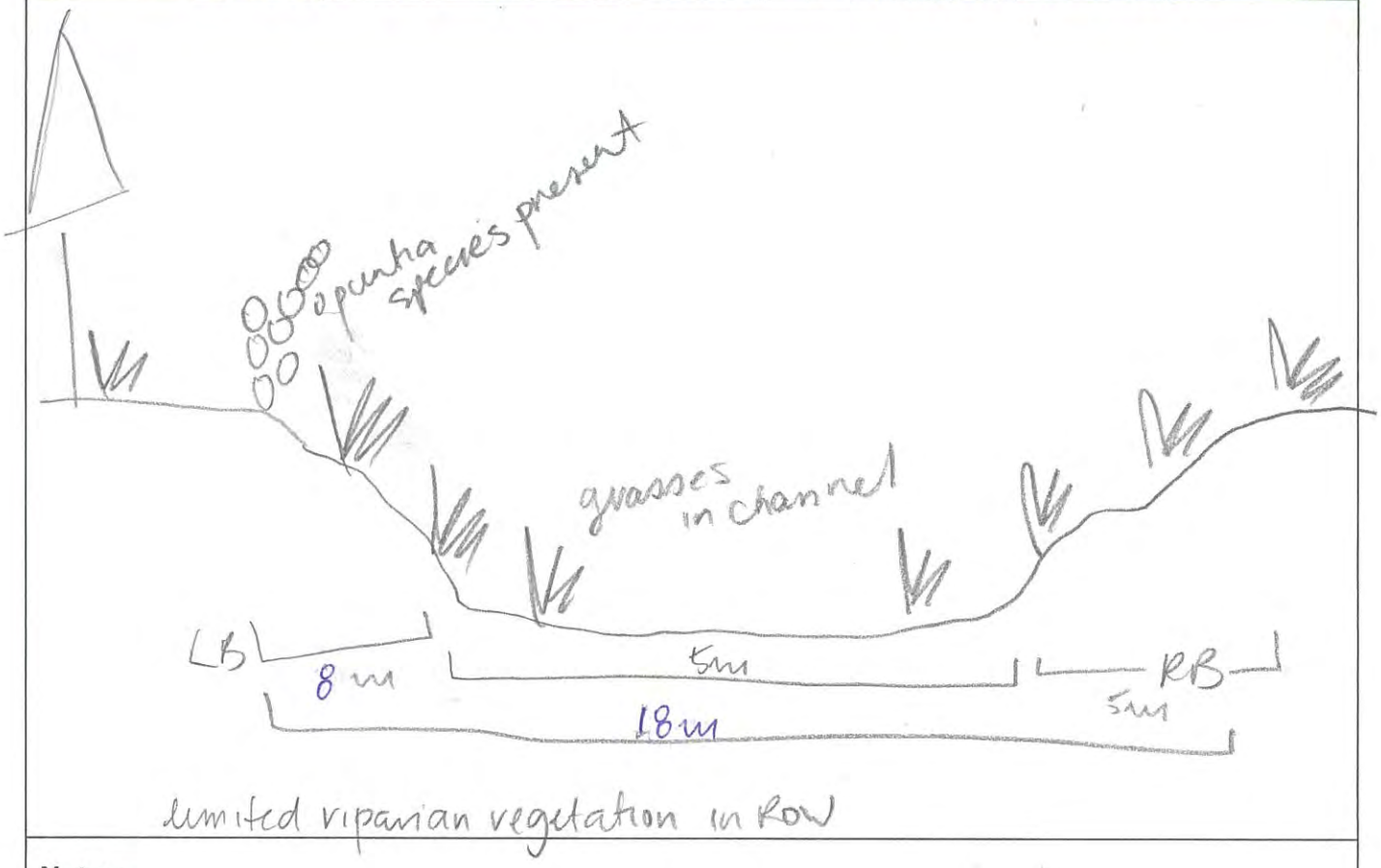
SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)



limited riparian vegetation in ROW

Notes:

WC 08 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

Has a pre-disturbance assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If no, a pre-disturbance assessment may be required
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable: Non remnant vegetation
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail ESA category:
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☐ No ☐	If no, Check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required.
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☐	If Yes, detail site:
General Vegetation Community description: (including a list of dominant flora species within each stratum)	*Non remnant vegetation with occasional mature eucalypts, a sparse shrub layer of native species including eucalyptus sp. and juncus sp. and a mid-dense ground layer of native and exotic grass species.*	

Are there any declared weeds within the area of the crossing?	Yes☒ No ☐	If yes, describe flag on the ground and GPS and provide on map. Opuntia sp.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☐ No ☒	
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	0 % 1 % 2 % 90 %	
Riparian vegetation patchiness:	Isolated/ scattered	
Describe the riparian vegetation condition:	VAST 4 – Replaced- Adventive	

Native woody vegetation regeneration:	Abundant ☐	Present ☒	Limited ☐

SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☒yes ☐no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements. **No evidence of aquatic life. Vegetation consistent with areas surrounding (outside of area of influence**	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream islands, benches or bars?	☒yes ☐no ☒yes ☐no ☐yes ☒no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** ☐ **YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. ☒ **NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** ☒ **YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. ☐ **NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☒yes ☐no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	<0.25 ha of vegetation will require clearing Majority of the crossing location has already been cleared Potential species to be cleared include: Eucalyptus sp. Juncus sp. Native and exotic grasses
Can the water crossing be located in a previously disturbed area?	☒yes ☐no	If No, why not?	Non-remnant vegetation
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☒yes ☐no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior to works commencing.	X **YES** **(APPROVAL REQUIRED)** ☐ **NO** **(NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)**
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ **YES** **(APPROVAL REQUIRED)** X **NO** **(NO LODGEMENT REQUIRED)**
Is a development approval required (i.e. the self assessable code can not be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	Non-remnant vegetation

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Roisin Feeney	GHD	**Inspected Date:**	22/01/2014
Company:			**Time:**	9:30 am

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – L1
Watercourse ID	WC 9	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 37 on WV421	**Location Reference**	Mt Hope
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	Freehold / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☐ New crossing in previously disturbed area: ☒ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Cultural Heritage Approval to undertake assessment:	Yes ☐ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☒ Hot (>35◦C) ☐	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☐ Humid ☒ Rain (Steady) ☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☒ Humid ☐ Rain (Steady) ☐ Rain (Heavy) ☐

CROSSING LOCATION (REFER SECTION 8.2)					
GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94					
Latitude (E)	706551	**Longitude (S)**	7076944		
Bankfull Width (m)	18 m	**Bank Width (m):**	Left Bank: 8 m Right Bank: 5 m		
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	5 m		
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 0.3 m/ NA Downstream Right Bank 0.3 m/ NA	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	**Location**	**Latitude (E)**	**Longitude (S)**
			A	NA	NA
			B	NA	NA
			C	NA	NA
			D	NA	NA
			E	NA	NA
Water Present:	Yes ☐ No ☒				
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒				
Sample Site Length: 50 m		Water Surface Depth to Bed: NA			

CHANNEL DETERMINATION (REFER TO SECTION 8.3)			
Stream Order: 1☒ 2☐ 3☐ 4☐ 4+☐		Functional Zone Type - Sediment	Supply☒ Transfer☐ Storage☐
Identify Channel Type:	Mildly sinuous		
Channel Modifications:	None		
Bed Sediment Character:	Tight ☐ Packed ☐ Moderate ☐ Low 1 ☐ Low 2 ☒		
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 0 % Pebble 0 % Gravel 0 % Sand Fines 100 %		
Bed Material Angularity:	Very Angular☐ Angular ☐ Sub-angular ☐ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☒		
Bank Predominant Shape:	Concave ☐ Convex ☐ Stepped ☐ Wide lower bench ☐ Undercut ☒		
Bank Slope Downstream Right:	Vertical 80-90° ☒ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☐		
Bank Slope Downstream Left:	Vertical 80-90° ☒ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☐		
Channel Shape:	Flat U Shape		
Bed Stability:	Severe Erosion ☒ Moderate Erosion ☐ Bed Stable ☐ Moderate Deposition ☐ Severe Deposition ☐		
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒		
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐		

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)		
Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed** **<0.25 ha**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If yes, reference Report No:

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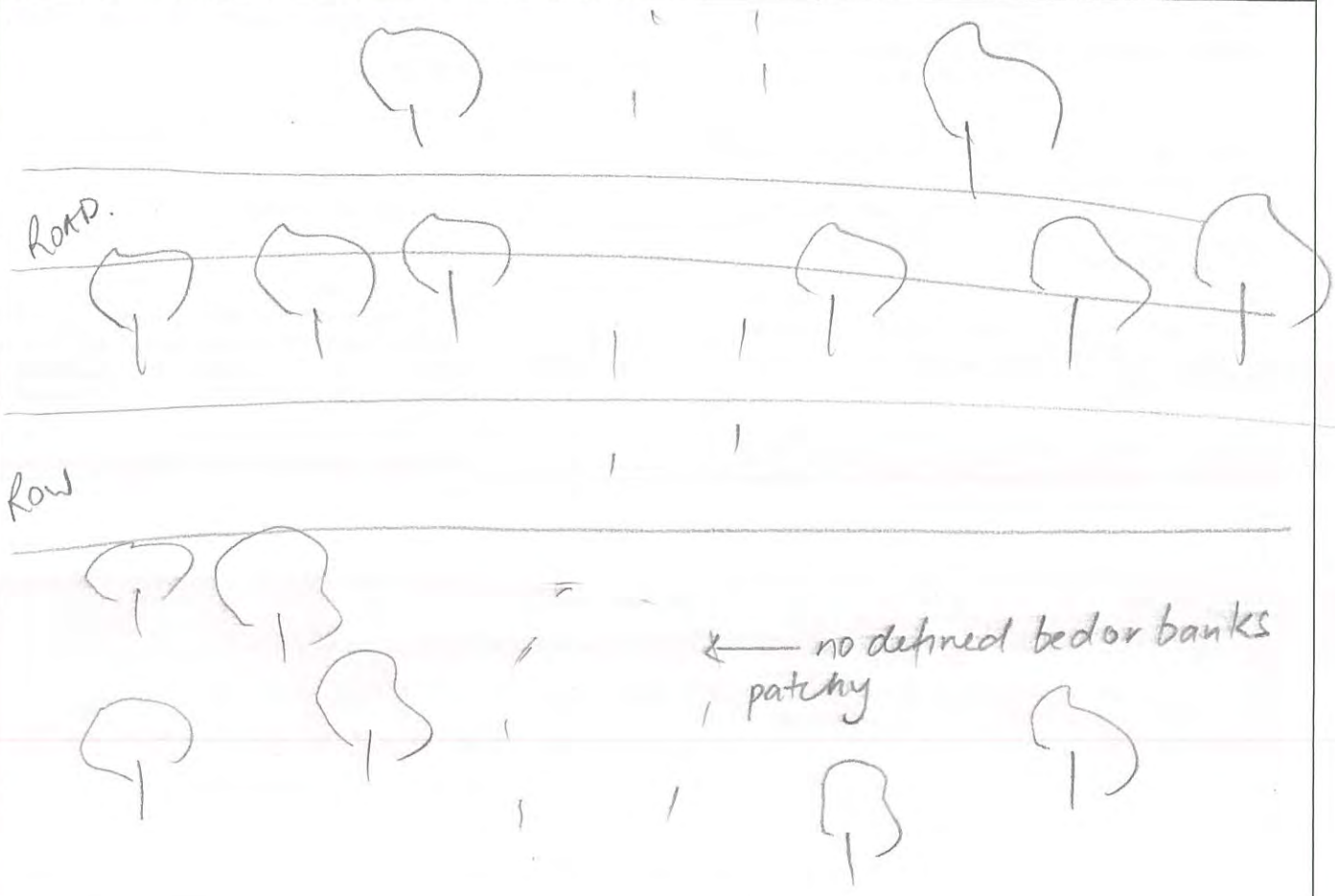
SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).



