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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)	**13**
Subject	**Roma Ecological Assessment Report – Addendum Lot 94 on WV456**		

Mr Stannard

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

- Area A to the west of the R78 corridor within Lot 94 on WV456
- Area B along the north-western property border of Lot 94 on WV456 and adjacent road reserve

Ecological investigations of the proposed development areas were undertaken on 14 June 2012 by two Aurecon ecologists (Cassandra Arkinstall and John Lynn).

Multiple reports and addendums have been previously prepared and submitted to Santos which contain ecological assessments of additional proposed development areas within Lot 94 WV456.

The Santos Document Reference numbers for these documents are:

- 0020-GLNG-4-1.3-0086 and associated addendums
- 0020-GLNG-4-1.3-0026
- 0020-GLNG-4-1.3-0022-02
- 0020-GLNG-4-1.3-0022-04
- 0020-GLNG-4-1.3-0078-01
- 0020-GLNG-4-1.3-0079-01

This memorandum should be treated as an addendum to the report listed above. This memorandum is specific to the ecology of the proposed development area illustrated in Figure 1.1.

1 Ecological Assessment

1.1 Area A

1.1.1 General

The proposed development area is situated within a modified/disturbed environment that has resulted from clearing for agricultural activities (eg grazing of livestock). Mature woody vegetation is therefore limited and occurs sporadically throughout Area A.

Woody vegetation is generally denser along a drainage-line which traverses the proposed development area. This drainage-line is mapped as a ‘stream order 1’ ‘watercourse’ by the Department of Environment and Heritage Protection (DEHP) hydrology layer (version 2.1, 2011) and is the only mapped ‘watercourse’ located within the proposed development area. The ‘watercourse’ flows north to south through Area A and crosses through a small (approximately 0.13 ha) dam constructed in the south of the proposed development area. The ‘watercourse’ converges with a large ‘stream order 5’ ‘watercourse’ approximately 80 m south of Area A.

The woody vegetation and cleared areas within the proposed development area are mapped as ‘non-remnant’ in 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 approximately 560 m to the north-east and is a Category C ESA).

The landform of Area A is flat to gently sloping and the soil structure is comprised mostly of dark clayey loam with alluvial soils occurring along the extent of the watercourse.

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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 Liquified 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: 27/07/2012 Version: 1

Map by: JPC P:\GIS\Projects\215648_Fairview_Eco_Assessment\215648_Fairview_146.mxd 27/07/20 12 15:17

A1 scale: 1:4,300

0 100 200 400 Meters

Job No: 225678

Coordinate system: GDA_1994_MGA_Zone_55

Santos Ecological Assessment

Figure 1: Additional Development Areas on Lot 94WV456

1.1.2 Floristics

The landscape of Area A has been modified as a result of previous land management practices. Clearing for agricultural purposes has previously occurred throughout most of the proposed development area and woody vegetation in these areas is therefore likely to be regrowth. This is evident in the sporadic cover of the canopy/sub-canopy strata and the dominance of exotic pasture grasses in the ground stratum (refer Photo 1.1). Extensive clearing of vegetation has not, however, occurred along the extent of the mapped 'stream order 1' 'watercourse' (refer Photo 1.2). Woody vegetation in immediate proximity to the 'watercourse' is denser and most likely older regrowth.

The species composition of the canopy stratum was consistent throughout the proposed development area and was dominated by *Eucalyptus populnea* (Poplar Box) with associated *Eucalyptus melanophloia* (Silver Leaf Ironbark). The canopy cover was approximately 30% on average for the entire proposed development area. The canopy cover within the vegetation along the extent of the 'watercourse' was denser than the surrounding fields and the Foliage Projective Cover (FPC) recorded in this area was approximately 70%. FPC was calculated using the line-intercept method over 100 m transect adapted from Eyre *et al*, 2011 (refer Appendix B). The canopy stratum had a height range of 8 to 14 m which was consistent throughout the proposed development area.

The species composition and vegetation structure of the sub-canopy stratum was consistent throughout Area A. The sub-canopy stratum had a height range of 5 to 8 m and contained *Alectryon oleifolius* (Boonaree) and *Callitris glaucophylla* (White Cypress Pine). An FPC of approximately 14% was recorded within the sub-canopy of the vegetation along the extent of the 'watercourse' (refer Appendix B). This result was also representative of the sub-canopy cover throughout the entire proposed development area.

