GLNG Project

Remediation, Rehabilitation, Recovery and Monitoring Plan

Coal Seam Gas Fields

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Important Note

In preparing this report we have made certain assumptions. We have assumed that all information and documents provided to us by the Client or as a result of a specific request or enquiry were complete, accurate and up-to-date. Where we have obtained information from a government register or database, we have assumed that the information is accurate. Where an assumption has been made, we have not made any independent investigations with respect to the matters the subject of that assumption. We are not aware of any reason why any of the assumptions are incorrect.

Document Control

Version	Purpose of Document	Orig	Review	Review Date	QA Review	RPS Release Approval	Issue Date
Rev 1	Final for Submission	HR	BD	12/7/2011	BD	BD	13/7/2011
Rev 2	Final, incorporating SEWPaC amendments	HR	BD	29/9/2011	BD	BD	7/11/2011
Rev 3	Final, including Arcadia Valley Project Area	HR	BD	2/12/2011	BD	BD	2/12/2011
Rev 4	Final, incorporating SEWPaC amendments	HR	BD	19/12/2011	BD	BD	19/12/2011

Qualifications

Name	Position	Qualification	Role
Brad Dreis	Senior Ecologist	B Env Mgt (Hons)	Project Manager / Technical Review
Hannah Rowan	Ecologist	BSc (Env)	Author
Colleen Regan	Technical Director	BSc (AES)	Project Director / Quality Assurance

Revision Register

Revision Reference	Purpose	Date	Approval

The above register is intended to record and describe changes to the document arising from internal review, updates, and audits. This document is considered a living document, and will be periodically updated. All revisions will be submitted to SEWPaC for approval prior to implementation.

List of Abbreviations

Abbreviation	Meaning
APIA	Australian Pipeline Industry Association
APPEA	Australian Petroleum Production and Exploration Association
ASS	Acid Sulfate Soils
ATP	Authority To Prospect
AVPA	Arcadia Valley Project Area
CG	Coordinator-General
CG Conditions	Conditions of the Coordinator-General's evaluation report for an environmental impact statement – GLNG project dated May 2010
CS	Compressor Station
CSG	Coal Seam Gas
DDMP	Demolition Management Plan
DEEDI	Department of Employment, Economic Development and Innovation
DERM	Department of Environment and Resource Management
E	Endangered
EA	Environmental Authority
EA Conditions	*Conditions of EA PEN 101578919 (Roma field), EA PEN 100178208 Fairview field), EA PEN 102125611 (Arcadia Valley field)*
EHS	Environmental, Health and Safety
EHSMS	Environment Health and Safety Management System
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Cth)*
EMP	Environmental Management Plan
EPBC Act Approval	EPBC Act Approval dated 22 October 2010 in respect of referral EPBC No 2008/4059
EIS	Environmental Impact Statement
EQ	Environmental Quality
ESA	Environmentally Sensitive Areas
ESCM	Erosion and Sediment Control Manual
FPA	Fairview Project Area
Field MP	Field Management Procedures
FMP	Fauna Management Plan
FDP	Field Development Plan
GTP	Gas Transmission Pipeline
GLNG	Gladstone Liquefied Natural Gas
GPS	Global Positioning System
GQAL	Good Quality Agricultural Land
HDPE	High-density Polyethylene
HVR	High Value Regrowth
LC	Least Concern
LNG	Liquefied Natural Gas

MNES	Matters of National Environmental Significance
MSDS	Material Safety Data Sheet
NC Act	*Nature Conservation Act 1992*
OC	Of Concern
PL	Petroleum Lease
PPL	Petroleum Pipeline License
PWMP	Pest and Weed Management Plan
QFRS	Queensland Fire and Rural Service
RE	Regional Ecosystem
RFDA	Reasonably Foreseeable Development Area
RO	Reverse Osmosis
RoW	Right of Way
RRRMP	Remediation, Rehabilitation, Recovery and Monitoring Plan
RSGPA	Roma Shallow Gas Project Area
SEIS	Supplementary Environmental Impact Statement
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
SMP	Soil Management Procedure
SSMP	Significant Species Management Plan
TEC	Threatened Ecological Community
The Project	The GLNG Project
VMA	*Vegetation Management Act 1999*

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1.0 Introduction

1.1 Background

The Gladstone Liquefied Natural Gas (GLNG) project (the Project), including the Coal Seam Gas (CSG) fields, gas transmission pipeline (GTP), LNG liquefaction and export facility and associated marine facilities, have been approved by the Minister for Sustainability, Environment, Water, Population and Communities and the Queensland Coordinator-General. The Coal Seam Gas fields component of the Project is operated by Santos on behalf of the GLNG joint venture.

The Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) approval conditions (EPBC referral number 2008/4059) (EPBC Act Approval) require the development and approval of a Remediation, Rehabilitation, Recovery and Monitoring Plan (RRRMP) before the commencement of gas field development, including responses to threats to Matters of National Environmental Significance (MNES) and measures to support recovery of threatened species habitat and threatened ecological communities.

The conditions of the Coordinator-General's evaluation report for the Project dated May 2010 (CG Conditions) and the Environmental Authorities (EAs) PEN 101578910, PEN 100178208, and PEN102125611 being the EAs issued to date for the Fairview, Roma and Arcadia Valley project areas respectively also contain rehabilitation requirements. Additionally, the Environmental Management Plans (EMPs) for the CSG fields include commitments to the development of a comprehensive rehabilitation plan to guide environmental management and rehabilitation processes.

This RRRMP has been developed to address the relevant requirements of:

(1) the EPBC Act Approval;

(2) the CG Conditions; and

(3) the EA Conditions including the relevant commitments made within the associated EMPs.

Appendix 1 includes a compliance matrix outlining the relevant report sections where each condition is addressed.

1.2 RRRMP Context

This RRRMP will form part of the Environmental Protocol for Constraints Planning and Field Development (the Protocol, Santos 2011a), Operational Plans and Decommissioning Plans as required by the EPBC Act Approval and CG Conditions. The Protocol outlines the approach Santos as Operator on behalf of the GLNG joint venture will take in identifying, assessing and managing potential impacts to Matters of National Environmental Significance (MNES) and State related matters through the use of Field Management Procedures (FMP), and is discussed further in **Section 2.2**.

This RRRMP has been prepared to address the Roma, Fairview and Arcadia Valley fields known as the Reasonably Foreseeable Development Area (RFDA). The development of the GLNG CSG fields will involve a rolling program of construction, operation, decommissioning and rehabilitation of GLNG CSG

infrastructure over a large area for a significant length of time. Planning for field development, including the specific locations of exploration and development wells and associated infrastructure is determined incrementally based on the outcome of ongoing exploration programs. Accordingly, the RRRMP has been prepared to specifically address the rehabilitation requirements for the first significant stage of the gas field development, known as Stage 1 of the CSG field development (refer to **Section 2.1**). This plan also provides a framework to guide rehabilitation for future areas of development The RRRMP will be updated as required, as specific future locations are determined. Refer to **Section 4.2** for Revision and Reporting.

The RRRMP is closely associated with several management plans and procedures prepared for the RFDA, as well as the Protocol. As with the RRRMP, these plans and procedures will be updated as part of future CSG field development, and subject to approval from SEWPaC prior to implementation. In particular, the RRRMP is closely related with the following documentation, which are referred to within the RRRMP as required:

- Significant Species Management Plan (SSMP), prepared for the RFDA, specifically Stage 1, Santos Document Number 0020-GLNG-4-1.3-0003 (Santos, 2011b);
- Pest and Weed Management Plans (PWMP), prepared for Roma and Fairview CSG Fields (Santos Document Numbers: 0020-GLNG-4-1.3-0015 (Santos, 2011c) and 0020-GLNG-4-1.3-0015 (Santos, 2011d)). The RRRMP will be updated as required to incorporate management measures for additional areas as PWMPs are made available. Of note, a PWMP will be implemented within Arcadia Valley, that is consistent with the measures outlined in the Roma and Fairview FMPs;
- Fauna Management Plans (FMP), prepared for Fairview and Roma CSG fields (Santos Document Numbers 0020-GLNG-4-1.3-0014 (Santos, 2011e) and 0020-GLNG-4-1.3-0015 (Santos, 2011f)). The RRRMP will be updated to incorporate management measures for additional areas as FMPs are made available. Of note, a FMP will be implemented within Arcadia Valley, that is consistent with the measures outlined in the Roma and Fairview PWMP ;
- Soil Management Procedure (SMP), Aurecon 2011; and
- Erosion and Sediment Control Manual (ESCM), Aurecon, 2011.

1.3 Site Description

1.3.1 Fairview Project Area

The Fairview Project Area (FPA) is located to the north-east of Injune, and spans approximately 116 000ha. It incorporates an area of Expedition National Park, Stephenton, Hallett, Beilba, and Doonkuna State Forests and Expedition Resource Reserve. This field encompasses six petroleum leases (PL 90, PL 91, PL 92, PL 99, PL 100 and PL 232), two existing pipelines (PPL 76 and PPL 92) and two proposed pipelines (PPL 146 and 164).

In addition to conservation areas, landuse within the FPA includes grazing and existing CSG extraction activities associated with exploration and development activities. Santos also has a number of pre-existing or “legacy sites” within Fairview, including decommissioned CSG wells and dams. These sites were operational when Santos acquired the Fairview CSG Field in 2006. The FPA is currently

operational, with several compressor stations, camps, CSG wells and associated infrastructure within the area.

1.3.2 Roma Project Area

The Roma Shallow Gas Project Area (RSGPA) is centered around three townships, Roma, Wallumbilla and Yuleba, and spans approximately 259,652ha. The RSGPA encompasses Authority to Prospect (ATP) 336P and eleven petroleum leases (PL 309, PL 310, PL 313 – PL 319, PL 322 and PL 323). The field encompasses portions of Brucedale, Gubberamunda, Inglebogie, Tinowon, Trinidad, Wallabella, and Yalebone State Forests. Additionally, the RSGPA comprised large tracts of grazing lands, with minor cropping areas. Due to historical agricultural activities, remnant vegetation in the Roma field is limited.

The RSGPA is currently operational, with limited CSG production and conventional gas production occurring.

1.3.3 Arcadia Valley Project Area

The Arcadia Valley Project Area (AVPA) is located to the east of Taroom, and spans approximately 318 800ha. The AVPA comprises ATP 526P, and four petroleum leases (PL 233, PL 234, PL 235, and PL 236) and three petroleum lease applications (PLA 420, PLA 421 and PLA 440). The field encompasses portions of Expedition National Park and Resources Reserve, as well as Belington, Beilba, Stephenton, and Presho State Forests. This field includes portions of the Arcadia Valley as well as Expedition Range. In addition to conservation purposes, land use within the AVPA includes cattle grazing, forestry and existing CSG infrastructure.

The AVPA is currently operational, with limited exploration and appraisal activities occurring.

1.3.4 Threatened Ecological Communities

Five EPBC listed Threatened Ecological Communities (TEC) potentially occur within the project areas and surrounds, based on Regional Ecosystems (RE) mapping Version 6.0 (DERM 2010), and EPBC Act Protected Matters Search results. As detailed mapping for threatened ecological communities is not available, potential presence and mapping for TEC communities within the project areas is determined based on associated RE. **Table 1.1** outlines the TEC and the associated REs that are known to occur within the RFDA, with approval limits specified in the EPBC Approval (2009/4059). **Figure 1.1** outlines the potential locations of TEC, based on DERM RE mapping.

Table 1.1: Threatened Ecological Communities and Associated REs within the Project Areas

Threatened Ecological Community	Associated Regional Ecosystem	Project Area
Semi-evergreen Vine Thickets of the Brigalow Belt (north and south) and Nandewar Regions	11.9.4 - Semi-evergreen vine thicket on fine-grained sedimentary rocks 11.10.8 - Semi-evergreen vine thicket in sheltered habitats on medium to coarse-grained sedimentary rocks	Fairview, Roma, Arcadia Valley
Brigalow (*Acacia harpophylla* dominant and co-dominant);	11.9.5 - *Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	Fairview, Roma, Arcadia Valley
Natural grasslands on basalt and fine-textured alluvial plains of northern New South Wales and southern Queensland	11.3.21 - *Dichanthium sericeum* and/or *Astrebla* spp. grassland on alluvial plains. Cracking clay soils	Roma

*Only Associated RE's known to occur within the project area are included within the above table

1.3.5 Significant Species

Numerous flora and fauna species listed under the EPBC Act 1999 and NC Act 1992 potentially occur within the project areas, summarised in **Table 1.2,** as identified within the SSMP and EIS for the GLNG project. Refer to SSMP for migratory species.

Table 1.2: Listed Species under the EPBC Act 1999 and NCA 1992

Scientific Name	Common Name	EPBC Status	NCA Status	Project Area
Accipiter novaehollandiae	Grey Goshawk	-	NT	FPA/ RSGPA / AVPA
Calyptorhynchus lathami	Glossy Black Cockatoo	-	V	FPA/ RSGPA / AVPA
Ephippiorhynchus asiaticus	Black-necked Stork / Jabiru	-	NT	FPA/ RSGPA / AVPA
Erythrotriorchis radiatus	Red Goshawk	V	E	FPA/ RSGPA / AVPA
Falco hypoleucos	Grey Falcon	-	NT	FPA/ RSGPA / AVPA
Geophaps scripta scripta	Squatter Pigeon (southern form)	V	V	FPA/ RSGPA / AVPA
Grantiella picta	Painted Honey-eater	-	V	RSGPA / AVPA
Lophoictinia isura	Square-tailed Kite	-	NT	FPA/ RSGPA / AVPA
Melithreptus gularis	Black-chinned Honeyeater	-	NT	AVPA
Nettapus coromandelianus	Cotton-pygmy Goose	Marine	NT	AVPA
Ninox strenua	Powerful Owl	-	V	FPA/ RSGPA / AVPA

Scientific Name	Common Name	EPBC Status	NCA Status	Project Area
Rostratula australis	Australian Painted Snipe	V	V	FPA/ RSGPA / AVPA
Turnix melanogaster	Black-breasted Button-quail	V	V	FPA / AVPA
Amphibians				
Adelotus brevis	Tusked Frog	-	V	FPA / RSGPA / AVPA
Cyclorana verrucosa	Warty Waterholding Frog / Rough Collared Frog	-	NT	FPA / RSGPA / AVPA
Reptiles				
Aspidites ramsayi	Woma Python	-	NT	FPA / RSGPA / AVPA
Acanthophis antarcticus	Common Death Adder	-	NT	RSGPA
Delma torquata	Collared Delma	V	V	FPA / AVPA
Denisonia maculata	Ornamental Snake	V	V	FPA
Egernia rugosa	Yakka Skink	V	V	FPA / RSGPA / AVPA
Furina dunmalli	Dunmall's Snake	V	V	FPA / AVPA
Paradelma orientalis	Brigalow Scaly-foot	V	V	AVPA / RSGPA
Rheodytes leukops	Fitzroy River Turtle	V	V	FPA / AVPA
Strophorus taenicauda	Golden-tailed Gecko	-	NT	FPA / AVPA
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	FPA / RSGPA / AVPA
Chalinolobus picatus	Little Pied Bat	-	NT	FPA / RSGPA / AVPA
Dasyurus hallucatus	Northern Quoll	E	-	AVPA / RSGPA
Nyctophilus corbeni	South-eastern Long-eared Bat	V	V	FPA / RSGPA
Onychogalea fraenata	Bridled Nailtail Wallaby	E	E	FPA / RSGPA / AVPA
Ornithorhynchus anatinus	Platypus	-	Special Least Concern	FPA
Phascolarctos cinereus	Koala	-	V (SEQ); Special Least Concern in other areas	FPA / RSGPA / AVPA
Tachyglossus aculeatus	Echidna	-	Special Least Concern	FPA / AVPA

Scientific Name	Common Name	EPBC Status	NCA Status	Project Area
Flora				
Acacia calantha	-	-	NT	FPA
Acacia islana	-	-	V	FPA
Acacia spania	-	-	NT	FPA / RSGPA
Acacia wardellii	Thomby Range Wattle	V	V	RSGPA
Apatophyllum teretifolium	Sandstone Prickle Bush	-	NT	FPA
Bertya opponens	Coolabah Bertya	V	-	FPA
Brachychiton species	-	-	Type A restricted	FPA / RSGPA / AVPA
Cadellia pentastylis	Ooline	V	V	FPA / RSGPA / AVPA
Calocephalus sonderi	Pale Beauty Head	-	NT	FPA / RSGPA / AVPA
Calytrix islensis	-	-	V	FPA
Commersonia argentea	-	-	V	FPA / RSGPA / AVPA
Cryptandra ciliata	-	-	V	FPA
Cymbonotus maidenii	-	-	E	FPA
Cyperus clarus	-	-	V	FPA / RSGPA / AVPA
Dichanthium queenslandicum	King Bluegrass	V	V	AVPA / RSGPA
Dicanthium setosum	Bluegrass	V	NT	FPA / RSGPA / AVPA
Eleocharis blakeana	-	-	NT	FPA / RSGPA / AVPA
Eriocaulon carsonii	Salt Pipewort	E	E	FPA
Eucalyptus virens	Shiny-leaved Ironbark	V	V	FPA
Gonocarpus urceolatus	Raspweed	-	V	FPA
Homopholis belsonii	Belson's Panic	V	E	FPA / RSGPA
Homoranthus decasetus	Red Mouse Bush	-	NT	FPA
Leucopogon grandiflorus	-	-	NT	FPA / AVPA
Livistona nitida	Carnarvon Fan Palm	-	NT	FPA
Macrozamia fearnsidei		V	-	FPA
Macrozamia platyrhachis		E	E	AVPA
Melaleuca groveana	-	-	V	FPA

Scientific Name	Common Name	EPBC Status	NCA Status	Project Area
Melaleuca irbyana	Bush House Paperbark	-	E	FPA
Myriophyllum artesium	Artesian Milfoil	-	E	FPA / RSGPA / AVPA
Platycerium veitchii	Silver Staghorn	-	Type A restricted	FPA
Pseudanthus pauciflorus	-	-	NT	FPA / AVPA / RSGPA
Rutidosis crispata	-	-	V	FPA
Rutidosis glandulosa	-	-	NT	FPA / RSGPA
Rutidosis lanata	-	-	E	FPA / RSGPA
Senna acclinis	Rainforest Cassia	-	NT	AVPA
Swainsona murrayana	Slender Darling Pea	V	V	RSGPA
Thelypteris confluens	Swamp Fern	-	NT	FPA / RSGPA / AVPA
Wahlenbergia islensis	-	-	NT	FPA
Xanthorrhoea species	Grass Trees	-	Type A restricted	FPA / RSGPA / AVPA
Xerothamnella herbacea	-	E	E	AVPA

E: Endangered, V: Vulnerable, NT: Near Threatened

1.3.6 Regional Ecosystems

Fairview Project Area

Regional Ecosystem mapping (Version 6) identifies remnant vegetation over large portions of the FPA, with scattered areas of regrowth vegetation also occurring. Twenty Regional Ecosystems are mapped within the FPA, including three listed as Endangered, and five listed as Of Concern under the *Vegetation Management Act 1999* (VM Act 1999). Refer to **Section 6.0** for further details. RE and High Value Regrowth (HVR) mapping is included in **Figure 1.2** and **1.3**.

Roma Shallow Gas Project Area

Regional Ecosystem mapping (Version 6) identifies fragmented remnant vegetation occurring, with scattered areas of regrowth vegetation also occurring. Forty-two Regional Ecosystems occur within the RSGPA, including five listed as Endangered, and thirteen listed as Of Concern under the VM Act 1999. Refer to **Section 6.0** for further details.

Arcadia Valley Project Area

Regional Ecosystem mapping (Version 6) identifies remnant vegetation over large portions of the AVPA, with scattered areas of regrowth vegetation also occurring. Fifteen Regional Ecosystems occur within the AVPA, including one listed as Endangered, and five listed as Of Concern under the VM Act 1999. Refer to **Section 6.0** for further details**.**

1.3.7 Agricultural Land Use

The primary agricultural land use within the CSG fields is grazing, comprising of cattle and to a lesser degree sheep; subsequently the majority of agricultural land is comprised of grassland agroecosystems. The grasslands of the CSG fields were primarily observed to be either improved pastures or native pastures and in some circumstances, a combination of both. The improved pastures within the CSG fields are typically dominated by exotic species that have been introduced into the agroecosystem to increase pasture and livestock productivity. The native pastures within the CSG fields are typically dominated by native species but may also contain some invasive exotic species.

Small areas of cropping occur within the more fertile soils within areas of the RSGPA. Additionally, Santos has extensive irrigation areas within the FPA, including hard wood plantations and fodder crops including Leucaena production.

The inherent land capability of agricultural land dictates whether the land can be pasture improved or not. Land capability is primarily determined upon soil type and topography; however climatic conditions and water availability also play a significant role in determining the land capability of agroecosystems.

The land capability of the agricultural land within the project areas has been mapped in accordance with the Good Quality Agricultural Land (GQAL) guidelines. **Figure 1.4** indicates that the agricultural land within the project areas contain GQAL classes A, B and C. Further detail in relation to the CSG fields soil characteristics, and GQAL classes, as well as the rationale used to establish pasture benchmarks is provided in **Section 6.2.2**.

1.4 Scope of Works

This plan provides remediation, rehabilitation, recovery and monitoring actions for a range of CSG infrastructure and associated disturbances proposed within the CSG Fields including:

- Exploration activities (e.g. Seismic, core holes etc);
- Production activities - CSG well leases and associated infrastructure;
- Linear Infrastructure - Includes gas, water and power transmission and distribution lines, Right of Ways (RoWs) for linear infrastructure, access tracks and road networks;
- Temporary supporting infrastructure such as accommodation camps, laydown areas and storage facilities.
- Permanent Infrastructure – Includes administration buildings, offices, accommodation and associated infrastructure for the Operational work force and associated activities etc; and

- Centralised Gas and Water Treatment Facilities – Includes compressor stations (CS), water treatment facilities (e.g. Reverse Osmosis (RO) Plants) and associated infrastructure (e.g. dams, storage ponds and brine ponds).

This report outlines a series of standardised remediation and rehabilitation procedures that are considered current best practice, as per the following guidelines and literature sources:

- *Code of Environmental Practice – Onshore Pipelines* (Australian Pipeline Industry Association, 2009);
- *Revegetation Planting Standards – Guidelines for establishing native vegetation for net gain* (Department of Sustainability and the Environment, 2006);
- *A Field Manual For Describing and Mapping Revegetation Activities in Australia* (Atyeo & Thackway, 2009); and
- Threatened Species and Threatened Ecological Communities Recovery Advice prepared by SEWPaC.

This plan takes native vegetation, including remnant and regrowth vegetation, and existing agricultural land uses into consideration. This RRRMP is intended to apply for the life of the project, and is considered to be a 'living document.' As such, this RRRMP includes provision for review of the RRRMP framework and methods, to ensure that changing best practice standards are reflected (Refer to **Section 4.0**). While this version of the RRRMP has been prepared for the Stage 1 field development area, it will be updated to ensure future development areas are incorporated.

Specifically, this RRRMP outlines principles to mitigate and manage direct and indirect impacts upon MNES and State listed Environmentally Sensitive Areas (ESAs). This plan includes provisions for the restoration of threatened species habitat, including Commonwealth listed species and restoration of TEC, and reflects mitigation measures outlined within the SSMP, as well as recovery measures published by SEWPaC.

N

Arcadia Project Area
Brigalow
Natural Grasslands
Semi-evergreen Vine Thicket

0 2.5 5 10 15 20
Kilometers

Project Manager	BD
Compiled by	CA
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR106904-1
Sheet Number	1 of 3

Client
Santos

Title
Figure 1.1 (a)
Arcadia Valley Project Area
Threatened Ecological Communities

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:400,000	29/04/2011	PR106904	A

N

Fairview Project Area
Brigalow
Natural Grasslands
Semi-evergreen Vine Thicket

0 1 2 4 6 8
Kilometers

Project Manager	BD
Compiled by	CA
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR106904-1
Sheet Number	2 of 3

Client

Santos

Title

Figure 1.1 (b)
Fairview Project Area
Threatened Ecological Communities

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:200,000	29/04/2011	PR106904	A

N

Roma Shallow Gas Area
Brigalow
Natural Grasslands
Semi-evergreen Vine Thicket

0 1 2 4 6 8
Kilometers

Project Manager: BD
Compiled by: CA
Map Projection: MGAz55
Map Datum: GDA94
File Reference: PR106904-1
Sheet Number: 3 of 3

Client: Santos

Title: Figure 1.1 (c)
Roma Project Area
Threatened Ecological Communities

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:300,000	29/04/2011	PR106904	A

N

Arcadia Project Area

Regional Ecosystems (Version 6.0b)

- Non-remnant / regrowth
- Endangered - Sub-dominant
- Endangered - Dominant
- Of Concern - Sub-dominant
- Of Concern - Dominant
- Not Of Concern
- Plantation forest
- Water

0 2.5 5 10 15 20

Kilometers

Regional ecosystem linework compiled at scale greater than 1:100,000, except in designated areas, where a compilation scale of 1:50,000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100,000 is +/-100 metres.

The aerial photography used in this plan has not been rectified.
The image has been overlaid as a best fit on the boundaries shown and position is approximate only.

Project Manager	BD
Compiled by	CA
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR106904-1
Sheet Number	1 of 3

Client: Santos

Title: Figure 1.2 (a)
Arcadia Valley Project Area
Regional Ecosystems (Version 6.0b)

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:400,000	29/04/2011	PR106904	A

N

Fairview Project Area

Regional Ecosystems (Version 6.0b)

- Non-remnant / regrowth
- Endangered - Sub-dominant
- Endangered - Dominant
- Of Concern - Sub-dominant
- Of Concern - Dominant
- Not Of Concern
- Plantation forest
- Water

0 1 2 4 6 8

Kilometers

DIGITAL CADASTRAL DATA BASE - BOUNDARY INFORMATION.
REGIONAL ECOSYSTEM VERSION 6 DATA
DERM AERIAL PHOTOGRAPHY.
Based on or contains data provided by the State of Queensland (Department of Environment and Resource Management) 2010. 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 direct marketing or be used in breach of the privacy laws.

Regional ecosystem linework compiled at scale greater than 1:100,000, except in designated areas, where a compilation scale of 1:50,000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100,000 is +/-100 metres.

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Project Manager	BD
Compiled by	CA
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR106904-1
Sheet Number	2 of 3

Client: Santos

Title: Figure 1.2 (b)
Fairview Project Area
Regional Ecosystems (Version 6.0b)

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:200,000	29/04/2011	PR106904	A

N

Roma Shallow Gas Area

Regional Ecosystems (Version 6.0b)

- Non-remnant / regrowth
- Endangered - Sub-dominant
- Endangered - Dominant
- Of Concern - Sub-dominant
- Of Concern - Dominant
- Not Of Concern
- Plantation forest
- Water

0 1 2 4 6 8
Kilometers

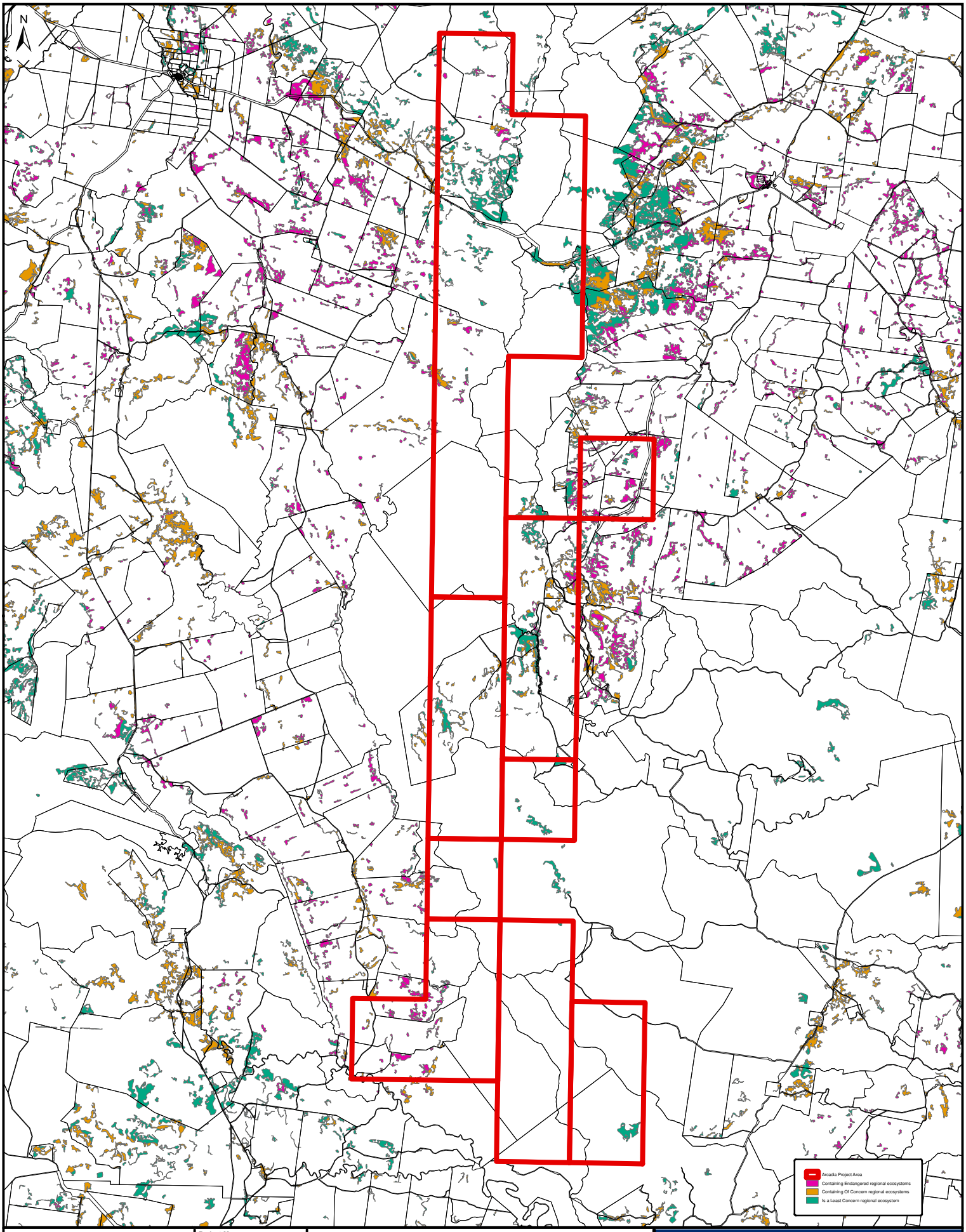
Project Manager	BD
Compiled by	CA
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR106904-1
Sheet Number	3 of 3

Client: Santos

Title: Figure 1.2 (c)
Roma Project Area
Regional Ecosystems (Version 6.0b)

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:300,000	29/04/2011	PR106904	A



Project Manager	BD
Compiled by	CA
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR106904-1
Sheet Number	1 of 3

Client: Santos

Title: Figure 1.3 (a)
Arcadia Valley Project Area
High Value Regrowth

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:550,000	04/01/2011	PR106904	A

N

Fairview Project Area

High Value Regrowth (Version 2.0)

- Containing Endangered regional ecosystems
- Containing Of Concern regional ecosystems
- Is a Least Concern regional ecosystem

0 1 2 4 6 8

Kilometers

Regional ecosystem linework compiled at scale greater than 1:100,000, except in designated areas, where a compilation scale of 1:50,000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100,000 is +/-100 metres.

The aerial photography used in this plan has not been rectified.
The image has been overlaid as a best fit on the boundaries shown and position is approximate only.

Project Manager	BD
Compiled by	CA
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR106904-1
Sheet Number	2 of 3

Client: Santos

Title: Figure 1.3 (b)
Fairview Project Area
High Value Regrowth (Version 2.0)

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:200,000	29/04/2011	PR106904	A

N

Roma Shallow Gas Area

High Value Regrowth (Version 2.0)

- Containing Endangered regional ecosystems
- Containing Of Concern regional ecosystems
- Is a Least Concern regional ecosystem

0 1 2 4 6 8

Kilometers

Project Manager	BD
Compiled by	CA
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR106904-1
Sheet Number	3 of 3

Client: Santos

Title: Figure 1.3 (c)
Roma Project Area
High Value Regrowth (Verison 2.0)

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:300,000	29/04/2011	PR106904	A

N

Arcadia Project Area

GQAL Classification

- A
- A1
- A2
- B
- B1
- B2
- C
- C1
- C2
- C3
- D
- W*

0 2.5 5 10 15 20

Kilometers

Project Manager	BD
Compiled by	CA
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR106904-1
Sheet Number	1 of 3

Client: Santos

Title: Figure 1.4 (a)
Arcadia Valley Project Area
GQAL Classification

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:400,000	29/04/2011	PR106904	A

N

Fairview Project Area

GQAL Classification

- A
- A1
- A2
- B
- B1
- B2
- C
- C1
- C2
- C3
- D
- W*

0 1 2 4 6 8

Kilometers

Project Manager	BD
Compiled by	CA
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR106904-1
Sheet Number	2 of 3

Client: Santos

Title: Figure 1.4 (b)
Fairview Project Area
GQAL Classifications

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:200,000	29/04/2011	PR106904	A

N

Mine

Roma Shallow Gas Area

GQAL Classification

- A
- A1
- A2
- B
- B1
- B2
- C
- C1
- C2
- C3
- D
- W*

0 1 2 4 6 8

Kilometers

Project Manager	BD
Compiled by	CA
Map Projection	MGAz55
Map Datum	GDA94
File Reference	PR106904-1
Sheet Number	3 of 3

Client: Santos

Title: Figure 1.4 (c)
Roma Project Area
GQAL Classifications

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:300,000	29/04/2011	PR106904	A

2.0 Field Development

2.1 Operational Plan

An Operational Plan has been developed for each project area to comply with conditions set forth in the EAs received to date. A summary of the operational infrastructure is provided in **Section 2.4**. A detailed review of the existing and proposed infrastructure is included within the relevant Operational Plans.

2.2 Field Development Protocol

Activities undertaken within the CSG fields will be a staged process. The stages are defined within Operational Plans for each project area. The current Operational Plans for the Fairview Project Area (FPA), Roma Shallow Gas Project Area (RSGPA), and Arcadia Valley Project Area (AVPA) apply to the first three year period of the relevant EA. The purpose of the Operational Plan is to document the nature and extent of activities and disturbances relative to existing landforms, land uses and sensitive environmental settings during the three year period of the plan. The figures that have been provided with the Operational Plans depict the existing and proposed petroleum activities. Santos is currently conducting field surveys ('ground truthing') to confirm the locations environmental constraints and quantify disturbances. The figures and text of the Operational Plans will be updated to reflect the results of the ground truthing. The Operational Plans outline the extent of stage 1 of the CSG field development.

The Environmental Protocol for Constraints Planning and Field Development (the Protocol, Santos 2011a) has been developed to satisfy the EPBC Act Approval, the CG Conditions, the EA Conditions and the clearing permit exemption obtained under section 41(1)(a)(ii) of the *Nature Conservation (Protected Plant) Conservation Plan* 2000 for the Project.

The Protocol outlines the approach Santos will take in identifying, assessing and managing potential impacts to MNES and State related matters through the use of an internal approval process, constraints mapping and specific Field Management Procedures (Field MP).

The Protocol includes specific Field MP that will be implemented for five constraints classes identified. The Field MP sets out:

- The nature of the development which is proposed to be undertaken within each constraints class;
- The process to be undertaken to determine the specific location of the development within each constraints class having regard to the local ecological values of the area; and
- The mitigation measures that will be implemented to minimise the impact of the development on the ecological values of the area.

The Protocol details the requirements for:

- Obtaining internal approval for any new CSG activity;
- Ensuring that appropriate planning is undertaken prior to conducting any new land disturbance associated with the authorised CSG activities;

- Conducting CSG activities in a way that avoids or minimises land disturbance and potential impacts to MNES; and
- Compliance monitoring and reporting requirements to SEWPaC, DERM and the CG.

Prior to conducting petroleum activities that involve significant disturbance to land, an assessment will be undertaken of the condition, type and ecological value of any vegetation in such areas where the activity is proposed to take place.

Each activity undertaken in environmentally sensitive areas will be subject to stringent conditions to minimise environmental impacts. These will depend on the location and the activity being undertaken. A number of management strategies have been formulated with practical prescriptions for on the ground management and confirmation of sensitive environmental values and constraints.

2.3 Rehabilitation and Decommissioning Requirements

Upon cessation of a petroleum activity(ies) the relevant petroleum infrastructure will be decommissioned in accordance with the approved Demolition and Decommissioning Plans (DDMP) and in accordance with the requirements of the *Petroleum and Gas (Production and Safety) Act 2004* (Qld). A DDMP has been developed that provides discussion regarding the potential future decommissioning and demolition activities, focusing on the process of decommissioning and demolition and the mitigation of environmental impacts. The DDMP:

a) Includes the progressive removal or reuse of infrastructure where gas field operations cease during the project life;

b) Establishes management practices and safeguards to minimise environmental disturbance;

c) Ensures that Matters of National Environmental Significance (MNES) are not impacted by progressive decommissioning, or final decommissioning of gas field infrastructure;

d) Defines rehabilitation actions for the infrastructure sites following decommissioning;

e) Optimises habitat and habitat connectivity for MNES; and

f) Enhances pre-construction environmental quality.

Santos will commence rehabilitation as soon as practicable in accordance with the relevant statutory requirements, unless an agreement is in place with the relevant administering authority and relevant Landholder. This agreement may allow the disturbance to be beneficially re-used, for example farm dams, roads, etc. Where a direct or indirect impact has occurred to a MNES, Santos will apply remediation, rehabilitation, recovery and monitoring measures appropriate for each MNES to restore connectivity or rehabilitate disturbed areas to pre-clearance quality or better and to minimise cumulative impacts throughout the life of the project. Additionally, where significantly disturbed lands are rehabilitated, Santos will meet its obligation to ensure that maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance by petroleum activities.

Where regulated dams are constructed, site specific decommissioning and rehabilitation plans will be prepared.

2.4 CSG Field Infrastructure

The following sections provide a brief summary of CSG infrastructure within the project areas. Detailed descriptions of existing and proposed infrastructure can be found within the relevant project area Operational Plans.

2.4.1 Proposed CSG Infrastructure

A range of CSG infrastructure will be constructed within the project areas, with varying degrees of disturbance and operation life spans (e.g. life of temporary camps versus life of CSG well leases). Each type of infrastructure will require varying rehabilitation and decommissioning treatments, as well as varying timeframes. The following sections outline the disturbances associated with various infrastructure types, as well as an overview of required rehabilitation staging.

CSG Exploration, Appraisal and Production Well Leases

Following seismic surveys, CSG exploration wells are drilled to confirm the presence of coal measures, to determine coal permeabilities and the potential for CSG production. Appraisal wells are subsequently drilled to test the potential of the CSG reservoir and to provide an indication of water quality and water production from the gas field. Exploration and appraisal well leases generally result in a disturbance of approximately 1ha (i.e. 100m x 100m) to facilitate the safe operation of the drilling rig and associated equipment and the well lease infrastructure. Well lease size may be increased to approximately 1.5ha where directional drilling for multiple wells is planned to occur. Site works include clearing of vegetation and topsoil prior to levelling the well pad, fencing the lease and constructing flare pits and sumps.

Where CSG resources are found, a well head valve assembly is installed, and a production casing string is set to allow for the construction of surface production facilities, including a well pump, gas engine, separator and flare stack. Additional appraisal wells are drilled to investigate the discovered hydrocarbon accumulation, generally resulting in up to five appraisal wells spaced approximately 1km apart. Where exploration and testing results in a commercial operation, additional production well leases are established, generally between 500m and 1.5km apart.

Following the completion of the CSG well, partial rehabilitation or restoration of the well lease will occur to reduce the footprint of the well lease area to approximately 50m^2 (10m x 5m). The operating life of a CSG well is approximately 15 years. Therefore, a staged approach to rehabilitation or restoration for CSG exploration, appraisal and production well leases is required. Following construction, soil stabilisation methods will be implemented within the construction footprint, prior to total rehabilitation following decommissioning of the well lease.

Co-located CSG Infrastructure

To minimise the cumulative impacts from multiple linear infrastructure networks, Santos has adopted a field development plan that involves collocating linear infrastructure, within a shared services corridor. Where practicable, Santos will co-locate infrastructure to reduce the total disturbance size, reduce fragmentation of the landscapes or disruption to existing land use. Where co-location is not practicable, Santos will ensure that infrastructure corridors are aligned along existing easements where appropriate.

Access Tracks and Roads

Access tracks and roads are required to each CSG well and supporting infrastructure. Where practicable, existing tracks and roads will be utilised, however additional roads of varying grades will be constructed, ranging from farm tracks to asphalt. The width of tracks will vary due to requirements for larger vehicles. Generally, access roads will be limited to areas of slope less than 10%. Clearing within remnant vegetation is limited to 10m in width for access tracks, and 20m for dual carriageway roads.

While erosion and sediment control measures will be implemented throughout construction and operation, rehabilitation along access roads will not occur until the access tracks are decommissioned.

The EPBC Act Approval and CG Conditions impose limitations of the widths of access tracks and roads, with variations to take into consideration co-located infrastructure.

Gas and Water Pipeline Gathering Systems and Power Lines

To minimise disturbances to existing vegetation, gas, water pipeline gathering systems and power corridors will be located parallel to access tracks and fence lines wherever practicable. Additionally, fibre optic systems for infield communication and telemetry networks will be co-located to minimise disturbances where required. Where clearing may impact upon MNES or remnant vegetation, clearing widths are imposed by the EPBC Act Approval and CG Conditions.

Santos will adopt a staged approach to rehabilitation for pipeline easements. Immediately following construction, stabilisation methods will be utilised, and natural regeneration will be promoted. Following decommissioning, full rehabilitation will occur to re-instate a natural landform and associated vegetation, or to re-establish pasture (as appropriate). Decommissioning of pipeline systems will be carried out in accordance with Australian Standard (AS) 2885.

Centralised CSG Facilities

Nodal compressors and water management facilities (e.g. RO Plants) will be co-located within the Compression Station footprints to minimise the length of the gathering pipelines and pumping requirements. The Compression Station compounds are approximately 70 – 80 ha in size, fenced and contain the infrastructure and equipment within its boundary. This infrastructure may include nodal and hub compressors, power generation (either gas turbine alternators or transmission lines), water treatment and/or amendment facilities and storage ponds for water or brine.

Additional supporting infrastructure located within Compressor Station Compounds may include:

- Oily water treatment;
- Piping, fittings and support;
- Control systems;
- Flare systems;
- Fuel tanks; and
- Offices, workshops and emergency accommodation.

Following construction of facilities, stabilisation of disturbed areas will be required. Upon decommissioning of above ground treatment facilities, intensive rehabilitation will be required.

Regulated Dams and Ponds

Regulated dams and ponds of varying carrying capacities will be required for associated water prior to treatment. Where ponds are required for saline water, they will include a clay liner, followed by a HDPE liner and sand drains. Regulated dams and ponds will require initial rehabilitation following construction for stabilisation. Intensive rehabilitation will occur following decommissioning. In accordance with the DERM *Hazardous Dam Guidelines* and relevant EA requirements, detailed design plans and decommissioning plans will be developed for each regulated dam to ensure the dam either becomes a stable landform similar to that of surrounding undisturbed areas, that no longer contains substances that will migrate into the environment, or is approved or authorised by the administering authority for use by the landholder following cessation of the petroleum activities.

Borrow Pits

Borrow pits will be required for construction materials such as gravel and clay. Borrow pits will require progressive stabilisation, followed by rehabilitation upon decommissioning. Upon decommissioning, borrow pits will be re-shaped/re-contoured to ensure a safe and stable landform is achieved.

Sewerage Treatment Facilities

Sewerage treatment facilities will be designed, constructed and decommissioned in accordance with statutory approvals. As further detailed design occurs, this plan will be developed to provide specific rehabilitation measures for each specific facility.

Permanent Accommodation Camps

Permanent accommodation camps will be designed, constructed and decommissioned in accordance with statutory approvals. Although the scale of these camps are yet to be determined, rehabilitation actions have been determined based on the likely impacts. Intensive rehabilitation of permanent camps will be required upon decommissioning due to the long-term disturbance.

Temporary Infrastructure

A range of temporary infrastructure is required to facilitate construction and operational activities of the CSG fields, including temporary accommodation and lay down areas. These areas will require rehabilitation upon decommissioning, and are generally sites suitable for natural regeneration or re-instatement of pasture.

3.0 Rehabilitation Objectives

3.1 Overall Objectives

This RRRMP provides a framework that aims to return disturbed areas to a pre-clearance condition or better, with a stable landform that is similar to that of the surrounding undisturbed areas, as required by the relevant State and Federal approvals. The RRRMP details rehabilitation activities to meet three overarching objectives, to provide a:

- Safe landform for humans, native fauna, and livestock;
- Non-polluting landform; and
- Stable landform.

Additionally, implementation of the RRRMP will minimise long term impacts on MNES, including TEC and significant species habitat. The RRRMP includes recommendations towards rehabilitation outlined in the SSMP, as well as relevant recovery actions outlined by SEWPaC. The RRRMP additionally outlines measures to rehabilitate Regional Ecosystems and High Value Regrowth (HVR) vegetation to pre-disturbed condition, and ensure no loss in land capability within grazing areas.

3.2 Landholder Requests

This RRRMP will guide rehabilitation to ensure that lands are compatible with pre-disturbance land use prior to transferring decommissioned areas to landholders. Accordingly, where petroleum activities will result in land disturbance, Santos will:

- Consult with the landholder regarding the rehabilitation of the land;
- As soon as practicable restore the surface of the land; and
- Where practicable, reasonable and allowable, ensure that access roads and dams are not decommissioned where approval from the relevant regulatory authority and landholder is granted.

3.3 EPBC Act Approval

EPBC Act Approval Condition 15 requires the development of an RRRMP to rehabilitate disturbed areas to pre-clearance condition or better. To satisfy the requirements of Condition 15, the RRRMP outlines:

- Specific remediation measures, including timing and standards for preventing erosion and stabilising disturbed soil in impact areas as per the CSG Fields ESCM, and SMP (Aurecon 2011);
- Responses to threats to MNES from petroleum activities and land management activities including the disposal and use of CSG water, damage by livestock and impacts from weeds and pest animals;
- Basic fire prevention and management regimes during construction, operation and decommissioning appropriate for the MNES;

- Measures to support the recovery of listed species habitat and recovery of listed ecological communities, as per the Santos SSMP and FMP, and relevant recovery advice from SEWPaC (**Appendix 4**);
- Performance criteria and related monitoring to assess site remediation, rehabilitation and recovery;
- Reporting requirements on the implementation of site remediation, rehabilitation and recovery, including monitoring and performance to a standard which can be independently audited; and
- References to relevant conservation advice, recovery plans, species management plans and policies, practices, standards and guidelines endorsed or approved by SEWPaC.

This RRRMP forms part of the Protocol and includes management practices and methods including site rehabilitation timeframes, standards and methods, as well as monitoring requirements for rehabilitation success and recovery. The RRRMP outlines options to mitigate and manage direct and indirect impacts upon MNES identified within environmental Constraint Class B. This includes threatened ecological communities (TEC), all listed threatened flora species and those listed threatened and migratory fauna species habitats as identified in management plans required under the EPBC Act Approval. Constraints Class B also includes the impact risk zone, which is the area within 200m from the perimeter of Constraints Class B and the no impact zone, which is the area within 300m from the perimeter of Constraints Class B. The RRRMP provides broad procedures to remediate and rehabilitate impacted areas to ensure the long-term recovery of MNES. The RRRMP provides provisions for annual reporting requirements to be included within the Annual Environmental Returns required under the EPBC Approval.

This RRRMP has been prepared to supplement Decommissioning Plans as required by the EPBC Act Approval. This RRRMP defines management practices to progressively restore and rehabilitate MNES, to be included within Decommissioning Plans.

The RRRMP incorporates the relevant aspects of the Santos SSMP (Santos, 2011b), FMP (Santos 2011e & f), PWMP (Santos 2011c & d), ESCM (Aurecon, 2011) and SMP (Aurecon, 2011).

3.4 Queensland Coordinator-General Conditions and DERM Environmental Authorities

This RRRMP has been developed to satisfy the requirements of the EPBC Act Approval, the CG Conditions and the EA Conditions. This RRRMP is designed to complement the Operational Plans developed for the project areas, and outlines the broad rehabilitation activities for each site to be disturbed, including methods to determine the use of appropriate reference sites, species composition and post-disturbance land use. In accordance with CG Conditions, the RRRMP outlines the broad methods required to undertake progressive rehabilitation.

This RRRMP provides methods to:

- Return all significantly disturbed to a stable landform with a self-sustaining vegetation cover and species that are similar to that of adjoining undisturbed areas (except where re-use is to occur);
- Return all lands to a similar quality of the pre-disturbed land;
- Take practical measures to re-establish surface drainage lines and topsoil;

- Undertake rehabilitation in accordance with the SMP (Aurecom, 2011); and
- Ensure that maintenance requirements of rehabilitated land are no greater than that required of pre-disturbed land.

4.0 Remediation, Rehabilitation, Recovery and Monitoring Framework and Structure

4.1 RRRMP Framework

The RRRMP provides a framework to guide the remediation, rehabilitation and recovery actions for varying land uses and disturbance levels. The following sections describe the RRRMP framework.

4.1.1 Structure of the RRRMP

The RRRMP provides a broad guide for the identification of the appropriate rehabilitation schedule based on broad land use and disturbance type. **Figure 4.1** provides a process to guide rehabilitation actions, including the selection of an appropriate benchmark guideline (**Section 6.0**) and rehabilitation schedule (**Section 7.0**).

4.1.2 Pre-clearance Survey

Prior to construction, a pre-clearance survey is required as per the Protocol, as outlined in **Section 5.0**. During the pre-clearance survey, information to document the condition and values of a site prior to disturbance, including habitat resources, species composition and level of disturbance will be collected.

4.1.3 Benchmark Guidelines

A range of benchmarks have been selected to guide rehabilitation for broad ecosystems, including pasture grasses, identified in the project areas. The benchmark guidelines provide a summary of the key condition indicators of a range of vegetation and grazing communities. Benchmarks provide information on the best condition on offer for each broad ecosystem, and are considered to be the minimum target for rehabilitation. This information is designed to be supplemented by the pre-clearance survey, and provide a means to rehabilitate disturbance areas to better than pre-clearance condition.

The pre-clearance survey includes methods to select the appropriate benchmark guideline. These Guidelines provide specific information to assist with rehabilitation of TEC.

Benchmark guidelines are outlined in **Section 6.0** and **Appendix 2**.

4.1.4 Rehabilitation Schedules

GLNG Project Development

The rehabilitation schedules for each disturbance type and broad land use (vegetation or agriculture), include specific objectives and performance criteria to ensure disturbed sites are rehabilitated to a pre-disturbed condition.

The rehabilitation schedules include performance measures and related monitoring actions to assess site remediation, rehabilitation, recovery and monitoring, as well as provisions for reporting on the

implementation of the RRRMP including monitoring and performance to a standard which can be independently audited.

Rehabilitation schedules include site remediation measures by stage of development (e.g. pre-construction, construction, post-construction and decommissioning), as well as the inclusion of timeframes and standards for conducting rehabilitation activities.

The schedules provide practical rehabilitation measures to support recovery of threatened species habitat and recovery of TEC, in line with the SSMP, as well as recovery plans provided by SEWPaC and DERM.

Existing CSG Field Infrastructure

The project areas include a number of legacy sites from previous CSG operators. The majority of the sites are decommissioned, with rehabilitation occurring to varying quality standards. Legacy sites will be audited to assess the current condition of each site and extent of rehabilitation completed. The audit will determine the extent of rehabilitation required at each of the legacy sites to be undertaken by Santos. While the rehabilitation actions listed in the schedules and as the benchmarks guidelines can be utilised to guide future rehabilitation activities within legacy sites, the reporting and monitoring requirements within this RRRMP are not considered to include legacy sites.

Rehabilitation Schedules are outlined in **Section 7.0** and **Appendix 3**.

4.1.5 Threatened Species Rehabilitation Management Actions

Appendix 4 outlines specific rehabilitation measures to ensure the recovery and long term viability of threatened species listed under the EPBC Act. **Appendix 4** has been prepared to complement the rehabilitation schedules for each infrastructure type, with rehabilitation actions to be incorporated as required. Information within **Appendix 4** has been sourced from the Santos SSMP and the EIS.

The schedules included in **Appendix 3** outline broad management measures that address rehabilitation of threatened species habitat. **Appendix 5** has been prepared to include monitoring and maintenance requirements for threatened species habitat, as required under the SSMP.

Additionally, in accordance with the Condition 13(D) of the CG Conditions, flora families requiring translocation, such as *Cycadaceae*, *Orchidaceae*, and *Zamiaceae*; and species in the genus: *Brachychiton*; *Hydnophytum*; *Huperzia; Livistona*; *Myrmecodia; Platycerium*; and *Xanthorrhoea*, have been included within **Appendix 4**, and the rehabilitation schedules. The Type A Restricted Plant Species Salvage Management Plan for the Coal Seam Gas Fields (Santos Document Number 0020-GLNG-4-1.3-0104) has been referenced as required.

4.1.6 Monitoring and Maintenance Plan

Appendix 5 outlines a rehabilitation monitoring and maintenance plan to complement each rehabilitation schedule. Monitoring is required for a three year period, or until rehabilitation objectives are met. The Monitoring and Maintenance plan is designed to be flexible to allow adaptations for natural disasters such as fire, drought and flood.

All monitoring will be undertaken by a suitably qualified person (s).

All monitoring results and records will be compiled and stored for a minimum of 5 years and made available for inspection upon request. Refer to **Section 7.5**.

4.2 RRRMP Responsibilities, Revision and Reporting

4.2.1 Responsibilities

The Protocol clearly allocates roles and responsibilities for the various tasks that are required as part of development and operation of the CSG fields. All responsibilities are referred back to the Protocol to ensure consistency between the documents.

4.2.2 Revision

A review process will be implemented to ensure that this plan is updated to identify improvements in 'best practice' standards, as outlined in **Section 1.3**, and reflect changes in rehabilitation practices. The RRRMP will be periodically reviewed by suitably qualified independent ecologists as approved by SEWPaC, and take feedback from Santos Field Services and rehabilitation contractors into account, including feedback on rehabilitation implementation success and failures, as outlined in the Protocol.

Additionally, the Protocol and related plans, including the RRRMP, will be reviewed and updated to take into account the findings of the Cumulative Impact Assessment Report required by the Queensland Government, before each major stage of CSG field development, or following a written request from SEWPaC. It is noted that that the Federal Minister may obtain independent review of the RRRMP, at the financial expense of Santos. When the RRRMP is updated, the reviewed plans will be submitted to the Minister for Sustainability, Environment, Water, Population and Communities for approval.

As the RRRMP relates to potential direct, indirect or cumulative adverse impacts on MNES, Santos will notify SEWPaC when developing or reviewing the plan under the Queensland Government requirements. In the notification, the relevant components of the RRRMP relating to MNES and their management, as well as the timeframe for development and approval of the Plan under the CG and EA Conditions will be indicated.

If the RRRMP is required to be changed in any way, all relevant stakeholders will be engaged to review the changes where practical. Updates to the RRRMP may be required due to:

- Changes in listed flora and fauna species;
- Changes in Threatened Ecological Communities;
- Updates to related plans, including the SSMP, SMP, and ESCM;
- Revisions to databases and datasets, including data provided by DERM such as Regional Ecosystems, Regrowth Vegetation, and Wildlife Online records;
- Amendments to BioCondition methods;
- Amendments to EAs;

- Amendments to legislation;
- At the request of the State or Commonwealth Governments; and
- Following periodic internal review of the RRRMP.

4.2.3 Reporting

Santos must also produce Annual Environmental Returns to satisfy the EPBC Act Approval and the EA Conditions.

The Annual Environmental Return for the EPBC Act Approval will:

- Address compliance with the conditions;
- Include record of any unavoidable adverse impacts on MNES, mitigation measures applied to avoid adverse impacts on MNES, and any rehabilitation work undertaken in connection with unavoidable adverse impact on MNES;
- Identify all non-compliance with the conditions and provide details regarding complaints; and
- Identify any amendments needed to plans to achieve compliance with the conditions.

The Annual Environmental Return for rehabilitation activities for the EAs will:

- Provide details regarding the status of disturbance, progressive rehabilitation and final rehabilitation associated with project activities;
- Identify all relevant non-compliances with the following documents:
  - Gladstone Liquefied Natural Gas - GLNG Project – Coordinator-General's evaluation report on the environmental impact statement, May 2010;
  - the conditions of the environmental authority;
  - any current Operational Plan for the project; and
  - measurable criteria outlined within the rehabilitation monitoring and maintenance plan.;
- Identify any amendments needed to the RRRMP to achieve compliance with the relevant EA conditions.

Additionally, a Return of Operations is required to satisfy the CG Conditions and clearing permit conditions that includes a summary of rehabilitation actions completed. In the case of pipeline construction, the CG Conditions (Condition 13(g) requires that for clearing impacts that result in permanent loss of least concern native plants (cannot be re-established within three (3) years of clearing or floristic modification), the holder of the permit issued under the *Nature Conservation Act 1992* must provide DERM with a written detailed report of permanent vegetation loss, including the area, species affected and mapping of affected areas, within three (3) months of completion of the pipeline construction (Note: this is in addition to the required Return of Operations).

Data collected as part of rehabilitation monitoring (Refer to **Section 7.5** and **Appendix 5**) will be incorporated within the Annual Environmental Return and Return of Operations under the EPBC Act and EA approval requirements. The information collected as part of monitoring will be assessed and summarised to provide an overview of rehabilitation progress within the CSG fields. Additionally, assessment of collected data will be used to identify any amendments required to the RRRMP.

Table 4.1 outlines a review and reporting program for the RRRMP document. The program includes provision for periodic review as required, as well as revision as part of the Protocol and Operational Plans. A revision register has been included at the beginning of this document to ensure all amendments are documented. Reporting timeframes will be tracked by Santos via processes outlined in the Protocol.

Table 4.1: RRRMP Review and Reporting Program

Timing	Requirement	Responsibility
Review		
Annual	Revision of RRRMP framework, benchmark guidelines and schedules to ensure: ▪ additional requirements / amendments to conditions are updated; ▪ changes in 'best practice' methods are included ▪ feedback from rehabilitation successes and failures are reflected in the RRRMP to ensure effective methods are highlighted.	▪ Santos (refer to the Protocol) ▪ Suitably Qualified Restoration Ecologist.
With revised FDP	▪ Where the Protocol is updated, the RRRMP will be reviewed to ensure compliance.	▪ Santos (refer to the Protocol).
With revised Operations Plan	▪ Where Operational Plans are updated, the RRRMP will be reviewed to ensure compliance.	▪ Santos (refer to the Protocol).
As requested by SEWPaC	▪ SEWPaC may request in writing for the periodic review of the RRRMP.	▪ As per SEWPaC request.
Reporting		
Annual Return to SEWPaC as per EPBC Act Approval	▪ Summary of rehabilitation actions, including monitoring and maintenance completed.	▪ Santos (refer to the Protocol) ▪ Suitably Qualified Restoration Ecologist (or similar), that is either 'independent', or an 'other expert approved by SEWPaC.
Return of Operations as per CG Conditions		
Annual Return for EA Conditions to DERM		
DERM Permanent Vegetation Loss report	▪ Where pipeline construction will result in the permanent loss of vegetation, a detailed report must be provided to DERM within 3 months of the completion of pipeline construction.	▪ Santos (refer to the Protocol) ▪ Suitably Qualified Restoration Ecologist (or similar), that is either 'independent', or an 'other expert approved by SEWPaC.

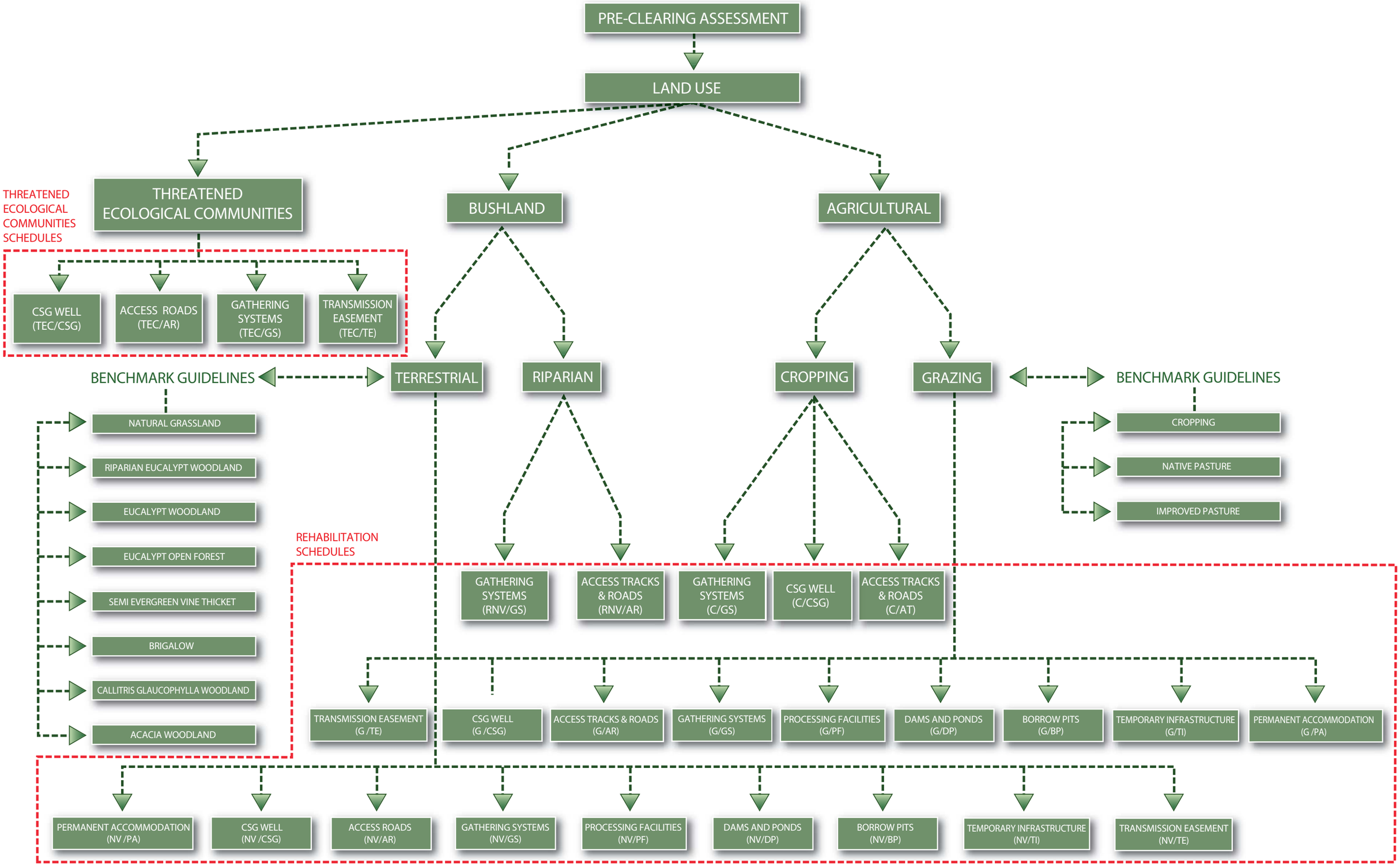


Figure 4.1 – RRRMP Structure Plan

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5.0 Pre-clearance Survey Requirements

Pre-clearance surveys will be undertaken for each disturbance site prior to commencement of clearing, as per the Protocol. The Protocol outlines the approach Santos will take in identifying, assessing and managing potential impacts to MNES and State related matters through the use of constraints mapping and specific Field MP. The Protocol adopts the following management measures:

- **Avoidance** – Avoiding direct and indirect impacts to environmentally sensitive areas, including MNES;
- **Minimise** – Minimise potential impacts on environmentally sensitive areas, including MNES and ESA's, as well as minimising disturbance to land that may otherwise result in land degradation;
- **Mitigate** – Implement mitigation measures to reduce impacts where operating in environmentally sensitive areas cannot be avoided; and
- **Remediation and Rehabilitation** – Actively remediate and rehabilitate impacted areas to promote and maintain long-term recovery of environmentally sensitive areas, including MNES.

A Land Disturbance - Site Selection and Inspection Form will be completed for each site, as per the Protocol. Information collected as part of the pre-clearance survey will be utilised to guide rehabilitation, as it will be utilised in conjunction with benchmark guidelines to determine appropriate rehabilitation actions. Information requirements are outlined in the following section.

5.1 Native Vegetation

The following information collected as part of the pre-clearing assessment will be used to determine the appropriate rehabilitation treatments in areas of native vegetation, including TEC, remnant and regrowth vegetation, as well as critical habitat for threatened species:

- Identification of the representative RE and TEC (if applicable);
- Structural characteristics of the vegetation community, including number of strata, and average and range of heights for each strata and percentage cover of each strata;
- Species requiring translocation as per *NC Act* clearing permit requirements and EPBC conditions;
- Native species richness and composition, including dominant species of each vegetation strata;
- Dominant weed species and percentage cover;
- Ground cover composition and percentage cover;
- Species suitable for seed collection prior to vegetation clearing (in accordance with the Salvage Management Plan and as deemed suitable and required);
- Site stability (i.e. identification of erosion prone areas etc);
- Slope and landform information;
- Soil characteristics; and
- Additional key habitat features for threatened fauna including fallen woody timber, hollow bearing trees and foraging resources.

Upon the collation of data, the appropriate benchmark guideline can be selected and modified with site specific data to guide long term rehabilitation efforts (**Section 6**). All data collected relating to MNES and rehabilitation must be collected to data standards as notified by SEWPaC. All ecological survey data relating to MNES will be provided to SEWPaC within 30 business days of request, as per EPBC 2009/4059.

5.2 Grazing Pasture

The following information is required to determine appropriate rehabilitation treatments in grazing areas:

- Ground cover species richness and composition;
- Dominant weed species and percentage cover, excluding favorable pasture species (eg. Buffel Grass, Sorghum);
- Ground cover composition and percentage cover;
- Site stability (i.e. identification of erosion prone areas etc);
- Soil type and GQAL classification; and
- Landscape elements including slope and landform.

Similarly to Native Vegetation, following the pre-clearance survey, the appropriate benchmark guideline can be selected and modified with site-specific data to guide long-term rehabilitation efforts.

6.0 Benchmark Guidelines

6.1 Application

Benchmark guidelines have been developed for a range of ecosystems within the CSG fields (**Appendix 2**). The benchmark guidelines have been developed to provide a reference for each broad ecosystem group within vegetation that is considered to be representative of the 'best on offer' in the CSG fields. As an over-arching objective of this RRRMP is to reinstate vegetation to pre-disturbance quality of better, the intent of the benchmark guidelines is to supplement the pre-clearance survey data to ensure that this objective can be achieved. In particular, the benchmark guidelines provide indicative conditions (e.g.: canopy cover, canopy height, species richness and ground cover) for remnant ecosystems in the region. They do not provide an exhaustive species list, rather the key species for each ecosystem, to be supplemented with data collected as part of the pre-clearance survey.

The appropriate benchmark guideline will be identified following the pre-clearance survey and identification of disturbance type. The ecologist conducting the pre-clearance survey can then utilise the benchmark guideline with input from the pre-clearance survey to provide suitable targets for rehabilitation standards. Similarly, the benchmark guideline can be supplemented with pre-clearance data to select appropriate species for rehabilitation. Refer to **Appendix 2**.

The following sections outline the methods and broad ecosystems types used to determine the benchmark guidelines, and describe additional information included within the benchmark guidelines.

6.2 Vegetation

6.2.1 Methods

Benchmark Conditions were developed for each ecosystem using BioCondition assessments at suitable reference sites. BioCondition is an assessment protocol that has been developed by DERM to rapidly assess how functional an area of vegetation is for the maintenance of biodiversity values. The BioCondition method outlines a repeatable procedure that provides a condition rating of 1 to 4, or functional through to dysfunctional condition for biodiversity. The condition rating takes into consideration how the attributes of a vegetation area differ to the attributes of an area of the same vegetation type in its reference state, known as a benchmark site.

Benchmark sites provide a reference for each site condition attribute assessed in BioCondition, and are specific to each RE. DERM provide a method for assessing reference sites in the Methodology for the Establishment and Survey of Reference Sites for Biocondition (Eyre et al. 2011). The assessment methods for condition reference site assessments outline the need to undertake sites in the best available condition. Sites were selected based on condition of the vegetation. Additionally, the sites were assessed in February 2011 following periods of heavy rainfall, resulting in optimal survey conditions. As a result however, benchmark guidelines may not accurately reflect the target condition for rehabilitation throughout times of drought.

To guide rehabilitation efforts, benchmark reference guidelines were established for each broad ecosystem type occurring within the project areas, rather than each mapped RE. Broad ecosystem types

were selected based on RE mapping and existing condition to provide representative guidelines for rehabilitation. Additionally, each TEC was assessed to provide guidelines to ensure compliance with the EPBC Act Approval. Benchmark guidelines will be applied to areas where remnant vegetation and HVR is disturbed.

BioCondition assessment and Quaternary Surveys (Nelder et al. 2005) were undertaken within each broad ecosystem represented in the project areas. Where possible, multiple sites were assessed across the project areas to account for landscape and sub-regional variations in each community. **Figure 6.1** outlines the locations of benchmark site assessments conducted across the project areas. The DERM BioCondition Benchmark Methods were adapted slightly to identify benchmarks for a range of broad vegetation groups including TEC. Adaptations included gathering data on weed cover and composition, as well as assessing disturbance within each benchmark site to gain a greater understanding of the reference site condition. Additionally, the Benchmark Methods were adapted to assess a broad ecosystem group rather than individual RE, as this was considered appropriate for determining the performance criteria for rehabilitation.

For each benchmark site, a 100m x 50m plot was established with a 100m tape. A range of biodiversity indicators measured were assessed within the plot, as summarised within **Table 6.1**. The following sections describe the biodiversity indicators measures within each benchmark site.

Disturbance and Severity

While disturbance and severity are not required for a BioCondition reference site, information on disturbances, including wildfire, prescribed burn, grazing, logging, treatment, erosion and regeneration was recorded. Additionally, landscape attributes were noted, such as position in the landscape and slope. This information was used to ensure appropriate data ranges were recorded within the benchmark guidelines.

Native Plant Species Richness

The richness of trees, shrubs, grass and herbs and forbs was assessed for each site, based on BioCondition assessment methods and definitions. Species richness is a key indicator for biodiversity, as it can have a direct relationship with the presence of fauna, as well as influence a range of functional processes (Eyre et al. 2010). Species richness was assessed within a 50m x 10m sub-quadrat, by noting the number of native species present within the sub-quadrat. Each benchmark guideline includes a species richness range as a target for rehabilitation.

Tree Canopy Cover

Tree canopy cover characterises patch productivity and the distribution and abundance of biomass (Eyre et al. 2010). It is also used as a key indicator of remnant status, as per the VM Act 1999. Canopy cover was assessed for each benchmark site utilising the canopy intercept method over a 100m transect, for the ecologically dominant layer. A canopy cover range is included within each benchmark guideline to provide a target cover for each broad ecosystem group.

Tree Canopy Height

Canopy height is another indicator of site productivity, as well as development (Eyre et al. 2010). It is also a key indicator of remnant status as per the VM Act 1999. Tree canopy height was assessed by measuring the average canopy height using a hypsometer, and included as a target height within the benchmark guidelines.

Shrub Cover

Shrub cover was assessed over a 100m transect utilising the canopy intercept method, where shrubs are considered to be woody plants that are multi-stemmed from the base (or within 200 mm from ground level) or if single stemmed, less than 2 m tall. It is included within the benchmark guidelines to provide guidance on target floristic structure.

Ground Cover Assessment

An assessment of ground cover was conducted over five 1m x 1m quadrats, located at 10m intervals between 35m and 75m along the 100m transect. The ground cover assessment included assessing the percentage cover of:

- Native grasses;
- Native shrubs;
- Native herbs and forbs;
- Introduced grasses;
- Introduced shrubs, herbs and forbs;
- Leaf litter;
- Bare ground; and
- Rock.

Ground cover composition was included within each benchmark guideline to ensure the re-instatement of appropriate ground covers.

Habitat / Large Tree

Large trees provide a vital habitat resource within many broad ecosystem groups. An assessment of large trees was undertaken to determine the indicative density of these features within a mature community. Additionally, a count of trees with hollows of a diameter greater than 10cm was conducted to gain an understanding of potential habitat value for hollow dependent species.

It is not possible for habitat trees to be re-established within the timeframes of this project. However this indicator may be used to determine suitable alternatives such as the installation of nest boxes in surrounding vegetation to the disturbance site.

Weed Cover

The Reference Site methods do not require an assessment of weed cover, as ideally weeds would be absent. Given that many areas within the project area have been historically disturbed due to previous and current land management practices, weed cover was assessed to identify current weed infestation levels within sites that are considered to be of the highest standard available.

Planting Density

Indicative planting densities are included within each benchmark guideline, to provide an estimate of required plants where revegetation is needed. This is intended to be a guide for initial planting efforts only, while target covers provides benchmark guidelines for regenerating rehabilitation areas.