Notes:

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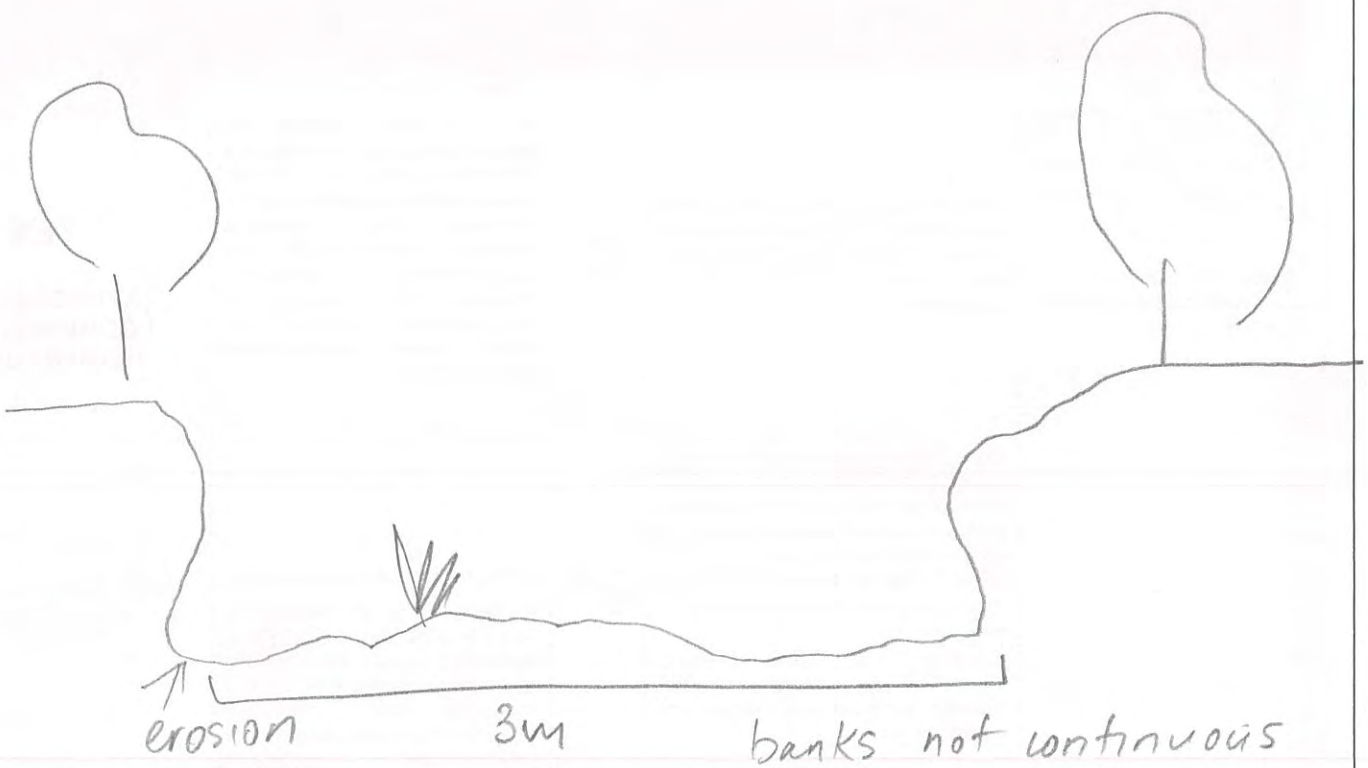
SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)



Notes:

WC 09 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

Has a pre-disturbance assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If no, a pre-disturbance assessment may be required
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable: Non remnant vegetation
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail ESA category:
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☐ No ☐	If no, Check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required.
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☐	If Yes, detail site:
General Vegetation Community description: (including a list of dominant flora species within each stratum)	*Non remnant vegetation with occasional mature Eucalyptus melanophloia, semi-dense shrub layer mid-dense ground layer of native and exotic grass species.*	

Are there any declared weeds within the area of the crossing?	Yes☒ No ☐	If yes, describe flag on the ground and GPS and provide on map. Opuntia sp. Brachychiton sp.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☒ No ☐	
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	0 % 20 % 40 % 60 %	
Riparian vegetation patchiness:	Isolated/ scattered	
Describe the riparian vegetation condition:	VAST 2 – Modified	
Native woody vegetation regeneration:	Abundant ☐ Present ☒ Limited ☐	

SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements. **No evidence of aquatic life. Vegetation consistent with areas surrounding (outside of area of influence**	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream islands, benches or bars?	☒yes ☐no ☒yes ☐no ☒yes ☐no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** [X] **YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. [ ] **NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** [ ] **YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. [X] **NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☒yes ☐no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	<0.25 ha of vegetation will require clearing Majority of the crossing location has already been cleared Potential species to be cleared include: Eucalyptus melanophloia
Can the water crossing be located in a previously disturbed area?	☒yes ☐no	If No, why not?	Non-remnant vegetation
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

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Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☐yes ☒no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior to works commencing.	☐ **YES** **(APPROVAL REQUIRED)** ☒ **NO** **(NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)**
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ **YES** **(APPROVAL REQUIRED)** ☒ **NO** **(NO LODGEMENT REQUIRED)**
Is a development approval required (i.e. the self assessable code can not be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	Brachychiton sp. present (Type A)
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	Non-remnant vegetation

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Peter Wagner	GHD	**Inspected Date:**	22/01/2014
Company:			**Time:**	10:30 am

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – L1
Watercourse ID	WC10	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 10 on WV1758	**Location Reference**	Dalmuir
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	**Freehold** / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☐ New crossing in previously disturbed area: ☒ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	14-01-08 16:37 [Multiple Sites - Ecol assessment]
Cultural Heritage Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☐ Hot (>35◦C) ☒	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☒ Humid ☐ Rain (Steady)☐ Rain (Heavy) ☐

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CROSSING LOCATION (REFER SECTION 8.2)

GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94

Latitude (E)	706165	**Longitude (S)**	7076925
Bankfull Width (m)	No defined banks	**Bank Width (m):**	Left Bank: 0 m Right Bank: 0 m
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	0 m
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 0 m Downstream Right Bank 0 m	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	

Location	Latitude (E)	Longitude (S)
A	706165	7076925
B	706165	7076925
C	706165	7076925
D		
E		

Water Present:	Yes ☐ No ☒
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒
Sample Site Length: 100 m	Water Surface Depth to Bed: NA

CHANNEL DETERMINATION (REFER TO SECTION 8.3)

Stream Order: 1☒ 2☐ 3☐ 4☐ 4+☐	Functional Zone Type - Sediment	Supply☒ Transfer☐ Storage☐
Identify Channel Type:	No defined channel	
Channel Modifications:	NA	
Bed Sediment Character:	Tight ☐ Packed ☒ Moderate ☐ Low 1 ☐ Low 2 ☐	
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 0 % Pebble 0 % Gravel 10 % Sand Fines 90 %	
Bed Material Angularity:	Very Angular☐ Angular ☒ Sub-angular ☐ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☐	
Bank Predominant Shape:	Concave ☐ Convex ☐ Stepped ☐ Wide lower bench ☐ Undercut ☐	
Bank Slope Downstream Right:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☐	
Bank Slope Downstream Left:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☐	
Channel Shape:	No defined channel	
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☐ Bed Stable ☐ Moderate Deposition ☒ Severe Deposition ☐	
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒	
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐	

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)

Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☐ No ☒	If yes, reference Report No:
Has a pre-disturbance assessment been undertaken previously that encompasses the	Yes ☐ No ☒	If no, a pre-disturbance assessment may be required

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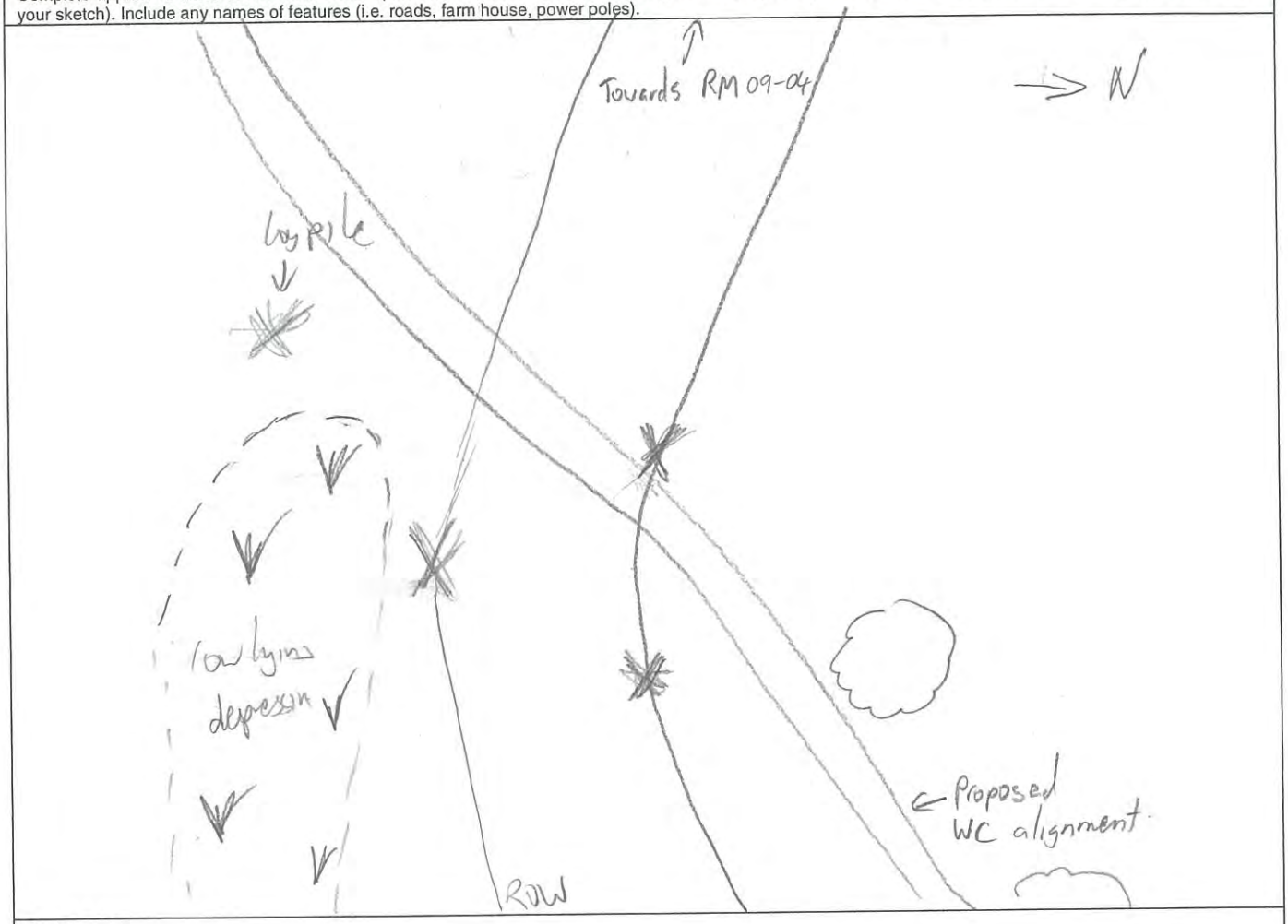
SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).



Notes:

No defined B+ B- no watercourse
low lying area/depression

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SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)

Notes:

WC 10 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

watercourse crossing point (both for flora and fauna characteristics).		
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable:
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail ESA category: Category B Primary Buffer (Endangered Regional Ecosystems)
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☒ No ☐	If no, check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail site: Unsure if Cultural Heritage assessment has been conducted for the R.O.W.
General Vegetation Community description: (including a list of dominant flora species within each stratum)	Non-remnant pasture: S = *Eucalyptus melanophloia* (saplings) G = *Aristida caput-medusae*, *Bothriochloa pertusa**, *Cenchrus ciliaris**, *Cymbopogon refractus, Themeda avenacea, Verbena aristigera, Eragrostis sp. and Verbesina encelioides*	
Are there any declared weeds within the area of the crossing?	Yes☐ No ☒	If yes, describe flag on the ground and GPS and provide on map.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☐ No ☒	
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	5 % 5 % 5 % 85 %	
Riparian vegetation patchiness:	Isolated/scattered	
Describe the riparian vegetation condition:	Type III	
Native woody vegetation regeneration:	Abundant ☐ Present ☒ Limited ☐	
SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

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ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	NA
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	NA

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	NA

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream	☒yes ☐no ☒yes ☐no ☒yes ☐no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** ☒ **YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. ☐ **NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. ☒ **NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	Construction to place during dry conditions and comply with self-assessable guidelines (WAM/2008/3500)

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☒yes ☐no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	Refer to previous vegetation description
Can the water crossing be located in a previously disturbed area?	☐yes ☒no	If No, why not?	Occurs in existing non-remnant vegetation
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

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Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☐yes ☒no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED)
Is a development approval required (i.e. the self-assessable code cannot be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Roisin Feeney	GHD	**Inspected Date:**	22/01/2014
Company:			**Time:**	11:30 am

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – L1
Watercourse ID	WC 11	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 36 on WV421	**Location Reference**	Mt Hope
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	Freehold / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☐ New crossing in previously disturbed area: ☒ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Cultural Heritage Approval to undertake assessment:	Yes ☐ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☐ Hot (>35◦C) ☒	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☐ Humid ☒ Rain (Steady) ☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☐ Humid ☒ Rain (Steady) ☐ Rain (Heavy) ☐

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CROSSING LOCATION (REFER SECTION 8.2)

GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94

Latitude (E)	706656	**Longitude (S)**	7077530
Bankfull Width (m)	7 m	**Bank Width (m):**	Left Bank: 2 m Right Bank: 3 m
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	2 m
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 0.75 m/ NA Downstream Right Bank 0.75 m/ NA	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	

Location	Latitude (E)	Longitude (S)
A	NA	NA
B	NA	NA
C	NA	NA
D	NA	NA
E	NA	NA

Water Present:	Yes ☐ No ☒
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒
Sample Site Length: 50 m	Water Surface Depth to Bed: NA

CHANNEL DETERMINATION (REFER TO SECTION 8.3)

Stream Order: 1☐ 2☒ 3☐ 4☐ 4+☐		Functional Zone Type - Sediment	Supply☐ Transfer☒ Storage☐
Identify Channel Type:	Mildly sinuous		
Channel Modifications:	None		
Bed Sediment Character:	Tight ☐ Packed ☐ Moderate ☐ Low 1 ☐ Low 2 ☒		
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 0 % Pebble 0 % Gravel 0 % Sand Fines 100 %		
Bed Material Angularity:	Very Angular☐ Angular ☐ Sub-angular ☐ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☒		
Bank Predominant Shape:	Concave ☒ Convex ☐ Stepped ☐ Wide lower bench ☐ Undercut ☐		
Bank Slope Downstream Right:	Vertical 80-90° ☐ Steep 60-80° ☒ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☐		
Bank Slope Downstream Left:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☒ Low 10-30° ☐ Flat<10°☐		
Channel Shape:	U Shape		
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☐ Bed Stable ☒ Moderate Deposition ☐ Severe Deposition ☐		
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒		
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐		

