NARRABRI GAS PROJECT

Rehabilitation Management Plan

PHASE 1

0041-150-PLA-0001

Date	Revision	Reason for Issue	Author	Checked	Approved
29 August 2024	0E	DWH 34 location change	Onward Consulting	JT	DG – AW466112

Prepared by:

Title	Name	Date
Principal – Assessment and Approvals Onward Consulting	P. Burns	July 2024
Director Onward Consulting	M. Vile	July 2024

Reviewed by:

Title	Name	Date
Senior Environmental Advisor – Senior Environment Adviser Eastern AU & PNG EHSR Santos Ltd	J. Twyman	July 2024

Approved by:

Title	Name	Date
Manager Environment EA PNG Eastern AU & PNG EHSR Santos Ltd	D.Gornall – AW466112	29 August 2024

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Document revision history

In accordance with CoC D4, this document regularly reviewed and revisions to the plan have been made as follows:

Date	Version	Reason for revision	Prepared by	Reviewed by	Approved by
11 November 2022	0B	For approval	Eco Logical Australia / Onward Consulting	RM/LD	TD
Version OC provided as draft versions for review					
24 January 2024	0D	For approval	Onward Consulting	JT	TD

Acronyms and abbreviations

Acronym	Description
ACHMP	Aboriginal Cultural Heritage Management Plan
BAG	Biodiversity Advisory Group
BAM	Biodiversity Assessment Method
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BCD	The former Biodiversity Conservation Division within DPE
BCS	The Biodiversity, Conservation & Science directorate within DPE (formerly BCD)
BMP	Biodiversity Management Plan
BVT	biometric vegetation types
CCC	Community Consultative Committee
CoA	Conditions of approval
CoC	Conditions of consent for the NGP SSD 6456
CSG	coal seam gas
DA	development application
DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DCCEEW Water	The Water Group within DCCEEW
DPE	The former NSW Department of Planning and Environment
DPIE	The former NSW Department of Planning and Environment
DRG	The former Division of Resources and Geoscience (now Regional NSW - Mining, Exploration and Geoscience [MEG])
EEC	endangered ecological communities
EMP	Environmental Management Plan
EMS	Environmental Management Strategy for the NGP
ENM	excavated natural material
EIS	Environmental Impact Statement
EPA	The NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	Environmental Planning and Assessment Regulation 2021
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPL	Environment Protection Licence under the POEO Act
EQuIS	Environmental Quality Information System
FCNSW	Forestry Corporation of NSW
ha	hectare
IEA	Independent Environmental Audit
LSC	land and soil capability
MEG	Regional NSW - Mining, Exploration and Geoscience
m	metre
m^2	square metre

Acronym	Description
m^3	cubic metre
mm	millimetre
MNES	Matters of National Environmental Significance
NGP	Narrabri Gas Project
NOA	naturally occurring asbestos
OEH	Former NSW Office of Environment and Heritage
PAL	Petroleum Assessment Lease under the PO Act
PCT	plant community type
PEL	petroleum exploration licence under the PO Act
PO Act	*Petroleum (Onshore) Act 1991* (NSW)
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
POEO Regulation	Protection of the Environment Operations (General) Regulation 2022
POP	Petroleum Operations Plan
PPL	petroleum production lease under the PO Act
PPLA	petroleum production lease application under the PO Act
RDM	residual drilling materials
RMP	Rehabilitation Management Plan (this Plan)
Santos	Santos NSW Pty Ltd
SMS	Santos Management System
WoNS	Weeds of National Significance

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1. Introduction

1.1 Narrabri Gas Project

1.1.1 Background

Resource exploration has been occurring in the north-western area of NSW since the 1960s; initially for oil, but more recently for coal and gas. Santos began exploring for natural gas from coal seams in north-western NSW in 2008 and is currently conducting coal seam gas (**CSG**) exploration and appraisal activities within Petroleum Exploration Licence (**PEL**) 238, Petroleum Assessment Lease (**PAL**) 2 and Petroleum Production Lease (**PPL**) 3, located in the Gunnedah Basin about 20 kilometres (**km**) south-west of the town of Narrabri. Activities in PAL 2 have focussed on the Bibblewindi and Bohena CSG pilots, whilst recent activities in PEL 238 have focussed on the Dewhurst and Tintsfield CSG pilots.

The Narrabri Coal Seam Gas Utilisation Project (Wilga Park Power Station and associated infrastructure) operates under an existing Part 3A approval under the *Environmental Planning and Assessment Act 1979* (NSW) (**EP&A Act**). It was originally approved in 2008, with various modifications approved between 2011 and 2019. It encompasses a gas gathering system, a compressor and associated flare, a gas flow line from Bibblewindi to Wilga Park within a 10 metre (**m**) corridor with a riser at Leewood and an expansion of the existing Wilga Park Power Station from 12 to 40 megawatts.

1.1.2 Current Project

On 30 September 2020, Santos NSW (Eastern) Pty Ltd (**Santos**) obtained consent for State Significant Development (**SSD**) 6456 to develop the Narrabri Gas Project (**NGP**) (**the Project**). Approval EPBC 2014/7376 under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (**EPBC Act**) was granted on 24 November 2020.

The Project includes the progressive installation of up to 850 new gas wells on up to 425 new well pads over approximately 20 years and the construction and operation of gas processing and water treatment facilities. The Project area covers approximately 950 square kilometres (95,000 hectares) in size and the Project footprint will only directly impact approximately 1 % of that area.

Four phases of development are defined under the consent (SSD 6456, condition A5), including:

- Phase 1 – ongoing exploration and appraisal activities;
- Phase 2 – construction activities for production wells and related infrastructure;
- Phase 3 – gas production operations; and
- Phase 4 – gas well and infrastructure decommissioning, rehabilitation and closure.

Phase 1 of the Project is defined in the consent as the phase of the development comprising ongoing exploration and appraisal activities in the Project area, including:

- seismic surveys;
- core and chip holes;
- construction and operation of pilot wells (up to 25 wells on up to 25 well pads across the Project area); and
- pilot well ancillary infrastructure, including access tracks, gas and water gathering lines, water balance tanks, safety flaring infrastructure, utilities and services, and environmental monitoring equipment including groundwater monitoring bores.

Santos plans to continue exploration and appraisal of the resource in the near term until a final investment decision can be made. The exploration and appraisal activities will include continued

operation of Santos' existing wells, infrastructure and facilities in PEL 238 and PAL 2, and construction and operation of new core holes, pilot wells and supporting infrastructure permitted under Phase 1.

Santos' existing exploration and appraisal activities in PEL 238 and PAL 2 as part of Phase 1 include:

- Tintsfield Pilot;
- Bibblewindi East Pilot;
- Bibblewindi West Pilot;
- Dewhurst North Pilot;
- Dewhurst South Pilot;
- Dewhurst northern and southern flow lines;
- Leewood Water Management Facility including ponds, the water and brine treatment plant and the irrigation area;
- Bibblewindi Facility including gathering system, water balance tank, compressor and flare; and
- Bibblewindi to Leewood buried gas pipeline.

These exploration and appraisal activities will continue as part of the NGP. The initial, new-appraisal Phase 1 scope is a relatively minor extension to these existing exploration and appraisal activities.

The Phase 1 scope is planned to include the construction and operation of:

- 4 coreholes;
- 6 pilot wells;
- 2 deep reservoir monitoring bore (converted coreholes);
- new shallow water monitoring bores;
- associated linear infrastructure;
- seismic surveys (length and location to be determined); and
- continued operation of Santos' existing exploration and appraisal activities, including workover activities.

The full definitions of the approved activities for Phases 2, 3 and 4 of the Project are provided in the consent, while further details regarding the staging of the works and the exact scope for each are as approved in the Field Development Plan. Santos is not prevented from carrying out any or all of the phases concurrently, subject to the conditions of the consent.

1.2 Purpose and scope of Plan

This Rehabilitation Management Plan (**RMP** or the **Plan**) has been prepared to define the rehabilitation activities, objectives and outcomes for Santos as part of the Narrabri Gas Project. It provides a framework for the management of rehabilitation associated with Phase 1 of the Project including existing wells and infrastructure and facilities at Bibblewindi and Leewood. More specifically, the Plan describes how the rehabilitation of the Project would achieve the objectives identified in Table 11 of SSD 6456. This includes all reasonable and feasible measures to prevent, or where prevention is not reasonable and feasible, minimise any material harm to the environment as required under condition A1 of Schedule 2 of SSD 6456.

This RMP has been developed in accordance with the *Exploration Code of Practice: Rehabilitation* (NSW Resources Regulator, 2022) and to address relevant compliance conditions of PEL 238; PAL 2, PPL 3, Environment Protection Licence (**EPL**) 20350 and the SSD 6456 conditions of consent (**CoC**).

It is applicable to Phase 1 of the development in accordance with condition A23 of SSD 6456. This particular revision of the RMP has been prepared to reflect a location change for well pad Dewhurst 34 (DWH 34). The original site identified for DWH 34 was on a private property and discussions had been held over several years with a registered titleholder that was residing on the property. A land access agreement was provided to the titleholders, all titleholders were not agreeable to the activity progressing and the agreement was not finalised. On this basis, the location for well pad DWH 34 has been moved from private property to State forest, with any relevant amendments addressed in this RMP.

Some minor adjustments and corrections have also been made throughout the document.