Table 6.1: Biodiversity Indicators and Plot Size

Plot Size	Biodiversity Indicator
100m x 50m	Disturbance and severity
	Large trees
100m transect	Tree and shrub canopy cover (%)
50m x 10m	Native plant species richness
	Weed cover (%)
Five 1m x 1m (35m, 45m, 55m, 65m, and 75m)	Ground cover
50m x 20m	Fallen woody material

6.2.2 Broad Ecosystem Types

An assessment of DERM Regional Ecosystem mapping and the Project EIS was conducted to identify broad vegetation groups occurring within the project areas. **Table 6.2** summarises the Benchmark Guidelines developed for the project areas. The benchmark guidelines were developed based on data collected by RPS, as well as existing DERM benchmarks for a range of Regional Ecosystems. Additional information within benchmark guidelines includes target planting densities in accordance with relevant standards and guidelines. Benchmark criteria for each Broad Ecosystem Group are included within **Appendix 2**.

The Benchmark Guidelines (**Appendix 2**) include guidelines for TEC that are approved for disturbance under the EPBC Act Approval, as part of Stage 1 of the RFDA (refer to the Protocol), namely:

- Natural Grasslands of the Queensland Central highlands and northern Fitzroy Basin;
- Semi-evergreen Vine Thicket of the Brigalow Belt (North and South) and Nandewar Bioregions; and
- Brigalow (*Acacia harpophylla* dominant and co-dominant).

Under the EPBC Act Approval, no disturbance of the community of native species dependent on natural discharge of groundwater from the Great Artesian Basin is authorised. Accordingly, a benchmark guideline has not been developed for this TEC.

Similarly, recently listed TEC including Coolibah - Black Box Woodlands of the Darling Riverine Plains and the Brigalow Belt South Bioregions will be addressed as required for future development.

Table 6.2: Broad Ecosystem Groups in the Project Areas

Broad Ecosystem	RE	VM Status	Project Area	RE Description	EPBC TEC
Natural Grasslands	11.3.21	E	RSGPA	*Dichanthium sericeum* and/or *Astrebla* spp. grassland on alluvial plains. Cracking clay soils	Natural Grasslands of the Queensland Central Highlands and the northern Fitzroy Basin
	11.8.11	OC	RSGPA	*Dichanthium sericeum* grassland on Cainozoic igneous rocks	
	11.9.3	LC	RSGPA	*Dichanthium* spp., *Astrebla* spp. grassland on fine-grained sedimentary rocks	
	11.9.3a	LC	RSGPA	*Dichanthium* spp., *Astrebla* spp. grassland on fine-grained sedimentary rocks	
Semi-evergreen Vine Thicket	11.8.3	LC	RSGPA	Semi-evergreen vine thicket on Cainozoic igneous rocks. Steep hillsides	Semi-evergreen Vine Thickets of the Brigalow Belt (north and south) and Nandewar Regions
	11.9.4a	OC	FPA, RSGPA, AVPA	Semi-evergreen vine thicket on fine-grained sedimentary rocks	
	11.9.4b	OC	FPA, RSGPA, AVPA	Semi-evergreen vine thicket on fine-grained sedimentary rocks	
	11.10.8	OC	FPA, RSGPA, AVPA	Semi-evergreen vine thicket in sheltered habitats on medium to coarse-grained sedimentary rocks	
Brigalow	11.4.3	E	RSGPA	*Acacia harpophylla* and/or *Casuarina cristata* shrubby open forest on Cainozoic clay plains	Brigalow (*Acacia harpophylla* dominant and co-dominant);
	11.4.7	E	RSGPA	Open forest to woodland of *Eucalyptus populnea* with *Acacia harpophylla* and/or *Casuarina cristata* on Cainozoic clay plains	
	11.9.5	E	FPA, RSGPA, AVPA	*Acacia harpophylla* and/or *Casuarina cristata* open forest on fine-grained sedimentary rocks	
	11.7.1	LC	RSGPA	*Acacia harpophylla* and/or *Casuarina cristata* and *Eucalyptus thozetiana* or *E. microcarpa* woodland on lower scarp slopes on lateritic duricrust	n/a
	11.9.1	E	RSGPA	*Acacia harpophylla*-*Eucalyptus cambageana* open forest to woodland	n/a

Broad Ecosystem	RE	VM Status	Project Area	RE Description	EPBC TEC
				on fine-grained sedimentary rocks	
	11.9.10	OC	RSGPA	*Acacia harpophylla, Eucalyptus populnea* open forest on fine-grained sedimentary rocks	n/a
	11.9.11	OC	RSGPA	*Acacia harpophylla* shrubland on fine-grained sedimentary rocks	n/a
Riparian Woodland	11.3.2	OC	FPA, RSGPA, AVPA	*Eucalyptus populnea* woodland on alluvial plains	n/a
	11.3.3	OC	RSGPA	*Eucalyptus coolabah* woodland on alluvial plains	n/a
	11.3.17	OC	FPA, AVPA	*Eucalyptus populnea* woodland with *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains	n/a
	11.3.18	LC	FPA	*Eucalyptus populnea, Callitris glaucophylla, Allocasuarina luehmannii* shrubby woodland on alluvium	n/a
	11.3.19	LC	RSGPA	*Callitris glaucophylla, Corymbia* spp. and/or *Eucalyptus melanophloia* woodland on Cainozoic alluvial plains	n/a
	11.3.25	LC	FPA, RSGPA, AVPA	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	n/a
	11.3.28	OC	RSGPA	*Casuarina cristata* +/- *Eucalyptus coolabah* open woodland on alluvial plains	n/a
	11.3.39	LC	FPA, AVPA	*Eucalyptus melanophloia* +/- *E. chloroclada* woodland on undulating plains and valleys with sandy soils	n/a
Eucalypt Open-forest	11.5.4	LC	RSGPA	*Eucalyptus crebra*, *Callitris glaucophylla*, *C. endlicheri*, *E. chloroclada, Angophora leiocarpa* on Cainozoic sand plains/remnant surfaces. Deep sands	n/a
	11.7.4	LC	RSGPA	*Eucalyptus decorticans* and/or *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp., *Lysicarpus angustifolius* on lateritic duricrust	n/a

Broad Ecosystem	RE	VM Status	Project Area	RE Description	EPBC TEC
	11.10.1	LC	FPA, RSGPA, AVPA	*Corymbia citriodora* open forest on coarse-grained sedimentary rocks	n/a
	11.10.13a	LC	FPA, AVPA	*Eucalyptus* spp. and/or *Corymbia* spp. open forest on scarps and sandstone tablelands	n/a
Eucalypt Woodland	11.3.17	OC	RSGPA	*Eucalyptus populnea* woodland with *Acacia harpophylla* and/or *Casuarina cristata* on alluvial plains	n/a
	11.3.18	LC	RSGPA	*Eucalyptus populnea*, *Callitris glaucophylla*, *Allocasuarina luehmannii* shrubby woodland on alluvium	n/a
	11.5.1	LC	RSGPA	*Eucalyptus crebra*, *Callitris glaucophylla*, *Angophora leiocarpa*, *Allocasuarina luehmannii* woodland on Cainozoic sand plains/remnant surfaces	n/a
	11.5.5	LC	FPA, RSGPA	*Eucalyptus melanophloia*, *Callitris glaucophylla* woodland on Cainozoic sand plains/remnant surfaces. Deep red sands	n/a
	11.5.9a	LC	RSGPA	*Eucalyptus crebra* and other *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains/remnant surfaces. Plateaus and broad crests	n/a
	11.5.13	OC	RSGPA	*Eucalyptus populnea* +/- *Acacia aneura* +/- *E. melanophloia* woodland on Cainozoic sand plains/remnant surfaces	n/a
	11.7.6	LC	RSGPA	*Corymbia citriodora* or *Eucalyptus crebra* woodland on lateritic duricrust	n/a
	11.7.7	LC	RSGPA	*Eucalyptus fibrosa* subsp. *nubila* +/- *Corymbia* spp. +/- Eucalyptus spp. on lateritic duricrust	n/a
	11.8.5	LC	RSGPA	Eucalyptus orgadophila open woodland on Cainozoic igneous rocks	n/a
	11.9.2	LC	AVPA	*Eucalyptus melanophloia* +/- *E. orgadophila* woodland on fine-grained sedimentary rocks	n/a

Broad Ecosystem	RE	VM Status	Project Area	RE Description	EPBC TEC
	11.9.7	OC	FPA, RSGPA	*Eucalyptus populnea, Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks	n/a
	11.9.7a	OC	RSGPA	*Eucalyptus populnea, Eremophila mitchellii* shrubby woodland on fine-grained sedimentary rocks	n/a
	11.10.4	LC	FPA, AVPA	*Eucalyptus decorticans, Lysicarpus angustifolius* +/- *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp. woodland on coarse-grained sedimentary rocks. Crests and scarps	n/a
	11.10.7	LC	FPA	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	n/a
	11.10.7a	LC	FPA	*Eucalyptus crebra* woodland on coarse-grained sedimentary rocks	n/a
	11.10.11	LC	FPA, RSGPA, AVPA	*Eucalyptus populnea, E. melanophloia* +/- *Callitris glaucophylla* woodland on coarse-grained sedimentary rocks	n/a
Acacia Open-forest	11.7.2	LC	RSGPA	*Acacia* spp. woodland on lateritic duricrust. Scarp retreat zone	n/a
	11.7.5	LC	RSGPA	Shrubland on natural scalds on deeply weathered coarse-grained sedimentary rocks	n/a
	11.10.3	LC	FPA, AVPA	*Acacia catenulata* or *A. shirleyi* open forest on coarse-grained sedimentary rocks. Crests and scarps	n/a
Callitris glaucophylla Woodland	11.3.19	LC	FPA	*Callitris glaucophylla, Corymbia* spp. and/or *Eucalyptus melanophloia* woodland on Cainozoic alluvial plains	n/a
	11.10.9	LC	RSGPA, AVPA	*Callitris glaucophylla* woodland on coarse-grained sedimentary rocks	n/a

E – endangered, OC – of concern, LC – least concern.

6.3 Agricultural Lands

Extensive livestock grazing currently occurs across the project areas. This land use entails the grazing of either native and/or improved pastures throughout this extensive agroecosystem. Additionally, Santos has extensive irrigation areas within the FPA, including hard wood plantations, improved pastures and fodder crops including Leucaena. Cropping lands are limited to RSGPA.

The assessment and establishment of pasture benchmarks for the agricultural land of the project areas were based upon the presence of native or improved pastures in combination with corresponding GQAL land capability classes, for which either of these pasture types are typically associated.

6.3.1 Benchmark Site Selection and Assessment

Native and improved pasture sites were selected to establish pasture benchmarks for the project areas. Site selection was based upon the following:

- Evidence of recent grazing activities (i.e. presence of livestock, manure and/or grazed pasture);
- Landscape positions representative of the varying GQAL classes;
- Good cover of native and / or exotic pasture species; and
- A typical representation of the pastures observed throughout the project area, both native and improved.

The BioCondition ground cover assessment methodology was applied to each benchmark site to determine ground cover composition, species richness, and weed cover. The aim was to establish benchmarks that are indicative of the pastures found throughout the project area. **Figure 6.1** depicts the location of selected pasture benchmark sites. **Appendix 2** includes pasture benchmarks for both native and improved pastures.

6.3.2 Soils and GQAL Classes

The GQAL classification is defined as agricultural land that is used for crop and / or livestock production. It excludes intensive agricultural land uses, such as feedlots, piggeries, poultry farms and plant nurseries that are based on either hydroponics or imported growth media (DPI & DHLGP, 1993). Four classes of agricultural land have been defined for Queensland, a description of each is provided in **Table 6.3**.

Variable soil characteristics such as soil structure, moisture retention, permeability and natural fertility can influence the abundance and distribution of native and/or exotic grass species on a given soil type. For example lower fertility, poorly structured and well drained granite sandy loam soil type is more likely to support deep rooted perennial native grass species such as Kangaroo Grass (*Themeda triandra*) that can withstand harsher conditions in association with this soil type, in contrast to shallower rooted exotic perennial grass species such as Johnson Grass (*Sorghum halepense*) that typically prefers a higher fertility, highly structured, moisture retaining clay loam soil types on floodplains.

Figure 1.4 provides an overview of the GQAL mapping in the CSG fields. The CSG fields comprise small areas of class A, and are dominated by B and C class GQAL. No class D occurs in the region. While small portions of cropping land occur in the RSGPA, it was observed that most of the GQAL class A and B land within the RSGPA is used for grazing livestock and may be primarily occurring where poorer soil types are in association with arable land.

The majority of the CSG fields are not suitable for cropping due to unfavorable climatic conditions. Class A and B agricultural land in the FPA and AVPA are used for grazing livestock in place of cropping. It is understood that there is no strategic cropping land within the FPA or AVPA.

Table 6.3: GQAL Classification Descriptions

Class	Description
Class A (A1, A2)	*Crop land* - Land that is suitable for current and potential crops with limitations to production which range from none to moderate levels.
Class B (B1, B2)	*Limited crop land* - Land that is marginal for current and potential crops due to severe limitations; and suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping.
Class C (C1, C2, C3)	*Pasture land* - Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production; but some areas may tolerate a short period of ground disturbance for pasture establishment.
Class D	*Non-agricultural land* - Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage.

Source: DPI & DHLGP (1993)

6.3.3 Pasture Benchmarks

In consideration of the aforementioned assessment methods to establish representative and practical benchmarks for pastures, the rehabilitation of pasture lands within the FPA, RSGPA and AVPA will be based upon benchmarks that combine the presence of either native or improved pastures with the relevant GQAL classes, for which these vegetation types are typically expected to occur.

However, the site rehabilitation of pastures will be representative of the results of the pre-clearance survey data that relate to species diversity, species richness and overall cover.

The pasture benchmarks will be:

- GQAL Class A and B – Improved Pastures; and
- GQAL Class C – Native Pastures.

It must be reiterated that even though the grasslands of the FPA, RSGPA and AVPA were primarily observed to be either improved pastures or native pastures, there were also mixtures of both types present and as such they do not conform to the standard GQAL class definitions. Evidence of this is where pasture benchmark surveys in the FPA, RSGPA and AVPA were undertaken within areas mapped as GQAL class C in that both improved and native pastures occur in areas that should typically be dominated by native pastures.

This has more than likely been facilitated by livestock movements and the potential broad casting of favorable pasture species by landholders that may have resulted in the occurrence of exotic grass species, such as the invasive Buffel Grass (*Cenchrus ciliaris*), within areas mapped as GQAL class C,

where it is typically expected that native pastures are the norm and most dominant. Agroecosystems are anthropogenic landscapes and such variations must be expected.

N

ROLLESTON
BAUHINIA
OOMBABEER
VERBENA
HUTTON
INJUNE
KOMINE
GUNNEWIN
BIMBADINE
ORALLO
HODGSON
ROMA
MUCKADILLA
BLYTHDALE
YULEBA
JACKSON
SURAT

Mine Lease
- Roma Shallow Gas Area
- Fairview Project Area
- Arcadia Project Area

Property
- Broandah
- Cottage Creek
- Coxons Creek
- Fairview
- Springwater
- The Bend
- Waddy Brae
- Wallumbilla

Benchmark Site
- Acacia Woodland
- Brigalow
- Callitris glaucophylla
- Eucalypt Open-forest
- Eucalypt Woodland
- Natural Grasslands
- Pasture
- Riparian Woodland
- Semi-evergreen Vine Thicket

0 1 2 4 6
Kilometers

Project Manager: BD8
Compiled by: CA
Map Projection: MGAz55
Map Datum: GDA94
File Reference: PR106904-1
Sheet Number: 1 of 2

Client: Santos

Title: Figure 6.1 (a)
Fairview & Arcadia Valley
Project Areas
Benchmark Guidline Sites

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:125,000	29/04/2011	PR106904	A

N

ROLLESTON
BAUHINIA
OOMBABEER
VERBENA
HUTTON
INJUNE
KOMINE
GUNNEWIN
BIMBADINE
ORALLO
HODGSON
ROMA
MUCKADILLA
BLYTHDALE
YULEBA
JACKSON
SURAT

ROMA
BLYTHDALE
PICKANJINNIE
WALLUMBILLA

Mine Lease
- Roma Shallow Gas Area
- Fairview Project Area
- Arcadia Project Area

Property
- Broandah
- Cottage Creek
- Coxons Creek
- Fairview
- Springwater
- The Bend
- Waddy Brae
- Wallumbilla

Benchmark Site
- Acacia Woodland
- Brigalow
- Callitris glaucophylla
- Eucalypt Open-forest
- Eucalypt Woodland
- Natural Grasslands
- Pasture
- Riparian Woodland
- Semi-evergreen Vine Thicket

0 1 2 4 6 8
Kilometers

Project Manager: BD
Compiled by: CA
Map Projection: MGAz55
Map Datum: GDA94
File Reference: PR106904-1
Sheet Number: 2 of 2

Client: Santos

Title: Figure 6.1 (b)
Roma Project Area & Surrounds
Benchmark Guidline Sites

RPS

SCALE (A4)	DATE	DRAWING NO.	ISSUE
1:225,000	29/04/2011	PR106904	A

7.0 Rehabilitation Schedule

Rehabilitation schedules have been developed to specify rehabilitation objectives, actions, monitoring and maintenance requirements for each disturbance type. **Table 7.1** outlines a framework for identifying the correct rehabilitation schedule when used in conjunction with the RRRMP Structure Plan framework (**Figure 4.1**).

Each rehabilitation schedule has been developed based on the structure and methods outlined in the following sections. Refer to **Appendix 3** for Rehabilitation Schedules.

Table 7.1: Rehabilitation Schedules

Disturbance Type	Land Use	Rehabilitation Schedule Code	Appendix 3 Reference Number
CSG Well Leases (exploration, appraisal, production)	Native Vegetation	NV/CSG	1
	TEC	TEC/CSG	2
	Grazing	G/CSG	3
Access Tracks and Roads	Native Vegetation	NV/AR	4
	Native Riparian Vegetation	NRV/AR	5
	TEC	TEC/AR	6
	Grazing	G/AR	7
Gathering Systems for Produced Water and Gas	Native Vegetation	NV/GS	8
	Native Riparian Vegetation	NRV/GS	9
	TEC	TEC/GS	10
	Grazing	G/GS	11
Processing Facilities	Native Vegetation	NV/PF	12
	Grazing	G/PF	13
Dams and Ponds	Native Vegetation	N/DP	14
	Grazing	G/DP	15
Borrow Pits	Native Vegetation	NV/BP	16
	Grazing	G/BP	17
Temporary Infrastructure (camps etc)	Native Vegetation	NV/TI	18
	Grazing	G/TI	19
Transmission Easements	Native Vegetation	NV/TE	20
	Native Riparian Vegetation	NRV/TE	21
	TEC	TEC/TE	22
	Grazing	G/TE	23

7.1 Performance Criteria

Performance criteria have been developed for each rehabilitation schedule in order to meet the overarching rehabilitation objectives of providing a safe, stable and non-polluting landform. In order to comply with the EPBC Act Approval, CG Conditions and EA Conditions, standard performance criteria for vegetated sites (including TEC, remnant and HVR vegetation) include the representativeness of species richness and diversity for the appropriate benchmark. Specific criteria to support the recovery of listed species habitat and recovery of TEC, RE and significant species habitat are also included within each rehabilitation schedule.

Standard performance criteria within agricultural sites across the project area include:

- Plant survival, height, recruitment and richness;
- Stability of landform;
- No declared pest plant under the LPA occurring;
- Pasture species richness representative of pre-disturbed condition;
- The preservation of inherent GQAL agricultural land use classes; and
- Pasture diversity, quality and productivity rehabilitated to pre-disturbance benchmarks.

7.2 Rehabilitation Actions

A range of general control strategies are included within the rehabilitation schedules, including topsoil, landform, erosion and sediment control and vegetation management actions. **Figure 7.1** outlines the general rehabilitation process and the following sections outline broad rehabilitation actions and methods that may be required.

7.2.1 Site Preparation

Vegetation Clearance

Vegetation clearance will be undertaken in accordance with the Protocol, and guided by information collected as part of the pre-clearance survey. Specific measures relating to vegetation clearance outlined within the SSMP (Santos, 2011b), the Protocol (Santos, 2011a), SMP (Aurecon, 2011) and FMP (Santos, e & f) will be implemented, including timing of vegetation removal, location of stockpiles, and landscape variation. The schedules included in Appendix 3 outline general vegetation clearance strategies that are consistent with these documents.

Seed Collection and Relocation

Where appropriate seed collection and relocation of species will be undertaken prior to vegetation clearing, in accordance with the SSMP and the Salvage Management Plan (Santos, 2011g) Additional requirements for seed collection and translocation, including target species and timing of actions will be determined as part of the pre-clearance survey.

Handling techniques for species requiring translocation will be followed as per the Salvage Management Plan. Key requirements to be implemented whilst salvaging the required species include:

- The completion of a site-specific Record of Clearing is required, and a Basis of Decision worksheet must be completed (Appendix B of the Salvage Management Plan (Santos 2011g));
- Care will be taken to prevent the spread of weed seeds, unwanted plants, and pathogens;
- Clean tools will be used (soap and water is an acceptable method of ensuring tools are clean), and tools will be cleaned prior to moving to a new location;
- Using removal methods that ensure minimal damage to both the plant and its surrounds;
- Ensuring a sufficient root ball is taken; and
- Ensuring plants are transported and stored in appropriate containers.

7.2.2 Topsoil Management

Useable topsoil resources are mainly confined to the surficial (A) horizon materials, and occasionally in the upper part of the subsurface (B1) horizons, as they contain seed-stock, micro-organisms, organic matter and nutrients necessary for plant growth. Soil microbial activity, organic matter content and other parameters affecting soil productivity and fertility tend to decrease with depth (Aurecon, 2011, Appendix **7**).

Topsoil will be stockpiled prior to construction activities for use in future rehabilitation activities, with piles not exceeding 1.5 m high with battered sides of less than 5% gradient. Topsoil will be stockpiled and stabilised to maintain the biological properties of the soil for future reuse. Appropriate erosion and sediment control measures will be implemented to ensure that stockpiles are not subject to erosion, as per the SMP and ESCM. Additionally, topsoil stockpiles will be stabilised by seeding with suitable grass species within six months following stockpiling.

The objective of topsoil management is to identify soil material within a designated area of proposed disturbance for the purpose of selective stripping, storing and treating (if required) in order to protect and preserve the viability of the in situ seed-stock, biological life and nutrient condition for reuse during site rehabilitation (Aurecon, 2011, **Appendix 7**).

Topsoil management measures relevant to this RRRMP have been established in Section 5.1.2 of the SMP report produced by Aurecon (2011), included within **Appendix 7**. This report also provides topsoil management objectives and performance criteria, as well as tables outlining specific topsoil management measures (Table 5.1 in SMP) and recommended topsoil stripping depths (Table 5.2 in SMP) .

Any soil that has been removed from areas of native vegetation or agricultural land will be appropriately stabilised when stockpiled and when it is re-instated at the rehabilitation stage, by means of re-establishing native and/or exotic grass species as appropriate. In regards to rehabilitating native vegetation, the establishment of grass species is fundamental to providing immediate soil stabilisation as well as being the first stage of ecosystem successional development.

Native Vegetation

Within native vegetation sites, including areas of remnant and regrowth vegetation, progressive rehabilitation will use dominant native grass species within the pre-disturbed area and surrounding vegetation. The Benchmark Guidelines provide common native grass species for each ecosystem. Suitable native grass species for soil stabilisation are listed below in order of soil stabilisation ability:

- Cotton Panic Grass (*Digitaria brownii*);
- Cockatoo Grass (*Alloteropsis semialata*);
- Many-headed Wiregrass (*Aristida caput-madusae*);
- Slender Chloris (*Chloris divaricata*);
- Coolabah Grass (*Panicum queenslandicum*);
- Pitted Bluegrass (*Bothriochloa decipiens*);
- Queensland Bluegrass (*Dichanthium sericeum*); and
- Brigalow Grass (Paspalidium caespitosum).

While the first two species listed are stoloniferus and rhizomatous species respectively and are likely to provide the best soil stabilisation ability, at least two other native grass species will also be included to increase the potential for long-term groundcover.

Within areas of native vegetation, Buffel Grass will not to be used to stabilise soils as it is an exotic species that is invasive by nature.

Rehabilitation of areas containing least concern plants that are disturbed during clearing activities, where required by the clearing permit, will be commenced within three months of completion of construction activities. Revegetation will be consistent with plant density, floristic composition and distribution of the surrounding regional ecosystems types and within the province of the vegetation being cleared, as identified through the pre-clearing assessment (refer to Section 5 and the Protocol).

Agricultural Lands

Within improved pasture lands, grass species to be used in site rehabilitation will be the dominant species. Where introduced grazing species are dominant prior to disturbance, they will be re-instated. Suitable native and / or exotic grass species for soil stabilisation are listed below in order of soil stabilisation ability:

- Cockatoo Grass;
- Many-headed Wiregrass;
- Slender Chloris;
- Pitted Bluegrass;
- Queensland Bluegrass;

- Buffel Grass (*Cenchrus ciliaris*); and
- *Panicum decompositum*.

Again, the first two species listed are stoloniferus and rhizomatous species respectively and are likely to provide the best soil stabilisation, at least two of the other species will also be included to increase the potential for long-term groundcover.

Revegetation will be consistent with plant density, floristic composition and distribution of the surrounding vegetation, as identified through the pre-clearing assessment (refer to Section 5 and the Protocol).

The use of Buffel Grass will be avoided as a stabilisation method when in close proximity (200m) to areas of native vegetation to prevent it from potentially invading native vegetation communities. Buffel Grass will not be utilised within riparian corridors to stabilize soils.

Topsoil stockpiles will be regularly inspected for declared and environmental weeds, with weed management procedures to be in accordance with the PWMP (Santos 2011, c & d) (**Section 7.2.5**) implemented where necessary. It is likely that where temporary disturbances are proposed (up to 18 months), the viability of the seed bank will be suitable for natural regeneration to be implemented.

7.2.3 Contaminated Land

Where there is a risk of contaminated land occurring, such as brine ponds, dams and storage facilities, a site specific contaminated land assessment and management plan will be developed for each asset. The contaminated land assessments will be developed in accordance with the Draft *Guidelines for the Assessment and Management of Contaminated Land in Queensland* (Queensland Government Department of Environment, 2008) and will be contained within an asset / site specific decommissioning and demolition plan. Further information is contained within the Decommissioning and Demolition Plan (EHS Support 2011).

7.2.4 Soil Factors that can Inhibit Effective Rehabilitation

Sodic Soils

Sodic soils can inhibit plant growth as they can create significant water logging above the soil B horizon, which can in effect kill plants or result in the poor performance of plants. Sodic soils when encountered will be blended with gypsum to reduce dispersiveness prior to stockpiling and appropriately protected from erosion. A good layer of topsoil will be placed on top of sodic soils whilst stockpiling and when redistributed during rehabilitation works, as per the SMP. Further details to effectively managing sodic soils are provided in Section 5.2.2 of the SMP, included in **Appendix 7**.

Acid Sulfate Soils

No acid sulfate soils (ASS) have been identified as occurring within the project areas (Golder and Associates, 2011). If ASS are encountered, a site specific management plan will be developed.

Saline Soils

Primary soil salinity (high levels of soluble salts) is salinity that occurs naturally within the soil profile, usually stored in the subsoil layers. Secondary salinity is typically associated with a rising groundwater table, as a result of vegetation clearing and the removal of deep-rooted perennial species. This is known to have deleterious effects on plant growth and can result in permanent salt scalds (Aurecon, 2011).

When encountered, saline soils will be stockpiled separately and appropriately stabilised. When rehabilitation occurs they will be sown with deep rooted native perennial grass species or where possible replanted with native tree species, as per the SMP. Further details to effectively managing saline soils are provided in Section 5.2.2 of the SMP, included in **Appendix 7**.

Low Nutrient Soils

A significant amount of the soil landscapes in the project area are comprised of skeletal, rocky or gravelly soils and sand to sandy loamy soils (Aurecon, 2011). In most instances, these soils are derived from intrusive granite rock and are inherently low in nutrients and organic matter levels. These soils typically have low nutrient levels and as such require fertilizer applications when rehabilitation or soil stabilisation of stockpiles is to occur. Where appropriate, fertilizer will be mixed with the seed of native and/or exotic grass species and then broad cast or direct drilled as required during rehabilitation or soil stabilisation activities.

Free Draining Soils

Many common soil types within the project area tend to drain freely and lose soil moisture rapidly; as a consequence the effective germination and establishment of grass or tree seedlings can be inconsistent or even ineffective.

To assist with plant establishment in these soils types, organic matter (mulch) will be used to help retain soil moisture. A regular monitoring program and follow up maintenance will ensure that effective seedling germination and establishment is achieved (**Appendix 5**).

7.2.5 Landform Management

Following decommissioning of infrastructure, sites will be re-shaped to a safe and stable landform, with surface drainage lines and topsoil profile re-instated. Where practical, sites will be reshaped to a natural landform. However, it is not practical to reshape sites where cut and fill operations have occurred on slopes, or within highly dispersive soils. Additionally, where borrow pits are decommissioned, it is not practical to completely infill the pit to its pre-disturbance landform. A stable landform will be reinstated in these areas by surface re-profiling, contouring or benching. Methods to reshape the landform will vary depending on the level of disturbance. Within MNES, particular care will be undertaken to ensure the landform is reshaped to pre-disturbance condition.

When re-instating pipeline trenches, soils will be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.

For long term disturbances such as CSG well leases and CS, it is likely that the soil will require deep ripping to alleviate soil compaction. This will occur prior to reshaping the upper layers of the soil stratum. Rip lines will be spaced greater than 1m apart to prevent mass surface movement. All dams, sump and flare pits will be infilled as part of the landform management process, taking into account potential contamination. Where contaminated land assessments are required, they will be conducted in accordance with the EA requirements, as well as the Draft *Guidelines for the Assessment and Management of Contaminated Lands* in Queensland.

7.2.6 Weed Management

Site assessments undertaken for this report as well as the Project EIS confirmed the presence of the following weed species declared under the *Land Protection (Pest and. Stock Route Management) Act. 2002* (LPA) within the project area:

- Prickly Pear (*Opuntia stricta*);
- Velvety Tree Pear (*Opuntia tomentosa*);
- Lantana (*Lantana camara*); and
- Parthenium (Parthenium hysterophorus).

Other environmental weeds (i.e. – locally declared weeds) also occur throughout the study area, as identified within the benchmark guidelines indicative weed species list and within the PWMP for each area.

The PWMP (Santos, 2011 c & d) outlines management strategies for prevention of and response to weed and pest infestations. It includes inspection and monitoring procedures and corrective action and reporting procedures to be implemented in the project area. Additionally, the PWMP outlines procedures for notifying for declared pest plant under the LPA. It is noted that PWMP have not been prepared for the RFDA in its entirety. As PWMP are updated and provided, the RRRMP will be amended as part of annual reviews.

Where required, the PWMP will be implemented as part of site rehabilitation activities. Of note, weed control is to occur prior to clearing and construction activities commencing to prevent the spread and importation of weed species, as well as throughout operational and rehabilitation phases. Where declared pest plant under the LPA are identified on site, notification processes will be followed as per the PWMP.

A number of weed control techniques will be implemented to manage weed and exotic species throughout rehabilitation areas, that are consistent with the PWMP. Two broad methods are generally used to treat weed invasions; mechanical removal or chemical control, as discussed in the following sections. Where possible, mechanical control will be employed as per the preferred method.

Mechanical Control

Mechanical control will be undertaken using a variety of methods only in areas where weed removal will not result in site erosion. Mechanical control methods include:

- Manual removal by hand or grubbing by using loppers, hatchets of small saws to remove the weed including the roots;
- Lopping where the weed is removed by an axe or chainsaw;
- Slashing to remove the seed heads of the weed species; and
- Ringbarking, which involves removing the sapwood around the entire girth of the trunk near the base of the exotic plant.

Chemical Control

This technique will be employed when mechanical controls are not appropriate i.e. are not cost or time efficient or will cause too much disturbance such as soil erosion on steep slopes or where there are potential health hazards (e.g. Parthenium). The use of chemicals will only be undertaken by a suitably qualified person (i.e. Agriculture Chemical Distribution Control certified) and must be used in accordance with the Material Safety Data Sheet (MSDS) and appropriate safety standards.

Herbicides used in the vicinity of waterways will be designed accordingly (e.g. Roundup® BioactiveTM Herbicide or Weedmaster® Herbicide). No broad scale spraying or overspray methods will be employed near waterways. No mixing of chemicals or rinsing of equipment will be carried out within 25m of any water bodies.

7.2.7 Approach to Revegetation

Revegetation is required to restore decommissioned sites to pre-disturbance condition to promote and maintain the long-term recovery of TEC, as per the EPBC Act Approval. The EA conditions outline the requirement of a minimum 80% of the species richness present in the surrounding areas.

Two approaches to revegetation are included within the RRRMP, natural regeneration and assisted re-vegetation, as outlined below.

Natural Regeneration

Natural regeneration is the preferred method for re-reinstating native vegetation where short term disturbances are proposed (less than 18 months) and a viable native seed bank is available. Disturbance sites where natural regeneration may be possible include:

- CSG wells, as part of lease reduction;
- Transmission easements;
- Access tracks and road reserves;
- Gathering systems
- Exploration areas; and
- Temporary infrastructure such as drilling camps (e.g. less than 12-18month disturbance).

Natural regeneration is advantageous over assisted re-vegetation, as the seedlings are more likely to establish and grow rapidly with less mortality than planted individuals because they are adapted to the local environment. Furthermore, this option is the most cost effective as the labour requirements and capital costs are minimised.

Where natural regeneration is proposed, topsoil will be re-spread following any required landform re-shaping. Re-spreading topsoil will assist with scarification of seed pods to promote regeneration. Weed management will be undertaken to ensure that pioneer species are predominantly native species. Where natural regeneration occurs, monitoring is required to ensure the effective establishment of species representative of the pre-clearing state.

Assisted revegetation will be undertaken where natural regeneration is deemed to be ineffective by the restoration ecologist. Where natural regeneration is ineffective following 12 months of monitoring, and conditions have been optimal for growth, the seed bank will be deemed as no longer viable. Where conditions are not optimal, an additional 12 months will be required to determine if the seed bank is unviable. Weed management will be implemented as outlined in **Appendix 5** to ensure native growth is promoted. Additionally, measures outlined within the SMP and ESCM will be implemented to ensure soil stability is maintained.

Assisted Revegetation

In areas where long term disturbances have occurred (such as CS and dams) and where natural regeneration is deemed as ineffective by the restoration ecologist, assisted revegetation will be required to ensure that disturbed areas are rehabilitated to a pre-clearance condition with species richness representative of the pre-clearing state. Species selection and richness will be based on the benchmark guidelines that have been supplemented by the pre-clearance survey, which will be undertaken by a suitably qualified ecologist.

Within areas of native vegetation, a combination of tube stock and seeding will be implemented. Tube stock will be used for canopy and shrub species, while a combination of tube stock and seeding is appropriate for herbs, forbs and grasses. Species will be selected based on pre-clearing composition and appropriate benchmark guidelines, as outlined above.

Where assisted revegetation is required, target planting densities are outlined within the relevant benchmark guidelines (**Section 6.0, Appendix 2**). The densities at which the proposed planting will occur are dependent upon a number of factors, including the density of the current established native vegetation and seasonality. Target planting densities are based on completely cleared areas, and will be adjusted to take naturally regenerated saplings into account. Planting methods are discussed in the following sections.

Revegetation will occur in optimal planting seasons (spring or February to April when the incidence of rainfall events are more likely) and environmental conditions (following a rainfall event of at least 25mm when soil moisture levels are highest) to maximise plant establishment, growth rates, and survival.

Translocation

In accordance with the Coordinator-General conditions, Type A restricted least concern plants (Schedule 7 of the *Nature Conservation (Administration) Regulation 2006*), including species in the families Cycadaceae, Orchidaceae, and Zamiaceae; and species in the genus: *Brachychiton*; *Hydnophytum; Huperzia; Livistona; Myrmecodia; Platycerium;* and *Xanthorrhoea*, must be salvaged and used for on-site revegetation purposes (i.e. translocated). Where translocated plants are located within rehabilitation areas, measures included in the Salvage Management Plan (Santos 2011g) are to be implemented. Specific measures include:

- Ensuring plants are secured with stakes, ropes or elastic ties;
- Ensuring after-care such as watering, pesticide and hormone treatments are implemented as required; and
- Implementing monitoring, as outlined in Section 3.2.2 of the Salvage Management Plan.

7.2.8 Planting Methods

Manual Planting

Manual planting is feasible for small scale disturbances such as CSG well leases, or within areas of MNES. The planting holes will be at least twice the width and half as deep again as the pot size. In the case of tube-stock, plants will be placed in a hole deeper than the pot, with the root ball just below the soil surface after planting.

Immediately before planting, each hole will be filled with water which is then allowed to drain away. Water-holding crystals may be added to each hole and mixed with the backfill soil to ensure that roots are not in direct contact with concentrated fertiliser. Plants will be tapped from their container and any pot-bound or circular roots loosened. The plant will be placed in the centre of the hole, filled in with loose crumbly soil, and then firmed in with the hands to create a shallow watering depression. Firming in the plant is very important for settling the roots in and providing a stress free start for each plant and also for minimising erosion.

Planting stock will be randomly planted (i.e. not in rows) which will also affect the densities to be planted.

Mechanical Planting

Mechanical planting is a feasible option for large scale disturbances, such as compressor stations and dams. Where mechanical planting occurs, species selection and planting densities will be based on bench mark guidelines and pre-clearance condition.

Planting Stock

All planting stock is required to be:

- Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container;
- Minimum of 20cm tall for (75mm) tube-stock (larger for potted stock); and
- Sun-hardened.

Where practical, species of local provenance are to be used.

Mulch

Site generated mulch from chipped trees and other vegetation and / or other non-weed bearing mulch will be used around all planted stock. Each plant will be mulched to a radius of 1m surrounding the plant at a depth of 100mm. Mulch will not touch plant stems. Mulch can also be used in areas awaiting rehabilitation to suppress weed growth.

7.2.9 Threats to MNES

Rehabilitation schedules have been prepared to include responses to threats to MNES occurring from Santos' operational activities and land management activities, including damage by livestock, impacts from feral animals and weeds and disposal and use of associated water (**Appendix 3**). Additionally, **Appendix 4** includes specific threatened species recovery actions to be implemented as part of site rehabilitation.

Livestock

Where livestock occur within areas of rehabilitated MNES, temporary stock fencing will be erected to ensure cattle cannot damage rehabilitation works in accordance with EHS01, Appendix D – Fencing Standard (**Appendix 8,** Santos 2011h**)**. Where operational works are in close proximity to areas of MNES that are currently inaccessible by cattle, existing fencing will be retained to minimise the likelihood of disturbance by livestock. Monitoring and maintenance plans include responses to grazing of livestock.

Pest and Weed Management

To ensure that operational activities do not promote the spread of feral animals and weeds, pest and weed management actions have been included in the rehabilitation schedules for all stages of construction and operation. Pest and weed management actions are in accordance with the PWMP developed for the FPA and RSGPA (Santos, 2011 c & d). Monitoring and maintenance actions include responses to weed infestations and damage from pest animals.

Associated Water, Surface Water and Groundwater Quality

Construction and operations near waterways and in particular the construction of roads/tracks in the vicinity of waterways may result in alteration of flows and impact on aquatic and terrestrial flora and fauna. Construction activities also have the potential to increase soil erosion and sedimentation of water courses, increasing turbidity and reducing flow rates. Impacts to waterways are most likely to occur

during construction phase and would impact only small areas. The avoidance of waterways during construction and the minimisation of changes to landscape features which might lead to changes in waterflows (outcrops, gullies etc) and rehabilitation will minimise the likelihood of changes to waterways. The Protocol outlines the hierarchy for siting of infrastructure to minimise impacts on MNES. Additionally, Santos has prepared a report to assess the impacts of CSG Water Management on MNES (Santos, 2011i).

The key potential impacts from CSG water management include:

- Changes to groundwater levels in the GAB;
- Changes to groundwater quality in GAB aquifers from contamination, via i) induced inter-aquifer drawdown, ii) seepage of CSG water, bringe and/or fraccing fluids into GAB aquifer, iii) loss of containment from storage ponds/turkey nests; and
- Impacts on species and threatened ecological communities – potential for impacts on the distribution, health or life cycle of listed flora and fauna.

The main components of CSG water management comprise:

- Gathering- infrastructure (e.g. pipelines and ponds) required to transfer CSG water from CSG producing wells to the CSG water treatment plants;
- Treatment- CSG water is and will be treated, based on its proposed use, to meet specific water quality objectives as defined by DERM;
- Brine Management- Water treated through RO produces a brine concentrate as a by-product. Brine will be injected into depleted coal seams or deeper basement formations. Where injection is not feasible, brine will be temporarily stored in containment ponds followed by solar evaporation/ crystallisation to concentrate the brine for disposal at a registered or purpose built repository, or for commercial production of mineral salt (UBMS Santos Document Number 0020-GLNG-3-1.3-0016 Rev 0); and
- Beneficial use- The selection of beneficial use options are guided by DERM's preferred CSG water management options and are specific to each CSG field. Santos is committed to treating the water to the requisite level prior to beneficial use.

Contamination of groundwater has the potential to occur during the construction phase as result of spillage of hydrocarbons from construction machinery, particularly during refuelling, or from fuel or chemical storage tanks. Contamination of waterways is unlikely, although some flow into waterways may occur following a large spill. Contamination of waterways may pose a risk to aquatic flora and fauna. Safe storage of chemicals and fuel and refuelling, avoidance of waterways by construction machinery and regular maintenance of machinery offsite will minimise potential for contamination of water. Fuels, chemicals and hazardous substances will be stored in accordance with the relevant Australian Standard and conditions of the relevant authorities. Specific management controls to minimise the likelihood of contamination of waterways in particular are summarised in the relevant FMPs.

Santos has prepared a Stage 1 CSG Water Monitoring and Management Plan (CSG WMMP Golder Associates, Report Number: 117636002-3000-001-Rev1) as required by Condition 49 of the EPBC Approval Act (2008/4059). This plan relates to groundwater monitoring and management, hydraulic

fracturing, surface water monitoring and management, response actions and reporting. Santos has also prepared Water Management Plans for the Arcadia, Fairview and Roma fields (Santos, 2011 j, k & l). The GLNG Project CSG Water Monitoring and Management Plan Summary Plan (Santos, 2011m) provides a summary of these plans. An Upstream Brine Management Strategy (UBMS Santos Document Number 0020-GLNG-3-1.3-0016 Rev 0 and I CSG WM MNES) has also been prepared and Santos will manage brine in accordance with the CSG water management policy (DERM 2010) and in accordance with the conditions imposed under the EPBC approval relating to salt management.

All activities will be carried out in compliance with the Roma, Fairview and Arcadia Valley Project Area EMPs that include surface water monitoring plans. Details of surface water monitoring to be undertaken are detailed in Appendix B of the EMP's. The CSG WMMP also outlines water treatment methods, identification of risks to and the vulnerability of MNES, risk control and mitigation. CSG water is and will be treated, based on its proposed use, to meet specific water quality objectives as defined by DERM. The potential risk of the CSG development to water quality and dependent MNES are therefore expected to be low (UBMS, I CSG WM MNES).

The potential risk of the development from the extraction and management of CSG water to surface and groundwater quality and quantity is expected to be low. The potential impacts of groundwater extraction on MNES are also expected to be low. Detailed hydraulic modelling shows that the estimated minor changes in water levels resulting from the addition of treated CSG water to waterways will not adversely impact upon riparian habitat during low, normal or high flow conditions (CSG WMMP).

Detailed modelling of the potential impacts of development for groundwater are detailed in the CSG WMMP. Modelling indicates that:

- GLNG project can be undertaken without compromising the viability of the GAB;
- Groundwater quality of the GAB aquifers is unlikely to be affected;
- No impacts to groundwater availability are expected in Arcadia Valley;
- Impacts to groundwater availability are likely to be minimal in Fairview and contained in Roma Shallow Gas Project Area; and
- Impacts to MNES, and specifically TEC dependent on groundwater and the community of native species dependent on natural discharge of groundwater from the GAB, are not expected (CSG WMMP SP).

Disposal and use of associated water will be in accordance with the relevant approvals to ensure that there are no unauthorised impacts on areas of MNES.

Trials will be commissioned to investigate the use of associated water for watering rehabilitation areas. Refer to 'Impacts of CSG Water Management on Matters of National Environmental Significance' (Santos 2011i).

Other CSG Operational Activities

Other CSG operational activities that may impact upon MNES include wastewater management, and accidental release of harmful materials. The Protocol outlines the hierarchy for siting infrastructure to ensure infrastructure is sited to avoid MNES. Furthermore, infrastructure, including storage facilities and

accommodation camps will be designed and sited in accordance with the relevant Australian Standards, EA Conditions, and EHS Standards.

Santos has prepared Environmental Management Plans for the Arcadia, Fairview and Roma fields (Santos, 2011 j, k, &l) that includes waste management and water quality mitigation measures to protect areas of MNES, including responses to accidental release of harmful materials. The EMPs also include monitoring programs relating to surface water quality and waste management. Where MNES are impacted due to accidental release, measures outlined within the EMP's will be implemented.

7.2.10 Fire Prevention and Management

The EQ Emergency Response Plan (Santos 2010) identifies prevention and response strategies for bushfires in the gas fields. Additionally, the SSMP provides fire management actions to prevent threats to MNES. Actions targeted at threatened species are reflected within **Appendix 4**. The following provides an overview of bushfire prevention and management measures, specifically targeting rehabilitation areas, and MNES.

Prevention

Firebreaks will be established in association with existing infrastructure and cleared areas to avoid additional vegetation clearing and ecological impacts. Therefore firebreaks will be developed in association with features and areas such as roads, tracks, fences networks and grazing pastures, which will be maintained through regular slashing. No additional clearing for firebreaks will occur within areas of MNES including threatened species habitat or TEC.

Annual fuel reduction strategies will be employed in buffer areas for key infrastructure as documented in the EQ Emergency Response Plan, however no burnoffs will be undertaken within areas of establishing revegetation. Fuel reduction strategies will include measures such as controlled burns, slashing and grazing. Chemical controls for protecting rehabilitated MNES areas from bushfire will also be considered where appropriate.

Field staff will be provided with appropriate training in bushfire prevention and response by Queensland Fire and Rural Service (QFRS). Training requirements for field staff is provided in the EQ Emergency Response Plan.

Activities involving potential ignition sources during extreme weather conditions will be limited in the gas fields. The EQ Emergency Response Plan identifies restrictions and actions for work practices during extreme fire weather days to minimise the risk of a human induced fire.

Response to Bushfire

In the event of a bushfire, emergency response will be undertaken in accordance with the EQ Emergency Response Plan. This plan provides details for bushfire response measures. The Santos Field Response Team will be responsible for initial bushfire response as well as notifying QFRS.

A range of fire-fighting equipment is located within the CSG fields, where the bushfire hazard is particularly significant. Where it is considered safe to do so, this equipment will be mobilised to control bushfires and protect property, infrastructure and MNES to the greatest possible extent.

Wildfires

Where wildfires impact upon rehabilitation areas, the monitoring and maintenance schedules outline appropriate mitigation measures to ensure rehabilitation objectives are not compromised (**Section 7.3**). Where rehabilitation areas are impacted by wildfire, the disturbed area will be left for 12 months to determine if natural regeneration is a viable recovery option. Where natural regeneration is ineffective, assisted revegetation will be implemented.

As wildfire is considered a natural and often beneficial process within most vegetation communities, additional rehabilitation will not be undertaken where natural bushfires impact upon undisturbed areas of MNES or areas where the rehabilitation monitoring period is complete.

Non-natural Fires Resulting From Santos Operations

All fire prevention and management measures incorporated within the rehabilitation schedules are tailored to address non-natural fires resulting from Santos' operational activities that impact upon regenerating areas.

It is noted that in the case of CS and accommodation camps, fire breaks may be required to provide protection to the facilities and personnel from natural bushfires. These firebreaks will also provide protection to areas of surrounding MNES and natural vegetation in the case of fire within the facility. The clearing of additional firebreaks around other facilities is not considered an appropriate mitigation measure to prevent the impact of fire on MNES due to the unnecessary vegetation clearing required.

Where non-natural fires arising from Santos' operations impact upon areas of MNES rehabilitation may be required. The rehabilitation schedules outline a 12 month minimum monitoring period prior to rehabilitation activities commencing to identify the potential for natural regeneration. Following fire, a 12 month period is to be used to assess for the potential for natural regeneration to occur. Where natural regeneration is not effective 12 months following the bushfire, the assisted revegetation actions outlined in the schedules are to be implemented to vegetation communities to pre-disturbance condition. Monitoring and maintenance schedules have been designed to address non-natural fires if required.

7.2.11 Rehabilitation of TEC

Rehabilitation schedules have been developed to guide rehabilitation within TEC for each disturbance type that is authorised for disturbance as part of the Stage 1 development of the RFDA (as per EPBC 2008/4059), including:

- Natural Grasslands of the Queensland Central highlands and northern Fitzroy Basin;
- Semi-evergreen Vine Thicket of the Brigalow Belt (North and South) and Nandewar Bioregions; and
- Brigalow (*Acacia harpophylla* dominant and co-dominant).

The schedules developed for TEC have taken the appropriate recovery plans and recommended management measures for each community into consideration.

7.2.12 Fauna Management

The rehabilitation schedules provide broad fauna management advice, including the need for sequential clearing, and the use of fauna spotters to ensure the welfare and safe handling of fauna, as outlined within Fauna Management Plans prepared for the CSG fields, the SSMP, and the Protocol.

The schedules also include rehabilitation measures to enhance fauna habitat, such as the relocation of hollow bearing logs, however specific rehabilitation measures for threatened fauna species are outlined in the SSMP and **Appendix 4**. The SSMP (Santos 2011b) and **Appendix 4** have both been prepared with reference to relevant national recovery plans and conservation advices for recovery and rehabilitation actions for threatened fauna species.

7.3 Monitoring, Maintenance and Corrective Procedures

7.3.1 Monitoring Schedule

Regular monitoring over a 3 to 5 year period will be required at the completion of the rehabilitation works to ensure that the objectives of the rehabilitation schedule are being achieved, as per EA conditions. Monitoring will be undertaken by a suitably qualified person (e.g. restoration ecologist). A monitoring plan is included within **Appendix 5**. Monitoring periods may require extension in the case of ineffective rehabilitation or natural disasters impeding rehabilitation efforts. Where monitoring extensions are required, it will be recorded and implemented by Santos, as outlined in the Protocol.

Specific monitoring criteria are outlined within each rehabilitation schedule, reflective of the performance criteria. Generally, the following indicators will be monitored:

- Indicators of growth and survival of all plantings;
- Plant height;
- Native species richness;
- Evidence of recruitment;
- Native species cover;
- Weed control – extent of declared and environmental weeds and adequacy of treatment, as well as any secondary weed responses to treatments;
- Indicators of the presence of threatened species and / or key habitat features (as per SSMP);
- Adequacy of site preparation, mulching, tree (and plant) protection and maintenance; and
- Landform stability – evidence of soil erosion as per the SMP and ESCM.

Monitoring is to occur where remnant, regrowth vegetation or TEC is to be rehabilitated. Monitoring will consist of vegetation surveys and photo monitoring, with one monitoring location established within a representative area for each rehabilitation site. Monitoring locations are to be determined by the suitably

qualified ecologist using BioCondition assessment methods (Nelder et al. 2011). Where possible monitoring plots will be established within the core of rehabilitation areas to avoid edge effects. Monitoring will take the impacts from seasonal variation into consideration.

Performance criteria to monitor the progress of each rehabilitation site will comprise of a combination of pre-clearing data and benchmark guidelines. It is noted that while 3 years is insufficient time for rehabilitation to meet the benchmark guidelines, it is sufficient to ensure that rehabilitation is well established and regenerating, as an improvement in BioCondition scoring should be clearly evident. The progression and improvement of key rehabilitation indicators such as species composition and diversity, weed cover, and plant densities will be evident over a three year period.

Vegetation Surveys

Vegetation surveys will be undertaken to monitor the progress of rehabilitation, utilising the BioCondition assessment method (Nelder et al 2011). BioCondition assessments will be conducted within native vegetation rehabilitation areas where disturbances are non-linear. A 100m x 50m plot will be established within each area, and the BioCondition assessment conducted as per the DERM methods. BioCondition assessments will be undertaken every 6 months after the commencement of rehabilitation for 3 years. The assessments will be conducted as per the specifications, milestones and timelines of the monitoring schedule (**Appendix 5**) using the BioCondition proforma included in **Appendix 6**.

In addition to the BioCondition assessment, the following information will be assessed within a 20m by 10m quadrate:

- Native flora species list;
- Mulch depth around planted species;
- Species richness;
- Native plant densities and average height;
- Weed species list; and
- Weed cover.

As part of the vegetation survey, a habitat assessment will be conducted, in line with the requirements of the SSMP.

Photo Monitoring

A photo monitoring point will be established in a representative location for native vegetation. This location will be GPS located and a surveyors pin be inserted to ensure the exact location is referenced each time. At each point the following will be conducted:

- Directional photography in a north, east, south, west direction sequence, recording compass bearings for each photo. It is preferable if a tripod or measuring stick be utilised to ensure the photo is taken from the same vertical height each time. All photos will be date stamped and photo number recorded with appropriate details (monitoring site number and direction of photo);
- Photo monitoring will be undertaken every six months after the commencement of rehabilitation for 3 years; and
- Photo monitoring will be in accordance with the specifications, milestones and timelines of the monitoring schedule (**Appendix 5**).

7.3.2 Maintenance Actions

Where monitoring identifies that performance criteria are not being met, maintenance actions are outlined, including replanting, weed removal, stabilisation and erosion and sediment control measures. Where rehabilitation areas require maintenance at the completion of the monitoring timeframes due to ineffective rehabilitation activities or natural disasters, the monitoring and maintenance schedule will be extended until the rehabilitation area meets the performance criteria. Refer to **Section 7.4**.

7.4 Rehabilitation Completion

Rehabilitation is considered complete when all performance criteria outlined in the rehabilitation schedules are met at the completion of the monitoring period, generally 5 years for erosion and subsidence, and 3 years for ecological characteristics.

Where rehabilitation areas require additional maintenance due to ineffective rehabilitation activities or the impacts of natural disasters, the monitoring schedule will be extended until the rehabilitation area meets the performance criteria. In circumstances where the rehabilitation does not meet performance criteria following an extension of monitoring and maintenance, DERM will be notified as part of the annual reporting. In addition, where rehabilitation is ineffective within areas of TEC, SEWPaC will be notified as part of annual reporting.

In the event that threatened species habitat, or translocated flora species do not re-establish, measures outlined in the SSMP are to be complied with.

7.5 Reporting

The monitoring and maintenance checklist included in **Appendix 5** has been designed to satisfy the reporting requirements referring to rehabilitation actions. Reporting checklists will be compiled and kept for a period of five years, and saved in a central location, as outlined in the Protocol. Information collected within the monitoring and maintenance checklist will be assessed and summarised to complete the Annual Environmental Returns and Annual Monitoring Reports required in compliance with the EPBC Act Approval, CG Conditions and EA Conditions (refer to **Section 4.2**).

All monitoring and reporting will be prepared by a suitably qualified ecologist or environmental officer. For each reporting period a review of the overall success of the current management actions will be undertaken. Any areas for improvement will be identified and management actions altered accordingly.

Where data is collected for rehabilitation purposes, it is required to conform to data standards as notified by SEWPaC. All species and ecological survey data relating to MNES must be provided to SEWPaC within 30 business days of request.

7.6 Auditing

The pre-clearance survey forms as well as monitoring and maintenance checklists must be completed and stored in a central location. Santos will undertake internal auditing. Third party audits will be undertaken annually as part of the CG Conditions. Third party audits will also be undertaken to ensure compliance with EA Conditions on a three year basis and upon request for the EPBC Act Approval. Where the auditing process identifies any improvements, the RRRMP will be updated to reflect any changes.

PRIOR TO CONSTRUCTION

Pre-clearing Assessment As Per The Protocol
- Identification of CSG field infrstructure
- Locate infrastructure in accordance with the Protocol

Weed Management
- Prevent dispersal on and offsite as per PWMP

DURING CONSTRUCTION

Vegetation Clearance
- Salvage as per Salvage Management Plan
- Stockpiling
- Mulching

Topsoil Management
- Stockpiling
- Erosion and Sediment Control

Erosion and Sediment Control
- Stabilise site to prevent runoff and erosion as per Erosion and Sediment Control Plan

Weed Management
- As per PWMP

Monitoring
- Follow Monitoring and Maintenance Schedule

POST CONSTRUCTION

Stabilise construction footprint
- Rip soils where required
- Re-spread topsoil
- Seed where required

Monitoring
- Follow Monitoring and Maintenance Schedule

DECOMMISSIONING

Decommissioning
- Decommission CSG infrastructure in accordance with Demolitian and Decommissioning Plans

Contaminated Land Assessment
- Ensure safe, non-polluting environment

Re-shape to stable landform
- Rip soils if required
- Fill flare pits, sumps, dams as required
- Respread topsoil if required
- Comply with Erosion and Sediment Control Plan

Revegetation
- Encourage natural regeneration
- Replant with species selected from benchmark guidelines and pre-clearing assessment where required
- Implement weed management as per PWMP

Monitoring
- Follow Monitoring and Maintenance Schedule

Figure 7.1 Rehabilitation Process

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Appendix 1

Compliance Matrix

EPBC Conditions		
EPBC Condition 4	4. The Protocol must include and apply for the life of the project and include the principles of: (a) avoiding direct and indirect adverse impacts on MNES; (b) mitigating and managing direct and indirect impacts to minimise cumulative adverse impacts on MNES; (c) active site remediation and rehabilitation of impacted areas to promote and maintain long-term recovery of MNES.	RRRMP document.
EPBC Condition 8	i) relevant management practices and methods to minimise impact and recover from impact that should include: i) site rehabilitation timeframes, standards and methods; ii) use of sequential clearing to direct fauna away from an impact zone; iii) re-establishment of native vegetation in linear infrastructure corridors; iv) welfare and safe handling of fauna specimens requiring relocation from impact sites; v) handling practices for flora specimens; vi) translocation practices and monitoring for translocation success; vii) monitoring methods including for rehabilitation success and recovery.	Section 1.2.1; Section 4.0; Section 7.0; Appendix 2; Appendix 3; Appendix 5; Refer to Fauna Management Plan.
	k) reference relevant conservation advice, recovery plans, or other policies, practices, standards or guidelines relevant to MNES published or approved from time to time by the Department or the Minister.	Appendix 4 (within recovery actions); Section 8.
EPBC Condition 14	14. Where a direct or indirect impact has occurred to MNES (which may include a presumed impact where the species is presumed to be present) the proponent must under the Protocol apply remediation, rehabilitation and recovery measures appropriate for each MNES to restore connectivity or rehabilitate disturbed areas to pre-clearance quality or better, and to minimise cumulative impacts throughout the life of the project.	RRRMP document; Section 4.0; Section 7.0; Appendix 2 (refer to Semi-evergreen Vine-thicket, Natural Grasslands and Brigalow Benchmarks); Appendix 3 (rehabilitation measures); Appendix 4 (within recovery actions).
EPBC Condition 15	15. Before commencement of gas field development the proponent must develop a Remediation, Rehabilitation, Recovery and Monitoring Plan. The Plan must: a) include site remediation measures including timeframes and standards for preventing erosion and stabilising disturbed soil in impact areas;	Section 7.2.4; Appendix 3; Appendix 5; Refer to Soil Management Procedure and Erosion and Sediment Control Manual

		(Aurecon 2011), included in Appendix 7.
	b) include measures to support recovery of listed species' habitat and recovery of listed ecological communities affected by gas field development;	Section 4.1.5; Appendix 2 (refer to Semi-evergreen Vine-thicket, Natural Grasslands and Brigalow Benchmarks); Appendix 4; Refer to Significant Species Management Plan.
	c) include responses to threats to MNES from the proponent's operational activities and land management activities including the disposal and use of associated water, damage by livestock, and impacts from feral animals and weeds;	Section 7.2.9; Appendix 4 (within recovery actions); Appendix 5; Refer to Pest and Weed Management Plan.
	d) provide for fire prevention and management regimes during construction, operation, and decommissioning to protected MNES;	Section 7.2.10; Appendix 4 (within recovery actions); Appendix 5.
	e) include performance measures and related monitoring to assess site remediation, rehabilitation and recovery;	Section 4.1.6; Section 7.3; Appendix 5.
	f) provide for reporting on the implementation of the Remediation, Rehabilitation, Recovery and Monitoring Plan including monitoring and performance to a standard which can be independently audited;	Section 7.3; Section 7.5; Section 7.6; Appendix 5.
	g) Reference relevant conservation advice, recovery plans, species management plans, or policies, practices, standards or guidelines endorsed or approved from time to time by the Department. Note: The proponent may develop the plan to satisfy the requirements of both the Queensland Government and these conditions as indicated in condition 98 b).	Section 8; Appendix 4 (within recovery actions).
EPBC Condition 16	16. The Remediation, Rehabilitation, Recovery and Monitoring Plan must be submitted for the approval of the Minister. Commencement of gas field development must not occur without written approval of this Plan. The proponent may undertake activities that are critical to commencement that are associated with mobilisation of plant and equipment, materials, machinery and personnel prior to the start of	RRRMP document.

	development only if such activities will have no adverse impact on MNES, and only if the proponent has notified the Department in writing before an activity is undertaken. The approved Remediation, Rehabilitation, Recovery and Monitoring Plan must be implemented.	
EPBC Condition 17	17. The proponent must establish a program to routinely review the Remediation, Rehabilitation, Recovery and Monitoring Plan by an independent qualified ecologist, or other experts, approved by the Department to take into account any new information available to the proponent, including any information and advice provided by Commonwealth or Queensland Government agencies, or available from other CSG proponents.	Section 4.2.
EPBC Condition 18	18. The Minister may require through a request in writing the periodic review of the Remediation, Rehabilitation, Recovery and Monitoring Plan by the Department; or alternatively by independent qualified ecologist, or other experts, approved by the Department. Plans must be approved by the Department in writing.	Section 4.2; Section 7.5.
EPBC Condition 22	22. The Protocol and related plans must be reviewed and updated by the proponent: to take into account the findings of the *Cumulative Impact Assessment Report* required by the Queensland Government; before each major stage of the proponent's gas field development; or following a written request from the Department; or following a written request from the Department. Reviewed and updated Protocols and plans must be submitted for the Minister's written approval. Once approved, updated Protocols and plans must be implemented.	Section 4.2; Section 7.5.
EPBC Condition 77	77. The proponent must notify the Department in writing when developing or reviewing construction, operational, groundwater, CSG water, brine management, salinity management, environmental management, or other plans where the scope of the plans relates to potential direct, indirect or cumulative adverse impacts on MNES, or involves management of MNES. The proponent must in the notification indicate the relevant components of such plans relating to MNES and their management, and the timeframe for development and approval of the plans under Queensland Government requirements.	Section 4.2; Section 7.5.
EPBC Condition 78	78. Where the scope of the plans relates to potential adverse impact on MNES, or involves management of MNES the plans must be submitted to the Minister for approval of those components. Approved components of plans must be implemented. Note: Where efficiency will be enhanced the proponent may also prepare and align management plans required under these conditions with the requirements of the Queensland Government as long as the relevant matters under the conditions of this approval are clearly and adequately addressed.	Section 4.2; Section 7.5.
EPBC Condition 82	82. Within five years of the commencement of gas field development, the proponent must develop a Decommissioning Plan. The Plan must: (a) require the progressive removal or reuse of infrastructure where gas field operations cease during the project life;	Section 2.3; Appendix 3.
	(b) establish management practices and safeguards to minimise environmental disturbance;	Appendix 3; Refer to Operational Plan.

	(c) ensure MNES are not impacted by progressive decommissioning, or final decommissioning of gas field infrastructure;	Appendix 3; Appendix 4.
	(d) define rehabilitation actions for the infrastructure sites following decommissioning including for;	
	(e) optimising habitat and habitat connectivity for MNES;	Appendix 3; Appendix 4.
	(f) enhancing pre-construction environmental quality; and	Appendix 3.
	(g) ongoing management during rehabilitation.	Appendix 3,
EPBC Condition 84	84. All survey data collected for the project must be collected and recorded so as to conform to data standards notified from time to time by the Department. When requested by the Department, the proponent must provide to the Department all species and ecological survey data and related survey information from ecological surveys undertaken for MNES. This survey data must be provided within 30 business days of request, or in a timeframe agreed to by the Department in writing.	Section 4.2; Section 7.4; Section 7.5.
EPBC Condition 110	110. The proponent must produce an Annual Environmental Return which: (c) addresses compliance with these conditions;	Section 4.2.1; Section 4.2.2; Section 4.2.3
	(d) records any unavoidable adverse impacts on MNES, mitigation measures applied to avoid adverse impacts on MNES; and any rehabilitation work undertaken in connection with any unavoidable adverse impact on MNES;	Section 4.2.1; Section 4.2.2; Section 4.2.3
	(e) identifies all non-compliances with these conditions; and	Section 4.2.1; Section 4.2.2; Section 4.2.3
	(f) identifies any amendments needed to plans to achieve compliance with these conditions.	Section 4.2.1; Section 4.2.2; Section 4.2.3
Coordinator-General Conditions		
Appendix 2, Part 3, SCHEDULE A7	The Plan must be consistent with the requirements of the environmental authority and include, but not be limited to: (a) a stated period, not exceeding 3 years, to which the Plan applies;	Section 2.1.
	(b) a description of the existing infrastructure for conducting the petroleum activities;	Section 2.4.1; Refer to Operational Plan.

	(c) a description of proposed infrastructure that will be developed during the term of the Plan;	Refer to Operational Plan.
	(d) a map or maps that: i. record the location of the infrastructure in place for conducting the petroleum activities that exists at the commencement of the period of the Plan, including but not limited to: - regulated dams - wells - transmission flow lines - gas processing facilities, and - water treatment facilities a. records the location of approved additional infrastructure that will be developed for the conduct of the petroleum activities during the period of the Plan.	Refer to Operational Plan.
	(e) for proposed disturbance or vegetation clearing in an Environmentally Sensitive Area (ESA) provide details on the scale and extent of the disturbance or clearing and if required a commitment to provide an environmental offset;	Refer to Operational Plan.
	(f) for each site to be disturbed, a description of the rehabilitation activities to be performed during the period of the Plan, including but not limited to: ii. location (e.g. tenure, coordinates) and disturbance type (e.g. well lease, flow line, access track) iii. area to be rehabilitated iv. use of reference sites v. species compositions, and (a) post-disturbance land use	Section 7; Appendix 2 (species composition; reference sites); Appendix 3 (rehabilitation activities); Refer to Operational Plan.
	(g) a description of progressive rehabilitation carried out including performance in relation to the requirements set out in the environmental authority and the proposed rehabilitation activities set out in the previous Plan; and	Section 7; Appendix 3.
	(h) the calculation of the financial assurance for the proposed maximum disturbance expected during the period of the Plan.	Section 2.1; Refer to Operational Plan.
Appendix 2, Part 3 SCHEDULE H2	The holder of this environmental authority must not abandon any dam but must decommission each dam so as to prevent and/or minimise any environmental harm.	Section 2.4.1; Appendix 3 (refer to schedules for dams).
Appendix 2, Part 3 SCHEDULE H2	As a minimum, decommissioning must be conducted such that each dam either: (a) becomes a stable landform similar to that of surrounding undisturbed areas, that no longer contains substances that will migrate into the environment, or (b) is approved or authorised by the administering authority for use by the landholder following cessation of	Section 2.4.1; Appendix 3 (refer to schedules for dams).

	the petroleum activities.	
Appendix 2, Part 3 SCHEDULE H3	Progressive rehabilitation of disturbed areas must commence as soon as practicable following the completion of any construction or operational works associated with the petroleum activities.	Section 7; Appendix 3.
Appendix 2, Part 3 SCHEDULE H4	As soon as practicable but no later than 12 months (or longer period agreed in writing by the administering authority) after the end of petroleum activities causing significant disturbance to land, the holder of the authority must: (a) remediate contaminated land (e.g. dams containing salt);	Section 7; Appendix 3.
	(b) reshape all significantly disturbed land to a stable landform similar to that of surrounding undisturbed areas;	Section 7.2.4; Appendix 3.
	(b) on all significantly disturbed land, take all reasonable and practicable measures to: i. re-establish surface drainage lines ii. reinstate the top layer of the soil profile i. promote establishment of vegetation	Section 7.2.4; Appendix 3.
	(c) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or treated so as to not be likely to cause environmental harm; and	Section 7.2.3.
	(d) decommission all inactive buried pipelines in accordance with the requirements of AS 2885 and ensuring that there will not be any subsequent subsidence of land along the pipeline route.	Section 7; Appendix 3.
Appendix 2, Part 3 SCHEDULE H5	All significantly disturbed land caused by the carrying out of the petroleum activities must be rehabilitated to: (a) a stable landform and with a self-sustaining vegetation cover and species that are similar to adjoining undisturbed areas;	Section 7; Appendix 3.
	(b) ensure that all land is reinstated to the pre-disturbed land use and suitability class;	Section 7; Appendix 3.
	(c) ensure that the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance by petroleum activities; and	Section 7; Appendix 3.
	(d) ensure that the water quality of any residual void or water bodies constructed by petroleum activities meets criteria for subsequent uses and does not have potential to cause environmental harm.	Section 7; Appendix 3.
Appendix 2, Part 3 SCHEDULE H6	Maintenance of rehabilitated areas must take place to ensure and demonstrate: (a) stability of landforms;	Section 7; Appendix 3.
	(b) erosion control measures remain effective;	Section 7;

		Appendix 3; Refer to Soil Management Procedure and Erosion and Sediment Control Manual (Aurecon 2011).
	(c) stormwater runoff and seepage from rehabilitated areas does not negatively affect the environmental values of any waters;	Section 7; Appendix 3.
	(d) plants show healthy growth and recruitment is occurring; and	Section 7; Appendix 3; Appendix 5.
	(e) rehabilitated areas are free of any declared pest plants.	Section 7; Appendix 3; Appendix 5.
Appendix 2, Part 3 SCHEDULE H7	Rehabilitation can be considered successful when: (a) the site can be managed for its designated land-use (e.g. similar to that of surrounding undisturbed areas);	Section 7; Appendix 3; Appendix 5.
	(b) no greater management input than for other land in the area being used for a similar purpose is required and there is evidence that the rehabilitation has been successful for at least three (3) years;	Section 7; Appendix 3; Appendix 5.
	(c) the rehabilitation is carried out in accordance with the goals, objectives indicators and completion criteria as specified in Schedule H, Table 1—Planned rehabilitation specifications (safe, non-polluting, stable and self-sustaining);and	Section 7; Appendix 3; Appendix 5.
	(d) written agreement is obtained from the landowner/holder and administering authority.	Section 7; Appendix 3; Appendix 5.
Appendix 2, Part 3 SCHEDULE D4	The holder of this environmental authority, when carrying out petroleum activities must: iii. avoid, minimise or mitigate (in order of preference) any impacts on areas of vegetation or other areas of ecological value;	Section 7; Appendix 3.
	iv. minimise the risk of injury, harm, or entrapment to wildlife and stock;	Section 7; Appendix 3; Refer to Fauna Management Plan.
	v. minimise disturbance to land that may otherwise result in land degradation;	Section 7;

		Appendix 3.
	(e) ensure that for land that is to be significantly disturbed by petroleum activities: ii. the top layer of the soil profile is removed; iii. stockpiled in a manner that will preserve its biological and chemical properties; and (a) used for rehabilitation purposes (in accordance with Condition H6); and	Section 7; Appendix 3.
	(f) prior to carrying out field based activities, make all relevant staff, contractors or agents carrying out those activities, aware of the location of any category A, B or C ESA's and the requirements of this environmental authority. Note: This environmental authority does not authorise the taking of protected animals or the tampering with an animal breeding place as defined under the *Nature Conservation Act 1992* and Regulations.	Section 7; Appendix 3.
Appendix 2, Part 3 SCHEDULE B9	Activities or works resulting in significant disturbance to the bed or banks of a watercourse or wetland, or a spring must: (a) only be undertaken where necessary for the construction and/or maintenance of roads, tracks and pipelines that are essential for carrying out the authorised petroleum activities and no reasonable alternative location is feasible;	Appendix 3.
	(b) be no greater than the minimum area necessary for the purpose of the significant disturbance;	Appendix 3.
	(c) be designed and undertaken by a suitably qualified and experienced person taking into account the matters listed in Section 5. Planning Activities and Section 6 Impact Management During Activities of DERM's "Guideline – Activities in a watercourse, lake or spring associated with mining operations" dated April 2008, or more recent editions as such become available; and	Appendix 3.
	(d) upon cessation of the activities or works, commence rehabilitation immediately such that the final rehabilitation is to a condition that will ensure the ongoing physical integrity and the natural ecosystem values of the site.	Appendix 3.
Appendix 2, Part 3 SCHEDULE C15	The design plan must include, but not be limited to: (a) a statement of the relevant legislation, regulatory documents and engineering practice relied upon in the design plan;	Appendix 3.
	(b) a statement of the facts and data being used in the design plan and the limitations to the application and interpretation of that material;	Appendix 3.
	(c) an assessment of the hazard category of the proposed dam based on the identification of potential impacts on any sensitive receptors for any applicable dam failure scenarios, including the cumulative impact should all dams fail at once;	Appendix 3.
	(d) detailed specifications for the design, operation, maintenance and decommissioning of the dam(s);	Appendix 3.
	(e) an operational plan that includes contingency / emergency response procedures designed to avoid /	Appendix 3.

	minimise discharges resulting from any overtopping or loss of structural integrity of the dam;	
	(f) design, specification and operational rules for any related structures and systems used to prevent the overtopping of the proposed dam;	Appendix 3.
	(g) a detailed plan for the decommissioning and rehabilitation of the dam at the end of its operational life;	Appendix 3.
	(h) any other matter required by the certifying suitably qualified and experienced person; and	Appendix 3.
	(i) evidence supporting the claims of the certifier that they are a suitably qualified and experienced person.	Appendix 3.
Appendix 2, Part 2 Condition 13	The following requirements apply to clearing of plants protected under the *Nature Conservation Act 1992*: (a) clearing of plants must only occur in accordance with a clearing permit issued under the *Nature Conservation Act 1992;*	Refer to Operational Plan.
	(b) for near threatened, rare, vulnerable and endangered species listed under the *Nature Conservation (Wildlife) Regulation 2006,* and species identified as critical and high priority under the DERM "Back on Track" species prioritisation methodology, a Significant Species Management Plan detailing specific measures for the mitigation or offsetting of all impacts must be provided to DERM for approval;	Section 4.1.5; Refer to Significant Species Management Plan.
	(c) offsets must be provided for the permanent loss (take) of near threatened, rare, vulnerable and endangered plants in accordance with the Queensland Government *Environmental Offsets Policy 2008* and generally in accordance with the Queensland Government Policy for Biodiversity Offsets (Consultation Draft);	Refer to GLNG Offsets Management Plan.
	(d) type A restricted least concern plants (Schedule 7 of the *Nature Conservation (Administration) Regulation 2006*) must be salvaged and used for on-site revegetation purposes. This includes species in the Family: Cycadaceae, Orchidaceae, and Zamiaceae; and species in the genus: *Brachychiton*; *Hydnophytum*; *Huperzia*; *Livistona*; *Myrmecodia*; *Platycerium*; and *Xanthorrhoea;*	Section 4.1.5; Appendix 4.
	(e) clearing shall be conducted in a sequential manner and in a way that directs escaping wildlife away from the activity and into adjacent natural areas;	Section 7.2.10; Appendix 3; Refer to Fauna Management Plan.
	(f) rehabilitation of areas containing least concern plants that are disturbed during clearing activities, where required by the clearing permit, must be commenced within three (3) months of completion of pipeline construction. Revegetation should be consistent with the plant density, floristic composition and distribution of the surrounding regional ecosystem types and within the province of the vegetation being cleared; and	Section 7; Appendix 3.
	(g) for clearing impacts that result in permanent loss of least concern native plants (cannot be re-established within three (3) years of clearing or floristic modification), the permit holder must provide the DERM with a written detailed report of permanent vegetation loss, including the area, species affected and mapping of affected areas, within three (3) months of completion of the pipeline construction (Note: this is in addition to the required Return of operations).	Section 4.2.1; Section 4.2.2.

