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Memorandum

To	Andrew Stannard	From	Jane Stark c/o Aurecon
Copy		Reference	225678
Date	13 August 2012	Pages (including this page)	14
Subject	Roma Ecological Report – Addendum Memo Lot 2 on RP858912		

Mr Stannard

This memorandum relates to the ground-truthing of the proposed development areas shown in Figure 1.1. This memorandum documents the results of ecological investigations on the following areas:

- Area A near the RM08-17-1 Laydown Plateau on Lot 2 on RP858912 which includes three investigation polygons
- Area B along the north-eastern border of Lot 2 on RP858912 which includes one investigation polygon

The ecological investigations were undertaken on 15 June 2012 by two Aurecon ecologists (Cassandra Arkinstall and John Lynn).

A report specific to the proposed development areas within Lot 2 on RP858912 has previously been prepared and submitted to Santos (Ecological Assessment Report – Roma 2 RP858912; Santos Document Reference 0020-GLNG-4-1.3-0058).

This memorandum should be considered as an addendum to the report listed above. This memorandum is specific to the ecology of Area A and Area B as shown in Figure 1.1. For additional ecological information related to the proposed development area that is in addition to that covered by this memorandum, refer to the appropriate Lot-specific report.

1 Ecological Assessment

1.1 Area A

1.1.1 General

Area A is comprised of three investigation polygons that are all within close proximity to the RM08-17 Laydown Plateau in the south-west of Lot 2 on RP858912. Each polygon (referred to as A1, A2 and A3 in Figure 1.1) contained on average analogous vegetation assemblages and features. Therefore the aggregate results for areas A1 to A3 are presented together in this section.

The landscape of the proposed development area contained a combination of tall woody vegetation and cleared fields. Vegetation clearing for agricultural purposes (ie for grazing and cropping) and road construction activities have previously occurred throughout Area A. Parts of Area A contained agricultural crops at the time of the field investigations.

The landform of the proposed development area is flat and the soil structure contained black/brown clayey loam soils.

The woody vegetation and cleared areas within Area A are mapped as 'non-remnant' on the Department of Environment and Heritage Protection (DEHP) certified Regional Ecosystem (RE) mapping. There are no 'Environmentally Sensitive Areas' (ESAs) within or in close proximity to the proposed development area (closest is located approximately 2.2 km to the north-east).



Legend

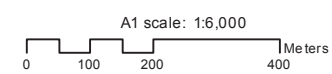
- ☆ EVNT and Type A Species
 - EVNT Region
 - Additional Areas Assessed
 - Corridors - Ground Truth
 - Watercourse
- Amended Regional Ecosystem (Biodiversity Status)**
- Endangered - Dominant
 - Endangered - Sub-dominant
 - Of Concern - Dominant
 - Of Concern - Sub-dominant
 - Not of Concern
- ESA Mapping**
- Category A
 - Category B
 - Category C

Source:
 Cadastre: DERM, 2011.
 Regional Ecosystems: Version 6.1, The State of Queensland (Department of Environment and Resource Management), Sept 2011. As amended by Aurecon, 2011.
 ESAs: Coordinator-General's Evaluation Report for an Environmental Impact Statement – Gladstone Liquefied Natural Gas GLNG Project (May 2010) and the Santos GLNG Project CSG Fields – Environmental Protocol for Constraints Planning and Field Development (September 2011). Note: No ESA buffers have been included on this figure.

Date: 24/07/2012

Version: 1

Map by: PIC P:\GIS\Projects\215648_Fairview_Eop_Assessment\215648_Fairview_145.mxd 24/07/2012 16:22



Job No: 225678
 Coordinate system: GDA_1994_MGA_Zone_55

Santos Upstream Ecological Assessment

Figure 1.1: Additional Development Areas on Lot 2RP858912

A DEHP mapped 'stream order 1' 'watercourse' bisects Area A3 which was dry at the time of assessment. A small drainage line (not mapped by DEHP) was observed within Area A1. This drainage line did not contain a defined bank or bed.

Area A1 contained a recently graded private vehicle access road approximately 7 m in width. This road followed the alignment of the proposed development area.

1.1.2 Floristics

Portions of the landscape of Area A have been modified/disturbed as a result of vegetation clearing associated with agricultural purposes and road construction activities. Portions of Area A contained cultivated crops at the time of the field assessment and displayed limited floristic diversity. Separate portions of Area A contained patches of woody vegetation (ie areas located within the eastern and western portions of Area A1).