The shrub stratum covered less than 5% of the proposed development area and there were no shrub species recorded within the transect plots along the extent of the watercourse (refer Appendix B). Species recorded in the shrub stratum included regrowth of common canopy/sub-canopy strata species (eg *Allocasuarina luehmannii* [Bull Oak], *Acacia excelsa* [Ironwood] and *C. glaucophylla* [White Cypress Pine]) and typical shrub species at an average height of 1.5 m.

The species composition of the ground stratum was not homogenous throughout the proposed development area. Along the extent of the 'watercourse' the ground stratum was dominated by native grasses including *Themeda triandra* (Kangaroo Grass) and *Themeda avenacea* (Wild Oats Grass). The ground stratum in the more disturbed areas was dominated by the exotic pasture grass *Pennisetum ciliare* (Buffel Grass). The ground cover within the 'watercourse' vegetation was approximately 87% (calculated from the average of five (5) 1 m by 1 m survey plots). This result was also representative of the ground cover throughout the proposed development area.

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 list of botanical species recorded in Area A is provided in Appendix A.

Photo 1.1 **Landscape facing south in Area A towards the mapped 'watercourse' depicting sporadic canopy/sub-canopy strata and exotic pasture grass dominated ground stratum**

Photo 1.2 **Depiction of typical dense canopy/sub-canopy vegetation and native grass dominated ground stratum along the extent of the mapped 'watercourse'**

1.1.3 Habitat Values

Sixteen incidental fauna observations were recorded during site investigations (refer Table 1.1). Fauna species included 15 birds and one mammal which occur commonly in the area and have broad habitat ranges (*Pizzey & Knight 1997*; *Menkhorst & Knight 2010*).

Table 1.1 Incidental fauna species recorded within Area A

Class	Common Name	Scientific Name
Birds	Australian Magpie	*Gymnorhina tibicen*
	Cockatiel	*Nymphicus hollandicus*
	Glossy Black-Cockatoo	*Calyptorhynchus lathami*
	Laughing Kookaburra	*Dacelo novaeguineae*
	Little Corella	*Cacatua sanguinea*
	Magpie-Lark	*Grallina cyanoleuca*
	Noisy Miner	*Manorina melanocephala*
	Pale-headed Rosella	*Platycercus adscitus*
	Pied Butcherbird	*Cracticus nigrogularis*
	Striated Pardalote	*Pardalotus striatus*
	Sulphur-crested Cockatoo	*Cacatua galerita*
	Torresian Crow	*Corvus orru*
	Weebill	*Smicrornis brevirostris*
	White-faced Heron	*Egretta novaehollandiae*
	Willie Wagtail	*Rhipidura leucophrys*
Mammals	Eastern Grey Kangaroo	*Macropus giganteus*

The landscape of Area A contained heterogeneous vegetation structures that have been subject to varying levels of modification/disturbance. Habitat opportunities were consequently lower in the areas where more extensive clearing has occurred when compared to areas that have experienced fewer disturbances (ie along the extent of the mapped 'watercourse').

Habitat opportunities in the cleared areas were limited to dense groundcover vegetation and leaf litter which may provide shelter/nesting sites for reptiles or small mammals. The canopy cover throughout the proposed development area could provide shelter, foraging and nesting sites for utilisation by birds. The habitat potential was higher along the extent of the 'watercourse' where the canopy cover was denser than the surrounding cleared areas.

Throughout Area A there were potential feeding and shelter opportunities provided by fissured tree bark and woody debris from fallen/felled timber. Insects within the decaying woody debris/tree bark may provide suitable feeding opportunities for various insectivorous mammals, birds and reptiles.

The dam in the south of Area A had the potential to provide shelter/breeding/feeding sites for amphibians and reptiles, and act as a water source for birds. The 'stream order 5' 'watercourse' (located approximately 80 m to the south) is expected to be supportive of various bird, reptile and mammal species. These fauna species could also occupy and utilise habitat opportunities provided by the 'stream order 1' 'watercourse' and dam within the proposed development area.

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

The overall habitat value of Area A is considered low to moderate due to the reasons listed above.

1.2 Area B

1.2.1 General

The proposed development area is located along the north-western border of Lot 94 on WV456 and also within an adjacent road casement. The landscape of Area B is a highly modified/disturbed environment as a result of clearing for the construction of a road. Woody vegetation within the proposed development area occurs sporadically and is fragmented from surrounding vegetation by the cleared fields to the north and south.