Appendix 2, Part 3 SCHEDULE D7	Cleared vegetation must be stockpiled in a manner that facilitates respreading or salvaging and does not impede vehicle, stock or wildlife movements.	Appendix 3.
Appendix 2, Part 3 SCHEDULE I1	(I1) The holder of this environmental authority must develop and implement a monitoring program, the result of which will demonstrate compliance with the conditions of this environmental authority.	Appendix 5.
Appendix 2, Part 3 SCHEDULE I10	An annual monitoring report must be prepared each year and presented to the administering authority when requested. This report shall include but not be limited to: (a) a summary of the previous twelve (12) months monitoring results obtained under any monitoring programs required under this environmental authority and, a comparison of the previous twelve (12) months monitoring results to both the limits set in this environmental authority and to relevant prior results;	Section 4.2.1; Section 4.2.2.
	(b) an evaluation/explanation of the data derived from any monitoring programs;	Section 4.2.1; Section 4.2.2.
	(c) a summary of any record of quantities of releases required to be kept under this environmental authority; and	Section 4.2.1; Section 4.2.2.
	(d) an outline of actions taken or proposed to minimise the risk of environmental harm from any condition or elevated contaminant level identified by the monitoring or recording programs.	N/A
Appendix 2, Part 3 SCHEDULE I2	All monitoring under this environmental authority must be conducted by a suitably qualified person.	Section 4.2.1; Section 4.2.2.
Appendix 2, Part 3 SCHEDULE I8	Any management or monitoring plans, systems or programs required to be developed and implemented by a condition of this environmental authority must be reviewed for performance and amended if required on an annual basis.	Section 4.2.1; Section 4.2.2.
Appendix 2, Part 3 SCHEDULE I9	The holder of this environmental authority must record, compile and keep for a minimum of five years all monitoring results required by this environmental authority and make available for inspection all or any of these records upon request by the administering authority.	Section 4.2.1; Section 4.2.2; Section 7.4; Section 7.5; Section 7.6; Appendix 5.
Appendix 2, Part 2 Condition 6	The proponent must provide to the Coordinator-General for review, prior to the commencement of petroleum activities, an Operational Plan that provides detailed information about the activities to be carried out under the environmental authority. The Operational Plan must cover, at least, one field development area (e.g. the Roma field) The activities identified in the Operational Plan must incorporate but not be limited to the petroleum activities set out in the approved Work Program and/or Development Plan for the relevant petroleum authority as required under	Refer to Operational Plan.

	the *Petroleum Act (1923)* or the *Petroleum and Gas (Production and Safety) Act 2004.* The Operational Plan must be consistent with the requirements of the environmental authority(s) and include, but not be limited to: (e) a stated period, not exceeding 3 years, to which the Plan applies;	
	(f) a description of the existing infrastructure for conducting the petroleum activities;	Refer to Operational Plan.
	(g) a description of proposed infrastructure that will be developed during the term of the Operational Plan;	Refer to Operational Plan.
	(h) a map or maps that record the location of the infrastructure in place for conducting the petroleum activities that exists at the commencement of the period of the Operational Plan, including but not limited to: ▪ regulated dams; ▪ wells; ▪ transmission flow lines ▪ gas processing facilities ▪ water treatment facilities ▪ records the location of approved additional infrastructure that will be developed for the conduct of the petroleum activities during the period of the Plan;	Refer to Operational Plan.
	(i) a description of proposed infrastructure that will be developed during the term of the Operational Plan;	Section 2.0; Refer to Operational Plan.
	(a) for proposed disturbance or vegetation clearing in an Environmentally Sensitive Area (ESA) provide details on the scale and extent of the disturbance or clearing and if required a commitment to provide an environmental offset;	Refer to Operational Plan.
	(j) for each site to be disturbed, a description of the rehabilitation activities to be performed during the period of the Operational Plan, including but not limited to: ▪ location (e.g. tenure, coordinates) and disturbance type (e.g. well lease, flow line, access track) ▪ area to be rehabilitated ▪ use of reference sites ▪ species compositions (b) post-disturbance land use;	Section 7; Appendix 2; Appendix 3; Refer to Operational Plan.
	(c) a description of progressive rehabilitation carried out including performance in relation to the requirements set out in the environmental authority and the proposed rehabilitation activities set out in the previous Operational Plan; and	Appendix 4.

	(k) calculation of the financial assurance for the proposed maximum disturbance expected during the period of the Operational Plan. Note: where the CSG fields are intended to be operated under separate project environmental authorities, separate Operational Plans can be provided under this condition.	Section 2.1; Refer to Operational Plan.
Appendix 2, Part 2 Condition 14	▪ Potential impact mitigation measures must include the allowance for regrowth of natural vegetation in the parts of the pipeline corridors (flow lines, trunk lines and water pipelines) not required for routine operation and maintenance in order to partially address fragmentation of habitat for small animals including birds, mammals, reptiles and amphibians;	Section 7.2.6; Appendix 2; Appendix 3; Appendix 4.
	▪ Preconstruction surveys of the activities in gas fields must identify koala habitat as defined under the *Nature Conservation (Koala) Conservation Plan 2006*. Specific mitigation measures and habitat offsets for residual impacts to koala habitat must be provided;	Refer to the Protocol.
	▪ An authorised person must be employed where there is a risk to native fauna present within the clearing site. An authorised person is a person permitted to tamper and interfere with a protected animal or a protected animal's breeding place. (For example, a licensed spotter-catcher is someone who is specifically licensed as a spotter-catcher through a Rehabilitation Permit issued by DERM);	Section 7.2.10; Appendix 3; Refer to Fauna Management Plan.
	▪ The permit holder must ensure any animals injured by clearing activities under this permit are referred to an appropriate wildlife carer group or veterinarian (to be predetermined prior to clearing) and DERM must be notified within 24 hours of any injuries or deaths; and	Refer to Fauna Management Plan.
	▪ Rehabilitation of the gas fields must allow for the maximum re-establishment of native vegetation including the shrubby understorey and ground cover, providing habitat for small ground dwelling fauna species and restoration of landscape connectivity.	Section 7; Appendix 3.
Fairview Project Area EMP		
Section 4, Operation Plan, page 19	The Operational Plan will include: ▪ a description of the rehabilitation activities to be performed during the period of the Plan ▪ a description of progressive rehabilitation carried out including performance in relation to the requirements set out in the environmental authority and the proposed rehabilitation activities set out in the previous Plan calculation of the financial assurance for the proposed maximum disturbance expected during the period of the Plan.	Section 7; Appendix 3.
Section 6.4.2, Environmental Values, page 50	On completion of a project activity the objective is to successfully revegetate and rehabilitate disturbed areas.	Section 7; Appendix 2; Appendix 3.
Section 6.9.1 (Rehabilitation) Methodology, page	The decommissioning and rehabilitation of the FPA will be undertaken progressively over the life of the project. The FPA development is staggered, therefore a staggered approach will also be applied to decommissioning and rehabilitation. Santos will develop a comprehensive rehabilitation plan that will	Section 7; Appendix 2;

77	consider items such as monitoring and benchmarking reference sites which will guide on-going environmental management and rehabilitation activities. Reference (or analogue) sites will be established in representative land systems that will be impacted by the project. At each site where natural regeneration is unlikely, Santos will determine the floristic and structural characteristics of the remnant vegetation, ground cover percentages, shrub layers and structural characteristics of the vegetation, and undertake an assessment of the stability of site (for example, existing soil erosion). The analogue sites will be used to determine appropriate rehabilitation criteria. The proposed final land use will be determined by a number of factors including: ▪ Compliance with relevant legislative and statutory requirements; ▪ The views of all stakeholders, particularly the current landholder and the local community; ▪ The land use of surrounding areas; ▪ The receiving environment (for example, climate, geological, geomorphological, hydrological and biological characteristics); ▪ The conservation, cultural and heritage values of the area. The report will include a map outlining the proposed final land use within the project area and define the locations of the various rehabilitation outcomes. Santos aims to progressively rehabilitate land over the life of the project. Santos will therefore implement a rehabilitation program on all land significantly disturbed by the project to: ▪ Investigate and remediate contaminated land caused by the authorised petroleum activities. ▪ Take all reasonable and practicable measures to: - Re-establish surface drainage lines; - Reinstate the top layer of the soil profile; and - Promote the re-establishment of vegetation. ▪ Rehabilitate disturbed areas to: - A stable landform and with a self-sustaining vegetation cover and species that are similar to adjoining undisturbed areas; - Ensure that all land is reinstated to the pre-disturbed land use and suitability class; - Ensure that the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance by petroleum activities; and - Ensure that the water quality of any residual void or water bodies constructed by petroleum activities meets criteria for subsequent uses and does not have potential to cause environmental harm. ▪ Maintain rehabilitated areas to ensure and demonstrate the: - Stability of landforms;	Appendix 3; Appendix 5.

	- Erosion control measures remain effective; - Stormwater runoff and seepage from rehabilitated areas does not negatively affect the environmental values of any waters; - Plants show healthy growth and recruitment is occurring; and - Rehabilitated areas are free of declared pest plants. ▪ Monitoring of rehabilitated sites will be undertaken to ensure natural or assisted regeneration is progressing, weeds are appropriately managed and soil erosion is minimised. Rehabilitation will be considered successful when the site can be managed for its designated land use (either similar to that of surrounding undisturbed areas, representative analogue sites or as otherwise agreed in a written document with the landholder and administering authority) without any greater management input than for other land in the area being used for a similar purpose and there is evidence that the rehabilitation has been successful for at least three years. The general control strategies for managing rehabilitation activities are as follows: ▪ Topsoil management – during earthworks, strip topsoil resources will be stripped and stored separately from subsoil, for re-use in rehabilitation; ▪ Landform management – disturbed lands will be reshaped to stable landform similar to that of similar undisturbed surrounding areas; ▪ Vegetation management – cleared vegetation will be stockpiled adjacent to the lease area and where possible, mulched for subsequent latter reuse for rehabilitation purposes; ▪ Santos will monitor land disturbance surrounding new project areas; and ▪ Santos will conduct environmental compliance audit post-decommissioning to evaluate effectiveness of rehabilitation, and carry out remedial work as necessary as detailed in Santos EHSMS11.11.	
Section 6.9.2 (Rehabilitation) Management Controls, page 78	Management strategies will be implemented to minimise impacts associated with the FPA, including: ▪ Dams and ponds will not be abandoned but will be decommissioned so as to prevent and/or minimise environmental harm; ▪ Decommissioning will be conducted such that each dam or pond either; ▪ Becomes a stable landform, that no longer contains substances that will migrate into the environment; ▪ Is approved or authorised by the administering authority for use by the landholder following cessation of the petroleum activities; ▪ Progressive rehabilitation of disturbed areas will commence as soon as practicable following the completion of construction or operational works associated with the petroleum activities; ▪ As soon as practicable after the end of petroleum activities causing significant disturbance the following will be undertaken: - Remediate contaminated land (for example, dams or ponds containing salt); - Reshape all significantly disturbed land to a stable landform similar to that of surrounding undisturbed	Section 7; Appendix 2; Appendix 3.

	areas; - On all significantly disturbed land, take all reasonable and practicable measures to: ▪ Re-establish surface drainage lines; ▪ Reinstate the top layer of the soil profile; and ▪ Promote establishment of vegetation. - Decommission inactive buried pipelines by in-situ decommissioning (i.e. abandonment in place) consistent with the requirements of AS 2885. ▪ All significantly disturbed land caused by the carrying out of the petroleum activities will be rehabilitated to: - A stable landform and with a self-sustaining vegetation cover and species that are similar to adjoining undisturbed areas; - Ensure that all land is reinstated to the pre-disturbed land use and suitability class; - Ensure that the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance by petroleum activities; and - Ensure that the water quality of any residual void or water bodies constructed by petroleum activities meets criteria for subsequent uses and does not have potential to cause environmental harm. ▪ Maintenance of rehabilitated areas will take place to ensure and demonstrate: - Stability of landforms; - Erosion control measures remain effective; - Stormwater runoff and seepage from rehabilitated areas does not negatively affect the environmental values of any waters; - Plants show healthy growth and recruitment is occurring; and - Rehabilitated areas are free of any declared pest plants. ▪ Rehabilitation will be considered successful when: - The site can be managed for its designated land use (either similar to that of surrounding undisturbed areas); - No greater management input than for other land in the area being used for a similar purpose is required and there is evidence that the rehabilitation has been successful for at least three years; - The rehabilitation is carried out in accordance with the goals, objectives indicators and completion criteria as specified in Table 6-11; and - Written agreement is obtained from the landholder.	
Section 6.9.2 (Rehabilitation) Management Controls, page 79	Table 6-11 Planned Rehabilitation Specifications (safe, non-polluting, stable, self-sustaining).	Section 3.0.
Section 6.4.4.1,	Cleared vegetation will be stockpiled in a manner that facilitates respreading or salvaging and does not	Appendix 3.

Management Controls - General, page 51	impede vehicle, stock or wildlife movements.	
Section 6.4.4.1, Management Controls - General, page 51	When carrying out petroleum activities, the following will be undertaken: (a) avoid, minimise or mitigate (in order of preference) any impacts on areas of vegetation or other areas of ecological value;	Section 2.1.
	(b) minimise the risk of injury, harm, or entrapment to wildlife and stock;	Refer to Fauna Management Plan.
	(c) minimise disturbance to land that may otherwise result in land degradation; and	Appendix 3.
	(a) ensure that for land that is to be significantly disturbed by petroleum activities: i. the top layer of the soil profile is removed; ii. stockpiled in a manner that will preserve its biological and chemical properties; and iii. used for rehabilitation purposese prior to carrying out field based activities, make all relevant staff, contractors or agents carrying out those activities, aware of the location of any category A, B or C ESA's and the requirements of this environmental authority.	Section 7.2.1; Appendix 3; Refer to the Protocol.
Section 6.4.4.1, Management Controls - General, page 51	If significant disturbance to land is unavoidable, then vegetation will not be cleared or fill placed: (a) in a way which significantly isolates, fragments or dissects tracts of vegetation resulting in a reduction in the current level of ecosystem functioning, ecological connectivity (i.e. stepping stone or contiguous bioregional/local corridor networks) and/or results in an increase in threatening processes (e.g. potential impacts associated with introduced species);	Section 7; Appendix 3.
	(b) on slopes greater than 10 per cent; or	Section 7; Appendix 3.
	(c) in discharge areas.	Section 7; Appendix 3.
Appendix B, Part 3, Schedule H Rehabilitation, page 14	Part 3 Schedule H does not provide any specific monitoring requirements for rehabilitation. Monitoring will be required to be able demonstrate that rehabilitated land is suitable for its original purpose and that the surrounding environment has not been adversely affected by rehabilitation.	Section 7.3; Appendix 5.
Appendix B, 2.1 Part 2 – General Environmental Conditions, Condition 13 – Nature Conservation Act	This Condition relates to the clearing of vegetation for construction activities. Monitoring related to the Nature Conservation Act will consist of regular (six monthly) inspections of regrowth in areas cleared for construction (e.g. access tracks, drill pads) not required for routine operation and maintenance.	Section 7.3; Appendix 5.

Section 4.3.2 Regulatory Compliance, page 12	Regulatory monitoring requirements are generally on a regular recurring basis (monthly, quarterly, six monthly or annually) and will, be completed within seven days of the scheduled date.	Section 7.3; Appendix 5.
Environmental Authorities: PEN100178208 (FPA) and PEN101578910 (RSGPA)		
Condition A7	The Operational Plan must be consistent with the requirements of the environmental authority and include, but not be limited to: A rehabilitation plan for the disturbance to land as a result of existing and programmed and approved proposed infrastructure during the period of the operation plan, including, but not limited to the following: i. (a) A description of the area to be disturbed (e.g. tenure, coordinates) and disturbance type (e.g. well lease, flow line, access track); (b) pre-disturbance land use; (c) timeframes for commencing rehabilitation of disturbed areas not required for the ongoing conduct of petroleum activities, not greater than three months for the rehabilitation of buried pipelines and not greater than 9 months for any other disturbed area; (d) forecasted total area to be rehabilitated under the life of the Operational Plan; (e) soil types of areas to be rehabilitated; and (f) final land use, post rehabilitation. ii. (a) proposed revegetation methods inclusive of plant species selection, re-profiling, re-spreading topsoil, soil ameliorants / amendments, surface preparation and method of propagation so as to meet the progressive and final acceptance criteria of this EA; (b) suitable analogue sites to be used for measuring rehabilitation success that represent pre-disturbed land use and the ecological values of the area (s) to be significantly disturbed form the carrying out of the petroleum activities; (c) the percentage foliage cover, flora species richness and diversity and fauna species diversity for analogue sites; (d) the parameters to be measured in analogue and rehabilitated sites for determining rehabilitation success, including, as a minimum, vegetation cover, flora species richness and diversity and fauna species diversity at a minimum yearly monitoring frequency; (e) the experimental design for analysing analogue and rehabilitated site data including statistical methods of analysis; (f) a high level rehabilitation strategy, including final land use, for all proposed infrastructure which is not programmed and approved at the commencement of the Operational Plan; (g) the results and a description of monitoring undertaken on progressive rehabilitation carried out under the previous Operational Plan(s) in relation to the requirements and acceptance	Section 7; Appendix 2; Appendix 3; Appendix 5; Refer to Operational Plan.

	criteria set out in the environmental authority; and (h) the calculation of financial assurance for the proposed maximum disturbance expected during the period of the Operational Plan.	
Condition B10	(B10) The petroleum activity(ies) or works resulting in significant disturbance to the bed and banks of a watercourse, lake, wetland, or a spring must: (h) be no greater than the minimum area necessary for the purpose of the significant disturbance; (i) be designed and undertaken by a suitably qualified person taking into account the matters listed in the "Planning Activities" and " Impact Management" sections of the Department of Environment and Resource Management's "Guideline – Activities in a watercourse, lake or spring associated with mining operations" December 2010, as amended from time to time; and (j) upon cessation of the petroleum activity(ies) or works, commence rehabilitation immediately.	Appendix 3.
Condition C9	(C9) All aggregation dams must: (a) be designed with a floor and sides of material that will contain the wetting front and any entrained contaminants within the bounds of the containment system during its operational life including any period of decommissioning and rehabilitation; and (b) have a system that will detect any passage of the wetting front or entrained contaminants through the floor or sides of the dam.	Section 2.4.1; Section 7; Appendix 2; Appendix 3.
Condition C10	(C10) All brine dams must: (a) be designed with a floor and sides of material that will contain the wetting front and any entrained contaminants within the bounds of the containment system during its operational life including any period of decommissioning and rehabilitation; (b) have a system that will detect any passage of the wetting front or entrained contaminants through the floor or sides of the dam; and (c) have a system for the collection and proper disposal of any contaminants that move beyond the bounds of the containment system.	Section 2.4.1; Section 7; Appendix 2; Appendix 3.
Condition C14	(C14) The design plan must include, but not be limited to: (a) a statement of the relevant legislation, regulatory documents and engineering practice relied upon in the design plan; (b) a statement of the facts and data being used in the design plan and the limitations to the application and interpretation of that material; (c) an assessment of the hazard category of the proposed dam based on the indentification of potential impacts on any relevant sensitive places for any applicable dam failure scenarios, including the cumulative impact should all dams fail at once; (d) detailed specifications for the design, operation, maintenance and decommissioning of the dam(s); (e) an operational plan that includes contingency / emergency response procedures designed to avoid / minimise discharges resulting from any overtopping or loss of structural integrity of the dam; (f) design, specification and operational rules for any related structures and systems used to prevent the overtopping of the proposed dam;	Appendix 3.

	(g) a detailed plan for the decommissioning and rehabilitation of the dam at the **end** of its operational life; (h) any other matter required by the certifying suitably qualified and experienced person; and evidence supporting the claims of the certifier that they are a suitably qualified and experienced person.	
Condition D6	The holder of this environmental authority, when carrying out petroleum activities must: (d) avoid, minimise or mitigate (in order of preference) any impacts on areas of vegetation or other areas of ecological value; (e) minimise disturbance to land that may otherwise result in land degradation; (f) ensure that for land that is to be **significantly disturbed** by petroleum activities: i. the top layer of the soil profile is removed; ii. stockpiled in a manner that will preserve its biological and chemical properties; and iii. used for **rehabilitation** purposes (in accordance with condition (H6)). (g) avoid clearing mature trees; and (i) prior to carrying out field based activities, make all relevant staff, contractors or agents carrying out those activities, aware of the location of any category A, B or C ESA's and the requirements of this environmental authority.	Section 2.1; Appendix 3.
Condition D7	(D7) In accordance with condition (D6) above, if significant disturbance to land is unavoidable, the holder of this environmental authority must not clear vegetation or place fill: (a) in a way which significantly isolates, fragments or dissects tracts of vegetation resulting in a reduction in the current level of ecosystem functioning, ecological connectivity (i.e. stepping stone or contiguous bioregional/local corridor networks) and/or results in an increase in threatening processes (e.g. potential impacts associated with edge effects or introduced species); (b) on slopes greater than 10% for activities other than pipelines and wells; or (c) in discharge areas.	Appendix 3.
Condition H1	(H1) Pipelines trenches must be backfilled immediately after pipe laying and rehabilitated as soon as practicable but not longer than three (3) months after completion.	Appendix 3.
Condition H2	(H2) During backfilling of pipeline trenches, soils must be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area.	Section 7.2.1; Appendix 3.
Condition H3	(H3) Backfilled and rehabilitated pipeline trenches must: (a) be a stable landform; (b) exhibit no subsidence or erosion gullies for the life of the operational pipeline; (c) be re-profiled to a level consistent with surrounding soils; (d) be re-profiled to original contours and established drainage lines; (e) be visually consistent with the surround land features; and (f) be vegetated with groundcover as a minimum to ensure that erosion is minimised.	
Condition H4	(H4) Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) (other than constructing pipelines) which is not required for the ongoing conduct of	Section 7.0;

	the petroleum activity(ies) must commence as soon as practicable, but not longer than nine (9) months following the completion of any construction or operational works associated with the petroleum activity(ies).	Appendix 3.
Condition H5	(H5) Progressive rehabilitation of significantly disturbed land caused by the carrying out of the petroleum activity(ies) must: (g) remediate any contaminated land (e.g. contaminated soils, decommissioned dams containing salt); (h) reshape all significantly disturbed land to a stable landform; (i) reprofile all significantly disturbed land to a level consistent with that of surrounding undisturbed areas; (j) reprofile all significantly disturbed land to original contours; (k) on all significantly disturbed land: i. re-establish surface drainage lines; ii. reinstate the top layer of the soil profile; iii. establish groundcover to ensure that erosion is minimised; and iv. establish vegetation of floristic species composition found in analogue sites. (l) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or are treated to prevent and / or minimise environmental harm.	Section 2.3; Section 2.4.1; Appendix 3.
Condition H6	(H6) All significantly disturbed land caused by the carrying out of the petroleum activity(ies) must be rehabilitated to meet the following final acceptance criteria: (a) all significantly disturbed land is reinstated to the pre-disturbed land use unless otherwise agreed to between the environmental authority holder, the landholder and the administering authority and is provided for in the Operational Plan; (b) all significantly disturbed land is reinstated to the pre-disturbed soil suitability class; (c) the landform is safe for humans and fauna; (d) the landform is stable with no subsidence or erosion gullies for at least five (5) years; (e) a minimum of 80% foliage cover of analogue sites is maintained in the rehabilitated sites for at least three (3) years; (f) a minimum of 80% of the flora species in the analogue sites is maintained in the rehabilitated sites for at least three (3) years; (g) a minimum of 80% of the fauna species diversity in analogue sites is maintained in the rehabilitated sites for at least three (3) years; (h) erosion is minimised with appropriate sediment traps and erosion control measures installed as determined by a suitably qualified person; (i) the water quality of any residual void or water bodies constructed by the petroleum activity(ies) meets criteria for subsequent uses and does not have potential to cause environmental harm; (j) there is no ongoing contamination to surface water; (k) there is no ongoing contamination to groundwater from dams or monocells (demonstrated via groundwater monitoring and leak detection monitoring systems); and (l) the maintenance requirements for rehabilitated land is no greater than that required for the land prior to	Section 2.3; Section 2.4.1; Appendix 3.

	its disturbance by petroleum activity(ies).	
Condition H7	(H7) Notwithstanding condition (H6), all buried pipelines must be decommissioned in accordance with the requirements of Australian Standard 2885.	Section 2.4.1; Appendix 3.
Condition H8	Notwithstanding condition (H6), any dam may be decommissioned for a beneficial use provided that it is approved or authorised by the administering authority and the landowner.	Section 2.3; Section 2.4.1.
Condition I48	Regular maintenance and at least yearly monitoring of rehabilitated areas must take place to measure compliance with the requirements of condition (H5).	Section 7.3; Appendix 5.
Condition A10	The Constraints and Field Development Plan must be updated annually and submitted to the administering authority as part of the Annual Environmental Return required by Condition (A23).	Section 4.1.6; Section 4.2.1; Section 4.2.2; Section 4.3; Section 7.3.

Appendix 2

Benchmarks for Representative Ecosystems

Benchmark	Reference Number
Riparian Woodland	1
Callitris Glaucophylla Woodland	2
Acacia Open-Forest	3
Brigalow	4
Eucalypt Woodland	5
Eucalyptus Open-Forest	6
Semi-Evergreen Vine Thicket	7
Natural Grasslands	8
Grazing Land – Native Pasture	9

A range of benchmarks have been selected to guide rehabilitation for broad ecosystems, including pasture grasses, identified in the project areas. The benchmark guidelines provide a summary of the key condition indicators of a range of vegetation and grazing communities. Benchmarks provide information on the best condition on offer for each broad ecosystem, and are considered to be the minimum target for rehabilitation. This information is designed to be supplemented by the pre-clearance survey, and provide a means to rehabilitate disturbance areas to better than pre-clearance condition. The pre-clearance survey includes methods to select the appropriate benchmark guideline. These Guidelines provide specific information to assist with rehabilitation of TEC.

Refer to **Section 5** of the RRRMP for methods.

BENCHMARK 1: RIPARIAN WOODLAND

Representative Ecosystem	Riparian Eucalypt Open-forest
Site Vegetation Descriptions	▪ *Eucalyptus populnea* Woodland; ▪ *Eucalyptus coolabah* Woodland on alluvial plains; ▪ *E. populnea, Allocasuarina luehmannii and Callitris glaucophylla* Woodland; ▪ *E. tereticornis and E. camaldulensis* Woodland; ▪ *E. camaldulensis and Angophora floribunda* Open-forest; ▪ *Casuarina cristata* +/- *Eucalyptus coolabah* Open woodland on alluvial plains and ▪ *E. melanophloia* +/- *E. chloroclada* Woodland.
Regional Ecosystems	11.3.2, 11.3.3, 11.3.17, 11.3.18, 11.3.19, 11.3.25, 11.3.29, 11.3.39.
Available DERM Benchmarks	RE 11.3.2
Site Assessment Information	RE: 11.3.25. Property: Springwater (Christmas Creek) Location:8.922148 -25.729544. RE 11.3.2. Property: Coxon Creek. Location: 149.091744 -26.382334

Species Richness	Average Native Species Richness	Pre-Clearing Species Richness	Target Species Richness
Trees	3	TBC	TBC
Shrubs	4	TBC	TBC
Herbs and Forbs	13	TBC	TBC
Grasses	9	TBC	TBC
		*TBC: to be completed by suitably qualified ecologist using pre-clearance survey data	*TBC: to be determined and completed by suitably qualified ecologist, based on average native species richness and pre-clearance survey

Overall Weed Cover: 5 – 15%

Indicative Species List		
Tree Species		**Species in Disturbance Area[1]**
Allocasuarina luehmannii	Bulloak	TBC
*Angophora floribunda**	Rough-barked Apple	TBC
Callitris glaucophylla	White Cypress Pine	TBC
Casuarina cunninghamii	River She-oak	TBC
*Eucalyptus camaldulensis **	River Red Gum	TBC
*Eucalyptus chloroclada**	Baradine Red Gum	TBC
Eucalyptus coolabah	Coolabah	TBC
Casuarina cristata	Belah	TBC
*Eucalyptus melanophloia**	Silver-leaved Ironbark	TBC
*Eucalyptus populnea**	Poplar Box	TBC
*Eucalyptus tereticornis**	Queensland Blue Gum	TBC
Melaleuca viminalis	Weeping Bottlebrush	TBC
Melia azedarach	White Cedar	TBC
Shrub Species		**Species in Disturbance Area[1]**
*Acacia salicina**	Native Willow	TBC
Breynia oblongifolia	Coffee Bush	TBC
Notelaea microphylla	Native Olive	TBC
Psydrax oleifolia	Myrtle Tree	TBC
Herb and Forb Species		**Species in Disturbance Area[1]**
Cyperus haspan	Dwarf Cyperus	TBC
Cyperus gracilis	Slender Flat-sedge	TBC
Geitonoplesium cymosum	Scrambling Lily	TBC
Lomandra hystrix	Slender Mat-rush	TBC
Lomandra longifolia	Spiny-headed Mat-rush	TBC
Neoachmandra cunninghamii	Slender Cucumber	TBC
Grass Species		**Species in Disturbance Area[1]**
Dichanthium sericium	Queensland Bluegrass	TBC
Heteropogon contortus	Black Speargrass	TBC
Imperata cylindrica	Blady Grass	TBC
Oplismenus aemulus	Creeping Beard Grass	TBC
Paspalidium caespitosum	Brigalow Grass	TBC
Themeda triandra	Kangaroo Grass	TBC
Wahlenbergia gracillis	Australian Blue Bell	TBC
Common Weed Species		**Species in Disturbance Area[1]**
Bidens pilosa	Cobblers Pegs	TBC
Cirsium vulgare	Scotch Thistle	TBC
Conyza bonariensis	Flax-leaf Fleabane	TBC

Glandularia aristigera	Mayne's Pest	TBC
Gomphocarpus physocarpus	Balloon Cotton Bush	TBC
Megathyrsus maximus var maximus	Guinea Grass	TBC
Sida rhombifolia	Paddy's Lucerne	TBC
Sigesbeckia orientalis	Indian Weed	TBC
Xanthium occidentale	Noogoora Burr	TBC
Additional Species[1]		

* Key Species for broad ecosystem group

[1] TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey

Trees and Shrubs Data							
	Average Cover (%)	**Pre-clearing Cover (%)***	**Target Cover (%)***	**Height Range (M)**	**Average Large Tree DBH (cm) Threshold**	**Average Large Tree Count (per ha)**	**Average Hollow Bearing Tree Count (per ha)**
Eucalypt Trees	64	TBC	TBC	19 – 22	42	17	7
Non-eucalypt trees				12 – 19	28	2	0
Shrubs	3	TBC	TBC	N/A	N/A	N/A	N/A
* TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey							

Ground Cover (%)				
Type	**Average**	**Range**	**Pre-clearing Average***	**Target***
Native grass	38	7 – 45	TBC	TBC
Native herbs and forbs	22	4 – 41	TBC	TBC
Native shrubs	0.5	0 – 1	TBC	TBC
Non-native grass	3	0 – 5	TBC	TBC
Non-native herbs, forbs and shrubs	3	0 – 5	TBC	TBC
Litter	14	2 – 25	TBC	TBC
Rock	0	0	TBC	TBC
Bare ground	19	1 - 37	TBC	TBC
*TBC: to be completed by suitably qualified ecologist based on pre-clearance survey				

Target Planting Densities	
Layer	**Density (plants/ha)**
Canopy	100
Shrubs	100
Herbs and forbs	200
Grasses	300
* Based on *Revegetation Planting Standards* (Department of Sustainability and the Environment, 2006)	

Potential Threatened Species (based on RE / SSMP)				
Scientific Name	**Common Name**	**EPBC Status**	**NCA Status**	**Associated RE**
Aves				
Geophaps scripta scripta	Squatter Pigeon (southern form)	V	V	11.3.2, 11.3.17, 11.3.18, 11.3.25, 11.3.39
Reptiles				
Delma torquata	Collared Delma	V	V	11.3.2
Denisonia maculata	Ornamental Snake	V	V	11.3.17, 11.3.18, 11.3.25
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	11.3.2, 11.3.17, 11.3.18, 11.3.25, 11.3.39
Nyctophilus corbeni	South-eastern Long-eared Bat	V	V	11.3.2, 11.3.17, 11.3.18, 11.3.25, 11.3.39
Flora				
Bertya opponens	Coolabah Bertya	V	-	11.3.25

Coxon Creek, Benchmark Site, RE 11.3.2

Christmas Creek Benchmark Site, RE11.3.25

BENCHMARK 2: CALLITRIS GLAUCOPHYLLA WOODLAND

Representative Ecosystem	*Callitris glaucophylla* Open Forest
Site Vegetation Descriptions	▪ *Callitris glaucophylla* Woodland
Regional Ecosystems	11.10.9
Available DERM Benchmarks	Nil
Site Assessment Information	RE: 11.10.9. Property: Springwater. Location: 148.955175 -25.762183

Species Richness	Average Native Species Richness	Pre-Clearing Species Richness	Target Species Richness
Trees	4	TBC	TBC
Shrubs	4	TBC	TBC
Herbs and Forbs	5	TBC	TBC
Grasses	7	TBC	TBC
		*TBC: to be completed by suitably qualified ecologist using pre-clearance survey data	*TBC: to be determined and completed by suitably qualified ecologist, based on average native species richness and pre-clearance survey

Overall Weed Cover: 5%

Indicative Species List		
Tree Species		**Species in Disturbance Area[1]**
Callitris glaucophylla *	White Cypress Pine	TBC
Corymbia clarksoniana	Clarkson's Bloodwood	TBC
Eucalyptus chloroclada	Baradine Red Gum	TBC
Eucalyptus melanophloia	Silver-leaved Ironbark	TBC
Shrub Species		**Species in Disturbance Area[1]**
Acacia holosericea	Silver Wattle	TBC
Petalostigma pubescens	Quinine Tree	TBC
Alphitonia excelsa	Red Ash	TBC
Herbs and Forbs		**Species in Disturbance Area[1]**
Cheilanthes sieberi	Mulga Fern	TBC
Fimbristylis dichotoma	-	TBC
Wahlenbergia gracillis	Australian Bluebell	TBC
Grass Species		**Species in Disturbance Area[1]**

Aristida calycina	-	TBC
Aristida ramosa	Purple Wiregrass	TBC
Cymbopogon refractus	Barbed Wire Grass	TBC
*Eragrostis sororia**	Woodland Lovegrass	TBC
Enneapogon acenaceus	Common Bottle Cleaner	TBC
Heteropogon contortus	Black Spear Grass	TBC
Common Weeds		**Species in Disturbance Area[1]**
Conyza bonariensis	Flax-leaf Fleabane	TBC
Glandularia aristigera	Mayne's Pest	TBC
Gomphrena celosioides	Gomphrena Weed	TBC
Opuntia stricta	Prickly Pear (LPA Class 1)	TBC
Commelina diffusa	Wandering Jew	TBC
Additional Species[1]		

* Key Species representative of broad ecosystem group

[1] TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey

Trees and Shrubs Data							
	Average Cover (%)	**Pre-clearing Cover (%)***	**Target Cover (%)***	**Height Range (M)**	**Average Large Tree DBH (cm) Threshold**	**Average Large Tree Count (per ha)**	**Average Hollow Bearing Tree Count (per ha)**
Eucalypt Trees	87	TBC	TBC	10	N/A	N/A	0
Non-eucalypt trees				13	24	27	0
Shrubs	4	TBC	TBC	N/A	N/A	N/A	N/A
* TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey							

Ground Cover (%)				
Type	**Average**	**Range**	**Pre-clearing Average***	**Target***
Native grass	27	25-29	TBC	TBC
Native herbs and forbs	25	22-28	TBC	TBC
Native shrubs	1	1-3	TBC	TBC
Non-native grass	0	0	TBC	TBC
Non-native herbs, forbs and shrubs	1	1	TBC	TBC
Litter	14	14	TBC	TBC
Rock	0	0	TBC	TBC
Bare ground	30	29-31	TBC	TBC
* TBC: to be completed by suitably qualified ecologist based on pre-clearance survey				

Target Planting Densities	
Layer	**Density (plants/ha)**
Canopy	200
Shrubs	50
Herbs and forbs	150
Grasses	150
* Based on *Revegetation Planting Standards* (Department of Sustainability and the Environment, 2006)	

Potential Threatened Species (based on RE)				
Scientific Name	**Common Name**	**EPBC Status**	**NCA Status**	**Associated RE**
Aves				
Calyptorhynchus lathami	Glossy Black Cockatoo	-	V	11.10.9
Geophaps scripta scripta	Squatter Pigeon (southern form)	V	V	11.10.9
Reptiles				
Egernia rugosa	Yakka Skink	V	V	11.10.9
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	11.10.9
Nyctophilus timoriensis	Long-eared Bat	V	V	11.10.9
Flora				
Cadellia pentastylis	Ooline	V	V	11.10.9

Springwater, RE 11.10.9

BENCHMARK 3: ACACIA OPEN-FOREST BENCHMARK

Representative Ecosystem	Acacia Woodland
Site Vegetation Descriptions	▪ *Acacia catenulata and/ or Acacia shirleyi* Woodland
Regional Ecosystems	11.7.2, 11.7.5, 11.10.3
Available DERM Benchmarks	Nil
Site Assessment Information	RE: 11.7.2. Property: Broandah. Location: 149.262915 -26.478901 RE 11.10.3. Property: Waddy Brae. Location: 148.924961 -25.599553

Species Richness	Average Native Species Richness	Pre-Clearing Species Richness	Target Species Richness
Trees	2	TBC	TBC
Shrubs	11	TBC	TBC
Herbs and Forbs	9	TBC	TBC
Grasses	5	TBC	TBC
		* TBC: to be completed by suitably qualified ecologist using pre-clearance survey data	* TBC: to be determined by suitably qualified ecologist, based on average native species richness and pre-clearance survey

Overall Weed Cover: <1%

Indicative Species List		
Tree Species		**Species in Disturbance Area[1]**
*Acacia shirleyi**	Lancewood	TBC
*Acacia catenulata**	Bendee	TBC
*Eucalyptus crebra**	Narrow-leaved Ironbark	TBC
Shrub Species		**Species in Disturbance Area[1]**
Alphitonia excelsa	Red Ash	TBC
*Alstonia constricta**	Bitter Bark	TBC
*Callitris endlicheri**	Black Cypress	TBC
*Callitris glaucophylla**	White Cypress	TBC
Carissa ovata	Currant Bush	TBC
*Eremophila longifolia**	Dogwood	TBC
Hovea longifolia	Rusty Pods	TBC
Psydrax oleifolia	Myrtle Tree	TBC
Herb and Forb Species		**Species in Disturbance Area[1]**
Acrotriche aggregata	Ground Berry	TBC
Bursaria spinosa	Prickly Pine	TBC
Cheilanthes sieberi	Mulga Fern	TBC

Goodenia rotundifolia	Star Goodenia	TBC
Solanum ellipticum	Potato Bush	TBC
Vittadinia dissecta	-	TBC
Grass Species		**Species in Disturbance Area[1]**
Entolasia stricta	Wiry Panic	TBC
Eragrostis sororia	Woodland Lovegrass	TBC
Common Weed Species		**Species in Disturbance Area[1]**
Optunia stricta	Prickly Pear (LPA Class 1)	TBC
Additional Species[1]		

* Key Species representative of broad ecosystem group

[1] TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey

Trees and Shrubs Data							
	Average Cover (%)	**Pre-clearing Cover (%)***	**Target Cover (%)***	**Height Range (M)**	**Average Large Tree DBH (cm) Threshold**	**Average Large Tree Count (per ha)**	**Average Hollow Bearing Tree Count (per ha)**
Eucalypt Trees	55	TBC	TBC	14	35	10	4
Non-eucalypt trees				12	23	17	0
Shrubs	7	TBC	TBC	N/A	N/A	N/A	N/A
* TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey							

Ground Cover (%)				
Type	**Average**	**Range**	**Pre-clearing Average***	**Target***
Native grass	20	5 - 65	TBC	TBC
Native herbs and forbs	9	5 – 15	TBC	TBC
Native shrubs	1	0 – 5	TBC	TBC
Non-native grass	0	0	TBC	TBC
Non-native herbs, forbs and shrubs	0	0	TBC	TBC
Litter	41	15-80	TBC	TBC
Rock	5	0-20	TBC	TBC
Bare ground	23	5-40	TBC	TBC
* TBC: to be completed by suitably qualified ecologist based on pre-clearance survey				

Target Planting Densities	
Layer	**Density (plants/ha)**
Canopy	200
Shrubs	200
Herbs and forbs	50
Grasses	150
* Based on *Revegetation Planting Standards* (Department of Sustainability and the Environment, 2006)	

Potential Threatened Species (based on RE)				
Scientific Name	**Common Name**	**EPBC Status**	**NCA Status**	**Associated RE**
Aves				
Calyptorhynchus lathami	Glossy Black Cockatoo	-	V	11.10.3
Geophaps scripta scripta	Squatter Pigeon (southern form)	V	V	11.10.3
Reptiles				
Egernia rugosa	Yakka Skink	V	V	11.10.3
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	11.10.3
Flora				
Bertya opponens	Coolabah Bertya	V	-	11.10.3
Cadellia pentastylis	Ooline	V	V	11.10.3

Waddy Brae, RE 11.10.3

BENCHMARK 4: BRIGALOW

Representative Ecosystem	Brigalow (Dominant and Co-dominant)
Site Vegetation Descriptions	▪ *Acacia harpophylla* Open-forest*;* ▪ *Acacia harpophylla* and/or *Casuarina cristata* shrubby Open-forest and ▪ *Acacia harpophylla & Eucalyptus populnea* Woodland.
Regional Ecosystems	11.4.3, 11.4.7, 11.9.5, 11.9.5a, 11.7.1, 11.9.1, 11.9.10, 11.9.11
Available DERM Benchmarks	11.4.3, 11.9.5
Site Assessment Information	RE: 11.9.5a. Property: Coxon Creek. Location: 149.090330 -26.349438 RE: 11.9.5. Property: Springwater. Location: 148.949149 -25.701510 Re 11.9.5. Property: N/A – Within AVPA. Location: 148.917537 -25.499639 RE 11.9.5. Property: N/A – within AVPA. Location: 148.920056 -25.494751

Species Richness	Average Native Species Richness	Pre-Clearing Species Richness	Target Species Richness
Trees	4	TBC	TBC
Shrubs	6	TBC	TBC
Herbs and Forbs	9	TBC	TBC
Grasses	9	TBC	TBC
		* TBC: to be completed by suitably qualified ecologist using pre-clearance survey data	* TBC: to be determined by suitably qualified ecologist, based on average native species richness and pre-clearance survey

Overall weed cover: <5 – 15%

Indicative Species List		
Tree Species		**Species in Disturbance Area[1]**
*Acacia harpophylla**	Brigalow	TBC
*Casuarina cristata **	Belah	TBC
Callitris glaucophylla	White Cypress	TBC
Eucalyptus populnea	Poplar Box	TBC
Flindersia australis	Australian Teak	TBC
*Geijera parviflora**	Wilga	TBC
Lysiphyllum carronii	Queensland Ebony	TBC
Shrub Species		**Species in Disturbance Area[1]**
*Alstonia constricta**	Bitter Bark	TBC
Bursaria incana	Prickly Pine	TBC
*Carissa ovata**	Currant Bush	TBC
Cheilanthes sieberi	Mulga Fern	TBC
*Eremophila mitchellii**	False Sandalwood	TBC
Notelaea microphylla	Native Olive	TBC
Pittosporum angustifolium	Cattle Bush	TBC
Psydrax odorata	Shiny-leaved Canthium	TBC
Psydrax oleifolia	Myrtle Tree	TBC
Sarcostemma viminale subsp. australe	Caustic Vine	TBC
Herbs and Forbs		**Species in Disturbance Area[1]**
Abutilon oxycarpum	Lantern Bush	TBC
Asperula conferta	Common Woodruff	TBC
Bulbine bulbosa	Native Leek	TBC
Cyperus gracillis	Slender Flat-sedge	TBC
Enchylaena tomentosa	Ruby Saltbush	TBC
Lomandra filiformis	Wattle Mat-rush	TBC
Pittosporum spinescens	Wallaby Apple	TBC
Sida filiformis	Fine Sida	TBC
Grass Species		**Species in Disturbance Area[1]**
Alloteropsis semialata	Cockatoo Grass	TBC
Ancistrachne uncinulata	Hooked-hairy Panic Grass	TBC
Aristida contorta	Bunched Kerosene Grass	TBC
Bothriochloa bunyensis	Satin Top	TBC
*Bothriochloa decipiens **	Pitted Blue Grass	TBC
Chloris divaricata	Slender Chloris	TBC
Cymbopogon refractus	Barbed Wire Grass	TBC
Dactyloctenium radulans	Button Grass	TBC
*Dichanthium sericeum **	Queensland Blue grass	TBC

Digitaria brownii	Cotton Panic Grass	TBC
Enneapogon acenaceus	Common Bottle Cleaner	TBC
Entolasia stricta *	Wiry Panic	TBC
Eragrostis megalosperma	-	TBC
Eragrostis sororia *	Woodland Lovegrass	TBC
Leptochloa decipiens	Umbrella Cane Grass	TBC
Panicum decompositum	Native Millet	TBC
Panicum queenslandicum	Coolabah Grass	TBC
Paspalidium caepitosum *	Brigalow Grass	TBC
Common Weed Species		**Species in Disturbance Area[1]**
Bidens pilosa	Cobblers Pegs	TBC
Cenchrus cilaris	Buffel Grass	TBC
Conyza bonariensis	Flax-leaf Fleabane	TBC
Glandularia aristigera	Mayne's Pest	TBC
Optunia stricta	Prickly Pear (LPA Class 1)	TBC
Sigesbeckia orientalis	Indian Weed	TBC
Additional Species[1]		

* Key Species representative of broad ecosystem group

1 TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey

Trees and Shrubs Data							
	Average Cover (%)	**Pre-clearing Cover (%)***	**Target Cover (%)***	**Height Range (M)**	**Average Large Tree DBH (cm) Threshold**	**Average Large Tree Count (per ha)**	**Average Hollow Bearing Tree Count (per ha)**
Eucalypt Trees	65	TBC	TBC	12 – 25	34	0	3
Non-eucalypt trees				11 - 15	27	17	0
Shrubs	25	TBC	TBC	N/A	N/A	N/A	N/A
* TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey							

Ground Cover (%)				
Type	**Average**	**Range**	**Pre-clearing Average***	**Target***
Native grass	26	10 – 40	TBC	TBC
Native herbs and forbs	8	2 – 20	TBC	TBC
Native shrubs	0.5	0 – 2	TBC	TBC
Non-native grass	0	0	TBC	TBC
Non-native herbs, forbs and shrubs	0.5	0 - 1	TBC	TBC
Litter	18	6 – 25	TBC	TBC
Rock	17	1 – 26	TBC	TBC
Bare ground	32	9 – 64	TBC	TBC
* TBC: to be completed by suitably qualified ecologist based on pre-clearance survey				

Target Planting Densities	
Layer	**Density (plants/ha)**
Canopy	150
Shrubs	200
Herbs and forbs	50
Grasses	150
* Based on *Revegetation Planting Standards* (Department of Sustainability and the Environment, 2006)	

Potential Threatened Species (based on RE)				
Scientific Name	**Common Name**	**EPBC Status**	**NCA Status**	**Associated RE**
Aves				
Calyptorhynchus lathami	Glossy Black Cockatoo	-	V	11.9.5, 11.9.5a
Geophaps scripta scripta	Squatter Pigeon (southern form)	V	V	11.9.5, 11.9.5a
Reptiles				
Egernia rugosa	Yakka Skink	V	V	11.9.5, 11.9.5a
Denisonia maculata	Ornamental Snake	V	V	11.9.5, 11.9.5a
Furina dunmalli	Dunmall's Snake	V	V	11.9.5, 11.9.5a
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	11.9.5, 11.9.5a
Flora				
Cadellia pentastylis	Ooline	V	V	11.9.5, 11.9.5a

Arcadia Valley, RE 11.9.5

Fairview, RE 11.9.5

BENCHMARK 5: EUCALYPT WOODLAND

Representative Ecosystem	Eucalypt Woodland
Site Vegetation Descriptions	▪ *Eucalyptus melanophloia*, *Callitris glaucophylla* Woodland; ▪ *Eucalyptus populnea*, *Eremophila mitchellii* shrubby Woodland; ▪ *Eucalyptus populnea*, *E. melanophloia* +/- *Callitris glaucophylla* Woodland; ▪ *Corymbia citriodora* or *Eucalyptus crebra* Woodland; ▪ *Eucalyptus decorticans, Lysicarpus angustifolius* +/- *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp. Woodland; ▪ *Eucalyptus decorticans, Lysicarpus angustifolius* +/- *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp. Woodland; ▪ *Eucalyptus melanophloia* +/- *E. orgadophila* Woodland; ▪ *Eucalyptus fibrosa* subsp. *nubila* +/- *Corymbia* spp. +/- Eucalyptus spp Woodland and ▪ *Eucalyptus crebra* Woodland.
Regional Ecosystems	11.5.1, 11.5.5, 11.5.9, 11.5.13, 11.7.6, 11.7.7, 11.8.5, 11.9.2,11.9.7, 11.10.4, 11.10.7,11.10.11
Available DERM Benchmarks	Nil
Site Assessment Information	RE: 11.10.11. Property: Coxon Creek. Location: 149.114793 -26.367161 RE11.10.7a. Property: Fairview. Location: 148.970158 -25.641712.

Species Richness	Average Native Species Richness	Pre-Clearing Species Richness	Target Species Richness
Trees	4	TBC	TBC
Shrubs	7	TBC	TBC
Herbs and Forbs	7	TBC	TBC
Grasses	6	TBC	TBC
		* TBC: to be completed by suitably qualified ecologist using pre-clearance survey data	* TBC: to be determined by suitably qualified ecologist, based on average native species richness and pre-clearance survey

Overall Weed Cover: 10%

Indicative Species List		
Tree Species		**Species in Disturbance Area[1]**
*Acacia shirleyi**	Lancewood	TBC
*Angophora leiocarpa **	Smooth-barked Apple	TBC
Callitris glaucophylla	White Cypress Pine	TBC
*Corymbia clarksoniana **	Clarkson's Bloodwood	TBC
*Eucalyptus crebra **	Narrow-leaved Ironbark	TBC
Eucalyptus decorticans	Gum-topped Ironbark	TBC
*Eucalyptus melanophloia**	Silver-leaved Ironbark	TBC
*Eucalyptus populnea**	Poplar Box	TBC
Lysicarpus angustifolius	Queensland Ebony	TBC
Shrub Species		**Species in Disturbance Area[1]**
Acacia leiocalyx	Black Wattle	TBC
Alphitonia excelsa	Red Ash	TBC
Alstonia constricta	Bitter Bark	TBC
Breynia oblongifolia	Coffee Bush	TBC
Carissa ovata	Currant Bush	TBC
Cassinia laevis	Cough Bush	TBC
Dodonaea viscosa	Purple Hop-bush	TBC
Eremophila mitchellii	False Sandalwood	TBC
Fimbristylis dichotoma	Common Fringe-sedge	TBC
Notelaea longifolia	Long-leaved Mock Olive	TBC
Psydrax oleifolia	Myrtle Tree	TBC
Herb and Forb Species		**Species in Disturbance Area[1]**
Abutilon oxycarpum	Straggly Lantern Bush	TBC
Bursaria spinosa	Prickly Pine	TBC
Cheilanthes sieberi	Mulga Fern	TBC
Cyperus haspan	Dwarf Cyperus	TBC
Fimbristylis dichotoma	Common Fringe-sedge	TBC
Goodenia rotundifolia	Star Goodenia	TBC
Lomandra longifolia	Spiny-headed Mat-rush	TBC
Sida filiformis	Fine Sida	TBC
Grass Species		**Species in Disturbance Area[1]**
Aristida ramosa	Purple Wiregrass	TBC
Bothriochloa decipiens	Pitted Bluegrass	TBC
Chloris divaricata	Spreading Windmill Grass	TBC
Cymbopogon refractus	Barbed Wire Grass	TBC
Dichanthium sericium	Queensland Bluegrass	TBC
Enneapogon acenaceus	Common Bottle Cleaner	TBC

Eragrostis sororia	Woodland Lovegrass	TBC
Heteropogon contortus	Black Speargrass	TBC
Panicum decompositum	Native Millet	TBC
Common Weed Species		**Species in Disturbance Area[1]**
Bidens pilosa	Cobblers Pegs	TBC
Conyza bonariensis	Flax-leaf Fleabane	TBC
Optunia stricta	Prickly Pear (LPA Class 1)	TBC
Sigesbeckia orientalis	Indian Weed	TBC
Additional Species[1]		

* Key Species representative of broad ecosystem group

[1] TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey

Trees and Shrubs Data							
	Average Cover (%)	**Pre-clearing Cover (%)***	**Target Cover (%)***	**Height Range (M)**	**Average Large Tree DBH (cm) Threshold**	**Average Large Tree Count (per ha)**	**Average Hollow Bearing Tree Count (per ha)**
Eucalypt Trees	51	TBC	TBC	15	34	25	6
Non-eucalypt trees				N/A	N/A	N/A	N/A
Shrubs	11	TBC	TBC	N/A	N/A	N/A	N/A
* TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey							

Ground Cover (%)				
Type	**Average**	**Range**	**Pre-clearing Average***	**Target***
Native grass	75	64-80	TBC	TBC
Native herbs and forbs	6	2-15	TBC	TBC
Native shrubs	1	0-5	TBC	TBC
Non-native grass	0.5	0-5	TBC	TBC
Non-native herbs, forbs and shrubs	5	2-10	TBC	TBC
Litter	8	3-15	TBC	TBC
Rock	0	0	TBC	TBC
Bare ground	4	0-10	TBC	TBC
* TBC: to be completed by suitably qualified ecologist based on pre-clearance survey				

Target Planting Densities	
Layer	**Density (plants/ha)**
Canopy	100
Shrubs	100
Herbs and forbs	150
Grasses	200
* Based on *Revegetation Planting Standards* (Department of Sustainability and the Environment, 2006)	

Potential Threatened Species (based on RE)				
Scientific Name	**Common Name**	**EPBC Status**	**NCA Status**	**Associated RE**
Aves				
Calyptorhynchus lathami	Glossy Black Cockatoo	-	V	11.9.7, 11.10.4, 11.10.7, 11.10.11
Geophaps scripta scripta	Squatter Pigeon (southern form)	V	V	11.5.5, 11.9.7, 11.10.4, 11.10.7, 11.10.11
Reptiles				
Egernia rugosa	Yakka Skink	V	V	11.5.5, 11.9.7, 11.10.4, 11.10.7, 11.10.11
Denisonia maculata	Ornamental Snake	V	V	11.5.5
Furina dunmalli	Dunmall's Snake	V	V	11.5.5, 11.9.7,
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	11.5.5, 11.9.7, 11.10.4, 11.10.7, 11.10.11
Flora				
Cadellia pentastylis	Ooline	V	V	11.9.7, 11.10.4, 11.10.7, 11.10.11

Broandah, RE 11.10.7

BENCHMARK 6: EUCALYPTUS OPEN-FOREST

Representative Ecosystem	Eucalypt Open-forest
Site Vegetation Descriptions	▪ *Corymbia citriodora* Open-forest; ▪ *Eucalyptus spp.* and/or *Corymbia spp.* Open-forest; and ▪ *Eucalyptus crebra*, *Callitris glaucophylla*, *C. endlicheri*, *E. chloroclada, Angophora leiocarpa* Open-forest.
Regional Ecosystems	11.5.4, 11.7.4, 11.10.1, 11.10.13
Available DERM Benchmarks	11.10.1
Site Assessment Information	RE: 11.10.1. Property: Springwater. Location: 148.992485 -25.744935

Species Richness	Average Native Species Richness	Pre-Clearing Species Richness	Target Species Richness
Trees	4	TBC	TBC
Shrubs	6	TBC	TBC
Herbs and Forbs	10	TBC	TBC
Grasses	12	TBC	TBC
		* TBC: to be completed by suitably qualified ecologist using pre-clearance survey data	* TBC: to be determined by suitably qualified ecologist, based on average native species richness and pre-clearance survey

Overall weed cover: 2 - 10%

Indicative Species List		
Tree Species		**Species in Disturbance Area[1]**
Acacia catenulata	Bendee	TBC
Callitris glaucophylla	White Cypress Pine	TBC
Corymbia citriodora	Spotted Gum	TBC
*Corymbia clarksoniana**	Clarkson's Bloodwood	TBC
*Eucalyptus crebra**	Narrow-leaved Ironbark	TBC
Eucalyptus populnea *	Poplar Box	TBC
Eucalyptus melanophloia	Silver-leaved Ironbark	TBC
Shrub Species		**Species in Disturbance Area[1]**
Acacia victoriae	Prickly Wattle	TBC
Bursaria incana	Mock Orange	TBC
Bursaria spinosa	Boxthorn	TBC

Dodonaea viscosa	Purple Hop Bush	TBC
Eremophila mitchellii	False Sandalwood	TBC
Geijera parviflora	Wilga	TBC
Grevillea striata	Beefwood	TBC
Notelaea longifolia	Long-leaved Mock Olive	TBC
Herb and Forb Species		**Species in Disturbance Area[1]**
Abuliton oxycarpum	Lantern Bush	TBC
Bursaria spinosa	Prickly Pine	TBC
Cyperus haspan	Dwarf Cyperus	TBC
Cyperus iria	Rice Flat-sedge	TBC
Eremophila delbis	Winter Apple	TBC
Evolvulus alsinoides	Evolvulus	TBC
Fimbristylis dichotoma	Common Fringe-sedge	TBC
Goodenia rotundifolia	Star Goodenia	TBC
Lomandra longifolia	Spiny-headed Mat-rush	TBC
Solanum ellipticum	Potato Bush	TBC
Vittadinia dissecta	Daisy	TBC
Wahlenbergia gracilis	Australian Bluebells	TBC
Grass Species		**Species in Disturbance Area[1]**
Alloteropsis semialata	Cockatoo Grass	TBC
Ancistrachne uncinulata	Hooked-hairy Panic Grass	TBC
*Aristida calycina**	Dark Wiregrass	TBC
Aristida caput-medusae	Many-headed Wiregrass	TBC
Aristida jerichoensis	Jericho Wiregrass	TBC
*Bothriochloa decipiens **	Pitted Bluegrass	TBC
Capillipedium parviflorum	Scented Top	TBC
*Chloris divaricata **	Slender Chloris	TBC
Cymbopogon refractus	Barb-wire Grass	TBC
*Dichanthium sericium **	Queensland Bluegrass	TBC
*Enneapogon acenaceus **	Common Bottle Cleaner	TBC
Entolasia stricta	Wiry Panic	TBC
Eragrostis sororia	Woodland Lovegrass	TBC
*Heteropogon contortus **	Black Spear Grass	TBC
Leptochloa decipiens	Slender Canegrass	TBC

Panicum decompositum	Native Millet	TBC
Paspalidium caepitosum	Brigalow Grass	TBC
Themeda triandra *	Kangaroo Grass	TBC
Common Weeds		**Species in Disturbance Area[1]**
Bidens pilosa	Cobblers Pegs	TBC
Conyza bonariensis	Flax-leaf Fleabane	TBC
Glandularia aristigera	Mayne's Pest	TBC
Optunia stricta	Prickly Pear (LPA Class 1)	TBC
Sida rhombifolia	Paddy's Lucerne	TBC
Sigesbeckia orientalis	Indian Weed	TBC
Xanthium pungens	Noogoora Burr	TBC
Additional Species[1]		

* Key Species representative of broad ecosystem group

[1] TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey

Trees and Shrubs Data							
	Average Cover (%)	**Pre-clearing Cover (%)***	**Target Cover (%)***	**Height Range (M)**	**Average Large Tree DBH (cm) Threshold**	**Average Large Tree Count (per ha)**	**Average Hollow Bearing Tree Count (per ha)**
Eucalypt Trees	55	TBC	TBC	14 - 18	35	17	5
Non-eucalypt trees				10 - 13	25	5	0
Shrubs	3	TBC	TBC	N/A	N/A	N/A	N/A
* TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey							

Ground Cover (%)				
Type	**Average**	**Range**	**Pre-clearing Average***	**Target***
Native grass	68	36 – 89	TBC	TBC
Native herbs and forbs	5	4– 7	TBC	TBC
Native shrubs	0.5	0 – 1.8	TBC	TBC
Non-native grass	2	0 – 5.4	TBC	TBC
Non-native herbs, forbs and shrubs	0	0 – 0.5	TBC	TBC
Litter	11	5 – 21	TBC	TBC
Rock	7	0 – 21	TBC	TBC
Bare ground	7	3 – 15	TBC	TBC
* TBC: to be completed by suitably qualified ecologist based on pre-clearance survey				

Target Planting Densities	
Layer	**Density (plants/ha)**
Canopy	100
Shrubs	100
Herbs and forbs	150
Grasses	200
* Based on *Revegetation Planting Standards* (Department of Sustainability and the Environment, 2006)	

Potential Threatened Species (based on RE)				
Scientific Name	**Common Name**	**EPBC Status**	**NCA Status**	**Associated RE**
Aves				
Calyptorhynchus lathami	Glossy Black Cockatoo	-	V	11.10.1, 11.10.13
Geophaps scripta scripta	Squatter Pigeon (southern form)	V	V	11.10.1, 11.10.13
Reptiles				
Egernia rugosa	Yakka Skink	V	V	11.10.1, 11.10.13
Denisonia maculata	Ornamental Snake	V	V	-
Furina dunmalli	Dunmall's Snake	V	V	-
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	11.10.1, 11.10.13
Flora				
Cadellia pentastylis	Ooline	V	V	11.10.1, 11.10.13

Springwater, RE11.10.1

BENCHMARK 7: SEMI-EVERGREEN VINE THICKET

Representative Ecosystem	Semi-evergreen Vine Thicket
Site Vegetation Descriptions	Semi-evergreen Vine Thicket – EPBC Listed TEC
Regional Ecosystems	11.8.3, 11.9.4, 11.10.8
Available DERM Benchmarks	11.8.3, 11.9.4a and 11.9.4c
Site Assessment Information	RE: 11.9.4. Property: Fairview. Location: 148.980722 -25.660450

Species Richness	Average Native Species Richness	Pre-Clearing Species Richness	Target Species Richness
Trees	10	TBC	TBC
Shrubs	17	TBC	TBC
Herbs and Forbs	3	TBC	TBC
Grasses	4	TBC	TBC
		* TBC: to be completed by suitably qualified ecologist using pre-clearance survey data	* TBC: to be determined by suitably qualified ecologist, based on average native species richness and pre-clearance survey

Overall Weed Cover: N/A

Indicative Species List		
Tree Species		**Species in Disturbance Area[1]**
Alectryon subdentatus *	Holly-leaved Birdseye	TBC
Brachychiton rupestris *	Narrow-leaved Bottle Tree	TBC
Brachychiton australis *	Broad-leaved Bottle Tree	TBC
Flindersia maculosa *	Leopard Tree	TBC
Excoecaria dallachyana	Scrub Poison Tree	TBC
Geijera salicifolia *	Wilga	TBC
Owenia venosa	Crow's Apple	TBC
Shrub Species		**Species in Disturbance Area[1]**
Acacia fasciculifera	Scrub Ironbark, Rosewood	TBC
Acalypha eremorum *	-	TBC
Alstonia constricta *	Bitter Bark	TBC
Apophyllum anomalum	Warrior Bush	TBC
Backhousia angustifolia	Narrow-leaved Myrtle	TBC
Bridelia leichhardtii	Small-leaved Scrub Ironbark	TBC
Bursaria incana	Prickly Pine	TBC
Bursaria spinosa	Blackthorn	TBC
Carissa ovata *	Currant Bush	TBC
Croton insularis *	Silver Croton	TBC
Ehretia membranifolia	Peach Bush	TBC
Alectryon diversifolius *	Holly Bush	TBC
Geijera parviflora	Wilga	TBC
Notelaea microcarpa *	Native Olive	TBC
Pittosporum spinescens	Wallaby Apple	TBC
Senna barclayana	Smooth Senna	TBC
Trema tomentosa	Poison Peach	
Herbs and Forbs		**Species in Disturbance Area[1]**
Ablution oxycarpum	Lantern Bush	TBC
Acalypha capillipes	-	TBC
Asperula cunninghamii	Common Woodruff	TBC
Cyperus gracilis	Slender Flat-sedge	TBC
Desmodium brachypodum	Large Tick-trefoil	TBC
Syngonium podophyllum	Arrow-head Vine	TBC
Pandorea pandorana *	Wonga Vine	TBC
Wahlenbergia gracilis	Australian Blue-bells	TBC
Grass Species		**Species in Disturbance Area[1]**
Entolasia stricta	Wiry Panic	TBC
Eragrostis sororia	Woodland Love-grass	TBC

Austrostipa ramosissima	Stout Bamboo Grass	TBC
Ancistrachne uncinulata	Hooky Grass	TBC
Common Weed Species		**Species in Disturbance Area[1]**
Bidens pilosa	Cobblers Pegs	TBC
Conyza bonariensis	Flax-leaf Fleabane	TBC
Gomphrocarpus physocarpus	Balloon Cotton Bush	TBC
Megathyrsus maximus	Guinea Grass	TBC
Opuntia stricta	Prickly Pear (LPA Class 1)	TBC
Additional Species[1]		

* Key Species representative of broad ecosystem group

[1] TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey

Trees and Shrubs Data							
	Average Cover (%)	**Pre-clearing Cover (%)***	**Target Cover (%)***	**Height Range (M)**	**Average Large Tree DBH (cm) Threshold**	**Average Large Tree Count (per ha)**	**Average Hollow Bearing Tree Count (per ha)**
Eucalypt Trees	70	TBC	TBC	12 - 16	38	10	0
Non-eucalypt trees				12 – 16	22	182	0
Shrubs	60	TBC	TBC	N/A	N/A	N/A	N/A
* TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey							

Ground Cover (%)				
Type	**Average**	**Range**	**Pre-clearing Average***	**Target***
Native grass	9	6 - 14	TBC	TBC
Native herbs and forbs	7	0– 19	TBC	TBC
Native shrubs	7	5-7	TBC	TBC
Non-native grass	2	1-4	TBC	TBC
Non-native herbs, forbs and shrubs	6	5-7	TBC	TBC
Litter	12	5-15	TBC	TBC
Rock	27	25-29	TBC	TBC
Bare ground	13	11-15	TBC	TBC
* TBC: to be completed by suitably qualified ecologist based on pre-clearance survey				

Target Planting Densities	
Layer	**Density (plants/ha)**
Canopy	100
Shrubs	150
Herbs and forbs	200
Grasses	50
* Based on *Revegetation Planting Standards* (Department of Sustainability and the Environment, 2006)	

Potential Threatened Species (based on RE)				
Scientific Name	**Common Name**	**EPBC Status**	**NCA Status**	**Associated RE**
Aves				
Calyptorhynchus lathami	Glossy Black Cockatoo	-	V	11.9.4
Geophaps scripta scripta	Squatter Pigeon (southern form)	V	V	11.9.4
Reptiles				
Egernia rugosa	Yakka Skink	V	V	11.9.4
Denisonia maculata	Ornamental Snake	V	V	-
Furina dunmalli	Dunmall's Snake	V	V	-
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	11.9.4
Flora				
Cadellia pentastylis	Ooline	V	V	11.9.4

Springwater, RE 11.9.4

BENCHMARK 8: NATURAL GRASSLANDS

Representative Ecosystem	Natural Grasslands
Site Vegetation Descriptions	Bluegrass Grassland
Regional Ecosystems	11.3.21, 11.8.11, 11.9.3
Available DERM Benchmarks	11.3.21
Site Assessment Information	RE: 11.9.3. Property: N/A - RPA. Location: 148.776979 -26.594726

Species Richness	Average Native Species Richness	Pre-Clearing Species Richness	Target Species Richness
Trees	0	TBC	TBC
Shrubs	0	TBC	TBC
Herbs and Forbs	2	TBC	TBC
Grasses	9	TBC	TBC
		* TBC: to be completed by suitably qualified ecologist using pre-clearance survey data	* TBC: to be determined by suitably qualified ecologist, based on average native species richness and pre-clearance survey

Overall Weed Cover: 2%

INDICATIVE SPECIES LIST		
Grass Species		**Species in Disturbance Area[1]**
*Dichanthium sericium**	Queensland Bluegrass	TBC
Digitaria brownii	Cotton Panic Grass	TBC
Digitaria divaricatissima	Umbrella Grass	TBC
Chloris divaricata	Slender Chloris	TBC
Leptochloa decipiens	Slender Cane-grass	TBC
Neptunia gracilis	Sensitive Weed	TBC
Panicum queenslandicum	Coolabah Grass	TBC
Common Weed Species		**Species in Disturbance Area[1]**
Cenchrus cilaris	Buffel Grass	TBC
Conyza bonariensis	Flax-leaf Fleabane	TBC
Glandularia aristigera	Mayne's Pest	TBC
Gomphrocarpus physocarpus	Balloon Cotton Bush	TBC
Megathyrsus maximus	Guinea Grass	TBC
Opuntia stricta	Prickly Pear (LPA Class 1)	TBC
Additional Species[1]		

* Key Species representative of broad ecosystem group

[1] TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey

Ground Cover (%)				
Type	**Average**	**Range**	**Pre-clearing Average***	**Target***
Native grass	89	75-90	TBC	TBC
Native herbs and forbs	4	2-6	TBC	TBC
Native shrubs	0	0	TBC	TBC
Non-native grass	0	0	TBC	TBC
Non-native herbs, forbs and shrubs	0.4	0 – 1	TBC	TBC
Litter	0	0	TBC	TBC
Rock	1.6	0-8	TBC	TBC
Bare ground	4.8	2-12	TBC	TBC
* TBC: to be completed by suitably qualified ecologist based on pre-clearance survey				

Target Planting Densities	
Layer	**Density (plants/ha)**
Canopy	0
Shrubs	0
Herbs and forbs	5% cover
Grasses	90% cover
* Based on *Revegetation Planting Standards* (Department of Sustainability and the Environment, 2006)	

Roma, RE 11.9.3

BENCHMARK 9: GRAZING LAND – NATIVE PASTURE

Representative Ecosystem	Native Pasture
Site Vegetation Descriptions	Native grassland
Regional Ecosystems	n/a
GQAL Classification	C