The vegetation patches each varied in composition and structure. The canopy stratum in the western portion of Area A1 was dominated by *Eucalyptus populnea* (Poplar Box) and *Casuarina cristata* (Belah). The height range of the canopy stratum was 12 to 15 m and the foliage project cover (FPC) was approximately 24.3% (calculated using the line-intercept method over a 100 m transect adapted from Eyre *et al.* 2011) (refer Appendix B). The stem count for the canopy stratum was calculated to be 1,100 stems per hectare (ha) (calculated from the average of five 10 m by 10 m survey plots) (refer Appendix B).

The patch of woody vegetation in the east of Area A1 was dominated by *C. cristata* (Belah) (refer Photo 1.1). The canopy stratum of this patch was not as dense (< 15% cover) and less high (average height 5 m) when compared with the western patch of vegetation.

Woody vegetation along the extent of the mapped 'watercourse' in Area A3 was sporadic and formed a fragmented canopy stratum (less than 10% cover). The canopy stratum contained equal proportions of *C. cristata* (Belah) and *E. populnea* (Poplar Box) at an average height of 14 m. Area A3 contained no distinct sub-canopy stratum and the composition of the shrub stratum was analogous with Area A1. Native grasses including *Sporobolus creber* (Western Rats Tail) and *Cymbopogon refractus* (Barb Wire Grass) dominated the ground stratum along the extent of mapped 'watercourse' in Area A3.



Photo 1.1 Typical *Casuarina cristata* (Belah) dominated vegetation within the eastern portion of the proposed development area

The sub-canopy stratum of Area A contained species such as *Eucalyptus populnea* (Poplar Box) and *C. cristata* (Belah). The sub-canopy also contained *Acacia harpophylla* (Brigalow). The sub-canopy stratum had a height range of 5 to 9 m. The FPC of the sub-canopy stratum in the western patch of woody vegetation in Area A1 was calculated to be 34% (refer Appendix B). These results are representative of the sub-canopy stratum within the eastern patch of *C. cristata* (Belah) dominated vegetation.

The species composition of the shrub stratum was consistent throughout Area A and contained species including *Eremophila mitchellii* (False Sandalwood), *Geijera parviflora* (Wilga) and *Psydrax oleifolia* (Hatstand). The height range of the shrub stratum was 1 to 4 m. The shrub stratum cover differed between the western and eastern portions of Area A1. The western patch recorded a stem count of 32,400 stems/ha (calculated from the average of five 10 m by 10 m quadrats) (refer Appendix B) while the eastern patch was not as dense. A vegetation assessment of the eastern portion was not undertaken due to lack of substantial mature vegetation and absence of vegetation structure.

Although the ground stratum in areas which had been recently cleared for agricultural purposes was generally depauperate (ie dominated by *Pennisetum ciliare* [(Buffel Grass)], in areas containing woody vegetation (ie eastern and western portions of A1), native grasses were dominant. The species recorded in the vegetated portions included *Chloris truncata* (Windmill Grass), *Aristida caput-medusae* (Curly Head Wire Grass) and *Chloris pectinata* (Comb Chloris). The ground cover was relatively sparse within the western vegetation portion in Area A1 at 44% (calculated from the average of five 1 m by 1 m survey plots) (refer Attachment 1).

No 'Type A Restricted Plant' species as listed under the provisions of the Queensland *Nature Conservation Act 1992* (NC Act) were recorded in the proposed development area. No species of conservation significance (ie 'endangered', 'vulnerable' and 'near threatened' species as listed under the provisions of the NC Act or 'critically endangered', 'endangered' and 'vulnerable' as listed under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act]) were recorded within Area A.

A complete botanical species list is provided in Appendix A.

1.1.3 Habitat Value

Nine (9) incidental fauna observations were recorded within Area A (refer Table 1.1). Fauna species observed are commonly found in the area and are typically generalist species capable of persisting and reoccupying disturbed/modified areas (*Pizzey & Knight 1997; Menkhorst & Knight 2010*).

Table 1.1 Fauna species recorded within Area A

Class	Common Name	Scientific Name
Birds	Australian Magpie	<i>Gymnorhina tibicen</i>
	Australian Raven	<i>Corvus coronoides</i>
	Cockatiel	<i>Nymphicus hollandicus</i>
	Magpie-lark	<i>Grallina cyanoleuca</i>
	Noisy Miners	<i>Manorina melanocephala</i>
	Pied Butcherbird	<i>Cracticus nigrogularis</i>
	Rufous Whistler	<i>Pachycephala rufiventris</i>
	Striated Pardalote	<i>Pardalotus striatus</i>
	Willie Wagtail	<i>Rhipidura leucophrys</i>

The habitat values were analogous for the portions of Area A that contained woody vegetation. The potential for habitat opportunities in the woody vegetation patches within the proposed development area have therefore been amalgamated in this section.