Area B is mapped as 'non-remnant' vegetation by DEHP certified RE mapping. There are no ESAs located within or in close proximity to the proposed development area (closest is approximately 580 m to the south and is a Category C ESA).

Two DEHP mapped 'watercourses' traverse the proposed development area;

- A 'stream order 2' 'watercourse' flowing north-west to south-east in the eastern portion of Area B
- A 'stream order 1' 'watercourse' flowing north-east to south-west approximately 100 m east of the above 'watercourse'

The landform of Area B is gently undulating and the soil structure is comprised of red loam.

1.2.2 Floristics

Area B contained sporadic stands of mature and regrowth vegetation along the alignment of the road casement. The patches of woody vegetation in Area B are a combination of both mature vegetation and regrowth vegetation that has established following clearing for road construction (refer Photo 1.3). This is reflected in the broad height range of the canopy stratum (16 to 23 m) and sporadic canopy cover (between 30 and 35%) throughout the proposed development area.

Photo 1.3 **Landscape facing south-west in Area B along the extent of the road depicting mature and regrowth vegetation, and the road casement**

The canopy stratum was comprised mainly of *E. populnea* (Poplar Box) and *E. melanophloia* (Silver Leaf Ironbark) which are both typical of landscapes in the region. These species were also recorded in the sub-canopy layer which also contained *Eremophila mitchellii* (False Sandalwood), *Geijera parviflora* (Wilga) and *C. glaucophylla* (White Cypress Pine). The sub-canopy had a height range of 6 to 12 m and sub-canopy cover was approximately 15%.

The shrub stratum in Area B was comprised of species recorded in the extant canopy/sub-canopy strata and other common shrub species. *Lycium ferocissimum* (African Boxthorn), *Opuntia stricta* (Prickly Pear) and *Opuntia tomentosa* (Velvet Tree Pear) were also recorded within the road casement. All three shrub species are declared as 'Class 2 Pest Plants' under the provisions of the Queensland *Land Protection (Pest and Stock Route Management) Act 2002*. The shrub stratum had a height range of 1 to 4.5 m and covered approximately 20% of the proposed development area.

The ground stratum within the proposed development area was relatively dense (between 90 and 95% not including the bare earth along the extent of the road reserve). The proportion of exotic grasses and forbs within the ground stratum of Area B was high and was dominated by *P. ciliare* (Buffel Grass).

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. No 'Type A Restricted Plant' species as listed under the provisions of the NC Act were recorded in the development areas.

A list of botanical species recorded within the development area is provided in Appendix A.

1.2.3 Habitat Values

Eight incidental fauna species were recorded during field investigations (refer Table 1.2). The species were all birds which are all commonly found in the area.

Table 1.2 Incidental fauna species recorded within Area B

Class	Common Name	Scientific Name
Birds	Australian Magpie	*Gymnorhina tibicen*
	Crested Pigeon	*Ocyphaps lophotes*
	Galah	*Eolophus roseicapilla*
	Magpie-Lark	*Grallina cyanoleuca*
	Noisy Miner	*Manorina melanocephala*
	Striated Pardalote	*Pardalotus striatus*
	Weebill	*Smicrornis brevirostris*
	Willie Wagtail	*Rhipidura leucophrys*

Habitat opportunities within Area B included:

- Canopy cover suitable for shelter, foraging and perching
- Fissured tree bark
- Dense groundcover vegetation

The canopy cover in the proposed development area could provide nesting/shelter sites for birds. The woody vegetation that forms the canopy cover in Area B was sporadic and fragmented and therefore unlikely to support arboreal mammals. The proposed development area also contains an active public vehicle road which is likely to further compromise habitat opportunities.

There were limited amounts of woody debris from fallen/felled timber, low amounts of leaf litter in the ground stratum and a small amount of rocky crevices. The potential for fauna to utilise these sites for shelter and feeding is limited as a result of their scarcity throughout the proposed development area.

The overall habitat of Area B is considered low due to its level of disturbance and fragmentation from surrounding vegetation.