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)

Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed** **<0.25 ha**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If yes, reference Report No:

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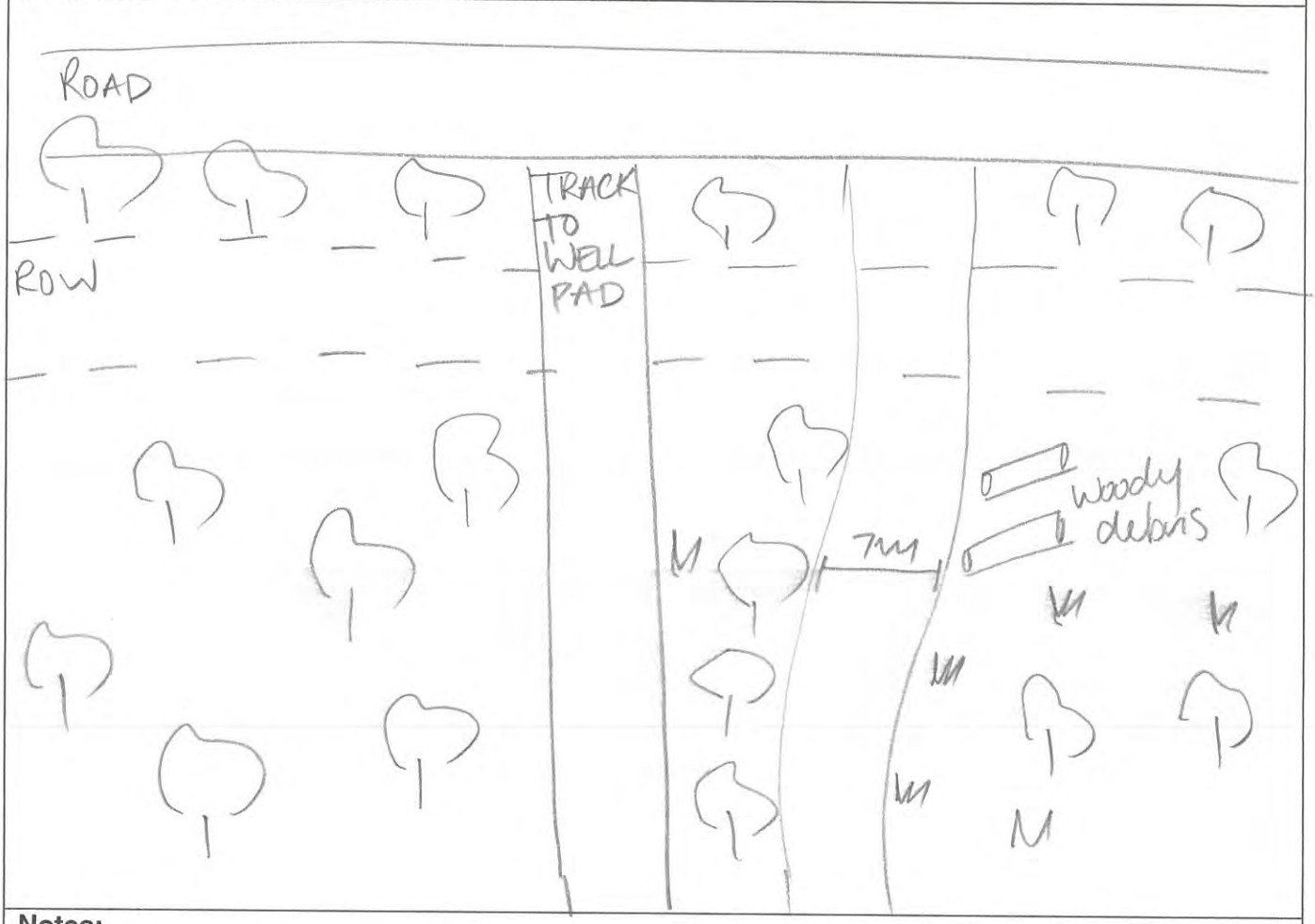
SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).



Notes:

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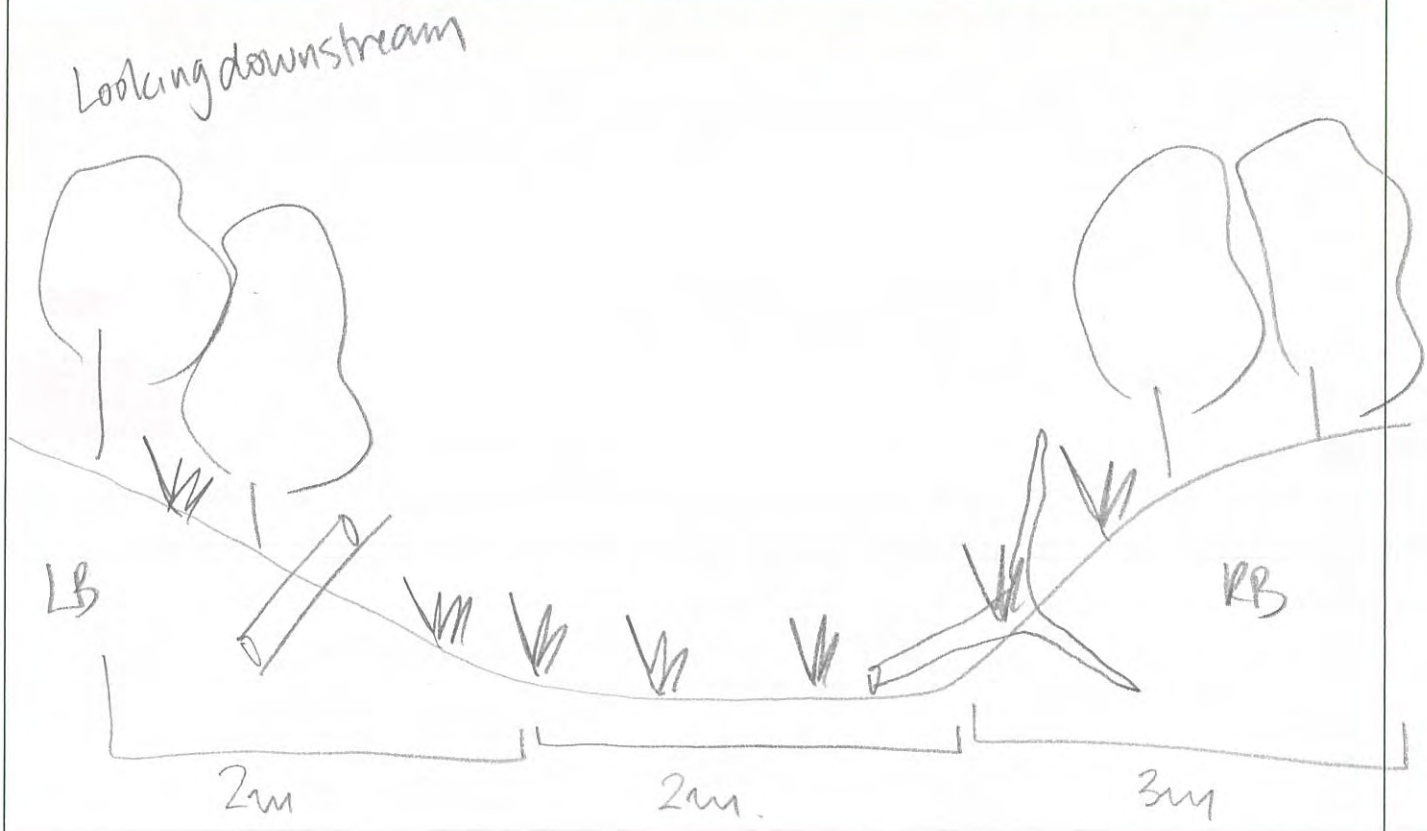
SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)



Notes:

WC 11 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

Has a pre-disturbance assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If no, a pre-disturbance assessment may be required
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable: Non remnant vegetation
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail ESA category:
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☐ No ☐	If no, Check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required.
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☐	If Yes, detail site:
General Vegetation Community description: (including a list of dominant flora species within each stratum)	*Non remnant vegetation with mid dense shrub layer of Eucalyptus melanophloia, Eucalyptus populnea and Acacia sp. and mid dense grass layer.*	

Are there any declared weeds within the area of the crossing?	Yes☒ No ☐	If yes, describe flag on the ground and GPS and provide on map. Opuntia sp.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☐ No ☒	
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	0 % 20 % 30 % 60 %	
Riparian vegetation patchiness:	Semi continuous	
Describe the riparian vegetation condition:	VAST 3 – Transformed	

Native woody vegetation regeneration:	Abundant ☐	Present ☒	Limited ☐

SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements. **No evidence of aquatic life. Vegetation consistent with areas surrounding (outside of area of influence**	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream islands, benches or bars?	☒yes ☐no ☒yes ☐no ☒yes ☐no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** [X] **YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. [ ] **NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** [ ] **YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. [X] **NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☒yes ☐no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	<0.25 ha of vegetation will require clearing Majority of the crossing location has already been cleared Potential species to be cleared include: Eucalyptus melanophloia Eucalyptus populnea Acacia sp.
Can the water crossing be located in a previously disturbed area?	☒yes ☐no	If No, why not?	Non-remnant vegetation
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

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Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☐yes ☒no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior to works commencing.	☐ **YES** **(APPROVAL REQUIRED)** ☒ **NO** **(NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)**
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ **YES** **(APPROVAL REQUIRED)** ☒ **NO** **(NO LODGEMENT REQUIRED)**
Is a development approval required (i.e. the self assessable code can not be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	Non-remnant vegetation

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Roisin Feeney	GHD	**Inspected Date:**	22/01/2014
Company:			**Time:**	12:45 pm

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – L1
Watercourse ID	WC 12	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 36 on WV421	**Location Reference**	Mt Hope
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	Freehold / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☐ New crossing in previously disturbed area: ☒ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Cultural Heritage Approval to undertake assessment:	Yes ☐ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☐ Hot (>35◦C) ☒	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☐ Humid ☒ Rain (Steady) ☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☐ Humid ☒ Rain (Steady) ☐ Rain (Heavy) ☐

CROSSING LOCATION (REFER SECTION 8.2)					
GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94					
Latitude (E)	706852	**Longitude (S)**	7077403		
Bankfull Width (m)	7 m	**Bank Width (m):**	Left Bank: 2 m Right Bank: 3 m		
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	2 m		
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 0.5 m/ NA Downstream Right Bank 0.5 m/ NA	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	**Location**	**Latitude (E)**	**Longitude (S)**
			A	NA	NA
			B	NA	NA
			C	NA	NA
			D	NA	NA
			E	NA	NA
Water Present:	Yes ☐ No ☒				
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒				
Sample Site Length: 50 m		Water Surface Depth to Bed: NA			

CHANNEL DETERMINATION (REFER TO SECTION 8.3)			
Stream Order: 1☐ 2☒ 3☐ 4☐ 4+☐		Functional Zone Type - Sediment	Supply☒ Transfer☐ Storage☐
Identify Channel Type:	Mildly sinuous		
Channel Modifications:	None		
Bed Sediment Character:	Tight ☐ Packed ☐ Moderate ☐ Low 1 ☐ Low 2 ☒		
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 0 % Pebble 0 % Gravel 0 % Sand Fines 100 %		
Bed Material Angularity:	Very Angular☐ Angular ☐ Sub-angular ☐ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☒		
Bank Predominant Shape:	Concave ☒ Convex ☐ Stepped ☐ Wide lower bench ☐ Undercut ☐		
Bank Slope Downstream Right:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☒ Low 10-30° ☐ Flat<10°☐		
Bank Slope Downstream Left:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☒ Low 10-30° ☐ Flat<10°☐		
Channel Shape:	U Shape		
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☐ Bed Stable ☒ Moderate Deposition ☐ Severe Deposition ☐		
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒		
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐		

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)		
Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed** **<0.25 ha**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If yes, reference Report No:

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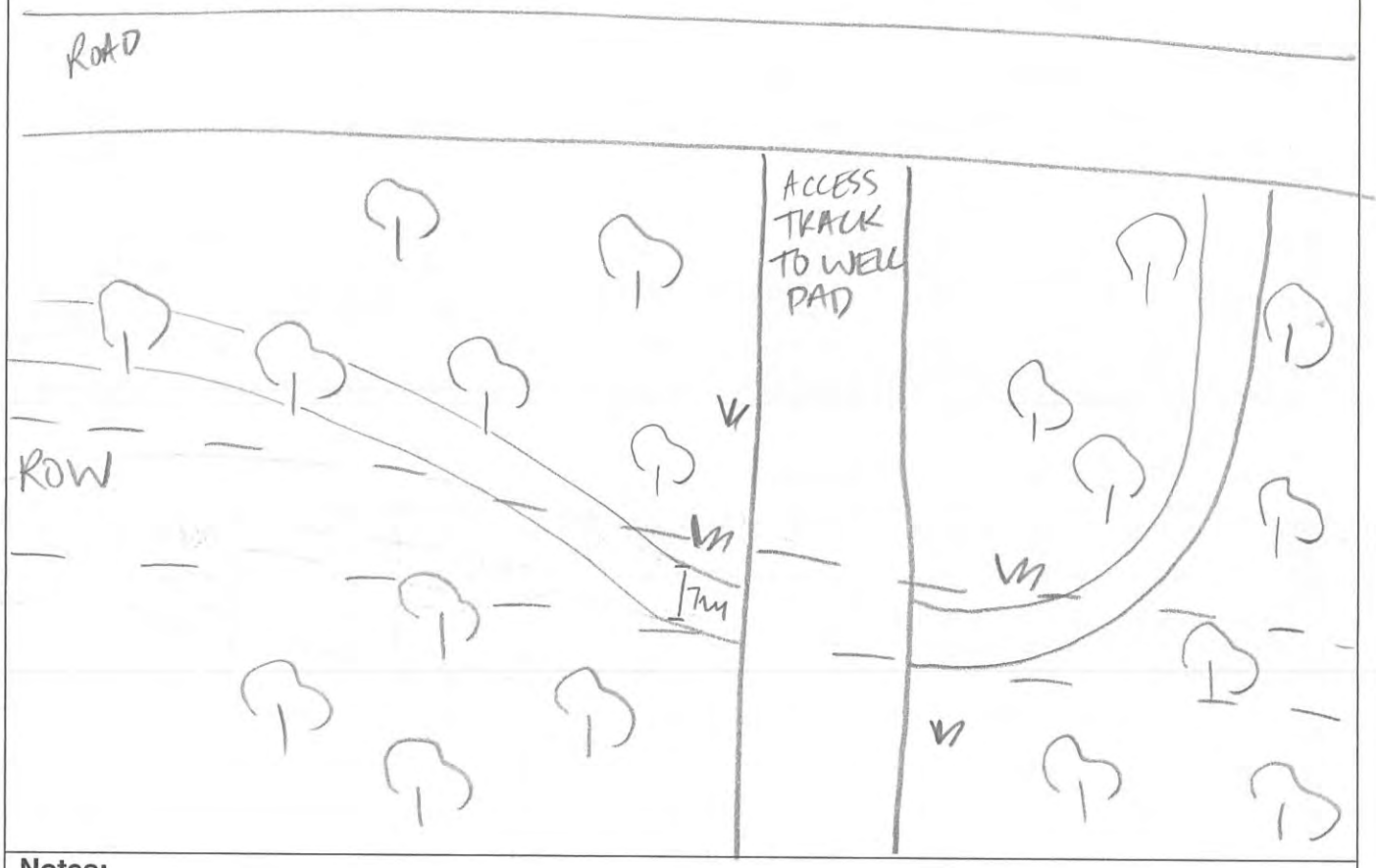
SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).



Notes:

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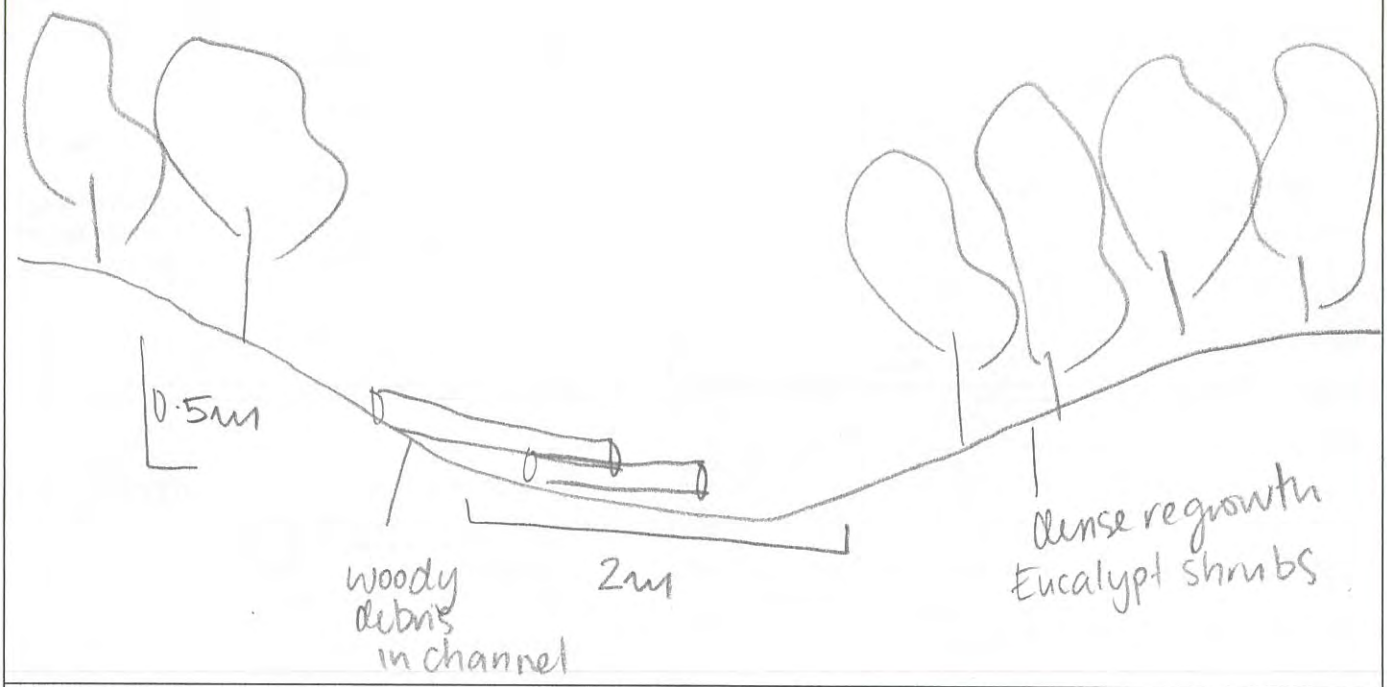
SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)



Notes:

dry at time of survey

WC 12 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

Has a pre-disturbance assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If no, a pre-disturbance assessment may be required
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable: Non remnant vegetation
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail ESA category:
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☐ No ☐	If no, Check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required.
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☐	If Yes, detail site:
General Vegetation Community description: (including a list of dominant flora species within each stratum)	*Non remnant vegetation with scattered mature Eucalyptus melanophloia, dense shrub layer of Eucalyptus populnea and mid-dense ground layer of native and exotic grass species.*	

Are there any declared weeds within the area of the crossing?	Yes☒ No ☐	If yes, describe flag on the ground and GPS and provide on map. Opuntia sp.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☐ No ☒	
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	0 % 20 % 40 % 60 %	
Riparian vegetation patchiness:	Semi continuous	
Describe the riparian vegetation condition:	VAST 3 – Transformed	
Native woody vegetation regeneration:	Abundant ☒ Present ☐ Limited ☐	

SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements. **No evidence of aquatic life. Vegetation consistent with areas surrounding (outside of area of influence**	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream islands, benches or bars?	☒yes ☐no ☒yes ☐no ☒yes ☐no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** [X] **YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. [ ] **NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** [ ] **YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. [X] **NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☒yes ☐no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	<0.25 ha of vegetation will require clearing Majority of the crossing location has already been cleared Potential species to be cleared include: Eucalyptus melanophloia Eucalyptus populnea
Can the water crossing be located in a previously disturbed area?	☒yes ☐no	If No, why not?	Non-remnant vegetation
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☐yes ☒no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior to works commencing.	☐ **YES** **(APPROVAL REQUIRED)** ☒ **NO** **(NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)**
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ **YES** **(APPROVAL REQUIRED)** ☒ **NO** **(NO LODGEMENT REQUIRED)**
Is a development approval required (i.e. the self assessable code can not be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	Non-remnant vegetation

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Roisin Feeney	GHD	**Inspected Date:**	22/01/2014
Company:			**Time:**	12:45 pm

Crossing Name:	Blyth Creek	**CWP Number**	Roma Train 2: CWP – N1
Watercourse ID	WC 13	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 39 on WV422	**Location Reference**	South Leigh
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	Freehold / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☐ New crossing in previously disturbed area: ☒ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Cultural Heritage Approval to undertake assessment:	Yes ☐ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☒ Hot (>35◦C) ☐	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☒ Windy ☐ Strong Wind ☐	Air now: Dry ☐ Humid ☒ Rain (Steady) ☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☒ Humid ☐ Rain (Steady) ☐ Rain (Heavy) ☐

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CROSSING LOCATION (REFER SECTION 8.2)

GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94

Latitude (E)	707433	**Longitude (S)**	7074221
Bankfull Width (m)	35 m	**Bank Width (m):**	Left Bank: 5 m Right Bank: 5 m
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	25 m
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 2 m/ NA Downstream Right Bank 3 m/ NA	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	

Location	Latitude (E)	Longitude (S)
A	NA	NA
B	NA	NA
C	NA	NA
D	NA	NA
E	NA	NA

Water Present:	Yes ☐ No ☒
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒
Sample Site Length: 50 m	Water Surface Depth to Bed: NA

CHANNEL DETERMINATION (REFER TO SECTION 8.3)

Stream Order: 1☐ 2☐ 3☐ 4☐ 4+☒	Functional Zone Type - Sediment	Supply☐ Transfer☐ Storage☒
Identify Channel Type:	Mildly sinuous	
Channel Modifications:	None	
Bed Sediment Character:	Tight ☐ Packed ☐ Moderate ☐ Low 1 ☐ Low 2 ☒	
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 0 % Pebble 0 % Gravel 2 % Sand Fines 98 %	
Bed Material Angularity:	Very Angular☐ Angular ☐ Sub-angular ☒ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☒	
Bank Predominant Shape:	Concave ☐ Convex ☐ Stepped ☐ Wide lower bench ☒ Undercut ☐	
Bank Slope Downstream Right:	Vertical 80-90° ☒ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☐	
Bank Slope Downstream Left:	Vertical 80-90° ☒ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☐	
Channel Shape:	Wide box	
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☐ Bed Stable ☐ Moderate Deposition ☒ Severe Deposition ☐	
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒	
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐	

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)

Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed** **<0.25 ha**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If yes, reference Report No:

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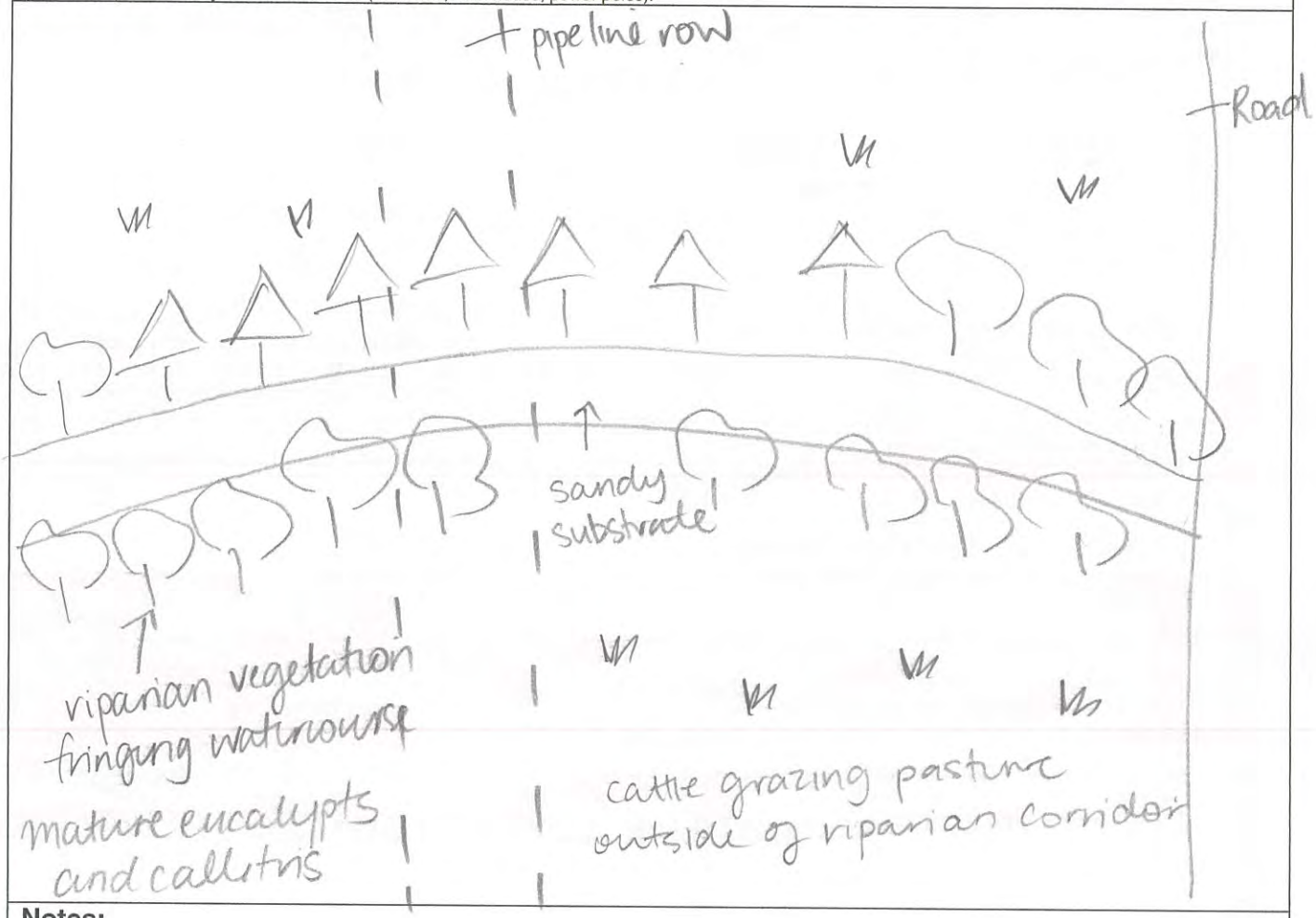
SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).