Species Richness	Average Native Species Richness	Pre-Clearing Species Richness	Target Species Richness
Trees	TBC	TBC	TBC
Shrubs	TBC	TBC	TBC
Herbs and Forbs	4	TBC	TBC
Grasses	5.5	TBC	TBC
		* TBC: to be completed by suitably qualified ecologist using pre-clearance survey data	* TBC: to be determined by suitably qualified ecologist, based on average native species richness and pre-clearance survey

Overall Weed Cover: 0 - 5 %

Indicative Species List		
Grass Species		
Alloteropsis semialata	Cockatoo Grass	TBC
Aristida caput-madusae	Many-headed Wiregrass	TBC
Bothriochloa decipiens *	Pitted Bluegrass	TBC
Chloris divdivaracata *	Slender Chloris	TBC
Dichanthium serisium *	Queensland Bluegrass	TBC
Eragrostis sororia	Woodland Lovegrass	TBC
Heteropogon contortus	Black Speargrass	TBC
Panicum decompositum *	Native Millet	TBC
Themeda triandra *	Kangaroo Grass	TBC
Herb and Forb Species		
Fimbristylis dichotoma	Common Fringe-sedge	TBC
Glycine microphylla	Small-leaf Glycine	TBC
Sida filiformis	Fine Sida	TBC
Vittadinia dissecta	-	TBC
Wahlenbergia gracillis	Australian Blue Bell	TBC
Common Weeds		
Cenchrus cilaris	Buffel Grass	TBC
Conyza bonariensis	Flax-leaf Fleabane	TBC
Glandularia aristigera	Mayne's Pest	TBC
Gomphrocarpus physocarpus	Balloon Cotton Bush	TBC

Megathyrsus maximus	Guinea Grass	TBC
Opuntia stricta	Prickly Pear (LPA Class 1)	TBC
Additional Species[1]		

* Key Species representative of broad ecosystem group

[1] TBC: To be completed by suitably qualified ecologist, based on pre-clearance survey

Ground Cover (%)				
Type	**Average**	**Range**	**Pre-clearing Average***	**Target***
Native grass	90	90	TBC	TBC
Native herbs and forbs	5	5	TBC	TBC
Non-native grass	1	0 - 2	TBC	TBC
Non-native herbs, forbs and shrubs	4	3 - 5	TBC	TBC
Litter	14	2 – 25	TBC	TBC
Rock	0	0	TBC	TBC
Bare ground	0	0	TBC	TBC
* TBC: to be completed by suitably qualified ecologist based on pre-clearance survey				

Appendix 3

Rehabilitation Schedules

Disturbance Type	Land Use	Rehabilitation Schedule Code	Appendix 3 Reference Number
CSG Well Leases (exploration, appraisal, production)	Native Vegetation	NV/CSG	1
	TEC	TEC/CSG	2
	Grazing	G/CSG	3
	Cropping	C/CSG	4
Access Tracks and Roads	Native Vegetation	NV/AR	5
	Native Riparian Vegetation	NRV/AR	6
	TEC	TEC/AR	7
	Grazing	G/AR	8
	Cropping	C/AR	9
Gathering Systems for Produced Water and Gas	Native Vegetation	NV/GS	10
	TEC	TEC/GS	11
	Native Riparian Vegetation	NRV/GS	12
	Grazing	G/GS	13
	Cropping	C/GS	14
Processing Facilities	Native Vegetation	NV/PF	15
	Grazing	G/PF	16
Dams and Ponds	Native Vegetation	N/DP	17
	Grazing	G/DP	18
Borrow Pits	Native Vegetation	NV/BP	19
	Grazing	G/BP	20
Temporary Infrastructure (camps etc)	Native Vegetation	NV/TI	21
	Grazing	G/TI	22
Transmission Easements	Native Vegetation	NV/TE	23
	TEC	TEC/TE	24
	Native Riparian Vegetation	NRV/TE	25
	Grazing	G/TE	26
Permanent Accommodation	Native Vegetation	N/ PA	27
	Grazing	G/ PA	28

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 1: CSG Well Lease – Native Vegetation (NV/CSG)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the CSG well;
Ensure a non-polluting environment is achieved;
Re-instate the well lease to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the lease;
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC and threatened species where applicable.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
No signs of subsidence or erosion;
Representative of species richness and diversity based on appropriate benchmark guideline and pre-clearing assessment;
No negative effect from stormwater runoff and seepage on environmental values of waters (as per Water Quality Management Plans);
Water quality of residual voids or water bodies meets the criteria for subsequent uses, and does not have the potential to cause environmental harm (as per Water Quality Management Plans);
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES); and
Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Decommissioning
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
Assisted revegetation schedules only</td><td>≥80% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥95% survival of planted stock</td></tr>
<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Recruitment
Natural regeneration schedules only</td><td>≥40% of target species richness*</td><td>≥50% of target species richness*</td><td>≥65% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
<tr><td>Declared</td><td>≤15% declared</td><td>≤10% declared</td><td>≤5% declared</td><td>≤5% declared</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 1: CSG Well Lease – Native Vegetation (NV/CSG)

Weeds	weed cover	weed cover	weed cover	weed cover
Environmental weeds	≤30% weed cover	≤20% weed cover	≤15% weed cover	≤15% weed cover
Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Decommissioning

Element	6 months	1 year	2 years	3 years	4 years	5 years
Stable / No erosion or subsidence	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform.	No evidence of erosion. Stable and self-sufficient landform.	No evidence of erosion. Stable and self-sufficient landform.	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol**; ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition and richness; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and	As per the Protocol

Rehabilitation Management Schedule 1: CSG Well Lease – Native Vegetation (NV/CSG)		
	▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure seed collection and translocation is conducted prior to vegetation clearance; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP; ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements; - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts.	As per the Protocol / SSMP / FMP
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual

Rehabilitation Management Schedule 1: CSG Well Lease – Native Vegetation (NV/CSG)		
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with native grasses identified throughout pre-clearing assessment or in relevant benchmark guideline to stabilise area. Introduced pasture species are not be seeded within areas of native vegetation; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon CSG Well Decommissioning	**Stabilisation of Well Lease** ▪ CSG infrastructure will be decommissioned in accordance with the statutory requirements outlined in the P&G Act; ▪ CSG infrastructure will be progressively removed and reused (where applicable), as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities do not impact upon MNES; and ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation.	As per the Protocol
Within 12 months of decommissioning (taking into consideration the wet season)	**Final Rehabilitation of Well Lease** ▪ Conduct Contaminated Land Assessment and follow Contaminated Land procedures as required, in accordance with the Draft Guidelines for the Assessment and Management of Contaminated Lands; ▪ Fill all sump and flare pits, or stabilise residual voids; ▪ Treat any declared weeds present on site; ▪ Rip soil to ensure no compaction. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil; ▪ Utilise appropriate benchmark site to identify target species composition and richness; ▪ Seed site with species identified within pre-clearing assessment and benchmark assessment; ▪ Undertake any specific rehabilitation requirements identified for threatened species as per **Appendix 4;** Within areas of threatened fauna habitat mapped within the SSMP (MNES): ▪ Re-plant tube stock where necessary to encourage regeneration of canopy and shrub layer. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose crumbly soil, and then firmed in will with the hands to create a shallow watering depression;	As per the Protocol

Rehabilitation Management Schedule 1: CSG Well Lease – Native Vegetation (NV/CSG)		
	▪ Replant as per densities outlined in appropriate Benchmark site; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; ▪ Mulch all seedlings with clean mulch to a radius of 1m surrounding the plant at a depth of 100mm. Mulch should not touch plant stems, and should be sourced from vegetation clearing within the surrounding project area; ▪ Seed with native grass and herb species as identified in pre-clearing assessment. Introduced pasture species are not be seeded within areas of native vegetation; and ▪ Where required, install temporary stock fencing in accordance with Appendix 8 to ensure regenerating areas of MNES are appropriately protected from livestock.	
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
	Maintenance Tasks / Corrective Procedures	**Responsibility**
As per monitoring and maintenance schedule (**Appendix 5**)	▪ Replace damaged / dead seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Install fencing as required to prevent damage by livestock; and ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to Coordinator-General, DERM and SEWPaC.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC. Coordinator-General and EA.	As per the Protocol

<table>
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<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the CSG well;
Ensure a non-polluting environment is achieved;
Re-instate the well lease to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the lease;
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC, including Brigalow and Semi-evergreen Vine Thicket.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
No signs of subsidence or erosion;
Representative of species richness and diversity based on appropriate benchmark guideline, pre-clearing assessment and relevant SEWPaC guidelines;
Water quality of residual voids or water bodies meets the criteria for subsequent uses, and does not have the potential to cause environmental harm (as per Water Quality Management Plans);
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES); and
Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Decommissioning
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
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<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥90% of target species richness*</td></tr>
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Natural regeneration schedules only</td><td>≥40% of target species richness*</td><td>≥50% of target species richness*</td><td>≥65% of target species richness*</td><td>≥90% of target species richness*</td></tr>
<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
<tr><td>Declared Weeds</td><td>≤15% declared weed cover</td><td>≤10% declared weed cover</td><td>≤5% declared weed cover</td><td>≤5% declared weed cover</td></tr>
<tr><td>Environmental weeds</td><td>≤30% weed cover</td><td>≤20% weed cover</td><td>≤15% weed cover</td><td>≤15% weed cover</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 2: CSG Well Lease – Threatened Ecological Communities (TEC/CSG)

Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Decommissioning

Element	6 months	1 year	2 years	3 years	4 years	5 years
Stable / No erosion or subsidence	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform.	No evidence of erosion. Stable and self-sufficient landform.	No evidence of erosion. Stable and self-sufficient landform..	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol**; ▪ Ensure disturbance limits are updated; ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Identify relevant SEWPaC guidelines; ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition and richness; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species	As per the Protocol

Rehabilitation Management Schedule 2: CSG Well Lease – Threatened Ecological Communities (TEC/CSG)		
	occur.	
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance, and do not result in additional disturbances to TEC; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection and translocation is conducted prior to vegetation clearing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP; ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements; - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary stock fencing to prevent accidental impacts.	As per the Protocol / SSMP / FMP
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual

Rehabilitation Management Schedule 2: CSG Well Lease – Threatened Ecological Communities (TEC/CSG)		
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with native grasses identified throughout pre-clearing assessment or in relevant benchmark guideline to stabilise area. Introduced pasture species are not be seeded within areas of native vegetation; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon CSG Well Decommissioning	**Stabilisation of Well Lease** ▪ CSG infrastructure will be decommissioned in accordance with the statutory requirements outlined in the P&G Act; ▪ CSG infrastructure will be progressively removed and reused (where applicable), as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities do not impact upon MNES; and ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation.	As per the Protocol
Within 12 months of decommissioning (taking into consideration the wet season)	**Final Rehabilitation of Well Lease** ▪ Conduct Contaminated Land Assessment and follow Contaminated Land procedures as required, in accordance with the Draft Guidelines for the Assessment and Management of Contaminated Lands; ▪ Fill all sump and flare pits, or stabilise residual voids; ▪ Treat any declared weeds present on site; ▪ Rip soil to ensure no compaction. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil; ▪ Utilise appropriate benchmark site to identify target species composition and richness; ▪ Seed site with species identified within pre-clearing assessment and benchmark assessment; ▪ Undertake any specific rehabilitation requirements identified for threatened species as per **Appendix 4;** ▪ Re-plant tube stock where necessary to encourage regeneration of canopy and shrub layer within TEC. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Tube-stock for select species is not considered necessary where a viable seed bank is present. Species that are unlikely to require tube stock include Brigalow, and White Cypress; ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose	As per the Protocol

Rehabilitation Management Schedule 2: CSG Well Lease – Threatened Ecological Communities (TEC/CSG)		
	crumbly soil, and then firmed in will with the hands to create a shallow watering depression; ▪ Replant as per densities outlined in appropriate Benchmark site; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; ▪ Mulch all seedlings with clean mulch to a radius of 1m surrounding the plant at a depth of 100mm. Mulch should not touch plant stems and should be sourced from vegetation clearing within the surrounding project area; ▪ Seed with native grass and herb species as identified in pre-clearing assessment. Introduced pasture species are not be seeded within areas of native vegetation; and ▪ Where required, install temporary stock fencing in accordance with Appendix 8 to ensure regenerating areas of MNES are appropriately protected from livestock.	
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
	Maintenance Tasks / Corrective Procedures	**Responsibility**
As per monitoring and maintenance schedule (**Appendix 5**)	▪ Replace damaged / dead seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Install fencing as required to prevent damage by livestock; and ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to Coordinator-General, DERM and SEWPaC.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC. Coordinator-General and EA.	As per the Protocol

Rehabilitation Management Schedule 3: CSG Well Lease – Grazing Land (G/CSG)		
Objectives	▪ Rehabilitate disturbed areas to pre-clearance quality or better; ▪ Ensure a stable landform is maintained throughout construction and operation of the CSG well; and ▪ Re-instate the site of the CSG well to a stable landform that is representative of the pre-clearing vegetation condition and composition (native and / or improved pasture) following decommissioning of the lease.	
Performance Criteria	▪ Stability of landform; ▪ Effective stabilisation of topsoil and soil stockpiles; - Pasture species richness representative of pre-disturbed condition; - The preservation of inherent GQAL agricultural land use classes - Pasture diversity, quality and productivity rehabilitated to pre-disturbance benchmarks ▪ No negative effect from stormwater runoff and seepage on environmental values of waters; ▪ Water quality of residual voids meets the criteria for subsequent re-use; ▪ Plants showing healthy growth and signs of recruitment; and ▪ Free of declared pest plants.	
Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify correct Rehabilitation Management Procedure; and ▪ Identify relevant Benchmark Guideline (native or improved pasture).	As per the Protocol
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 11%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with grasses identified as dominant within pre-clearing assessment. Refer to benchmark guideline for grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Clearing will be conducted in accordance with Site Specific Work Instructions as per the Protocol; ▪ Clearing is to follow relevant recommendations listed within the SSMP and FMP:; and ▪ Clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period.	Santos Operations
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual

Rehabilitation Management Schedule 3: CSG Well Lease – Grazing Land (G/CSG)		
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with grasses identified throughout pre-clearing assessment or in relevant benchmark guideline to stabilise area; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon CSG Well Decommissioning	**Stabilisation of CSG Well Lease** ▪ CSG infrastructure will be decommissioned in accordance with the statutory requirements outlined in the P & G Act; ▪ CSG infrastructure will be progressively removed and reused (where applicable) as per the appropriate decommissioning and demolition plan, particularly to ensure that decommissioning activities do not impact upon surrounding areas of MNES; and ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation.	As per the Protocol
Within 12 months of decommissioning	**Final Rehabilitation of CSG Well Lease** ▪ Conduct Contaminated Land Assessment and follow Contaminated Land procedures as required; ▪ Fill all sump and flare pits; ▪ Treat any declared weeds present on site; ▪ Rip soil to ensure no compaction. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil to pre-clearance depth; ▪ Direct drill an appropriate mixture of benchmark native and favourable exotic grass, herb and forb species and at a seeding rate with the intention to re-establish pastures that resemble the benchmark species composition that was identified in pre-clearing surveys (exclude species that are known agricultural pest weed species); ▪ Utilise appropriate benchmark site to identify target species composition and richness; and ▪ Apply fertiliser and water (if possible) as required to ensure successful germination and establishment.	Santos Operations
Timing	**Monitoring Tasks**	**Responsibility**
Two months following rehabilitation	▪ Plants showing healthy growth and signs of recruitment; ▪ Free of declared pest plants; and ▪ No signs of erosion or sedimentation.	As per the Protocol
Six months following rehabilitation	All supplementary plantings will be monitored to ensure their continued health. Apply soil conditions and fertilisers as required to ensure successful pasture establishment and coverage. ▪ Monitor seedling health; ▪ Check for erosion/sedimentation; ▪ Check erosion & sediment control devices are in place as required; ▪ Check for disturbances from pests (e.g. rabbits, vandals etc); ▪ Monitor weeds; and ▪ Monitor regeneration success.	As per the Protocol

Rehabilitation Management Schedule 3: CSG Well Lease – Grazing Land (G/CSG)		
Timing	**Maintenance Tasks**	**Responsibility**
As required	Weed management	As per the PWMP
Timing	**Corrective Procedures**	**Responsibility**
As required	▪ Replace damaged seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Replenish mulch if necessary.	Santos Operations
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	Internally to Santos Operations, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	Santos Operations
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	Santos Operations
N/A	All monitoring records to be kept on file for five years.	Santos Operations

Rehabilitation Management Schedule 4: CSG Well Lease – Cropping Land (C/CSG)		
Objectives	▪ Rehabilitate disturbed areas to pre-clearance quality or better; ▪ Ensure a stable landform is maintained throughout construction and operation of the CSG well; and ▪ Re-instate the site of the CSG well to a stable landform with ground cover or cover crop vegetation as specified by the landholder, following decommissioning of the lease.	
Performance Criteria	▪ Stability of landform; ▪ Effective stabilisation of topsoil and soil stockpiles; - Provide ground cover or cover crop as specified by landholder - The preservation of inherent GQAL agricultural land use classes - Soil productivity rehabilitated to pre-disturbance level of productivity ▪ No negative effect from stormwater runoff and seepage on environmental values of waters; ▪ Water quality of residual voids meets the criteria for subsequent re-use; and ▪ Plants showing healthy growth and signs of recruitment.	
Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify correct Rehabilitation Management Procedure; and ▪ Identify relevant Benchmark Guideline (as negotiated with landholder).	As per the Protocol
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed stockpile with grasses that are non-invasive. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 4: CSG Well Lease – Cropping Land (C/CSG)		
	suitable habitat resources; ▪ Vegetation is cleared and stockpiled in a manner to facilitate respreading and salvaging.	
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with ground cover or cover crop species as specified by landholder to stabilise area; and ▪ Implement erosion and sediment control measures as required.	As per the Protocol
Upon CSG Well Decommissioning	**Stabilisation of CSG Well Lease** ▪ CSG infrastructure will be decommissioned in accordance with the statutory requirements outlined in the P & G Act; ▪ CSG infrastructure will be progressively removed and reused (where applicable) as per the appropriate decommissioning and demolition plan, particularly to ensure that decommissioning activities do not impact upon surrounding areas of MNES; and ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation.	As per the Protocol / Erosion and Sediment Control Manual
Within 12 months of decommissioning	**Final Rehabilitation of CSG Well Lease** ▪ Conduct Contaminated Land Assessment and follow Contaminated Land procedures as required; ▪ Fill all sump and flare pits; ▪ Treat any declared weeds present on site; ▪ Rip soil to ensure no compaction. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil and subsoil to pre-clearance depth; ▪ Direct drill ground cover or cover crop species as specified by landholder (exclude species that are known agricultural pest weed species) or leave fallow; and ▪ Apply fertiliser and water (if possible) as required to ensure successful germination and establishment.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
Two months following rehabilitation	▪ Plants showing healthy growth and signs of recruitment; ▪ Free of declared pest plants; and ▪ No signs of erosion or sedimentation.	As per the Protocol

Rehabilitation Management Schedule 4: CSG Well Lease – Cropping Land (C/CSG)		
Six months following rehabilitation	All supplementary plantings will be monitored to ensure their continued health. Apply soil conditions and fertilisers as required to ensure successful ground cover or cover crop establishment and coverage. ▪ Monitor seedling health; ▪ Check for erosion/sedimentation; ▪ Check erosion & sediment control devices are in place as required; ▪ Check for disturbances from pests (e.g. rabbits, vandals etc); ▪ Monitor weeds; and ▪ Monitor success.	As per the Protocol
Timing	**Maintenance Tasks**	**Responsibility**
As required	Weed management	As per the PWMP
Timing	**Corrective Procedures**	**Responsibility**
As required	▪ Replace damaged seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Replenish mulch if necessary.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	Internally to Santos Operations, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	Santos Operations
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	Santos Operations
N/A	All monitoring records to be kept on file for five years.	Santos Operations

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 5: Access Tracks and Roads – Native Vegetation (NV/AR)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the access tracks and roads, ensuring compliance with the P & G Act;
Ensure a non-polluting environment is achieved;
Re-instate the easement to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the access road;
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC and threatened species where applicable.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
Representative of species richness and diversity based on appropriate benchmark guideline and pre-clearing assessment;
No negative effect from stormwater runoff and seepage on environmental values of waters (as per Water Quality Management Plans);
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES);

Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Decommissioning
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
Assisted revegetation schedules only</td><td>≥80% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥95% survival of planted stock</td></tr>
<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Recruitment
Natural regeneration schedules only</td><td>≥40% of target species richness*</td><td>≥50% of target species richness*</td><td>≥65% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
<tr><td>Declared Weeds</td><td>≤15% declared weed cover</td><td>≤10% declared weed cover</td><td>≤5% declared weed cover</td><td>≤5% declared weed cover</td></tr>
<tr><td>Environmental weeds</td><td>≤30% weed cover</td><td>≤20% weed cover</td><td>≤15% weed cover</td><td>≤15% weed cover</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 5: Access Tracks and Roads – Native Vegetation (NV/AR)

Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Decommissioning

Element	6 months	1 year	2 years	3 years	4 years	5 years
Stable / No erosion or subsidence	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained. Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition and richness; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species	As per the Protocol

Rehabilitation Management Schedule 5: Access Tracks and Roads – Native Vegetation (NV/AR)		
	occur.	
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure seed collection and translocation has been conducted prior to vegetation removal; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts.	As per the Protocol / SSMP / FMP
	Erosion and Sediment Control ▪ Install erosion and sediment control measures as per Erosion and Sediment Control Manual.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation**	As per the Protocol

Rehabilitation Management Schedule 5: Access Tracks and Roads – Native Vegetation (NV/AR)		
	▪ Treat weeds present on site; ▪ Allow natural regeneration to occur within road reserves; ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	
Upon Decommissioning	**Final Rehabilitation** ▪ Access tracks and roads will be progressively removed and reused (where applicable), as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities do not impact upon MNES; ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation. ▪ Re-spread topsoil, apply mulch and spread seed mix; ▪ Species are to be native, and representative of pre-disturbed species composition, as per Benchmark Guideline; and ▪ Implement erosion and sediment control measures as required. Within areas of threatened fauna habitat mapped within the SSMP (MNES): ▪ Re-plant tube stock where necessary to encourage regeneration of canopy and shrub layer. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose crumbly soil, and then firmed in will with the hands to create a shallow watering depression; ▪ Replant as per densities outlined in appropriate Benchmark site; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; ▪ Mulch all seedlings with clean mulch to a radius of 1m surrounding the plant at a depth of 100mm. Mulch should not touch plant stems, and should be sourced from vegetation clearing within the surrounding project area; ▪ Seed with native grass and herb species as identified in pre-clearing assessment; and ▪ Where required, install temporary stock fencing in accordance with Appendix 8 to ensure regenerating areas of MNES are appropriately protected from livestock.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		

Rehabilitation Management Schedule 5: Access Tracks and Roads – Native Vegetation (NV/AR)		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and maintenance schedule	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	As per the Protocol
N/A	All monitoring records to be kept on file for five years	As per the Protocol

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 6: Access Tracks and Roads – Riparian Native Vegetation (RNV/AR)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the access tracks and roads, ensuring compliance with the P & G Act;
Ensure a non-polluting environment is achieved;
Re-instate the easement to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the access track or road; and
Ensure a self-sustaining landform is achieved;
Ensure physical integrity (e.g. bed and bank stability) and natural ecosystem values of waterways are maintained;
Ensure no deterioration in water quality of waterways; and
Ensure long-term recovery of TEC and threatened species where applicable.

</td></tr>
<tr><td>Performance Criteria</td><td>

Stability of landform (particularly waterway bed and banks);
Representative of species richness and diversity for appropriate benchmark site;
No discharge of contaminated water to receiving waters unless authorised by the relevant EA;
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
No negative effect from stormwater runoff and seepage on environmental values of waters (as per Water Quality Management Plans); and
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES).

Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.
Performance Criteria – Assessable for 3 years following Decommissioning
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
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<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Recruitment
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<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 6: Access Tracks and Roads – Riparian Native Vegetation (RNV/AR)

Declared Weeds	≤15% declared weed cover	≤10% declared weed cover	≤5% declared weed cover	≤5% declared weed cover
Environmental weeds	≤30% weed cover	≤20% weed cover	≤15% weed cover	≤15% weed cover
Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Decommissioning

Element	6 months	1 year	2 years	3 years	4 years	5 years
Stable / No erosion or subsidence	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; and ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and	As per the Protocol

Rehabilitation Management Schedule 6: Access Tracks and Roads – Riparian Native Vegetation (RNV/AR)		
	▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection and translocation is completed prior to vegetation clearing commencing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements; - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts. Fencing is to be in accordance with EHS01, Appendix D – Fencing Standard.	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 6: Access Tracks and Roads – Riparian Native Vegetation (RNV/AR)		
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Conduct works at a time of no flow / low flow. ▪ Avoid grading watercourses, and delay grading until crossing is imminent to minimise erosion and sedimentation risk; and ▪ Where the streambed comprises rocks, pebbles, or coarse gravel overlaying finer materials, this material is to be stockpiled separately.	As per the Protocol
	Water Quality ▪ Emergency Response Plan to be developed and implemented in the case of any fuel or chemical spills. Water that is contaminated by fuels, oil, chemicals, etc. or loaded with insoluble matter is not to be deliberately discharged into stormwater or natural drainage systems; ▪ Vehicles and machinery should be refuelled away from watercourses and no fuels should be stored near any watercourse; ▪ Major vehicle maintenance, plant maintenance and wash down should be completed offsite at an appropriate facility; ▪ Disposal of all waste (fuel, oil, chemicals and sewage, etc.) should occur offsite in accordance with Local Authority and Government regulations and documented to demonstrate appropriate waste disposal; ▪ Exposed contaminated surfaces are to be cleaned up by dry methods as soon as practicable and before storm events or otherwise protected from rain and runoff. Contaminated materials are to be protected from rain and runoff; and ▪ Works within waterways should be designed to avoid where possible impacts on existing flow paths; and ▪ Water should be diverted off bridges and culverts through grass swales.	As per the Protocol
Post Construction	**Rehabilitation** ▪ Treat weeds present on site; ▪ Revegetate creek banks utilising tube stock (of native provenance, minimum of 20cm tall and sun-hardened). Species composition and planting densities are to be selected based on Benchmark Guidelines; ▪ Use hydromulch, geotextile fabric or bonded fibre matrix or other appropriate measures to assist in revegetation along creek banks; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon Decommissioning	**Final Rehabilitation** ▪ CSG infrastructure will be progressively removed and reused (where applicable), as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities do not impact upon MNES;	As per the Protocol

Rehabilitation Management Schedule 6: Access Tracks and Roads – Riparian Native Vegetation (RNV/AR)		
	▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation; ▪ Within creek banks, apply hydromulch, geotextile fabric, bonded fibre matrix or other appropriate measures, and revegetate using tube stock; ▪ In other areas, re-spread topsoil, apply mulch and spread seeds; ▪ Species are to be native, and representative of pre-disturbed species composition, as per Benchmark Guideline; ▪ Complete any specific rehabilitation requirements as per **Appendix 4** where EPBC listed species potentially occur; ▪ Implement erosion and sediment control measures as required' Within areas of threatened fauna habitat mapped within the SSMP (MNES): ▪ Re-plant tube stock where required to encourage regeneration of canopy and shrub layer. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose crumbly soil, and then firmed in will with the hands to create a shallow watering depression; ▪ Replant as per densities outlined in appropriate Benchmark site; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; ▪ Mulch all seedlings with clean mulch to a radius of 1m surrounding the plant at a depth of 100mm. Mulch should not touch plant stems; ▪ Seed with native grass and herb species as identified in pre-clearing assessment. Introduced pasture species are not be seeded within areas of native vegetation; and ▪ Where required, install temporary stock fencing in accordance with Appendix 8 to ensure regenerating areas of MNES are appropriately protected from livestock.	
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and maintenance schedule	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance	As per the Protocol

Rehabilitation Management Schedule 6: Access Tracks and Roads – Riparian Native Vegetation (RNV/AR)		
	with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; ▪ Conduct feral animal management as required.	
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	As per the Protocol
N/A	All monitoring records to be kept on file for five years.	As per the Protocol

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 7: Access Tracks and Roads – Threatened Ecological Communities (TEC/AR)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the access tracks and roads, ensuring compliance with the P & G Act;
Ensure a non-polluting environment is achieved;
Re-instate the easement to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the access road;
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC and threatened species where applicable.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
Representative of species richness and diversity based on appropriate benchmark guideline, pre-clearing assessment and relevant SEWPaC guidelines;
No negative effect from stormwater runoff and seepage on environmental values of waters (as per Water Quality Management Plans);
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES);

Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Decommissioning
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
Assisted revegetation schedules only</td><td>≥80% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥95% survival of planted stock</td></tr>
<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Recruitment
Natural regeneration schedules only</td><td>≥40% of target species richness*</td><td>≥50% of target species richness*</td><td>≥65% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
<tr><td>Declared Weeds</td><td>≤15% declared weed cover</td><td>≤10% declared weed cover</td><td>≤5% declared weed cover</td><td>≤5% declared weed cover</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 7: Access Tracks and Roads – Threatened Ecological Communities (TEC/AR)

Environmental weeds	≤30% weed cover	≤20% weed cover	≤15% weed cover	≤15% weed cover
Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Decommissioning

Element	6 months	1 year	2 years	3 years	4 years	5 years
Stable / No erosion or subsidence	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol**; ▪ Ensure disturbance limits are updated; ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition and richness; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; and ▪ Identify species requiring translocation as per the	As per the Protocol

Rehabilitation Management Schedule 7: Access Tracks and Roads – Threatened Ecological Communities (TEC/AR)		
	Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection and translocation is complete prior to vegetation clearing commencing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP; ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts. Fencing is to be in accordance with EHS01, Appendix	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 7: Access Tracks and Roads – Threatened Ecological Communities (TEC/AR)		
	D – Fencing Standard.	
	Erosion and Sediment Control ▪ Install erosion and sediment control measures as per Erosion and Sediment Control Manual.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation** ▪ Treat weeds present on site; ▪ Allow natural regeneration to occur within road reserves; ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon Decommissioning	**Final Rehabilitation** ▪ Access tracks and roads will be progressively removed and reused (where applicable), as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities do not impact upon MNES; ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation. ▪ Re-spread topsoil, apply mulch and spread seed mix; ▪ Species are to be native, and representative of pre-disturbed species composition, as per Benchmark Guideline; ▪ Implement erosion and sediment control measures as required; ▪ Re-plant tube stock where necessary to encourage regeneration of canopy and shrub layer. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Tube-stock for select species is not considered necessary where a viable seed bank is present. Species that are unlikely to require tube stock include Brigalow, and White Cypress; ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose crumbly soil, and then firmed in will with the hands to create a shallow watering depression; ▪ Replant as per densities outlined in appropriate Benchmark site; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; ▪ Mulch all seedlings with clean mulch to a radius of 1m surrounding the plant at a depth of 100mm. Mulch should not touch plant stems; ▪ Seed with native grass and herb species as identified in pre-clearing assessment; and	As per the Protocol

Rehabilitation Management Schedule 7: Access Tracks and Roads – Threatened Ecological Communities (TEC/AR)		
	▪ Where required, install temporary stock fencing in accordance with Appendix 8 to ensure regenerating areas of MNES are appropriately protected from livestock.	
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and maintenance schedule	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	As per the Protocol
N/A	All monitoring records to be kept on file for five years	As per the Protocol

Rehabilitation Management Schedule 8: Access Tracks and Roads – Grazing Land (G/AR)		
Objectives	▪ Rehabilitate disturbed areas to pre-clearance quality or better; ▪ Ensure a stable landform is maintained throughout construction and operation of access tracks and roads; and ▪ Re-instate those access tracks and roads (that are not to be retained) back to a stable landform that is representative of the pre-clearing vegetation condition and composition (native and / or improved pasture) following the decommissioning of access tracks and roads.	
Performance Criteria	▪ Stability of landform; ▪ Effective stabilisation of topsoil and soil stockpiles - Pasture species richness representative of pre-disturbed condition - The preservation of inherent GQAL agricultural land use classes - Pasture diversity, quality and productivity rehabilitated to pre-disturbance benchmarks ▪ No negative effect from stormwater runoff and seepage on environmental values of waters; ▪ Plants showing healthy growth and signs of recruitment; and ▪ Free of declared pest plants, except those that are beneficial pasture species (i.e. high in protein, palatable to livestock and drought tolerant).	
Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify correct Rehabilitation Management Procedure; and ▪ Identify relevant Benchmark Guideline (native or improved pasture).	As per the Protocol
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Refer to benchmark guideline for grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 8: Access Tracks and Roads – Grazing Land (G/AR)		
	dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; and ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site.	
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with grasses identified throughout pre-clearing assessment or in relevant benchmark guideline to stabilise area; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon Access Track and Road Decommissioning	**Stabilisation of Access Tracks and Roads** ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation	As per the Protocol
Within 12 months of decommissioning	**Final Rehabilitation of Access Tracks and Roads** ▪ Treat any declared weeds present on site; ▪ Rip soil to ensure no compaction. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil to pre-clearance depth; ▪ Direct drill an appropriate mixture of benchmark native and favourable exotic grass, herb and forb species and at a seeding rate with an intention to re-establish pastures that resemble the benchmark species composition that was identified in pre-clearing surveys (exclude species that are known agricultural pest weed species); ▪ Utilise appropriate benchmark site to identify target species composition and richness; and ▪ Apply fertiliser and water (if possible) as required to ensure successful germination and establishment.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
Two months following rehabilitation	▪ Plants showing healthy growth and signs of recruitment; ▪ Free of declared pest plants; and ▪ No signs of erosion or sedimentation.	As per the Protocol

Rehabilitation Management Schedule 8: Access Tracks and Roads – Grazing Land (G/AR)		
Six months following rehabilitation	All supplementary plantings will be monitored to ensure their continued health. Apply soil conditions and fertilisers as required to ensure successful pasture establishment and coverage. ▪ Monitor seedling health; ▪ Check for erosion/sedimentation; ▪ Check erosion & sediment control devices are in place as required; ▪ Check for disturbances from pests (e.g. rabbits, vandals etc); ▪ Monitor weeds; ▪ Watering; and ▪ Monitor regeneration success.	As per the Protocol
Timing	**Maintenance Tasks**	**Responsibility**
As required	Weed management	As per the PWMP
Timing	**Corrective Procedures**	**Responsibility**
As required	▪ Replace damaged seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Replenish mulch if necessary.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	Internally to Santos Operations, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	Santos Operations
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	Santos Operations
N/A	All monitoring records to be kept on file for five years.	Santos Operations

Rehabilitation Management Schedule 9: Access Tracks and Roads – Cropping Land (G/AR)		
Objectives	▪ Rehabilitate disturbed areas to pre-clearance quality or better; ▪ Ensure a stable landform is maintained throughout construction and operation of access tracks and roads; and ▪ Re-instate the site of the CSG well to a stable landform with ground cover or cover crop vegetation as specified by the landholder, following decommissioning of the system.	
Performance Criteria	▪ Stability of landform; ▪ Effective stabilisation of topsoil and soil stockpiles; - Provide ground cover or cover crop as specified by landholder - The preservation of inherent GQAL agricultural land use classes - Soil productivity rehabilitated to pre-disturbance level of productivity ▪ No negative effect from stormwater runoff and seepage on environmental values of waters; ▪ Water quality of residual voids meets the criteria for subsequent re-use; and ▪ Plants showing healthy growth and signs of recruitment.	
Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify correct Rehabilitation Management Procedure; and ▪ Identify relevant Benchmark Guideline (as negotiated with landholder).	As per the Protocol
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed stockpile with grasses that are non-invasive. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 9: Access Tracks and Roads – Cropping Land (G/AR)		
	suitable habitat resources; ▪ Vegetation is cleared and stockpiled in a manner to facilitate respreading and salvaging.	
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with ground cover or cover crop species as specified by landholder to stabilise area; and ▪ Implement erosion and sediment control measures as required.	As per the Protocol
Upon Access Tracks and Roads Decommissioning	**Stabilisation of Access Tracks and Roads** ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation.	As per the Protocol / Erosion and Sediment Control Manual
Within 12 months of decommissioning	**Final Rehabilitation of Access Tracks and Roads** ▪ Treat any declared weeds present on site; ▪ Respread topsoil to pre-clearance depth; ▪ Direct drill ground cover or cover crop species as specified by landholder (exclude species that are known agricultural pest weed species) or leave fallow; and ▪ Apply fertiliser and water (if possible) as required to ensure successful germination and establishment.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
Two months following rehabilitation	▪ Plants showing healthy growth and signs of recruitment; ▪ Free of declared pest plants; and ▪ No signs of erosion or sedimentation.	As per the Protocol
Six months following rehabilitation	All supplementary plantings will be monitored to ensure their continued health. Apply soil conditions and fertilisers as required to ensure successful pasture establishment and coverage. ▪ Monitor seedling health; ▪ Check for erosion/sedimentation; ▪ Check erosion & sediment control devices are in place as required; ▪ Check for disturbances from pests (e.g. rabbits, vandals etc); ▪ Monitor weeds; ▪ Watering; and ▪ Monitor regeneration success.	As per the Protocol
Timing	**Maintenance Tasks**	**Responsibility**
As required	Weed management	As per the PWMP
Timing	**Corrective Procedures**	**Responsibility**
As required	▪ Replace damaged seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering	As per the Protocol

Rehabilitation Management Schedule 9: Access Tracks and Roads – Cropping Land (G/AR)		
	erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Replenish mulch if necessary.	
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	Internally to Santos Operations, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	Santos Operations
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	Santos Operations
N/A	All monitoring records to be kept on file for five years.	Santos Operations

<table>
<tr><th colspan="2">Rehabilitation Management Schedule10: Gathering Systems – Native Vegetation (NV/GS)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the gathering system, ensuring compliance with the P & G Act;
Ensure a non-polluting environment is achieved;
Re-instate the easement to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the gathering system;
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC and threatened species where applicable.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
No signs of subsidence or erosion;
Representative of species richness and diversity based on appropriate benchmark guideline and pre-clearing assessment;
No negative effect from stormwater runoff and seepage on environmental values of waters (as per Water Quality Management Plans);
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES);
Ensure long-term recovery of TEC and threatened species where applicable; and
Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Construction
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
Assisted revegetation schedules only</td><td>≥80% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥95% survival of planted stock</td></tr>
<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Recruitment
Natural regeneration schedules only</td><td>≥40% of target species richness*</td><td>≥50% of target species richness*</td><td>≥65% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
<tr><td>Declared Weeds</td><td>≤15% declared weed cover</td><td>≤10% declared weed cover</td><td>≤5% declared weed cover</td><td>≤5% declared weed cover</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule10: Gathering Systems – Native Vegetation (NV/GS)

Environmental weeds	≤30% weed cover	≤20% weed cover	≤15% weed cover	≤15% weed cover
Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Construction

Element	Monthly (6 months)	1 year	2 years	3 years	4 years	5 years
Stable / Safe / Non-polluting	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011)	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011)	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition and richness; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; and ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species	As per the Protocol

Rehabilitation Management Schedule10: Gathering Systems – Native Vegetation (NV/GS)		
	occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 11%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection and translocation is complete prior to commencing vegetation clearing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP; ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements; - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts. Fencing is to be in accordance with EHS01, Appendix D – Fencing Standard.	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule10: Gathering Systems – Native Vegetation (NV/GS)		
During Construction	**Erosion and Sediment Control** ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation of Easement** Post-construction rehabilitation is considered 'final' rehabilitation, as pipelines will be decommissioned in situ. ▪ Treat weeds present on site; ▪ Respread topsoil and allow natural regeneration to occur using existing seed bank. Where trenches require backfilling, soils are to be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area; ▪ Where areas of TEC require rehabilitation, seed using species identified within the Benchmark Guideline; ▪ Mulch with site-generated mulch where available; ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual); and ▪ Undertake specific tasks outlined in **Appendix 4** for EPBC listed flora and fauna species.	As per the Protocol
Upon Decommissioning	**Final Rehabilitation** ▪ Gas and water pipelines will be decommissioned in accordance with statutory approvals and the requirements of the P&G Act, as well the requirements within AS 2885; ▪ Gathering systems are to be decommissioned in-situ to minimise disturbances; and ▪ Re-spread topsoil, apply mulch and spread seed mix in areas requiring rehabilitation. Seeds are to be native, and representative of pre-disturbed species composition, as per Benchmark Guideline; ▪ Undertake specific tasks outlined in **Appendix 4** for EPBC listed flora and fauna species.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and maintenance schedule (**Appendix 5**).	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. .jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures

Rehabilitation Management Schedule10: Gathering Systems – Native Vegetation (NV/GS)		
Annually	Reports provided to DERM, Coordinator-General and SEWPaC.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	As per the Protocol

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 11: Gathering Systems – Threatened Ecological Communities (TEC/GS)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the gathering system , ensuring compliance with the P & G Act;
Ensure a non-polluting environment is achieved;
Re-instate the easement to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the gathering system;
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC (Brigalow and Semi-evergreen Vine Thicket) and threatened species

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
No signs of subsidence or erosion;
Representative of species richness and diversity based on appropriate benchmark guideline, pre-clearing assessment and SEWPaC guidelines;
No negative effect from stormwater runoff and seepage on environmental values of waters (as per Water Quality Management Plans);
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES);
Ensure long-term recovery of TEC and threatened species; and
Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Construction
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
Assisted revegetation schedules only</td><td>≥80% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥95% survival of planted stock</td></tr>
<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
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<tr><td>Recruitment
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<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
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</table>
</td></tr>
</table>

Rehabilitation Management Schedule 11: Gathering Systems – Threatened Ecological Communities (TEC/GS)

Environmental weeds	≤30% weed cover	≤20% weed cover	≤15% weed cover	≤15% weed cover
Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Construction

Element	Monthly (6 months)	1 year	2 years	3 years	4 years	5 years
Stable / Safe / Non-polluting	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011)	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011)	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol**; ▪ Ensure disturbance limits are updated; ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Identify relevant SEWPaC guidelines; ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition and richness; ▪ Identify specific rehabilitation requirements as per	As per the Protocol

Rehabilitation Management Schedule 11: Gathering Systems – Threatened Ecological Communities (TEC/GS)		
	Appendix 4 of RRRMP; and ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure seed collection and translocation is completed prior to vegetation clearing commencing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site.	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 11: Gathering Systems – Threatened Ecological Communities (TEC/GS)		
	Erosion and Sediment Control ▪ Minimise timing of operations; ▪ Conduct works at a time of no flow / low flow; ▪ Topsoil and cleared vegetation to be stockpiled 20m from water courses; ▪ Install erosion and sediment control measures as per Erosion and Sediment Control Manual; and ▪ Avoid grading watercourses, and delay grading until crossing is imminent to minimise erosion and sedimentation risk; Where the streambed comprises rocks, pebbles, or coarse gravel overlaying finer materials, this material is to be stockpiled separately.	As per the Protocol / Erosion and Sediment Control Manual
	Water Quality ▪ Emergency Response Plan to be developed and implemented in the case of any fuel or chemical spills. Water that is contaminated by fuels, oil, chemicals, etc. or loaded with insoluble matter is not to be deliberately discharged into stormwater or natural drainage systems; ▪ Water that is contaminated by fuels, oil, chemicals, etc. or loaded with insoluble matter is not to be deliberately discharged into stormwater or natural drainage systems; ▪ Vehicles and machinery should be refuelled away from watercourses and no fuels should be stored near any watercourse; ▪ Major vehicle maintenance, plant maintenance and wash down should be completed offsite at an appropriate facility; ▪ Disposal of all waste (fuel, oil, chemicals and sewage, etc.) should occur offsite in accordance with relevant statutory approvals; ▪ Exposed contaminated surfaces are to be cleaned up by dry methods as soon as practicable and before storm events or otherwise protected from rain and runoff. Contaminated materials are to be protected from rain and runoff; and Works within waterways should be designed to avoid where possible impacts on existing flow paths.	As per the Protocol
Post Construction	**Rehabilitation of Easement** ▪ Treat weeds present on site; ▪ Respread topsoil. Where trenches require backfilling, soils are to be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area; ▪ Revegetate creek banks utilising tube stock (of native provenance, minimum of 20cm tall and sun-hardened). Species composition and planting densities are to be selected based on Benchmark Guidelines; ▪ Use hydromulch, geotextile fabric or bonded fibre matrix or other appropriate measures to assist in revegetation along creek banks; ▪ Use mulch on other areas; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and	As per the Protocol

Rehabilitation Management Schedule 11: Gathering Systems – Threatened Ecological Communities (TEC/GS)		
	Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	
Upon Decommissioning	**Final Rehabilitation** ▪ CSG infrastructure will be decommissioned in accordance with the statutory requirements outlined in the P& G Act as well the requirements within AS 2885; ▪ CSG infrastructure will be progressively removed and reused (where applicable), as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities do not impact upon MNES; ▪ Gathering systems are to be decommissioned in-situ to minimise disturbances; ▪ Re-instate the watercourse banks to the their original profiles; ▪ Re-spread topsoil, apply mulch and spread seeds. Within creek banks, apply hydromulch, geotextile fabric, bonded fibre matrix or other appropriate measures, and revegetate using tube stock; and ▪ Species are to be native, and representative of pre-disturbed species composition, as per Benchmark Guideline; ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual). ▪ Implement specific rehabilitation actions for threatened species as required, in accordance with **Appendix 4.** Within areas of threatened fauna habitat mapped within the SSMP: ▪ Re-plant tube stock where necessary to encourage regeneration of canopy and shrub layer. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose crumbly soil, and then firmed in will with the hands to create a shallow watering depression; ▪ Replant as per densities outlined in appropriate Benchmark site; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; ▪ Mulch all seedlings with clean mulch to a radius of 1m surrounding the plant at a depth of 100mm. Mulch should not touch plant stems; and Seed with native grass and herb species as identified in	As per the Protocol

Rehabilitation Management Schedule 11: Gathering Systems – Threatened Ecological Communities (TEC/GS)		
	pre-clearing assessment.	
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and maintenance plan (**Appendix 5**)	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	▪ Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	▪ Reports provided to DERM, SEWPaC, and Coordinator-General.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	▪ Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	As per the Protocol
N/A	▪ All monitoring records to be kept on file for five years.	As per the Protocol

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 12: Gathering Systems – Riparian Native Vegetation (RNV/GS)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the gathering system, ensuring compliance with the P & G Act;
Ensure a non-polluting environment is achieved;
Re-instate the easement to a stable landform that is representative of the pre-clearing vegetation condition and composition; and
Ensure a self-sustaining landform is achieved;
Ensure physical integrity (e.g. bed and bank stability) and natural ecosystem values of waterways are maintained;
Ensure no deterioration in water quality of waterways;
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC and threatened species where applicable.

</td></tr>
<tr><td>Performance Criteria</td><td>

Stable landform (particularly waterway bed and banks);
No signs of subsidence or erosion, particularly waterway banks;
Representative of species richness and diversity based on appropriate benchmark guideline and pre-clearing assessment;
Self-sustaining vegetative cover;
No negative effect from stormwater runoff and seepage on environmental values of waters (as per Water Quality Management Plans);
No discharge of contaminated water to receiving waters unless authorised by the relevant EA;
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES);
Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Decommissioning
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<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
Assisted revegetation schedules only</td><td>≥80% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥95% survival of planted stock</td></tr>
<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Recruitment
Natural regeneration schedules only</td><td>≥40% of target species richness*</td><td>≥50% of target species richness*</td><td>≥65% of target species richness*</td><td>≥80% of target species richness*</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 12: Gathering Systems – Riparian Native Vegetation (RNV/GS)

Plant Cover	≥75% of target covers*	≥75% of target covers*	≥80% of target covers*	≥90% of target covers.*
Declared Weeds	≤15% declared weed cover	≤10% declared weed cover	≤5% declared weed cover	≤5% declared weed cover
Environmental weeds	≤30% weed cover	≤20% weed cover	≤15% weed cover	≤15% weed cover
Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Decommissioning

Element	Monthly (for 6 months)	1 year	2 years	3 years	4 years	5 years
Stable / No erosion or subsidence	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition	As per the Protocol

Rehabilitation Management Schedule 12: Gathering Systems – Riparian Native Vegetation (RNV/GS)		
	and richness; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil on site in non-vegetated areas with a flat surface; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection and translocation is complete prior to vegetation clearing commencing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 12: Gathering Systems – Riparian Native Vegetation (RNV/GS)		
	subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts. Fencing is to be in accordance with EHS01, Appendix D – Fencing Standard.	
	Erosion and Sediment Control ▪ Minimise timing of operations; ▪ Conduct works at a time of no flow / low flow; ▪ Topsoil and cleared vegetation to be stockpiled 20m from water courses; ▪ Install erosion and sediment control measures as per Erosion and Sediment Control Manual; and ▪ Avoid grading watercourses, and delay grading until crossing is imminent to minimise erosion and sedimentation risk; ▪ Where the streambed comprises rocks, pebbles, or coarse gravel overlaying finer materials, this material is to be stockpiled separately.	As per the Protocol / Erosion and Sediment Control Manual
	Water Quality ▪ Emergency Response Plan to be developed and implemented in the case of any fuel or chemical spills. Water that is contaminated by fuels, oil, chemicals, etc. or loaded with insoluble matter is not to be deliberately discharged into stormwater or natural drainage systems; ▪ Water that is contaminated by fuels, oil, chemicals, etc. or loaded with insoluble matter is not to be deliberately discharged into stormwater or natural drainage systems; ▪ Vehicles and machinery should be refuelled away from watercourses and no fuels should be stored near any watercourse; ▪ Major vehicle maintenance, plant maintenance and wash down should be completed offsite at an appropriate facility; ▪ Disposal of all waste (fuel, oil, chemicals and sewage, etc.) should occur offsite in accordance with relevant statutory approvals; ▪ Exposed contaminated surfaces are to be cleaned up by dry methods as soon as practicable and before storm events or otherwise protected from rain and runoff. Contaminated materials are to be protected from rain and runoff; and ▪ Works within waterways should be designed to avoid where possible impacts on existing flow paths.	As per the Protocol
Post Construction	**Rehabilitation of Easement** ▪ Treat weeds present on site; ▪ Respread topsoil. Where trenches require backfilling, soils are to be replaced so that the soil horizons are consistent with the soil horizons of the immediately surrounding area; ▪ Revegetate creek banks utilising tube stock (of native provenance, minimum of 20cm tall and sun-hardened). Species composition and planting densities are to be selected based on Benchmark Guidelines; ▪ Use hydromulch, geotextile fabric or bonded fibre	As per the Protocol

Rehabilitation Management Schedule 12: Gathering Systems – Riparian Native Vegetation (RNV/GS)		
	matrix or other appropriate measures to assist in revegetation along creek banks; ▪ Use mulch on other areas; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	
Upon Decommissioning	**Final Rehabilitation** ▪ CSG infrastructure will be decommissioned in accordance with the statutory requirements outlined in the P& G Act as well the requirements within AS 2885; ▪ CSG infrastructure will be progressively removed and reused (where applicable), as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities do not impact upon MNES; ▪ Gathering systems are to be decommissioned in-situ to minimise disturbances; ▪ Re-instate the watercourse banks to the their original profiles; ▪ Re-spread topsoil, apply mulch and spread seeds. Within creek banks, apply hydromulch, geotextile fabric, bonded fibre matrix or other appropriate measures, and revegetate using tube stock; and ▪ Species are to be native, and representative of pre-disturbed species composition, as per Benchmark Guideline; ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual). ▪ Implement specific rehabilitation actions for threatened species as required, in accordance with **Appendix 4.** Within areas of threatened fauna habitat mapped within the SSMP (MNES): ▪ Re-plant tube stock where necessary to encourage regeneration of canopy and shrub layer. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose crumbly soil, and then firmed in will with the hands to create a shallow watering depression; ▪ Replant as per densities outlined in appropriate Benchmark site; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; ▪ Mulch all seedlings with clean mulch to a radius of 1m surrounding the plant at a depth of 100mm. Mulch	As per the Protocol

Rehabilitation Management Schedule 12: Gathering Systems – Riparian Native Vegetation (RNV/GS)		
	should not touch plant stems; and ▪ Seed with native grass and herb species as identified in pre-clearing assessment.	
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and maintenance plan (**Appendix 5**)	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	As per the Protocol
N/A	All monitoring records to be kept on file for five years.	As per the Protocol

Rehabilitation Management Schedule 13: Gathering Systems – Grazing Land (G/GS)		
Objectives	▪ Rehabilitate disturbed areas to pre-clearance quality or better; ▪ Ensure a stable landform is maintained throughout construction and operation of the gathering systems; and ▪ Re-instate the site of gathering systems back to a stable landform that is representative of the pre-clearing vegetation condition and composition (native and / or improved pasture) following decommissioning of the system	
Performance Criteria	▪ Stability of landform; ▪ Effective stabilisation of topsoil and soil stockpiles; - Pasture species richness representative of pre-disturbed condition - The preservation of inherent GQAL agricultural land use classes - Pasture diversity, quality and productivity rehabilitated to pre-disturbance benchmarks ▪ No negative effect from stormwater runoff and seepage on environmental values of waters; ▪ Plants showing healthy growth and signs of recruitment; and ▪ Free of declared pest plants, except those that are beneficial pasture species (i.e. high in protein, palatable to livestock and drought tolerant).	
Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify correct Rehabilitation Management Procedure; and ▪ Identify relevant Benchmark Guideline (native or improved pasture).	As per the Protocol
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Refer to benchmark guideline for grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearing is to occur in a sequential manner, and in accordance with Fauna Management Plans; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes;	As per the Protocol

Rehabilitation Management Schedule 13: Gathering Systems – Grazing Land (G/GS)		
	- On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site.	
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with grasses identified throughout pre-clearing assessment or in relevant benchmark guideline to stabilise area; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon Gathering Systems Decommissioning	**Stabilisation of Gathering Systems** ▪ Gathering systems will be decommissioned in accordance with the P & G Act, and left in situ; ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation.	As per the Protocol
Within 12 months of decommissioning	**Final Rehabilitation of Gathering Systems** ▪ Fill all depressions or remaining holes; ▪ Treat any declared weeds present on site; ▪ Rip soil to ensure no compaction. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil to pre-clearance depth; ▪ Direct drill an appropriate mixture of benchmark native and favourable exotic grass, herb and forb species and at a seeding rate with an intention to re-establish pastures that resemble the benchmark species composition that was identified in pre-clearing surveys (exclude species that are known agricultural pest weed species); ▪ Utilise appropriate benchmark site to identify target species composition and richness; and ▪ Apply fertiliser and water (if possible) as required to ensure successful germination and establishment.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
Two months following rehabilitation	▪ Plants showing healthy growth and signs of recruitment; ▪ Free of declared pest plants; and ▪ No signs of erosion or sedimentation.	As per the Protocol

Rehabilitation Management Schedule 13: Gathering Systems – Grazing Land (G/GS)		
Six months following rehabilitation	All supplementary plantings will be monitored to ensure their continued health. Apply soil conditions and fertilisers as required to ensure successful pasture establishment and coverage. ▪ Monitor seedling health; ▪ Check for erosion/sedimentation; ▪ Check erosion & sediment control devices are in place as required; ▪ Check for disturbances from pests (e.g. rabbits, vandals etc); ▪ Monitor weeds; ▪ Watering; and ▪ Monitor regeneration success.	As per the Protocol
Timing	**Maintenance Tasks**	**Responsibility**
As required	Weed management	As per the PWMP
Timing	**Corrective Procedures**	**Responsibility**
As required	▪ Replace damaged seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Replenish mulch if necessary.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	Internally to Santos Operations, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	Santos Operations
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	Santos Operations
N/A	All monitoring records to be kept on file for five years.	Santos Operations

Rehabilitation Management Schedule 14: Gathering Systems – Cropping Land (C/GS)		
Objectives	▪ Rehabilitate disturbed areas to pre-clearance quality or better; ▪ Ensure a stable landform is maintained throughout construction and operation of the gathering systems; and ▪ Re-instate the site of the gathering systems back to a stable landform with ground cover or cover crop vegetation as specified by the landholder, following decommissioning of the system.	
Performance Criteria	▪ Stability of landform; ▪ Effective stabilisation of topsoil and soil stockpiles; - Provide ground cover or cover crop as specified by landholder - The preservation of inherent GQAL agricultural land use classes - Soil productivity rehabilitated to pre-disturbance level of productivity ▪ No negative effect from stormwater runoff and seepage on environmental values of waters; ▪ Water quality of residual voids meets the criteria for subsequent re-use; and ▪ Plants showing healthy growth and signs of recruitment.	
Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify correct Rehabilitation Management Procedure; and ▪ Identify relevant Benchmark Guideline (as negotiated with landholder).	As per the Protocol
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed stockpile with grasses that are non-invasive. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled in a manner to facilitate respreading and salvaging.	As per the Protocol / SSMP / FMP
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual

Rehabilitation Management Schedule 14: Gathering Systems – Cropping Land (C/GS)		
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with ground cover or cover crop species as specified by landholder to stabilise area; and ▪ Implement erosion and sediment control measures as required.	As per the Protocol
Upon Gathering System Decommissioning	**Stabilisation of Gathering Systems** ▪ CSG infrastructure will be decommissioned in accordance with the statutory requirements outlined in the P & G Act; ▪ CSG infrastructure will be progressively removed and reused (where applicable) as per the appropriate decommissioning and demolition plan, particularly to ensure that decommissioning activities do not impact upon surrounding areas of MNES; and ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation.	As per the Protocol / Erosion and Sediment Control Manual
Within 12 months of decommissioning	**Final Rehabilitation of Gathering Systems** ▪ Fill all depressions or remaining holes; ▪ Treat any declared weeds present on site; ▪ Rip soil to ensure no compaction. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil and subsoil to pre-clearance depth; ▪ Direct drill ground cover or cover crop species as specified by landholder (exclude species that are known agricultural pest weed species) or leave fallow; and ▪ Apply fertiliser and water (if possible) as required to ensure successful germination and establishment.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
Two months following rehabilitation	▪ Plants showing healthy growth and signs of recruitment; ▪ Free of declared pest plants; and ▪ No signs of erosion or sedimentation.	As per the Protocol
Six months following rehabilitation	All supplementary plantings will be monitored to ensure their continued health. Apply soil conditions and fertilisers as required to ensure successful ground cover or cover crop establishment and coverage. ▪ Monitor seedling health; ▪ Check for erosion/sedimentation; ▪ Check erosion & sediment control devices are in place as required; ▪ Check for disturbances from pests (e.g. rabbits, vandals etc); ▪ Monitor weeds; and ▪ Monitor success.	As per the Protocol
Timing	**Maintenance Tasks**	**Responsibility**
As required	Weed management	As per the PWMP
Timing	**Corrective Procedures**	**Responsibility**
As required	▪ Replace damaged seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering	As per the Protocol

Rehabilitation Management Schedule 14: Gathering Systems – Cropping Land (C/GS)		
	erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Replenish mulch if necessary.	
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	Internally to Santos Operations, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	Santos Operations
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	Santos Operations
N/A	All monitoring records to be kept on file for five years.	Santos Operations

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 15: Processing Facilities – Native Vegetation (NV/PF)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the processing facilities, ensuring compliance with the P & G act;
Ensure a non-polluting environment is achieved;
Re-instate the disturbance area to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the processing facility;
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC and threatened species where applicable.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
Representative of species richness and diversity based on appropriate benchmark guideline and pre-clearing assessment;
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES);

Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Decommissioning
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
Assisted revegetation schedules only</td><td>≥80% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥95% survival of planted stock</td></tr>
<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Recruitment
Natural regeneration schedules only</td><td>≥40% of target species richness*</td><td>≥50% of target species richness*</td><td>≥65% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
<tr><td>Declared Weeds</td><td>≤15% declared weed cover</td><td>≤10% declared weed cover</td><td>≤5% declared weed cover</td><td>≤5% declared weed cover</td></tr>
<tr><td>Environmental weeds</td><td>≤30% weed cover</td><td>≤20% weed cover</td><td>≤15% weed cover</td><td>≤15% weed cover</td></tr>
<tr><td>Mulching</td><td>≥100mm deep mulch cover around planted</td><td>≥100mm deep mulch cover around planted</td><td>Presence of organic matter</td><td>Presence of organic matter</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 15: Processing Facilities – Native Vegetation (NV/PF)

	stock	stock		
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Decommissioning

Element	**6 months**	**1 year**	**2 years**	**3 years**	**4 years**	**5 years**
Stable / No erosion or subsidence	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition and richness; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	As per the Protocol
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-	As per the PWMP

Rehabilitation Management Schedule 15: Processing Facilities – Native Vegetation (NV/PF)		
	site; and ▪ Implement measures consistent with the PWMP.	
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection and translocation is complete prior to vegetation clearing commencing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts.	As per the Protocol / SSMP / FMP
	Erosion and Sediment Control ▪ Install erosion and sediment control measures as per Erosion and Sediment Control Manual.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation** ▪ Treat weeds present on site; ▪ Respread topsoil and spread native seeds. Species are to be native, and representative of pre-disturbed	As per the Protocol

Rehabilitation Management Schedule 15: Processing Facilities – Native Vegetation (NV/PF)		
	species composition, as per Benchmark Guideline. ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; ▪ Mulch with site-generated mulch where available; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	
Upon Decommissioning	**Final Rehabilitation** ▪ facilities will be decommissioned in accordance with the statutory requirements outlined in the P & G Act; ▪ CSG infrastructure will be progressively removed and reused (where applicable), as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities do not impact upon MNES; ▪ Conduct a site Contaminated Land assessment as per the Draft Guidelines for Assessment and Management of Contaminated Land; ▪ Re-spread topsoil over disturbed areas, apply mulch and revegetate using a seed mix comprised of native species that are representative of pre-disturbed species composition, as per Benchmark Guideline; ▪ Complete any specific rehabilitation requirements as per **Appendix 4** where EPBC listed species potentially occur; ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual); Within areas of threatened fauna habitat mapped within the SSMP (MNES): ▪ Re-plant tube stock where necessary to encourage regeneration of canopy and shrub layer. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose crumbly soil, and then firmed in will with the hands to create a shallow watering depression; ▪ Replant as per densities outlined in appropriate Benchmark site; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; ▪ Mulch all seedlings with clean mulch to a radius of 1m surrounding the plant at a depth of 100mm. Mulch should not touch plant stems; ▪ Seed with native grass and herb species as identified in pre-clearing assessment; and ▪ Where required, install temporary stock fencing in accordance with Appendix 8 to ensure regenerating	As per the Protocol

Rehabilitation Management Schedule 15: Processing Facilities – Native Vegetation (NV/PF)		
	areas of MNES are appropriately protected from livestock.	
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and maintenance schedule	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	As per the Protocol
N/A	All monitoring records to be kept on file for five years.	As per the Protocol

Rehabilitation Management Schedule 16: Processing Facilities – Grazing Land (G/PF)		
Objectives	▪ Rehabilitate disturbed areas to pre-clearance quality or better; ▪ Ensure a stable landform is maintained throughout construction and operation of processing facilities; and ▪ Re-instate processing facilities back to a stable landform that is representative of the pre-clearing vegetation condition and composition (native and / or improved pasture) following the decommissioning of processing facilities.	
Performance Criteria	▪ Stability of landform ▪ Effective stabilisation of topsoil and soil stockpiles - Pasture species richness representative of pre-disturbed condition - The preservation of inherent GQAL agricultural land use classes - Pasture diversity, quality and productivity rehabilitated to pre-disturbance benchmarks ▪ No negative effect from stormwater runoff and seepage on environmental values of waters ▪ Plants showing healthy growth and signs of recruitment ▪ Free of declared pest plants, except those that are beneficial pasture species (i.e. high in protein, palatable to livestock and drought tolerant)	
Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol** ▪ Identify correct Rehabilitation Management Procedure ▪ Identify relevant Benchmark Guideline (native or improved pasture)	As per the Protocol
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes;	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 16: Processing Facilities – Grazing Land (G/PF)		
	- On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; and ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site.	
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with grasses identified throughout pre-clearing assessment or in relevant benchmark guideline to stabilise area; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon Processing Facility Decommissioning	**Stabilisation of Processing Facilities** ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation.	As per the Protocol / Erosion and Sediment Control Manual
Within 12 months of decommissioning	**Final Rehabilitation of Processing Facilities** ▪ Conduct Contaminated Land Assessment and follow Contaminated Land procedures as required; ▪ Fill all depressions or remaining holes; ▪ Regrade areas of construction earthworks (cut and fill) to reduce potential erosion hazards; ▪ Treat any declared weeds present on site; ▪ Rip soil to ensure no compaction where relevant. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil to pre-clearance depth; ▪ Direct drill an appropriate mixture of benchmark native and favourable exotic grass, herb and forb species and at a seeding rate with an intention to re-establish pastures that resemble the benchmark species composition that was identified in pre-clearing surveys (exclude species that are known agricultural pest weed species); ▪ Utilise appropriate benchmark site to identify target species composition and richness; ▪ Apply fertiliser and water (if possible) as required to ensure successful germination and establishment; and ▪ Where required, install temporary stock fencing in accordance with Appendix 8 to ensure regenerating areas of MNES are appropriately protected from livestock.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
Two months following rehabilitation	▪ Plants showing healthy growth and signs of recruitment; ▪ Free of declared pest plants; and ▪ No signs of erosion or sedimentation.	As per the Protocol

Rehabilitation Management Schedule 16: Processing Facilities – Grazing Land (G/PF)		
Six months following rehabilitation	All supplementary plantings will be monitored to ensure their continued health. Apply soil conditions and fertilisers as required to ensure successful pasture establishment and coverage. ▪ Monitor seedling health; ▪ Check for erosion/sedimentation; ▪ Check erosion & sediment control devices are in place as required; ▪ Check for disturbances from pests (e.g. rabbits, vandals etc); ▪ Monitor weeds;; and ▪ Monitor regeneration success.	As per the Protocol
Timing	**Maintenance Tasks**	**Responsibility**
As required	Weed management	As per the PWMP
Timing	**Corrective Procedures**	**Responsibility**
As required	▪ Replace damaged seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Replenish mulch if necessary.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	Internally to Santos Operations, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	Santos Operations
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	Santos Operations
N/A	All monitoring records to be kept on file for five years.	Santos Operations

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 17: Regulated Dams and Ponds – Native Vegetation (NV/DP)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the regulated dams and ponds , ensuring compliance with the P & G Act;
Ensure a non-polluting environment is achieved;
Re-instate the regulated dams and ponds to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning; and
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC and threatened species where applicable.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
Representative of species richness and diversity based on appropriate benchmark guideline and pre-clearing assessment;
No negative effect from stormwater runoff and seepage on environmental values of waters (as per Water Quality Management Plans);
Water quality of residual voids or water bodies meets the criteria for subsequent uses, and does not have the potential to cause environmental harm (as per Water Quality Management Plans);
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES);

Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Decommissioning
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
Assisted revegetation schedules only</td><td>≥8% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥95% survival of planted stock</td></tr>
<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Recruitment
Natural regeneration schedules only</td><td>≥40% of target species richness*</td><td>≥50% of target species richness*</td><td>≥65% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
<tr><td>Declared weeds</td><td>≤15% declared weed cover</td><td>≤10% declared weed cover</td><td>≤5% declared weed cover</td><td>≤5% declared weed cover</td></tr>
<tr><td>Environmental</td><td>≤30% weed</td><td>≤20% weed</td><td>≤15% weed</td><td>≤15% weed</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 17: Regulated Dams and Ponds – Native Vegetation (NV/DP)

weeds	cover	cover	cover	cover
Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Decommissioning

Element	6 months	1 year	2 years	3 years	4 years	5 years
Stable / No erosion or subsidence	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Identify specific rehabilitation requirements as per **Appendix 4** of the RRRMP; and ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition and richness; ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the	As per the Protocol

Rehabilitation Management Schedule 17: Regulated Dams and Ponds – Native Vegetation (NV/DP)		
	Salvage Management Plan or where suitable species occur.	
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Plan); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection and translocation is completed prior to vegetation clearing commencing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearing is to occur in a sequential manner, and in accordance with Fauna Management Plans; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts. Fencing is to be in accordance with EHS01, Appendix D – Fencing Standard.	As per the Protocol / SSMP / FMP
	Erosion and Sediment Control ▪ Install erosion and sediment control measures as per Erosion and Sediment Control Manual.	As per the Protocol / Erosion and Sediment Control Manual

Rehabilitation Management Schedule 17: Regulated Dams and Ponds – Native Vegetation (NV/DP)		
Post Construction	**Rehabilitation** ▪ Treat weeds present on site as per PWMP; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon Decommissioning	**Final Rehabilitation** ▪ As per the QLD Hazardous Dam Guidelines, a Decommissioning Plan will be submitted to DERM as part of the design process, that will include provisions to ensure the dam no longer contains substances that will migrate into the environment; ▪ Regulated dams will be decommissioned in accordance with Statutory requirements, and in accordance with the QLD Hazardous Dam Guidelines; ▪ A Contaminated Land assessment is required prior to rehabilitation in accordance with the Draft Guidelines for Assessment and Management of Contaminated Land; ▪ Regulated ponds and dams will be decommissioned din accordance with the statutory requirements outlined in the P & G Act; ▪ The water will be visually inspected for oil or grease prior to dewatering; ▪ If oil is present appropriate absorbent materials will be used until all traces have been removed; ▪ The disturbance area will be reshaped to ensure long-term stability, and covered with topsoil; ▪ Apply mulch and seed disturbed areas using species that are native, and representative of pre-disturbed species composition, as per Benchmark Guideline; ▪ Implement erosion and sediment control measures as required; and ▪ Complete any specific rehabilitation requirements as per **Appendix 4** where EPBC listed species potentially occur. Within areas of threatened fauna habitat mapped within the SSMP (MNES): ▪ Re-plant tube stock where necessary to encourage regeneration of canopy and shrub layer. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display ‘yellowing’, leaf or stem damage or disease, root curling or restriction related to being ‘pot bound’, or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose crumbly soil, and then firmed in will with the hands to create a shallow watering depression; ▪ Replant as per densities outlined in appropriate Benchmark site; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient;	As per the Protocol

Rehabilitation Management Schedule 17: Regulated Dams and Ponds – Native Vegetation (NV/DP)		
	▪ Mulch all seedlings with clean mulch to a radius of 1m surrounding the plant at a depth of 100mm. Mulch should not touch plant stems; ▪ Seed with native grass and herb species as identified in pre-clearing assessment; and ▪ Where required, install temporary stock fencing in accordance with Appendix 8 to ensure regenerating areas of MNES are appropriately protected from livestock.	
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and maintenance schedule	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	As per the Protocol
N/A	All monitoring records to be kept on file for five years.	As per the Protocol

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<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the unregulated dams and ponds , ensuring compliance with the P & G Act;
Ensure a non-polluting environment is achieved;
Re-instate the unregulated dams and ponds to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning; and
Ensure a self-sustaining landform is achieved;
Ensure long-term recovery of MNES (where applicable) as per SSMP.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
Representative of species richness and diversity based on appropriate benchmark guideline and pre-clearing assessment;
No negative effect from stormwater runoff and seepage on environmental values of waters (as per Water Quality Management Plans);
Water quality of residual voids or water bodies meets the criteria for subsequent uses, and does not have the potential to cause environmental harm (as per Water Quality Management Plans);
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants; and
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES).

Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.
Performance Criteria – Assessable for 3 years following Decommissioning
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
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</table>
</td></tr>
</table>

Rehabilitation Management Schedule 17: Unregulated Dams and Ponds – Native Vegetation (NV/DP)

Declared Weeds	≤15% declared weed cover	≤10% declared weed cover	≤5% declared weed cover	≤5% declared weed cover
Environmental weeds	≤30% weed cover	≤20% weed cover	≤15% weed cover	≤15% weed cover
Mulching	≥100mmdeep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m),			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Decommissioning

Element	6 months	1 year	2 years	3 years	4 years	5 years
Stable / No erosion or subsidence	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify relevant Benchmark Guideline (**Section 6** of	As per the Protocol

Rehabilitation Management Schedule 17: Unregulated Dams and Ponds – Native Vegetation (NV/DP)		
	RRRMP); ▪ Identify specific rehabilitation requirements as per **Appendix 4** of the RRRMP; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection an translocation is complete prior to vegetation clearing commencing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 17: Unregulated Dams and Ponds – Native Vegetation (NV/DP)		
	of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts. Fencing is to be in accordance with EHS01, Appendix D – Fencing Standard.	
	Erosion and Sediment Control ▪ Install erosion and sediment control measures as per Erosion and Sediment Control Manual.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation** ▪ Treat weeds present on site as per PWMP; ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon Decommissioning	**Final Rehabilitation** ▪ A Contaminated Land assessment is required prior to rehabilitation in accordance with the QLD Draft Guidelines for Assessment and Management of Contaminated Land; ▪ The water will be visually inspected for oil or grease prior to dewatering; ▪ If oil is present appropriate absorbent materials will be used until all traces have been removed; ▪ The disturbance area will be reshaped to ensure long-term stability, and covered with topsoil; ▪ Apply mulch and seed disturbed areas using species that are native, and representative of pre-disturbed species composition, as per Benchmark Guideline; ▪ Implement erosion and sediment control measures as required; and ▪ Complete any specific rehabilitation requirements as per **Appendix 4** where EPBC listed species potentially occur. Within areas of MNES: ▪ Re-plant tube stock where necessary to encourage regeneration of canopy and shrub layer. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose crumbly soil, and then firmed in will with the hands to create a shallow watering depression; ▪ Replant as per densities outlined in appropriate Benchmark site; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient;	As per the Protocol

Rehabilitation Management Schedule 17: Unregulated Dams and Ponds – Native Vegetation (NV/DP)		
	▪ Mulch all seedlings with clean mulch to a radius of 1m surrounding the plant at a depth of 100mm. Mulch should not touch plant stems; and ▪ Seed with native grass and herb species as identified in pre-clearing assessment.	
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and maintenance schedule	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	As per the Protocol
N/A	All monitoring records to be kept on file for five years.	As per the Protocol

Rehabilitation Management Schedule: Dams and Ponds – Grazing Land (G/DP)		
Objectives	▪ Rehabilitate disturbed areas to pre-clearance quality or better; ▪ Ensure a stable landform is maintained throughout construction and operation of the dams and ponds; and ▪ Re-instate those dams and ponds (that are not to be retained) back to a stable landform that is representative of the pre-clearing vegetation condition and composition (native and / or improved pasture) following the decommissioning of dams and ponds.	
Performance Criteria	▪ Stability of landform; ▪ Effective stabilisation of topsoil and soil stockpiles; - Pasture species richness representative of pre-disturbed condition - The preservation of inherent GQAL agricultural land use classes - Pasture diversity, quality and productivity rehabilitated to pre-disturbance benchmarks ▪ No negative effect from stormwater runoff and seepage on environmental values of waters; ▪ Plants showing healthy growth and signs of recruitment; and ▪ Free of declared pest plants, except those that are beneficial pasture species (i.e. high in protein, palatable to livestock and drought tolerant).	
Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify correct Rehabilitation Management Procedure; and ▪ Identify relevant Benchmark Guideline (native or improved pasture).	As per the Protocol
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule: Dams and Ponds – Grazing Land (G/DP)		
	dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; and ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site	
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with grasses identified throughout pre-clearing assessment or in relevant benchmark guideline to stabilise area; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon Dams and Ponds Decommissioning	**Stabilisation of Dams and Ponds** ▪ Dams and ponds will be decommissioned and rehabilitated in accordance with site specific Decommissioning Management Plans; ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation.	As per the Protocol / Erosion and Sediment Control Manual
Within 12 months of decommissioning	**Final Rehabilitation of Dams and Ponds** ▪ Conduct Contaminated Land Assessment and follow Contaminated Land procedures as required; ▪ Fill all dams and ponds that are not going to be retained by landholders; ▪ Treat any declared weeds present on site; ▪ Rip soil to ensure no compaction. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil to pre-clearance depth; ▪ Direct drill an appropriate mixture of benchmark native and favourable exotic grass, herb and forb species and at a seeding rate with an intention to re-establish pastures that resemble the benchmark species composition that was identified in pre-clearing surveys (exclude species that are known agricultural pest weed species); ▪ Utilise appropriate benchmark site to identify target species composition and richness; and ▪ Apply fertiliser and water (if possible) as required to ensure successful germination and establishment.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
Two months following rehabilitation	▪ Plants showing healthy growth and signs of recruitment; ▪ Free of declared pest plants; and ▪ No signs of erosion or sedimentation.	As per the Protocol

Rehabilitation Management Schedule: Dams and Ponds – Grazing Land (G/DP)		
Six months following rehabilitation	All supplementary plantings will be monitored to ensure their continued health. Apply soil conditions and fertilisers as required to ensure successful pasture establishment and coverage. ▪ Monitor seedling health; ▪ Check for erosion/sedimentation; ▪ Check erosion & sediment control devices are in place as required; ▪ Check for disturbances from pests (e.g. rabbits, vandals etc); ▪ Monitor weeds; and ▪ Monitor regeneration success.	As per the Protocol
Timing	**Maintenance Tasks**	**Responsibility**
As required	Weed management	As per the PWMP
Timing	**Corrective Procedures**	**Responsibility**
As required	▪ Replace damaged seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Replenish mulch if necessary.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	Internally to Santos Operations, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	Santos Operations
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	Santos Operations
N/A	All monitoring records to be kept on file for five years.	Santos Operations

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 19: Borrow Pits and Quarries – Native Vegetation (NV/BP)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the borrow pits and quarries, ensuring compliance with the P & G Act;
Ensure a non-polluting environment is achieved;
Re-instate the disturbance area to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the temporary facility; and
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC and threatened species where applicable.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
No signs of erosion;
Representative of species richness and diversity based on appropriate benchmark guideline and pre-clearing assessment;
Plants showing healthy growth and signs of recruitment;
Water quality of voids meet the criteria for subsequent uses (as per water quality management plans);
Free of declared pest plants; and
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES).

Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.
Performance Criteria – Assessable for 3 years following Decommissioning
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
Assisted revegetation schedules only</td><td>≥80% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥95% survival of planted stock</td></tr>
<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Recruitment
Natural regeneration schedules only</td><td>≥40% of target species richness*</td><td>≥50% of target species richness*</td><td>≥65% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
<tr><td>Declared Weeds</td><td>≤15% declared weed cover</td><td>≤10% declared weed cover</td><td>≤5% declared weed cover</td><td>≤5% declared weed cover</td></tr>
<tr><td>Environmental weeds</td><td>≤30% weed cover</td><td>≤20% weed cover</td><td>≤15% weed cover</td><td>≤15% weed cover</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 19: Borrow Pits and Quarries – Native Vegetation (NV/BP)

Mulching	≥100mmdeep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			

Performance Criteria – Assessable for 5 years following Decommissioning

Element	6 months	1 year	2 years	3 years	4 years	5 years
Stable / No erosion or subsidence	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Utilise appropriate benchmark guideline to identify target species composition and richness; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	As per the Protocol
	Weed Management	As per the PWMP

Rehabilitation Management Schedule 19: Borrow Pits and Quarries – Native Vegetation (NV/BP)		
	▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection and translocation is complete prior to vegetation removal commencing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts. Fencing is to be in accordance with EHS01, Appendix D – Fencing Standard.	As per the Protocol / SSMP / FMP
	Erosion and Sediment Control ▪ Install erosion and sediment control measures as per Erosion and Sediment Control Manual.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation**	As per the Protocol

Rehabilitation Management Schedule 19: Borrow Pits and Quarries – Native Vegetation (NV/BP)		
	▪ Treat weeds present on site; ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	
Upon Decommissioning	**Final Rehabilitation** ▪ Progressively decommission as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities do not impact upon MNES; ▪ Rip soils in trafficked areas along the contour as required, ▪ Re-profile the site to achieve soil stability and congruity with the surrounding landscape to a minimum of 2:1 batter (as per APIA guidelines); ▪ Decommission accordance with statutory requirements; ▪ Ensure the site is secure from vehicle access. Fencing is to be in accordance with EHS01, Appendix D – Fencing Standard; ▪ Ensure stock are unable to access the site; ▪ Apply mulch and seed mix, ensuring species are to be native, and representative of pre-disturbed species composition, as per Benchmark Guideline; and ▪ Implement erosion and sediment control measures as required.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and maintenance schedule	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	As per the Protocol
N/A	All monitoring records to be kept on file for five years.	As per the Protocol

Rehabilitation Management Schedule 20: Borrow Pits – Grazing Land (G/BP)		
Objectives	▪ Rehabilitate disturbed areas to pre-clearance quality or better; ▪ Ensure a stable landform is maintained throughout construction and operation of the s borrow pits; and ▪ Re-instate borrow pits back to a stable landform that is representative of the pre-clearing vegetation condition and composition (native and / or improved pasture) following the decommissioning of borrow pits.	
Performance Criteria	▪ Stability of landform; ▪ Effective stabilisation of topsoil and soil stockpiles - Pasture species richness representative of pre-disturbed condition - The preservation of inherent GQAL agricultural land use classes - Pasture diversity, quality and productivity rehabilitated to pre-disturbance benchmarks ▪ No negative effect from stormwater runoff and seepage on environmental values of waters; ▪ Plants showing healthy growth and signs of recruitment; and ▪ Free of declared pest plants, except those that are beneficial pasture species (i.e. high in protein, palatable to livestock and drought tolerant).	
Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify correct Rehabilitation Management Procedure; and ▪ Identify relevant Benchmark Guideline (native or improved pasture).	As per the Protocol
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 20: Borrow Pits – Grazing Land (G/BP)		
	dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; and ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site	
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with grasses identified throughout pre-clearing assessment or in relevant benchmark guideline to stabilise area; and ▪ Implement erosion and sediment control measures as required.	As per the Protocol
Upon Borrow Pit Decommissioning	**Stabilisation of Borrow Pits** ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation	As per the Protocol / Erosion and Sediment Control Manual
Within 12 months of decommissioning	**Final Rehabilitation of Borrow Pits** ▪ Conduct Contaminated Land Assessment and follow Contaminated Land procedures as required (lay down areas); ▪ Regrade borrow pits where practical to reduce potential erosion hazards; ▪ Treat any declared weeds present on site; ▪ Rip soil to ensure no compaction where relevant. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil to pre-clearance depth; ▪ Direct drill an appropriate mixture of benchmark native and favourable exotic grass, herb and forb species and at a seeding rate with an intention to re-establish pastures that resemble the benchmark species composition that was identified in pre-clearing surveys (exclude species that are known agricultural pest weed species); ▪ Utilise appropriate benchmark site to identify target species composition and richness; and ▪ Apply fertiliser and water (if possible) as required to ensure successful germination and establishment.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
Two months following rehabilitation	▪ Plants showing healthy growth and signs of recruitment; ▪ Free of declared pest plants; ▪ No signs of erosion or sedimentation.	As per the Protocol

Rehabilitation Management Schedule 20: Borrow Pits – Grazing Land (G/BP)		
Six months following rehabilitation	All supplementary plantings will be monitored to ensure their continued health. Apply soil conditions and fertilisers as required to ensure successful pasture establishment and coverage. ▪ Monitor seedling health; ▪ Check for erosion/sedimentation; ▪ Check erosion & sediment control devices are in place as required; ▪ Check for disturbances from pests (e.g. rabbits, vandals etc); ▪ Monitor weeds; and ▪ Monitor regeneration success.	As per the Protocol
Timing	**Maintenance Tasks**	**Responsibility**
As required	Weed management	As per the PWMP
Timing	**Corrective Procedures**	**Responsibility**
As required	▪ Replace damaged seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Replenish mulch if necessary.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	Internally to Santos Operations, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	Santos Operations
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	Santos Operations
N/A	All monitoring records to be kept on file for five years.	Santos Operations

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 21: Temporary Facilities – Native Vegetation (NV/TF)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the temporary facility, ensuring compliance with the P & G Act;
Ensure a non-polluting environment is achieved;
Re-instate the disturbance area to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the temporary facility;
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of MNES (where applicable) as per SSMP.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
No signs of subsidence or erosion;
Representative of species richness and diversity based on appropriate benchmark guideline and pre-clearing assessment;
No negative effect from stormwater runoff and seepage on environmental values of waters (as per Water Quality Management Plans);
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES);
Ensure long-term recovery of TEC and threatened species where applicable;
Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Decommissioning
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
Assisted revegetation schedules only</td><td>≥80% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥95% survival of planted stock</td></tr>
<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Recruitment
Natural regeneration schedules</td><td>≥40% of target species richness*</td><td>≥50% of target species richness*</td><td>≥65% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
<tr><td>Declared Weeds</td><td>≤15% declared weed cover</td><td>≤10% declared weed cover</td><td>≤5% declared weed cover</td><td>≤5% declared weed cover</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 21: Temporary Facilities – Native Vegetation (NV/TF)

Environmental weeds	≤30% weed cover	≤20% weed cover	≤15% weed cover	≤15% weed cover
Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Decommissioning

Element	6 months	1 year	2 years	3 years	4 years	5 years
Stable / No erosion or subsidence	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained. Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition and richness; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP;	As per the Protocol

Rehabilitation Management Schedule 21: Temporary Facilities – Native Vegetation (NV/TF)		
	▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	
	Weed Management ▪ Undertake weed control to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection and translocation is completed prior to vegetation clearing commencing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP; ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements; - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts.	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 21: Temporary Facilities – Native Vegetation (NV/TF)		
	Fencing is to be in accordance with EHS01, Appendix D – Fencing Standard.	
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Stabilisation of Disturbance Area** ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual). ▪ Treat any declared weeds present on site.	Post Construction
Upon Decommissioning	**Rehabilitation of Facility** ▪ CSG temporary infrastructure will be decommissioned in accordance with the statutory requirements outlined in the P& G Act; ▪ Temporary infrastructure will be progressively removed and reused (where applicable), as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities do not impact upon MNES; ▪ Respread topsoil and allow natural regeneration to occur using existing seed bank; ▪ Utilise appropriate benchmark site to identify target species composition and richness; ▪ Mulch with site-generated mulch where available; ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation. ▪ Complete any specific rehabilitation requirements as per **Appendix 4** where listed species potentially occur. Within areas of threatened fauna species habitat mapped in the SSMP: ▪ Re-plant tube stock where necessary encourage regeneration of canopy and shrub layer. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose crumbly soil, and then firmed in will with the hands to create a shallow watering depression; ▪ Replant as per densities outlined in appropriate Benchmark site; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient;	As per the Protocol

Rehabilitation Management Schedule 21: Temporary Facilities – Native Vegetation (NV/TF)		
	▪ Mulch all seedlings to a radius of 1m surrounding the plant at a depth of 100mm. Mulch should not touch plant stems; and ▪ Seed with native grass and herb species as identified in pre-clearing assessment.	
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and maintenance schedule	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	As per the Protocol

Rehabilitation Management Schedule 22: Temporary Infrastructure – Grazing Land (G/TI)		
Objectives	▪ Rehabilitate disturbed areas to pre-clearance quality or better; ▪ Ensure a stable landform is maintained throughout construction and operation of temporary infrastructure; and ▪ Re-instate the site of temporary infrastructure back to a stable landform that is representative of the pre-clearing vegetation condition and composition (native and / or improved pasture) following decommissioning of the infrastructure.	
Performance Criteria	▪ Stability of landform; ▪ Effective stabilisation of topsoil and soil stockpiles; - Pasture species richness representative of pre-disturbed condition - The preservation of inherent GQAL agricultural land use classes - Pasture diversity, quality and productivity rehabilitated to pre-disturbance benchmarks ▪ No negative effect from stormwater runoff and seepage on environmental values of waters; ▪ Plants showing healthy growth and signs of recruitment; and ▪ Free of declared pest plants, except those that are beneficial pasture species (i.e. high in protein, palatable to livestock and drought tolerant).	
Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify correct Rehabilitation Management Procedure; and ▪ Identify relevant Benchmark Guideline (native or improved pasture).	As per the Protocol
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 22: Temporary Infrastructure – Grazing Land (G/TI)		
	increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site.	
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with grasses identified throughout pre-clearing assessment or in relevant benchmark guideline to stabilise area; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon Temporary Infrastructure Decommissioning	**Stabilisation of Temporary Infrastructure Sites** ▪ Decommissioning will be carried out progressively, as per the appropriate Decommissioning and Demolition Plan; and ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation.	As per the Protocol
Within 12 months of decommissioning	**Final Rehabilitation of Temporary Infrastructure Sites** ▪ Fill all depressions or remaining holes, footing trenches etc.; ▪ Treat any declared weeds present on site; ▪ Rip soil to ensure no compaction. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil to pre-clearance depth; ▪ Direct drill an appropriate mixture of benchmark native and favourable exotic grass, herb and forb species and at a seeding rate with an intention to re-establish pastures that resemble the benchmark species composition that was identified in pre-clearing surveys (exclude species that are known agricultural pest weed species); ▪ Utilise appropriate benchmark site to identify target species composition and richness; and ▪ Apply fertiliser and water (if possible) as required to ensure successful germination and establishment.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
Two months following rehabilitation	▪ Plants showing healthy growth and signs of recruitment; ▪ Free of declared pest plants; and ▪ No signs of erosion or sedimentation.	As per the Protocol

Rehabilitation Management Schedule 22: Temporary Infrastructure – Grazing Land (G/TI)		
Six months following rehabilitation	All supplementary plantings will be monitored to ensure their continued health. Apply soil conditions and fertilisers as required to ensure successful pasture establishment and coverage. ▪ Monitor seedling health; ▪ Check for erosion/sedimentation; ▪ Check erosion & sediment control devices are in place as required; ▪ Check for disturbances from pests (e.g. rabbits, vandals etc); ▪ Monitor weeds; ▪ Watering; and ▪ Monitor regeneration success.	As per the Protocol
Timing	**Maintenance Tasks**	**Responsibility**
As required	Weed management	As per the PWMP
Timing	**Corrective Procedures**	**Responsibility**
As required	▪ Replace damaged seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Replenish mulch if necessary.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	Internally to Santos Operations, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	Santos Operations
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	Santos Operations
N/A	All monitoring records to be kept on file for five years.	Santos Operations

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 23: Transmission Easements – Native Vegetation (NV/TE)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the easement, ensuring compliance with the P & G Act;
Ensure a non-polluting environment is achieved;
Re-instate the easement to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the easement;
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC and threatened species where applicable.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
No signs of erosion;
Representative of species richness and diversity based on appropriate benchmark guideline and pre-clearing assessment;
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES);
Ensure long-term recovery of TEC and threatened species where applicable;
Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Construction
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
Assisted revegetation schedules only</td><td>≥80% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥95% survival of planted stock</td></tr>
<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Recruitment
Natural regeneration schedules only</td><td>≥40% of target species richness*</td><td>≥50% of target species richness*</td><td>≥65% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
<tr><td>Declared Weeds</td><td>≤15% declared weed cover</td><td>≤10% declared weed cover</td><td>≤5% declared weed cover</td><td>≤5% declared weed cover</td></tr>
<tr><td>Environmental weeds</td><td>≤30%weed cover</td><td>≤20% weed cover</td><td>≤15% weed cover</td><td>≤15% weed cover</td></tr>
<tr><td>Mulching</td><td>≥100mm deep</td><td>≥100mm deep</td><td>Presence of</td><td>Presence of</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 23: Transmission Easements – Native Vegetation (NV/TE)

	mulch cover around planted stock	mulch cover around planted stock	organic matter	organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Construction

Element	6 months	1 year	2 years	3 years	4 years	5 years
Stable / Safe / Non-polluting	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); and ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition and richness; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; and ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	As per the Protocol

Rehabilitation Management Schedule 23: Transmission Easements – Native Vegetation (NV/TE)		
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection and translocation is complete prior to vegetation clearing commencing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements; - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts. Fencing is to be in accordance with EHS01, Appendix D – Fencing Standard.	As per the Protocol / SSMP / FMP
During Construction	**Erosion and Sediment Control** ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control	As per the Protocol / Erosion and Sediment Control Manual

Rehabilitation Management Schedule 23: Transmission Easements – Native Vegetation (NV/TE)

Manual.

Post Construction	**Rehabilitation of Easement** ▪ Control weeds present on site; ▪ Respread topsoil and allow natural regeneration to occur using existing seed bank; ▪ Where areas of TEC require rehabilitation, seed using species identified within the Benchmark Guideline; ▪ Mulch with site-generated mulch where available; ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual). ▪ Undertake specific tasks outlined in **Appendix 4** for EPBC listed flora and fauna species.	As per the Protocol
Upon Decommissioning	**Final Rehabilitation** ▪ Progressive decommissioning will occur as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities to not impact upon MNES; ▪ Re-spread topsoil, apply mulch and spread seed mix in areas requiring rehabilitation following decommissioning. Seeds are to be native, and representative of pre-disturbed species composition, as per Benchmark Guideline; ▪ Undertake specific tasks outlined in **Appendix 4** for EPBC listed flora and fauna species.	Santos Operations
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and maintenance schedule (**Appendix 5**).	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to DERM, Coordinator-General and SEWPaC.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC. Coordinator-General and EA.	As per the Protocol

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 24: Transmission Easements – Threatened Ecological Communities (TEC/TE)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the easement, ensuring compliance with the P & G Act;
Ensure a non-polluting environment is achieved;
Re-instate the easement to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the easement;
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC and threatened species where applicable.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
No signs of erosion;
Representative of species richness and diversity based on appropriate benchmark guideline, pre-clearing assessment and SEWPaC guidelines;
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES);
Ensure long-term recovery of TEC and threatened species where applicable;
Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Construction
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
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<tr><td>Recruitment
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<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
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<tr><td>Environmental</td><td>≤30%weed</td><td>≤20% weed</td><td>≤15% weed</td><td>≤15% weed</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 24: Transmission Easements – Threatened Ecological Communities (TEC/TE)

weeds	cover	cover	cover	cover
Mulching	≥100mm deep mulch cover around planted stock	≥100mm deep mulch cover around planted stock	Presence of organic matter	Presence of organic matter
Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			
* As per targets outlined in benchmark guidelines, set by suitably qualified ecologists				

Performance Criteria – Assessable for 5 years following Construction

Element	6 months	1 year	2 years	3 years	4 years	5 years
Stable / Safe / Non-polluting	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol**; ▪ Ensure disturbance limits are updated; ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Identify relevant SEWPaC guidelines; and ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition and richness; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; ▪ Identify species requiring translocation as per the	As per the Protocol

Rehabilitation Management Schedule 24: Transmission Easements – Threatened Ecological Communities (TEC/TE)		
	Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	
	Weed Management ▪ Undertake weed control to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection and translocation is complete prior to vegetation clearance commencing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements; - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts.	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 24: Transmission Easements – Threatened Ecological Communities (TEC/TE)		
	Fencing is to be in accordance with EHS01, Appendix D – Fencing Standard.	
During Construction	**Erosion and Sediment Control** ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation of Easement** ▪ Treat weeds present on site; ▪ Respread topsoil and allow natural regeneration to occur using existing seed bank; ▪ Where areas of TEC require rehabilitation, seed using species identified within the Benchmark Guideline; ▪ Mulch with site-generated mulch where available; ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual). ▪ Undertake specific tasks outlined in **Appendix 4** for EPBC listed flora and fauna species.	As per the Protocol
Upon Decommissioning	**Final Rehabilitation** ▪ Progressive decommissioning will occur as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities to not impact upon MNES; ▪ Re-spread topsoil, apply mulch and spread seed mix in areas requiring rehabilitation following decommissioning. Seeds are to be native, and representative of pre-disturbed species composition, as per Benchmark Guideline; ▪ Supplement seeding with tube stock where necessary to encourage regeneration of canopy and shrub layer within TEC. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose crumbly soil, and then firmed in will with the hands to create a shallow watering depression; ▪ Undertake specific tasks outlined in **Appendix 4** for EPBC listed flora and fauna species.	Santos Operations
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**

Rehabilitation Management Schedule 24: Transmission Easements – Threatened Ecological Communities (TEC/TE)		
As per monitoring and maintenance schedule (**Appendix 5**).	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Conduct feral animal management as required.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to DERM, Coordinator-General and SEWPaC.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC. Coordinator-General and EA.	As per the Protocol

Rehabilitation Management Schedule 26: Transmission Easement – Grazing Land (G/TE)		
Objectives	▪ Rehabilitate disturbed areas to pre-clearance quality or better; ▪ Ensure a stable landform is maintained throughout construction and operation of transmission easements; and ▪ Re-instate transmission easements back to a stable landform that is representative of the pre-clearing vegetation condition and composition (native and / or improved pasture) following the decommissioning of transmission easements.	
Performance Criteria	▪ Stability of landform; ▪ Effective stabilisation of topsoil and soil stockpiles; - Pasture species richness representative of pre-disturbed condition; - The preservation of inherent GQAL agricultural land use classes; - Pasture diversity, quality and productivity rehabilitated to pre-disturbance benchmarks; ▪ No negative effect from stormwater runoff and seepage on environmental values of waters; ▪ Plants showing healthy growth and signs of recruitment; and ▪ Free of declared pest plants, except those that are beneficial pasture species (i.e. high in protein, palatable to livestock and drought tolerant).	
Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol**; ▪ Identify correct Rehabilitation Management Procedure; and ▪ Identify relevant Benchmark Guideline (native or improved pasture).	As per the Protocol
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Refer to benchmark guideline for grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP: ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; ▪ Vegetation is cleared and stockpiled: - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or	As per the Protocol / SSMP / FMP

Rehabilitation Management Schedule 26: Transmission Easement – Grazing Land (G/TE)		
	dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; and ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site.	
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Allow natural regeneration of easement. Seed with grasses identified throughout pre-clearing assessment or in relevant benchmark guideline to stabilise area where necessary; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	As per the Protocol
Upon Transmission Easement Decommissioning	**Stabilisation of Transmission Easements** ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation.	As per the Protocol / Erosion and Sediment Control Manual
Within 12 months of decommissioning	**Final Rehabilitation of Transmission Easements** ▪ Fill any remaining potholes, gutters, drains etc; ▪ Control any declared weeds present on site; ▪ Rip soil to ensure no compaction. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil to pre-clearance depth ; ▪ Direct drill an appropriate mixture of benchmark native and favourable exotic grass, herb and forb species and at a seeding rate with an intention to re-establish pastures that resemble the benchmark species composition that was identified in pre-clearing surveys (exclude species that are known agricultural pest weed species); ▪ Utilise appropriate benchmark site to identify target species composition and richness; and ▪ Apply fertiliser and water (if possible) as required to ensure successful germination and establishment.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
Two months following rehabilitation	▪ Plants showing healthy growth and signs of recruitment; ▪ Free of declared pest plants; and ▪ No signs of erosion or sedimentation.	As per the Protocol

Rehabilitation Management Schedule 26: Transmission Easement – Grazing Land (G/TE)		
Six months following rehabilitation	All supplementary plantings will be monitored to ensure their continued health. Apply soil conditions and fertilisers as required to ensure successful pasture establishment and coverage. ▪ Monitor seedling health; ▪ Check for erosion/sedimentation; ▪ Check erosion & sediment control devices are in place as required; ▪ Check for disturbances from pests (e.g. rabbits, vandals etc); ▪ Monitor weeds; and ▪ Monitor regeneration success.	As per the Protocol
Timing	**Maintenance Tasks**	**Responsibility**
As required	Weed management	As per the PWMP
Timing	**Corrective Procedures**	**Responsibility**
As required	▪ Replace damaged seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Replenish mulch if necessary.	As per the Protocol
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	Internally to Santos Operations, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	Santos Operations
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	Santos Operations
N/A	All monitoring records to be kept on file for five years.	Santos Operations

<table>
<tr><th colspan="2">Rehabilitation Management Schedule 27: Permanent Accommodation – Native Vegetation (NV/PA)</th></tr>
<tr><td>Objectives</td><td>

Rehabilitate disturbed areas to pre-clearance quality or better;
Ensure a safe environment for humans, native fauna and livestock;
Ensure a stable landform is maintained throughout construction, operation and decommissioning of the accommodation facility;
Ensure a non-polluting environment is achieved;
Re-instate the disturbance area to a stable landform that is representative of the pre-clearing vegetation condition and composition following decommissioning of the facility;
Ensure a self-sustaining landform is achieved; and
Ensure long-term recovery of TEC and threatened species where applicable.

</td></tr>
<tr><td>Performance Criteria</td><td>

Self-sustaining vegetative cover;
Representative of species richness and diversity based on appropriate benchmark guideline and pre-clearing assessment;
Plants showing healthy growth and signs of recruitment;
Free of declared pest plants;
Provision of fauna habitat to a similar standard identified within pre-clearing assessment (as per Appendix 4 for MNES);

Rehabilitation is considered finalised when the performance criteria outlined below are met. If they are not satisfactorily met at the end of the assessable period, further monitoring and maintenance will be required, in accordance with DERM and SEWPaC requirements.

Performance Criteria – Assessable for 3 years following Decommissioning
<table>
<tr><th>Element</th><th>6 months</th><th>1 year</th><th>2 years</th><th>3 years</th></tr>
<tr><td>Plant Survival
Assisted revegetation schedules only</td><td>≥80% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥90% survival of planted stock</td><td>≥95% survival of planted stock</td></tr>
<tr><td>Plant Height</td><td>Evidence of growth</td><td>All planted canopy & shrub stock ≥0.3m high</td><td>All planted canopy & shrub stock ≥0.6m high</td><td>All planted canopy stock ≥1.5m high & shrub stock ≥1.0m high</td></tr>
<tr><td>Native Species Richness</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Recruitment
Natural regeneration schedules only</td><td>≥40% of target species richness*</td><td>≥50% of target species richness*</td><td>≥65% of target species richness*</td><td>≥80% of target species richness*</td></tr>
<tr><td>Plant Cover</td><td>≥75% of target covers*</td><td>≥75% of target covers*</td><td>≥80% of target covers*</td><td>≥90% of target covers.*</td></tr>
<tr><td>Declared Weeds</td><td>≤15% declared weed cover</td><td>≤10% declared weed cover</td><td>≤5% declared weed cover</td><td>≤5% declared weed cover</td></tr>
<tr><td>Environmental weeds</td><td>≤30% weed cover</td><td>≤20% weed cover</td><td>≤15% weed cover</td><td>≤15% weed cover</td></tr>
<tr><td>Mulching</td><td>≥100mmdeep mulch cover around planted stock</td><td>≥100mm deep mulch cover around planted stock</td><td>Presence of organic matter</td><td>Presence of organic matter</td></tr>
</table>
</td></tr>
</table>

Rehabilitation Management Schedule 27: Permanent Accommodation – Native Vegetation (NV/PA)

Threatened species habitat	Evidence of food sources, woody material & rocks, as per **Appendix 4.**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**	Evidence of food sources, woody material & rocks, as per **Appendix 4**
Water quality	As per water quality monitoring and management plans (Santos 2011, i-m).			

Performance Criteria – Assessable for 5 years following Decommissioning

Element	6 months	1 year	2 years	3 years	4 years	5 years
Stable / No erosion or subsidence	Landform reshaped and topsoil respread. Seeding and/or revegetation completed. Erosion and sediment control measures in place as per Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	Groundcover established. No evidence of erosion. Erosion and sediment control measures maintained. Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011).	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform	No evidence of erosion. Stable and self-sufficient landform

Timing	Rehabilitation Actions	Responsibility
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol;** ▪ Identify relevant Benchmark Guideline (**Section 6** of RRRMP); ▪ Utilise appropriate benchmark guideline and pre-clearance data to identify target species composition and richness; ▪ Identify specific rehabilitation requirements as per **Appendix 4** of RRRMP; ▪ Identify species requiring translocation as per the Salvage Management Plan, or where suitable species occur; and ▪ Identify species suitable for seed collection as per the Salvage Management Plan or where suitable species occur.	As per the Protocol
	Weed Management ▪ Undertake weed removal to prevent weed dispersal off-site; and ▪ Implement measures consistent with the PWMP.	As per the PWMP

Rehabilitation Management Schedule 27: Permanent Accommodation – Native Vegetation (NV/PA)		
	Topsoil Management ▪ Stockpile topsoil within areas of disturbance; ▪ Ensure stockpiles are not: - Located in an area which significantly isolates, fragments or dissects tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas. ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with native grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Introduced pasture species are not be seeded within areas of native vegetation. Refer to benchmark guideline for native grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Ensure all seed collection and translocation is complete prior to vegetation clearing commencing; ▪ Vegetation will be cleared in accordance with Site Specific Work Instructions as per the Protocol; ▪ Vegetation clearance is to follow recommendations listed within the SSMP and FMP; ▪ Vegetation clearing is to occur in a sequential manner, at a rate of no more than 3ha in a 24 hour period; - in a way that does not impede vehicle, stock or wildlife movements - In a location that does not significantly isolate, fragment or dissect tracts of vegetation connectivity, or results in an increase in threatening processes; - On slopes of greater than 10%; or - In discharge areas facilitate respreading and salvaging of suitable habitat resources; ▪ Habitat values (e.g. hollow logs, felled hollow-bearing trees) will be salvaged and used for later rehabilitation of the site or be placed in adjoining undisturbed areas; ▪ Appropriate vegetation will be mulched and stored for subsequent rehabilitation of the site; and ▪ Where MNES including TEC and threatened species habitat are adjacent to construction areas, install temporary fencing to prevent accidental impacts. Fencing is to be in accordance with EHS01, Appendix D – Fencing Standard.	As per the Protocol / SSMP / FMP
	Erosion and Sediment Control ▪ Install erosion and sediment control measures as per Erosion and Sediment Control Manual.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation** ▪ Control weeds present on site; ▪ Landscape as per design plans; and ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control	As per the Protocol

Rehabilitation Management Schedule 27: Permanent Accommodation – Native Vegetation (NV/PA)		
	Manual).	
Upon Decommissioning	**Final Rehabilitation** ▪ The facility will be progressively removed and reused (where applicable), as per the appropriate Decommissioning and Demolition Plan, particularly to ensure decommissioning activities do not impact upon MNES; ▪ Conduct a site Contaminated Land assessment as per the Draft Guidelines for Assessment and Management of Contaminated Land; ▪ Rip construction footprint to ensure no compaction; ▪ Re-spread topsoil over disturbed areas, apply mulch and revegetate using a seed mix comprised of native species that are representative of pre-disturbed species composition, as per Benchmark Guideline; ▪ Complete any specific rehabilitation requirements as per **Appendix 4** where EPBC listed species potentially occur; ▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual). Within areas of threatened fauna habitat mapped in the SSMP (MNES): ▪ Re-plant tube stock where necessary to encourage regeneration of canopy and shrub layer. Ensure tube stock is: - Preferably local provenance; - Healthy and displaying signs of active growth. Plants will be rejected if they display 'yellowing', leaf or stem damage or disease, root curling or restriction related to being 'pot bound', or have weed species in the container; - Minimum of 20cm tall for (75mm) tube-stock; and - Sun-hardened. ▪ Ensure tube stock is placed in a hole deeper than the pot, with the root ball just below the soil surface; ▪ Place plant in the centre of the hole, filled in with loose crumbly soil, and then firmed in will with the hands to create a shallow watering depression; ▪ Replant as per densities outlined in appropriate Benchmark site; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; ▪ Mulch all seedlings with clean mulch to a radius of 1m surrounding the plant at a depth of 100mm. Mulch should not touch plant stems; ▪ Seed with native grass and herb species as identified in pre-clearing assessment; and ▪ Where required, install temporary stock fencing as outlined in Appendix 8 to ensure livestock is prevented from entering.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
REFER TO APPENDIX 5 – MONITORING AND MAINTENANCE SCHEDULE		
Timing	**Maintenance Tasks / Corrective Procedures**	**Responsibility**
As per monitoring and	▪ Monitor success of natural regeneration. Where natural regeneration is ineffective, assisted	As per the Protocol

Rehabilitation Management Schedule 27: Permanent Accommodation – Native Vegetation (NV/PA)		
maintenance schedule	revegetation may be required; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other weeds; and ▪ Install fencing as required to prevent damage by livestock; ▪ Conduct feral animal management as required.	
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	As per the Protocol- internal reporting, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	As per the Protocol
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	As per the Protocol
N/A	All monitoring records to be kept on file for five years.	As per the Protocol

Rehabilitation Management Schedule 28: Permanent Accommodation – Grazing Land (G/PA)		
Objectives	▪ Rehabilitate disturbed areas to pre-clearance quality or better; ▪ Ensure a stable landform is maintained throughout construction and operation of permanent accommodation; and ▪ Re-instate the site of permanent accommodation back to a stable landform that is representative of the pre-clearing vegetation condition and composition (native and / or improved pasture) following decommissioning of permanent accommodation.	
Performance Criteria	▪ Stability of landform; ▪ Effective stabilisation of topsoil and soil stockpiles; - Pasture species richness representative of pre-disturbed condition; - The preservation of inherent GQAL agricultural land use classes; - Pasture diversity, quality and productivity rehabilitated to pre-disturbance benchmarks; ▪ No negative effect from stormwater runoff and seepage on environmental values of waters; ▪ Plants showing healthy growth and signs of recruitment; and ▪ Free of declared pest plants.	
Timing	**Rehabilitation Actions**	**Responsibility**
Pre- Construction	**Pre-clearing Assessment** ▪ Complete pre-clearing procedures outlined in **The Protocol**; ▪ Identify correct Rehabilitation Management Procedure; and ▪ Identify relevant Benchmark Guideline (native or improved pasture).	As per the Protocol
	Topsoil Management ▪ Stockpile topsoil on site in rows no more than 1.5 m high (Aurecon, 2011) with battered sides <5 % gradient; ▪ Install erosion and sediment control devices to ensure stockpile remains intact (as per Erosion and Sediment Control Manual); and ▪ Seed with grasses identified as dominant within pre-clearing assessment within 6 months of stockpiling. Refer to benchmark guideline for grass cover if required. Water (if required) topsoil stockpile to stabilise and protect biological integrity.	As per the Protocol
During Construction	**Vegetation Clearance** ▪ Vegetation is cleared and stockpiled in a manner to facilitate respreading and salvaging; and ▪ Vegetation is cleared and stockpiled in a way that does not impede stock or wildlife movements.	As per the Protocol / SSMP / FMP
	Erosion and Sediment Control ▪ Ensure construction site is stabilised to prevent runoff and erosion as per Erosion and Sediment Control Manual; and ▪ Install measures such as berms and sediment fencing as required.	As per the Protocol / Erosion and Sediment Control Manual
Post Construction	**Rehabilitation of Construction Footprint** ▪ Rip soil to ensure no compaction; ▪ Seed with grasses identified throughout pre-clearing assessment or in relevant benchmark guideline to stabilise area; and	As per the Protocol

Rehabilitation Management Schedule 28: Permanent Accommodation – Grazing Land (G/PA)		
	▪ Implement erosion and sediment control measures as required (refer to the Erosion and Sediment Control Manual).	
Upon Permanent Accommodation Decommissioning	**Stabilisation of Permanent Accommodation Sites** ▪ Following decommissioning ensure erosion and sediment control measures are implemented to reduce runoff and disturbances prior to rehabilitation	As per the Protocol / Erosion and Sediment Control Manual
Within 12 months of decommissioning	**Final Rehabilitation of Permanent Accommodation Sites** ▪ Conduct Contaminated Land Assessment and follow Contaminated Land procedures as required (septic tanks, sewage facilities); ▪ Fill all depressions or remaining holes, footing trenches etc.; ▪ Treat any declared weeds present on site; ▪ Rip soil to ensure no compaction. Ensure rip lines are spaced >1m apart to prevent soil mass movement; ▪ Respread topsoil to pre-clearance depth; ▪ Direct drill an appropriate mixture of benchmark native and favourable exotic grass, herb and forb species and at a seeding rate with an intention to re-establish pastures that resemble the benchmark species composition that was identified in pre-clearing surveys (exclude species that are known agricultural pest weed species); ▪ Utilise appropriate benchmark site to identify target species composition and richness; and ▪ Apply fertiliser and water (if possible) as required to ensure successful germination and establishment.	As per the Protocol
Timing	**Monitoring Tasks**	**Responsibility**
Two months following rehabilitation	▪ Plants showing healthy growth and signs of recruitment; ▪ Free of declared pest plants; and ▪ No signs of erosion or sedimentation.	Santos Operations
Six months following rehabilitation	All supplementary plantings will be monitored to ensure their continued health. Apply soil conditions and fertilisers as required to ensure successful pasture establishment and coverage. ▪ Monitor seedling health; ▪ Check for erosion/sedimentation; ▪ Check erosion & sediment control devices are in place as required; ▪ Check for disturbances from pests (e.g. rabbits, vandals etc); ▪ Monitor weeds; and ▪ Monitor regeneration success.	As per the Protocol
Timing	**Maintenance Tasks**	**Responsibility**
As required	Weed management	As per the PWMP
Timing	**Corrective Procedures**	**Responsibility**
As required	▪ Replace damaged seedlings; ▪ Implement erosion & sediment control in accordance with the Sediment and Erosion Control Manual (e.g. jute matting, mulch, sediment fencing in areas suffering erosion); ▪ Treat declared weed species and manage spread of other	As per the Protocol

Rehabilitation Management Schedule 28: Permanent Accommodation – Grazing Land (G/PA)		
	weeds; ▪ Where practicable, water the rehabilitated area if rainfall has not been sufficient; and ▪ Replenish mulch if necessary.	
Timing	**Reporting**	**Responsibility**
As works are completed	Completion of rehabilitation actions, monitoring and maintenance checklist.	Internally to Santos Operations, as per Santos procedures
Annually	Reports provided to DERM, SEWPaC, and Coordinator-General.	Santos Operations
Timing	**Auditing**	**Responsibility**
As required	Third party auditing may be requested by SEWPaC, Coordinator-General and EA.	Santos Operations
N/A	All monitoring records to be kept on file for five years.	Santos Operations

Appendix 4

Threatened Species Rehabilitation Management Actions

Fauna

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
Birds						
Erythrotriorchis radiatus	Red Goshawk	E	V	Not been formally identified from the CSG fields, however the home range of the species can be up to 200 km^2 and it is likely that the CSG Fields are part of an individual's home range. Potential – Arcadia Valley, Fairview..	Inhabits open forests, woodlands especially near rivers, wetlands and rainforest fringes in coastal and subcoastal north and northeast Australia from the Kimberley (WA) to the Queensland / New South Wales border (Pizzey and Knight 2007). REs of importance within the CSG Fields include all REs on Land zones 3, 4, 5, 7, 8, 9, 10 and 11. Non-remnant and regrowth vegetation is also likely to be utilised for foraging. RE 11.3.2 and 11.3.25 are likely to be of particular importance for nesting.	▪ Establish an exclusion zone (200m) and a visual barrier around nest sites. This will also include briefing relevant staff and contractors; ▪ No rehabilitation works will occur within 200m of active nests during the breeding and rearing season (April – September) where possible; ▪ Consider fire regimes in adjacent areas to reduce the effect fire can have on reducing the prey base for the red goshawk (DERM, 2009); and ▪ Report rehabilitation that has been undertaken within Red Goshawk habitat to DERM and SEWPaC as part of annual reporting. Refer to: ▪ Draft National Recovery Plan for the Red Goshawk (DERM, 2009).
Geophaps scripta scripta	Squatter Pigeon (southern form)	V	V	Regularly recorded from the Fairview CSG Field and parts of the Arcadia CSG Field. Although the Roma CSG Field is within the historical range of this species, they are now absent from this area.	The Squatter Pigeon (southern) is never far from water in grassed woodlands; foothills, watercourses, riverflats, grassy plains; environs of homesteads (Pizzey and Knight 2007). At the Fairview gas field, Squatter Pigeons inhabit woodlands dominated by Poplar	▪ If active nests are located, an exclusion zone of 200m around the nest site will be established, and a visual barrier erected; ▪ Ensure no burn-offs within regenerating habitat (SEWPaC, 2008); ▪ No rehabilitation works will occur

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
					Box *Eucalyptus populnea*, Narrow-leaved Ironbark *E. crebra*, Spotted Gum *Corymbia citriodora* subsp. *variegata*, Dusky-leaved Ironbark *E. fibrosa* and White Cypress Pine *Callitris glaucophylla*.The Squatter Pigeon has been observed foraging along roads and railway lines (SEWPaC 2010) and is known to inhabit other disturbed habitats associated with CSG infrastructure e.g. gas wells, flowlines and camps. In the Arcadia Valley and Fairview CSG Fields the species is associated with the following REs, 11.3.2, 11.3.3, 11.3.4, 11.3.14, 11.3.18, 11.3.19, 11.3.25, 11.3.27, 11.3.39, 11.10.1, 11.10.3, 11.10.4, 11.10.9, 11.10.10, 11.10.11, 11.10.13 and 11.10.14. Non-remnant and regrowth areas are also utilised by this species, particularly in areas on land zone 3 and/or near permanent water.	within 200m of active nests during the breeding and rearing season (May – June) where possible; and ▪ Notify DERM and/or SEWPaC of sightings and/or nesting areas, as rehabilitation that has occurred within Squatter Pigeon habitat as part of annual reporting. Refer to: ▪ Approved Conservation Advice for *Geophaps scripta scripta* (SEWPaC, 2008).
Rostratula australis	Australian Painted Snipe	V	V	This species has been recorded on an infrequent basis from wetland habitats within and around the townships of Roma, Springsure and Taroom. It is likely to occur in low numbers in suitable habitats within all of the CSG Fields.	This species is cryptic and is known to inhabit shallow, vegetated, temporary or infrequently filled wetlands, sometimes where there are trees such as *Eucalyptus camaldulensis* (River Red Gum) or *E. populnea* (Poplar Box), shrubs such as *Muehlenbeckia florulenta* (Lignum) or *Halosarcia spp*. (Samphire) or other cover such as *Eragrostis australisica* (Canegrass) and sedges (e.g. *Eleocharis* spp.).	▪ Establish an exclusion zone (200m) around nest site(s). This will also include briefing staff and contractors and erecting visual barriers around the nest site(s); ▪ No rehabilitation works will occur within 200m of this area during the breeding and rearing season (August - February) where possible; ▪ Limit the use of pesticides and

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
					Wetlands within and adjacent non-remnant and regrowth areas may also be utilised including the margins of well vegetated farm dams and sewage treatment ponds (Pizzey and Knight 2007). This species occurs primarily at wetlands associated with the following REs: 11.3.2, 11.3.25, 11.3.3, 11.3.4, 11.3.22 and 11.3.27. Other REs which may contain potentially suitable habitat at temporary wetlands (such as gilgais) within the CSG Fields include:11.3.17, 11.4.3, 11.4.7, 11.4.8, 11.9.1 and 11.9.5.	other chemicals near wetlands and consider alternatives where available; ▪ Ensure additional drainage or clearance of wetlands is appropriately managed (SEWPaC, 2011); ▪ Implement feral animal control within rehabilitation areas as required; ▪ During rehabilitation activities, minimise lighting disturbances, particularly near wetlands; ▪ Where grazing occurs within riparian rehabilitation areas, fence throughout establishment period where possible; and ▪ Notify DERM and/or SEWPaC of sightings and/or nesting areas, as well as rehabilitation undertaken within Australian Painted Snipe habitat as part of annual reporting requirements. Refer to: Recovery outline for *Rostratula australis* (SEWPaC, 2011).
Turnix melanogaster	Black-breasted Button-quail	V	V	Not formally identified from the CSG Fields, however the species has been recorded from contiguous habitats adjacent the CSG Fields (ie Palmgrove National Park). Suitable habitat, in the form of Semi-Evergreen Vine Thicket (SEVT) occurs within the Fairview and Arcadia	Inhabits microphyll and notophyll vine forest, semi-evergreen vine thickets and coastal scrubs. Within the Brigalow Belt, semi-evergreen vine thicket (SEVT) is the core habitat for this species, however, it is also known to utilise low thickets or woodlands with a dense understorey but little ground cover,	▪ Establish an exclusion zone (200m) around nest site(s). This will also include briefing relevent staff and contractors and erecting visual barriers around the nest site(s); ▪ No rehabilitation works will occur within 200m of this area during the breeding and rearing season

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
				Valley CSG Fields.	typically dominated by *Acacia* species, including *Acacia harpophylla* (Brigalow) (SEWPaC 2010). Likely to be primarily associated with RE11.9.4. Other REs which may be utilised within the CSG Fields include 11.3.11, 11.8.3, 11.9.5 and 11.9.8..	(September – April / May); ▪ Where rehabilitation occurs in Lantana thickets occupied by Black-breasted Button-quail, care should be taken to stage removal of lantana and replacement with appropriate planting of native species to ameliorate the impacts of sudden loss of vegetation being utilised by the species (Mathieson and Smith, 2009); ▪ Implement feral animal control within rehabilitation areas as required; ▪ Undertake weed management as per (Mathieson and Smith, 2009); ▪ Ensure no burn-offs are undertaken within regenerating areas (Mathieson and Smith, 2009); ▪ During rehabilitation activities, vehicle and pedestrian access within the CSG Fields will be restricted to defined access tracks; ▪ Revegetation shall include vine-thicket species where appropriate; ▪ Ensure no futher thinning of regenerating areas (Mathieson and Smith, 2009); ▪ Report any sightings of the Black-breasted Button-quail, to DERM and SEWPaC as part of annual reporting; and ▪ Report any rehabilitation

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						undertaken within Black-breasted Button-quail habitat to DERM and SEWPaC as part of annual reporting. Refer to: ▪ The National Recovery Plan for the Black-breasted Button-quail (Mathieson and Smith, 2009);
Reptiles						
Delma torquata	Collared Delma	V	V	Been recorded from remnant vegetation communities which are contiguous with the Arcadia CSG Fields, Based on known distribution it is possible that this species may also occur in Roma and Fairview CSG Fields. .	This species has been recorded from a number of disturbed habitats, normally in eucalypt-dominated woodlands and open-forests, within remnant and disturbed habitats. It occurs in a variety of woodland types, with dominant species often including Spotted Gum, Narrow-leaved Ironbark, Smooth-barked Apple, and Poplar Box. It is found under rocks, logs and other ground cover. The Collared Delma is a burrowing species, found about 15cm below the ground (SEWPaC 2010; Cogger 2000). likely to inhabit vegetation with suitable cover (e.g. rocks, leaflitter and grass tussocks) on land zone 10 (e.g. 11.10.1, 11.10.3, 11.10.4, 11.10.7, 11.10.9, 11.10.11 and 11.10.13) within the Arcadia and Fairview CSG Fields. Species is also likely to inhabit RE11.3.2 in the	▪ Establish an exclusion zone (200m) around known breeding areas. This will also include briefing relevant staff and contractors and erecting visual barriers around the habitat area; ▪ No rehabilitation works will occur within 200m of this area during the breeding and rearing season (December - March) where possible; ▪ Rehabilitation of the gas fields must allow for the maximum re-establishment of native vegetation including the shrubby understorey and ground cover, providing habitat for small ground dwelling fauna species and restoration of landscape connectivity; ▪ Identify and undertake weed management of Creeping Lantana (*Lantana montevidensis*) (SEWPaC, 2008); ▪ Undertake continued weed

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
					Roma CSG Fields	removal (SEWPaC, 2008); ▪ Re-introduce surface rocks and other habitat such as logs (to be salvaged during pre-construction) in rehabilitation areas; ▪ Actively discourage any further removal of rock (SEWPaC, 2008); ▪ Potential sightings of the species will be reported to the EO, who will confirm the sightings and record them in a Species of Conservation Interest (SOCI) logbook; and ▪ Notify DERM and/or DSEWPC of sightings and/or breeding areas, as well as rehabilitation undertaken within Collared Delma habitat as part of the annual returns. Refer to: ▪ Queensland Brigalow Belt Reptile Recovery Plan (Richardson, 2006); ▪ Approved conservation advice for *Delma torquata* (SEWPac, 2008).
Denisonia maculata	Ornamental Snake	V	V	Known from remnant vegetation communities adjacent to the Arcadia Valley CSG Field. The Fairview CSG Field is within the range of the species but there are no known records to date. Ornamental Snake is not likely to occur in the Roma CSG Field	Preferred habitat is within, or close to habitat that is favoured by its prey, frogs. The species is known to prefer woodlands and open forests associated with moist areas, particularly gilgai (melon-hole) mounds and depressions, but also lake margins and wetlands. Ornamental Snake habitat is likely	▪ Establish an exclusion zone (200m) around habitat areas known to support this species. This will also include briefing relevent staff and contractors and erecting visual barriers around the habitat area; ▪ No rehabilitation works will occur within 200m of this area during

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
					to be found in Brigalow, Gidgee (*Acacia cambagei*), Blackwood (*Acacia argyrodendron*) or Coolibah (*Eucalyptus coolabah*)-dominated vegetation communities, or pure grassland associated with gilgais (SEWPaC 2010). The species is associated with the following REs: 11.3.3, 11.3.25 and 11.3.27. Other REs which may be important within the CSG Fields include 11.3.2, 11.3,4, 11.3.17, 11.3.21, 11,3,22, 11.3,27, 11.4.3, 11.4.7,11.4,8, 11.9.1, 11.9.3 and 11.9.5, However, non-remnant and regrowth areas, in particular areas near watercourses with cracking clays and/or natural levees may also be utilised by this species.	the breeding and rearing season; ▪ Re-introduce surface rocks and other habitat such as logs (to be salvaged during pre-construction) in rehabilitation areas; ▪ Rehabilitation of the gas fields must allow for the maximum re-establishment of native vegetation including the shrubby understorey and ground cover, providing habitat for small ground dwelling fauna species and restoration of landscape connectivity; ▪ Implement feral animal control within rehabilitation areas are required; ▪ Exclude grazing in rehabilitating riparian zones and known habitats to protect the ground cover and reduce soil erosion where practical; and ▪ Notify DERM and SEWPaC of sightings and/or breeding places, as well as rehabilitation undertakenwithin Ornamental Snake habitat as part of annual reporting. Refer to: ▪ Queensland Brigalow Belt Reptile Recovery Plan (Richardson, 2006).
Egernia rugosa	Yakka Skink	V	V	This species is known from Arcadia Valley and Roma CSG Fields. It is also likely to occur in	Known to occur in open dry sclerophyll forest, woodland and scrub. The core habitat of this	▪ Establish an exclusion zone (200m) around known populations. This will also include

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
				the Fairview CSG Field.	species is within the Mulga Lands and Brigalow Belt South Bioregions. It is commonly found in cavities under and between partly buried rocks, logs or tree stumps, root cavities and abandoned animal burrows. The species often takes refuge in large hollow logs and has been known to excavate deep burrow systems, sometimes under dense ground vegetation. In cleared habitat, Yakka Skinks can persist where there are shelter sites such as raked log piles, deep gullies, tunnel erosion/sinkholes and rabbit warrens. The species has also been found sheltering under sheds and loading ramps (Cogger 2000, DERM 2007, Richardson 2008, SEWPaC 2011c). Associated with the following REs:11.3.2, 11.4.3, 11.4.10, 11.4.12, 11.5.1, 11.5.4, 11.5.5, 11.7.1, 11.7.2, 11.7.4, 11.7.6, 11.7.7, 11.9.5, 11.9.7 11.10.1, 11.10.9 and 11.10.11.Other RE's which may be important within the CSG Fields, include 11.3.6, 11.3,14, 11.3.17, 11.3.18, 11.3,19, 11.3.39, 11.9.1, 11.9.2 and 11.9.13.However, non-remnant and regrowth areas may also be utilised by this species where they contain suitable shelter sites such as hollow logs, sink holes, rocky crevices and abandoned rabbit	briefing re;evemt staff and contractors and erecting visual barriers around the burrows; ▪ No rehabilitation works will occur within 200m of this area during the breeding and rearing season; ▪ Re-introduce fallen timber, rocks and ground cover in rehabilitation activities; ▪ Rehabilitation of the gas fields must allow for the maximum re-establishment of native vegetation including the shrubby understorey and ground cover, providing habitat for small ground dwelling fauna species and restoration of landscape connectivity; ▪ Implement feral animal controls within rehabilitation areas are required; ▪ Exclude grazing in rehabilitating core habitat areas throughout the establishment phase where possible; ▪ During rehabilitation, vehicle and pedestrian access within the CSG Fields will be restricted to defined access tracks; and ▪ Notify DERM and/or DSEWPC of sightings and burrows, as well as rehabilitation undertaken within Yakka Skink habitat as part of annual reporting. Refer to:

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
					warrens.	▪ Queensland Brigalow Belt Reptile Recovery Plan (Richardson, 2006).
Furina dunmalli	Dunmall's Snake	V	V	May potentially occur in all CSG Fields.	Dunmall's Snake has been found in a broad range of habitats, including forests and woodlands on black alluvial cracking clay and clay loams dominated by Brigalow, other Wattles, White Cypress Pine or Bull-oak, and various Spotted Gum, Ironbark, White Cypress Pine and Bulloak open forest and woodland associations on sandstone derived soils. likely to inhabit remnant vegetation on land zone 4, 5, 7, 9 and 10. This species is associated with the following REs, 11.5.1, 11.9.5 and 11.10.1. Other REs which may be important within the CSG Fields, include 11.3.2, 11.3.14, 11.3.17, 11.3.18, 11.3.19, 11.3.39, 11.4.3, 11.4,10, 11.4.12, 11.5.4, 11.5.5, 11.7.1, 11.7.2, 11.7.4, 11.7.7, 11.9.7 and 11.10.9, Non-remnant and regrowth areas may also be utilised by this species.	▪ Establish an exclusion zone (200m) around habitat areas known to support this species. This will also include briefing relevent staff and contractors and erecting visual barriers around the habitat area; ▪ No rehabilitation works will occur within 200m of this area during the breeding and rearing season where possible; ▪ Re-introduce surface rocks and other habitat such as logs (to be salvaged during pre-construction) in rehabilitation areas; ▪ Rehabilitation of the gas fields must allow for the maximum re-establishment of native vegetation including the shrubby understorey and ground cover, providing habitat for small ground dwelling fauna species and restoration of landscape connectivity; ▪ Implement feral animal control within rehabilitation areas are required; and ▪ Notify DERM and DSEWPC of sightings and/or breeding places, as well as rehabilitation undertaken within Dunmall's Snake habitat as part of annual reporting.

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						Refer to: ▪ Queensland Brigalow Belt Reptile Recovery Plan (Richardson, 2006).
Paradelma orientalis	Brigalow Scaly-foot	V	V	Potential – Arcadia Valley, Roma (URS, 2009). Recorded from Brigalow regrowth near the Dawson River in the Arcadia Valley CSG Fields. In addition, the Brigalow scaly-foot is likely to inhabit remnant vegetation on land zones 4, 5, 7 9 and 10. The species has also been recorded from vegetation communities contiguous with habitats within the CSG Fields, including areas within Expedition National Park and Carnarvon National Park.	Occurs in a wide range of (dry) forest and woodland habitats, including Brigalow woodland, Vine thicket regrowth and rocky habitats on sandstone ridges to flats and gently undulating plains with clay, loam or sand. Not tolerant of clearings. Specific habitat where species found includes remnant Brigalow woodland with sparse tussock grasses on grey cracking clay soils (Santos, 2009). REs – Arcadia Valley: 11.9.2, 11.9.4a, 11.9.4b, 11.9.5, 11.10.1, 11.10.3, 11.10.4, 11.10.7a, 11.10.8, 11.10.9, 11.10.11, 11.10.13a (URS, 2009). REs – Roma: 11.9.1, 11.9.3, 11.9.3a, 11.9.4a, 11.9.4b, 11.9.5, 11.9.7, 11.9.7a, 11.9.10, 11.9.11, 11.10.1, 11.10.9, 11.10.11 (URS, 2009).	▪ Establish an exclusion zone (200m) around known breeding habitat areas. This will include briefing staff and contractors and erecting visual barriers around the habitat area; ▪ No rehabilitation works will occur within 200m of this area during the breeding and rearing season where possible; ▪ Rehabilitation of the gas fields must allow for the maximum re-establishment of native vegetation including the shrubby understorey and ground cover, providing habitat for small ground dwelling fauna species and restoration of landscape connectivity; ▪ Undertake weed removal mechanically, or ensure chemicals used do not impact upon this species (SEWPaC, 2008); ▪ Re-introduce surface rocks and other habitat such as logs (to be salvaged during pre-construction) in rehabilitation areas; ▪ Carry out feral animal and weed

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						control measures as part of rehabilitation where required; ▪ Implement feral animal control within rehabilitation areas are required; and ▪ Notify DERM and DSEWPC of sightings and/or breeding places, as well as rehabilitation carried out in Brigalow Scaly-foot habitat as part of annual reporting. Refer to: ▪ Queensland Brigalow Belt Reptile Recovery Plan Approved conservation advice for *Paradelma orientalis* (SEWPaC, 2008).
Rheodytes leukops	Fitzroy River Turtle	V	V	Known to occur within the Fitzroy River catchment, including the Dawson River. Due to the ephemeral nature of the watercourses within the CSG Fields will limit the species distribution. This species is unlikely to occur within the Roma CSG Fields.	flowing streams and permanent waterbodies. In the dry season it may be found in large slow-flowing pools and non-flowing permanent water holes (DERM 2007). These waterbodies are usually rivers with large, deep, well oxygenated pools with rocky, gravelly or sandy substrates, connected by shallow riffles. Their preferred areas are often associated with *Vallisneria* spp. (Ribbonweed) beds (SEWPaC 2010). The only RE which is likely to provide suitable habitat for this species is 11.3.25.	▪ Establish an exclusion zone (200m) around habitat areas known to support this species. This will also include briefing staff and contractors and erecting visual barriers around the habitat area; ▪ No rehabilitation works will occur within 200m of this area during the breeding and rearing season; ▪ Reinstate natural hydrology where possible as part of rehabilitation; ▪ Exclude stock from rehabilitating riparian areas where possible; ▪ Waterway crossing(s) will be designed to ensure that construction time will be

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						minimised and rehabilitation can commence straight away; ▪ To avoid impacting on regenerating riparian zone and associated turtle nesting habitat, vehicle and pedestrian access within and adjacent watercourses and wetlands shall be restricted to the defined access tracks; ▪ Weather permitting, rehabilitation and reconsolidation of impacted watercourses shall commence immediately after the pipeline has been lowered in and backfilled; ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent riparian and creek bed communities; ▪ Wherever practicable, the use of large rocks and logs to moderate flows and/or stabilise banks should be employed as opposed to concrete; ▪ Ensure rehabilitation does not result in sediment runoff, pollution or change in the water table in areas where this species may occur (SEWPaC, 2008); and ▪ Notify DERM and SEWPaC of sightings and/or breeding areas, as well as rehabilitation conducted within Fitzroy River Turtle habitat as part of annual reporting. Refer to:

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						▪ Approved conservation advice for Rheodytes leukops (SEWPaC, 2008).
Mammals						
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Known to occur in the Expedition Range, which is contiguous with habitats in the Arcadia Valley and Fairview CSG Fields. Documented records of this species from the southern Brigalow Belt are scant, but there have been few targeted surveys. Both the Arcadia Valley and Fairview CSG Fields provide many potentially suitable roost sites (i.e. rocky overhangs and caves).The Large-eared Pied Bat is unlikely to occur in the Roma CSG Field due to a lack of suitable roost sites.	Roosts are primarily in cavities, overhangs, caves and holes among sandstone outcrops/escarpments, however this species has been observed roosting in disused mine shafts and disused Fairy Martin (*Hirundo ariel*) nests. It also possibly roosts in the hollows of trees in dry and wet sclerophyll forest. Known foraging habitat includes Cypress-pine dominated forest, tall open eucalypt forest with a rainforest sub-canopy, sub-alpine woodland, and sandstone outcrop country. In southeast Queensland the species has primarily been recorded from higher altitude, moist, tall, open forest adjacent to rainforest (SEWPaC 2010b). This species is associated with the sandstone landscapes of land zone 10, particularly REs: 11.10.1, 11.10.2, 11.10.3, 11.10.4, and 11.10.13.However, the species is likely to forage in a range of adjoining habitats including RE 11.3.2, 11.3.25, 11.3.39, 11.9.4 and 11.9.5, as well as regrowth and non-remnant areas.	▪ Establish an exclusion zone (200m) around known roost sites. This will also include briefing relevant staff and contractors and erecting visual barriers around the roost site; ▪ No rehabilitation works will occur within 200m of this area during the breeding and rearing season (June to March); ▪ Reduce the use of pesticides and consider alternatives where available; ▪ Re-instate, where necessary, vegetation surrounding and immediately adjacent to cave or tunnel entrances as part of rehabilitation; ▪ Install 'Fairy Martin friendly structures' in any road culverts and bridges (as a means to promote bat roost sites) (Schultz, 1998); and ▪ Notify DERM and SEWPaC of sightings and/or roosting habitats, as well as rehabilitation undertaken within Large-eared Pied Bat habitat as part of annual reporting. Refer to: ▪ The Action Plan for Australian

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						Bats (Environment Australia, 1999).
Dasyurus hallucatus	Northern Quoll	-	E	Potential – Arcadia Valley, Roma (URS, 2009). Recorded from the local area in the last 10 to 30 years, including Carnarvon, Bigge and Expedition Ranges.	The Northern Quoll occupies a diversity of habitats across its range which includes rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert. Northern Quoll are also known to occupy non rocky lowland habitats such as beachscrub communities in Queensland and are more likely to be present in high relief areas that have shallower soils, greater cover of boulders, less fire impact and closer to permanent water (SEWPaC 2010). They make dens in rock crevices and tree hollows (Menkhorst and Knight 2004). This species is associated with the following REs, 11.8.3, 11.9.4, 11.9.5, 11.10.1, 11.10.2, 11.10.3, 11.10.4 and 11.10.13. Other important REs are likely to include RE 11.3.2, 11.3.39, 11.7.1, 11.7.2, 11.7.4, 11.7.6, 11.7.7, 11.9.8, 11.10.7, 11.10.8, 11.10.9, 11.10.10 and 11.10.11. This species is also likely to disperse and/or forage in non-remnant and regrowth areas.	▪ Establish an exclusion zone (200m) around den sites. This will also include briefing relevant staff and contractors and erecting visual barriers around the den site; ▪ No rehabilitation works will occur within 200m of this area during the breeding and rearing season (June – September); ▪ Undertake weed management, with a focus on *Andropogon gayanus* and *Mission spp*. (SEWPaC, 2008); ▪ Do not undertake burn-offs within regenerating areas of habitat (SEWPaC, 2011); ▪ Implement feral animal control measures within rehabilitation areas as required; and ▪ Notify SEWPaC of sightings and den sites, as well as rehabilitation undertaken within Northern Quoll habitat as part of annual reporting. Refer to: ▪ Approved conservation advice for *Dasyurus hallucatus* (SEWPaC, 2008). ▪ Recovery outline for the Northern Quoll (SEWPaC, 2011).

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
Nyctophilus corbeni	South-eastern Long-eared Bat	V	V	This species has been recorded from habitats contiguous with the Fairview CSG Field. Potentially suitable roosting and foraging habitat occurs throughout the Fairview, Arcadia Valley and Roma CSG Fields.	This species occurs in a range of inland woodland vegetation types, including Box, Ironbark, Cypress Pine, Mallee, Bulloak, Brigalow and Belah woodlands / forests and will roost in tree hollows, crevices and under loose bark within these communities. The South-eastern Long-eared Bat forages within 3km from the roost in the understorey of the abovementioned communities, including the ground (Churchill 2008, SEWPaC 2010). Most records of the species in the Brigalow Belt South have been from REs, 11.3.2, 11.3.39, 11.5.1, 11.10.1 and 11.10.9. The species is likely to forage in a wide range of inland woodland vegetation types including REs 11.3.3, 11.3.25, 11.5.4, 11.9.5, 11.10.1, 11.10.4, 11.10.7 and 11.10.13. Roosting sites will be dependent on the availability of hollow bearing trees.	▪ Establish an exclusion zone (200m) around roost sites. This will also include briefing staff and contractors and erecting visual barriers around the roost site; ▪ No rehabilitation works will occur within 200m of this area during the breeding and rearing season where possible; ▪ Implement feral animal control within rehabilitation areas as required; ▪ Where disturbance to roosting habitats has occurred, provide appropriate nest boxes within retained or rehabilitated vegetation where practical; ▪ All removed hollows not containing fauna shall be used in rehabilitation works; ▪ Minimise chemicals such as herbicides and pesticides near roost areas; and ▪ Notify DERM and/or SEWPaC of sightings and/or roosting areas, as well as rehabilitation undertaken within South-eastern Long-eared Bat habitat as part of annual reporting. Refer to: ▪ The Action Plan for Australian

Scientific Name	Common Name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						Bats (Environment Australia, 1999).

Flora

Note: in accordance with the Coordinator-General conditions, type A restricted least concern plants (Schedule 7 of the *Nature Conservation (Administration) Regulation 2006*) should be avoided as far as possible. These species must be salvaged and used for on-site revegetation purposes (i.e. translocated). This includes species in the families Cycadaceae, Orchidaceae, and Zamiaceae; and species in the genus: *Brachychiton*; *Hydnophytum; Huperzia; Livistona; Myrmecodia; Platycerium;* and *Xanthorrhoea*. Procedures within the Salvage Management Plan (Santos, 2011) are to be followed for all type A restricted plants.

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
Acacia wardellii	Thomby Range Wattle	V	V	Observed within the Roma gas fields.	*Acacia wardellii* grows in shallow gravelly, weathered sandstone soils in eucalypt woodland and has been recorded from disturbed and recently burnt areas (TSSC 2008a). This species commonly occurs with Dusky-leaved Ironbark (*Eucalyptus fibrosa* subsp. *nubila*), Narrow-leaved Ironbark (*E. crebra*), Queensland Peppermint (*E. exserta*), White Cypress Pine (*Callitris glaucophylla*), Smooth-barked Apple (*Angophora leiocarpa*), Quinine Tree (*Petalostigma pubescens*), Bull Oak (*Allocasuarina luehmannii*) and other wattles (Santos 2007). RE associations within the Roma CSG field are unknown, however, in other parts of its range it occurs within RE 11.7.2, 11.7.4, 11.7.5, 11.7.6, 11.7.7 and in 11.5.1 where this RE adjoins land zone 7.	▪ Rehabilitation will include re-planting of this species, using endemic seedlings where possible; ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant communities and where possible, should encourage the natural progression of this species back into the disturbed areas; ▪ Weather permitting, rehabilitation of disturbed populations of this species shall commence within 3 months from the completion of the works; ▪ A PWMP will be implemented and will outline specific measures to minimise the risk of weed establishment within and adjacent the populations of this species; ▪ During rehabilitation works, access to these areas should be restricted to designated tracks only; ▪ Where required, reduce grazing pressures throughout the establishment periord, using temporary stock fencing (SEWPaC, 2008); ▪ Ensure no burning off is undertaken within

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						rehabilitating areas (SEWPaC, 2008); and ▪ SEWPaC and DERM will be notified of locations where this species has been observed, as well as where rehabilitation and re-planting of this species has occurred as part of annual reporting. Refer to: ▪ Approved conservation advice for *Acacia wardellii* (SEWPaC, 2008).
Bertya opponens	Coolabah Bertya	-	V	Observed within the Fairview gas fields.	Coolabah Bertya occurs in a range of habitats ranging from stony mallee ridges and cypress pine forest on red soils, to coastal cliff edges in open eucalypt forest (NPWS NSW 2002a). The wide variation in habitat type between the populations makes the identification of critical habitat very difficult (NPWS NSW 2002a). Coolabah Bertya is known to inhabit remnant vegetation on land zone 10 (especially RE 11.10.4). RE associations will be refined for this species during the course of the project.	▪ Rehabilitation will include re-planting of this species, using endemic seedlings where possible; ▪ Propagate this species for use in revegetation by collecting seeds (the species generally flowers between July and August, but has been recorded as early as June and as late as February as required (NPWS, 2002); ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant communities and where possible, should encourage the natural progression of this species back into the disturbed areas ▪ Weather permitting, rehabilitation of disturbed populations of this species shall commence within 3 months from the completion of the works; ▪ Where required, reduce grazing pressures throughout the establishment periord, using temporary stock fencing (NSW National Parks and Wildlife Service, 2003); ▪ A PWMP will be implemented and will outline specific measures to minimise the

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						risk of weed establishment within and adjacent the populations of this species; ▪ Ensure weed removal techniques do not pose a threat to the viability of the species (NSW National Parks and Wildlife Service, 2003); ▪ Implement feral animal control measures in rehabilitating core habitat areas as required; ▪ During rehabilitation works, access to these areas should be restricted to designated tracks only; and ▪ SEWPaC and DERM will be notified of locations where this species has been observed, as well as where rehabilitation and re-planting of this species has occurred as part of annual reporting. Refer to: ▪ Cobar-Coolabah Recovery Plan (NSW National Parks and Wildlife Service, 2003).
Brachychiton species: Brachychiton australis (Broad-leaved bottle tree), B. bidwillii (Little kurrajong), B. populneus (Kurrajong), B. rupestris (Narrow-leaved bottle tree).	Broad-leaved Bottle Tree / Little Kurrajong / Kurrajong / Narrlow-leaved Bottle Tree	Type A restricted	-	Likely to be present throughout a number of locations within the CSG Fields.	Variety of habitats throughout the CSG Fields including gullies, hillslopes, ridgelines, sandstone escarpments, sandplains, alluvial flats, rocky outcrops on sand, loam or clay soils.	▪ The type A Restricted Plants Salvage Plan shall be implemented in accordance with NCA approval conditions.