The woody vegetation in Area A provides the following habitat resources:

- Canopy cover suitable for shelter, foraging and perching
- Fissured tree bark
- Dense groundcover vegetation (ie grassy tussocks)
- Woody debris (ie fallen/felled timber, including hollow-bearing logs)
- Small amounts of leaf litter

The canopy cover was considered suitable for utilisation by birds for nesting and shelter sites. There were also potential habitat sites for arboreal mammals provided by numerous hollows in standing and fallen *E. populnea* (Poplar Box) trees. Fissured tree bark, dense groundcover vegetation, woody debris and small amounts of leaf litter may provide habitat suitable for reptiles and small mammals in the form of shelter/nesting/feeding sites.

Parts of Area A have been extensively cleared for agricultural purposes and vegetation in these sections was limited to shelter/foraging sites provided by dense ground cover.

No conservation significant fauna species as listed under the provisions of the EPBC Act and/or the NC Act were recorded during the field investigations.

Overall, the fauna habitat value of Area A was considered medium for the portions that contained suitable canopy cover and habitat opportunities in the ground stratum. The fauna habitat value outside these vegetated portions within Area A was considered low.

1.2 Area B

1.2.1 General

Area B is comprised of a single polygon (approximately 0.82 ha) situated on the north-eastern border of Lot 1 on RP858912 (refer Figure 1.1). The polygon is rectangular in shape and is parallel to a road-reserve running north-south.

A small amount of clearing had recently occurred within the proposed development area. This has resulted from the widening of the existing road. The extent of the clearing was approximately 10 m in width and 100 m in length. All levels of vegetation strata appeared to be impacted by the observed works (refer Photo 1.2).

The landform of Area B was gently undulating and the soil structure contained red clayey-loam soils.

Area B is mapped as 'non-remnant' vegetation on the DEHP certified RE mapping. There are no ESAs located within or in close proximity to the proposed development area (closest is approximately 320 m to the north).

There are no DEHP mapped watercourses within or in proximity to the proposed development area (closest is a 'stream order 2' 'watercourse' located approximately 290 m to the north).

1.2.2 Floristics

The landscape of Area B has been extensively disturbed due to land clearing for agricultural purposes and road construction activities (refer Photo 1.2).



Photo 1.2 Road constructed adjacent to the proposed development area showing patches of *Acacia harpophylla* (Brigalow) disturbed by recent works

A limited amount of woody vegetation was recorded in the canopy and sub-canopy strata within Area B. The canopy stratum was very sparse (< 5% cover) and contained *Eucalyptus melanophloia* (Silver Leaved Ironbark) and *E. populnea* (Poplar Box). The canopy stratum had a height range of 8 to 15 m and was restricted to small stands adjacent to the road reserve. The sub-canopy stratum was comprised of *A. harpophylla* (Brigalow) and *Acacia excelsa* (Ironwood) in addition to species contained recorded in the extant canopy stratum. The height range of the sub-canopy was 4 to 7 m. The sub-canopy cover was approximately 25%.

The shrub stratum within the proposed development area contained species typical of the region including *E. mitchellii* (False Sandalwood), *Alectryon oleifolius* (Boonaree) and *G. parviflora* (Wilga). The shrub stratum also contained species recorded in the extant canopy/sub-canopy stratum and had a height range of 1 to 3 m. The shrub stratum cover was approximately 15% within the proposed development area.

The ground stratum contained a high proportion of exotic species and was dominated by *P. ciliare* (Buffel Grass). The ground stratum was typical of disturbed/modified landscapes in the region and covered approximately 90% of the proposed development area (not including the bare earth along the extent of the road reserve).

No species of conservation significance as listed under the provisions of the NC Act and/or the EPBC Act were recorded within Area B during site investigations.

One 'Type A restricted plant' species was recorded within Area B (ie *Brachychiton populneus* [Kurrajong]). The location of this 'Type A restricted plant' is provided in Table 1.2.

Table 1.2 'Type A Restricted Plant' species recorded within Area B

Scientific Name	Common Name	Easting (GDA 94, Zone 55)	Northing (GDA 94, Zone 55)
<i>Brachychiton populneus</i>	Kurrajong	699391	7074397

1.2.3 Habitat Values

Eleven incidental fauna observations were recorded during site investigations (refer Table 1.3). Fauna species identified are commonly found in the area and are typically generalist species capable of persisting and reoccupying disturbed/modified areas (Pizzey & Knight 1997; Menkhorst & Knight 2010).