The RMP will be updated prior to the commencement of Phase 2, 3 and 4 to include specific rehabilitation and/or decommissioning activities related to those phases. In the event the Project does not proceed to Phase 2, 3 or 4, this document covers final rehabilitation of Phase 1 sites and existing facilities at Bibblewindi and Leewood.

This RMP has been prepared to integrate with other management plans as required by SSD 6456, specifically the Biodiversity Management Plan and the Field Development Protocol. Where relevant, this RMP references these and other documents throughout.

As required by CoC B84, Santos will implement the latest revision of this Plan once approved by the Planning Secretary.

1.3 Preparation of this Plan

This Plan has been prepared by Mr. Servaes van der Meulen and Mr. Mark Vile of Onward Consulting Pty Ltd, who are qualified and competent environmental practitioners with more than 20 years' experience each. Considering their individual and combined industry experience and professional expertise, both Servaes and Mark are deemed to be suitably qualified and experienced for the preparation of this RMP, as required by CoC B83(a).

1.4 Objectives

The rehabilitation objectives of this RMP are generally consistent with the proposed rehabilitation strategy described in the EIS. Additionally, all rehabilitation will be undertaken to the satisfaction of the NSW Resources Regulator and the NSW Department of Planning, Housing and Infrastructure (**DPHI**).

Condition B81 and the associated Table 11 [of the CoC] specify the rehabilitation objectives relevant to the Project. These are reproduced in full in Table 1.1.

Table 1.1 - Rehabilitation objectives

Feature	Objective
All areas of the project area affected by the development	• Safe, stable and non-polluting • Fit for the intended post-mining land use/s
Areas proposed for Ecological Rehabilitation	• For each plant community type, establish self-sustaining native woodland ecosystems that meet the performance and completion criteria approved under the Rehabilitation Management Plan • For each threatened flora species, establish a self-sustaining population that meets the performance and completion criteria approved under the Rehabilitation Management Plan • For each threatened fauna species, establish self-sustaining habitat that meets the performance and completion criteria approved under the Rehabilitation Management Plan
Areas proposed for native woodland	• Restore self-sustaining native woodland ecosystems using species found in the local area and complement the areas proposed for Ecological Rehabilitation • Establish areas of self-sustaining: ▪ riparian vegetation, within any diverted and/or re-established creek lines and retained water features; ▪ habitat resources for threatened flora and fauna species; and • Vegetation connectivity and wildlife corridors, as far as is reasonable and feasible
Areas proposed for agricultural land	• Establish/restore agricultural areas to support sustainable agricultural activities • No reduction in land and soil capability class
Surface infrastructure	• To be decommissioned and removed, unless the Resources Regulator agrees otherwise
Wells and gas field infrastructure	• Wells to be progressively decommissioned and rehabilitated in accordance with the *Code of practice*: *Construction, operation and decommissioning of petroleum wells* (2023, as may be updated or amended) • Well cementing to include sub-vertical and horizontal well sections, where reasonable and feasible • Gas field infrastructure to be progressively decommissioned and rehabilitated in accordance with the *Exploration Code of Practice Rehabilitation* (2022, as may be updated or amended)
Rehabilitation materials	• Materials from areas disturbed under this consent (including topsoils, substrates and seeds) are to be recovered, managed and used as rehabilitation resources, to the greatest extent practicable
Water quality	• Water retained in the project area is fit for the intended post-mining land use/s • Water discharged from the development is suitable for receiving waters and fit for aquatic ecology and riparian vegetation
Community	• Ensure public safety • Minimise adverse socio-economic effects associated with petroleum development closure

1.5 Consultation

As required by CoC B83(b), this RMP has been prepared in consultation with the **DPHI**, the Water group within the NSW Department of Climate Change, Energy, the Environment and Water (**DCCEEW**) (generally referred to as **DCCEEW Water**), the NSW Environment Protection Authority (**EPA**), Forestry Corporation of New South Wales (**FCNSW**), the former DPE Biodiversity Conservation Division (**BCD**) [now the Biodiversity, Conservation & Science directorate (**BCS**)], Mining Exploration and Geoscience (**MEG**) and Narrabri Shire Council (**NSC** or **Council**). All stakeholders, except for DPHI, provided written feedback on the draft version of the RMP. DCCEEW Water and MEG did not provide any specific comments in their responses.

The comments received from BCS generally related to the cross-referencing with the Biodiversity Management Plan (**BMP**) and the preparation of detailed rehabilitation performance and completion criteria. BCS further provided advice regarding natural regeneration methods and activities.

FCNSW provided comments predominantly reflecting the requirements and obligations outlined in the Access Arrangement, which allows Santos to conduct its NGP activities within State forest lands, subject to specific terms and conditions. The comments centred around landform and revegetation standards and completion objectives; the seeding of local native forest species in disturbed areas; and the provision of spatial information for residual drilling materials (**RDM**) incorporation locations, historic heritage sites, rehabilitation sites and proposed monitoring sites.

The comments received from NSC and the EPA related to a number of internal documents referencing errors; the review of 'loose' language and indeterminate language; and the further development of auditable completion criteria.

All consultation correspondence and the responses to comments are provided in Appendix A.

No further consultation was required to be undertaken for this minor revision of the RMP, as the then NSW Department of Planning and Environment (**DPE**) considered the changes are relatively minor and agreed that further consultation with other agencies was not required. This is reflected in the DPE letter of approval for the revised FDP (Rev 0B), issued on 28 November 2023.

A copy of the DPE FDP approval letter is available on the Project website.

1.6 Structure of this Plan

The structure of this RMP is as follows:

Sections

Section 1	Provides an introduction to the Project and the context, scope, purpose and objectives of this Plan
Section 2	Summarises the roles and responsibilities of personnel involved with the implementation of the Plan
Section 3	Outlines the compliance requirements related to this Plan
Section 4	Describes the existing environment
Section 5	Presents a copy of the risk assessment
Section 6	Describes the rehabilitation domains and proposed final land uses.
Section 7	Provides the proposed rehabilitation approach including objectives and strategy
Section 8	Describes the rehabilitation phases

Section 9	Details of the proposed completion criteria
Section 10	Describes the proposed rehabilitation methods
Section 11	Describes progressive rehabilitation and indicative schedule for rehabilitation
Section 12	Describes the proposed rehabilitation monitoring
Section 13	Describes adaptive management procedures and the rehabilitation TARP
Section 14	Details the reporting requirements and obligations
Section 15	Describes data analysis, performance, and auditing and reporting requirements
Section 16	Describes review, and revision requirements
Section 17	References
Section 18	Provides a glossary of terms used in this Plan

Appendices

Appendix A	Consultation records
Appendix B	Compliance conditions relevant to the RMP
Appendix C	Describes topsoil management procedures
Appendix D	Describes regeneration, seeding and planting procedures
Appendix E	Lists native plant species appropriate for use in rehabilitation
Appendix F	Provides the protocol for the management of residual drilling materials

1.7 Interaction with related plans

The RMP is a part of the project environmental management framework. The structure of the RMP, BMP and sub-plans, and other biodiversity-related management plans is intricately linked with the Field Development Protocol and Field Development Plan. The protocols and management plans provide a framework for the development of Field Development Plan. A conceptualisation of the interactions between these plans and the timing of application is provided below (Figure 1.1). Note that the full suite of management plans for the NGP is not shown. The complete management plan framework is presented in the EMS.

The RMP will be maintained throughout the life of the Project to ensure adaptive management principals are applied, including future updates to the Field Development Protocol and Field Development Plans prior to the commencement of Phase 2.