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
Cadellia pentastylis	Ooline	V	V	*Cadellia pentastylis* has been observed within the Arcadia and Roma gas fields (Santos 2007).	Ooline occurs on the western edge of the NSW north-west slopes, from Gunnedah to west of Tenterfield, and extends into Queensland to Carnarvon Range and Callide Valley, south-west of Rockhampton. Ooline grows in dry rainforest, semi-evergreen vine thickets and sclerophyll woodlands of Bendee (*Acacia catenulata*), Brigalow (*A. harpophylla*) and Mountain Yapunyah (*Eucalyptus thozetiana*), often locally dominant or as an emergent (TSSC 2008b). Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project. *Cadellia pentastylis* is known to inhabit remnant vegetation on land zones 7, 9 and 10 (especially RE 11.7.1, 11.7.2, 11.9.4 and 11.9.5).	▪ Rehabilitation will include re-planting of this species, using endemic seedlings where possible; ▪ Propagate this species for use in revegetation from semi-hard cuttings or fresh seed collected in late summer from ripening drupes (fruits) as required; ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant communities and where possible, should encourage the natural progression of this species back into the disturbed areas; ▪ Weather permitting, rehabilitation of disturbed populations of this species shall commence within 3 months from the completion of the works; ▪ Where required, reduce grazing pressures throughout the establishment periord, using temporary stock fencing (SEWPaC, 2008); ▪ A PWMP will be implemented and will outline specific measures to minimise the risk of weed establishment within and adjacent the populations of this species; ▪ Ensure weed removal techniques do not pose a threat to the viability of the species (SEWPaC, 2008); ▪ Implement feral animal control measures within rehabilitation areas as required; ▪ During rehabilitation works, access to these areas should be restricted to designated tracks only; and ▪ SEWPaC and DERM will be notified of locations where this species has been observed, as well as where rehabilitation and re-planting of this species has occurred

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						as part of annual reporting. Refer to: ▪ Approved conservation advice for *Cadellia pentastylis* (SEWPaC, 2008).
Cycas megacarpa	Large-fruited Zamia	E	E	Potential – Arcadia Valley (URS, 2009).	Spotted gum (*Eucalyptus maculata*) and narrow-leaved ironbark (*Eucalyptus crebra*) woodland and open forest with a grassy understorey. It has also been recorded on rainforest margins. The species usually grows on hill tops and steep slopes. It is found on varying topsoils; commonly sandy loams or shallow clay loams which are often stony. *C. megacarpa* occurs at altitudes of 40-600m above sea level (DERM, 2009). REs within Arcadia Valley: 11.9.2, 11.9.4a, 11.9.4b, 11.9.5, 11.10.1, 11.10.3, 11.10.4, 11.10.7a, 11.10.8, 11.10.9, 11.10.11, 11.10.13a (URS, 2009).	▪ Prior to disturbance, this species is to be prepared for translocation, as per the Salvage Management Plan; ▪ Rehabilitation sites are suitable locations for translocated species; ▪ Rehabilitation will include re-planting of this species, using endemic seedlings where possible; ▪ Where required, reduce grazing pressures throughout the establishment periord, using temporary stock fencing (Queensland Herbarium, 2007); ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant communities and where possible, should encourage the natural progression of this species back into the disturbed areas; ▪ Weather permitting, rehabilitation of disturbed populations of this species shall commence within 3 months from the completion of the works; ▪ A PWMP will be implemented and will outline specific measures to minimise the risk of weed establishment within and adjacent the populations of this species; ▪ Implement feral animal control measures within rehabilitation areas as required; ▪ During rehabilitation works, access to these areas should be restricted to designated

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						tracks only; ▪ Manage actvities in adjacent areas to ensure individuals and especially seedlings are not damage (Queensland Herbarium, 2007); and ▪ SEWPaC and DERM will be notified of locations where this species has been observed, as well as where rehabilitation and re-planting of this species has occurred as part of annual reporting. Refer to: National Multi-species Recovery Plan for the Cycads (Queensland Herbarium, 2007).
Dichanthium queenslandicum	King Bluegrass	V	V	Further studies required.	Endemic to Qld where it is usually observed in black clay soils around Emerald and occasionally the Darling Downs. RE associations are unknown for the CSG fields, however, grassland REs occurring on land zone 3, 8 and 9 are likely to be important.	▪ Rehabilitation will include re-planting of this species, using endemic seed stock where possible; ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant communities and where possible, should encourage the natural progression of this species back into the disturbed areas; ▪ Weather permitting, rehabilitation of disturbed populations of this species shall commence within 3 months from the completion of the works; ▪ A PWMP will be implemented and will outline specific measures to minimise the risk of weed establishment within and adjacent the populations of this species ; ▪ Implement feral animal control measures, within rehabilitation areas as required; ▪ Exclude grazing from rehabilitating habitat areas where possible; ▪ During rehabilitation works, access to these

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						areas should be restricted to designated tracks only; and ▪ SEWPaC and DERM will be notified of locations where this species has been observed, as well as where rehabilitation and re-planting of this species has occurred as part of annual reporting.
Dicanthium setosum	Bluegrass	NT	V	Not been observed within the CSG fields, however, been located within adjacent habitats (Santos, 2007).	In Queensland, this species has been recorded from the Leichhardt, Moreton, North Kennedy and Port Curtis pastoral districts. *Dichanthium setosum* is associated with heavy basaltic black soils and stony red-brown loam with clay subsoil and has been observed in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pastures (TSSC 2008d). Results of the pre-clearance data will be used to refine distribution and habitat preferences for this species during the course of the project. RE associations are unknown for the CSG fields, however, grassland REs occurring on land zone 3, 8 and 9 are likely to be important (i.e. 11.3.21, 11.8.11, 11.9.3 and 11.9.3a). RE associations will be refined for this species during the course of the project.	▪ Rehabilitation will include re-planting of this species, using endemic seed stock where possible; ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant communities and where possible, should encourage the natural progression of this species back into the disturbed areas; ▪ Weather permitting, rehabilitation of disturbed populations of this species shall commence within 3 months from the completion of the works; ▪ A PWMP will be implemented and will outline specific measures to minimise the risk of weed establishment within and adjacent the populations of this species (SEWPaC, 2008); ▪ Implement feral animal control measures, within rehabilitation areas as required; ▪ Where required, reduce grazing pressures throughout the establishment periord, using temporary stock fencing (SEWPaC, 2008); ▪ During rehabilitation works, access to these areas should be restricted to designated tracks only; and ▪ SEWPaC and DERM will be notified of

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						locations where this species has been observed, as well as where rehabilitation and re-planting of this species has occurred as part of annual reporting. Refer to: Approved conservation advice for *Dichanthium setosum* (SEWPaC, 2008).
Eriocaulon carsonii	Salt Pipewort	E	E	Has been observed within the gas fields (Santos, 2007).	Restricted to flowing mound springs (NSW NPWS, 2003).	▪ Control feral herbivores within rehabilitation areas as required; ▪ Carry out weed control as required within rehabilitation areas; ▪ DERM will be notified of locations where this species has been observed; ▪ Where applicable, a Weed Management Plan (WMP) will be developed and implemented and will outline specific measures to minimise the risk of weed establishment within and adjacent the populations of this species; ▪ Weather permitting, rehabilitation of disturbed populations of this species shall commence within 3 months from the completion of the works; ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant communities and where possible, should encourage the natural progression of this species back into the disturbed areas; ▪ Where required, reduce grazing pressures throughout the establishment periord, using temporary stock fencing (NSW National Parks and Wildlife Service, 2007);

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						▪ and ▪ To avoid impacting on regenerating populations, access to these areas should be restricted to designated tracks only. Refer to: Approved recovery plan – Salt Pipewort (NSW National Parks and Wildlife Service, 2007).
Eucalyptus virens	Shiny-leaved Ironbark	V	V	Has been observed within the Fairview and Arcadia Valley gas fields (Santos, 2007).	Shiny-leaved Ironbark is endemic to south-east Queensland and is known from near Inglewood, Tara, north-east of Eidsvold and the scarp on approach to the Maranoa River near Mt Moffat. This species occurs in Burnett–Mary, Border Rivers Maranoa–Balonne, Fitzroy, Condamine and South West Queensland Natural Resource Management Regions. Eucalyptus virens is known to inhabit remnant vegetation on land zone 10 (especially RE 11.10.4). RE associations will be refined for this species during the course of the project.	▪ Rehabilitation will include re-planting of this species, using endemic seed stock where possible; ▪ Collect seeds for propagating this species for use in revegetation where required; ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant communities and where possible, should encourage the natural progression of this species back into the disturbed areas; ▪ Weather permitting, rehabilitation of disturbed populations of this species shall commence within 3 months from the completion of the works; ▪ A PWMP will be implemented and will outline specific measures to minimise the risk of weed establishment within and adjacent the populations of this species; ▪ Implement feral animal control measures, within rehabilitation areas as required; ▪ Where required, reduce grazing pressures throughout the establishment periord, using temporary stock fencing (SEWPaC, 2008); ▪ During rehabilitation works, access to these

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						areas should be restricted to designated tracks only; and ▪ SEWPaC and DERM will be notified of locations where this species has been observed, as well as where rehabilitation and re-planting of this species has occurred as part of annual reporting. Refer to: Approved conservation advice for *Eucalyptus virens* (SEWPaC, 2008).
Homopholis belsonii	Belson's Panic	E	V	Not recorded from the CSG Fields, however recorded from habitats to the north of Capricorn Highway between the townships of Miles and Roma.	*Homopholis belsonii* is usually found in dry woodland habitats at elevations ranging from 200-520m altitude including rocky hills supporting White Box (*Eucalyptus albens*) and in Wilga (*Geijera parviflora*) woodland; flat to gently undulating alluvial areas supporting Belah (*Casuarina cristata*) forest ; soils and plant communities of Poplar Box (*Eucalyptus populnea*) woodlands and shadier areas of Brigalow (*Acacia harpophylla*), Yarran (*A. melvillei*), and Weeping Myall (*A. pendula*) communities; in Mountain coolibah (*Eucalyptus orgadophila*) communities; and on roadsides (TSSC 2008f). Within these habitats, the species is associated with fallen timber at the base of trees or shrubs, among branches and leaves of trees hanging to ground level or along the bottom of netting fences (TSSC	▪ Rehabilitation will include re-planting of this species, using endemic seed stock where possible; ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant communities and where possible, should encourage the natural progression of this species back into the disturbed areas; ▪ Weather permitting, rehabilitation of disturbed populations of this species shall commence within 3 months from the completion of the works; ▪ A PWMP will be implemented and will outline specific measures to minimise the risk of weed establishment within and adjacent the populations of this species; ▪ Ensure weed removal techniques do not pose a threat to the viability of the species (SEWPaC, 2008); ▪ Ensure fertilisers used in adjancet areas do not have an impact on this speices (SEWPaC, 2008);

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
					2008f). RE associations are unknown for the CSG fields, however, woodland and open woodland REs occurring on land zone 3, 4, 8 and 9 are likely to be important, particularly 11.3.2, 11.4.3, 11.9.5 and 11.9.6.	▪ Implement feral animal control measures within rehabilitation areas as required; ▪ Where required, reduce grazing pressures throughout the establishment periord, using temporary stock fencing (SEWPaC, 2008); ▪ During rehabilitation works, access to these areas should be restricted to designated tracks only; and ▪ SEWPaC and DERM will be notified of locations where this species has been observed, as well as where rehabilitation and re-planting of this species has occurred as part of annual reporting. Refer to: Approved conservation advice for *Homopholis belsonii* (SEWPaC, 2008).
Macrozamia fearnsidei	Curly Zamia	-	V	Has been observed within the Fairview gas fields (Santos, 2007).	Curly Zamia occurs in open woodlands of Large-fruited Yellow Jacket (*Corymbia watsoniana*), Lemon-scented Gum (*C. citriodora*), Smooth-barked Apple (*Angophora leiocarpa*) and Budgeroo (*Lysicarpus angustifolius*).It grows on flat-topped or undulating sandstone ridges with sandy or loamy substrate. Curly Zamia is known to inhabit remnant vegetation on land zone 10, especially RE 11.10.1, 11.10.4 and 11.10.13.	▪ Prior to disturbance, this species is to be prepared for translocation, as per the Salvage Management Plan; ▪ Rehabilitation sites are suitable locations for translocated species; ▪ Rehabilitation will include re-planting of this species, using endemic seedlings where possible; ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant communities and where possible, should encourage the natural progression of this species back into the disturbed areas; ▪ Weather permitting, rehabilitation of disturbed populations of this species shall commence within 3 months from the

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
						completion of the works; ▪ A PWMP will be implemented and will outline specific measures to minimise the risk of weed establishment within and adjacent the populations of this species; ▪ Implement feral animal control measures, within rehabilitation areas as required; ▪ Where required, reduce grazing pressures throughout the establishment periord, using temporary stock fencing (SEWPaC, 2008); ▪ During rehabilitation works, access to these areas should be restricted to designated tracks only; and ▪ SEWPaC and DERM will be notified of locations where this species has been observed, as well as where rehabilitation and re-planting of this species has occurred as part of annual reporting. Refer to: Approved conservation advice for *Macrozamia fearnsidei* (SEWPaC, 2008).
Macrozamia platyrhachis	-	E	E	Potential – Arcadia Valley (URS, 2009).	Scattered and locally abundant in eucalypt woodland or open forest at altitudes between 300-780m above sea level. The species grows on deep sandy soils, derived from sandstone (DERM, 2009). REs within Arcadia Valley: 11.9.2, 11.9.4a, 11.9.4b, 11.9.5, 11.10.1, 11.10.3, 11.10.4, 11.10.7a, 11.10.8, 11.10.9, 11.10.11, 11.10.13a (URS,	▪ Prior to disturbance, this species is to be prepared for translocation, as per the Salvage Management Plan; ▪ Rehabilitation sites are suitable locations for translocated species; ▪ Rehabilitation will include re-planting of this species, using endemic seedlings where possible; ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
					2009).	communities and where possible, should encourage the natural progression of this species back into the disturbed areas; ▪ Weather permitting, rehabilitation of disturbed populations of this species shall commence within 3 months from the completion of the works; ▪ A PWMP will be implemented and will outline specific measures to minimise the risk of weed establishment within and adjacent the populations of this species; ▪ Implement feral animal control measures, within rehabilitation areas as required; ▪ Where required, reduce grazing pressures throughout the establishment periord, using temporary stock fencing (Queensland Herbarium, 2007); ▪ During rehabilitation works, access to these areas should be restricted to designated tracks only; and ▪ SEWPaC and DERM will be notified of locations where this species has been observed, as well as where rehabilitation and re-planting of this species has occurred as part of annual reporting. Refer to: National Multi-species Recovery Plan for the Cycads (Queensland Herbarium, 2007).
Swainsona murrayana	Slender Darling Pea	V	V	Has been observed within the Roma gas fields (Santos, 2007).	*Swainsona murrayana* is found in grassland, herbland, and open Black-box woodland, often in depressions. This species grows in heavy grey or brown clay, loam, or red cracking clays. It is often	▪ Rehabilitation will include re-planting of this species, using endemic seed stock where possible; ▪ Revegetation shall be consistent with the plant density, floristic composition and distribution of the adjacent remnant

Scientific name	Common name	Status – NCA	Status – EPBC	Records	Habitat	Recovery Actions
					associated with low chenopod shrubs (*Maireana* spp.), wallaby-grass (*Austrodanthonia* spp), and spear grass (*Austrostipa* spp). The species may require some disturbance and has been known to occur in paddocks that have been moderately grazed or occasionally cultivated (TSSC 2008h). RE associations within the CSG fields are unknown for this species, however, REs likely to be of importance may potentially include 11.3.28, 11.4.4, 11.9.3 and 11.9.14.	communities and where possible, should encourage the natural progression of this species back into the disturbed areas; ▪ Propagate this species for use in revegetation by collecting seeds where required; ▪ Weather permitting, rehabilitation of disturbed populations of this species shall commence within 3 months from the completion of the works; ▪ A PWMP will be implemented and will outline specific measures to minimise the risk of weed establishment within and adjacent the populations of this species (REF); ▪ Implement feral animal control measures, within rehabilitation areas as required; ▪ Where required, reduce grazing pressures throughout the establishment periord, using temporary stock fencing (SEWPaC, 2008); ▪ During rehabilitation works, access to these areas should be restricted to designated tracks only; and ▪ SEWPaC and DERM will be notified of locations where this species has been observed, as well as where rehabilitation and re-planting of this species has occurred as part of annual reporting. Refer to: Approved conservation advice for *Swainsona murrayana* (SEWPaC, 2008).

Appendix 5

Monitoring and Maintenance Plan

Monitoring Plan (for all CSG activities other than pipelines)

Time	Management Actions	Monitoring	Responsibility
Commencement of rehabilitation	Site preparation (as per Rehabilitation Schedule): ▪ Reshaping of landform (where applicable); ▪ Installation of erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Respreading of topsoil; ▪ Weed control in accordance with PWMP; ▪ MNES areas are protected from livestock by fencing where appropriate. Revegetation (where applicable): ▪ Planting of tubestock; ▪ Replanting of significant flora species, as per SSMP and Salvage Management Plan; ▪ Fertiliser; ▪ MNES areas are protected from livestock by fencing; ▪ Spread mulch around planted stock to a radius of 1m and 100mm depth; ▪ Watering as required; Natural regeneration (where applicable): ▪ Respreading of cleared vegetation; ▪ MNES areas are protected from livestock by fencing; ▪ Replanting of significant flona species,	N/A	▪ Santos Operations

Time	Management Actions	Monitoring	Responsibility
	as per SSMP and Salvage Management Plan. Fauna habitat management ▪ Re-instate fauna habitat features such as woody material and rocks as per Appendix 4.		
6 months	▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Watering as required; ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011) (as required); ▪ Maintain fencing in MNES areas.	▪ Photo monitoring; ▪ Vegetation surveys, including BioCondition assessment; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011); ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks as per Appendix 4).	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)
12 months	▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Watering as required; ▪ Where natural regeneration is deemed unsuccessful due to unviable seedbank (i.e – optimal conditions for natural regeneration have occurred, and no evidence of growth is observed), replant with tubestock (refer to relevant rehabilitation schedule). Where conditions are not considered optimal, re-assess in 6-12 months; ▪ Reinstate of erosion and sediment control measures in accordance with	▪ Photo monitoring; ▪ Vegetation surveys; ▪ BioCondition assessments; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011); ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks as per Appendix 4).	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)

Time	Management Actions	Monitoring	Responsibility
	Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (Aurecon 2011) (as required); ▪ Maintain fencing in MNES areas.		
18 months	▪ Weed control; ▪ Watering as required; ▪ Reinstate of erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required); ▪ Maintain fencing in MNES areas.	▪ Photo monitoring; ▪ Vegetation surveys, including BioCondition assessments; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks as per Appendix 4).	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)
24 months	▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Where natural regeneration is deemed unsuccessful due to unviable seedbank, replant with tubestock (refer to relevant rehabilitation schedule). ▪ Watering as required; ▪ Reinstate of erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required); ▪ Maintain fencing in MNES areas.	▪ Photo monitoring; ▪ Vegetation surveys, including BioCondition assessments; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual' ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks as per Appendix 4).	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)
30 months	▪ Weed control; ▪ Replacement of plant mortalities (as required);	▪ Photo monitoring; ▪ Vegetation surveys; ▪ BioCondition assessments;	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)

Time	Management Actions	Monitoring	Responsibility
	▪ Watering as required; ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required); ▪ Maintain fencing in MNES areas.	▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival and recruitment of threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks as per Appendix 4); ▪ Evidence of threatened fauna presence (e.g. direct observation, call identification, scratches, scats, hair/feathers, feeding indicators) as per SSMP.	
36 months	▪ At 36 months (3 years), rehabilitation for ecological components should be complete. Additional management actions will be undertaken on an as needed basis, to be determined final (36 month) monitoring period. ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required);	▪ Photo monitoring; ▪ Vegetation surveys; ▪ BioCondition assessments; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival and recruitment of threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks as per Appendix 4).	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)
48 months	▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required).	▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual.	▪ Santos Operations (Maintenance)
60 months	At 60 months (5 years) rehabilitation and subsequent monitoring for erosion and subsidence should be complete. Additional management actions will be	▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual.	▪ Santos Operations (Maintenance)

Time	Management Actions	Monitoring	Responsibility
	undertaken on an as needed basis, to be determined as part of the final (60 month) monitoring period).		
Where rehabilitation sites do not meet the performance criteria at 36 & 60 months, extension of the monitoring and maintenance program is required. In the event of bushfire, monitoring and maintenance actions are to be implemented following a 12 month period to detect if natural regeneration is a viable option for regeneration. Where assisted regeneration is required following bushfire, monitoring periods are to be extended. Monitoring is to be conducted in all areas of MNES disturbed by non-natural fires to determine rehabilitation requirements. As above, Where natural regeneration is not effective 12 months following the bushfire, the assisted revegetation actions outlined in the schedules are to be implemented to vegetation communities to pre-disturbance condition.			
As required			

Pipeline Monitoring Plan

Time	Management Actions	Monitoring	Responsibility
Commencement of rehabilitation	Site preparation (as per Rehabilitation Schedule): ▪ Reshaping of landform (where applicable); ▪ Installation of erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Respreading of topsoil; ▪ Weed control in accordance with PWMP; Revegetation (where applicable): ▪ Planting of tubestock; ▪ Fertiliser; ▪ Spread mulch around planted stock to a radius of 1m and 50mm depth; ▪ Watering as required; Natural regeneration (where applicable): ▪ Respreading of cleared vegetation;	N/A	▪ Santos Operations
1 month	▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Watering as required; ▪ Reinstate of erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control	▪ Photo monitoring; ▪ Vegetation surveys; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival of planted threatened flora;	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)

Time	Management Actions	Monitoring	Responsibility
	Manual(as required).	▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks) as per Appendix 4).	
2 months	▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Watering as required; ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required).	▪ Photo monitoring; ▪ Vegetation surveys; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks) as per Appendix 4).	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)
3 months	▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Watering as required; ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required).	▪ Photo monitoring; ▪ Vegetation surveys; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks) as per Appendix 4).	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)
4 months	▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Watering as required; ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required).	▪ Photo monitoring; ▪ Vegetation surveys; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks) as per	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)

Time	Management Actions	Monitoring	Responsibility
		Appendix 4).	
5 months	▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Watering as required; ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required). ▪	▪ Photo monitoring; ▪ Vegetation surveys; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks) as per Appendix 4).	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)
6 months	▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Watering as required; ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required).	▪ Photo monitoring; ▪ Vegetation surveys; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks) as per Appendix 4)	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)
12 months	▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Where natural regeneration is deemed unsuccessful due to unviable seedbank (i.e – optimal conditions for natural regeneration have occurred, and no evidence of growth is observed) , replant with tubestock (refer to relevant rehabilitation schedule). Where conditions are not considered optimal, re-assess in 6-12	▪ Photo monitoring; ▪ Vegetation surveys; ▪ BioCondition assessments; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks) as per Appendix 4).	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)

Time	Management Actions	Monitoring	Responsibility
	months; ▪ Watering as required; ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required).		
18 months	▪ Weed control; ▪ Watering as required; ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required).	▪ Photo monitoring; ▪ Vegetation surveys including BioCondition assessments; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks) as per Appendix 4).	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)
24 months	▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Where natural regeneration is deemed unsuccessful due to unviable seedbank, replant with tubestock (refer to relevant rehabilitation schedule). ▪ Watering as required; ▪ Reinstate of erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control	▪ Photo monitoring; ▪ Vegetation surveys including BioCondition assessments; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks) as per Appendix 4).	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)

Time	Management Actions	Monitoring	Responsibility
	Manual (as required); ▪ Maintain fencing in MNES areas. ▪ Watering as required; ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required).		
30 months	▪ Weed control; ▪ Replacement of plant mortalities (as required); ▪ Watering as required; ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required).	▪ Photo monitoring; ▪ Vegetation surveys including BioCondition assessments; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival of planted threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks) as per Appendix 4).	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)
36 months	▪ At 36 months (3 years), rehabilitation for ecological components should be complete. Additional management actions will be undertaken on an as needed basis, to be determined final (36 month) monitoring period. ▪ Reinstate erosion and sediment control measures in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required);	▪ Photo monitoring; ▪ Vegetation surveys including BioCondition assessments; ▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual; ▪ Survival and recruitment of threatened flora; ▪ Evidence of threatened fauna habitat features (e.g. food sources, woody material & rocks) as per Appendix 4.	▪ Santos Operations (Maintenance) ▪ Ecologist (Monitoring)
48 months	▪ Reinstate erosion and sediment control measures in accordance with Soil	▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure	▪ Santos Operations (Maintenance)

Time	Management Actions	Monitoring	Responsibility
	Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual (as required).	(Aurecon 2011)/ Erosion and Sediment Control Manual.	
60 months	At 60 months (5 years) rehabilitation and subsequent monitoring for erosion and subsidence should be complete. Additional management actions will be undertaken on an as needed basis, to be determined as part of the final (60 month) monitoring period).	▪ Erosion and sediment control effectiveness in accordance with Soil Management Procedure (Aurecon 2011)/ Erosion and Sediment Control Manual.	▪ Santos Operations (Maintenance)
Where rehabilitation sites do not meet the performance criteria at 36 & 60 months, extension of the monitoring and maintenance program is required. In the event of bushfire, monitoring and maintenance actions are to be implemented following a 12 month period to detect if natural regeneration is a viable option for regeneration. Where assisted regeneration is required following bushfire, monitoring periods are to be extended. Monitoring is to be conducted in all areas of MNES disturbed by non-natural fires to determine rehabilitation requirements. As above, Where natural regeneration is not effective 12 months following the bushfire, the assisted revegetation actions outlined in the schedules are to be implemented to vegetation communities to pre-disturbance condition.			
As required			

Monitoring and Maintenance Record (for all CSG activities other than pipelines)

(To be updated after each monitoring event)

Monitoring Timing	Date Completed	Maintenance Required?	Maintenance details
6 months*		**Y / N**	
12 months		**Y / N**	
18 months		**Y / N**	
24 months		**Y / N**	
30 months		**Y / N**	
36 months Final monitoring period for ecological components		**Y / N** If no, rehabilitation considered final for ecological components. If yes, specify additional monitoring and maintenance requirements	
48 months Erosion & Subsidence Only		**Y / N**	
60 months Erosion & Subsidence Only		**Y / N** If no, landform is considered stable. If yes, specify additional monitoring and maintenance requirements	
As required			
Feedback to be incorporated into review of RRRMP methods / procedures			

*where natural regeneration methods have been implemented, the viability of the seed bank is to be assessed at 12 months. Where the seed bank is unviable (i.e. – no regeneration apparent, or poor species richness), regevetation is to occur as per the relevant benchmark schedule.

Pipeline Monitoring and Maintenance Record

(To be updated after each monitoring event)

Monitoring Timing	Date Completed	Maintenance Required?	Maintenance details
1 month		**Y / N**	
2 months		**Y / N**	
3 months		**Y / N**	
4 months		**Y / N**	
5 months		**Y / N**	
6 months*		**Y / N**	
12 months		**Y / N**	
18 months		**Y / N**	
24 months		**Y / N**	
30 months		**Y / N**	
36 months		**Y / N** If no, rehabilitation considered final. If yes, specify additional monitoring and maintenance requirements	
48 months Erosion & Subsidence Only		**Y / N**	
60 months Erosion & Subsidence Only		**Y / N** If no, landform is considered stable. If yes, specify additional monitoring and maintenance requirements	
As required			
Feedback to be incorporated into review of RRRMP methods / procedures			

*where natural regeneration methods have been implemented, the viability of the seed bank is to be assessed at 12 months. Where the seed bank is unviable (i.e. – no regeneration apparent, or poor species richness), revegetation is to occur as per the relevant benchmark schedule.

Monitoring and Maintenance Checklist

To be completed for each monitoring event in conjunction with BioCondition Proforma

Site Reference:			**Date of Rehabilitation Commencement**					
Photo Points	**N**		**S**		**E**		**W**	
Monitoring Date			**Waypoints**					
Monitoring Period			**Photo Reference**					
Relevant Benchmark Guideline			**Relevant TEC / Significant Species Management Plan:**					
Type of rehabilitation								
Revegetation (tree planting)			**Natural regeneration**					
(weedy) Regrowth management (e.g. poisoning exotic trees)			**Other** (describe)					
Native species composition	Canopy		Shrub		Herbs and Forbs		Ground Cover	
		Abundance		Abundance		Abundance		Abundance
Species Richness (total)								
Plant health (number of dead plants)								
Plant density (per ha)								
Plant height								
Weeds present								

% Weed cover				
Evidence of disturbance (record location with GPS)	Erosion / sedimentation:	Damage to sediment fencing	Fire	Drought
	Flood:	Grazing	Other	
Mulch depth				
Evidence of threatened species habitat (where required)				
Corrective Action Required? Y / N (if yes, describe actions taken)				
Recommended updated to RRRMP methods / procedures?				

Appendix 6

BioCondition Proforma

Appendix 2: BioCondition field assessment sheet (v 2.1)

Site:	**RE/Landtype:**	**Bioregion:**	**Property:**
Date:	**Photos** (optional) **N:**	**S:**	**E:** **W:**
Landscape photo(s):			**Spot photo (s):**
Datum: WGS84 or GDA94 Zone:	**0m mark AMGE:**		**AMGN:**
	50m mark AMGE:		**AMGN:**
Transect bearing:			
General description:			

100 x 50 m area: * Ecologically Dominant Layer (EDL)

Eucalypt large tree DBH **(from benchmark doc.):**	**Non-eucalypt large tree DBH** **(from benchmark doc.):**
Number of large eucalypt trees:	**Number of large non-eucalypt trees:**
Total large trees:	
Tree canopy (EDL) height:	
Subcanopy and/or emergent height (where relevant)**: S:** **E:**	
Proportion of dominant canopy (EDL) species with evidence of recruitment:	
Total tree species richness includes all tree (i.e. single stemmed >2 m height) species in 100 x 50 m, not just EDL species:	

50 x 10 m area: (*list species if known or count if unknown)

Shrub species richness (defined as single stemmed below 2 m or multi-stemmed from base or below 20 cm) ***:**
Grass species richness:
Forbs and others (non grass ground) species richness:
Non-native plant cover:

50 x 20 m area: Coarse woody debris (CWD; >10 cm, >0.5 m, measured to the plot boundary):

CWD Length:		CWD Length:		CWD Length:		CWD Length:		CWD Length:		CWD Length:	
1		8		15		22		29		36	
2		9		16		23		30		37	
3		10		17		24		31		38	
4		11		18		25		32		39	
5		12		19		26		33		40	
6		13		20		27		34		41	
7		14		21		28		35		Total:	

Five 1 x 1 m plots (* attributes used in scoring, however assessment of all attributes helps accurately estimate cover of each attribute)

Ground cover:	1	2	3	4	5	Mean
Native perennial ('decreaser') grass cover*						
Native other grass cover (if relevant)*						
Native forbs and other species (non-grass)						
Native shrubs (<1 m height)						
Non-native grass						
Non-native forbs and shrubs						
Litter*						
Rock						
Bare ground						
Cryptograms						
Total	**=100%**	**=100%**	**=100%**	**=100%**	**=100%**	

100 m transect

Tree canopy cover: (only assess Emergent (E) or Subcanopy (S) layers if the benchmark document stipulates that these layers should be present *trees in the same layer and continuous along the transect can be grouped)

Tree or group* (C or S or E)	Distance (m)	Total	Tree or group* (C or S or E)	Distance (m)	Total	Tree or group* (C or S or E)	Distance (m)	Total	Tree or group* (C or S or E)	Distance (m)	Total
										Total C:	
										Total S:	
										Total E:	

Shrub canopy cover: (*denote as native or exotic—only native shrub cover used in scoring)

Shrubs*	Distance (m)	Total	Shrubs	Distance (m)	Total	Shrubs	Distance (m)	Total	Shrubs	Distance (m)	Total	Shrubs	Distance (m)	Total
												Total native:		
												Total exotic:		

Appendix 7

Soils Management Plan / Erosion and Sediment Control Manual

Soil Management Procedure
Coal Seam Gas Fields
Santos Ltd

Report ref:
213885
18 February 2011
Revision 2

aurecon

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Document control

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Rev No	Date	Revision details	Typist	Author	Verifier	Approver
0	12 November 2010	Working Draft	CRB	CRB	AA	SJM
1	20 January 2011	Final Draft for Client Comment	KH	CRB	CM/MH	SJM
2	18 February 2011	Final	KH	CRB	CM	SJM

Contents

Revision register

Revision number / Reference number	Issue date	Revision description	Approver	Signature

The Soil Management Procedure is a living document and as such revision will be made over time. The Revision register has the purpose of summarising revision details, providing reference numbers, document issue dates and recording approval of revisions using wet signatures.

1. Purpose and objectives

The Gladstone Liquefied Natural Gas (GLNG) Project comprises:

- Extraction of Coal Seam Gas (CSG)
- A pipeline from the CSG fields to Gladstone
- A liquefied natural gas plant at Curtis Island

The GLNG project was declared to be a significant project under the *State Development and Public Works Organisation Act 1971 (Qld)* on the 16 July 2007. An Environmental Impact Statement (EIS) for the GLNG project as well as a supplementary EIS have been prepared and publicly exhibited under the Sated Development Act. A draft Environmental Management Plan (EMP) has been prepared. The State Development Act provides that once declared as a "significant" project and an EIS process is being followed, new or amended Environmental Authority (EA) and/or tenure application cannot be authorised until the Coordinator General's Report (Queensland Government, 2010), pursuant to the State Development Act, in April 2010. The CG comments directly related to this Soil Management Procedure (SMP) are as follows:

Condition 11 – Soils Information

Operational plans developed to support the applications for petroleum leases for the gas fields must be accompanied with soils management procedure for areas to be disturbed by petroleum activities to prevent or minimise the impacts of soil disturbance. These procedures must include but not be limited to:

a) establish baseline soils information for areas to be disturbed including soil depth, pH, electrical conductivity (EC), chloride, cations (calcium, magnesium and sodium), exchangeable sodium percentage (ESP), particle size and soil fertility (including nitrogen, phosphorous, potassium, sulphur and micronutrients);
b) a soils monitoring program outlining parameters to be monitored, frequency of monitoring and maximum limits for each parameter;
c) identify soil units within areas to be disturbed by petroleum activities at a scale of 1:10000, in accordance with the "Guidelines for Surveying Soil and Land Resources, 2nd Edition" (McKenzie et al. 2008), "Australian Soil and Land Survey Handbook, 3rd Edition" (National Committee on Soil and Terrain 2009) and "The Australian Soil Classification" (Isbell 2002);
d) develop soil descriptions that are relevant to assessment for agricultural suitability, topsoil assessment, erodibility and rehabilitation, for example:
    i) shallow cracking clay soils;
    ii) deep cracking clay soils;
    iii) deep saline and/or sodic cracking clay soils with melonholes;
    iv) thin surface, sodic duplex soils;
    v) medium to thick surface (say >15 cm), sodic duplex soils; and
    vi) non-sodic duplex soils;
e) detailed mitigation measures and procedures to manage the risk of adverse soil disturbance in the carrying out of the petroleum activity; and
f) for areas of good quality agricultural land, detailed methods to be undertaken to minimise potential impacts.

The SMP provides a framework to facilitate the successful implementation of soil management measures to mitigate potential environmental impacts and ensure compliance with the commitments of the GLNG EIS for the CSG field components. In addition the SMP provides a mechanism to ensure that Santos meets its internal environmental performance targets and where applicable, realise potential opportunities for enhanced environmental outcomes. The SMP forms part of a series of management plans developed under the draft EMP and Operational Plans (OP) for each CSG field in the GLNG project.

The Coordinator-General Evaluation Report (Queensland Government, 2010) for the GLNG EIS includes conditions that relate to soil management. The SMP aims to address the soil management related conditions of the Coordinator-General's Evaluation Report (Queensland Government, 2010) and incorporate soil management into Santos' OPs for the CSG fields.

Due to the extensive project area and changing nature of gas field projects this SMP has been developed to serve as a management framework document that outlines general soil management policies, specific investigation methodologies as well as information needed to guide day to day soil management decisions. The SMP also provides guidance on performance and compliance monitoring of management measures, development and implementation of corrective actions, and the review process for continual improvement. Table 1.1 provides an overview of the document structure and content in each section.

Table 1.1 Overview of document structure and content

Section	Heading	Content
1.0	Purpose and objectives	Outlines the purpose and content structure of the soil management procedure
2.0	Context	Outlines the geographical context of the site and provides an inventory of the potential disturbance activities
3.0	Baseline data collection and identification of soils management areas	Outlines the baseline soil sampling and data collection requirements including an assessment of the existing soil data available and a data gap analysis to determine the information required during future field investigations Identifies soil types and situations requiring specific management policies. This includes identification techniques that have been developed to assist in correct soil identification by site personnel
4.0	Soil mapping	Outlines the data and parameters required to be included in the production of a GIS soils map. These parameters have been determined and are included in detail in this document, as are the ongoing maintenance requirements necessary to ensure that the mapping remains current and up to date
5.0	Management and mitigation measures	Outlines management and mitigation measures for problem soils and general soil issues (eg topsoil, stockpiling)
6.0	Performance and compliance monitoring	Outlines performance criteria to measure the success of soil management activities. These assessment criteria have been developed to demonstrate regulatory compliance, but also to guide on-site management actions and to provide a basis for continuing improvement

This SMP is intended as a working document to provide continual improvement of environmental performance and to provide guidance to contractors to ensure all reasonable measures are taken to reduce environmental impact. This SMP is the key reference document that identifies actions and commitments to be followed by the designers, construction contractors and operators and incorporated into project documentation and procedures.

Where contractors' work covers routine and non routine activities not stipulated in the SMP, it is the responsibility of the contractor to identify the environmental aspects associated with these activities and to develop and implement plans and procedures to address these activities.

A copy of the SMP will be made available to the administering authority on request.

2. Context

2.1 Project location

The project is located in Queensland, Australia. The CSG fields extend from south of Roma to Emerald in Queensland. For detail of the project property descriptions, easement and local government boundaries refer to Appendix I of the GLNG EIS (URS, 2009).

2.2 Project description

The development of CSG fields will be undertaken pursuant to petroleum authorities granted under the *Petroleum and Gas (Production and Safety) Act 2004* and the *Petroleum Act 1923* administered by the Department of Mines and Energy. These authorities allow the holder to perform petroleum exploration (including coal seam gas), production and other incidental activities over land tenures. Agriculture is the primary land use for these land tenures. The industry operates on a multiple land use premise and works with local communities and landholders to ensure that while gas reserves can be developed other land uses such as grazing and agriculture, can continue. As agriculture relies on the soil environment it is important that the soil environment is not adversely affected due to the CSG activities.

Santos has established a development scenario for the GLNG project to assess the development potential for the CSG fields. Development areas will comprise of tenements within parts of Roma, Fairview, Arcadia Valley and part of the Comet Ridge fields. The development scenario is likely to require up to 1,200 development wells prior to 2015 and up to a total of 1,450 wells after 2015. The establishment of wells, pipeline networks and related infrastructure at the scale proposed will result in considerable localised disturbance to the soil environment and the impact of these will require appropriate assessment and management.

Although the Santos CSG tenures cover an area of approximately 24,000 km², the amount of land required for development is only expected to encompass about 6,900 km² equating to approximately 28 % of the total Santos tenure area (URS, 2009).

2.3 CSG field development and environmental management process

As outlined in the GLNG EIS (URS, 2009) developments of the CSG field may include a range of activities from geophysical investigation through to production and processing. Project phases include:

- Exploration – including geophysical survey and drilling of exploration wells
- Appraisal – drilling and testing of appraisal wells (also called pilot holes)
- Development, including:
  - Drilling and completion of production wells (wells drilled to enable gas production
  - Construction of centralised compression and water treatment facility, gas and water gathering networks, associated water management facilities and other related infrastructure
- Production/operation
- Rehabilitation and decommissioning

The development of the CSG fields involves a rolling program of exploration, appraisal, construction, operation, decommissioning and rehabilitation of CSG infrastructure over a large physical area and an extended period of time. Due to the nature of CSG exploration, the planning for field development, including the specific location of exploration and development wells and associated infrastructure is determined incrementally based on the outcome of ongoing exploration programs.

Initially the development in the CSG fields will begin with a small number of wells. This number will increase over time (several years). In addition, road networks will expand to provide access to each well and water and gas gathering lines will be established. Once sufficient wells are developed,

centralised compression and water treatment facilities will also be developed. As the wells are utilised and become depleted, they will be decommissioned over time and the area rehabilitated.

Based on the rolling nature of CSG field development, an OP will be used to manage the environmental risks associated with the project. The purpose of the OP will be to provide site and asset specific information regarding the actual and near term foreseeable CSG assets and activities. It will also provide detailed environmental management, monitoring requirements and control strategies in accordance with the agreed environment performance criteria as specified activities within the EA. The SMP integrates soil management into Santos' OPs for the CSG fields.

2.4 Potential disturbance activities

The exploration and development of the CSG field will result in activities that will impact on the soil environment during construction and operation. The potential disturbance activities have been summarised in Table 2.1. Further detailed information on disturbance activities can be found in the GLNG EIS (URS, 2009).

Table 2.1 Potential soil disturbance activities

Project component	Potential disturbance activity	Potential impact	Impact level[1]
Exploration • Access and maintenance tracks • Exploration wells	• Clearing of surface vegetation	• Increased gully and tunnel erosion of cleared surfaces • Sedimentation of adjacent waterbodies • Increased soil salinity through changes in hydrology	High
	• Earthworks involved in formation of safe and stable tracks	• Increased gully and tunnel erosion on tracks • Sedimentation of adjacent waterbodies • Loss of fertile soil	High
Appraisal and testing (up to 100 m x 110 m) • Appraisal (pilot) wells	• Clearing of surface vegetation and topsoil which are stockpiled for future rehabilitation	• Increased gully and tunnel erosion of cleared surfaces and stockpiles • Sedimentation of adjacent waterbodies • Increased soil salinity through changes in hydrology	High
	• Levelling the ground surface for the drill rig	• Loss of landform pattern • Increased gully and tunnel erosion form changes in overland flow	High
	• Construction of an earthen pit or sump to contain the cuttings removed from the well by water or air	• Decrease in landform stability • Increased gully and tunnel erosion during pit or sump construction • Increased soil salinity through increased water infiltration • Loss of fertile soil	High
	• Constructing a flare pit to contain the flare associated with the combustion of produced gas	• Decrease in landform stability • Loss of fertile soil • Increased gully and tunnel erosion during flare pit construction	High

Project component	Potential disturbance activity	Potential impact	Impact level[1]
	• Installing a cellar (a 2 m^3 void through which the drilling assembly passes) and surface conductor pipe.	• Decrease in landform stability • Increased gully and tunnel erosion during cellar construction • Loss of fertile soil	High
	• Disposal of cuttings will be by means of burial onsite	• Loss of fertile soil • Increased potential of soil contamination from burial of contaminated cuttings • Increased soil salinity from burial of saline cuttings	High
Development • Production wells • Pipelines • Water storage and treatment facilities • Centralised compressor stations • Nodal compressor stations • Accommodation facilities • Borrow pits and storage areas • Associated infrastructure (waste management, sewage, power, telecommunications, stormwater drainage)	• Clearing of surface vegetation	• Increased gully and tunnel erosion of cleared surfaces • Sedimentation of adjacent waterbodies • Increased soil salinity through changes in hydrology	High
	• Trenching and blasting for pipeline network installation	• Increased gully and tunnel erosion in trenches and blasting sites • Sedimentation of adjacent waterbodies • Loss of fertile soil	High
	• Pipeline integrity testing with treated hydrotest water	• Increased soil contamination for hydrotest water	Medium
	• Disposal of excess trench soil	• Disposal of soil in areas of unmatched soil properties (eg saline soils in non-saline affect areas) • Disposal of contaminated soil on uncontaminated areas	Medium
	• Levelling the ground surface for infrastructure	• Loss of landform pattern • Increased gully and tunnel erosion form changes in overland flow	High
	• Saline water application	• Increased saline and sodic soils from changes in hydrology and increasing salt levels in the soil profile	High
	• Construction earthworks for CSG infrastructure and associated infrastructure	• Increased gully and tunnel erosion during earthworks • Sedimentation of adjacent waterbodies • Loss of fertile soil	High
	• Excavation and blasting for borrow pits	• Loss of landform pattern • Increased gully and tunnel erosion during excavation and blasting	High

Project component	Potential disturbance activity	Potential impact	Impact level[1]
	• Sewage effluent absorption beds, irrigation fields and treatment ponds	• Increased soil contamination from contaminated effluent exposure • Increased saline and sodic soils from changes in hydrology and increasing salt levels in the soil profile	Medium
	• Brine containment and water management ponds	• Increased saline and sodic soils from changes in hydrology and increasing salt levels in the soil profile	Medium
Production/Operation	• Excavations for maintenance operations	• Increased gully and tunnel erosion during earthworks • Sedimentation of adjacent waterbodies • Loss of fertile soil	High
	• Emergency mitigation earthworks (ie bunds and containment areas)	• Increased gully and tunnel erosion during earthworks • Sedimentation of adjacent waterbodies • Loss of fertile soil • Increased soil contamination if bunded material is contaminaed • Increased saline and sodic soils if bunded material is saline	High
Rehabilitation and Decommissioning	• Excavation for removal of underground infrastructure	• Increased gully and tunnel erosion during earthworks • Sedimentation of adjacent waterbodies • Loss of fertile soil	Medium
	• Earthworks for landscaping	• Increased gully and tunnel erosion during earthworks • Sedimentation of adjacent waterbodies • Loss of fertile soil	Medium

1 Disturbance level indicates the affect or potential to affect the soil environment. The levels are summarised below:

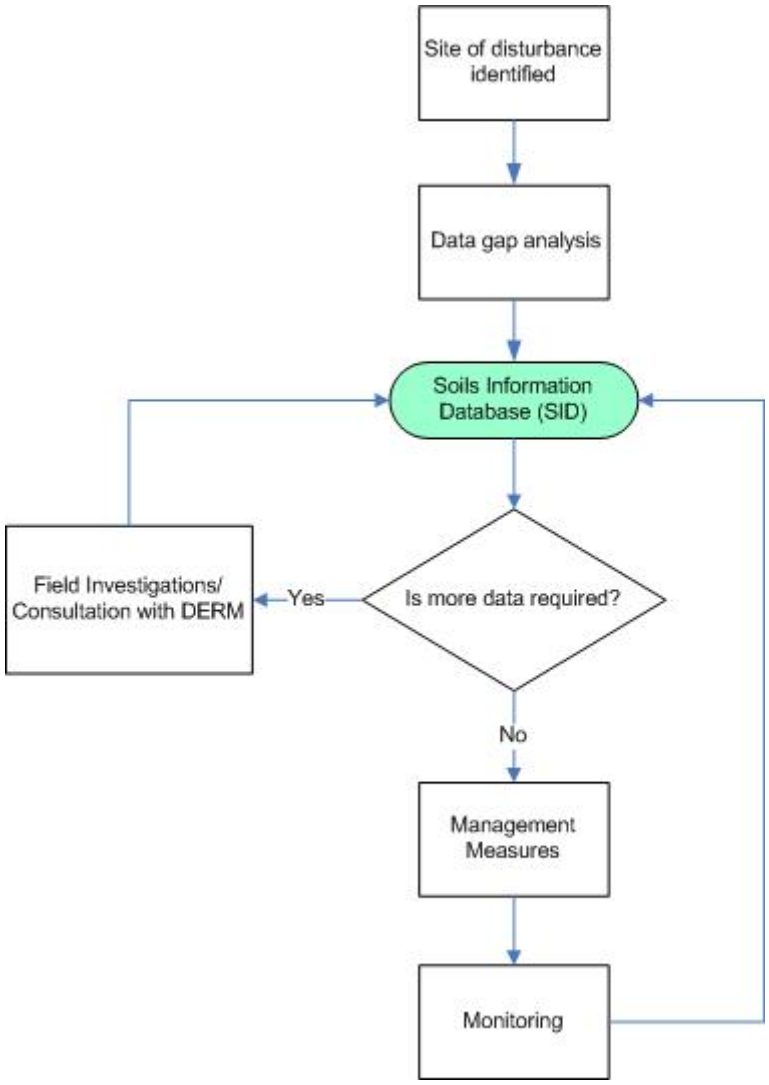
High: Direct affects or high potential
Medium: Indirect affects or medium potential
Low: No affect or low potential

Accelerated erosion is a key mechanism for soil loss. Mitigation and management measures relating to erosion and sediment control are detailed in the Erosion and Sediment Control Plan for the CSG fields.

3. Framework approach for the collection of soil data and identification of soil management areas

This section outlines the framework approach that will be implemented to collect existing data that will be used to inform soil management and determine soil management areas. Figure 3.1 illustrates the framework for the collection of soil data.

Figure 3.1 Soil data collection framework



3.1 Scale

To allow for a suitable level of detail to inform decision making the data for soil resources needs to be identified at a scale of 1:10 000. The recommended ground observation densities for conventional qualitative land resource survey are presented in Table 3.1 below (McKenzie *et al*, 2008).

Table 3.1 Recommended ground observation densities for conventional qualitative land resource surveys

Cartographic scale	Area per observation			No. observations made per unit area		
	Recommended range		Minimum acceptable	Recommended range		Minimum acceptable
	Upper	Lower		High	Low	
	Area (cm²) of published map per site					
1:10 000	1	2	4	1	0.5	0.25

Source: (McKenzie *et al*, 2008)

To meet the recommended 1:10 000 scale, baseline data must be reported at a minimum of 4 ha/site (ie 1 soil investigation point every 4 ha).

3.2 Existing data

To inform decision making, existing soil related data will be drawn upon.

Existing data sources include:

- Department of Environment and Resource Management (DERM) soils reports and mapping
- Aerial photography
- Geology and topography mapping
- Local government mapping
- Australian Soil Resource Information System (ASRIS)
- Santos investigations

The data will be collated and input into a Soils Information Database (SID) administered by Santos to allow data queries and analysis to be performed. The database will use a Microsoft Access environment and will be compatible for use in Geographical Information Systems (GIS) programs and Santos' EnviroSys. The database will store information with fields which correspond to the soil classifications (Greater Soil Groups, Australian Soil Classification, Factual Key, Soil Taxonomy Order) and soil attributes.

The compilation of the SID will provide information to inform the overall management evaluation process for the soil environment of the proposed disturbance. Existing data for each site from the SID will be reviewed and a data gap analysis performed. The outcome of this data gap analysis will provide the scope for targeted field investigation and information requests.

3.3 Data gap analysis

A data gap analysis of the existing data will be conducted using the minimum requirement soil attributes (refer Table 3.2). Any data gaps will build the scope for further investigation into the soil environment on the site of disturbance. The scale (refer Section 3.1) and currency of the existing data will also be assessed. The minimum attributes to be recorded for each soil data point are detailed below.

Table 3.2 Minimum requirement soil attributes for baseline data

Soil attribute	Units
pH	pH units
Electrical conductivity (EC) 1:5 solution - when used as a measure for salinity values should be converted to saturated extract values as outlined in the Salinity Management Handbook (Department of Natural Resources, 1997)	Decisiemens per metre (dS/m)
Exchangeable cations (aluminium, sodium, magnesium, calcium and potassium ions) and **Cation Exchange Capacity** (CEC)	Centimoles of positive charge per kilogram or milliequivalents per 100 grams (cmol(+)/kg or meq/100 g)
Particle size analysis clay = <0.002 mm silt = 0.002 – 0.02 mm fine sand = 0.02 – 0.20 mm coarse sand = 0.20 – 2.0 mm gravel = >2.0 mm	Millimetres (mm)
Exchangeable Sodium Percentage (ESP) - proportion of the cation exchange capacity occupied by sodium ions expressed as a percentage	Percentage (%)
Nitrogen, Phosphorus and **Potassium**	Milligram per kilogram (mg/kg)
Organic carbon – percentage of carbon lost on ignition	Percentage (%)
Extractable Sulphur	Milligram per kilogram (mg/kg)
Extractable Micronutrients	Milligram per kilogram (mg/kg)
Fabric/soil structure	Refer to Australian Soil and Land Survey Field Handbook Third Edition (The National Committee on Soil and Terrain, 2009)
Soil depth	Metres (m)
Good Quality Agricultural Land (GQAL) classification	Class A - Crop land Class B – Limited crop land Class C – Pasture land Class D – Non-agricultural land (DPI/DHLGP, 1993)
Topsoil/A horizon thickness	Metres (m)

This processes between the SID and field investigation is cyclical with all data feeding back into the SID and the SID informing targeted field investigations through data gap analysis (refer Figure 3.1)

Further investigation resulting from the data gap analysis will generally be via field investigation including soil sampling. In certain cases, consultation with the DERM and other organisations may provide further information reducing the need for further field investigations.

Through the data gap analysis the need and scope of field investigation will be defined annually using the minimum requirement soil attributes (refer Table 3.2). This will ensure the data collection and sampling process is targeted, thus reducing the duplication of data.

Once data at the adequate scale has been collected, management measures for each proposed disturbance can be determined.

3.4 Field investigations

The results of the data gap analysis will provide the scope for each field investigation. The field investigation may include soil sampling and analysis, landform surveys and soil profile description in accordance with:

- Guidelines for Surveying Soil and Land Resources, 2nd Edition (McKenzie et al. 2008)
- Australian Soil and Land Survey Handbook, 3rd Edition" (National Committee on Soil and Terrain 2009)

The use of rapid measurement of land survey tools based on spectral reflectance imagery or imaging spectroscopy of soil specimens should be considered, in conjunction with invasive soil investigations. These may also be of benefit for future soil monitoring (refer Section 6).

3.5 Identification of soil properties requiring management

Table 3.3 lists the soil properties that will require management during the CSG field development, operation, rehabilitation and decommissioning. These soil properties were identified in the GLNG EIS (URS, 2009).

Table 3.3 Soil areas requiring specific management

Properties	Indicators
Saline soils	Electrical conductivity of >4 dS/m Salt crusting on the soil surface Vegetation stress
Cracking clay/shrink swell soils	Melon hole Gilgai microrelief Visible cracking in the soil profile High clay content
Good quality agricultural land	Good Quality Agricultural Land mapping
Sodic and dispersive soils	ESP > 15 % Emerson dispersion test Visible signs of erosion
Topsoil	A horizon and sometimes B1 horizon materials that contain seed-stock, micro-organisms, organic matter and nutrients necessary for plant growth

Using the minimum required soil attributes for the CSG fields, management areas and specific management measures will be implemented (refer Section 5).

4. Soil Types and Mapping

4.1 Soil Types

The GLNG EIS (URS, 2009) identified soil types known to occur in the project area. The soil types and potential constraints are presented in the Table 4.1 below.

Table 4.1 Soil classification, description and potential constraints

Summary soil description	Australian Soils Classificaiton	Potential constraints
Skeletal, rocky or gravelly soils (>60% coarse fragments) with sandy, sily, loamy or clayey soil matrix	Lithosolic/Colluvic Rudosols	Skeletal to shallow rocky soils (>60% coarse fragments); rock outcrop and surface boulders
Sand soils; shallow to deep uniform or weakly gradational profiles; includes stratified alluvial soils, residual sand soils, earthy sands	Rudosol, Tenosol Podosol	Strongly acidic subsoils
Coarse to medium-textured soils; uniform or gradational profiles; predominantly sandy earths with sand, silty or clayey sand over clayey sand-sandy clay soil profiles; in parts with siliceous (Si) stone and/or ferruginous (Fe) gravel lenses included	Tenosols or Podosols.	Strongly acidic subsoils (>0.2 m)
Medium-textured sandy, sandy loam or silt to clay loamy surface uniform or gradational profiles with clay loam, light clay or medium clay subsoils, in places with siliceous stone and/or ferruginous gravelly lenses included	Tenosols, Kandosols or Ferrosols.	
Sand, loamy sand, sandy loam or loamy surface duplex soils over acidic to locally strongly acidic, in places neutral or slightly alkaline sandy clay to medium to heavy clay subsoils	Ferric Red-Brown Chromosols;	Strongly acidic in deeper subsoils
Fine sandy, silty or clay loamy surface duplex soils with neutral to alkaline often calcareous, sodic and locally saline medium to heavy clay or heavy clay subsoils	Sodic Yellow & Brown Kurosols	Shallow soils Strongly alkaline subsoils Hard clay subsoils Sodic subsoils
Shallow uniform often gravelly fine-textured soils, medium to deep uniform fine-textured (non-cracking) clay soils or gradational often stony or gravelly clay loam or light clay surface soils over alkaline medium to heavy clay subsoils, locally sodic and saline in the deeper subsoils – some deep incipient cracking clays	Subnatric Brown Sodosols, Chromosols, Sodosols or Calcarosols	Highly alkaline/calcareous Locally strongly acidic Sodic subsoils Moderately highly saline in the subsoil
Shallow to medium to deep uniform fine-textured (cracking) clay soils, locally with thin self-mulching surficial soils with dark grey, brown or black mostly alkaline or alkaline over acidic heavy clay subsoils in areas with gilgai micro-relief	Dermosol or Hydrosols.	Saline below 0.2 m on gilgai mounds Acidic heavy clay subsoils Sodic subsoils Often classified as GQAL

(URS, 2009)

4.2 Project soil mapping

4.2.1 Development of soil map

A soil map for the project area will be developed in accordance with the minimum requirements listed in Section 3.1 and 3.2 using MapInfo GIS software.

The soil mapping will use the existing soil unit mapping from the GLNG EIS (URS, 2009) as a base. An iterative approach will be undertaken for updating the GLNG EIS mapping with soil information and boundaries being updated with information from the SID and as data is gathered during field investigations and is uploaded in the MapInfo GIS software.

4.2.2 Soil map purpose

The final Project Soil Map will be used as a field tool to identify which soil types occur in specific locations. This will inform field staff of mitigation measures (see Section 5) to be implemented. This final Project Soil Map will include:

- Soil units map layer
- Disturbance sites
- GQAL
- Problem soils layer

Base data layers (soil units, GQAL and problem soils) will be over-laid with the proposed CSG field disturbance area. Mapping will be updated as the project develops to assess the nature of disturbance and the adequacy of the management measures. Appendix A presents an example of the soil maps that will be developed.

Checklists will be developed to correspond to the soil mapping information which will allow field staff to adopt appropriate mitigation measures during construction. Appendix B presents an example of the checklists that will be developed.

5. Management and mitigation measures

5.1 Management and mitigation measures for all areas

5.1.1 General soil management

General Erosion Control Measures

Erosion on field development construction and operational sites (i.e. well leases, compressor stations, accommodation facilities, in field pipeline networks and roads etc) will be minimised by:

- Limiting the area disturbed, and clearing progressively, immediately prior to construction activities commencing
- Planning activities with knowledge of soil types and soil characteristics
- Scheduling major earthworks activities to avoid, where possible, the higher rainfall months of December to March
- Safeguarding the surface layer by stripping and stockpiling topsoil prior to construction;
- Controlling runoff and sediment loss from disturbed areas using appropriate short term erosion control measures such as silt fences, hay bales, diversion mounds, etc
- Using temporary soil diversion mounds to control runoff within and to divert water away from the construction site where practicable
- Minimising the period that the bare soil is left exposed to erosion by rapidly establishing complete grass covers including perennial, creeping species with water truck or other irrigation if necessary
- Using sediment traps and sediment collection ponds to minimise off-site effects of erosion
- Where buried pipelines or other services are to be installed in sloping ground, in particular on slopes to drainage lines where surface runoff or sub-surface drainage may erode the trench backfill material, trench - breakers (vertical barriers to flow) should be installed at regular intervals to reduce flow along the trench and promote seepage to the groundwater. This will apply in particular where sodic and/or dispersive soils may occur. The locations of the trench-breakers will be identified prior to backfilling of the trench
- A series of low water diversion mounds (contour banks) will be installed across the entire width of the working area immediately following clearing, grading and stripping of topsoil. The diversion mounds should be located every 25 - 75 m, depending on the surface gradient and soil type. Water contained by each mound will be diverted to stable vegetated land on the down-slope side of the easement or into an area protected by a silt fence if surface vegetation is sparse or absent
- In sloping woodland areas, felled timber and vegetative matter could be respread on the contour over the cleared working area to assist soil stabilisation and to discourage 3rd party vehicle assess into these areas

Erosion Control on Sloping Land

- On sloping ground and in particular on slopes to drainage lines where surface runoff or sub - surface drainage along trenches housing pipelines or other buried services may erode the backfill material, trench-breakers (vertical barriers to flow) are to be installed at regular intervals to reduce flow along the trench and promote seepage to the groundwater. This will apply in particular where sodic and/or dispersive soils occur. Identify the locations of the trench-breakers prior to backfilling of the trench
- Install a series of low water diversion mounds across the entire width of the working area immediately following clearing, grading and stripping of topsoil. Locate diversion mounds every 25 - 75 m depending on the surface gradient and soil type. Divert water contained by each mound to stable vegetated land on the down-slope side of the disturbed area or into an area protected by a silt fence if surface vegetation is sparse or absent
- In sloping woodland areas felled timber and vegetative matter will be respread on the contour over the cleared working area to assist soil stabilisation and to discourage access into these areas and suitable, adapted creeping grasses will be established

Drainage Line Management

- Where pipelines or other buried services are required to cross water courses, where practicable these areas will be directionally drilled to reduce surface area disturbance and minimise environmental impact
- In other drainage lines, if required a 50 m vegetative buffer will be retained until construction across the streambed is imminent
- Streambed and bank materials will be graded away (upslope) from the streambed and placed in temporary stockpiles, a minimum of 50 m beyond the bank and protected on the down - slope side by a silt fence
- Where it is necessary to divert water flow around the crossing site, it will be pumped into a geofabric - lined containment area and control released a suitable distance downstream of the crossing site
- Temporary earth banks will be installed across the approach slopes to the drainage line to divert upslope surface runoff down stream of the crossing site
- When the pipe installation is complete the stream bed will be re-instated using material consistent with the existing streambed material. Stream banks will be re-established to a stable slope consistent with the existing bank slopes both upstream and downstream of the crossing site. Topsoil will be replaced and the area revegetated as soon as practicable. In places it may be necessary to place jute matting or use rock armouring for erosion control purposes
- Stabilisation of these sites would be assisted by pushing disturbed riparian vegetation back over the re-instated area to provide seed stock augmented with seeding with adapted low growing grasses. This will also help restrict cattle from accessing the area; otherwise it may be necessary to install temporary fencing

Dust Mitigation

- The methods employed should aim to reduce exposure of disturbed areas to the minimum period required and undertake revegetation or rehabilitation as soon as practicable after the completion of construction;
- Access tracks may require regular spraying using water trucks for dust suppression, in particular in established farming and other built-up areas
- Continued use of access tracks by heavy vehicles tends to pulverise the soil and produce bulldust. Upgrading the access track with gravel or bitumen will help reduce the potential for bulldust to develop. This should be assessed as the field develops
- Temporary use of cover crops may be utilised to stabilise bare soil stockpiles or other bare soil areas

The control of erosion and sediment movement within the CSG fields study area will be employed both during the construction stage and subsequently during the operating life. Where access is required in the long term, roads and access tracks will be constructed to Santos standards for rig roads, lease roads and field roads. In general local roads and access tracks will be sealed or constructed with a gravel surface and maintained to permit all weather access. Where access is required for temporary (construction) use only, disturbed areas will be lightly ripped, restored to a stable condition and revegetated or returned to their pre-disturbance land use condition as soon as practicable following the completion of construction activities.

Infrastructure and Development Areas

Erosion on construction areas will be minimised by:

- Limiting the area disturbed, and clearing progressively, immediately prior to construction activities commencing;
- Safeguarding the surface layer by stripping and stockpiling topsoil prior to construction;

- Using temporary soil diversion mounds to control runoff within and divert water away from the construction site where practicable;
- Minimising the period that bare soil is left exposed to erosion; and
- Using sediment traps/silt fences etc. to minimise off-site effects of erosion

Where practicable, organic mulching and/or planting of bare soil surfaces will be undertaken to reduce the effects of wind and water erosion and dust generation.

The project environmental officer will be responsible for maintaining a regular site monitoring program to ensure that the erosion control measures implemented are effective. Where necessary, an environmental management plan (EMP) will be implemented to address any new or ongoing problem areas.

The control of erosion and sediment movement throughout the site will be necessary both during the construction stage and subsequently during the operating life of the CSG fields. Where access is required for temporary use only, disturbed areas will be lightly ripped, restored to a stable condition and re-vegetated or returned to their pre-disturbance land use condition as soon as practicable following the completion of construction. Particular attention will be paid to those areas known to include dispersive soils, to ensure that if exposed they do not remain untreated or unprotected.

The strategy outlined above provides a summary of general erosion control measures that will be adopted. As field development progresses, and the nature and location of actual field development activities is more accurately determined, additional site specific erosion control measures will be developed and implemented.

Access Roads, Service Roads and Temporary Access Tracks

The following erosion control measures will be implemented, as required:

- Major access roads will normally be sealed and constructed to appropriate engineering design standards
- Unsealed or gravelled service tracks will be graded to a crown and provided with efficient surface drainage to prevent runoff eroding either the road surface or the adjacent land. Where necessary, low mounds angled across the track will be construction to divert runoff (at non-erosive velocity) into adjacent areas
- Cut and fill batters associated with service tracks will be formed to a safe slope and stabilized by vegetation, stone or rock armouring, or by the use of geo-fabric where appropriate
- Where table drains need to be established, they will be constructed to a broad dish shape, seeded with appropriate grasses and fertilized or lined appropriately, to prevent erosion. Table-drains will be slashed periodically to ensure vegetation growth is not restricting drainage flow
- Approaches on service tracks to gully and creek crossings will be as flat as practicable. The track will be sloped to direct runoff to a table-drain constructed as above. In some vulnerable areas, it may be necessary to spread and compact coarse aggregate along the approaches to the crossing to provide permanent, stable access, and reduce erosion
- Where provision of access across gullies or creeks cause disturbance, re-vegetation work will be undertaken
- All temporary construction tracks and associated disturbed areas will be ripped, seeded and fertilized when no longer required for use. Stockpiled topsoil will be re-spread before sowing. On steeper slopes the seeded areas will be protected if necessary

Borrow Pits

For locations proposed as borrow sources, soil erosion control measures will be introduced to minimise sediment movement onto adjacent land or into streams. The following erosion control management procedures will be adopted:

- Prior to significant site disturbance, drainage works will be installed to control both external runoff entering the site and the water drainage from it

- Runoff from land above the borrow site will be diverted around it. Runoff will be intercepted by banks and directed at a non-erosive velocity to a safe disposal area, such as a grassed waterway, or a pipe may be used to collect runoff and carry it through the site. Where the catchment above the site is large, stormwater retaining basins will be installed to augment these measures
- One or more banks will be located below the site to collect stormwater from it and direct it into a sediment basin to avoid damage to adjacent land or pollution of streams

Once a borrow pit is established, the following techniques will be implemented (where necessary) as a part of on-going site management:

- Disturbance will be restricted to a minimum area consistent with efficient operation of the site;
- Excavation will be designed to minimise the accumulation of water in stagnant pools
- Banks or channels will be located below areas yielding excessive runoff. These structures will collect the runoff before it erodes any bare areas downslope
- Where necessary, unsurfaced tracks will be treated with gravel and/or watered to reduce the generation of dust
- Topsoil will be progressively stripped from areas to be excavated and stockpiled separately from other excavated material. These stockpiles can take the form of wind-rows on the contour and can serve as the collector banks for runoff, so protecting land down slope
- Where practical, cut batters which have been created by the excavation, will be formed to a stable grade and topsoil spread over them. Revegetation of batters will be carried out to prevent runoff erosion. Stabilised chutes or pipe drops may be required to carry water safely down such embankments
- Where necessary, diversion banks will be constructed across the site to protect rehabilitation works

Clearing (where necessary), will be carried out progressively and immediately prior to each phase of the operation. Every effort will be made to retain some form of vegetative or grass cover for as long as practicable prior to stripping the topsoil layer. Uncontrolled surface water runoff from disturbed surface soil areas, and from any of the cracking clay soil areas with self mulching topsoils, may give rise to sheet or rill erosion with consequent sediment load increases in the local stream systems. Adequate measures will be taken to ensure that excessive erosion does not occur, and silt traps will be constructed where necessary.

Vegetation Clearing – General

- Disturbance of vegetation in construction areas will be limited to the minimum practicable
- Selective clearing techniques and heavy duty mulching of small-medium density vegetation will be used where practicable which will cause a minimum of disturbance to surface conditions
- Chipping/heavy duty mulching of smaller branches and foliage from the clearing operations in areas of high and very high erosion potential will provide a useful form of surface mulch to reduce surface erosion in the rehabilitation area
- Any millable timber resources will be identified and salvaged during the site clearing process, if practicable and economically feasible
- Clearing will be carried out in such a manner that where practicable, seed/root stock is left in the ground and surface soils are disturbed as little as possible
- Site rehabilitation and where appropriate, re - vegetation should be carried out progressively and as soon as practicable following the completion of construction in the area.

5.1.2 Topsoil management

Rationale

Useable topsoil resources are mainly confined to the surficial (A) horizon materials and in places in the upper part of the subsurface (B1) horizons, as they contain seed-stock, micro-organisms, organic matter and nutrients necessary for plant growth. Soil microbial activity, organic matter content and other parameters affecting soil productivity and fertility, tend to decrease with depth.

Management objectives

The objective of soil management is to identify soil material within a designated area of proposed disturbance for the purpose of selective stripping, storing and treating (if required) in order to protect and preserve the viability of the insitu seed-stock and nutrient condition for reuse during site rehabilitation.

Performance criteria

- Clearly mark clearing boundaries, no-go zones, vulnerable soils, vegetation and sites to be protected and parking, stockpiling and storage areas prior to disturbance
- Ensure topsoil resources from areas to be disturbed are salvaged
- Topsoil, vegetation, sub-soils and earthworks spoil will be stockpiled separately within designated storage locations throughout the duration of the project (APIA, 2009)
- Sediment control measures will be implemented, such as the installation of silt fences, around stockpiles to control potential loss of stockpiled soil prior to vegetative stabilisation.
- The potential proliferation of weeds species within topsoil will be assessed prior to soil handling operations and where appropriated control measures implemented in accordance with EHS09 – Weed and Pest Animal Control, prior to topsoil stripping
- Implement and maintain vegetation protection barriers, drainage protection and erosion and sediment control devices in accordance with approved plans
- Adopt suitable topsoil stripping depths for each mapped soil unit (refer Table 5.2)

Management measures

Table 5.1 documents the management measures to be implemented for soil management in order to mitigate the potential impact of surface soil disturbance activities.

Table 5.1 Soil management measures

Disturbance activity	Control activity	Action
Clearing surface vegetation	• Clearly mark the boundary of the area to be cleared and any 'no-go zones' • Confirm and implement control measures required to protect/identify hollow trees, waterways, drainage lines, and flora, fauna and Aboriginal cultural heritage resources identified within the area of disturbance • Implement weed control measures, if required • Restrict vegetation clearing within designated clearing boundaries	• Comply with legislative and permit requirements • Comply with EHS01 – Land disturbance • Comply with EHS11 Aboriginal cultural heritage management • Comply with QPWS requirements • Comply with EHS09 – Weed and pest animal control
Soil stripping	• Confirm mapped soil units and stripping depths (refer Table 5.2) to be applied during soil stripping • Utilise loaders and trucks for stripping activities to minimise impacts to topsoil structure	• Conduct soil stripping activities in accordance with stripping plans

Disturbance activity	Control activity	Action
Levelling, excavation and earthworks (including blasting)	• Restrict vehicle and plant movements to designated roads and active earthworks locations • Implement stripping of surface soils to mitigate impacts of compaction • Implement and maintain effective function erosion and sediment control devices • Install runoff diversion measures to direct offsite stormwater away from disturbed areas	• Inspect active earthworks locations daily and implement corrective actions as required • Inspect condition of erosion and sediment control devices daily and immediately after rainfall and implement corrective actions as required • Inspect drainage lines and receiving waterways immediately after rainfall and implement corrective actions as required • Inspect condition of designated roads, access tracks and implement corrective actions as required

Disturbance activity	Control activity	Action
Stockpiling and storage of material	• Restrict vehicle and plant movements to designated roads and active earthworks, stockpiling and storage locations • Locate designated stockpile and storage locations at least 50m away from surface waterways • Do not allow stockpiled material to encroach within the drip line of trees that are retained • Install runoff diversion measures to direct offsite stormwater away from stockpiles • Implement stockpile stabilisation for soil stockpiles • Deep rip all topsoil stockpiles to maintain aerobic conditions prior to reuse during rehabilitation • Implement weed control measures for all stockpiled material • Clearly sign-post stockpiled material for easy identification • Line sewage effluent absorption beds, treatment ponds, brine containment ponds and water management ponds to prevent uncontrolled infiltration of contaminants (including salts)	• Inspect designated stockpiling and storage locations daily and immediately after rainfall and implement corrective actions as required • Construct stockpiles in low mounds (maximum height 1.5m) • Construct stockpiles with 'rough' surface if intended for reuse or disposal within 6 months • Deep rip and sow soil stockpiles with local grass seed-stock if they are to be retained for more than 6 months • Apply ameliorant to stockpiles of dispersive soils • Comply with EHS09 – Weed and animal control • Comply with EHS requirements for water storage, management and reuse
Irrigation and water application	• Implement approved water management and reuse procedures for irrigation and dust suppression • Water use for dust suppression shall be implemented in accordance with EHS requirements for vehicle access tracks and stockpiles • Clearly mark designated uses/locations for water reuse	• Comply with regulatory and EHS requirements for water storage, management and reuse (including quantity and quality limits) • Comply with water quality limits stipulated in the EA for water reuse and dust suppression

Indicative stripping depths of potential topsoil resources have been determined for each of the major soil types identified, which are summarised in Table 5.2. Once a topsoil stripping area has been identified a pre-stripping assessment of topsoil depth will be conducted using a hand auger or site equipment to confirm depths.