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

Botanical species recorded within the proposed development areas on Lot 94 on WV456

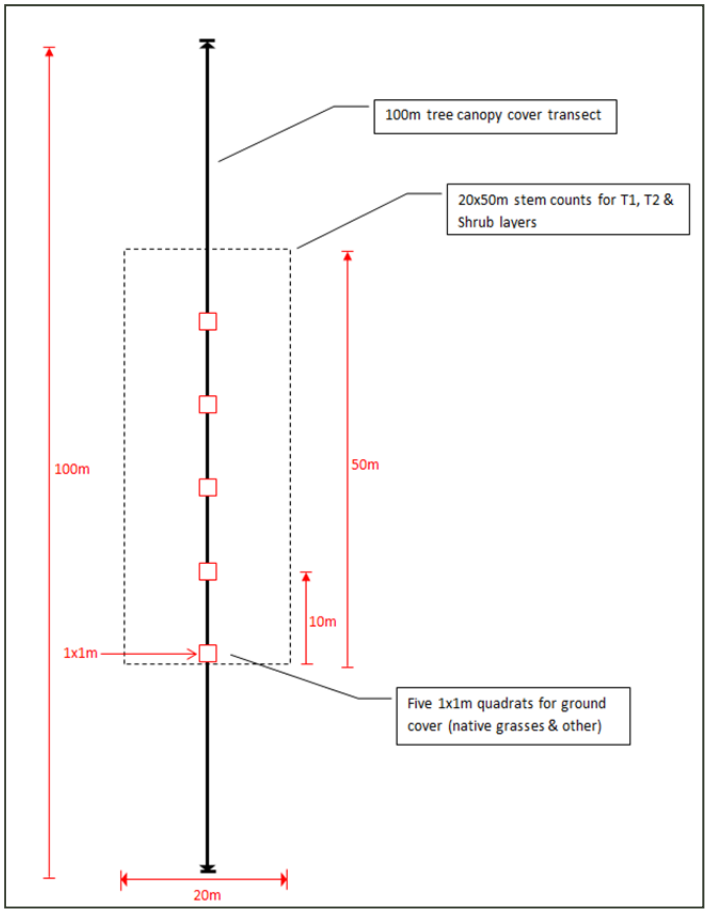
Family	Scientific Name	Common Name	Notes
Adiantaceae	*Cheilanthes sieberi*	Mulga Fern	
Asteraceae	*Bidens pilosa*	Cobblers Pegs	Non-native
Asteraceae	*Chrysocephalum apiculatum*	Yellow Buttons	
Asteraceae	*Cirsium vulgare*	Black Spear Thistle	Non-native
Asteraceae	*Conyza bonariensis*	Fleabane	Non-native
Asteraceae	*Tagetes minuta*	Stinking Rodger	Non-native
Asteraceae	*Xanthium occidentale*	Noogoora Burr	Non-native
Asteraceae	*Xerochrysum bracteatum*	Everlasting Daisy	
Brassicaceae	*Rapistrum rugosum*	Turnip Weed	Non-native
Cactaceae	*Opuntia stricta*	Prickly Pear	LP Act Class 2 Weed
Cactaceae	*Opuntia tomentosa*	Velvety Tree Pear	LP Act Class 2 Weed
Casuarinaceae	*Allocasuarina luehmannii*	Bull Oak	
Casuarinaceae	*Casuarina cristata*	Belah	
Chenopodiaceae	*Sclerolaena muricata*	Black Roly-poly	
Chenopodiaceae	*Maireana microphylla*	Small-leaf Bluebush	
Convolvulaceae	*Evolvulus alsinoides*	Speed Well	
Cupressaceae	*Callitris glaucophylla*	White Cypress Pine	
Cyperaceae	*Cyperus bifax*	Star Sedge	
Cyperaceae	*Cyperus rotundus*	Nut Grass	Non-native
Cyperaceae	*Fimbristylis dichotoma*	Fimbristylis	
Fabaceae	*Glycine tomentella*	Hairy Glycine	
Juncaceae	*Juncus usitatus*	Juncus	
Lamiaceae	*Salvia reflexa*	Mint Bush	Non-native
Lamiaceae	*Spartothamnella puberula*	Spiky Bush	
Laxmanniaceae	*Lomandra leucocephala*	Lomandra	
Laxmanniaceae	*Lomandra multiflora*	Lomandra	
Malvaceae	*Abutilon malvifolium*	Chinese Lantern	
Malvaceae	*Malvastrum americanum*	Spiny Malvastrum	
Malvaceae	*Sida acuta*	Spiny-headed Sida	
Malvaceae	*Sida hackettiana*	Queensland Hemp	
Mimosaceae	*Acacia excelsa*	Ironwood	
Myoporaceae	*Eremophila mitchellii*	False Sandalwood	
Myrsinaceae	*Anagallis arvensis*	Scarlett Pimpernel	Non-native
Myrtaceae	*Eucalyptus melanophloia*	Silver Leaved Ironbark	
Myrtaceae	*Eucalyptus populnea*	Poplar Box	
Pittosporaceae	*Pittosporum undulatum*	Pittosporum	