Table 1.3 Fauna species observed within Area B

Class	Common Name	Scientific Name
Birds	Apostle Bird	<i>Struthidea cinerea</i>
	Australian Magpie	<i>Gymnorhina tibicen</i>
	Galah	<i>Eolophus roseicapilla</i>
	Magpie-lark	<i>Grallina cyanoleuca</i>
	Mistletoe Bird	<i>Dicaeum hirundinaceum</i>
	Noisy Miners	<i>Manorina melanocephala</i>
	Pale-headed Rosella	<i>Platycercus adscitus</i>
	Pied Butcherbird	<i>Cracticus nigrogularis</i>
	Sulphur-crested Cockatoo	<i>Cacatua galerita</i>
	Torresian Crow	<i>Corvus orru</i>
	Weebill	<i>Smicromnis brevirostris</i>

Area B is contained within a highly modified landscape which has resulted from historical agricultural land management and road construction activities. Area B is unlikely to provide shelter/nesting habitat opportunities suitable for arboreal mammals or birds due to the sparse canopy/sub-canopy cover and limited amount of hollows in standing/fallen timber. There was a limited amount of fissured tree bark, dense groundcover, woody debris and leaf litter which have the potential to provide shelter and nesting sites for small mammals and reptiles.

The overall habitat value of Area B is considered low due to the lack of mature canopy vegetation and disturbance from recent clearing.

2 References

- Eyre, T.J., Kelly, A.L., Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2011). *BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual*. Version 2.1. Department of Environment and Resource Management (DERM), Biodiversity and Ecosystem Sciences, Brisbane.
- Pizzey G and Knight F, 1997, *Field Guide to the Birds of Australia*, Harper Collins Publishers, Australia
- Menkhorst P and Knight F, 2010, *A Field Guide to the Mammals of Australia*, Oxford University Press, United Kingdom

Appendix A

Full list of botanical species recorded within the proposed development areas on Lot 2 on RP858912