Table 5.2 Topsoil stripping depths

Summary soil description	Soil Group	Indicative stripping depth (m)
Skeletal, rocky or gravely soils (>60% coarse fragments) with sandy, silty, loamy or clayey soil matrix.	Lithosolic/Colluvic Rudosols	0
Sand soils; shallow to deep uniform or weakly gradational profiles; includes stratified alluvial soils, residual sand soils, earthy sands.	Rudosol, Tenosol Podosol	0.1 – 0.25
Coarse to medium-textured soils; uniform or gradational profiles; predominantly sandy earths with sand, silty or clayey sand over clayey sand-sandy clay soil profiles; in parts with siliceous (Si) stone and/or ferruginous (Fe) gravel lenses included.	Tenosols or Podosols.	0.2 – 0.3
Medium-textured sandy, sandy loam or silt to clay loamy surface uniform or gradational profiles with clay loam, light clay or medium clay subsoils, in places with siliceous stone and/or ferruginous gravely lenses included.	Tenosols, Kandosols or Ferrosols.	0.2 – 0.3
Sand, loamy sand, sandy loam or loamy surface duplex soils over acidic to locally strongly acidic, in places neutral or slightly alkaline sandy clay to medium to heavy clay subsoils.	Ferric Red-Brown Chromosols;	0.2 – 0.3
Fine sandy, silty or clay loamy surface duplex soils with neutral to alkaline often calcareous, sodic and locally saline medium to heavy clay or heavy clay subsoils.	Sodic Yellow & Brown Kurosols	0.15 – 0.25
Shallow uniform often gravely fine-textured soils, medium to deep uniform fine-textured (non-cracking) clay soils or gradational often stony or gravely clay loam or light clay surface soils over alkaline medium to heavy clay subsoils, locally sodic and saline in the deeper subsoils – some deep incipient cracking clays.	Subnatric Brown Sodosols, Chromosols, Sodosols or Calcarosols	0.2 – 0.3
Shallow to medium to deep uniform fine-textured (cracking) clay soils, locally with thin self-mulching surficial soils with dark grey, brown or black mostly alkaline or alkaline over acidic heavy clay subsoils in areas with gilgai micro-relief.	Dermosol or Hydrosols.	0.2 – 0.2 (rises)/0.3 (in depressions)

(URS, 2009)

Some variability will occur with respect to the available topsoil resources within the soil groups and soil types identified within the respective CSG fields. Accordingly, monitoring of soil type variability will be undertaken by qualified personnel during the topsoil pre-stripping operations to ensure that the maximum quantity and quality of useable topsoil resources is recovered for later use in site rehabilitation (URS, 2009).

5.2 Management and Mitigation Measures for Specific Areas

Some locations within the project area will require additional management and mitigation measures to those listed above. These are detailed in the following sections.

5.2.1 Good Quality Agricultural Land (GQAL)

Rationale

Land classified as GQAL may be subject to short term disruption of existing land use during the development of the gas fields. As these lands represent existing or potentially arable lands which are subject to regular or periodic cultivation for crop production or improved pasture, it is important to

manage disturbance activities in a manner that will minimise the duration of the disruption and will not compromise the future land use viability

Management objectives

GQAL mapping will be made available to project teams so they can identify when to implement the management measures for proposed disturbance involving GQAL.

Performance criteria

- Achieve appropriate soil cover thickness over buried infrastructure
- Minimise disruption to agricultural activities and disturbance of GQAL
- Reinstate disturbed areas to pre-construction condition
- Maintain GQAL classification

Management measures

Table 5.3 documents the management measures to be implemented for GQAL management in order to mitigate the potential impact of surface soil disturbance activities.

Table 5.3 GQAL management measures

Disturbance Activity	Control activity	Action
Clearing surface vegetation	• Refer Table 5.1	• Refer Table 5.1
Soil stripping	• Refer Table 5.1	• Refer Table 5.1
Levelling, excavation and earthworks	• Refer Table 5.1 • Use existing access tracks where possible. Where this is not possible, efforts will be made to reduce the impact of infrastructure and trafficking on paddocks and farming patterns (eg running roads parallel to farming patterns) • Agree the location of new access tracks and their use with landowners • Remove temporary access tracks (unless otherwise agreed with the landholder) and disturbed land will be lightly ripped, topsoil will be replaced and the land returned as near as possible to its pre-construction land use condition • Construct permanent erosion and sediment control measures to reinstate overland flow patterns to return land to as near as possible to its pre-construction condition • Return ground levels to pre-construction levels during rehabilitation, to avoid negative impacts on irrigation, or the concentration of runoff or ponding • Reinstate soils over buried infrastructure to achieve a minimum soil cover thickness of 0.9m to allow for normal cultivation practices • In areas where deep ripping is a normal practice or is proposed to be carried out by the property landholder, then the minimum cover thickness will be extended to 1.8 m or a depth agreed with the land holder • Provide for ongoing maintenance programmes to treat areas of differential settlement associated	• Refer Table 5.1 • Clearly mark access tracks and restrict construction vehicle movements to the designated tracks • Restrict construction vehicle movements to clearly marked, designated access tracks • Comply with agreed reinstatement condition of disturbed areas • Comply with required/agreed soil cover thicknesses during reinstatement of disturbed areas

Disturbance Activity	Control activity	Action
	with buried infrastructure that interrupt the pre-existing surface water flow within intensively cultivated areas	
Stockpiling and storage of material	• Refer Table 5.1 • Remove temporary stockpiles and storage areas and disturbed land will be lightly ripped, topsoil will be replaced and the land returned as near as possible to its pre-construction land use condition	• Refer Table 5.1 • Comply with agreed reinstatement condition of disturbed areas
Irrigation and water application	• Refer Table 5.1	• Refer Table 5.1

5.2.2 Problem soils

For the purpose of this SMP, 'problem soils' have been identified as:

- Sodic and/or dispersive soils
- Reactive soils
- Saline soils

Rationale

Sodic and/or dispersive soils

Sodicity is the level of exchangeable sodium in the soil and is determined using the exchangeable sodium percentage (ESP), which is the amount of exchangeable sodium expressed as a percentage of the Cation Exchange Capacity (CEC) soils are considered to be sodic when they have an ESP >6%. Sodic soils when exposed tend to exhibit the following general problems:

- Severe surface crusting
- Likely dispersion on wetting
- Very low infiltration and hydraulic conductivity
- Very hard dense subsoils
- High susceptibility to severe gully erosion if exposed and unprotected
- High susceptibility to tunnel erosion

Soils with medium to high levels of exchangeable sodium (ESP) generally tend to pre-dispose the material to dispersion. As a result these soils may become subject to rill and/or gully erosion if disturbed or exposed and left unprotected from the effects of rainfall or surface water infiltration. However, in some situations where highly acidic soils occur (pH <5.5), this appears to counteract the dispersive effects of soil sodicity, with indicative dispersion testing indicating the majority of these sodic and strongly acidic materials being non-dispersive.

Reactive soils

These relate primarily to the occurrence of highly reactive (cracking) clay. These soils exhibit substantial shrinkage and swelling characteristics due to wetting and drying cycles which may result in damage to structures, foundations and buried services (including pipelines) due to differential ground movements. The degree of shrinkage and swelling of soils and associated soil movement is dependent on the thickness of the soil profile and the clay content and the clay mineral type present.

Shallow to medium deep and deep highly reactive soils occur extensively throughout the CSG fields.

Saline soils

Primary soil salinity (high levels of soluble salts) is salinity that occurs naturally within the soil profile usually in the subsoil layers. Secondary salinity including saline surface outbreaks occur as a result of rising groundwater in these areas usually as a result of clearing of trees and deep-rooted vegetation. In addition to deleterious effects on plant growth, soils with high levels of soluble salts increase the potential for corrosion of buried steel and/or concrete products.

Management objectives

Sodic and/or dispersive soils

Where sodic and dispersive soils do occur, adopting the relevant erosion control measures will assist in mitigating the deleterious effects of these problem soils.

Where strongly or very strongly sodic and/or dispersive materials are identified; these materials will not be used for rehabilitation purposes. However, should suspected sodic or dispersive materials be exposed as a result of site earthworks (subject to confirmation by appropriate soil testing), then dolomite or gypsum-based soil conditioner will be spread and blended into the exposed surface soils to restore the ionic balance and thus reduce levels of sodicity and dispersion effects in the soils. The use of a suitable thickness of topsoil as a cover over sodic/dispersive soils will also help to minimise the deleterious effects of these soils (URS, 2009).

Additional management measures are outlined in the Erosion and Sediment Control Plan for the CSG fields.

Reactive soils

The impact of differential soil movement with respect to the integrity of pipeline facilities and buried services can be mitigated to a large extent by the use of an inert (sandy) padding material encasing the facility.

Prior to the final engineering design being completed, detailed field investigations including drilling, soil sampling and testing will be undertaken to clearly define the properties and extent of occurrence of these reactive soils and their potential impact on the long-term integrity of structures and/or buried services (URS, 2009).

Saline soils

In areas with saline soils, a common salinity management recommendation is to avoid clearing of trees and other woody vegetation, or revegetate cleared areas as soon as practicable following disturbance. This helps to maintain groundwater at a lower level and reduces the risk of secondary salinisation that may result from a general rise in groundwater level as a result of clearing. However much of the existing high risk salinity areas have already previously been cleared for cropping and/or grazing and deep drainage vegetation is required to lower the water table below the root zone is necessary to combat secondary salinity effects in these areas. Application of excess water on occasions to leach the build-up of soluble salts in the plant root zone is one means of combating salt build-up in the surficial soils (URS, 2009).

Performance criteria

- Surface stabilisation in areas of mapped problem soils to achieve stable landform throughout the duration of disturbance
- Achieve stable permanent landform through reinstatement activities confirmed through visual monitoring event at the end of the first wet season after completion of reinstatement works
- Maintain soil nutrient condition and structural integrity confirmed through annual visual monitoring event and recording of active erosion conditions, presence/absence of surface scouring and presence/absence of vegetative cover

Management measures

Table 5.4 documents the management measures to be implemented for problem soils management in order to mitigate the potential impact of surface soil disturbance activities.

Table 5.4 Problem soils management measures

Disturbance activity	Control activity	Action
Clearing surface vegetation	• Refer Table 5.1 • In areas prone to salinity, removal of vegetation will be limited, to avoid the potential for groundwater tables to rise • If an area must be cleared, revegetation will be carried out as soon as is practicable • Rehabilitation/revegetation areas established will be maintained during construction of the project • Clearing methods, in sodic soils, will be utilised that minimise ground disturbance and maintains root stock as far as possible • In areas of sodic soil, vegetation will be mulched to provide additional organic matter to the soil for the reinstatement process	• Refer Table 5.1 • Visual monitoring for any signs of salinity will be conducted (eg saline outbreaks, vegetation and waterlogging) • Visual monitoring for signs of sodic and reactive soils (eg uncontrolled sedimentation, gully or tunnel erosion and gilgai microrelief)
Soil stripping	• Refer Table 5.1 • Sodic Soil topsoil removal will be limited to the area along the trench and where subsoil is to be placed	• Refer Table 5.1
Levelling, excavation and earthworks	• Refer Table 5.1 and 5.3 • Prior to major earthworks, ground investigations should be carried out in soils prone to salinity, to establish the depth at which saline conditions occur • In areas of sodic soil additional soil and erosion control measures will be implemented where evidence or erosion or scouring is found • Areas of sodic soil will be clearly marked on alignment sheets	• Refer Table 5.1 and 5.3 • Visual monitoring for any signs of salinity will be conducted (eg saline outbreaks, vegetation and waterlogging) • Visual monitoring for signs of sodic and reactive soils (eg uncontrolled sedimentation, gully or tunnel erosion and gilgai microrelief)

Disturbance activity	Control activity	Action
Stockpiling and storage of material	• Refer Table 5.1 and 5.3 • Excavated saline subsoil will be capped with suitable topsoil material when backfilling. This will support plant growth and provide a less-hostile medium for plant roots during establishment • Stockpiled saline subsoil will be bunded both upstream and downstream to reduce runoff ponding and salt ingress	• Refer Table 5.1 and 5.3 • Visual monitoring for any signs of salinity will be conducted (eg saline outbreaks, vegetation and waterlogging) • Visual monitoring for signs of sodic and reactive soils (eg uncontrolled sedimentation, gully or tunnel erosion and gilgai microrelief)
Irrigation and water application	• Refer Table 5.1	• Refer Table 5.1 • Visual monitoring for any signs of salinity will be conducted (eg saline outbreaks, vegetation and waterlogging) • Visual monitoring for signs of sodic and reactive soils (eg uncontrolled sedimentation, gully or tunnel erosion and gilgai microrelief)

6. Performance and compliance monitoring

6.1 Purpose

To ensure management measures are being implemented effectively and to ensure any changes in the soil environment are managed appropriately.

6.2 Performance criteria

The performance requirements for CSG fields will be:

- No loss of fertile topsoil material to occur on site
- No change to GQAL status
- No increase in the occurrence of problems soils
- No increase in erosion and sedimentation
- No increase in soil contamination
- Creation of stable landforms consistent with existing landform patterns

6.3 Inspection and surveillance

6.3.1 Construction

Site inspections are required in order to ensure that control structures and mitigation measures are effectively preventing environmental harm. The following inspections will occur throughout the construction period.

Table 6.1 Inspection and surveillance schedule

Monitoring activity	Monitoring criteria	Corrective actions
Daily		
Visually inspect erosion and sediment control devices at the boundary of the disturbance area Record need for corrective action in daily log	• 80% capacity • Good condition • Effective mitigation of sediment discharge offsite and/or signs of accelerated erosion	• Remove sediment build-up to maintain 80% capacity • Repair damage, as required to restore effective function of the device • Replace or relocate device where visual inspection indicates that the current device is ineffective or improperly installed
Visually inspect site rainfall gauge or obtain data from the Bureau of Meteorology for the nearest station to be site	• Record of rainfall for previous 24 hours	• Implement a process for monitoring rainfall for the site

Monitoring activity	Monitoring criteria	Corrective actions
Visually inspect construction activities and disturbed areas adjacent to no-go zones, protected/retained vegetation and mapped cultural heritage sites	• No disturbance/damage beyond designated clearing boundaries • No damage to protected/retained vegetation or mapped cultural heritage locations	• Record and report disturbance beyond designated clearing boundaries in compliance with site requirements • Commence reinstatement works to restore areas disturbed outside the clearing boundary • Record and report, if required disturbance or damage to protected/retained vegetation and cultural heritage sites in compliance with site and regulatory requirements
Weekly		
Visually inspect stockpiles	• Long-term storage stockpiles effectively covered or vegetation stabilised • Short-term or active stockpiles maintain structural integrity and comply with maximum height (1.5m)	• Reinstate/replace cover or apply local grass seed-stock • Reform stockpile to dimension which maintain structural integrity and maximum heights.
Visually inspect open excavations	• Ensure excavation dimension are consistent with design specifications and safety standards including batter slopes and benching • No unstable edges on open excavations	• Cordon off unstable areas from all traffic. Reconfigure excavation to stable dimension.
Visual inspection of major erosion and sediment control structures and any actions identified in monthly audit	• 80% capacity • Good condition • Effective mitigation of sediment discharge offsite and/or signs of accelerated erosion	• Remove sediment build-up to maintain 80% capacity • Repair damage, as required to restore effective function of the device • Replace or relocate device where visual inspection indicates that the current device is ineffective or improperly installed
Monitor known locations of problem soil	• No deterioration of problem soils at known locations	• Implement control activities (refer Section 5.2.2)
Visual inspection for weed species	• Minimise reoccurrence of weed species	• Implement weed control measures
Visual monitoring for signs of salinity (eg saline outbreaks, vegetation stress and poor establishment of vegetation)	• No increase in salinity areas	• Implement control activities (refer Section 5.2.2)

Monitoring activity	Monitoring criteria	Corrective actions
Monthly		
Visual inspection of the maintenance of stockpiles for storing topsoil and excavation spoil. This would involve assessing height and structure and an inspection of maintenance techniques and materials	• No sediment loss and sedimentation into waterways	• Review maintenance techniques and materials
Visual inspections of stockpile locations for potential material mixing and maintenance	• Minimise stockpiling areas and maintain stockpile structures	• Use and mix similar materials to maintain stockpile structure and to optimise stockpiling areas
Visually inspect remediation locations after excavation for native plant species growth	• Native plants species grown on all remediation locations	• Conduct soil testing and treat soil to establish of native plants species growth
Inspections of all E&SC controls onsite	• 80% capacity • Good condition • Effective mitigation of sediment discharge offsite and/or signs of accelerated erosion	• Remove sediment build-up to maintain 80% capacity • Repair damage, as required to restore effective function of the device • Replace or relocate device where visual inspection indicates that the current device is ineffective or improperly installed
Event based		
• An Inspection of soil 'hotspots' with a high potential for topsoil erosion or soil structure deterioration should occur before construction commences. This may involve soil sampling and testing. Continual monitoring of unstable locations will occur after the initial inspection	• No deterioration of problem soils at known locations	• Implement control activities (refer Section 5.2.2)
• An inspection of the site for the presence of all undesirable weed and pest species should occur prior to construction commencement. This would involve plant specialists assessing all plant	• Minimise reoccurrence of weed species	• Implement weed control measures

6.3.2 Operation

Monitoring soil change relies ultimately on very good quality measurement at representative field sites often over extended periods (ie decades) (McKenzie et al, 2002). Therefore during operation monitoring will be conducted annually for the CSG fields. Baseline sampling should be conducted prior to construction (refer Section 3).

Some soil properties exhibit natural cycles on a daily and seasonal basis. Failure to account for these makes the early detection of trends more difficult. For example, solute concentrations, pH and the

availability of various nutrients vary seasonally. Therefore the timing of monitoring should be consistent for each round of monitoring.

Monitoring will include visual inspection for any evidence of problem soils, soil sampling and analysis at a density developed in consultation with DERM.

Analysis parameters

Table 6.2 lists the parameters for monitoring.

Table 6.2 Parameter for analysis during soil monitoring

Soil parameters
pH
Electrical conductivity (1:5 solution)
Exchangeable cations and Cation Exchange Capacity
Particle size analysis
Exchangeable sodium percentages (ESP)
Nitrogen, Phosphorus and Potassium
Organic carbon
Extractable Sulphur
Extractable Micronutrients

6.3.3 Rehabilitation

All significantly disturbed land caused by the carrying out of the petroleum activities must be rehabilitated to meet the following final acceptance criteria:

- all significantly disturbed land is reinstated to the pre-disturbed land use unless otherwise agreed to between the environmental authority holder, the landholder and the administering authority
- ensure that all land is reinstated to the pre-disturbed land use and suitability class
- ensure that the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance by petroleum activities
- the landform is safe for humans and fauna
- ensure that the water quality of any residual void or water bodies constructed by petroleum activities meets criteria for subsequent uses and does not have potential to cause environmental harm.
- the landform is stable with no subsidence or erosion gullies for at least (5) years
- the minimum percent foliage cover of immediate surrounding area is maintained in the rehabilitated land for at least three (3) years
- a minimum of 80% of the flora species in the immediate surrounding area is maintained in the rehabilitated land for at least three (3) years
- a minimum of 80% of the fauna species diversity in the immediate surrounding area is maintained in the rehabilitated land for at least three (3) years
- erosion is minimised with appropriate sediment traps and erosion control measures installed as determined by a suitably qualified person

The Rehabilitation Plan will implement measures to meet the acceptance criteria above.

6.4 Performance auditing

Performance auditing of site construction activities is an important aspect in the management of impacts on the soil environment. Several audits will take place within the CSG fields to adequately measure the impact of the construction phase of the project including daily, weekly and monthly audits. Checklists will be developed to assist with performance auditing (refer to Appendix B for example).

6.4.1 Daily audits

The purpose of daily audits onsite is to ensure no significant soil impacts are occurring around site from day to day construction activities. Audits of weed movements, boundary erosion and sediment controls and major earthworks impacting on groundwater will be audited on a daily basis. Any construction activities in within highly sensitive areas will also be audited on a daily basis. These audits will be performed by the Contractor Environmental Officer. All major environmental breaches/incidents will be reported in the Monthly Environmental Report.

6.4.2 Weekly audits

Weekly audits of major environmental activities are to be conducted to ensure environmental standards are being met on a weekly basis and are to be conducted by the Principal's Environmental Manager. The purpose of this audit is to ensure the contractor is upholding the minimum standards of environmental compliance and identify any activities contributing to this standard not being met. Actions are to be identified along with close-out dates specified for each action. The following weeks audit will identify actions not closed out and also identify new actions to be undertaken. This audit is to be signed off by both the Contract Administrator's Environmental Officer along with the Contractor's Environmental Officer. All major environmental breaches/incidents will be reported in the Monthly Environmental Report.

6.4.3 Monthly audits

Monthly audits are to be performed on the entire construction site for all relevant environmental aspects identified by this SMP. This audit will identify areas of major concern or HIGH risk and that need to be addressed immediately. All control measures to prevent environmental harm will be audited with respect to the relevant standard for that item. The identification of any HIGH risk areas from this audit will be reported in the Monthly Environmental Report for the entire site. This audit will be conducted by the Principal's Environmental Manager.

6.5 Corrective action and notifications

Any breach of the performance requirements will require immediate corrective action and should be documented in a daily log. All incidents and non-conformances should be investigated/reported to the Environmental Manager and corrective action is to be taken immediately upon inspection. In response to all reports of non-conformance, this soil management procedure and subsequent soil management plans will be open for assessment in order to ascertain the effectiveness of their goals and targets and revised where appropriate.

7. References

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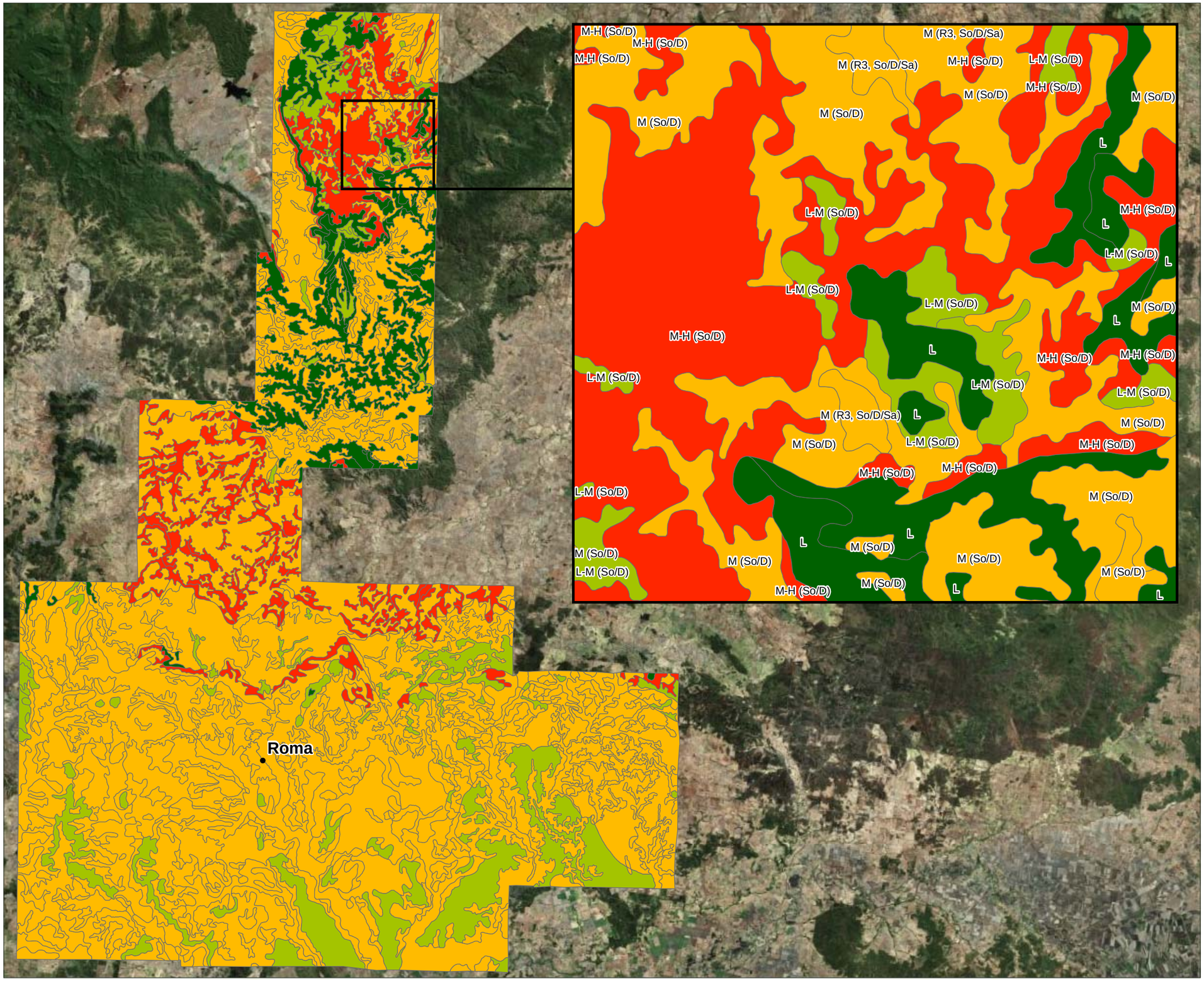
Appendix A
Problem Soils Map Example



Map by: PIC
P:\GIS\Projects\213885_Santos_CSG_Soil\213885_002.mxd 18/02/2011 12:33

A3 scale: 1:1,000,000

0 10 20 30 40 50km

Job No: 213885

Coordinate system: GDA_1994_MGA_Zone_55

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Legend

Problem Soils Risk Level

- Low
- Low - Medium
- Medium
- Medium - High

So/D - Sodic/Dispersive Soils
Sa - Saline Soils
R1 - Moderately Reactive Soils
R2 - Shallow or Medium Deep, Highly Reactive Clay Soils
R3 - Deep, Highly Reactive Clay Soils

Source:
GLNG EIS (URS, 2009)

Date: 18/02/2011 Version: 1

Santos Coal Seam Gas Soil Management Procedure

Appendix A: Problem Soils Map Example

Appendix B
Soil Management Checklist Example

Appendix B

	Yes	No
Topsoil		
The boundary of the area to be cleared and any 'no-go zones' are clearly marked		
Weed control measures implemented		
Confirmation of soil units and stripping depths to be applied during soil stripping		
Erosion and sediment control devices are installed and functional		
Stormwater runoff diversion measures installed away from disturbed areas		
Stormwater runoff diversion measures installed away from stockpiles		
Vehicle and plant movements are only designated roads and active earthworks, stockpiling and storage locations		
Stockpile and storage locationed at least 50m away from surface waterways		
Stockpiled material not within the drip line of retained trees		
Stockpile stabilisation implemented for topsoil stockpiles		
Topsoil stockpiles deep ripped		
Stockpiled material clearly sign-posted		
Sodic and dispersive soils		
Sodic Soil topsoil removal is limited to the area along the trench and where subsoil is to be placed		
Clearing methods, in sodic soils minimises ground disturbance and maintains root stock as far as possible		
Vegetation is mulched in areas of sodic soil prior to the soil being reinstated		
Additional soil and erosion control measures are implemented where evidence or erosion or scouring is found In areas of sodic soil		
Areas of sodic soil are clearly marked on alignment sheets		
Saline Soils		
Water reuse locations clearly marked		
Excavated saline subsoil is capped with suitable topsoil material when backfilling		
Stockpiled saline subsoil is bunded both upstream and downstream		
Sewage effluent absorption beds, treatment ponds, brine containment ponds and water management ponds are lined to prevent uncontrolled infiltration		

GLNG Project Upstream Activities Erosion and Sediment Control Manual
GLNG ESC Manual
Santos

Report ref:
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Revision 1

aurecon

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Document control

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Rev No	Date	Revision details	Typist	Author	Verifier	Approver
0	4 April 2011	Draft for Client Comment	CS	BE	SO	MJM
1	27 July 2011	Final	CS	BE	SO	MJM

This Erosion and Sediment Control Plan satisfies the following requirements:

(i) The intent and minimum standards established by all relevant local, state and federal policies relating to erosion and sediment control.

(ii) Review and approval by personnel suitably trained and experienced in each of the following categories: construction, soil science, hydrology/hydraulics, and site revegetation and rehabilitation.

(iii) Is both reasonable and practicable.

(iv) Contains sufficient information to allow appropriate implementation of Erosion and Sediment Control Plans

Signature: Oldridge Date: 27/7/2011

Printed Name: Dr Sanja Oldridge RPEQ: 08072

Contents

Executive summary

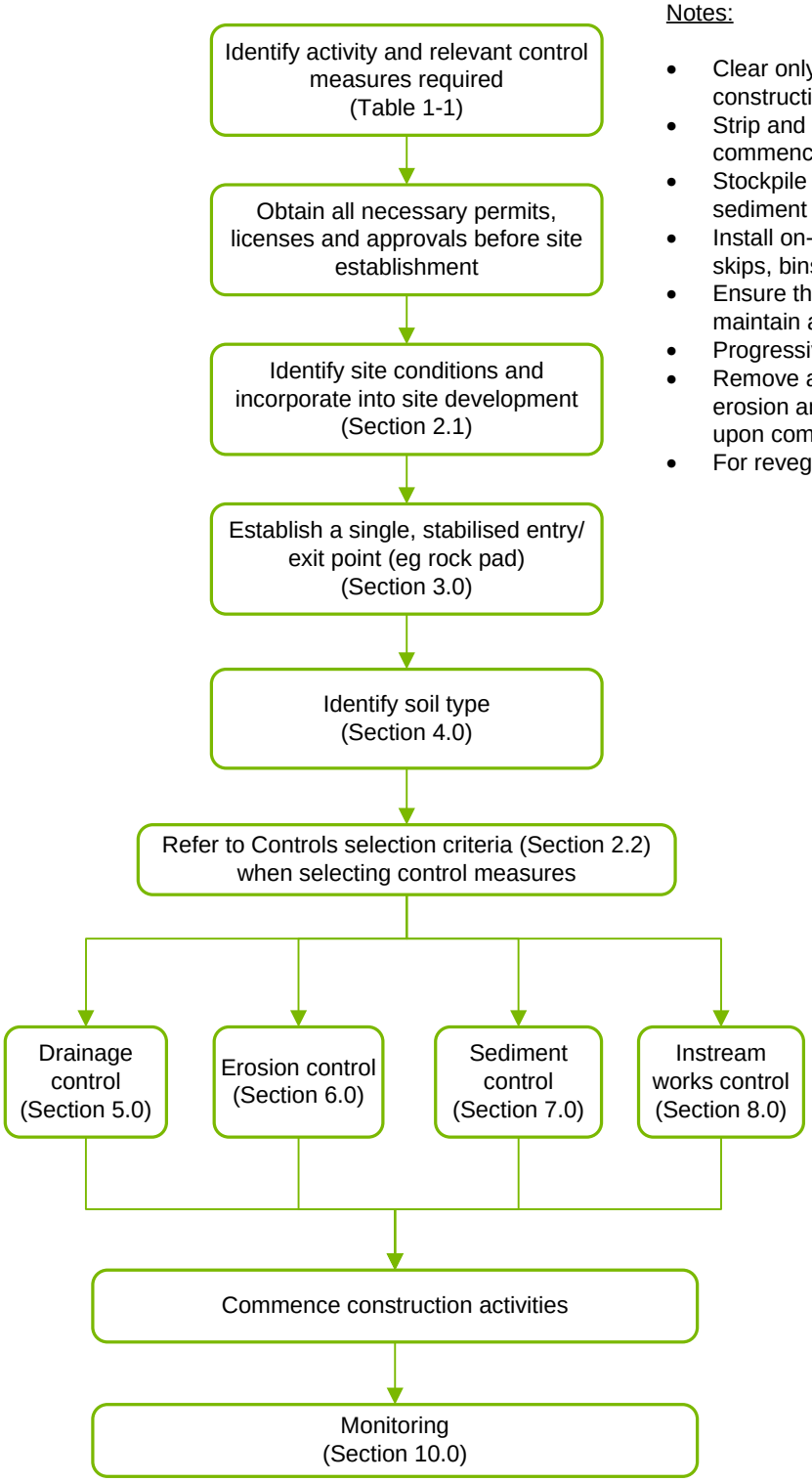
The Erosion and Sediment Control (ESC) manual has been developed on behalf of Santos for use on the Coal Seam Gas (CSG) fields located upstream of the Gladstone Liquefied Natural Gas Project (GLNG Project). The ESC manual is based on the best management practice guidelines outlined in the in Best Practice Erosion and Sediment Control (2008), developed by the International Erosion Control Association.

The purpose of this ESC manual is to detail control strategies to be implemented in order to minimise any detrimental impacts on the surrounding environment resulting from soil erosion and subsequent sedimentation that may result from works associated with the CSG operations. It provides appropriate erosion and sedimentation remedial actions when land is disturbed by construction activities to ensure compliance with the conditions set out by the environmental authority. This manual demonstrates Santos' commitment to:

a) Conducting activities at the CSG site of the GLNG Project that align with best practice erosion and sediment control
b) Achieving and maintaining compliance with the requirements prescribed by environmental licenses

This ESC manual has been developed to serve as a document for the use on the CSG fields, when conducting associated CSG operational activities.

Figure 1 outlines the ESC process for the CSG operational activities – the process is supported by the detailed description of each control measure.



Notes:

- Clear only those areas necessary for construction works to occur
- Strip and stockpile topsoil before commencing earthworks or excavations
- Stockpile erodible materials within the sediment control zone
- Install on-site waste receptors (eg mini-skips, bins)
- Ensure that adequate access is provided to maintain all ESC measures
- Progressively rehabilitate the site
- Remove any remaining temporary drainage, erosion and sediment control measures upon complete stabilisation of the site
- For revegetation refer to Section 9.0

Figure 1 ESC process for the CSG operational activities

1. Introduction

1.1 Purpose

The Erosion and Sediment Control (ESC) manual has been developed on behalf of Santos for use on the Coal Seam Gas (CSG) fields located upstream of the Gladstone Liquefied Natural Gas Project (GLNG Project). The ESC manual is based on the best management practice guidelines outlined in the in Best Practice Erosion and Sediment Control (2008), developed by the International Erosion Control Association.

The development of the CSG fields will be undertaken pursuant to petroleum authorities granted under the Petroleum and Gas (Production and Safety) Act 2004 and the Petroleum Act 1923 administered by the Department of Mines and Energy. These authorities allow the holder to perform petroleum exploration (including coal seam gas), production and other incidental activities over land tenures. Erosion and sediment control strategies are required when conducting activities in the CSG fields, to minimise adverse effects to the environment.

The purpose of this ESC manual is to detail control strategies to be implemented in order to minimise any detrimental impacts on the surrounding environment resulting from erosion and sedimentation associated with the CSG operations. It provides appropriate erosion and sedimentation remedial actions when land is disturbed by construction activities to ensure compliance with the conditions set out by the environmental authority. This manual demonstrates Santos' commitment to:

a) Conducting activities at the CSG site of the GLNG Project that align with best practice erosion and sediment control
b) Achieving and maintaining compliance with the requirements prescribed by environmental licenses

This ESC manual has been developed to serve as a document for the use on the CSG fields, when conducting associated CSG operational activities.

Where contractors' work covers routine and non routine activities not stipulated in this manual, it is the responsibility of the contractor to identify the environmental aspects associated with these activities and to develop and implement plans and procedures to address these activities.

1.2 The GLNG Project

The GLNG Project was declared to be a "significant" project under the State Development and Public Works Organisation Act 1971 (Qld) on the 16 July 2007. An Environmental Impact Statement (EIS) for the GLNG Project, as well as a supplementary EIS have been prepared and publicly exhibited under the Stated Development Act. A draft Environmental Management Plan (EMP) has been prepared. The State Development Act provides that once declared as a "significant" project and an EIS process is being followed, new or amended Environmental Authority (EA) and/or tenure application cannot be authorised until the Coordinator General's Report (Queensland Government 2010), pursuant to the State Development Act, in April 2010.

The GLNG Project is located in Queensland, Australia. The project area will comprise of tenements within parts of Roma, Fairview, Arcadia Valley and part of the Comet Ridge fields. The development scenario is likely to require up to 1200 development wells prior to 2015 and up to a total of 1450 wells after 2015.

The GLNG Project comprises of the following:

- Extraction of CSG
- A pipeline from the CSG fields to Gladstone
- A liquefied natural gas plant at Curtis Island

The development of the CSG fields involves a rolling program of exploration, appraisal, construction, operation, decommissioning and rehabilitation of CSG infrastructure over a large physical area and an extended period of time. Due to the nature of CSG exploration, the planning for field development, including the specific location of exploration and development wells and associated infrastructure is determined incrementally based on the outcome of ongoing exploration programs.

Initially the development in the CSG fields will begin with a small number of wells. This number will increase over time (several years). In addition, road networks will expand to provide access to each well and water and gas gathering lines will be established. Once sufficient wells are developed, centralised compression and water treatment facilities will also be developed. As the wells are utilised and become depleted, they will be decommissioned over time and the area rehabilitated.

For detail of the project property descriptions, easement and local government boundaries refer to Appendix I of the GLNG EIS (URS, 2009).

1.3 Project activities

This manual has been developed to provide a general plan that covers construction scenarios that may occur within the CSG fields. It identifies the appropriate erosion and sediment controls for implementation of regular activities, instream works, road construction and provides a guide for preparing site-based ESC plans for 'one-off' projects.

As outlined in the GLNG EIS (URS, 2009) developments of the CSG fields may include a range of activities from geophysical investigation through to production and processing, including the following:

- Exploration – including geophysical survey and drilling of exploration wells
- Appraisal – drilling and testing of appraisal wells (also called pilot holes)
- Development, including:
  - Drilling and completion of production wells (wells drilled to enable gas production)
  - Construction of centralised compression and water treatment facility, gas and water gathering networks, associated water management facilities and other related infrastructure
- Production/operation
- Rehabilitation and decommissioning

For the purpose of this ESC manual, the project activities are split into categories:

- Regular activities – addressed in this manual by means of ESC measures
- In-stream works
- Road construction
- "One-off projects – addressed by specific ESC Plans prepared for these projects

1.3.1 Regular activities

Table 1-1 outlines the regular activities addressed in this procedure manual by means of ESC measures and identifies the required control measures for each activity. The required erosion and sediment controls for these activities can be achieved through the use of this manual.

The associated control measures are described in this ESC manual (ie drainage – Section 5, erosion – Section 6 and/or sediment – Section 7).

Table 1-1 ESC activities

Activity	Required control measures		
	Drainage	**Erosion**	**Sediment**
Construction of an earthen pit, sump or flare pit			
Carry out vegetation clearance	Y	Y	Y
Stockpile of cleared vegetation	Y	N	Y
Remove topsoil	Y	Y	Y
Stockpile topsoil	Y	N	Y
Excavate soil	Y	N	Y
Carry out soil fill/compaction	Y	Y	Y
Bund construction material	Y	N	Y
Undertake clean-up and site housekeeping practices	Y	Y	Y
Installing a cellar			
Excavate pit	Y	N	Y
Stockpile excavated material	Y	N	Y
Bund construction material	Y	N	Y
Undertake clean-up and site housekeeping practices	Y	Y	Y
Pipeline network installation			
Carry out vegetation clearance	Y	Y	Y
Stockpile of cleared vegetation	Y	N	Y
Remove topsoil	Y	Y	Y
Stockpile topsoil	Y	N	Y
Excavate soil	Y	N	Y
Carry out soil fill/compaction	Y	Y	Y
Bund construction material	Y	N	Y
Undertake clean-up and site housekeeping practices	Y	Y	Y
Rehabilitation			
Backfill topsoil	Y	Y	Y
Carry out re-contouring	Y	Y	Y
Topsoil respreading	Y	Y	Y
Carry out revegetation	Y	Y	Y

The following activities need to be designed and constructed under the supervision of ESC specialists.

- Sediment basin design and construction (see Section 7.5.5)
- Design of velocity control structures (see Section 5.6.4)
- Detailed design of instream works (see Section 8)

1.3.2 In-stream works

Water flow associated with the in-stream works includes stream flow passing through the work area (in-bank stream flow) and lateral flows entering from local stormwater runoff.

The control measures described in this ESC manual (ie drainage – Section 5, erosion – Section 6 and/or sediment – Section 7), apply to in-stream works. However, in-stream works may require additional control measures including water flow controls (Section 8.1) and in-stream sediment control measures (Section 8.2). Best practice erosion control measures are identified in Section 6.

1.3.3 Roads and access tracks

The ESC measures identified in this manual for construction activities are applicable to road construction. However, issues specific to road design and construction are identified in road design and batters are identified in Section 9.1 and 9.2, respectively, and must be considered.

1.3.4 “One-off” projects

Specific ESC plans are to be prepared for the ‘one-off’ projects. The ‘one-off’ projects associated with the upstream GLNG Project activities include construction of the following infrastructure:

- Temporary and permanent camps
- Compressor stations
- Dams
- Borrow pits
- Roads and access tracks

2. Site conditions and controls selection criteria

2.1 Site conditions

Site characteristics including soil, topography, water, vegetation and ecology generally impact the level of erosion and associated sediment transport. The site characteristics factors should be appropriately addressed during ESC management. These characteristics and associated general ESC principles are outlined in Table 2-1.

Table 2-1 General ESC principles adapted from IECA (2008, pp3.5-3.10)

Site characteristics	General ESC principles
Soil	Reference should be made to the soil type that activities are being conducted in. Identification of the existence of any problematic soils and the recommended soil treatment and management techniques should occur before/during construction
Topography	One of the most efficient ways of minimising the adverse effects of soil erosion is to minimise land reshaping. Developments should, where reasonable and practicable, utilise existing topography. Identification of topographic issues that will influence the development of the site must occur and be dealt with. These issues include: drainage and existing erosion problem areas, flood prone land, land prone to mass movement erosion, local microclimates, rock outcrops, steep slopes and waterways and wetlands
Water	The long-term success of many erosion and sediment control measures can depend on a reliable supply of suitable water. Water, either in the form of local stormwater runoff, on-site dam water, town water, or watercourse discharge, may be required to maintain the performance of permanent urban features and temporary erosion and sediment control measures
Vegetation	The protection or enhancement of vegetative cover can significantly reduce short and long-term erosion problems
Ecology	Ecological considerations may limit the type of erosion and sediment control measures applied to the site. Examples of this include the use of Erosion Control Blankets containing reinforced mesh being avoided where there is the risk of birds or ground-dwelling reptiles becoming entangled

2.2 Controls selection criteria

The following controls selection criteria adopted from IECA (2008, p 4.2).

Where one or more control measures are applicable, then selection of the most appropriate measure should be chosen based on site conditions. The proposed criteria are as follows:

- Applicability to the full range of site conditions considered reasonably possible during the construction period
- Availability of materials from local suppliers and delivery time frame
- Anticipated community acceptance and potential environmental impact
- Benefit/cost ratio based on performance history (if available) and expected purchase, installation and maintenance costs
- Ongoing structural integrity or durability during the required operational period. This includes having an acceptable ability to sustain hydraulic and structural integrity under normal site conditions
- Technical capabilities of site personnel with regard to the appropriate installation and maintenance of the control measures, otherwise site-specific training or specialist installation teams will be required
- Ability to perform the required task and achieve the desired performance standard

3. Entry/exit point establishment

A single, stabilised entry/exit point (eg rock pad) should be established for the construction site.

Site access should be restricted to one entry/exit point, where reasonable and practicable. This is done to minimise excessive land disturbance (and thus erosion and resulting sedimentation) and to provide only a singular point necessary for sediment control leaving the site, assuming all other controls are effectively implemented.

Refer to Section 7.5.9 for best practice sediment control on construction sites at entry/exit points.

4. Identify soil type

Identification of the correct soil type that work will be conducted in is critical before any activities are carried out. Before implementing any ESC measures, reference should be made to the Soil Management Plan (Aurecon, 2011) for identification of soil types and soil location. This is required because the ESC controls will vary depending on the soil associated with a site and activity.

The GLNG EIS (URS, 2009) identified soil types known to occur in the project area. These soil types have been classified further into coarse, fine and dispersive soil groups (based on their particle size) to ensure simplified implementation of erosion and sediment control techniques depending on the soil characteristics.

Dispersive soils

Dispersive (sodic) soils are structurally unstable in water, breaking down into their constituent particles (sand, silt and clay) and consequently allowing the dispersible clay fraction to disperse and cloud the water. Highly dispersible soils are normally highly erodible and are likely to cause problems to road cuttings and dam/pond embankments. They are structurally unstable soils. 'In most circumstances, the best engineering treatment is to ensure that dispersible soils are buried under a layer of non-dispersible soils. The minimum thickness of the non-dispersive soil layer is generally between 50 mm and 300 mm depending on the likely level of exposure of the soil surface to erosion risks. A minimum cover of 100 mm is generally recommended on gentle slopes and 200 mm on steep slopes' (IECA, 2008, pp C.25-26).

Fine

Fine soils include loamy, silty and clayey soils. For the purpose of this procedure manual, soils that have a typical grain size less than 0.14 mm are regarded as fine.

Coarse

Coarse-grained soils include sands or gravels. For the purpose of this procedure manual, soils that have a typical grain size greater than 0.14 mm are regarded as coarse.

A summary of soil groups, descriptions and potential constraints is outlined in Table 4-1.

Table 4-1 Summary soil description adopted from URS (2009, pp 6.3.25-6.3.26)

Soil group	Soil description	Potential constraints
Coarse	Skeletal, rocky or gravelly soils (>60% coarse fragments) with sandy, silty, loamy or clayey soil matrix	Skeletal to shallow rocky soils (>60% coarse fragments); rock outcrop and surface boulders
	Sand soils; shallow to deep uniform or weakly gradational profiles; includes stratified alluvial soils, residual sand soils, earthy sands	Strongly acidic subsoils
Fine	Coarse to medium-textured soils; uniform or gradational profiles; predominantly sandy earths with sand, silty or clayey sand over clayey sand-sandy clay soil profiles; in parts with siliceous (Si) stone and/or ferruginous (Fe) gravel lenses included	Strongly acidic subsoils (>0.2 m)

Soil group	Soil description	Potential constraints
	Medium-textured sandy, sandy loam or silt to clay loamy surface uniform or gradational profiles with clay loam, light clay or medium clay subsoils, in places with siliceous stone and/or ferruginous gravelly lenses included	
	Sand, loamy sand, sandy loam or loamy surface duplex soils over acidic to locally strongly acidic, in places neutral or slightly alkaline sandy clay to medium to heavy clay subsoils	Strongly acidic in deeper subsoils
Dispersive	Fine sandy, silty or clay loamy surface duplex soils with neutral to alkaline often calcareous, sodic and locally saline medium to heavy clay or heavy clay subsoils	Shallow soils Strongly alkaline subsoils Hard clay subsoils Sodic subsoils
	Shallow uniform often gravelly fine-textured soils, medium to deep uniform fine-textured (non-cracking) clay soils or gradational often stony or gravelly clay loam or light clay surface soils over alkaline medium to heavy clay subsoils, locally sodic and saline in the deeper subsoils – some deep incipient cracking clays	Highly alkaline/calcareous Locally strongly acidic Sodic subsoils Moderately highly saline in the subsoil
	Shallow to medium to deep uniform fine-textured (cracking) clay soils, locally with thin self-mulching surficial soils with dark grey, brown or black mostly alkaline or alkaline over acidic heavy clay subsoils in areas with gilgai micro-relief	Saline below 0.2 m on gilgai mounds Acidic heavy clay subsoils Sodic subsoils Often classified as Good Quality Agricultural Land

5. Drainage control

5.1 Purpose

The requirement for drainage controls is subject to site assessment, and therefore site conditions must be observed before deciding if drainage control techniques are required.

Drainage controls should be implemented if flow diversion is required, or rainfall is likely to occur during the time taken to complete the activity.

The diversion of up-slope stormwater runoff is done to divert flow around construction activities, stockpiles and soil disturbances. Flow diversion measures should be implemented on all construction sites to prevent upstream stormwater entering the site.

Clean water should be diverted away from sediment control devices, whenever reasonable and practicable, to maintain water quality. Appropriate drainage controls must be implemented on the construction site to control dirty water runoff and direct it towards appropriate sediment traps.

If flow within a drainage system is expected to cause erosion then additional methods need to be implemented to stop or minimise this occurring. Reference should be made to the relevant sections within erosion and sediment controls for techniques to stop or minimise erosion from occurring.

Refer to Section 5.5 Drainage control reference and Section 5.6 Drainage measures, for the reference to drainage controls applicable to site/activity.

5.2 Drainage design standard for Queensland

All drainage control measures must be designed, installed, operated and maintained in accordance with the best management practice guideline (IECA, 2008).

The recommended drainage design standard for temporary drainage works are outlined in Table 5-1.

Table 5-1 Recommended drainage design standard for temporary drainage works adopted from IECA (2008, p 4.3)

Drainage structure	Anticipated design life		
	< 12 months	**12 – 24 months**	**> 24 months**
Temporary drainage structures [1] Queensland	1 in 2 year	1 in 5 year	1 in 10 year
Temporary drainage structures (eg catch drain, flow diversion bank) located immediately up-slope of an occupied property that would be adversely affected by the failure or overtopping of the structure [1] [2]	1 in 10 year	1 in 10 year	1 in 10 year
Temporary culvert crossing	Minimum 1 in 1 year ARI hydraulic capacity wherever reasonable and practicable		

Notes: [1] Design capacity excludes minimum 150 mm freeboard
[2] Design flow rate based on up-slope drainage structures operating in accordance with their design capacity excluding freeboard, ie any constructed freeboard is assumed to have been washed away or otherwise deactivated.

5.3 Drainage control requirements

Selection of appropriate drainage controls is influenced by site-specific characteristics; this includes land slope in which the drainage is required and associated land cover.

The criteria for slope and land cover are presented in Table 5-2. The associate drainage controls are presented in Sections 5.6.1 and 5.6.2.

Table 5-2 Criteria for slope and land cover

Land cover	Slope classification
Vegetated slope	Low-gradient slope – Flatter than 1 in 4
Unvegetated slope	Steep-gradient slope – Steeper than 1 in 4

5.4 Technical notes

The following technical notes have been adopted from IECA (2008) to provide general guidelines that should be followed for correct implementation of drainage controls:

- The permanent and temporary drainage requirements for a site need to be appropriately considered during the development of an ESC plan
- Scheduling of works should be planned so that, when practicable, any major earthworks are completed during periods of low rainfall
- Wherever reasonable and practicable, stormwater runoff entering the site from external areas, and non-sediment laden (clean) stormwater runoff entering a work area or area of soil disturbance, must be diverted around or through that area in a manner that minimises soil erosion and contamination of that water for all discharges up to the specified design storm discharge
- Construction sites need to employ appropriate short-term drainage control measures to deal with impending storms
- Flow velocities need to be limited to the maximum allowable velocity for each individual drainage system
- The diversion of up-slope stormwater around stockpiles is recommended during periods when rainfall is possible and the up-slope catchment area exceeds 1500 m^2 and the average monthly rainfall exceeds 45 mm
- Suitable construction access needs to be provided to allow for the installation and maintenance of all drainage controls

5.5 Drainage controls reference

Table 5-3 outlines drainage controls and associated actions. Drainage controls outlined in Table 5-3 are described in Section 5.6 – Drainage control measures.

Table 5-3 Drainage control

Drainage controls	Reference section	Drainage controls	Reference section
Lateral drain spacing on continuous slopes	Section 5.6.1	**Outlet structures for temporary drainage systems**	Section 5.6.3
Non-vegetated slope	Section 5.6.1	**Flow velocity control**	Section 5.6.4
Vegetated slope	Section 5.6.1	Allowable flow velocities	Section 5.6.4
Flow-diversion method	Section 5.6.2	Velocity control techniques	Section 5.6.4
Low-gradient slope	Section 5.6.2	• Velocity control structures	
Steep-gradient slope	Section 5.6.2	• Chute and channel linings	

5.6 Drainage control measures

The drainage controls listed in Table 5-3 are presented in this section.

5.6.1 Spacing of lateral drains down long continuous slopes

'Long unstable slopes must be subdivided into manageable drainage areas to prevent the formation of rill erosion. Catch drains or flow diversion banks should be placed at regular intervals down the slope to collect and divert surface runoff to a stable outlet' (IECA (2008, pp 4.4-4.5).

Non-vegetated slope

Table 5-4 provides the recommended maximum spacing of drainage systems down long exposed, non-vegetated or recently seeded slopes. Table 5-4 does not apply if protection is provided for the slope through suitable erosion control techniques (eg erosion control mats).

Table 5-4 Recommended maximum drain, bank and bench spacing on non-vegetated slopes [1] adopted from IECA (2008, p 4.4)

Batter slope			Horizontal spacing (m)	Vertical spacing (m)
Percentage	Degrees	(H):(V)		
1%	0.57	100:1	80[2]	0.8[2]
2%	1.15	50:1	60	1.2
4%	2.29	25:1	40	1.6
6%	3.43	16.7:1	32	1.9
8%	4.57	12.5:1	28	2.2
10%	5.71	10:1	25	2.5
12%	6.84	8.3:1	22	2.6
15%	8.53	6.7:1	19	2.9
20%	11.3	5:1	16	3.2
25%	14.0	4:1	14	3.5
30%	16.7	3.3:1	12	3.5
35%	19.3	2.9:1	10	3.5
40%	21.8	2.5:1	9	3.5
50%	26.6	2:1	6	3.0

Note: [1] Maximum recommended spacings based on medium rainfall erosivity and low to moderately erodible soil
[2] Maximum recommended spacing of lateral drains is 80 m

Refer to manufacturers for advice on erosion control products and the associated maximum recommended slope lengths if necessary. In absence of this information, drain spacing should be based on Table 5-4.

Maximum horizontal spacing of drains presented in Table 5-4 for land slopes steeper than 1% can be estimated by using the following equation:

Maximum horizontal spacing (m) = 100/ (batter slope (%)) 0.64.

Vegetated slope

Table 5-5 provides recommended maximum spacing on vegetated slopes.

Table 5-5 Recommended maximum drain, bank and bench spacing on vegetated slopes adopted from IECA (2008, p 4.5)

Batter slope			Horizontal spacing (m)	Vertical spacing (m)
Percentage	**Degrees**	**(H):(V)**		
<10%	5.71	10:1	Site specific	Site specific
12%	6.84	8.3:1	100	12
15%	8.53	6.7:1	80	12
20%	11.3	5:1	55	11
25%	14.0	4:1	40	10
30%	16.7	3.3:1	30	9
>36%	>19.8	2.8:1	Site specific	Site specific

Maximum horizontal spacing of lateral drains and benches on well-vegetated slopes can be estimated by using the following equation:

Horizontal spacing (m) = 2700/ (batter slope (%))$^{1.3}$

5.6.2 Flow diversion methods

Appropriate flow diversion methods must be incorporated into the site design to control erosion and minimise sediment-laden runoff. Table 5-6 and Table 5-7 outline the best practice flow diversion methods for different slope gradients.

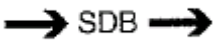
If flow velocity control is required for a specific drainage activity then refer to Section 5.6.4 for best practice techniques.

Low-gradient drainage techniques

Table 5-6 outlines the drainage techniques appropriate for use on low-gradient slopes (ie flatter than 1 in 4 slopes).

Table 5-6 Low-gradient drainage techniques adopted from IECA (2008, p 4.6)

Technique	Symbol	Typical use
Catch Drain (CD)		For the collection and dispersion of sheet flow across a slope or around soil disturbances Best used in non-dispersive soils[1]
Compost Berm (CB)		Primarily used as a Sediment Filter Berm, but can be used as a Flow Diversion Bank Use when on-site land clearing produces significant qualities of organic matter
Diversion Channel (DC)		For diversion of large concentrated flows A permanent flow diversion channel
Flow Diversion Bank – earth, sandbags, etc (DB)		For diversion of smaller flows when in situ subsoils are dispersive or otherwise highly erodible Use for flow diversion at the base of fill slopes

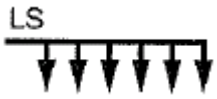
Technique	Symbol	Typical use
Straw Bale Flow Diversion Bank (SDB)		Only for temporary (ie days, not weeks) flow diversion in the event of imminent rainfall Use for short-term flow diversion up-slope of excavations and trenches

Note: [1] Wherever possible, avoid cutting Catch Drains into dispersible soils. Instead, Flow Diversion Banks should be used to temporarily divert stormwater across the site (IECA, 2008, p 2.15)

Steep-gradient drainage techniques

Table 5-7 outlines the drainage techniques appropriate for use on steep-gradient slopes (ie steeper than 1 in 4 slopes).

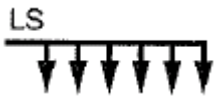
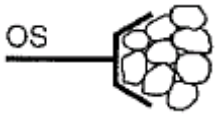
Table 5-7 Steep-gradient drainage techniques adopted from IECA (2008, p 4.6)

Technique	Symbol	Typical use
Chute (CH)		For discharge of concentrated flows down steep slopes Use to control flow into Sediment Basins Use for temporary drainage down the face of newly formed road embankments
Level Spreader (LS)		For conversion of minor concentrated flows back to “sheet” flow Use for discharge of flows down grassy slopes Use for discharge of “sheet” flow into bushland
Slope Drain (SD)		For the discharge of minor flows down steep slopes For the discharge of minor flows through bushland and other areas where it is essential to minimise disturbance to vegetation and soil

5.6.3 Outlet structures for temporary drainage systems

The recommended outlet structures for usage in chutes and slope drains are outlined in Table 5-8.

Table 5-8 Outlet structures adopted from IECA (2008, p 4.7)

Outlet structure	Symbol	Typical Use
Level Spreader (LS)		Use at the end of Flow Diversion Banks and Catch Drains to discharge minor concentrated flows down stable, grassed slopes Use for the discharge of Catch Drains into bushland
Outlet Structure (OS)		Use at the end of Chutes and Slope Drains to dissipate flow energy and control scour Use as a permanent energy dissipater on pipe and culvert outlets

5.6.4 Flow velocity control

A low velocity of stormwater runoff is required to ensure that erosion is minimised; therefore it must be ensured that non-erosive flow velocities occur within all drains during the design storm.

The flow velocity control measures were adopted from IECA (2008, pp 4.7-4.8) and outlined below.

Temporary or permanent drainage channels, wherever reasonable and practicable, should be designed and constructed at a gradient that limits the maximum velocity to a value not exceeding the maximum allowable flow velocity for the given surface material. Methods for reducing the flow velocity include:

- Reduce the depth of flow (ie increase the width of the channel)
- Reduce the bed slope
- Reduce the peak discharge (ie reduce the effective catchment area or divert the water away from the channel)
- Increase the channel roughness

If the channel width, depth or gradient cannot be altered, then there are two options available for preventing, or at least controlling, erosion. Either:

- Reduce the flow velocity through the placement of velocity control structures
- Increase the effective scour resistance of the drain through the placement of a channel lining

Allowable flow velocities

The allowable flow velocities are presented in Table 5-9.

Table 5-9 Allowable flow velocities for soil types

Type	Description	Allowable velocity
Open earth (unlined channels)	Clay soils	1 m/s
	All other soils	0.3 m/s

If these allowable flow velocities are likely to be exceeded, refer to Section 5.6.4 for appropriate velocity control structures or channel linings to employ.

Velocity control techniques

The velocity control structures and linings outlined in this section are as follows:

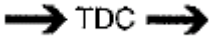
- Velocity control structures for channels and drains
- Chute and channel linings

The velocity control technique (eg check dam) is the most appropriate when used in channels with a gradient less than 10% (1 in 10). In channels with a gradient steeper than 10% it is normally more economical to line the channel instead of trying to reduce flow velocities down the slope (IECA, p 4.8).

Velocity control structures for channels and drains

If the maximum flow velocities (see Table 5-9) are likely to occur within a drainage channel then the implementation of a flow velocity control structure should be employed (Table 5-10). Design of velocity control structures should be carried out by a qualified ESC specialist.

Table 5-10 Velocity control structures for channels and drains adopted from IECA (2008, p 4.8)

Velocity control structure	Symbol	Typical use
Fibre Roll (FCD)		Use in wide, shallow drains where the logs can be successfully anchored down Use in locations where it is desirable to allow the log to integrate into the vegetation, such as vegetated channels Can also be used as a minor sediment trap
Rock Check Dam (RCD)		Use in drains with a depth exceeding 500 mm, and gradient less than 10% Should only be used in locations where it is known that they will be removed once a suitable grass cover has been established
Recessed Rock Check Dam (RRC)		Use in wide, shallow, high velocity channels where *Sandbag Check Dams* would likely wash away These check dams are recessed into the soil to maintain hydraulic capacity within the channel Can also be used as a minor sediment trap
Sandbag Check Dam		Use in shallow drains with a depth less than 50 mm, and gradient less than 10% These check dams are typically small (in height) and therefore less likely to divert water out of the drain Can also be used as a minor sediment trap
Triangular Ditch Check		Commercially available, re-useable product Commonly used to stabilise newly formed table drains Use in drains with less than 10% gradient Can also be used as a minor sediment trap

Chute and channel linings

Table 5-11 outlines the appropriate linings for use in chutes and channels.

Table 5-11 Chute and channel linings adopted from IECA (2008, p 4.9)

Technique	Symbol	Typical use
Cellular Confinement System (CCS)		Use to stabilise Chutes when the only local supply of rock consists of small rocks smaller than 200 mm diameter May be filled with small rocks and grassed to form a permanent, reinforced grass Chute Can also be used to form temporary construction access across dry, sand bed streams
Erosion Control Mat (ECM)		Temporary or permanent scour protection of medium velocity drains Includes the use of Erosion Control Mesh made from jute or coir (temporary mat)
Geosynthetic lining (GEO)		Heavy grade filter cloth can be used to form temporary drainage Chutes down steep batters Sheets of plastic have also been used to form short drainage Chutes down earth batters

Technique	Symbol	Typical use
Grass lining (GC)		Permanent protection of low to medium velocity Chutes and channels
Grass Pavers (GP)		Permanent, trafficable grassed surface An alternative to reinforced grass and TRMs
Hard Armouring (HA)		Large variety of hard armouring systems including corrugated sheet metal, grass pavers, reinforced concrete and shotcrete
Reinforced Grass (TRM)		Refer to Turf Reinforcement Mats
Rock Mattress (RM)		Suitable for temporary and permanent high velocity Chutes and spillways
Rock lining (RR)		High velocity drainage channels Drainage chutes Sediment Basin spillways
Turfing (T)		Permanent lining of low velocity Chutes, Catch Drains and Diversion Channels
Turf Reinforcement Mat (TRM)		Permanent lining of high-velocity Chutes Permanent lining of grassed bywash spillways for dams and Sediment Basins

6. Erosion control

6.1 Purpose

Erosion control measures are required where activities causing land disturbance are being conducted. This is done to prevent, or at least minimise, soil erosion and thus the development of sediment-laden runoff. The implementation of drainage control measures, in combination with erosion control measures, ensures best management practice.

The standard of erosion control needs to be appropriate for the given soils properties, expected weather conditions, and drainage controls (IECA, 2008).

Refer to Section 6.4 Erosion control reference and Section 6.5 Erosion control measures, for the reference to erosion controls applicable to site/activity.

6.2 Types of erosion

Table 6-1 outlines different forms of soil erosion that may occur on site, and the appropriate control measures that are necessary to minimise, or prevent, their occurrence.

Table 6-1 Management of soil erosion adopted from IECA (2008, p 1.4)

Forms of soil erosion	Primary control measure
Splash erosion	Erosion control
Sheet erosion	
Rill erosion	Drainage control
Gully erosion	Management of stormwater during the operational phase
Tunnel erosion	Soil management and detailing of the earthworks and drainage
Mass movement	Vegetation, stormwater and land management
Watercourse erosion	Permanent stormwater and sediment control
Wind erosion	Erosion control

Note: Refer to Appendix B for description of soil erosion forms

6.3 Technical notes

The following technical notes are adopted from IECA (2008) to provide general guidelines that should be followed for correct implementation of erosion controls:

- Appropriate erosion control measures need to be incorporated into all stages of a development (including each phase of earthworks), and must be designed, installed, operated and maintained in accordance with the latest best management practice guidelines
- The standard of erosion control needs to be appropriate for the given soil properties, expected weather conditions, and drainage controls
- Wherever reasonable and practicable, priority needs to be given to preventing, or at least minimising soil erosion (ie drainage and erosion control measures), rather than allowing the erosion to occur and trying to trap the resulting sediment. Where this is not practicable, then all reasonable and practicable measures need to be taken to minimize soil erosion even if the adopted sediment control measures comply with the required treatment standard
- Best practice erosion control requires appropriate measures to be employed as soon as reasonable and practicable to limit soil erosion and, in particular, to protect any and all exposed areas of soil from rainfall impact erosion

- Drainage controls can also form part of erosion control where stormwater runoff can cause excess erosion
- Wherever reasonable and practicable, the use of synthetic reinforced erosion control mats and erosion control blankets needs to be avoided within bushland and other areas where they could endanger wildlife such as ground-dwelling animals
- Finished soil surfaces need to be left in an appropriate roughened state and quality to encourage revegetation where required
- Independent of the type of revegetation or the stage of revegetation, soil coverage of at least 70% is considered necessary to adequately control raindrop impact erosion, particularly on clayey soils. In the early stages of revegetation, such soil coverage is usually achieved through the application of a mulch layer or erosion control blanket
- Suitable construction access needs to be provided to allow for the installation and maintenance of all erosion controls

6.4 Erosion controls reference

Table 6-2 outlines erosion controls and associated actions. Erosion controls outlined in Table 6-2 are described in Section 6.5 Erosion control measures.

Table 6-2 Erosion control

Erosion controls	Reference section	Erosion controls	Reference section
Erosion control techniques	Section 6.5.1	**Soil erosion on slopes**	Section 6.5.2
Vegetative control of soil erosion	Section 6.5.1	Best practice procedure	Section 6.5.2
Mulching • Light Mulching • Heavy Mulching • Attributes of various mulches	Section 6.5.1	Selection of erosion control measures for soil slopes	Section 6.5.2
Erosion control blankets	Section 6.5.1	Mulch anchoring on slopes	Section 6.5.2

6.5 Erosion control measures

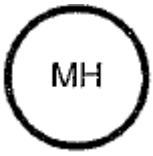
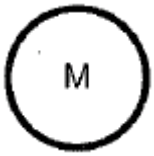
The erosion controls listed in Table 6-2 are presented in this section.

6.5.1 Erosion control techniques

Surface cover is the most important method of controlling soil erosion. Increasing the effective surface cover directly decreases soil erosion.

Table 6-3 outlines appropriate erosion control techniques for use.

Table 6-3 Summary of erosion control techniques adopted from IECA (2008, p 4.17)

Technique	Symbol	Typical use
Bonded Fibre Matrix (BFM)		Grass establishment and protection of newly seeded areas
Cellular Confinement System (CCS)		Containment of topsoil or rock mulch on medium to steep slopes Control erosion on non-vegetated medium to steep slopes such as bridge abutments and heavily shaded areas
Compost Blanket (CBT)		Use during the revegetation of steep slopes either incorporating grasses or other plants Particularly useful when the slope is too steep for the placement of topsoil, or when sufficient topsoil is absent from the slope
Erosion Control Blanket (ECB)		Temporary erosion control on exposed soils not subjected to concentrated flow Temporary control of raindrop impact erosion on earth embankments before and during the revegetation phase
Gravelling (Gravel)		Protection of non-vegetated soils from raindrop impact erosion Stabilisation of site office area, temporary car parks and access roads
Heavy Mulching (MH) - Refer to Mulching - Section 6.5.1.2, for more information		Stabilisation of soil surfaces that are expected to remain non-vegetated for medium to long periods Suppression of weed growth on non-grassed areas
Light Mulching (M) - Refer to Mulching - Section 6.5.1.2, for more information		Control of rainfall impact on flat and mild slopes. May be placed on steeper slopes with appropriate anchoring Control water loss and assist seed germination on newly seeded soil
Revegetation (R)		Temporary and permanent stabilisation of soil Stabilisation of long-term stockpiles Includes Turfing and temporary seeding
Rock Mulching (MR)		Stabilisation of long-term, non-vegetated banks and minor drainage channels

Technique	Symbol	Typical use
Soil Binders (SBS)		Dust control Stabilisation of unsealed roads

Vegetative control of soil erosion

Each form of soil erosion identified in Table 6-1 is best controlled by a combination of different types of vegetation cover. Table 6-4 outlines these practices.

Table 6-4 Plant selection for the control of soil erosion adopted from IECA (2008, p C.3)

Erosion form	Primary vegetation	Secondary vegetation	Comments
Splash erosion (raindrop impact)	Ground covers, grasses, and living or dead organic matter	Trees, shrubs	Ground covers need to quickly cover the soil surface (ie not just straight, vertical shoots – which is often the early growth characteristic of many annuals) Grasses including living, dormant and dead grasses Trees contribute by supplying leaf and bark litter (mulch)
Sheet erosion	Ground covers, grasses		Non-clumping, continuous ground cover is required
Rill erosion	Ground covers, grasses		Non-clumping, continuous ground cover is required
Gully erosion	Ground covers, vetiver grass	Trees, shrubs, woody debris	Vetiver grass can be used to form a vegetative sediment barrier Trees and shrubs may be required for bank stability
Tunnel erosion	Not directly applicable	Not directly applicable	Stabilisation of soil and control of water pathways are of primary importance Avoid deep-rooted or short-lived plants on water impoundment embankments
Mass movement	Trees, vetiver grasses	Shrubs	Use of deep-rooted plants is critical
Wind erosion	Ground covers	Tree, shrubs, mulches	Trees can form windbreaks Aided by increased surface roughness

Revegetation work should be carried out in accordance with the site-specific revegetation plan. For further information regarding revegetation practices refer to the Santos Rehabilitation Plan.

Mulching

The mulching control measures were adopted from IECA (2008, p 4.18) and outlined below.

Mulching can be either heavy or light, and incorporated into, or separate from, the revegetation process. There are numerous types of mulch, all of which perform slightly and sometimes significantly different tasks. To maximise the use of onsite resources, cleared vegetation should be used as mulching where appropriate.

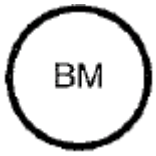
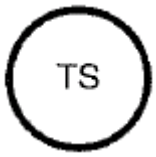
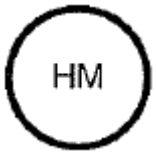
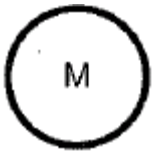
Grass seeded areas should be lightly mulched immediately after seeding to protect them from raindrop impact erosion and to aid seed germination and plant growth. Mulching holds the seed and fertilizer in place, protects the soil from erosion, conserves essential surface moisture (to assist in seed germination and growth) and reduces overall water usage.

Mulching can also encourage successful seed germination by preventing soil crusting while also insulating the soil against rapid temperature changes.

Light mulching techniques

Mulch should be spread evenly with a maximum depth of 50 mm when placed over seed. Table 6-5 outlines light mulching technique attributes.

Table 6-5 Attributes of light mulching adopted from IECA (2008, p 4.18)

Type	Symbol	Typical use
Bonded Fibre Matrix (BFM) A hydraulically-applied mix of seed, fertiliser, a cellulose mulch, mulch tackifier and water which dries to form a seeded erosion control blanket		Revegetation of steep batters Highly successful grassing procedure, but requires strict control of application rates Often the preferred grass seeding technique in wet environments due to the use of non re-wettable tackifiers Expensive but usually highly successful
Brush Mulch (BM)		Use as light mulch when it is desirable to maintain a natural appearance, or regeneration is required from the retained native seed Effective reuse of cleared vegetation
Dead or dormant grass cover (TS) (temporary seeding)		In certain situations, a rapid and complete cover of “annual grass” cover can act as an effective, well-anchored mulch on embankments, batters and table drains, even if the grass is allowed to die-off after initial establishment – thus avoiding the need for ongoing watering
Hydromulch[1] (HM) The spraying of a homogenous mix of seed, fertiliser, a cellulose mulch, mulch tackifier and water onto the soil		Used for grass establishment and protection of newly seeded areas Best used on slopes <10% and slope lengths less than 10 m Requires higher watering requirements than Straw Mulching
Straw Mulching, including sugarcane mulch (M)		Used as light mulching for the protection of newly seeded areas Most beneficial when it is important to minimise watering requirements during seed germination and plant establishment

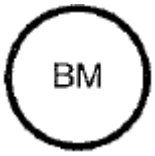
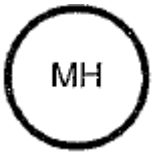
Note: [1] Hydroseeding is not considered a form of mulching due to the minimal application of mulch; however, hydroseeding can be used in partnership with Straw Mulching

Hydroseeding does not provide any initial erosion protection to the soil unless supplemented with a light mulch cover.

Heavy mulching techniques

Mulch should be spread evenly to a depth of 75 to 100 mm – this will generally inhibit seed germination, and is thus used for moisture retention and weed control around tube stock and established plants. Table 6-6 outlines heavy mulching technique attributes.

Table 6-6 Attributes of heavy mulching adopted from IECA (2008, p 4.19)

Type	Symbol	Typical use
Brush, bark and woodchip mulch (BM)		Use for temporary protection of exposed soils prior to the completion of earthworks or other construction activities Some wood-based (woodchip) mulches can reduce nitrogen levels within the soil
Compost Blanket (CBT) A surface application of composted organic material containing selected plant seed, fertilisation and tackifier (optional)		Use for the revegetation of steep slopes using grasses and/or other plants Particularly useful when the slope is too steep for the placement of topsoil, or when insufficient topsoils exists on the site Expensive but usually highly successful
Rock Mulching (MR)		Use in arid areas as a replacement for vegetation Use on garden beds subject to high velocity or high volume overland flows Use on heavily shaded areas (eg under bridges and suspended slabs)
Straw Mulching, including sugarcane mulch (MH)		Use as a heavy mulch to control weed growth and soil moisture loss Most beneficial when it is important to minimise watering requirements of seedlings

Relative attributes of various mulches

Table 6-7 summaries the relative key attributes (eg cost, water usage) of the various mulches identified in Table 6-5 and Table 6-6.