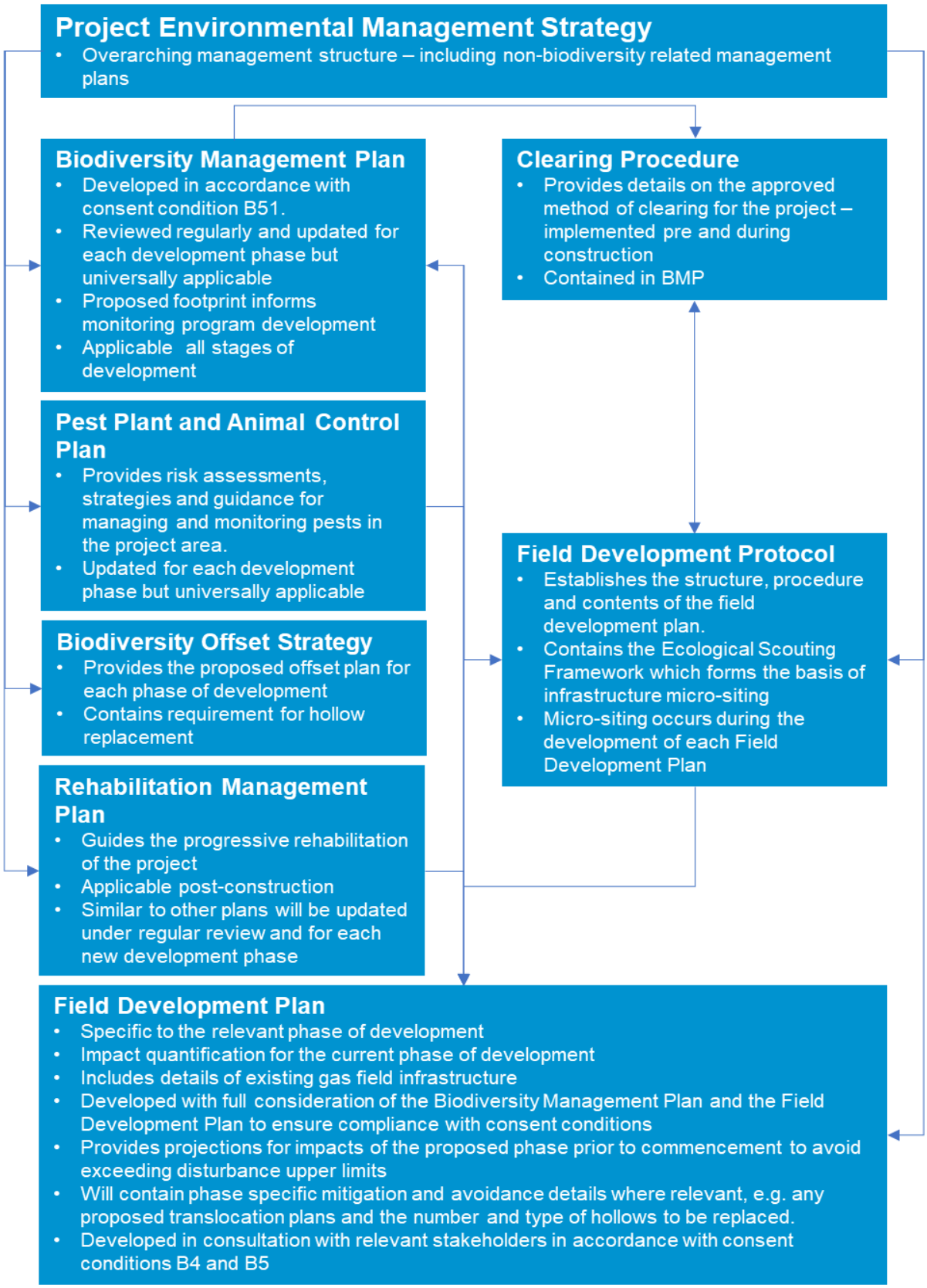

Figure 1.1 - Conceptual overview of management plan and field development integration

1.8 Distribution

A copy of the approved RMP is available to all relevant Santos personnel via the Santos intranet. In accordance with condition D13, the latest copy of the Plan including all associated appendices, audits and reports, and summaries of all monitoring data (where relevant), can also be found on the Project website, once these have been approved by the Planning Secretary. This information will be kept up to date.

In accordance with specific licence, approval or code of practice conditions, a copy of the approved RMP will be kept at the Santos Operations Centre located at 300 Yarrie Lake Road in Narrabri. This is where operational and field staff commence and finish each workday.

Note that any printed copies of this Plan are uncontrolled.

2. Roles and responsibilities

All Santos employees and contractors involved in the Narrabri Gas Project are responsible for the environmental performance of their activities and for complying with all legal requirements and obligations. Project personnel will be required to comply with approval requirements of the activities they undertake and potential environmental impacts from all activities is managed in accordance with the Project's relevant management plan(s).

In accordance with consent condition D1, the Environmental Management Strategy (**EMS**) sets out the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the Project, including the requirements and obligations in this RMP. All roles, responsibilities and accountabilities have been assigned in accordance with Santos Management System *SMS-MS_14 People Management Standard*.

3. Regulatory requirements

The Project is permissible with development consent under the *State Environmental Planning Policy (Resources and Energy) 2021*, and is identified as a 'State Significant Development' under Section 4.38 of the EP&A Act and the *State Environmental Planning Policy (Planning Systems) 2021*.

The Project was subject to the State significant development assessment and approval provisions of Division 4.7 of Part 4 of the EP&A Act and was approved as a State significant development under the EP&A Act and the EPBC Act.

The Project will be carried out in accordance with:

- relevant existing development consents and activity approvals;
- the conditions of relevant tenements including PEL 238, PAL 2, PPL 3;
- the provisions of the *Petroleum (Onshore) Act 1991* (NSW) (**PO Act**) and relevant codes of practice and guidelines;
- EPL 20350 issued by the EPA and the provisions of the *Protection of the Environment Operations Act 1997* (**POEO Act**); and
- the Conditions of Consent (CoC) for the Project, SSD 6456.

3.1 Compliance conditions

Compliance conditions associated with the following licence(s), lease(s) and consent(s) are or will be relevant to this Plan:

- PEL 238, granted on 1 September 1980, most recently renewed on 12 April 2022 and varied on 5 September 2023;
- PAL 2, granted on 30 October 2007 and varied on 5 September 2023;
- PPL 3, granted on 15 December 2003 and varied on 5 September 2023;
- PPLs 13, 14, 15 and 16, once issued;
- EPL 20350, as varied;
- SSD 6456; and
- EPBC 2014/7376

3.1.1 PEL 238

Licence condition 5 of PEL 238 is directly relevant to rehabilitation management, and states that Santos is to carry out rehabilitation of all disturbance caused by activities carried out under this licence in accordance with the requirements of the *Exploration Code of Practice: Rehabilitation* (Department of Regional NSW, March 2022), as amended or replaced from time to time, to the satisfaction of the Minister[1]. This is further addressed in section 3.2.1, and throughout this Plan.

3.1.2 PAL 2 and PPL 3

Lease condition 5 of PAL 2 and PPL 3 states that disturbed land must be rehabilitated to a sustainable/agreed end land use to the satisfaction of the Director-General. This is fully addressed in section 10.1 of this Plan.

[1] This is the Minister for Regional NSW.

3.1.3 EPL 20350

Petroleum exploration, assessment and production' is a scheduled activity listed in Schedule 1 of the POEO Act. Under Section 48 of the POEO Act, all scheduled activities are required to hold an EPL. EPL 20350 is held for CSG activities in PEL 238, PAL 2 and PPL 3. There are conditions in EPL 20350 that relate to erosion and sediment control which are applicable to rehabilitation. Additionally, condition L3.4 states that Santos may transport rock-based drill cuttings from any of the well pads to other well pads and apply these to land, in accordance with this Plan and the approved Waste Management Plan.

3.1.4 Development Consent SSD 6456

There are a number of SSD 6456 consent conditions directly relevant to the RMP. The key conditions are B81 to B84, which are provided below. Table B1 in Appendix B specifies where each of the requirements of all the specific and general consent conditions relevant to this RMP are addressed in this Plan.

Consent condition B81 requires Santos to rehabilitate all areas of the Project area affected by the development. This rehabilitation must be generally consistent with the proposed rehabilitation activities described in the EIS and comply with the objectives in Table 11 of the CoC. This table provides the rehabilitation objectives and has been previously presented in Table 1.1 in section 1.3.

Consent condition B82 requires Santos to rehabilitate the development progressively, that is, as soon as reasonably practicable following disturbance. All reasonable steps must be taken to minimise the total unrehabilitated disturbed area. Interim stabilisation and temporary vegetation strategies must be employed when areas prone to dust generation, soil erosion and weed incursion cannot be permanently rehabilitated.

Consent condition B83 states that prior to the commencement of Phase 1, Santos is to prepare a Rehabilitation Management Plan for the Project to the satisfaction of the Resources Regulator. This plan must:

(a) be prepared by a suitably qualified and experienced person/s;

(b) be prepared in consultation with the Department, EPA, DCCEEW Water, FCNSW, BCD, MEG and Council;

(c) be prepared in accordance with any relevant MEG code of practice and/or guideline;

(d) describe how the rehabilitation of the project area would achieve the objectives identified in Table 10 (of the CoC) and be integrated with the measures in the Biodiversity Management Plan;

(e) include detailed petroleum mining plan closure and final landform designs;

(f) include a detailed plan for the reinstatement and review of the proposed:

  (i) ecological rehabilitation and native woodland areas, including a protocol for progressive reviews to demonstrate that the target vegetation communities are being achieved; and agricultural land rehabilitation;

(g) include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the project area, and for triggering remedial action;

(h) include protocols and procedures for testing and management of drill cuttings used for rehabilitation of well pads to ensure the materials are fit for purpose to achieve rehabilitation objectives;

(i) describe the measures to be implemented to ensure compliance with the relevant conditions of this consent, and address all aspects of rehabilitation including closure and final land use/s;

(j) include a program to monitor, independently audit and report on the effectiveness of the measures in paragraph (i), and progress against the detailed performance and completion

criteria in paragraph (g);

(k) to the greatest extent practicable build on and integrate with the other management plans required under this consent; and

(l) include detailed scheduling for progressive rehabilitation to be initiated, undertaken and/or completed over the next 3 years.

Consent condition B84 states that Santos must implement the Rehabilitation Management Plan once approved by the Planning Secretary.

3.1.5 EPBC 2014/7376

The Project was declared to be a controlled action under the EPBC Act on 5 December 2014 and was assessed under the bilateral agreement between the Commonwealth and NSW Governments as it triggered the following controlling provisions:

- listed threatened species and ecological communities;
- a water resource (specifically for coal seam gas developments); and
- Commonwealth land.

The approval decision EPBC 2014/7376 was received on 24 November 2020, subject to a number of conditions of approval (**CoA**). The majority of the conditions either mirror or reinforce the SSD 6456 CoC, with CoA 1 stating that Santos must undertake the Project as described in and in accordance with the SSD 6456 consent conditions (referred to as the NSW approval).

There are no CoA directly applicable to the RMP. Any CoA related to biodiversity offset requirements and the retirement of credits are detailed in the Biodiversity Offset Strategy.