Notes:

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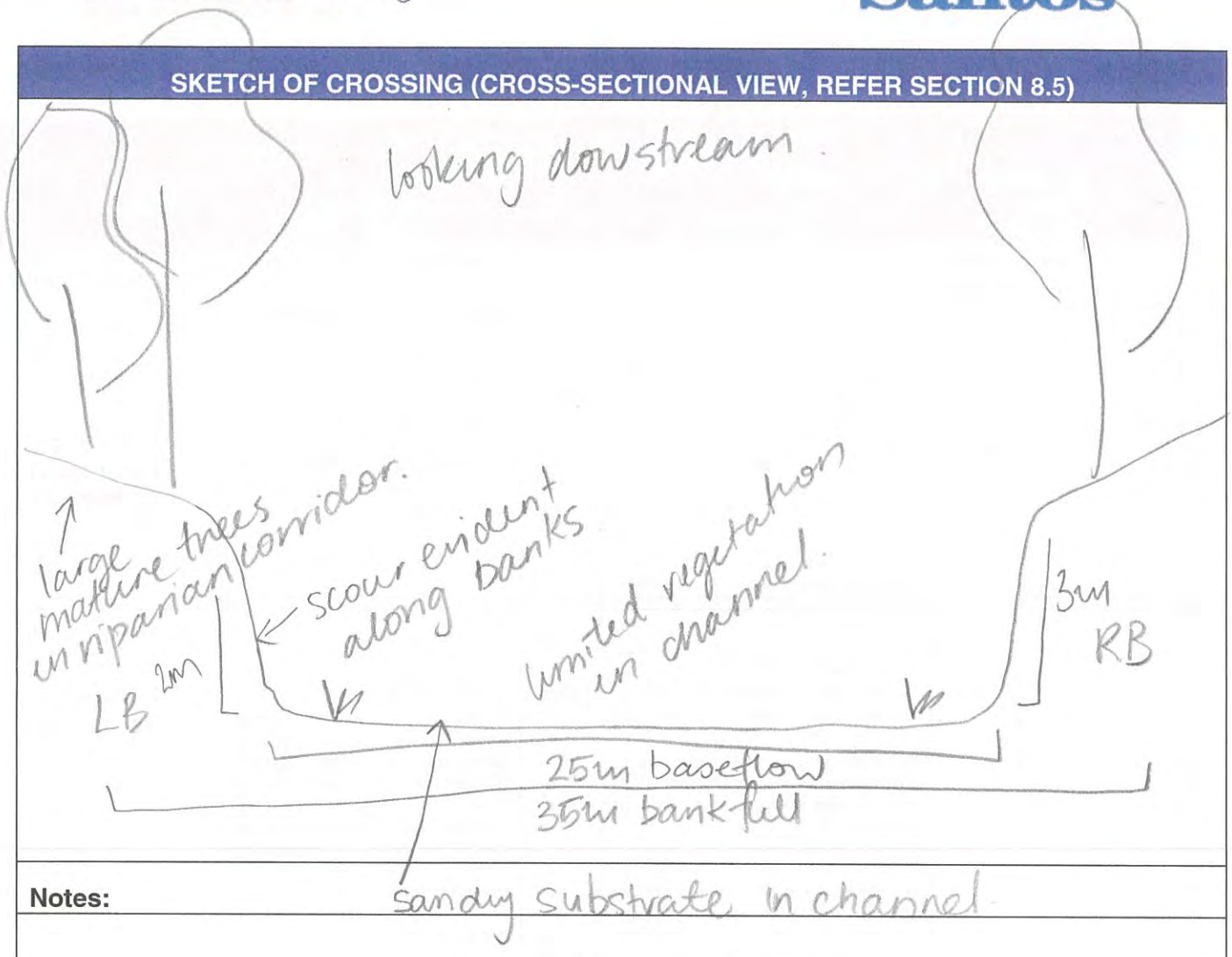
SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)



Notes:

WC 13 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

Photo D – Left bank at the proposed site of works

Photo E – Right bank at the proposed site of works

Has a pre-disturbance assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If no, a pre-disturbance assessment may be required
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☒ No ☐	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable: RE 11.3.25/ 11.3.2
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☒ No ☐	If Yes, detail ESA category: Category C ESA (Of Concern RE)
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☒ No ☐	If no, Check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required.
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☐	If Yes, detail site:
General Vegetation Community description: (including a list of dominant flora species within each stratum)	Open woodland fringing watercourse with mixed eucalypt and Callitris glaucophylla, sparse shrub layer and mid-dense grass layer of native and exotic species.	

Are there any declared weeds within the area of the crossing?	Yes☐ No ☒	If yes, describe flag on the ground and GPS and provide on map.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☐ No ☒	
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	10 % 40 % 1 % 80 %	
Riparian vegetation patchiness:	Semi continuous	
Describe the riparian vegetation condition:	VAST 1 – Residual	
Native woody vegetation regeneration:	Abundant ☐ Present ☒ Limited ☐	

SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

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ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☒yes ☐no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☒ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☒yes ☐no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements. **Riparian vegetation present including large mature eucalypts. Aquatic plants present in channel including juncus sp.**	☐ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☒yes ☐no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☒no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☒no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☒yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream islands, benches or bars?	☐yes ☒no ☐yes ☒no ☐yes ☒no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** ☐ **YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. ☒ **NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** ☒ **YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. ☐ **NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☒yes ☐no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☒yes ☐no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	<0.25 ha of vegetation will require clearing Majority of the crossing location has already been cleared Potential species to be cleared include: Eucalyptus spp. Callitris glaucophylla grass species
Can the water crossing be located in a previously disturbed area?	☒yes ☐no	If No, why not?	
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

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Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☒yes ☐no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior to works commencing.	X YES (APPROVAL REQUIRED) ☐ NO (NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)
Has the stream order been assessed as a waterway (*Fisheries Act*)	☒yes ☐no	If **Yes** complete check boxes below If **No** – no further assessment required	X YES (APPROVAL REQUIRED) ☐ NO (NO LODGEMENT REQUIRED)
Is a development approval required (i.e. the self assessable code can not be adhered to)?	☒yes ☐no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☒yes ☐no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☒yes ☐no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	

WORKS WITHIN A WATERCOURSE ASSESSMENT

This watercourse assessment is to be filled out for all watercourse crossings to ensure compliance with environmental requirements and to ensure appropriate approvals are obtained.

FIELD ASSESSMENT

Inspected by:	Roisin Feeney	GHD	**Inspected Date:**	23/01/2014
Company:			**Time:**	11:40 am

Crossing Name:	Un-named watercourse	**CWP Number**	Roma Train 2: CWP – N1
Watercourse ID	WC 14	**Crossing Type (E.g. pipeline/road)**	Pipeline
Lot/Plan:	Lot 49 on WV422	**Location Reference**	South Leigh
Site	R-HCS-02 ☒ F-HCS-04 ☐ F-HCS-05 ☐ other/area:		
Land Tenure:	Freehold / Leasehold / other :	**Petroleum Tenure**	
Crossing Disturbance Status:	Existing crossing with no upgrade required: ☐ Existing crossing with upgrade required: ☐ New crossing in previously disturbed area: ☒ New crossing in undisturbed area: ☐		
Land Access Approval to undertake assessment:	Yes ☒ No ☐	**Approval No:**	
Cultural Heritage Approval to undertake assessment:	Yes ☐ No ☐	**Approval No:**	
Anticipated commencement date:		**Can the crossing be installed within 10 days?** If No, development approval and other approvals may be required.	Yes ☒ No ☐

HEALTH AND SAFETY		
Have you completed a Safety Task Assessment (STA)?	Yes ☒ No ☐	If No, cease inspection and complete.
Do you have appropriate PPE for the task?	Yes ☒ No ☐	
Do you have adequate amount of water – at least 10 litres?	Yes ☒ No ☐	

GENERAL ENVIRONMENTAL CONDITIONS	
Temp: Cold (<5◦C) ☐ Cool (<15◦C) ☐ Mild (<25◦C) ☐ Warm (<35◦C) ☐ Hot (>35◦C) ☒	Weather now: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
	Past 24 hrs: Clear/Fine ☒ Scattered Clouds ☐ Cloudy ☐
Wind: Still ☐ Slight breeze ☐ Windy ☒ Strong Wind ☐	Air now: Dry ☐ Humid ☒ Rain (Steady) ☐ Rain (Heavy) ☐
	Air past 24hrs: Dry ☐ Humid ☒ Rain (Steady) ☐ Rain (Heavy) ☐

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CROSSING LOCATION (REFER SECTION 8.2)					
GPS Coordinates - Latitude/Longitude (E – 6 Figs, N – 7 Figs) GDA94					
Latitude (E)	708562	**Longitude (S)**	7073281		
Bankfull Width (m)	12 m	**Bank Width (m):**	Left Bank: 2 m Right Bank: 5 m		
Stream Width at Water Surface (m):	NA	**Baseflow Stream Width (m):**	5 m		
Bank Height: Baseflow and water surface height difference:	Downstream left Bank: 0.25 m/ NA Downstream Right Bank 0.75 m/ NA	**Photographs of site** Provide photos looking upstream and downstream from crossing location, as well as relevant to watercourse / waterway determination. Label photos.	**Location**	**Latitude (E)**	**Longitude (S)**
			A	NA	NA
			B	NA	NA
			C	NA	NA
			D	NA	NA
			E	NA	NA
Water Present:	Yes ☐ No ☒				
Water Type:	Flowing ☐ Pool(s) present ☐ Dry ☒				
Sample Site Length: 50 m		Water Surface Depth to Bed: NA			

CHANNEL DETERMINATION (REFER TO SECTION 8.3)			
Stream Order: 1☒ 2☐ 3☐ 4☐ 4+☐		Functional Zone Type - Sediment	Supply☒ Transfer☐ Storage☐
Identify Channel Type:	Mildly sinuous		
Channel Modifications:	Infilled with logs and dammed upstream of ROW		
Bed Sediment Character:	Tight ☐ Packed ☐ Moderate ☐ Low 1 ☐ Low 2 ☒		
Bank Sediments Composition:	Bedrock 0 % Boulder 0 % Cobble 1 % Pebble 1 % Gravel 2 % Sand Fines 96 %		
Bed Material Angularity:	Very Angular☐ Angular ☐ Sub-angular ☒ Rounded ☐Well-rounded ☐ Cobble peddle and gravel fractions not present ☐		
Bank Predominant Shape:	Concave ☒ Convex ☐ Stepped ☐ Wide lower bench ☐ Undercut ☐		
Bank Slope Downstream Right:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☒ Low 10-30° ☐ Flat<10°☐		
Bank Slope Downstream Left:	Vertical 80-90° ☐ Steep 60-80° ☐ Moderate 30-60° ☐ Low 10-30° ☐ Flat<10°☒		
Channel Shape:	Flat U shape		
Bed Stability:	Severe Erosion ☐ Moderate Erosion ☐ Bed Stable ☒ Moderate Deposition ☐ Severe Deposition ☐		
Potential Fish Habitat Class:	Class1 ☐ Class2 ☐ Class3 ☐ Class4 ☒		
Fish Migratory Passage Potential:	Nil ☒ Very Restricted ☐ Moderately Restricted ☐ Partly Restricted ☐ Good Passage ☐ Unrestricted Passage ☐		

FLORA/FAUNA ASSESSMENT (REFER TO SECTION 8.4)		
Does any vegetation need to be removed?	Yes ☒ No ☐	**If Yes, no more than 0.25 Ha can be removed Estimate how much needs to be removed** **<0.25 ha**
Vegetation community description		
Has an Aquatic and Ecological Assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If yes, reference Report No:

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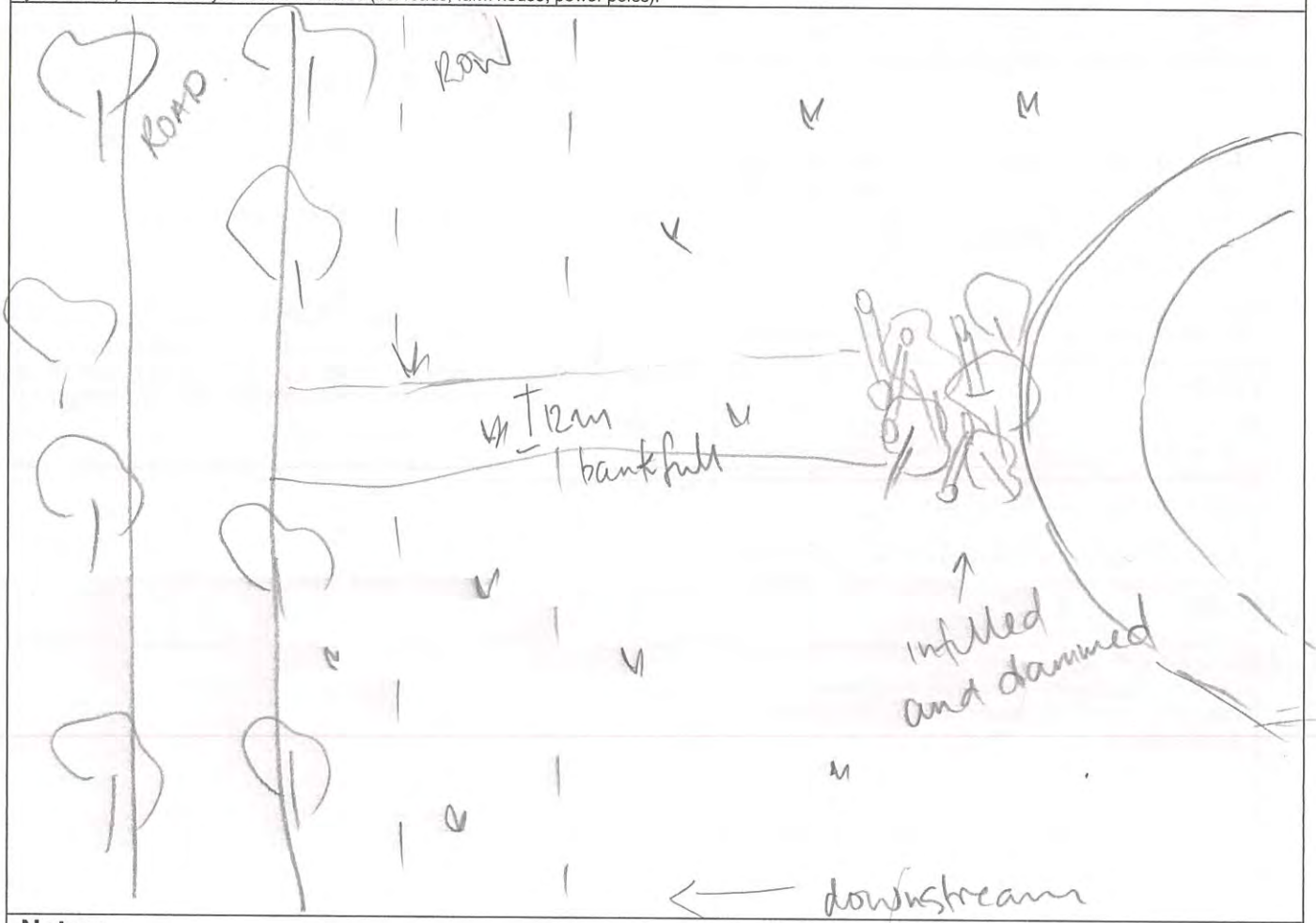
SKETCH OF CROSSING (BIRDS EYE VIEW) (REFER SECTION 8.5)

Sketch birds eye view (i.e. view looking from above), depict how the stream curves, any vegetation, trees, areas of significance (cultural significance if known). Complete approx 10 times the Bankfull Width upstream and downstream of crossing site. Take photographs upstream and downstream (write photo locations on your sketch). Include any names of features (i.e. roads, farm house, power poles).



Notes:

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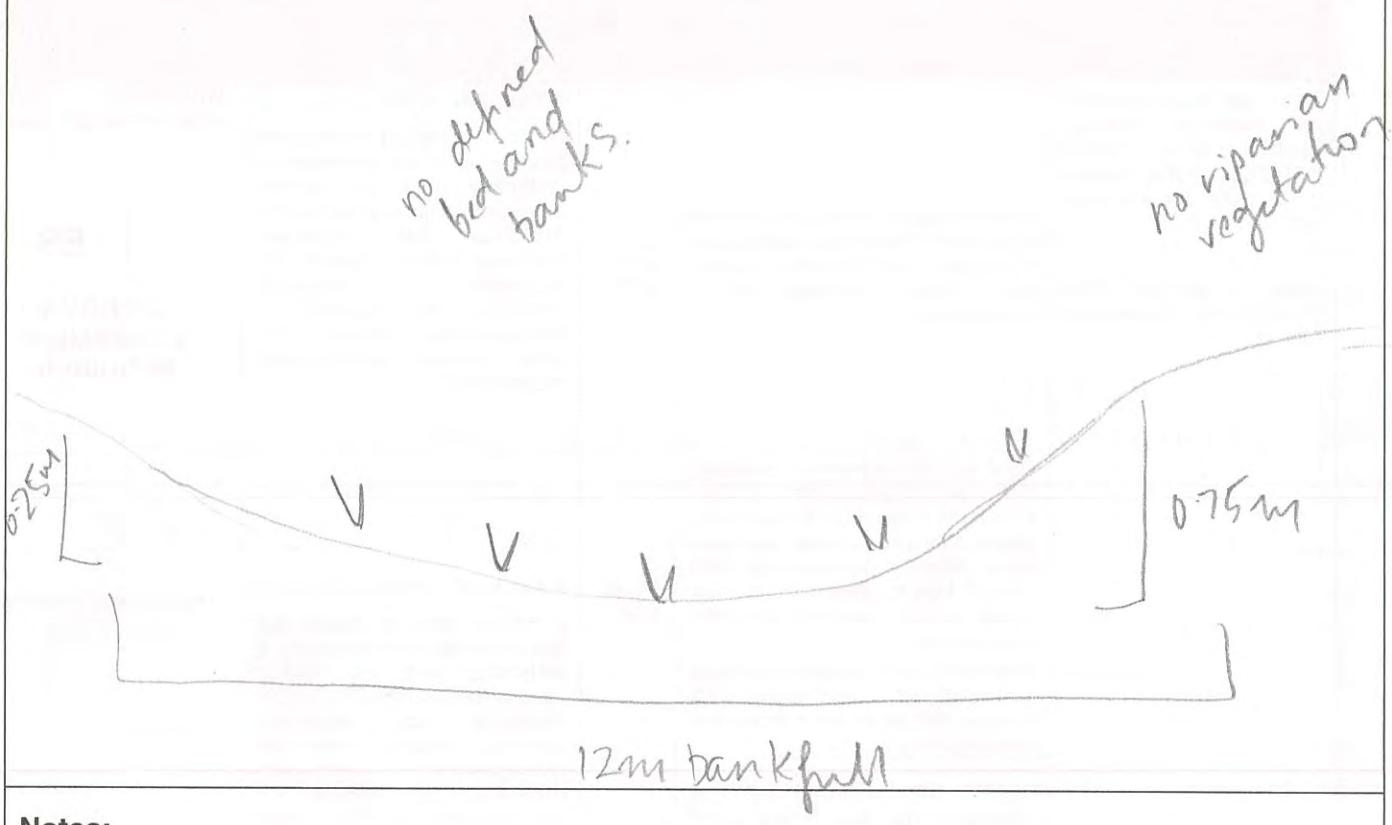
SKETCH OF CROSSING (CROSS-SECTIONAL VIEW, REFER SECTION 8.5)



Notes:

WC 14 Pre-works Photographs

Photo A – Looking across the waterway at the proposed site works

Photo B – Looking downstream of the proposed site of works

Photo C – Looking upstream of the proposed site of works

Has a pre-disturbance assessment been undertaken previously that encompasses the watercourse crossing point (both for flora and fauna characteristics).	Yes ☒ No ☐	If no, a pre-disturbance assessment may be required
Does the riparian zone at the watercourse fall within a mapped extent of a Regional Ecosystem and/ or TEC? (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail mapped RE code (biodiversity status) and TEC where applicable: Non remnant vegetation
Does the riparian zone at the watercourse fall within any Category A, B or C Environmentally Sensitive Areas (ESAs) and/or their primary or secondary primary protection (buffer) zones (refer to Dekho maps)	Yes ☐ No ☒	If Yes, detail ESA category:
If present, is the mapped RE/TEC community consistent with the vegetation community observed on the ground	Yes ☒ No ☐	If no, Check whether discrepancies have already been recorded in previous reports and GIS layers updated. If not a pre-disturbance assessment or quaternary level assessment may be required.
Does the proposed development activity comply with the clearing/significant disturbance restrictions of the applicable EA (refer Table 3)	Yes ☒ No ☐	If, no then flag with FLUOR Environment Team for review.
Are there any Cultural Heritage sites located within the crossing location or nearby area (refer to Dekho maps)	Yes ☐ No ☐	If Yes, detail site:
General Vegetation Community description: (including a list of dominant flora species within each stratum)	*Non remnant vegetation with a sparse shrub layer including Acacia sp. and Eucalyptus populnea and mid-dense ground layer of native and exotic grasses*.	

Are there any declared weeds within the area of the crossing?	Yes☐ No ☒	If yes, describe flag on the ground and GPS and provide on map.
Are there any conservation significant species (i.e ENVT or Type A flora) within the area of the crossing?	Yes☐ No ☒	
Riparian vegetation cover: Trees > 10 m: Trees < 10 m: Shrubs: Grasses, herbs and sedges:	0 % 0 % 5 % 60 %	
Riparian vegetation patchiness:	None	
Describe the riparian vegetation condition:	VAST 4 – Replaced- Adventive	

Native woody vegetation regeneration:	Abundant ☐	Present ☒	Limited ☐

SAFETY CONSIDERATIONS		
Are there any safety implications at the proposed crossing due to decreased Right of Way from Environmental Sensitive Areas or other constraints like topography?	Yes ☐ No ☒	**If Yes, Note concerns**

ASSESSMENT OUTCOME

LEGISLATIVE REQUIREMENTS DETERMINATION				
Part 1 - Waterway Definition Assessment (*Fisheries Act 1994*)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
Does the feature satisfy the waterway definition requirements of FHMOP 008 2009 (refer section 7.3.2) under the *Fisheries Act 1994*? Refer to Section 7 of Watercourse Assessment Manual	Does the feature have a defined bed and banks: The bed and banks need to be continuous rather than isolated and broken sections of a depression.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements.	**WATERWAY UNDER *FISHERIES ACT 1994?*** ☐ **YES** **(APPROVAL/ LODGEMENT REQUIRED)**
	Does the feature have an extended, if non-permanent, period of flow: Flow must continue for a reasonable period after rain ceases and have some reliability commensurate with rainfall? Flow for several weeks after rainfall ceases does not constitute extended flow. Consider e.g. water present, catchment size, geomorphological features, and ecological indicators of sustained flow.	☐yes ☒no	If **Yes to all** , complete Section 2 If **No to any of these, the feature does not constitute a waterway and no further assessment is required for the Fisheries Act.** Implement waterway crossing design and environmental protection measures as required in Environmental Authority and other relevant environmental requirements. **No evidence of aquatic life. Vegetation consistent with areas surrounding (outside of area of influence**	☒ **NO** **(NO LODGEMENT REQUIRED**
	Does the feature have sufficient flow adequacy: The flow needs to be sufficient to sustain basic ecological processes and to maintain biodiversity within the feature. Comment on any ecological indicators present e.g. riparian vegetation, presence/evidence of aquatic life etc.	☐yes ☒no		

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
a. **Do the works constitute waterway barrier works as defined in FHMOP 008 2009 (Appendix 3)?**	As well as dams and weirs the following are examples of developments that are considered to be waterway barrier works: ▪ Temporary dams, barriers to flow ▪ Culverts ▪ Bed level waterway crossings ▪ Causeways (water crossings slightly above stream bed) ▪ Tidal or floodgates (including maintenance and repair) ▪ Partial bunds (where the development will only partially block a waterway) ▪ Levee banks ▪ Silt curtains ▪ Netting and screens ▪ Litter booms or Trash racks ▪ Riffle structure	☐yes ☐no	If **Yes**, complete Section **2b**. If **No**, implement construction works in accordance with environmental protection measures as requires in Environmental Authority and other relevant environmental requirements. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	
b. **Is the waterway crossing self assessable under WWBW01 for Temporary Waterway Barrier Works**	Do the works involve: ▪ Waterway barriers that will be in place for less than 42 calendar days ▪ Waterway barriers that are less than 20m in length across the waterway from bank to bank and; ▪ 10m or less in width (at the widest point). ▪ Waterway barriers that are at least 500m distance from any existing natural or artificial waterway barrier (upstream or downstream) unless: ○ the barrier is being constructed in order to perform maintenance or repairs on, or removal of, the existing barrier, or ○ the barrier is being constructed in order to facilitate dewatering between the new and existing barriers, or ○ the barrier is a silt curtain for control of sediment. ▪ Disturbance to the bed and banks of a waterway less than 5m from the toe of the barrier on either side. ▪ Construction at the time of the year when the flows are lowest or have completely stopped. ▪ A waterway barrier where there will be no ponding of water upstream.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW01 in addition to waterway crossing design and environmental protection measures as required in CEMP, Environmental Authority, EIS and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review. If **No**, go to Section **2c**.	