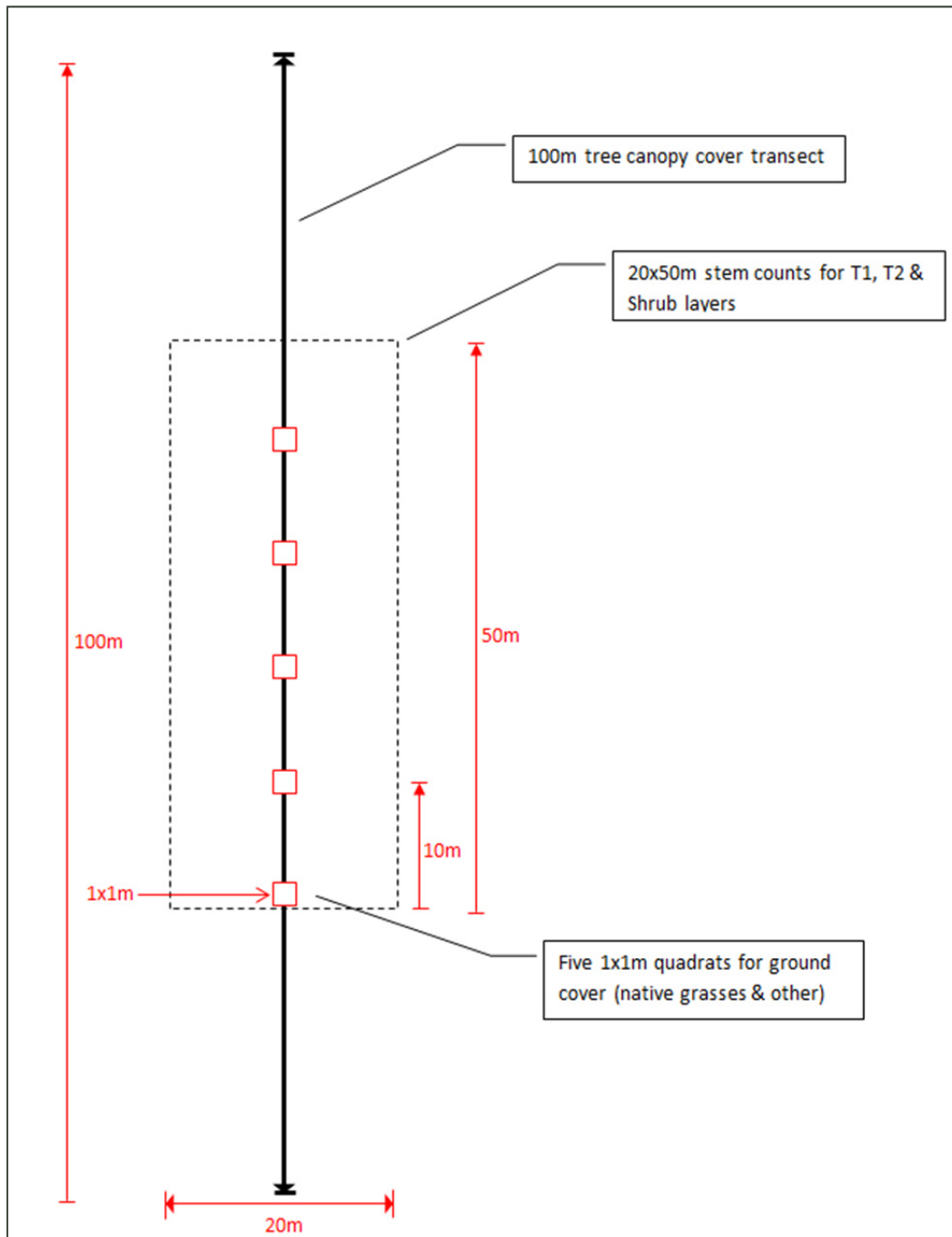
Family	Scientific Name	Common Name	Notes
Apocynaceae	<i>Alstonia constricta</i>	Bitter Bark	
Apocynaceae	<i>Carissa ovata</i>	Currant Bush	
Asteraceae	<i>Bidens pilosa</i>	Cobblers Pegs	Non-native
Asteraceae	<i>Cirsium vulgare</i>	Black Spear Thistle	Non-native
Asteraceae	<i>Conyza bonariensis</i>	Fleabane	Non-native
Cactaceae	<i>Opuntia stricta</i>	Prickly Pear	LP Act Class 2 Weed
Cactaceae	<i>Opuntia tomentosa</i>	Velvety Tree Pear	LP Act Class 2 Weed
Caesalpiniaceae	<i>Senna artemisioides</i>	Senna	
Capparaceae	<i>Apophyllum anomalum</i>	Warrior Bush	
Capparaceae	<i>Capparis lasiantha</i>	Nipan	
Casuarinaceae	<i>Casuarina cristata</i>	Belah	
Chenopodiaceae	<i>Chenopodium desertorum</i>	Desert Goosefoot	
Chenopodiaceae	<i>Einadia hastens</i>	Saltbush	
Chenopodiaceae	<i>Enchylaena tomentosa</i>	Ruby Saltbush	
Chenopodiaceae	<i>Sclerolaena muricata</i>	Black Roly-poly	
Cyperaceae	<i>Cyperus gracilis</i>	Bunchy Sedge	
Lamiaceae	<i>Salvia reflexa</i>	Mint Bush	Non-native
Loranthaceae	<i>Amyema cabbagei</i>	Mistletoe	
Malvaceae	<i>Abutilon oxycarpum</i>	Chinese Lantern	
Mimosaceae	<i>Acacia deanei</i>	Dean's Wattle	
Mimosaceae	<i>Acacia excelsa</i>	Ironwood	
Mimosaceae	<i>Acacia harpophylla</i>	Brigalow	
Myoporaceae	<i>Eremophila deserti</i>	Turkeybush	
Myoporaceae	<i>Eremophila mitchellii</i>	False Sandalwood	
Myrtaceae	<i>Eucalyptus melanophloia</i>	Silver Leaved Ironbark	
Myrtaceae	<i>Eucalyptus populnea</i>	Poplar Box	
Oleaceae	<i>Jasminum didymum</i>	Native Jasmine	
Pittosporaceae	<i>Pittosporum angustifolium</i>	Native Apricot	
Poaceae	<i>Aristida caput-medusae</i>	Curly Head Wire Grass	
Poaceae	<i>Aristida contorta</i>	Curly Wire-grass	
Poaceae	<i>Aristida jerichoensis</i>	Jericho Wire Grass	
Poaceae	<i>Aristida sp</i>		
Poaceae	<i>Chloris pectinata</i>	Comb Chloris	
Poaceae	<i>Chloris truncata</i>	Windmill Chloris	
Poaceae	<i>Cymbopogon refractus</i>	Barbwire Grass	