Family	Scientific Name	Common Name	Notes
Poaceae	*Aristida holathera*	Tall Wire Grass	
Poaceae	*Bothriochloa bladhii*	Forest Blue Grass	
Poaceae	*Bothriochloa decipiens*	Pitted Blue Grass	
Poaceae	*Bothriochloa ewartiana*	Desert Blue Grass	
Poaceae	*Chloris pectinata*	Comb Chloris	
Poaceae	*Chloris truncata*	Windmill Grass	
Poaceae	*Chloris virgata*	Silky Topped Rhodes Grass	
Poaceae	*Cymbopogon refractus*	Barbwire Grass	
Poaceae	*Dichanthium sericeum*	Queensland Blue Grass	
Poaceae	*Eragrostis fallax*	Tall Lovegrass	
Poaceae	*Heteropogon contortus*	Black Spear Grass	
Poaceae	*Megathyrsus maximus*	Green Panic	Non-native
Poaceae	*Melinis repens*	Red Natal	Non-native
Poaceae	*Panicum decompositum*	Native Millet	
Poaceae	*Panicum effusum*	Hairy Panic	
Poaceae	*Pennisetum ciliare*	Buffel Grass	Non-native
Poaceae	*Themeda avenacea*	Wild Oats Grass	
Poaceae	*Themeda triandra*	Kangaroo Grass	
Poaceae	*Urochloa mosambicensis*	Sabi Grass	Non-native
Polygonaceae	*Rumex sp.*	Swamp Dock	Non-native
Rubiaceae	*Psydrax oleifolia*	Hat stand	
Rutaceae	*Geijera parviflora*	Wilga	
Santalaceae	*Santalum lanceolatum*	Sandalwood	
Sapindaceae	*Alectryon diversifolius*	Scrub Boonaree	
Sapindaceae	*Alectryon oleifolius*	Boonaree	
Solanaceae	*Lycium ferocissimum*	African Boxthorn	LP Act Class 2 Weed
Verbenaceae	*Verbena officinalis*	Common Verbena	
Verbenaceae	*Verbena tenuisecta*	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' due to lack of substantial mature vegetation and absence of vegetation structure.



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	-	-	-	-	-	-
Grasses/forbs	95	93	85	85	80	87.6
Shrubs	-	-	-	-	-	
Woody debris and leaf litter	5	7	15	15	20	12.4

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 (20 x 50 m plot)		
	T1 (8-14 m)	T2 (5-8 m)	S1 (1-4 m)
0-10 m	1	0	0
10-20 m	7	1	0
20-30 m	7	1	1
30-40 m	5	0	0
40-50 m	4	0	2
Totals	**24**	**2**	**3**

Stems per hectare calculations

- **T1** (8-14 m) – 240 stems per hectare
- **T2** (5-8 m) – 20 stems per hectare
- **S1** (1-4 m) – 30 stems per hectare

Foliage Projective Cover data

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

- **T1** (8-14 m) – 70.4% **FPC**
- **T2** (5-8 m) – 14**% FPC**

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

Stratum	Distance (m)		Total (m)
	Start	End	
0-50 m			
T1	3.3	11.3	8
T2	8.6	13.9	5.3
T1	14.4	25.9	11.5
T1	30.7	33.2	2.5
T1	35.5	36	0.5
T1	37.1	50	12.9
50-100 m			
T1	50	54.2	4.2
T1	56.8	64.3	7.5
T2	67.6	72.5	4.9
T1	73.6	79.8	6.2
T2	78.4	81.2	2.8
T1	81.2	95.3	14.1
T2	92.6	93.6	1
T1	97	100	3
TOTAL T1 (%)			70.4
TOTAL T2 (%)			14