Section 2 - Waterway Barrier Works Requirements (Only complete if works are to take place within a waterway)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Field Comments**
c. **Is the waterway crossing self assessable under WWBW02 for Minor Waterway Barrier Works**	Do the works involve: • New waterway barrier works **at least 100m** from any other permanent waterway barrier works on same waterway. • Construction that is **not** on a bend or rapid section of a waterway. • Construction perpendicular to the water flow (within 10°). • Construction of minor barriers must commence and finish within 60 calendar days. • Construction during times of low flow, base flow or no flow conditions. • And either one of either: • *Part 1, Dams and Weirs* • Construction of a new **dam or weir** or maintenance of existing one on a waterway with a stream order of 1 or 2 • Maximum waterway barrier height is **one metre or less** above the lowest point of the waterway bed • Upstream and downstream disturbance area must not be more than **10 m** in total from the upstream and downstream toe of the barrier. • Or, *Part 3, Culverts* • Construction of a new **culvert** crossing or replacement/ modification or maintenance of existing culvert where the bankfull width of the waterway **is not** greater than 20m. • Construction of **culverts** where the **maximum** upstream/downstream length of the culvert cells is 15m plus apron (3m scour protection for culverts) or less. • The maximum disturbance area outside barrier footprint of 10 m (scour protection is included in the barrier footprint (upstream and/or downstream). • Or, *Part 4, Bed Level Crossings* • Construction of a new **bed level** crossing or replacement/ modification or maintenance of existing **bed level** waterway where the bankfull width of the waterway can be less than or greater than 20m. • **Bed level** crossing footprint is no more than **15 m wide** (upstream/downstream), with a maximum disturbance area outside crossing footprint of **10 m** (**25 m in total**). • Installation of **bed level** crossings **no higher** than natural bed level. • Installation of a **bed level** crossing at the same gradient as the waterway bed gradient.	☐yes ☐no	If **Yes**, comply with all applicable requirements of WWBW02 in addition to waterway crossing design and environmental protection measures as required, Environmental Authority and other relevant environmental requirements. Provide evidence that waterway crossing design satisfies DAFF self assessment codes including reference to design drawings. Attach/reference all records and place in Z:\653R_Environmental Complete paperwork and forward to FLUOR Environment Team for review.	

Part 3 - Water Definition Assessment (Water Act 2000) & Relevant Environmental Authority				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Overall Outcome**
Does the feature fit the definition of a ***Drainage Feature*** under the Water Act 2000? ***Drainage feature*** means a natural landscape feature, including a gully, drain, drainage depression or other erosion feature that— (a) is formed by the concentration of, or operates to confine or concentrate, overland flow water during and immediately after rainfall events; and (b) flows for only a short duration after a rainfall event, regardless of the frequency of flow events; and (c) commonly, does not have enough continuing flow to create a Riverine environment Refer to Section 7 of Watercourse Assessment Manual	1. Does the feature carrying water flow only for a short duration after a rainfall event? 2. Does the feature lack the presence of a riverine environment? (i.e flow adequacy to support riverine species). 3. Does the feature lack the presence of in-stream islands, benches or bars?	☒yes ☐no ☒yes ☐no ☒yes ☐no	If ***Yes to all*** of these questions then the feature does not constitute a watercourse and no further assessment is required for the Water Act. If ***no to any*** one of these questions then this feature constitutes a watercourse under the Water Act 2000	**Drainage Feature UNDER the *WATER ACT 2000?*** **X YES** **(NO APPROVAL REQUIRED)** Implement environmental protection measures as required in Environmental authority and other relevant environmental requirements. **☐ NO** **Determined a Watercourse – see below** **Watercourse under the *WATER ACT 2000*?** **☐ YES** **(APPROVAL/ LODGEMENT REQUIRED – DETERMINED A WATERCOURSE)** Complete Pre and Post works checklists, and ensure appropriate lodgements are undertaken as per Environmental Authority Requirements. **X NO** **Determined a drainage feature– see Above.**

Part 4 - Water Act Requirements (only complete if works are to take place within or adjacent to the watercourse – refer to Section 2 (Water Act) outcomes)				
Environmental Value	**Checklist**	**Y / N**	**Justification for Placement**	**Comments**
Do the works require approval under the Water Act? (Refer to summary flowchart within Section 9 of watercourse manual)	Do the works involve: • Excavation or placing fill in a way that would interfere with the flow of water in a watercourse, lake or spring by impounding or redirecting the flow of water (referring to completed product, following construction works).	☐yes ☒no	If **Yes**, go to Part **5**, works may require a Riverine Protection Permit under the Water Act. Provide evidence that waterway crossing design satisfies DEHP Guidelines (next section) including reference to design drawings. Attach/reference all records and store in relevant Environmental Drive. Complete paperwork and forward to FLUOR Environment Team for review. If No, adhere to EA requirements!	

Part 5 – DNRM Assessment Requirements (Guideline – activities in a watercourse, lake or spring associated with mining operations) (refer to Section 1 (Water Act) outcomes)			
What type (if any) vegetation will be required to be removed and quantity (area). (no more than 0.25ha), how will the vegetation be removed?	☒yes ☐no	List all species required for removal. Ensure FLUOR/SANTOS vegetation management plan and EA conditions are followed (indicate the requirements for this crossing).	<0.25 ha of vegetation will require clearing Majority of the crossing location has already been cleared Potential species to be cleared include: Acacia sp Eucalyptus populnea grasses
Can the water crossing be located in a previously disturbed area?	☒yes ☐no	If No, why not?	
Is the water course from groundwater origin?	☐yes ☒no	Determine upstream water sources	

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Section 6 – Overall Assessment Outcome			
Has the stream order been assessed a watercourse (Water Act)	☐yes ☒no	If Yes, must comply with the "Guideline – activities in a watercourse, lake or spring associated with mining operations" – Ensure all of this checklist is completed and conveyed to all relevant staff, contractors are to ensure compliance with EA conditions – ensure lodgement of PREWORKS TO DEHP 10 Business prior to works commencing.	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED, ASSESSED AS DRAINAGE FEATURE)
Has the stream order been assessed as a waterway (*Fisheries Act*)	☐yes ☒no	If **Yes** complete check boxes below If **No** – no further assessment required	☐ YES (APPROVAL REQUIRED) X NO (NO LODGEMENT REQUIRED)
Is a development approval required (i.e. the self assessable code can not be adhered to)?	☐yes ☒no	If **Yes** Contact FLUOR Environment Team.	
Was the crossing assessed as a 'minor waterway barrier'?, either:		If **Yes** complete the relevant 'Minor Waterway Barrier Works Self-Assessment Sheet' lodge to FLUOR Environment Team.	
Part 1 – Dams and Weirs	☐yes ☒no		
Part 3 – Culverts	☐yes ☒no		
Part 4 – Bed Level Crossings	☐yes ☒no		
Was the crossing assessed as a 'temporary waterway barrier'?	☐yes ☒no	If **Yes** complete a Temporary Waterway Barrier Works Self-Assessment Sheet lodge to FLUOR Environmental Team for review.	
Were any EVNT species listed under the EPBC Act and/or NC Act present within the riparian zone of the waterway crossing	☐yes ☒no	If Yes GPS the position of individuals/populations, flag on site and contact FLUOR Environmental Team for review. If No – no further assessment required	
Were any vegetation mapping discrepancies identified within the riparian zone of the waterway crossing	☐yes ☒no	If Yes undertake a quaternary level RE assessment and GPS the extent of the mapped community assemblage where applicable. Contact FLUOR Environment Team for review. If No – no further assessment required	

Wetlands Rapid assessment			
Site: Wetland 1 (Blyth Creek)	**Date:** 23/01/2014	**Observers:** LM/ RF	
Infrastructure reference: N1 Branch			
Photo nos: North: NA	East: NA	South: NA	West: NA
	GPS coords: 707433, 7074221		

Wetland class (tick one):

Riverine ✓ Estuarine Palustrine Lacaustrine Marine

Not a wetland under GLNG EA ✓

Where not a wetland select a reason (tick one):

	Modified (tick one below if so)
	H2M1 Riverine or ex-riverine (lacustrine) water bodies associated with dams and weirs located in a channel
	H2M3p Ponded pastures;
	H2M5 Palustrine / lacustrine water bodies where ecological character has changed due to gross mechanical disturbance (eg cropping);
	H2M6 Palustrine / lacustrine water bodies that have been converted, completely or mostly, to a ring tank or other controlled storage;
	H2M7 Riverine water bodies that have been converted mostly to canals or irrigation channels;
	H3C1 Artificial stand-alone water storages not within a natural water body or channel; or
	H3C2 Artificial Channel drain / canal –bore drains, swales, bores and irrigation channel overflows/ponding
✓	**Within outer banks of watercourse**
	Spring
	Does not meet hydrology criterion
	Meets hydrology criterion but doesn't meet other criteria

(Refer to back page, if not already ticked above):

Notes (additional description or map area of wetland)**:**

Feature assessed as non-wetland feature (the area between the outer banks of a watercourse)

No artificially modified features

Wetland 1 (Blyth Creek) Pre-works Photographs

Photo A – Looking across mapped wetland at the proposed site of works

Photo B – Looking downstream at proposed site of works

Photo C – Looking upstream of the proposed site of works

Photo D- Left bank looking downstream

Photo E- Right bank looking downstream

Riparian vegetation

Column Name	Data Type	Max. Chars	Mandatory?	Details
HYDROMOD	Char	30	Yes	Code representing the hydrological modifier of the wetland polygon. **Note:** Where NONWETCLASS = Modified, HYDROMOD must equal the appropriate correlating classification (one of H2M1, H2M3p, H2M5, H2M6, H2M7, H3C1 or H3C2).

Hydrological modifiers:

Description	HYDROMOD
No mocifications observed.	H1
Modified - Riverine wetlands associated with dams and weirs located in a natural channel.	H2M1
Modified - Palustrine/Lacustrine wetlands where size and/or hydrology has changed due to levee bank.	H2M2
Modified - Palustrine/Lacustrine wetlands where size and/or hydrology has changed due to levee bank and dominated by exotic pasture species.	H2M2p
Modified - Palustrine/Lacustrine wetlands where size and/or hydrology has changed the water body classification from estuarine to a fresh water system.	H2M3
Modified - Palustrine/Lacustrine wetlands where size and/or hydrology has changed the water body classification from estuarine to a fresh water system and dominated by exotic pasture species.	H2M3p
Modified - springs.	H2M4
Modified - springs (dominant).	H2M4a

Description	HYDROMOD
Modified - Palustrine/Lacustrine wetlands where ecological character has changed due to gross mechanical disturbance (e.g. cropping).	H2M5
Modified - Palustrine/Lacustrine wetlands that have been converted, completely or mostly, to a ring tank or other controlled storage.	H2M6
Modified - Riverine wetlands that have been converted mostly to canals or irrigation channels.	H2M7
Modified - Palustrine/Lacustrine/Riverine wetlands with no obvious structures, but where the local hydrology has been totally altered by irrigation activity.	H2M8
Artificial wetlands - dams, ringtanks.	H3C1
Artificial wetlands - channel drain/canals, bore drains.	H3C2
Artificial wetlands - levee bank across a floodplain.	H3C3
Unknown or Not Applicable	U

Microbat Call Identification Report

Prepared for ("Client"):	GHD
Survey location/project name:	Blythedale (Roma, SE Qld)
Survey dates:	January 2014
Client project reference:	412731205
Job no.:	GHD-1042
Report date:	5 February 2014

Methods

Data receipt and processing

Bat calls were recorded over three nights (20th, 21st and 22nd January 2014) using Anabat detectors (Titley Scientific, Brisbane). The Anabat data files were downloaded from the detectors by the client and converted to Anabat sequence files (zero-crossing format); with a total of 1280 sequence files submitted to *Balance! Environmental* for analysis.

Due to a detector clock error (presumably resulting from an expired internal clock battery) and subsequent date/time conflict encountered by *CFCread* during data conversion, the calls recorded by "Anabat 1 (no paint)" could not be separated into different detection nights. No such clock error occurred with "Anabat 2"; however no data was recorded on the second night (21st January).

Species identification

All Anabat sequence files were viewed using *AnalookW* (Corben 2013) and a subset of files containing representative samples of all call types recorded by each detector on each night were selected for further analysis. Calls with fewer than four clearly-defined, non-fragmented pulses were excluded from the analysis.

Species identification was achieved manually by comparing the sonograms of the selected calls with those of reference calls from southern and central Queensland and with reference to published call descriptions (e.g. Reinhold *et al.* 2001; Pennay *et al*. 2004).

Call identification was also guided by considering probability of occurrence based on general distribution information (Churchill 2008; van Dyck *et al.* 2013) and/or database records obtained from Wildlife Online (http://www.ehp.qld.gov.au/wildlife/wildlife-online/index.html) and the Atlas of Living Australia (http://www.ala.org.au).

Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at http://www.ausbats.org.au/.

Species nomenclature follows van Dyck *et al.* (2013).

Results & Discussion

Species identified

Ten species were positively identified from the Blythedale survey data (see Table 1); and another two species may have been present but could not be reliably identified, due to low recording quality and/or inter-specific call similarities.

A number of species that are likely to occur in the study area produce very similar calls that can be difficult to differentiate. Where calls were encountered that could not be resolved to species, all potential candidates were listed as possibly present. The characteristics of these unresolved calls and likelihood of species' presence is discussed further below Table 1.

Table 1. Microbat species recorded during the Blythedale survey, 20-22 January 2014.

♦ = species positively identified from call data

□ = species possibly present, but not reliably identified

Detector:	Anabat 1	Anabat 2	
Date:	3 nights	20-Jan	22-Jan
Total sequence files:	362	534	383
No. calls identified:	38	74	42
SPECIES			
Chalinolobus gouldii	♦	♦	♦
Chalinolobus picatus	□	□	♦
Scotorepens balstoni	♦	♦	♦
Scotorepens greyii	♦	♦	♦
Vespadelus baverstocki	□	♦	□
Vespadelus vulturnus	□	□	
Miniopterus orianae oceanensis	□	□	
Austronomus australis	♦	♦	♦
Mormopterus beccarii	♦	♦	♦
Mormopterus ridei	♦	♦	♦
Mormopterus species 3		♦	♦
Saccolaimus flaviventris	♦	♦	♦

Species/groups not reliably identified

Technical terms used in the following discussion are described in the Glossary.