Family	Scientific Name	Common Name	Notes
Poaceae	<i>Cymbopogon sp</i>		
Poaceae	<i>Megathyrsus maximus</i>	Green Panic	Non-native
Poaceae	<i>Panicum effusum</i>	Inquisitive Grass	
Poaceae	<i>Panicum simile</i>	Two-coloured Panic	
Poaceae	<i>Pennisetum ciliare</i>	Buffel Grass	Non-native
Poaceae	<i>Sporobolus caroli</i>	Desert Sporobolus	
Poaceae	<i>Sporobolus creber</i>	Western Rat's Tail Grass	
Poaceae	<i>Tragus australianus</i>	Burr Grass	
Poaceae	<i>Urochloa mosambicensis</i>	Sabi Grass	Non-native
Polygonaceae	<i>Rumex sp</i>	Dock	
Rubiaceae	<i>Psydrax oleifolia</i>	Hat stand	
Rutaceae	<i>Citrus glauca</i>	Lime Bush	
Rutaceae	<i>Geijera parviflora</i>	Wilga	
Santalaceae	<i>Santalum lanceolatum</i>	Sandalwood	
Sapindaceae	<i>Alectryon diversifolius</i>	Scrub Boonaree	
Sapindaceae	<i>Alectryon oleifolius</i>	Boonaree	
Sapindaceae	<i>Atalaya hemiglauca</i>	Whitewood	
Sapindaceae	<i>Dodonaea viscosa</i>	Sticky Hopbush	
Solanaceae	<i>Solanum nigrum</i>	Black Nightshade	Non-native
Solanaceae	<i>Solanum stelligerum</i>	Devil's Needles	
Sterculiaceae	<i>Keraudrenia collina</i>	Keraudrenia	
Verbenaceae	<i>Verbena tenuisecta</i>	Mayne's Curse	Non native

Appendix B – Detailed vegetation survey data collected for Area A

This attachment provides the ground cover, canopy cover and stem count data collected during the field investigation for Area A which is referenced throughout the ecological assessment. The diagram below shows the transect arrangement in the field.

This data was not collected for Area B as it was not considered to be a 'Vegetation Community' as defined under the Fairview Project Area Environmental Authority (DERM Permit Number: PEN100178208).



Woody vegetation patch in the west of Area A1

Ground cover data

The following values indicate the percentage of each ground cover category for five (5) 1x1 m quadrats. The average ground cover for each category is also provided in the 'Averages' column.

Groundcover	Q 1 (%)	Q 2 (%)	Q 3 (%)	Q 4 (%)	Q 5 (%)	Averages (%)
Bare ground/rock	5	15	15	5	10	10
Grasses/forbs	80	80	35	25	0	44
Shrubs	-	-	-	-	-	-
Woody debris and leaf litter	15	5	50	70	65	41

Stem count data

The following table is the stem count data collected during the field investigation for the Canopy (T1), Sub-canopy (T2) and Shrub layer (S1). The heights for each of the stratum are also defined below.

Transect	Stem counts per stratum per 50 x 20 m plot		
	T1 (12-15 m)	T2 (5-9 m)	S1 (1-4 m)
0-10m	2	6	45
10-20m	0	7	39
20-30m	1	8	80
30-40m	3	9	80*
40-50m	5	13	80*
Totals	11	43	324

Stems per hectare calculations

- **T1** (11-15 m) – 1100 stems per hectare
- **T2** (5-9 m) – 4300 stems per hectare
- **S1** (1-4 m) – 32400 stems per hectare

Foliage projective cover data

The total Foliage Projective Cover (FPC) for the T1 and T2 canopies along a 100 m transect, expressed as a percentage is:

- **T1** (11-15 m) – **24.3% FPC**
- **T2** (5-9 m) – **33.5% FPC**

The canopy transect data collected during the field investigation is provided in the following table.

Stratum	Distance		Total (m)
	Start	End	
0-50 m			
T2	0	2	2
T2	7.6	9.4	1.8
T2	9.6	13.3	3.7
T2	14.9	15.7	0.8
T1	27.1	31.9	4.8
T2	44.3	49.6	5.3
T1	45.1	46.8	1.7
T1	48	50	2
50-100 m			
T1	0	12.95	12.95
T2	14	17.9	3.9
T2	23.9	26	2.1
T2	27.1	29.6	2.5
T2	30.4	34	3.6
T2	38.8	46.6	7.8
T1	47.2	50	2.8