3.2 Relevant codes, standards, policies and guidelines

3.2.1 Exploration Code of Practice: Rehabilitation

Condition B83(c) requires this RMP to be prepared in accordance with any relevant MEG code of practice and/or guideline. The relevant MEG guideline(s) or code(s) of practice relevant to Phase 1 activities available at the time of preparing this RMP is the *Exploration Code of Practice: Rehabilitation* (NSW Resources Regulator, 2022)[2] (the **Rehabilitation Code**).

Part B of the Rehabilitation Code sets out mandatory requirements and provides title holders with related guidance regarding the expected performance to ensure that exploration is undertaken in a manner that manages and minimises risk and achieves sustainable rehabilitation outcomes. It enables industry to adopt a risk-based approach to ensure compliance with mandatory requirements related to rehabilitation, commit to measurable performance outcomes, monitor performance and take corrective action if these outcomes are not being achieved, keep and maintain relevant records of activities and/or actions.

The Rehabilitation Code provides guidance on final land use, rehabilitation objectives and completion criteria. It also describes recommended activities that should be undertaken prior to disturbance, during and after rehabilitation. Table B2 in Appendix B specifies where each of the mandatory requirements of the Rehabilitation Code are addressed in this Plan.

[2] The Exploration Code of Practice: Rehabilitation was originally published by the NSW Department of Planning and Environment, Division of Resources and Geoscience (DRG) in 2015. DRG was renamed as Regional NSW - Mining, Exploration and Geoscience (MEG). The latest version (version 5.0) of the Code of Practice: Rehabilitation has been published by the Resources Regulator.

Santos will review relevant guidance during the Project and update this RMP where material changes have been made or new guidance comes into force.

Reference to the Code of practice Construction, operation and decommissioning of petroleum wells (NSW Resources Regulator, 2023) (the **Petroleum Well Code**) is also made throughout this document. The Petroleum Well Code is provides a minimum set of mandatory requirements to ensure that petroleum wells are designed, constructed, operated, maintained and decommissioned to ensure their long-term integrity in NSW.

3.3 EIS commitments

In the EIS Chapter 31, and updated in Appendix B of the Response to Submissions, Santos committed to the implementation of a number of measures pending Project Approval and a final investment decision. The EIS commitments relevant to rehabilitation management have been reproduced in Table 3.1, in accordance with consent condition D3(c) which states that Santos must ensure that (where relevant) the management plans include any relevant commitments or recommendations identified in the EIS.

Table 3.1 - EIS commitment relevant to rehabilitation

Number	EIS Commitment relevant to rehabilitation
1.2	A Project-wide environmental management strategy, comprising a number of sub-plans to be used throughout the planning and design, construction, operation and decommissioning and rehabilitation stages of the Project are described in Chapter 30 [of the EIS]. The sub-plans are[3]: • … • …Rehabilitation Management Plan.
2.1	Drilling, completion and rehabilitation of wells in compliance with the NSW *Code of Practice for Coal Seam Gas - Well Integrity* 2017[1]
3.2/5.7	Only treated, amended or bore water will be used for dust suppression and rehabilitation.
5.5/6.7	Rehabilitation of impacted areas will occur in accordance with the Rehabilitation Strategy.
14.6	A Rehabilitation Plan and a Decommissioning Plan which build on the Rehabilitation Strategy and Decommissioning Strategy will be developed and implemented over the life of the Project.

Notes:

1 – Now updated to the Code of Practice: Construction, operation and decommissioning of petroleum (2023).

As described in section 16 of this Plan and section 8 of the EMS, the RMP will be subject to regular evaluation and review. This will include the EIS commitments to ensure they remain current, applicable, and generally improve the environmental performance of the Project.

[3] Only the plans relevant to rehabilitation have been listed. The full list of sub-plans is provided in the EMS section 3.5.

4. Existing environment

4.1 Overview

4.1.1 The Pilliga

The Pilliga represents the largest block of remnant vegetation in NSW, west of the Great Dividing Range. It is comprised mainly of State forests managed for timber production, as well as significant areas of conservation reserves.

In recognition of the high ecological and landscape value of the Pilliga, over 240,000 ha of conservation reserve have been gazetted under the NSW *National Park and Wildlife Act 1974* (**NP&W Act**) since the 1960s. Approximately half of the Pilliga is now reserved under the NP&W Act, with the other half retained as State forest for commercial timber production, recreation and mineral extraction.

4.1.2 Landscape context

The Pilliga and the Project area are located within the southern part of the Brigalow Belt South Bioregion, which extends over NSW and Queensland, with the majority in Queensland. In NSW, the bioregion covers an area of 52,409 km^2, which represents 18.7 % of the total bioregion (NPWS, 2000a).

The bioregion is divided into seven subregions in NSW: Liverpool Plains, Liverpool Range, Northern Outwash, Northern Basalt, Pilliga Outwash, Pilliga and Talbragar Valley. Of these, the Project area is situated in the Pilliga and Pilliga Outwash subregions. These subregions are characterised by occurring on Mesozoic bedrock containing extensive sandstone hills and coarse sandy soils (Pilliga), and on the plains of deep sandy texture dominated by alluvial and colluvial sediments (Pilliga Outwash) (NPWS, 2000a, 2000b).

4.1.3 Land use

Within the NSW section of the Brigalow Belt South Bioregion, the majority of land (approximately 85 %) is freehold land. Much of this is used for agricultural purposes, where cropping (dryland and irrigation farming) and grazing / pastoral activities dominate (NPWS, 2000a, 2000b). Approximately 5 % of the NSW sections of the bioregion are used by the forestry industry and 4 % forms Crown lands and conservation reserves. Other land uses include mining (mainly coal) and apiary industries.

Land use was mapped for the EIS and classified into the following categories; cleared, creek bed, dam, derived native grassland, native vegetation, cropping, improved pasture and previous evidence of pasture improvement, as presented in Figure 4.1. This mapping indicated that native vegetation covers approximately 75 % of the Project area whilst derived native grassland consists of approximately 10 % of the Project area. Agricultural areas of cropping, improved pasture or areas with evidence of previous pasture improvement together consist approximately 14 % of the Project area.

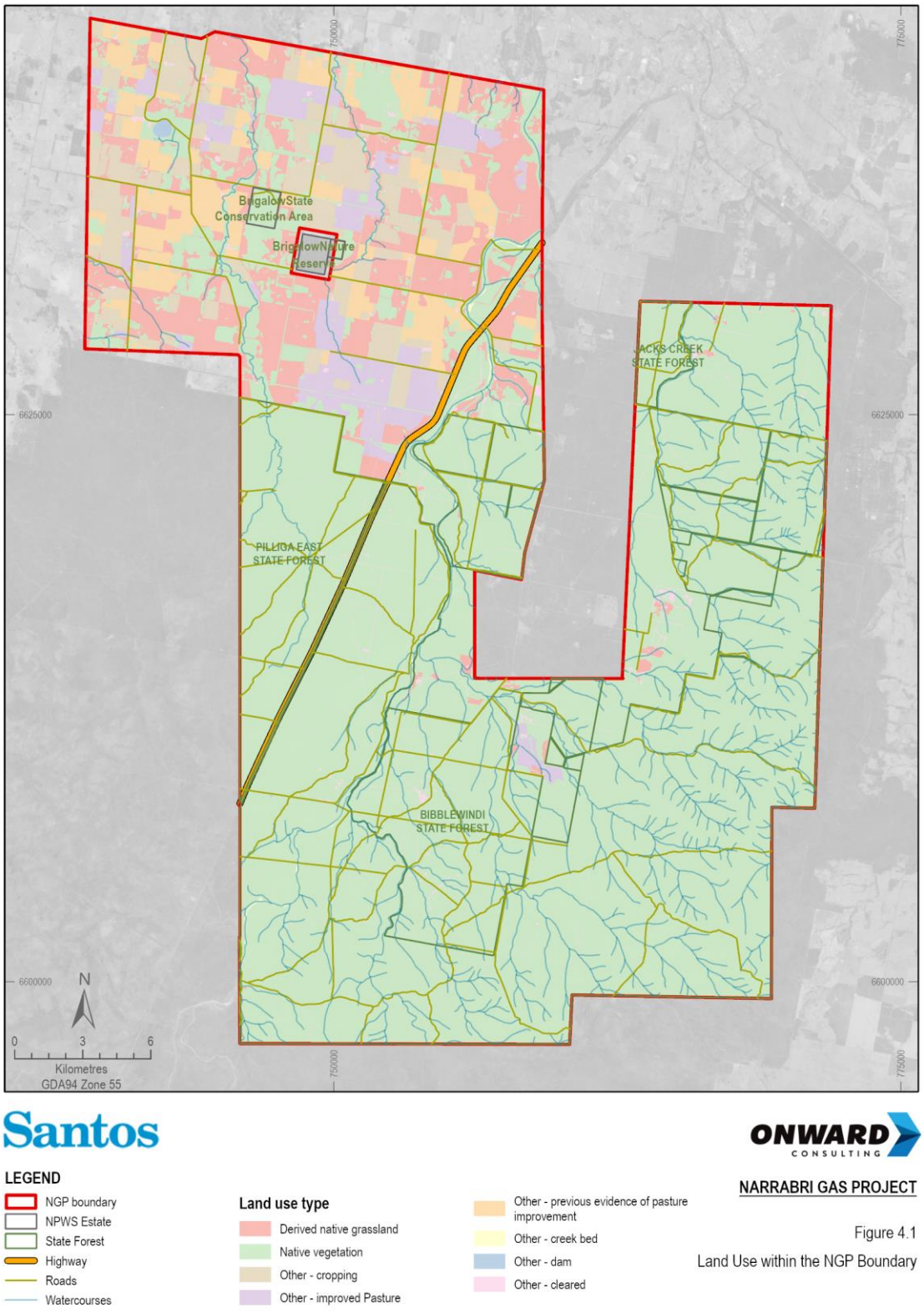

Figure 4.1 - Land use

4.2 Vegetation and flora

4.2.1 Vegetation communities

Vegetation communities (known as Plant Community Types [**PCTs**]) within the Project area were attributed in accordance with the NSW Vegetation Classification and assessment. Twenty-two plant communities occur within the Project area, covering an area of 80,398 hectares (**ha**) and 14,678 ha of 'other' for approximately 95,077 ha within the Project area. These communities and corresponding biometric vegetation types (**BVT**) are as detailed in Table 4.1 and shown in Figure 4.2.