Chalinolobus picatus, *Scotorepens greyii* and *Vespadelus baverstocki*

Chalinolobus picatus (little pied bat) is listed as **Near Threatened** under the Queensland *Nature Conservation Act 1992* (NCA).

All three species produce a steep FM-qCF pulse with broad frequency sweep and curved or hooked body. Characteristic frequency (Fc) overlaps substantially: with *C. picatus* Fc=39-43 kHz; *S. greyii* Fc=36-41 kHz; and *V. baverstocki* Fc=39-46 kHz. Most calls were reliably identified based on distinctive alternating pulse frequency (*C. picatus*) or uniform pulse frequency either <39 kHz (*S. greyii*) or >42 kHz (*V. baverstocki*). A number of calls with variable (but not distinctly alternating) pulse frequency around 39-41 kHz could have been from any of these three species.

Vespadelus baverstocki, Vespadelus vulturnus* and *Miniopterus orianae oceanensis

At the upper end of its Fc range, *V. baverstocki* also overlaps with both *V. vulturnus* (Fc=45-50 kHz) and *M. o. oceanensis* (Fc=43-48 kHz). The latter species is often distinguishable due to its longer pulse duration, shorter frequency sweep and straighter pulse body, either without a tail or with a down-swept tail ('droopy' pulse shape). The two *Vespadelus* spp. have virtually identical pulse shapes and can only be differentiated where Fc<43 kHz (*V. baverstocki*) or Fc>46 kHz (*V. vulturnus*).

A number of calls from both detectors had Fc=44-45 kHz and variable pulse shape and duration, so could have been from any of these three species. The majority of these had at least half of the pulses with an upswept tail, so were most likely from one or other of the *Vespadelus* spp.; however, the variability in pulse shape and existence of some 'droopy' pulses made reliable identification impossible.

References

Churchill, S. (2008). *Australian Bats*. Jacana Books, Allen & Unwin; Sydney.

Corben, C. (2013). *AnalookW for bat call analysis using ZCA.* Version 3.9f, 22 March 2013.

Pennay, M., Law, B. and Reinhold, L. (2004). *Bat Calls of New South Wales*. Department of Environment and Conservation, Hurstville.

Reardon, T. (2003). Standards in bat detector based surveys. *Australasian Bat Society Newsletter* **20**, 41-43.

Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001). *Key to the bat calls of south-east Queensland and north-east New South Wales*. Department of Natural Resources and Mines, Brisbane.

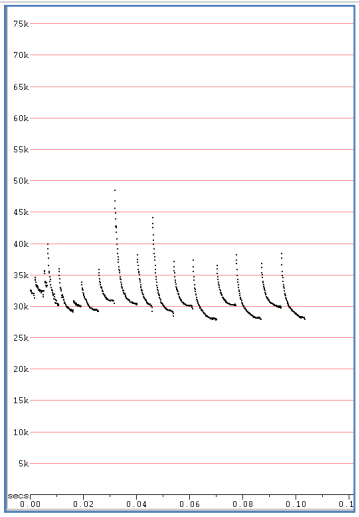
van Dyck, S., Gynther, I. and Baker, A. (eds.) (2013). *Field Companion to The Mammals of Australia.* New Holland; Sydney.

Glossary

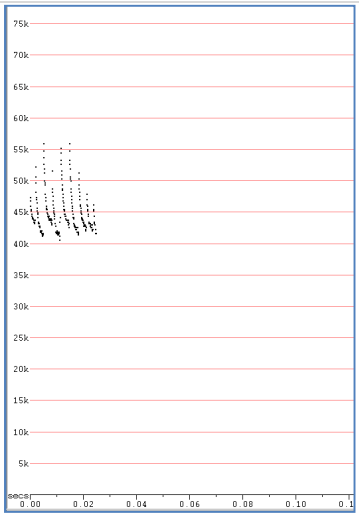
Technical terms used in this report are described in the following table.

Approach phase	The part of a bat *call* emitted as the bat starts to home in on a detected prey item; a transitional series of *pulses* between the *search phase* and *feeding buzz*, that become progressively steeper and shorter in duration.
Call	Refers to a single bat call, made up of a series of individual sound *pulses* in one or more *phases* (*search, approach, feeding buzz*).
CF (=Constant Frequency)	A type of *pulse* in which the dominant component consists of a more-or-less 'pure tone' of sound at a Constant Frequency; with *shape* appearing flat on the sonogram. Often also contains a brief *FM* component at the beginning and/or end of the CF component (*viz.* FM-CF-FM).
Characteristic frequency (Fc)	The frequency of the flattest part of a *pulse*; usually the lowest frequency reached in the *qCF* component of a pulse. This is often the primary diagnostic feature for species identification.
Duration	The time period from the beginning of a *pulse* to the end of the pulse.
Feeding buzz	The terminal part of a *call*, following the *approach phase*, emitted as the bat catches a prey item; a distinctive, rapid series of very steep, very short-duration pulses.
FM (=Frequency Modulated)	A type of *pulse* in which there is substantial change in frequency from beginning to end; *shape* ranges from almost vertical and linear through varying degrees of curvature.
FC range	Refers to the range of frequencies occupied by the *characteristic frequency* section of *pulses* within a call or set of calls.
Frequency sweep or "band-width"	The range of frequencies through which a *pulse* sweeps from beginning to end; Maximum frequency (Fmax) – minimum frequency (Fmin).
Knee	The transitional part of a *pulse* between the initial (usually steeper) frequency sweep and the *characteristic frequency* section (usually flatter); time to knee (Tk) and frequency of knee (Fk) can be diagnostic for some species.
Pulse	An individual pulse of sound within a bat *call*; the *shape*, *duration* and *characteristic frequency* of a pulse are the key diagnostic features used to differentiate species.
Pulse body	The part of the *pulse* between the *knee* and *tail* and containing the *characteristic frequency* section.
Pulse shape	The general appearance of a *pulse* on the sonogram, described using relative terms related to features such as slope and degree of curvature. See also *CF, qCF* and *FM*.
qCF (=quasi Constant Frequency)	A type of *pulse* in which there is very little change in frequency from beginning to end; *shape* appears to be almost flat. Some pulses also contain an *FM* component at the beginning and/or end of the qCF component (*viz.* FM-qCF).
Search phase	The part of a bat *call* generally required for reliable species diagnosis. A consistent series of *pulses* emitted by a bat that is searching for prey or and/or navigating through its habitat. Search phase pulses generally have longer duration, flatter slope and more consistent shape than *approach phase* and *feeding buzz* pulses.
Sequence	Literally, a sequence of *pulses* that may be from one or more bats; but generally refers to a *call* or part (e.g. *phase*) of a call.
Tail	The final component of a *pulse*, following the *characteristic frequency* section; may consist of a short or long sweep of frequencies either upward or downward from the Fc; or may be absent.

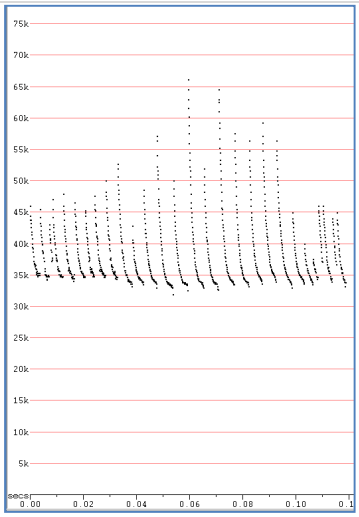
Appendix 1 Representative call sequences from the Blythedale survey, January 2014.
(Scale: 10msec per tick; time between pulses removed)



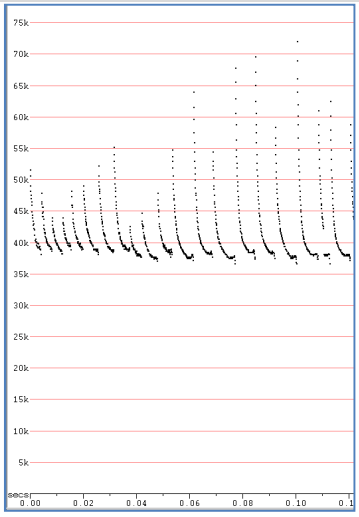
Chalinolobus gouldii



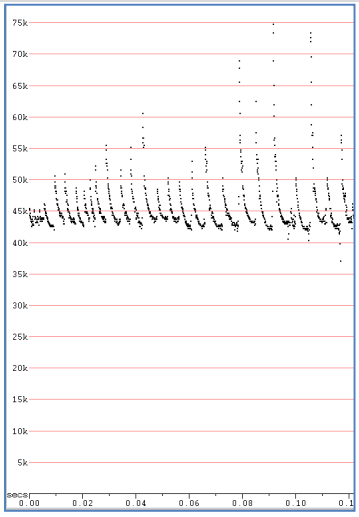
Chalinolobus picatus



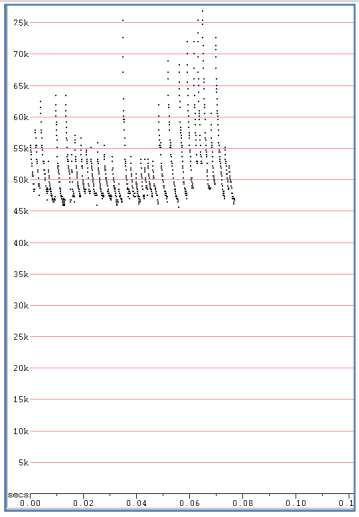
Scotorepens balstoni



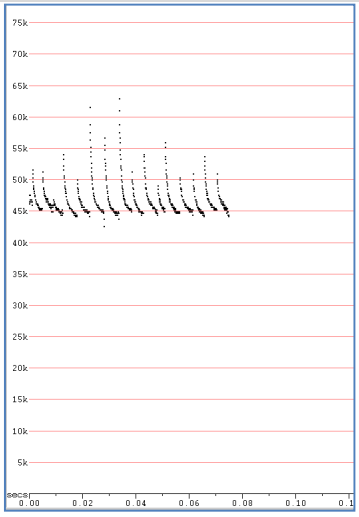
Scotorepens greyii



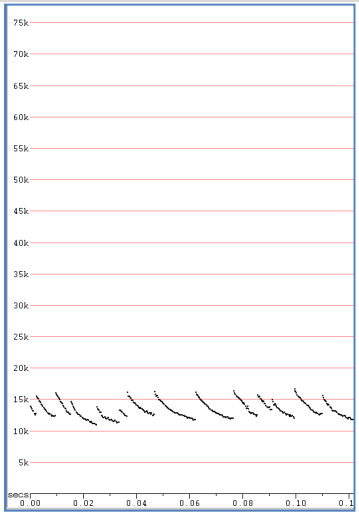
Vespadelus baverstocki



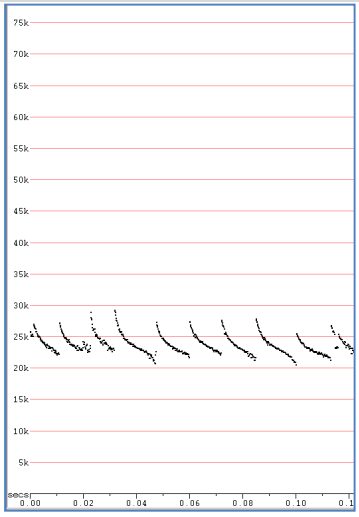
Possibly *Vespadelus vulturnus*



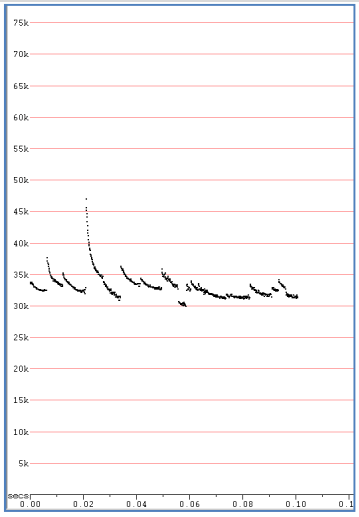
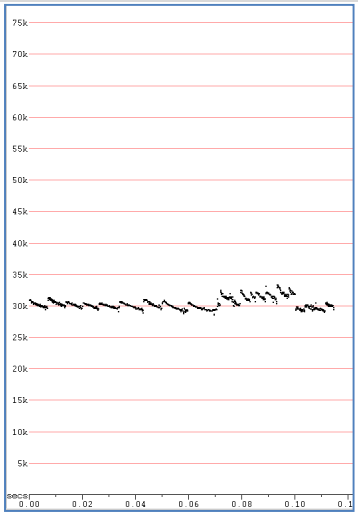
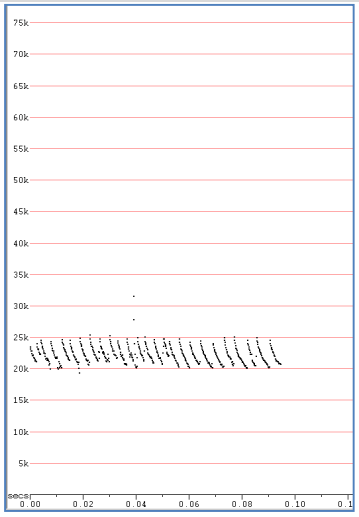
Vespadelus sp. or *M. o. oceanensis*



Austronomus australis



Mormopterus beccarii

		
Mormopterus ridei	*Mormopterus* species 3	*Saccolaimus flaviventris*

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	J Newton & R Feeney	M. Ward K. Neil	Draft	K Neil	Draft	29/02/2014
B	M Ward	K Neil		K Neil		10/06/2014

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