Table 6-7 Relative attributes[1] of various mulches adopted from IECA (2008, p 4.19)

	Cost	Water usage	Control of raindrop impact	Stability in wet areas	Durability	Placement on steep slopes	Placed with grass seed [4]
Bonded Fibre Matrix	H	M	H	H	M	H	Y
Brush Mulch	L-M	M	H	M	M	M	[5]
Compost Blanket	H	M	H	H	H	H	Y
Hydomulch	M	H	M	L	L-M	M	Y
Rock Mulching	M	L	H	H	H	M	N
Straw Mulch	M	L	H	[3]	M	[3]	N

	Cost	Water usage	Control of raindrop impact	Stability in wet areas	Durability	Placement on steep slopes	Placed with grass seed [4]
Temp grass	L-M	L-M	[2]	[2]	M	H	Y
Wood chip	L-M	M	H	L	M	L	N

Note: [1] Attributes defined as: H-high, M-medium, L-low, Y-yes and N-no
[2] May need to be incorporated with a jute/coir mesh and bitumen emulsion to achieve effective erosion control during the early grass establishment phase
[3] Stability on steep slopes and in high rainfall areas depends on the type and application rate of tackifier
[4] Grass seed can be incorporated into the mulch during application
[5] Plant seeding may be generated from native seed contained within the brush

Erosion control blankets

When selecting the appropriate control blanket, and/or mat or mesh to apply to a drainage channel, it is important to identify the attributes and features required for best practice performance. Table 6-8 outlines the attributes of erosion control blankets, mats and meshes.

The erosion control blankets outline was adopted from IECA (2008, p 4.18) and outlined below.

In areas of strong winds or overland flow, Erosion Control Blankets can be used as an alternative to loose mulching practices such as Straw Mulching. Both “thick” and “thin” blankets are available. The thin blankets perform a task similar to light mulching, while the thicker blankets perform a task similar to heavy mulching.

Table 6-8 Attributes of erosion control blankets, mats and meshes adopted from IECA (2008, p 4.19)

Product	Attributes
Hydraulically applied blankets	Includes Bonded Fibre Matrix and Compost Blankets Low to medium shear strength Suitable for application on irregular surfaces and steep slopes Compost Blankets can provide a nutrient source
100% biodegradable jute and coir blankets	Low shear strength Require good soil preparation and removal of surface irregularities
Jute and coir mesh	Medium shear strength Typical design life in dry environments of 12 to 24 months Do not represent a threat to wildlife
Short-term synthetic reinforced composite blanket	Medium shear strength Plastic mesh can represent a threat to wildlife Design life generally less than 12 months
Permanent turf reinforcement mats	High shear strength May be damaged by grass fires Can significantly limit the future reuse of the topsoil

6.5.2 Control of soil erosion on slopes

Best practice procedure

The best practice considerations for the control of soil erosion on slope, adopted from IECA (2008, p 4.21), are:

a) First priority during periods when rainfall is possible is to ensure suitable non-erosive drainage conditions are established (refer to drainage control – Section 5)
b) Second priority during periods when rainfall is possible is to establish a minimum 70% (or greater in accordance with local standards) of the soil surface
c) Third priority is to establish a complete and continuous cover of vegetation and/or mulch in accordance with a landscape plan
d) Slopes that can be vegetated should be as flat as possible within the scope of the project aims in order to reduce shear stress on the slope resulting from stormwater runoff
e) Slopes that are unlikely to be fully vegetated should be as steep as possible within the scope of the project aims in order to reduce the effective surface area of the slope subject to raindrop impact erosion
f) On steep, grass seeded slopes, turf strips pinned along the contour at a maximum 2 m spacing can be used to help maintain “sheet” flow down the slope and reduce the risk of rill erosion and the mulch being washed from the slope

Selection of erosion control measures for soil slopes

The erosion control techniques identified in Table 6-3, have been categorised into differing soils slopes depending on their applicability to varying soil slopes.

The application of various erosion control measures to low-gradient and steep-gradient slopes subject to “sheet” flow is outlined in Table 6-9.

Table 6-9 Application of erosion control measures to soil slopes adopted from IECA (2008, p 4.21)

Erosion control techniques on soil slopes		
Flat land (flatter than 1 in 10)	Mild slopes (1 in 10 – 1 in 4)	Steep slopes (steeper than 1 in 4)
Erosion Control Blankets	Bonded Fibre Matrix Compost Blankets	Bonded Fibre Matrix Cellular Confinement Systems
Gravelling	Erosion Control Blankets, Mats and Mesh	Compost Blankets
Mulching	Mulching well anchored	Erosion Control Blankets, Mats and Mesh
Revegetation	Revegetation	Revegetation
Rock Mulching	Rock Mulching	Rock Armouring
Soil Binder	Turfing	Turfing
Turfing		

Vegetation is one of the best long-term options to implement on site. It can also provide a short-term erosion control if turfing is applied.

On mild slopes (1 in 10 to 1 in 4) loose organic mulch may not be appropriate if heavy rains are expected, or if stormwater runoff is allowed to concentrate down the slope. However, if mulching is to be employed then anchoring may be required; refer to Section 6.5.2 for the control techniques.

Mulch anchoring on slopes

The mulching anchoring on slopes (control measures) were adopted from IECA (2008, p C.33) and outlined below.

It is often desirable to hold the mulch in position to reduce loss by wind and water runoff, especially on sloping ground. This may be achieved using one or more of the following methods:

- Light discing into the ground
- Working a tracked dozer up and down the slope
- Covering with biodegradable, synthetic or wire mesh – used with the extreme caution due to its potential to trap or injure wildlife
- Application of a slow setting (anionic) bitumen emulsion
- Regularly spaced and anchored logs

Mulch generated through either horizontal or tub grinder, not chipping, is likely to be more stable on sloping ground.

7. Sediment control

7.1 Purpose

The primary purpose of including sediment control measures is to trap the coarser sediment fraction and to control sediment-laden runoff. However, there are also a number of techniques that allow the capture of very fine sediments and can reduce the turbidity levels within stormwater runoff.

It is important to note that work sites must not rely solely on the application of sediment control measures to provide adequate environmental protection. Sediment control measures must be implemented in conjunction with appropriate erosion and/or drainage controls.

Refer to Section 7.4 Sediment control reference and Section 7.5 Sediment control measures, for the reference to erosion controls applicable to site/activity.

7.2 Classification of sediment traps

Selection of the appropriate sediment control technique is based on the soil type (eg size, dispersivity) contained in sediment-laden runoff. For the purpose of this ESC manual, sediment controls were split into four groups subject to their capacity to trap sediment loads with different particle size (Table 7-1).

Table 7-1 Sediment trap classification adopted from IECA (2008, p 4.26)

Classification	Minimum particle size	Soil group
Type 1	Less than 0.045 mm	Fine (Clay and Silt)
Type 2	0.045 mm – 0.14 mm	Fine (Silt)
Type 3	Greater than 0.14 mm	Coarse (Sand)
Supplementary	Greater than 0.14 mm	Coarse (Sand)

Note: [1] Technically, silt particles have a grain size between 0.002 and 0,02 mm which means that only Type 1 sediment traps are likely to cause silt-sized particles. However, for general purposes, it can be assumed that Type 2 systems capture a significant proportion of silt-sized particles.

7.3 Technical notes

The following technical notes adopted from IECA (2008) provide general guidelines that should be followed for correct implementation of sediment controls:

- All sediment control measures must be applied and maintained in accordance with the latest best management practice guidelines
- Construction sites must not rely solely on the application of sediment control measures to provide adequate environmental protection
- Suitable construction access needs to be provided to allow for the installation and maintenance of all sediment traps
- Optimum benefit must be made of every opportunity to trap sediment within the work site, and as close as practicable to the source
- Sediment traps must be installed and operated to both collect and retain sediment
- All reasonable and practicable measures must be taken to prevent, or at least minimise, the release of sediment from the site
- Materials, whether liquid or solid, removed from sediment control devices during maintenance or decommissioning, must be disposed of in a manner that does not cause ongoing soil erosion or environmental harm

7.4 Sedimentary controls reference

Table 7-2 outlines sediment controls and associated actions. Sediment controls outlined in Table 7-2 are described in Section 7.5 – Sediment control measures.

Table 7-2 Sediment control

Sedimentary control measures for:	Reference section	Sedimentary control measures for:	Reference section
Sheet flow	Section 7.5.1	Culvert and pipe inlets	Section 7.5.6
Kerb Inlets Best practice procedure	Section 7.5.2	Stormwater pipe outlets	Section 7.5.7
Field (drop) inlets	Section 7.5.3	Dewatering	Section 7.5.8
Minor concentrated flow	Section 7.5.4	Entry/Exit points	Section 7.5.9
Concentrated flow Sediment Basins Sediment Basin requirements	Section 7.5.5	Stockpile management	Section 7.5.10

7.5 Sediment control measures

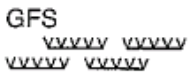
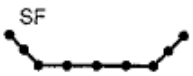
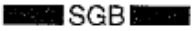
The drainage controls listed in Table 7-2 are presented in this section.

7.5.1 Sediment control measures for sheet flow

Table 7-3 outlines the sediment control measures appropriate for sheet flow.

Table 7-3 Sheet flow sediment control adopted from IECA (2008, p 4.28)

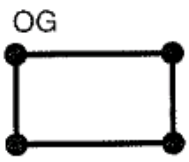
Technique	Symbol	Typical use
Buffer Zones (BZ)		Type 3 sediment trap Most suited to sandy soils Generally only suitable for rural and rural-residential building/construction sites Can provide some degree of turbidity control while the Buffer Zone remains unsaturated
Compost Berm (CB)	CB	Type 2 sediment trap Suitable for all soil types
Fibre Roll (FR)	FR	Supplementary sediment trap Most suitable for sandy soils Suitable for minor flows only
Filter Fence (FF)	FF	Type 3 sediment fence Very small catchment areas (eg stockpiles) Better capture of the finer (sand/silt) sediments compared to woven *Sediment Fence*
Filter Sock (FS)	FS	Type 2 sediment trap Suitable for all soil types

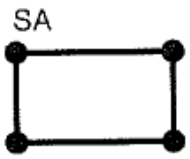
Technique	Symbol	Typical use
Grass Filter Strips (GFS)		Supplementary sediment trap Most suited to sandy soils Minor sediment traps placed along contour Can be used as a drainage control measure to maintain sheet flow down earth batters
Modular Sediment Trap (MST)		Type 3 sediment trap Modern replacement for Straw Bale Barriers
Mulch Berm (MB)		Type 2 sediment trap Suitable for all soil types
Sediment Fence – Woven Fabric (SF)		Type 3 sediment fence Suitable for all soil types Long duration construction sites likely to experience several storm events
Sediment Fence – Non-woven composite fabric (SF)		Type 3 sediment fence Suitable for all soil types Preferred type of Sediment Fence when placed adjacent critical habitats such as waterways Short duration construction sites or sites likely to experience only a few storm events
Stiff Grass Barrier (SGB)		Supplementary sediment trap Most suited to sandy soils Most commonly used as permanent sediment traps in rural areas

7.5.2 Sediment control measures at kerb inlets

Table 7-4 outlines the sediment control measures appropriate for use at roadside kerb inlets.

Table 7-4 Kerb inlet sediment control adopted from IECA (2008, p 4.29)

Technique	Symbol	Typical use
Gully Bag (GB)		Generally considered to represent best practice as a form of kerb inlet sediment control Use when it is considered unsafe to cause pond or sediment deposition on the roadway Includes the use of flexible filter bags, and filter boxes lined with filter fabric Significant variation in treatment standard of various commercial products
On-grade Kerb Inlet Sediment Trap (OG)		Up-slope of on-grad kerb inlets (ie kerb inlets not located at a sag point on a road) Used as a series of sediment traps to collect cement runoff during the preparation of exposed aggregate surfaces

Technique	Symbol	Typical use
Sag Inlet Sediment Trap (SA)		Used as a minor sediment trap constructed around kerb inlets located at sag points along a roadway

Due to the high risk of physical displacement and damage, most roadside kerb inlet sediment traps are classified as supplementary sediment traps. Gully bags and fixed, in-gully filter bags/boxes generally provide a higher treatment standard if correctly installed and appropriately maintained.

Best practice procedure

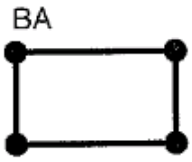
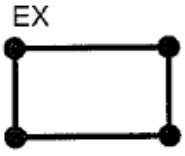
The following recommendations and procedures, adopted from IECA (2008, p 4.29), are considered to represent the best practice for roadside operations:

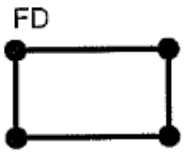
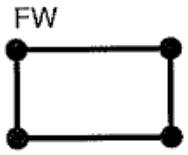
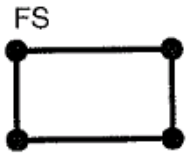
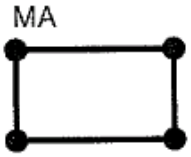
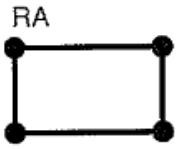
a) Wherever practicable, sediment runoff is collected and retained wholly within the work site
b) Where the work site includes roads, whether sealed or under construction, all reasonable and practicable measures are taken to trap sediment runoff prior to its entry onto a road surface
c) Where the sediment runoff has originated from the road surface, then all reasonable and practicable measures are taken to prevent the sediment entering a sealed (eg hard lined drainage system) or permanent drainage system (eg piped or open channel drain)
d) Sediment control measures used within, or adjacent, a roadside stormwater inlet are to represent current best available practice
e) The use of kerb inlet sediment traps must not replace the need for appropriate Type 1, Type 2 or Type 3 sediment traps up-slope of all stormwater inlets as required by the sediment control standard

7.5.3 Sediment control measures at field (drop) inlets

Table 7-5 outlines the sediment control measures appropriate for use at field (drop) inlets.

Table 7-5 Field (drop) inlet sediment control techniques adopted from IECA (2008, p 4.30)

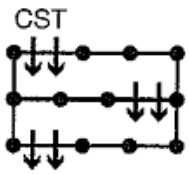
Technique	Symbol	Typical use
Block and Aggregate Drop Inlet Protection (BA)		Type 2 sediment trap Small to medium catchment areas Filter cloth may be placed between the aggregate and the support blocks to improve the removal of fine sediments The depth of ponding upstream of the field inlet is governed by the height of the blocks
Excavated Drop Inlet Protection (EX)		Type 2 or 3 sediment trap Use in locations where water ponding around the stormwater inlet is not allowed to reach a level significantly higher than the existing ground level (ie water ponding and sediment collection occurs below finished ground level) Safety issues may require the excavated pit to be surrounded by appropriate safety fencing

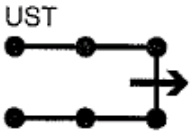
Technique	Symbol	Typical use
Fabric Drop Inlet Protection (FD)		Type 3 sediment trap Best used on sandy soils Use for small catchment areas containing sandy soils Use in locations where space is limited and a more substantial filter medium cannot be built
Fabric Wrap Inlet Protection (FW)		Type 3 sediment trap For very small catchment areas Most commonly used on building sites
Filter Sock Drop Inlet Protection (FS)		Type 2 sediment trap Small catchments Compost contained within the sock can absorb some dissolved and fine particulate matter
Mesh and Aggregate Drop Inlet Protection (MA)		Type 2 sediment trap Small to medium catchments The depth of ponding upstream of the field inlet is governed by the height of the aggregate filter placed around the wire mesh
Rock and Aggregate Drop Inlet Protection (RA)		Type 2 sediment trap Best used in coarse-grained (ie low clay) soil areas Large construction sites sich as a duel-carriage road with the drop inlet located within the median strip Locations where space is not critical

7.5.4 Sediment control measures in areas of minor concentrated flows

Table 7-6 outlines the sediment control measures appropriate for use in areas of minor concentrated flows.

Table 7-6 Sediment control techniques for minor concentrated flow adopted from IECA (2008, p 4.31)

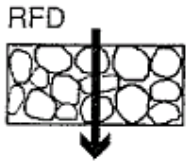
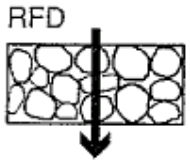
Technique	Symbol	Typical use
Check Dam Sediment Trap (CDT)		Supplementary sediment trap Trapping sediment in table drains and other minor drainage lines Check Dams may be constructed from rock, sand bags, or compost-filled socks Compost-filled socks can absorb some dissolved and fine particulate matter
Coarse Sediment Trap (CST)		Type 3 sediment trap Best used on sandy soils Commonly used as sediment trap at the low point of a Sediment Fence Used as an alternative to a spill-through weir on a sediment Fence

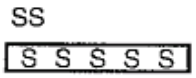
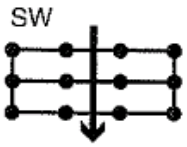
Technique	Symbol	Typical use
Filter Tube Dam (FTD)		Type 2 sediment trap Trapping sediment in minor drainage lines Generally provides greater treatment of low flows than a U-shaped sediment trap Filter traps can be integrated into a variety of type 2 and 3 sediment traps (such as a Rock Check Dam, U-shaped sediment trap, Rock filter dam, and Sediment Weir) to improve their efficiency during minor flows
Modular Sediment Trap (MST)		Type 3 sediment trap Modern replacement for Straw Bale Barriers Capability of accepting concentrated flows depends on construction techniques
U-Shaped Sediment Trap (UST)		Type 3 sediment trap Minor concentrated flows such as table drains The sediment fence must be constructed in a U-shape with an appropriate spill-through weir Filter tubes can be integrated into a U-shaped Sediment Trap to increase the effective hydraulic capacity and to improve the treatment of low flows

7.5.5 Sediment control measures in areas of concentrated flows

Table 7-7 outlines the sediment control measures appropriate for use in areas of concentrated flows.

Table 7-7 Concentrated flow sediment control techniques adopted from IECA (2008, p 4.32)

Technique	Symbol	Typical use
Rock Filter Dam (RFD): Filter cloth used as the primary filter medium		Type 2 sediment trap To be located where there is sufficient room to construct a relatively large rock embankment The incorporation of filter cloth is the preferred construction technique if the removal of fine-grained sediment is critical; however, de-silting and replacement of the fabric can be difficult and can lead to ongoing poor performance
Rock Filter Dam (RFD): Aggregate used as the primary filter medium		Type 2 sediment trap Best used on sandy soils Locations where there is sufficient room to construct a relatively large rock embankment Aggregate filters are normally used on long-term sediment trap, and sediment traps that are likely to be regularly de-silted

Technique	Symbol	Typical use
Sediment Basin – Type C (SB) Refer to information below on Sediment Basins	No standard symbol – draw actual basin layout on ESC plan	Type 1 sediment trap Best suited to coarse-grained soils Use for the trapping of coarse and fine sediments in major earthworks projects Use when a major (type 1) sediment trap is required when working in areas containing coarse-grained, good settling soils
Sediment Basin – Type F and Type D (SB) Refer to information below on Sediment Basins	No standard symbol – draw actual basin layout on ESC plan	Type 1 sediment trap Best suited to fine-grained or dispersive soils Used for the trapping of coarse and fine sediments Used for turbidity control Use when a major (type 1) sediment trap is required when working in areas containing fine-grained, dispersive or poor settling soils
Sediment Trench (SS)		Type 2 or 3 sediment trap Used in long, narrow spaces At the base of fill batters where there is limited space between the toe of the batter and the property boundary
Sediment Weir (SW)		Type 2 sediment trap Use where space is limited (ie when space is not available for use of a Rock Filter Dam) Where the sediment trap may be subjected to regular over-topping flows Used as a primary outlet structure on minor “dry” Type 2 Sediment Basins

Sediment basin design

Sediment basins

Sediment basins need to be designed and constructed under the supervision of ESC specialists.

‘A sediment basin is normally a Type 1 sediment trap that is usually required when the estimated soil erosion rates or hazard rating exceeds a nominal value’ (IECA, 2008, p B.4). ‘Sediment basins may also be required when the disturbed soils are dispersive, or there is a specific need to control runoff turbidity, or achieve a specified discharge water quality’ (IECA, 2008, p B.4).

Selection of the type of sediment basin is governed by the site’s soil properties as outlined in Table 7-8.

Table 7-8 Selection of basin type adopted from IECA (2008, p B.5)

Soil and/or catchment conditions [1]	Basin type
Less than 33% of soil finer than 0.02 mm (ie d_{33} > 0.02 mm) and no more than 10% of soil dispersive [2]	Type C basin
More than 33% of soil finer than 0.02 mm (ie d_{33} < 0.02 mm) and no more than 10% of soil dispersive [2]	Type F basin
More than 10% of soil dispersive [2], or when a Stormwater Management Plan, or adopted Water Quality Objectives specify strict controls on turbidity levels and/or suspended solids concentrations for discharged waters	Type D basin

Note: [1] If more than one soil type exists on the site, then the most stringent criterion applies (ie Type D supersedes Type F, which itself supersedes Type C).
[2] The percentage of soil that is dispersive is measured as the combined decimal fraction of clay (<0.002 mm) plus half the percentage of silt (0.002-0.02 mm), multiplied by the dispersion percentage

Table 7-9 provides a description of each sediment basin type.

Table 7-9 Basin type descriptions adopted from IECA (2008, p B.5)

Basin type	Description
Type C basin	These basins are mostly suitable for coarse grained, good settling soils (defined as type C soils). Type C basins may be operated as either "wet" or "dry" basins depending on the requirement for stormwater reuse on the site. The critical design parameter in a Type C basin is the effective surface area of the settling pond
Type F basin	These basins are generally suitable for fine grained soils than can readily settle without the need for flocculating agents (defined as Type F soils). Type F basins can only be operated as wet basins. The critical design parameter for a Type F basin is the volume of the settling pond
Type D Basin	These basins are required for the treatment of dispersive soils that do not readily settle without the use of flocculating agents (defined as Type D soils). Type D basins can only be operated as wet basins. The critical design parameter for a Type D basin is the volume of the settling pond
Note: Even if soil conditions satisfy the requirements for a Type C basin, this does not guarantee that the water quality achieved by the basin will satisfy the required environmental objectives. As such, a poorly performing Type C basin may need to be operated in accordance with the procedures defined for a Type F or Type D basin in order to satisfy specified water quality objectives. Similarly, Type F basins may need to be chemically treated (ie as per Type D basins) if they fail to achieve the specified water quality objectives	

Summary of Sediment Basin design requirements

Table 7-10 summarises the requirements for Sediment Basin design.

Table 7-10 Summary of Sediment Basin design requirements adopted from IECA (2008, p B.3)

Parameter	Type C basin	Type F and D basins
Soil characteristic	Less than 33% of soil finer than 0.02 mm and no more than 10 % of soil dispersive	Type F: More than 33% of soil finer than 0.02 mm Type D: More than 10% of soil dispersive, or where turbidity control is essential
Settling pond sizing, Surface Area (A_s), or settling volume (V_s)	$A_s = 3400\ H_e\ (Q)$ Q = 0.5 times 1 in 1yr flow [Q – design flow rate [m^3/s]]	$V_s = 10\ R_{(Y\%,\ 5\text{-day})}\ C_v\ A$ [$R_{(Y\%,\ 5\text{-day})}$ – Y%, 5-day rainfall depth [mm], C_v – volumetric runoff coefficient]

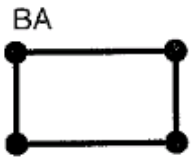
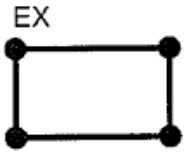
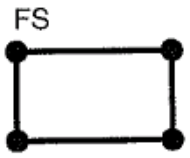
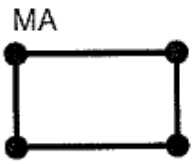
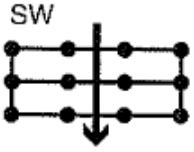
Parameter	Type C basin	Type F and D basins
Length to width ratio	Hydraulic efficiency factor (H_e) is reduced with increasing length to width ratio	L:W of 3:1 is highly desirable
Minimum depth of settling zone	0.6 m	0.6 m
Sediment storage volume	100% of settling volume	50% of settling volume
Use of inlet chamber	Desirable if length to width ration is less than 3:1, or if inflow is concentrated with high flow velocity	
Internal baffles	Desirable if length to width ration is less than 3:1	
Use of outlet chamber	Essential if skimmer pipe outlet system is employed	Use depends on type of outlet system adopted
Control inflow conditions	Used to control erosion at inlets and, where practicable, ensure the inflow pipe invert is above the spillway crest elevation	
Pre-treatment pond	Used to reduce the cost and frequency of de-silting operations	
Primary outlet	Ensure choice of outlet system is compatible with basin type	
Emergency spillway minimum design capacity	Less than 3 month design life: capacity of 1 in 10 year ARI 3 to 12 months design life: capacity of 1 in 20 year ARI Greater than 12 months design life: capacity of 1 in 50 year ARI	
Elevation from top of riser pipe outlet to spillway crest	300 mm (min)	N/A
Freeboard from maximum pond water level to top of virgin soil bank	150 mm	150 mm
Freeboard from maximum pond water level to top of fill embankment	300 mm (min)	300 mm (min)
Minimum freeboard along spillway chute	300 mm (min)	300 mm (min)
Minimum embankment crest	2.5 m	2.5 m
Maximum gradient of access ramp	6:1	6:1
Chemical flocculation	As required to satisfy water quality objectives	Type F: As required to satisfy water quality objectives Essential for Type D basins

Note: Refer to the Best Practice Erosion and Sediment Control (2008) guidelines, as developed by the International Erosion Control Association, for further detailing of Sediment Basin design

7.5.6 Sediment control measures at culvert and pipe inlets

Table 7-11 outlines the sediment control measures appropriate for use at culvert and pipe inlets.

Table 7-11 Sediment control techniques at the entrance to culverts and open stormwater pipes adopted from IECA (2008, p 4.33)

Technique	Symbol	Typical use
Block and Aggregate sediment trap (BA)		Type 2 sediment trap Small to medium catchment areas It is usually necessary for the block and aggregate barrier to be constructed in a manner that does not block or partially block the pipe or culvert entrance Filter cloth may be placed between the aggregate and the support blocks to improve the removal of fine sediments The depth of ponding upstream of the pipe or culvert entrance is governed by the height of the block wall Heavy, solid timber planks can be used as an alternative to concrete blocks
Excavated sediment trap (EX)		Type 3 sediment trap (when placed at the entrance of a culvert or open stormwater pipe) Generally the least desirable type of sediment trap placed at the entrance of a culvert or open stormwater pipe Suitable in locations where ponding upstream of the inlet is not allowed (ie water ponding and sediment collection occurs below finished ground level) Safety issues may require the excavated pit to be surrounded by appropriate safety fencing
Filter Sock sediment trap (FS)		Type 2 sediment trap Small catchments Compost contained within the sock can absorb some dissolved and fine particulate matter
Mesh and Aggregate sediment trap (MA)		Type 2 sediment trap Small to medium catchments Depth of ponding upstream of the inlet is governed by the height of the aggregate filter placed in front of the wire mesh
Sediment Fence (woven or non-woven) (SF)		Type 3 sediment fence Not recommended unless there is a very high expectation that flows will be very low Not suitable for culvert inlets
Sediment Weir (SW)		Type 2 sediment trap Generally stronger than a Mesh and Aggregate sediment trap Best used when high flow rates are expected

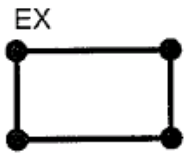
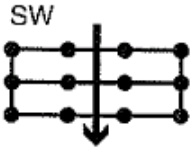
7.5.7 Sediment control measures for stormwater pipe outlets

Table 7-12 outlines the attributes of various temporary sediment control techniques that may be suitable for placement at the outlet of stormwater pipes. Extreme care must be taken when selecting the preferred technique, as not all of the listed techniques are suitable in all circumstances.

The sediment control measures for stormwater pipe outlets were adopted from IECA (2008, p 4.34) and outlined below.

> When locating a sediment trap at the outlet of a stormwater pipe, the sediment trap should ideally be located downstream of the influence of outlet "jetting" (ie 10-13 x pipe diameters downstream of the outlet). If located too close to the outlet, then high flow velocities discharging from the outlet can resuspend previously settled sediment washing it downstream of the sediment trap.
>
> Sediment traps must not be located within streams or major drainage channels unless they satisfy the requirements outlined for In-stream Works.

Table 7-12 Sediment control techniques at the outlet of stormwater pipes adopted from IECA (2008, p 4.34)

Technique	Symbol	Typical use
Excavated sediment trap (EX)		Type 3 sediment trap Generally the least desirable type of sediment trap placed at the entrance of a culvert or open stormwater pipe Best used when it is necessary to avoid backwater ponding and thus sedimentation within the stormwater pipe or culvert Safety issues may require the excavated pit to be surrounded by appropriate safety fencing
Filter Tube Dam (FTD)		Type 2 or Type 3 sediment trap Best used when there is significant fall immediately downstream of the stormwater outlet, thus allowing the Filter Tubes to be set below the invert of the pipe. This prevents ponding and sedimentation within the pipe It may not be practical to incorporate enough Filter Tubes to cater for the expected design flow rate. In which case the sediment trap may only be considered a Type 3 system Trapping sediment in minor drainage lines
Sediment Weir (SW)		Type 2 sediment trap Best used when high flow rates are expected Filter Tubes can be incorporated into the Sediment Weir to improve the treatment of low flows
Straw Bale Barrier (SBB)		Type 3 sediment trap Only suitable when poor site access prevents the use of other, more suitable, sediment traps

Note: The use of straw bales to form sediment traps should be avoided, unless site conditions prevent the use of other more appropriate sediment control systems

7.5.8 Dewatering sediment control measures

Table 7-13 outlines the best practice sediment control measures for the de-watering of excavated material and other stockpiles.

Table 7-13 De-watering of excavated material and other stockpiles adopted from IECA (2008, p 4.36)

Material	Sediment Control	Comments
Non-clayey material	Grass filter area or equivalent	Ensure grass area remains unsaturated during de-watering operations
Clayey material	Filter Fence (non-woven filter cloth)	Filter cloth must be supported by wire mesh, or aggregate berm Woven Sediment Fence fabric must not be used
	Compost Berm or Mulch Berm or Filter Sock	Ensure the berm/sock is placed along the contour to ensure flow is distributed evenly along the length of the berm/sock Ensure water does not bypass around the end of the berm/sock
Contaminated material	Not applicable	Seek expert advice on a case-by-case basis

Various sediment controls measures associated with dewatering activities are presented in Table 7 14.

Table 7-14 Recommended use and attributes of various sediment control techniques applicable to de-watering activities adopted from IECA (2008, p 4.36)

Expected Flow	Technique [1]	Application and comments
Low	Sump Pit	Filtration occurs at the pump inlet rather than at the outlet of the pipe Can be used in association with an outlet treatment system
	Filter Bag	Quick to install and remove Commercially available product
	Filter Tube	Commercially available product High flow rates can be treated by adding additional Filter Tubes operating in parallel
	Grass Filter Bed	Only suitable on sandy loamy soils Generally not effective on clayey soils Generally not effective during wet weather when the grass is wet Pipe outlet must be relocated once the grassed area becomes saturated. Use of an outlet manifold can delay soil saturation A Sediment Fence may be placed up-slope of the grass to collect coarse sediment and help distribute flow evenly across the width of the grass filter
	Filter Fence	Suitable for the finer grain soils, but not for turbidity control
	Sediment Fence	Only suitable for coarse-grained material
Moderate	Filter Tube Dam	Commercially available product High flow rates can be treated through the use of several Filter Tubes operating in parallel

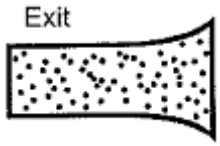
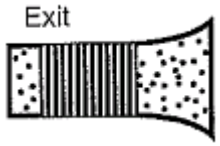
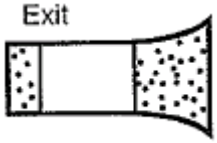
Expected Flow	Technique [1]	Application and comments
	Filter Sock	Filter Sock used as a type of Filter Pond with the sock placed as an enclosed circle Used on flat or near-flat ground Compost contained within the sock can absorb some dissolved and fine particulate matter
	Filter Pond	Used on flat or near-flat ground Most effective for coarse-grained sediment Limited control over turbidity, unless used on highly porous soil
	Portable Sediment Tank	Wide variety of different system can be employed Usually have limited control over turbidity High initial purchase cost, but operation costs can be low
	Settling Pond or Stilling Pond	Outlet structure may consist of a Rock Filter Dam, or a series of Filter Tubes Only suitable for waters containing fast settling sediments
	Hydroyclone	Transportable truck/trailer mount units Work well in confined spaces
High	Sediment Basin – Type F and Type D	Best option for turbidity control Disturbed material contains more than 33% finer than 0.02 mm Usually requires chemical flocculation

Note: [1] Techniques not listed in order of preference

7.5.9 Sediment controls at entry/exit points

Table 7-15 outlines the sediment control measures appropriate for the construction site entry/exit points.

Table 7-15 Use of stabilised construction exits adopted from IECA (2008, p 4.37)

Technique	Symbol	Typical use
Rock Pad (Exit)		Suitable for all soil types Minimum 15 m length for construction sites Generally better than a vibration grid during wet weather Drainage control methods may need to be incorporated into the rock pad to direct sediment-laden runoff to an appropriate sediment trap
Vibration Grid (Exit)		Best suited to sandy soils Can also be used in clayey soils regions to control weather sediment movement during the dry weather
Wash Bay (Exit)		When working near fragile environments, when turbidity control is a major issue, or when working with highly cohesive clays Options of in-situ, or commercial (hire), portable units Usually best practice on long-term sites

Drainage control may be required across an entry/exit pad if the construction site is elevated above ground level to above washing sediment off site. For a rock pad, construction of a raised flow diversion bund across the pad will direct stormwater runoff across the entry/exit pad. This can then be directed towards a sediment control (eg sediment fence).

7.5.10 Stockpile management

Stockpile management methods are outlined in Table 7-16 and Table 7-17.

Table 7-16 outlines the protection methods appropriate for sand and soil stockpiles from wind and rainfall.

Table 7-16 Protection of sand and soil stockpiles from wind and rainfall adopted from IECA (2008, p 4.38)

Material	Stockpile cover [1]	Comments
Sand	No cover	When wind erosion and dust control is not an issue
	Synthetic cover, porous or not porous	When the control of wind erosion is essential for reasons of safety
Soil	No cover	When wind erosion and dust control are not an issue
	Mulching, vegetative cover, chemical stabilisers, soil binders, or impervious blanket [2]	Long-term (>28 days) stockpiling of dispersive soils Long-term (>28 days) stockpiles of clayey soils when turbidity control is desirable Long term (>5/10 days) soil stockpiles during months of Extreme/High erosion risk

Note: [1] Applicable only when displacement of the stockpiled material has the potential to cause environmental harm. The practice of covering stockpiles may need to be modified if theft or damage to covers becomes excessive
[2] Mulching is normally applied at the first opportunity that mulch or hydromulch can be introduced to the site. Minimum 70% cover is required for both mulch and vegetative covers. Though still desirable, a cover may not be required if runoff from the stockpile is directed to a Type 1 sediment trap

Table 7-17 outlines the sediment control measures located down-slope of stockpiles to prevent sediment laden runoff.

Table 7-17 Sediment control practices down-slope of stockpiles adopted from IECA (2008, p 4.38)

Material	Sediment control	Comments
Sand or gravel	Woven Sediment Fence or equivalent	Sediment control is only required if stockpiled material could be displaced and cause safety risks or environmental harm
Topsoil	Woven Sediment Fence or equivalent	If the topsoil is moderately to highly erodible and is likely to release significant clay-rich (turbid) runoff, refer to the recommendations below for subsoil stockpiles
Subsoil	Woven Sediment Fence or equivalent	Stockpiles located up-slope of suitably grassed areas that will allow for the infiltration of stormwater runoff from the stockpile (minimum 15 m of flow length), or all runoff is directed to a Type 1 or Type 2 sediment trap
	Compost Berm, Filter Fence, composite (non-woven) Sediment Fence, or equivalent	Stockpiles not located up-slope of a suitable grassed area, or Type 1 or Type 2 sediment trap Soil stockpiles located adjacent permanent drainage channels or waterways

8. In-stream works

Water flow associated with the in-stream works includes stream flow passing through the work area (in-bank stream flow) and lateral flows entering from local stormwater runoff.

Ecological conditions and geological processes must be taken into consideration during in-stream work. Activities should be carried out in strict accordance with Environmental Approval requirements and not without the appropriate investigation of associated environmental conditions.

8.1 Water flow control methods

Table 8-1 outlines the types of water flow that occur during in-stream works and the necessary control measures.

Table 8-1 Types of water flow associated with in-stream flow

Type of water flow	Control measure
Stormwater runoff	Divert water using the drainage control techniques outlined in Section 5
In-bank stream flows Refer to Table 8-2 below for advantages and disadvantages of each in-bank stream flow diversion method	Cofferdam with a gravity bypass pipe Cofferdam with a pumped bypass Isolation barrier

Advantages and disadvantages of in-stream diversion methods are outlined in Table 8-2.

Table 8-2 Advantages and disadvantages of in-stream diversion methods adopted from IECA (2008, p I.18)

Diversion measure	Advantages	Disadvantages
Cofferdam with a gravity bypass pipe	No power cost	Bypass pipeline may interfere with work activities Flood flows still pass through the work site Disruption of fish passage
Cofferdam with a pumped bypass	Bypass pipeline does not interfere with work activities	Added power and maintanence costs Flood flows still pass through the work site Disruption of fish passage
Isolation barrier	Minimal disturbance to normal channel flow Minimal disruption to fish passage Better able to isolate the work area from flood flows	Some Isolation Barriers, such as Silt Curtains, are not watertight Requires work across the channel bed to be staged

Recommended flow diversion for in-stream works is outlined in Table 8-3.

Table 8-3 In-stream works recommended flow diversions adopted by IECA (2008, p I.18)

Condition	Recommendations
Default conditions	Flow diversion shall only occur if it is financially feasible and the environmental benefit gained by its use exceed the potential harm caused by the installation and removal of the Isolation Barrier or Cofferdams
No base flow	If there is no base flow (ie no obvious running water, but permanent pools may be present) and stream flow is not expected during the construction or maintenance activity, then refer to the default conditions
	If there is no base flow (ie no obvious running water, but permanent pools may be present) but stream flow is possible, then appropriate consideration must be given to the installation of an Isolation Barrier
Base flow exists in the stream	If there is a base flow and increased stream flows are not expected, then appropriate consideration must be given to the installation of Cofferdams with a low-flow bypass system
	If there is a bass flow and increased stream flows (ie in response to a storm) are possible, but not likely, then the choice between the use of an Isolation Barrier or cofferdams will depend on the likelihood of stream flows overtopping the cofferdams
	If there is a base flow and increased stream flows are expected (ie in response to a storm), then the first option should be to delay the proposed works until stream flows are a minimum. In any event, priority should be given to install an Isolation Barrier.
Fish passage required to be maintained	First preference: an isolation barrier that isolates no more than 30% of the stream width at any given time Second preference: an Isolation Barrier that isolates no more than 50% of the stream width at any given time if the first preference is either unreasonable or impracticable

8.2 Erosion and sediment control measures

In-stream erosion and sediment controls are outlined in the following sections:

- For best practice erosion control measures for in-stream works refer to Section 6
- For best practice sediment control measures for in-stream works refer to Table 8-4 and Table 8-5
- Further information regarding sediment control measures refer to Section 7

Refer to Table 7-1 for sediment trap classification of the In-stream sediment control techniques outlined in Table 8-4.

Table 8-4 Classification of in-stream sediment control techniques adopted from IECA (2008, p I.21)

Type 1	Type 2	Type 3
Pump sediment-laden water to an off-stream Type F or Type D Sediment Basin or high filtration system	Filter Tube Barrier Rock Filter Dam Sediment Weir	Modular Sediment Barrier Sediment Filter Cage Sediment Fence Straw Bale Barrier

Table 8-5 outlines various sediment control measures and typical site conditions for use in in-stream works.

Table 8-5 Recommended site conditions for use of various sediment controls adopted from IECA (2008, p I.21)

In-stream sediment trap	Typical site conditions
Filter Tube Barrier	Channels with "clear" base flow Channels with poor settling (ie clayey) sediment Suitable for medium and long-term works
Floating Silt Curtain	Water depths greater than 0.8 m Tidal waters Very low flow velocity Typically only used as an Isolation Barrier and thus not normally placed across the full channel width
Modular Sediment Barrier [1]	Concrete-lined channels and overhead flow paths Areas with poor access for heavy machinery Short-term works where the units can be reused
Rock Filter Dam [1]	Long-term works (ie more than 5 days) Dry weather conditions when over-topping flows are not expected Constructed or heavily modified channels only Channels with turbid or slightly turbid low-flow
Sediment Filter Cage [1]	Short-term works (ie 1 to 2 days) Channels with turbid or slightly turbid low-flow Channel containing good settling sediments Narrow channels
Sediment Weir [1]	Medium to long-term works (ie more than 2 days) Channels with turbid or slightly turbid base flows Sites with poor machinery access Channels with an irregular bed shape Wide channels
Sediment Fence	Dry channels/drains when channel flow is highly unlikely Only suitable for trapping sediment displaced by bed/bank works
Straw Bale Barrier	Can be used as a temporary sediment trap while installing the primary in-stream sediment control device

Note: [1] Techniques that can be supplemented with the use of one or more Filter Tubes

If detailed design of in-stream works is required then refer to Section I.7 of Best Practice Erosion and Sediment Control (2008) guideline, developed by the International Erosion Control Association.

9. Road construction

The ESC requirements and measures outlined below are adopted from IECA (2008, p J.1-J.8).

The ESC requirements for road construction can vary significantly compared to what is needed on a construction site. Regardless of the size of the road development, there are a number of common ESC problems that will occur and need to be addressed (IECA, 2008, p J.1-J.8).

The ESC measures identified throughout this manual for general construction activities are applicable to road construction and the procedures of best practice ESC implementation should be followed. However, issues specific to road design and construction are identified in Section 9.1 and 9.2 and must be considered.

9.1 Road planning

When planning the design and construction of a road, ESC must be incorporated into the planning process. Any other additional land requirements for construction of major sediment traps during road construction, such as Sediment Basins, must also be identified (IECA, 2008, p J.1-J.8).

When planning road design, factors that should be considered include:

- Soil erodibility
- Rainfall erosivity
- Topography
- Vegetation cover
- Land use
- Proximity of water bodies, high-risk habitats and valued ecosystems

9.2 Batters

9.2.1 Batter design

The long-term erosion potential of a road can be significantly affected by the road design, and in particular drainage and batter design; the design of a road is rarely controlled by the short-term requirements of erosion and sediment control. The benching of long batter slopes can help reduce ongoing erosion problems by allowing better control of runoff-producing erosion, in particular, the control of rilling (IECA, 2008, p J.1-J.8).

Batter design should be completed with consideration of site topography, soil type present, existing vegetation and the presence of any rock formations (IECA, 2008, p J.1-J.8).

Table 9-1 outlines typical maximum batter slopes for road batter design.

Table 9-1 Typical maximum batter slopes based on IECA (2008, p J.1-J.8).

Soil type	Maximum desirable batter slopes
Fine and Coarse	3:1 (H:V) and 2:1 (H:V), respectively
Dispersive	4:1 (H:V)

Batter slope design should focus on developing conditions appropriate for revegetation for control of soil erosion. Santos rehabilitation plan outlines revegetation requirements.

General guidelines of batter design include the following (IECA, 2008, p J.1-J.8):

- Earth batters that are to be revegetated should be constructed as flat as possible – within due regard to economics, loss of existing mature trees, and so on
- Earth batters that are unlikely to be vegetated (ie within arid and semi-arid zones) should be as steep as possible

IECA (2008, p J.1-J.8) states that berms or benches are recommended on batters with a vertical height greater than 5 m. The bench should be at least 1 m wide.

IECA (2008, p J.1-J.8) states that benches should have a positive slope in towards the hill and a maximum longitudinal grade of 1% if vegetated, or 0.5% if paved. Additionally, IECA (2008, p J.1-J.8) states that the maximum grades should be restricted to a level consistent with the maximum permissible velocity for the type of surface lining used. A maximum lateral bench slope of 10% (10:1) towards the toe of the upper batter should apply.

Table 9-2 provides the recommended maximum bench spacing on vegetated slopes, however, the appropriate bench spacing should always be based on site-specific investigation and design,

Table 9-2 Recommended maximum bench spacing on vegetated slopes as adopted from IECA (2008, p J.5)

Batter slope			Horizontal spacing (m)	Vertical Spacing (m)
Percentage	**Degrees**	**(H):(V)**		
< 10%	5.71	10:1	Site specific	Site specific
12%	6.84	8.33:1	100	12
15%	8.53	6.67:1	80	12
20%	11.3	5:1	55	11
25%	14.0	4:1	40	10
30%	16.7	3.33:1	30	9
> 36%	> 19.8	> 2.78:1	Site specific	Site specific

9.2.2 Batter construction

The following principles of batter construction were adopted from IECA (2008, p J.7), and are as follows:

- Provision must be made to prevent surface runoff damaging cut and fill batters. Catch Drains and Flow Diversion Banks above and below batters, and benches within the batter slopes, can be used to intercept surface runoff and transport it to safe disposal points
- Within cut batters, a Catch Drain or Flow Diversion Bank should be constructed above the top of the cut before excavation commences. Temporary toe drainage should be maintained as the work progresses, with permanent toe drainage installed when the final landform is achieved
- As the batter is excavated, serrated cuts may be placed in the batter to help hold topsoil and to assist with the establishment of vegetation
- For fill batters, permanent top drainage should be installed at an early age and should discharge to a suitable outlet. At the completion of each day's work, or at the onset of rain, a windrow of suitably compacted soil management should be constructed along the recently completed fill slope. Permanent toe drainage measures should be installed on completion of the filling operation
- Chutes or Slope Drains may be required at points along a Catch Drain or channel to allow safe disposal of runoff down the face of the batter

10. Revegetation

This ESC manual provides the best practice erosion and sediment control measures to prevent, or minimise, detrimental environmental impact from activities being conducted in the CSG fields.

Revegetation of a disturbed area should be completed as soon as practicable after the completion of works and reporting of the progress of rehabilitation works should be undertaken to address relevant environmental authority requirements.

The revegetation of the land should follow the site rehabilitation plan developed by Santos. This ESC manual provides the framework to ensure better implementation of Santos' rehabilitation plan.

11. Monitoring

11.1 Purpose

Monitoring reduces the likelihood of the potential impacts associated with the following:

- Increased and/or exacerbation of erosion and sedimentation and poor drainage
- Pollutants contaminating waterbodies
- Additional surface water
- Increased weed infestation
- Leaching of salts, metals and trace elements into groundwater causing potential surface water and groundwater quality impacts
- Environmental incidents resulting from discharges of pollutants that do not meet water quality discharge requirements

The site monitoring associated with the ESC includes water quality monitoring and site inspection.

11.2 Water quality monitoring

Monitoring sites should be implemented as soon as possible to provide the baseline of water quality prior to construction and operation.

The following steps should be adopted for ESC water quality monitoring:

a) Establish a controlled discharge point
b) Adopt water quality objectives (ie water quality targets) for the established discharge point
c) Prepare and implement the monitoring program for the site
d) Undertake water quality monitoring based on the water quality monitoring program for the site
e) Undertake compliance assessment against the water quality objectives (to enable reporting of any water quality incidents to a regulatory authority)
f) Undertake corrective actions

For work affecting surrounding waterways, water quality sampling both upstream and downstream of disturbed areas should be undertaken. Additionally, ICEA (2008) states that water quality must be carried out on any controlled discharge (ie post dewatering of water from sediment basin).

Recommended discharge standard for de-watering operations is outlined in Table 11-1.

Table 11-1 Recommended discharge standard for de-watering operations adopted from IECA (2008. p B.46)

Site conditions	Discharge water quality standard
Desired discharge water quality of free drainage Sediment Basins (eg free draining Type C basins)	Take all reasonable and practicable measures to operate and/or modify the basin to achieve a 90 percentile total suspended solids (TSS) concentration not exceeding 50 mg/L Unless otherwise reported by a scientific site based study, the pH of the water must be in the range of 6.5 to 8.5 prior to discharge. If this is not achieved, pH adjustment may be necessary (eg lime to raise or citric acid to lower)

Site conditions	Discharge water quality standard
Post-storm de-watering of sediment, basins (eg Type F and D basins, and Type C basin operating as wet basins)	90 percentile TSS concentration not exceeding 50 mg/L Unless otherwise reported by a scientific site based study, the pH of the water must be in the range of 6.5 to 8.5 prior to discharge. If this is not achieved pH adjustment may be necessary (eg lime to raise or citric acid to lower)

ICEA (2008) states that water quality monitoring at nominated in-stream monitoring stations must be carried out at least monthly and following runoff-producing rainfall.

ICEA (2008) recommends a minimum of 3 samples to be undertaken during one sampling event to determine water quality. 'Additional water quality monitoring may be required during periods when the water quality objectives are not being met' (ICEA, 2008, p 7.5).

The parameters to be tested for waters collected at in-stream monitoring stations include temperature, dissolved oxygen (DO), pH, salinity, turbidity, Total Suspended Solids (TSS).

11.3 ESC site inspection

ESC site inspection of regular activities must include the following:

- Maintain and supervise implementation of the ESC, and undertake scheduled inspections of the implementation of the ESC plan
- Undertake monitoring of the effectiveness of the ESC plan including diary notes/logbook entries of control techniques used on-site
- Record and report areas of non-compliance (eg ESC failure or excessive sediment leaving the site)
- Determine reason for non-compliance and undertake corrective actions

In addition ESC site inspection of regular activities and monitoring of the rehabilitated buried pipeline corridors (for subsidence and erosion) must occur at least every 20 business days for the first 120 business days after rehabilitation.

12. References

Aurecon Australia, 2011. Soil Management Procedure (Coal Seam Gas Fields)

International Erosion Control Association (IECA). 2008. Best Practice Erosion and Sediment Control, IECA Publishing

URS Australia. 2009. GNLG Project Environmental Impact Statement (GLNG EIS)

Appendix A
Example ESC plan site layout

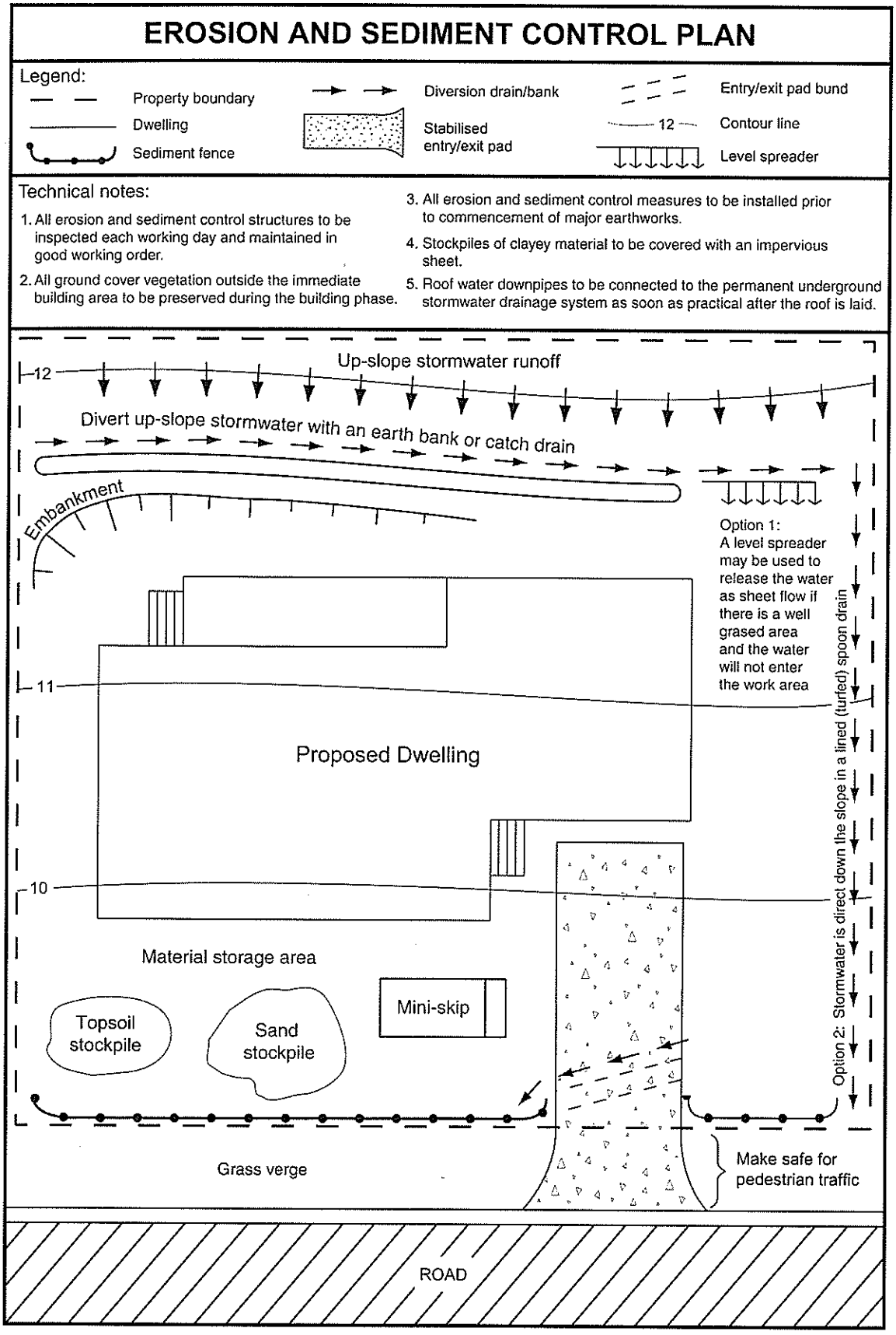


Figure H15 – Example Erosion and Sediment Control Plan

Appendix B
Soil erosion processes

Appendix B

Soil erosion processes

As adopted by IECA (2008, pp M.1-M.4)

Splash erosion

Splash erosion is the splattering of soil particles caused by the impact of raindrops on soil. Displaced soil particles are typically moved distances up to 1 m when initially dislodged.

Sheet erosion

Sheet erosion is the uniform removal of soil in thin layers from sloping land. The detachment of soil particles by raindrop impact, combined with shallow surface flow leads to sheet erosion. Although important, sheet erosion often remains unnoticed because it occurs gradually and evenly across a slope, and thus is often not obvious to the untrained observer.

Rill erosion

Rill erosion is the removal of soil by water concentrated in small but well-defined channels. Rill erosion is more apparent that sheet erosion (with rills generally being up to 300 mm deep) although is still often overlooked. However, rill erosion must be negated as it can contribute around as much as 50% of the eroded sediment leaving the site.

Gully erosion

Gully erosion produces channels deeper and larger than rills (generally greater than 300 mm deep). The channels carry water during and immediately after rainfall.

Tunnel erosion

Tunnel erosion is the removal of subsoils along a sub-surface tunnel. This form of erosion is usually associated with dispersive soils and normally occurs near gullies, creek lines and constructed embankments.

Mass movement erosion

Mass movement is the general term used to describe the movement of large volumes or soil and/or rock down steep slopes, or the movement of deep subsoils on slopes of various gradients. The most common triggering agent is heavy rainfall, which infiltrates the soil profile, reduces shear stress and increases slope load on susceptible soil surfaces.

Watercourse erosion

Stream banks in their natural state are generally in equilibrium. However, the removal or modification of stream flow, channel capacity, the soil/rock exposure, and the bed and bank vegetation will normally result in the initiation and/or propagation of bed and/or bank erosion. Developments adjacent to stream banks should avoid causing disturbance to the riparian zone and should incorporate adequate buffer zones to compensate for likely future erosion and stream migration

Wind erosion

Wind erosion is usually significant in regions where severe winds occur during the drier periods of the year. It can be widespread in the semi-arid and arid areas. The problem is usually associated with non-vegetated, dry, non-cohesive, granular soils that predominately consist of fine sands and silts.

Appendix 8

Fencing Standard

Appendix D Fencing Standard

1. Purpose

This appendix outlines fencing standards to minimise access by unauthorised people, stock and wildlife to facilities to:

- prevent access to facilities where there is a risk of drowning e.g. sumps, pits and ponds
- prevent access to potential sources of contamination
- minimise damage to infrastructure by animals e.g. earthen bunds, valves

Examples of potential sources of contamination include:

- produced formation water pits and ponds
- drilling mud sumps
- wellhead cellars
- well blowdown pits
- bulk chemical, oil and condensate storage
- waste landfills

Fencing shall be installed at all new field facilities. Fences will also be retrofitted to existing facilities on a prioritised basis.

The requirements of livestock quality systems (e.g. Cattle Care, Organic and Flock Care accreditation) require that care be taken to ensure that livestock access to potential sources of hydrocarbon or chemical contamination is restricted.

2. Standard vs Animal-proof Fencing

Factors that influence whether or not animal-proof fencing is required include:

- required under the relevant environmental authorisation (licence)
- relevant landholder requirements
- around regulated water storage e.g. evaporation ponds
- design of facility makes escape difficult e.g. steep or high sides of ponds or cellars
- facility located adjacent to a national park or other location where high concentrations of wildlife may be present e.g. permanent water
- proximity to housing

The relevant Environmental Adviser shall endorse the choice of fencing made *prior to construction*.

3. Design

Fences should be robust and able to withstand contact by large animals.

Environmental factors such as erosion should also be considered.

The following types of fencing have been approved for standard use at Santos facilities:

- Ring lock mesh (required on sheep stations)
- Wire fence (either chainmesh, 5-strand barb-wire or standard panel lock)
- Pool fence (mesh panel)
- Triguard fence (tubular panel)
- Security mesh (weldmesh panel)

Fences shall be designed and constructed in accordance with the relevant Santos engineering drawing (e.g. drawing number 1500-40-606, Standard Fencing Details).

3.1 Animal-proof Fencing

Factors that assist in making fencing animal-proof include:

- height (e.g. at least 1.8m above ground level)
- 'rabbit-proof' netting at ground level (e.g. for at least the first 500mm above ground level)
- hinge joint fencing (e.g. for 1.5m above ground level)
- barbed wire (e.g. single stand at 1.8m above ground level)
- spacing of pickets (e.g. no more than 4m apart)

Further information can be obtained from the relevant Environmental Adviser.

4. Installation

- If unsure about what form of fencing is appropriate, contact the relevant Field Services Officer or Environmental Adviser for advice.
- Ensure Cultural Heritage clearance is provided prior to installation, refer to EHS11 Aboriginal Cultural Heritage Management (for Australian Operations) for more information
- Consideration should be given to the potential impacts on other stakeholders. Where relevant, consultation with the relevant pastoralist/landholder should be undertaken, via the relevant Stakeholder Adviser, prior to installation of any fencing.
- Fencing shall be installed to ensure that access to any source of potential contamination by livestock or wildlife are minimised. Buffer distances for installations must consider potential lateral transfer of contaminants (e.g. overland flow/runoff of liquids, heat radiation from flare pits). A minimum buffer distance of 5m is recommended.
- Fence wires/bars/mesh shall be spaced to ensure that livestock cannot pass between or under them (e.g. fence wires/bars/mesh spaced at less than 240mm and less than 240mm from ground level).
- Fence height shall ensure that livestock cannot pass over (e.g. not less than 1.2m).
- Fence installation shall minimise environmental impact (e.g. erect fence without grading the right-of-way, position fence to avoid trees and shrubs).
- Under no circumstances, shall creosote treated timber (black) be used.
- CCA (copper chromium arsenate) treated pine posts, also known as copper logs, must not be used on stations with organic beef and/or cattle care programs in place.
- Use of CCA posts on other properties, should be avoided and can only be used where no other suitable alternative can be identified.
- Use of suitable recycled materials and recovered fencing should be considered prior to the use of new materials wherever possible. Consider using cut lengths of carbon steel from redundant and removed flowlines for posts, or recycled plastic posts.
- Table 1 provides guidance to what types of fencing should be installed at various kinds of facilities
- Gates and other access points shall be constructed to ensure that livestock cannot pass through.
- Wherever possible gates should be installed. Walk though structures are not recommended. Clearance between a gate and latch-post must be sufficient to allow the gate to swing both ways, but not be greater than 150mm.
- Cattle grids may also be used to restrict livestock access. Liaison with the relevant pastoralist/landholder should occur, via the relevant Stakeholder Adviser, prior to installation.

5. Operation

- Fences and related infrastructure shall be inspection regularly (e.g. placed on inspection/ maintenance schedule) to check fitness for use.

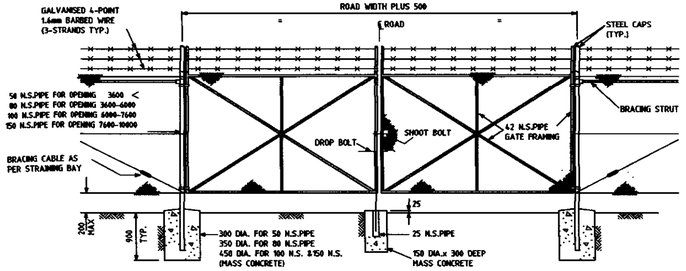
6. Retrieval / Disposal

- Where possible retrieve and reuse all fencing materials.

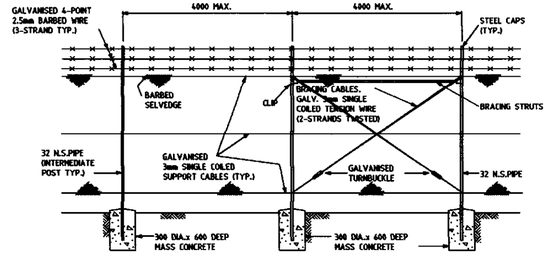
- All offcuts, discards and any other rubbish shall be collected and delivered to the appropriate waste management facility. Disposal to adjacent flare pits, sumps, or borrow pits is not permitted.
- Consideration should be given to making used, non-hazardous fencing materials available to landholders in preference to disposal as a waste material.
  Note: creosote treated timber, CCA timber and other potentially hazardous materials must not be provided to landholders.

Type of Facility	Fencing Alternatives
Satellites	Wire fencing (i.e. chainmesh, barb-wire or standard panel lock)
Produced Formation Water Disposal Facilities (including interceptor pits, polishing tanks, skimming tanks, bunded evaporation ponds)	Wire fencing
Wellsite facilities (including wellhead and artificial lift devices, field manifolds, test tanks, fuel tanks, inhibitor tanks)	Wire fencing Pool fencing Triguard fencing
Drilling mud pits and flare pits	Wire fencing Triguard fencing
Landfarms, sludge pits	Wire fencing
Spill sites	Wire fencing Triguard fencing
Landfills	Cyclone mesh only 5-strand barb or standard panel lock not permitted

Table 1. Fencing for Different Kinds of Santos Facilities

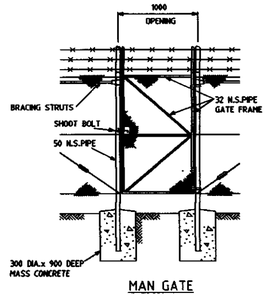


ROADWAY GATE

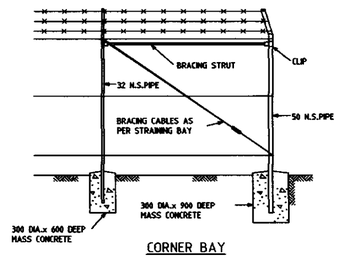


TYPICAL BAY

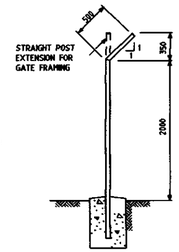
TYPICAL STRAINING BAY
(EVERY 6th BAY)



MAN GATE

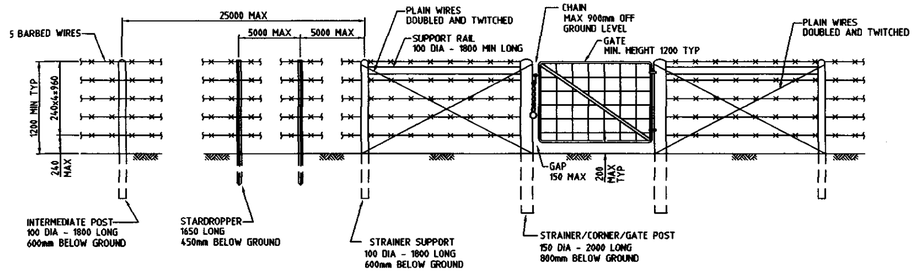


CORNER BAY

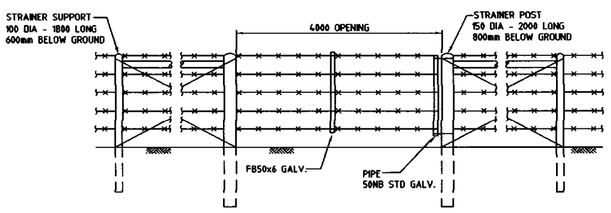


TYPICAL SECTION

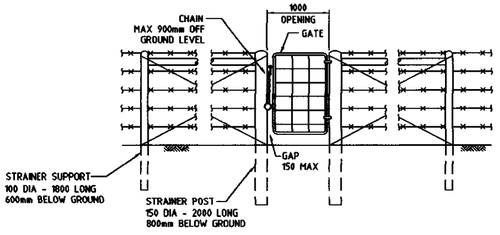
1 SECURITY FENCE DETAILS



ROADWAY GATE



EQUIPMENT GATE



MAN GATE

2 STOCK FENCE DETAILS

INSTALLATOIN PROCEDURES:

1. FENCES MUST BE INSTALLED A MIN. DISTANCE OF 5 METRE FROM THE EDGE OF ANY POTENTIAL SOURCE OF CONTAMINATION. SEPARATION DISTANCE AT FLARE PITS MUST TAKE INTO ACCOUNT POTENTIAL HEAT RADIATION WITH RESPECT TO DAMAGE TO FENCING MATERIALS.
2. PLAIN WIRES SHOULD NOT BE USED FOR FENCE CONSTRUCTION.
3. WHERE POSSIBLE FENCES SHOULD BE ERECTED WITHOUT GRADING THE RIGHT-OF-WAY.
4. FENCE LINES MUST BE CONSTRUCTED STRAIGHT AND SQUARE. ALL DIRECTION CHANGES IN THE FENCE LINE MUST HAVE STRAINER SUPPORT.
5. A SLIDE HAMMER (DOLLY) MUST BE USED TO DRIVE STAR DROPPERS. ALL WIRES SHALL BE TIED SECURELY TO STAR DROPPERS.
6. INTERMEDIATE WOODEN POSTS MUST BE INSTALLED AT MAXIMUM 25 METRE INTERVALS (OR AT CENTRE POINT OF FENCE LINE UP TO 49 METRES). WOODEN POSTS MUST BE RAMMED AND WELL COMPACTED.
7. WIRES SHALL BE STRAINED TO THE MATERIALS SPECIFICATION. USE CHAIN WALK WIRE STRAINERS ONLY, "DONALDSONS" OR SIMILAR.
8. BARBED AND PLAIN WIRE SHALL BE STAPLED TO WOODEN POSTS USING 1 STAPLE (MINIMUM) PER WIRE.

MATERIAL SPECIFICATIONS

BARBED WIRE

SIZE	1.57mm
LENGTH	STANDARD ROLL - 500 METRES
WEIGHT	24kg PER 500 METRE ROLL
TYPE	HIGH TENSILE - HEAVY GALVANISED
TENSION	1.3KN (RECOMMENDED BY MANUFACTURER)

PLAIN WIRE

SIZE	FENCE 2.8 MM, TIE 2 MM
LENGTH	STANDARD ROLL - 1000 METRES
TYPE	FENCE - HIGH TENSILE HEAVY GALVANISED
	TIE - SOFT GALVANISED
WEIGHT	48KG PER 1000 METRE ROLL
TENSION	1.3KN (RECOMMENDED BY MANUFACTURER)

STAPLES

TYPE	GALVANISED
SIZE	2 MM X 25 MM

STAR DROPPERS

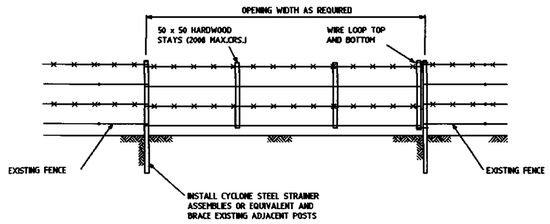
TYPE	STANDARD STEEL "WARATAH" BLACK VARNISH OR SIMILAR
LENGHTS	1650 MM
WEIGHT	32KG PER BUNDLE OF 10

GATES

TYPE	STANDARD STEEL "CYCLONE" OR SIMILAR
SIZE	32 NB STD PIPE
	2,970mm x 1,140mm (10 ft)
	OR 3,580mm x 1,140mm (12 ft)
	HINGES AND CHAIN/RING LATCH SUPPLIED WITH UNIT

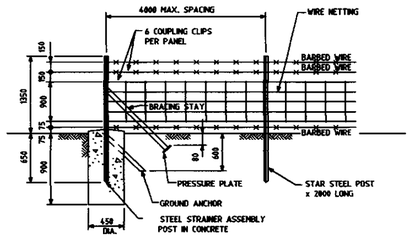
POSTS

TYPE	PERMA-PINE (CCA), STEEL OR CONCRETE (AS REQUIRED)
	NOTE: CREOSOTE TREATED TIMBER (BLACK) MUST NOT BE USED UNDER ANY CIRCUMSTANCES
SIZE	2 METRES x 150 MM DIA - STRAINER/CORNER/GATE
	1.8 METRES x 100 MM DIA - INTERMEDIATE POSTS AND RAILS



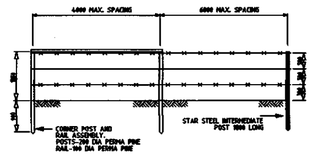
NOTE: CONTRACTOR TO SUPPLY ALL REQUIRED MATERIALS TO MATCH EXISTING FENCE. CONTRACTOR TO REINSTATE ORIGINAL FENCE AFTER COMPLETION OF WORK AND REMOVE SURPLUS FENCING MATERIALS FROM SITE.

3 TEMPORARY GATE



NOTE: MINIMUM 75 METRES BETWEEN BRACING STAYS

4 PERMANENT AIRSTRIP BOUNDARY FENCE



NOTE:200 DIA INTERMEDIATE STRAINER POST AT 100M INTERVALS

5 TEMPORARY STOCK FENCE
FOR USE ON LEASE TRUCKING UPGRADES

NOTES:

1. MATERIALS AND WORKMANSHIP TO BE IN ACCORDANCE WITH AS 1725
2. INSTALLATION TO BE IN ACCORDANCE WITH MANUFACTURERS SPECIFICATION
3. ALL PIPE TO BE HOT DIPPED GALVANISED
4. CONCRETE TO BE GRADE 15
5. CHAINWIRE TO BE MANUFACTURED FROM 3mm DIA. GALVANISED WIRE AT 50mm MAX. SPACING EACH WAY
6. PLAIN WIRE TO BE 3mm DIA. GALVANISED WIRE
7. BARBED WIRE TO BE 2-1.60mm DIA. GALVANISED WIRES TWISTED TOGETHER WITH FOUR POINT BARBS AT 90mm NOMINAL CENTRES
8. LACING AND TIE WIRE TO BE 2mm DIA. WIRE
9. SUPPORT CABLES TO BE 2-3mm DIA. GALVANISED WIRES
10. BRACING CABLES TO BE 2-3mm DIA. GALVANISED WIRES WITH TURNBUCKLE
11. CLIP TYPE HINGES TO BE USED WITH BEARING COLLAR WELDED TO GATE FRAME FOR EITHER TOP OR BOTTOM HINGE
12. SHOOT BOLTS TO BE MADE FROM 12mm DIA. MILD STEEL SET INTO HAND HOLE AND SHALL BE PROVIDED WITH PADLOCK
13. DROP BOLTS TO BE MADE FROM 20mm DIA. MILD STEEL AND FITTED TO ALL DOUBLE LEAF GATES
14. ALL SWING GATES TO BE PROVIDED WITH TRIP TYPE CATCHES FOR SLAM CLOSING AND WIRE TIES TO FENCE WHEN OPEN

No	DATE	DRN	CHKD	ENG	Q.A.	PROJ	ACC	DESCRIPTION	DRG No.	SUBJECT
								REVISIONS		REFERENCE DRAWINGS
4	3/10/00	CDS	ARH	[illegible]			81566	STOCK FENCE DETAIL CHANGED. TO ENVIR PO44 STD		
3	21/10/93	GSP	RJC	RJS	GJS		0031	TRANSLATED FROM MEDUSA TO AUTOCAD		
2	5.4.90	TW	DNK	SRF				TRANSLATED TO MEDUSA DRAWING.		
1	17.11.86	PM	AK	AST	JF			TEMP STOCK FENCE ADDED.		

DRN: KMc
DATE: 26/11/85
SCALE: NTS
CHKD: AL
ENG: AST
Q.A.: JF
PROJ.:
ACC:
A.B.N. 80 007 550 923

STANDARD DRAWING
FENCING DETAILS

Santos

DRAWING No. 1500-40-606
REV 4

STANDARD FENCING DETAILS A0SHEET

CLIENT No. -

WAS DELHI DWG DES-2240

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