Table 4.1 - Vegetation communities within the Project area

Plant community name (identification number)[a,b]	BVT identification number
Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions (27)	NA219
Brigalow – Belah open forest / woodland on alluvial often gilgaied clay from Pilliga Scrub to Goondiwindi, Brigalow Belt South Bioregion (35)	NA117
Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions (55)	NA102
River Red Gum riparian tall woodland / open forest wetland in the Nandewar and Brigalow Belt South Bioregions (78)	NA193
Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South Bioregion (88)	NA179
Broombush – wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion (141)	NA121
Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South (including Pilliga) and Nandewar Bioregions (202)	NA141
Green Mallee tall Mallee woodland on rises in the Pilliga – Goonoo regions, southern BBS Bioregion (256)	NA292
Inland Scribbly Gum – White Bloodwood – Red Stringybark – Black Cypress Pine shrubby sandstone woodland mainly of the Warrumbungle NP – Pilliga region in the BBS Bioregion (379)	NA294
Poplar Box – White Cypress Pine shrub grass tall woodland of the Pilliga – Warialda region, BBS Bioregion (397)	NA324
Narrow-leaved Ironbark – White Cypress Pine – Buloke tall open forest on lower slopes and flats in the Pilliga Scrub and surrounding forests in the central north BBS Bioregion (398)	NA314
Red gum – Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga – Goonoo sandstone forests, BBS Bioregion (399)	NA255
Rough-barked Apple – red gum – cypress pine woodland on sandy flats, mainly in the Pilliga Scrub region (401)	NA338
Mugga Ironbark – White Cypress Pine – gum tall woodland on flats in the Pilliga forests and surrounding regions, BBS Bioregion (402)	NA307
Red Ironbark – White Bloodwood -/+ Burrows Wattle heathy woodland on sandy soil in the Pilliga forests (404)	NA326
White Bloodwood – Red Ironbark – cypress pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions (405)	NA390
White Bloodwood – Motherumbah – Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests (406)	NA389

Plant community name (identification number)[a,b]	BVT identification number
Dirty Gum (Baradine Gum) – Black Cypress Pine – White Bloodwood shrubby woodland of the Pilliga forests and surrounding region (408)	NA279
White Cypress Pine – Silver-leaved Ironbark – Wilga shrub grass woodland of the Narrabri-Yetman region, BBS Bioregion (418)	NA409
Spur-wing Wattle heath on sandstone substrates in the Goonoo-Pilliga forests Brigalow Belt South Bioregion (425)	NA363
Carbeen – White Cypress Pine – Curracabah – White Box tall woodland on sand in the Narrabri-Warialda region of the Brigalow Belt South Bioregion (428)	NA267
White Bloodwood – Dirty Gum (Baradine Gum) – Rough Barked Apple – Black Cypress Pine heathy open woodland on deep sand in the Pilliga forests (40X)[c]	NA390
Cleared, creek bed, dams and improved pasture (Other)	-

Notes:

a - Plant community as per *NSW Vegetation Classification and Assessment*.
b - Communities listed under the BC Act and/or EPBC Act are highlighted in **bold**.
c - PCT ID40X does not correspond with the PCTs of the NSW Vegetation Classification Assessment. This community is most closely related to PCT ID405.

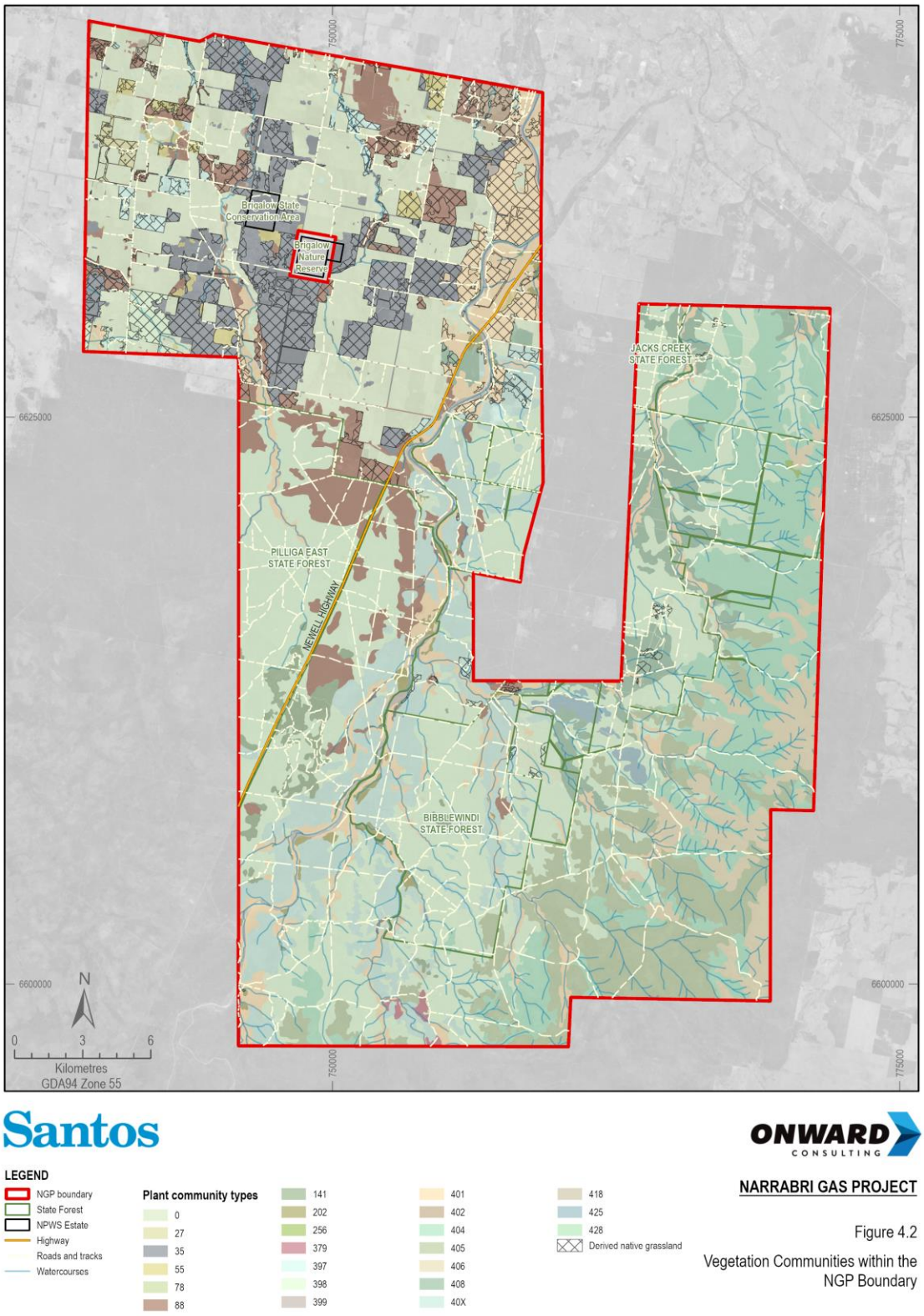

Figure 4.2 - Vegetation communities within the Project area

4.2.2 Threatened ecological communities

Four Endangered Ecological Communities (**EECs**) listed under the BC Act and/or EPBC Act were recorded within the Project area during field surveys and have the potential to be impacted as a result of the Project. These communities within the Project area are listed in Table 4.2 and the distribution based on listing status in Figure 4.3.

Table 4.2 - Vegetation communities within the Project area

Name (plant community identification number)[a]	Conservation status[b]	
	BC Act	EPBC Act
Brigalow within the Brigalow Belt South, Nandewar and Darling Riverine Plains Bioregions (BC Act) or Brigalow (*Acacia harpophylla* dominant and co-dominant) (EPBC Act) (35)	E	E
Carbeen Open Forest Community in the Darling Riverine Plains and Brigalow Belt South Bioregions (428)	E	-
Myall Woodlands in the Darling Riverine Plains, Brigalow Belt South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW south western slopes bioregions (BC Act) or Weeping Myall Woodlands (EPBC Act) (27)	E	E
Fuzzy Box Woodland on alluvial soils of the south western slopes, Darling Riverine Plains and Brigalow Belt South bioregions (202)	E	-

Notes:

a - Plant community as per *NSW Vegetation Classification and Assessment*.
b - E = Endangered ecological community (BC and EPBC Act).
c - Areas are not mutually exclusive and are calculated based on the definition of the community within the BC Act and EPBC Act.

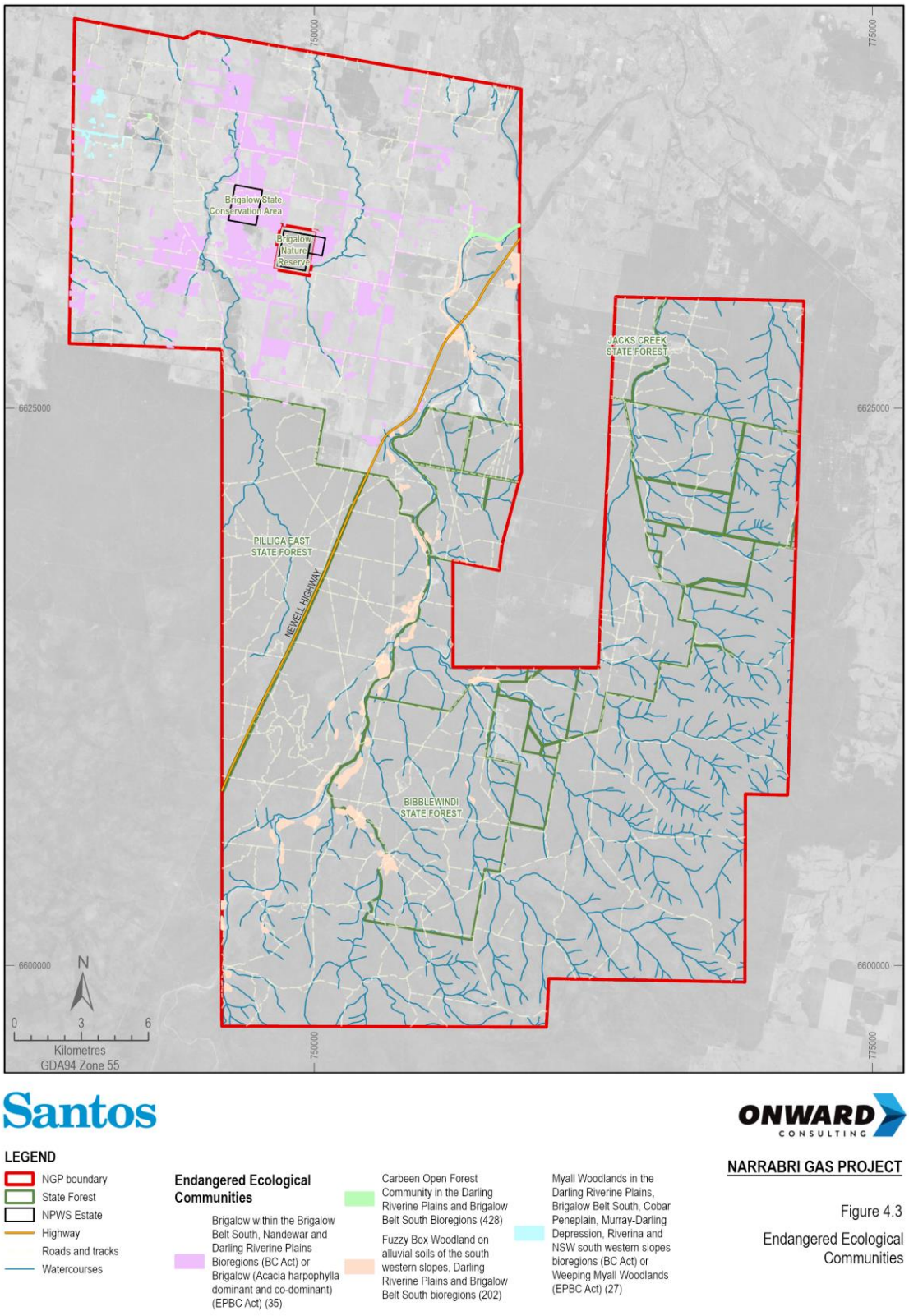

Figure 4.3 - Distribution of Endangered Ecological Communities within the Project area

4.2.3 Threatened flora

Ten threatened flora listed under the BC Act and/or EPBC Act species were recorded in the Project area during field surveys and may be impacted by the Project. These species are listed in Table 4.3.

Table 4.3 - Threatened flora recorded in the Project area

Scientific name	Common name	Conservation status[a]	
		BC Act	EPBC Act
Bertya opponens	Coolabah Bertya	V	V
Diuris tricolor	Pine Donkey Orchid	V	-
Lepidium aschersonii	Spiny Peppercress	V	V
Lepidium monoplocoides	Winged Peppercress	E1	E
Myriophyllum implicatum	-	CE	-
Polygala linariifolia	Native Milkwort	E1	-
Pomaderris queenslandica	Scant Pomaderris	E1	-
Pterostylis cobarensis	Greenhood Orchid	V	-
Commersonia procumbens[b]	-	V	V
Tylophora linearis	-	V	E

Notes: a - CE = Critically Endangered, E = Endangered (EPBC Act), E1 = Endangered (TSC Act) and V = Vulnerable.

b - Species listed as *Androcalva procumbens*, synonym for *Commersonia procumbens*, in EPBC 2014/7376. Note a recent taxonomic revision moved the species to a new genus, *Androcalva*, but *Commersonia* is used in this document for consistency with SSD-6456.

4.3 Fauna and habitat

4.3.1 Threatened and migratory fauna

Sixteen birds, ten mammals and one reptile listed as threatened under the BC Act, three mammals and one bird listed as threatened under the EPBC Act and five birds listed as migratory under the EPBC Act were recorded within the Project area during the field surveys, as presented in Table 4.4. Matters of National Environmental Significance (**MNES**) considered relevant to the Project under the EPBC approval (2014/7376) are also provided, in Table 4.5.

Table 4.4 - Threatened and migratory fauna recorded in the Project area

Scientific name	Common name	Conservation status[a]		Type
		BC Act	EPBC Act	
Apus pacificus	Fork-tailed Swift	-	M, Mar	Migratory bird
Ardea modesta	Great Egret, White Egret	-	Mar	Wetland bird
Ardea ibis	Cattle Egret	-	Mar	Wetland bird
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Woodland bird
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Hollow-dependent bird
Chthonicola sagittata	Speckled Warbler	V	-	Woodland bird
Daphoenositta chrysoptera	Varied Sittella	V	-	Woodland bird

Scientific name	Common name	Conservation status[a]		Type
		BC Act	EPBC Act	
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Wetland bird
Glossopsitta pusilla	Little Lorikeet	V	-	Hollow-dependent bird
Grantiella picta	Painted Honeyeater	V	V	Woodland bird
Hirundapus caudacutus	White-throated Needletail	-	M, Mar	Migratory bird
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	Woodland bird
Merops ornatus	Rainbow Bee-eater	-	Mar	Migratory bird
Myiagra cyanoleuca	Satin Flycatcher	-	M, Mar	Migratory bird
Neophema pulchella	Turquoise Parrot	V	-	Hollow-dependent bird
Plegadis falcinellus	Glossy Ibis	-	M, Mar	Migratory bird
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	Woodland bird
Stagonopleura guttata	Diamond Firetail	V	-	Woodland bird
Circus assimilis	Spotted Harrier	V	-	Raptor
Falco subniger	Black Falcon	V	-	Raptor
Hieraaetus morphnoides	Little Eagle	V	-	Raptor
Lophoictinia isura	Square-tailed Kite	V	-	Raptor
Ninox connivens	Barking Owl	V	-	Hollow-dependent bird
Tyto novaehollandiae	Masked Owl	V	-	Hollow-dependent bird
Cercartetus nanus	Eastern Pygmy-possum	V	-	Arboreal mammal
Petaurus norfolcensis	Squirrel Glider	V	-	Arboreal mammal
Macropus dorsalis	Black-striped Wallaby	E	-	Terrestrial mammal
Pseudomys pilligaensis	Pilliga Mouse	V	V	Terrestrial mammal
Chalinolobus picatus	Little Pied Bat	V	-	Microchiropteran bat
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-	Microchiropteran bat
Nyctophilus corbeni	South-eastern Long eared Bat / Corben's Long-eared Bat	V	V	Microchiropteran bat
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Microchiropteran bat
Vespadelus troughtoni	Eastern Cave Bat	V	-	Microchiropteran bat
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	Reptile

Notes: a. CE = Critically Endangered, E = Endangered (BC Act/EPBC Act), V = Vulnerable, M = Migratory (EPBC Act), Mar = Marine (EPBC Act).

Table 4.5 - MNES under EPBC 2014/7376 relevant to the Project area

Scientific name	Common name	EPBC Act status	Type
Brigalow – Belah open forest/woodland on alluvial often gilgaeied clay from Pilliga Scrub to Goondiwindi, Brigalow Belt South Bioregion	Brigalow woodland	E	Community
Weeping Myall open woodland of the Darling Riverine Plains and Brigalow Belt South Bioregions	Weeping Myall woodland	E	Community
Anthochaera phrygia	Regent Honeyeater	CE	Woodland bird
Lathamus discolor	Swift Parrot	CE	Hollow-dependent bird
Polytelis swainsonii	Superb Parrot	V	Hollow-dependent bird
Phascolarctos cinereus	Koala	V	Arboreal mammal
Dasyurus maculatus	Spotted-tail Quoll	E	Terrestrial mammal
Pseudomys pilligaensis	Pilliga Mouse	V	Terrestrial mammal
Nyctophilus corbeni	South-eastern Long-eared Bat	V	Microchiropteran bat
Bertya opponens	Coolabah Bertya	V	Perennial shrub
Lepidium aschersonii	Spiny Peppercress	V	Perennial herb
Lepidium monoplocoides	Winged Peppercress	E	Perennial herb
Androcalva procumbens	*Androcalva procumbens*	V	Perennial shrub
Tylophora linearis	*Tylophora linearis*	E	Perennial herb

Notes: CE = Critically Endangered, E = Endangered (BC Act/EPBC Act), V = Vulnerable

4.3.2 Key threatened fauna habitat

Nine fauna habitat types occur within the Project area:

- water bodies (lakes and dams);
- closed forest;
- riparian woodland;
- shrubby woodland;
- heathy woodland;
- shrub grass woodland;
- grassy woodland;
- heath; and
- grassland.

4.4 Pest plants and animals

Four Weeds of National Significance (**WoNS**), six State Priority and eight Regional Priority weeds were identified within the Project area, as presented in Table 4.6.

Table 4.6 - Pest plants - WoNS and Priority Weeds recorded in the Project area

Scientific name	Common name	WoNS	State Priority weed	Regional priority weed
Bryophyllum delagoense	Mother-of-Millions	N	Y	Y
Cestrum parqui	Green Cestrum	N	N	Y
Harrisia spp.	Harrisia cactus	N	N	Y
Lycium ferocissimum	African Boxthorn	Y	Y	Y
Olea europaea subsp. *cuspidata*	African Olive	N	N	Y
Opuntia aurantiaca	Tiger Pear	Y	Y	Y
Opuntia stricta	Prickly Pear, Common Pest Pear	Y	Y	Y
Opuntia tomentosa	Prickly Pear, Velvet Tree Pear	Y	Y	Y
Parthenium sp.	Parthenium	Y	Y	N
Ricinus communis	Castor Oil Plant	N	N	Key emerging weed
Solanum sp.		Y	Y	Y

Notes: Listed in State of NSW 2019. North West. Recent reports within and near the project area for *Parthenium* sp and *Harrisia* spp. Cactus have been included but have not been recorded in the Australian Virtual Herbarium (AVH, 2021) or the BioNet Atlas (DPIE, 2021) at the time of writing.

Five birds and 12 mammals listed as feral species were recorded in the Project area, as presented in Table 4.7.

Table 4.7 - Pest animals recorded in the Project area

Scientific name	Common name
Canis lupus familiaris	Wild Dog
Felis catus	Cat
Vulpes vulpes	Red Fox
Bos taurus	Cow
Capra hircus	Goat
Equus sp.	Horse
Lepus capensis	Hare
Sus scrofa	Pig
Oryctolagus cuniculus	Rabbit
Ovis arues	Sheep
Mus musculus	Mouse
Rattus rattus	Rat
Streptopelia chinensis	Spotted Turtle-dove
Sturnus tristis	Common Myna

Scientific name	Common name
Sturnus vulgaris	Starling
Passer domesticus	House Sparrow
Turdus merula	Eurasian Blackbird

4.5 Project area land and soil capability

Land and soil capability of agricultural land within the Project area was described in chapter 17 of the EIS and is reproduced in Table 4.8. The majority of the Project area is classified as Class 4, Class 5 or Class 7 agricultural land, meaning it is generally incapable of sustaining cropping without specialist management practices and resources. A relatively small proportion of the Project area is classified Class 3 and is therefore capable of sustaining higher productivity land uses, such as cropping.

Table 4.8 - Land and soil capability in the Project area

Classification	Land and soil capability	Area in Project area (ha)	Proportion of Project area (%)
Class 1	No limitations. This land is of extremely high capability and has no limitations. There are no special land management practices required and land is capable of all rural land uses and land management practices	0	0
Class 2	Slight limitations. Land is of very high capability and has slight limitations which can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.	0	0
Class 3	Moderate limitations. Land capable of sustaining high impact land uses using more intensive, readily available and accepted management practices.	17,000	18
Class 4	Moderate to severe limitations. Land generally not capable of sustaining high impact land uses unless using specialised management practices with high level of knowledge, expertise, inputs, investment and technology.	32,500	34
Class 5	Severe limitations. Land not capable of sustaining high impact land uses except where resources allow for highly specialised land management practices to overcome limitations (such as high value crops). Lower impact land uses (such as grazing) can be managed by readily available practices.	45,500	48
Class 6	Very severe limitations. Land incapable of sustaining many land use practices (e.g. cultivation, moderate to high intensity grazing and horticulture). Highly specialised practices can overcome some limitations for some high value products. Land often used for low intensity land uses (low intensity grazing).	<50	<0.1
Class 7	Extremely severe limitations. Land incapable of sustaining most land uses. Limitations cannot be overcome.	<50	<0.1
Class 8	Extremely severe limitations. Land is unusable for agricultural production	0	0

4.6 Phase 1 area overview

The Project area of Phase 1 is in the southern parts of the overall Project area mainly within the large forested area of ‘the Pilliga’, refer to Figure 4.4. Phase 1 includes the Bibblewindi and Leewood facility.

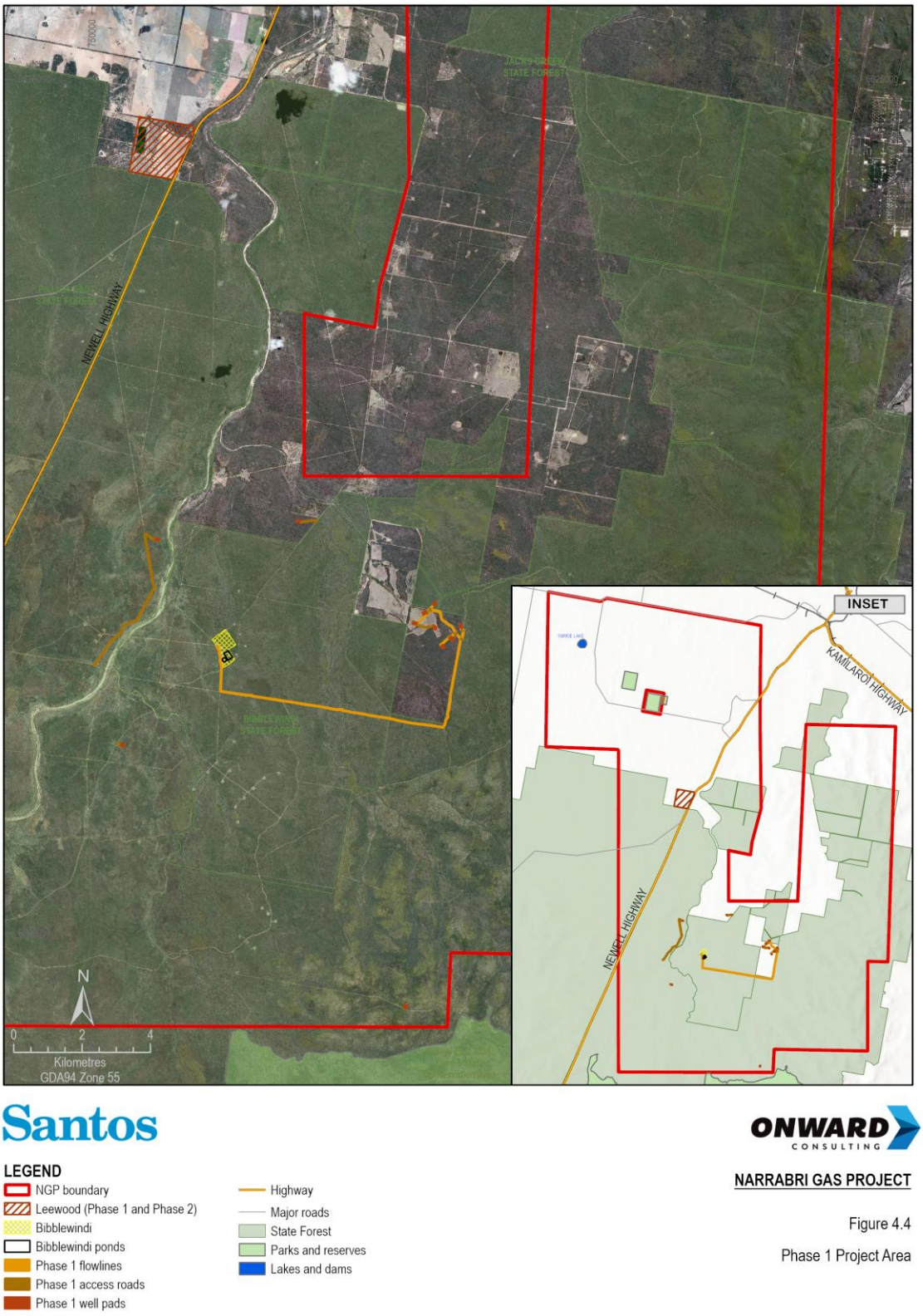

Figure 4.4 - Phase 1 Project area

Preliminary Phase 1 impacts were calculated from the development footprint with the approved Project EIS vegetation mapping. Final Phase 1 impacts will be calculated following completion of micro-siting processes including cultural heritage clearance in accordance with the approved Aboriginal Cultural Heritage Management Plan (**ACHMP**). The final Phase 1 impact area will be approved as part of the first Field Development Plan.

4.6.1 Phase 1 vegetation communities

Vegetation communities (PCTs) within the Phase 1 area were attributed in accordance with the *NSW Vegetation Classification and assessment*. Ten plant communities occur within the Phase 1 area, covering an area of 24.69 ha. These communities and corresponding biometric vegetation types are as detailed in Table 4.9.

Table 4.9 - Phase 1 direct impacts to native vegetation (indicative)

PCT	BVT ID (Oct 2008)	BVT ID (Oct 2014)	Phase 1 direct impacts (ha)
141 - Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion	NA121	NA121	0.60
404 - Red Ironbark - White Bloodwood -/+ Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	NA124	NA326	1.20
405 - White Bloodwood - Red Ironbark - cypress pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions	NA124	NA390	0.97
408 - Dirty Gum (Baradine Gum) - Black Cypress Pine - White Bloodwood shrubby woodland of the Pilliga forests and surrounding region	NA124	NA279	3.52
40X - White Bloodwood – Dirty Gum – Rough Barked Apple heathy open woodland on deep sand in the Pilliga forests	NA124	NA390	3.55
202 - Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South-western Slopes Bioregion	NA141	NA141	0.47
88 - Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	NA179	NA179	0.05
399 - Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, BBS Bioregion	NA197	NA255	0.03
401 - Rough-barked Apple - red gum - cypress pine woodland on sandy flats, mainly in the Pilliga Scrub region	NA197	NA338	1.98
398 - Narrow-leaved Ironbark - White Cypress Pine - Buloke tall open forest on lower slopes and flats in the Pilliga Scrub and surrounding forests in the central north BBS Bioregion	NA227	NA314	12.32
		Total	**24.69**

Notes:

a - Plant community as per *NSW Vegetation Classification and Assessment*.
b - Communities listed under the BC Act and/or EPBC Act are highlighted in **bold**.
c - Plant community type ID40X does not correspond with the plant community types of the *NSW Vegetation Classification Assessment*. This community is most closely related to plant community type ID405.

4.6.2 Phase 1 land and soil capability

Land and soil capability of land within the Project area was described in Chapter 17 of the EIS and is in part reproduced in Table 4.10 covering land in the Phase 1 area. The majority of the Phase 1 area is classified as Class 5, with a smaller area Class 4, meaning it is generally incapable of sustaining cropping without specialist management practices and resources. A relatively small proportion of the Phase 1 area is classified Class 3 and is therefore capable of sustaining higher productivity land uses, such as cropping, although much of this land is located closer to creeks and waterways.

Table 4.10 - Land and soil capability in the Phase 1 area

Class	Land and soil capability	Area in Phase 1 (ha)	Proportion of Phase 1 (%)
Class 3	Moderate limitations. Land capable of sustaining high impact land uses using more intensive, readily available and accepted management practices.	6.3	10
Class 4	Moderate to severe limitations. Land generally not capable of sustaining high impact land uses unless using specialised management practices with high level of knowledge, expertise, inputs, investment and technology.	1.3	2
Class 5	Severe limitations. Land not capable of sustaining high impact land uses except where resources allow for highly specialised land management practices to overcome limitations (such as high value crops). Lower impact land uses (such as grazing) can be managed by readily available practices.	55.4	88

5. Risk assessment

Risks to the implementation of the RMP were assessed during the preparation of the EIS using the Santos Risk Matrix, as presented in Table 5.1 below (definitions for the likelihood and consequence can be found in the Project EMS). These risks were developed in consultation with FCNSW and Santos. The risks considered in this assessment specifically relate to issues associated with Phase 1 and the implementation of this Plan.

The method used for the risk assessment encompassed the following key steps:

- identifying the related risks, including what could happen, when and where;
- analysing the risks using a qualitative risk approach (i.e. identifying existing controls, determining specific consequences/likelihoods and then determining the residual level of risk);
- evaluating the risks to determine the significant issues. The purpose of risk evaluation is to make decisions based on the outcomes of the risk assessment about which of the risks need additional controls or the implementation of a mitigation strategy; and
- establishing additional controls to mitigate/treat high or extreme risks identified as part of the process.

The risk assessment identified 39 key rehabilitation risks which are summarised as follows:

- 21 risks were ranked as very low;
- eight risks were ranked as low; and
- no risks were ranked as medium, high or very high.

The complete risk assessment is presented in Table 5.2.

Table 5.1 - Risk assessment matrix for rehabilitation

Likelihood	Consequence					
	Negligible	Minor	Moderate	Severe	Major	Critical
Almost certain	Low	Medium	High	Very high	Very high	Very high
Likely	Low	Medium	High	High	Very high	Very high
Occasional	Low	Low	Medium	High	High	Very high
Possible	Very low	Low	Low	Medium	High	Very high
Unlikely	Very low	Very low	Low	Low	Medium	High
Remote	Very low	Very low	Very low	Low	Medium	Medium

Other risks and contingency measures can be found in the EMS.

Table 5.2 - Rehabilitation risks of the Project

Situation/Activity / Location	Description of Risk	Consequence category	Potential consequence / impact	Existing controls	Risk control effectiveness	Initial risk		
						C	L	Risk Score
Land Clearance	Pre- clearance site conditions not fully inspected.	Environment	Insufficient material for rehabilitation.	Baseline surveys with regard to soils. Disturbance boundaries and clearing requirements	Satisfactory	Minor	Possible	Low
Land Clearance	Loss of biological resources – e.g. Subsoil, vegetation material, seedbank.	Environment	Insufficient material for rehabilitation. Poor quality rehabilitation.	Baseline surveys with regard to soils. Soil management procedures Native seed banking for use in rehabilitation procedures for the collection and reinstatement of habitat features	Satisfactory	Moderate	Possible	Low
Land Clearance	Clearing in inappropriate seasonal conditions to salvage biological resources	Environment	Insufficient material for rehabilitation. Poor quality rehabilitation.	Planning of clearance with consideration of formal requirements of government agencies. Inclusion of requirements in management plans	Satisfactory	Minor	Possible	Low
Land Clearance	Poor topsoil management.	Environment	Insufficient material for rehabilitation. Poor quality rehabilitation.	Topsoil management procedures included in rehabilitation and other management plans. Supervision in the field	Satisfactory	Minor	Unlikely	Very Low
Active Exploration / Production	Contamination from mining activities (hydrocarbons and chemicals).	Environment	Long-term environmental impacts. Costs to manage contamination issues.	Project planning and design to incorporate contamination control Hazardous materials management plan Management of small spills	Satisfactory	Minor	Unlikely	Very Low
Active Exploration / Production	Material prone to spontaneous combustion	Environment	Poor quality rehabilitation.	Spontaneous combustion not identified.	Satisfactory	Minor	Remote	Very Low
Active Exploration / Production	Contamination to surface or groundwater.	Environment	Long-term environmental impacts. Not operating in accordance with the Water Management Plan.	Water management plan in place. Project to incorporate contamination control Hazardous materials management plan Weed and pest management plan for herbicides	Satisfactory	Minor	Unlikely	Very Low
Land Clearance Active Exploration / Production Decommissioning	Impacts to heritage items	Environment	Not operating in accordance with the Aboriginal and Historical Heritage MP Financial and reputation impacts.	Heritage items identified during the EIS. Heritage management plans to be prepared Unexpected finds protocol Delineation and demarcation of heritage items prior to clearing. Removal and relocation protocols	Satisfactory	Moderate	Unlikely	Low
Decommissioning	Generation of hazardous waste from demolition.	Environment	Less than adequate waste disposal. Contamination Exposure to hazardous substances.	Hazardous materials management plan Risk assessment process and identification of issues	Satisfactory	Minor	Unlikely	Very Low
Landform Establishment Growth Medium Development Ecosystem Establishment	Use of inappropriate machinery in rehabilitation.	Environment	Poor quality rehabilitation.	Rehabilitation management plan Soil management protocols	Satisfactory	Minor	Unlikely	Very Low
Landform Establishment	Final landform unsuitable for final land use e.g. rock preventing agriculture.	Environment	Failure to meet land capability requirements. Long-term environmental impacts. Rehabilitation bond is not returned.	Rehabilitation management plan	Satisfactory	Minor	Unlikely	Very Low
Landform Establishment	Landform aspect not suitable for intended plant species	Environment	Failure to meet land capability requirements. Long-term environmental impacts. Rehabilitation bond is not returned.	Endemic native species for rehabilitation. Mix of species will mean variability in tolerance.	Satisfactory	Minor	Unlikely	Very Low
Landform Establishment	Inappropriate surface water management on rehabilitated landforms.	Environment	Long-term environmental impacts. Rehabilitation bond is not returned.	Water management plan. Clean and dirty water separation will be an integral part of the Water Management Plan	Satisfactory	Minor	Unlikely	Very Low
Landform Establishment	Water availability on and off site	Environment	Poor quality rehabilitation.	Watering requirements for tubestock in rehabilitation.	Satisfactory	Minor	Unlikely	Very Low
Growth Medium Development	Soil compaction from equipment.	Environment	Poor quality rehabilitation.	Rehabilitation management plan Soil management protocols	Satisfactory	Minor	Unlikely	Very Low
Growth Medium	Subsoil and topsoil deficit for	Environment	Failure to meet land capability requirements.	Soil balance has been quantified in the EIS.	Satisfactory	Minor	Unlikely	Very Low

Situation/Activity / Location	Description of Risk	Consequence category	Potential consequence / impact	Existing controls	Risk control effectiveness	Initial risk		
						C	L	Risk Score
Development	rehabilitation activities.		Poor quality rehabilitation. Increased costs.	Rehab management plan. Development and maintenance of soils inventory. Soil stripping and reinstatement procedures/protocols				
Growth Medium Development	Poor quality topsoil/subsoil for rehabilitation.	Environment	Failure to meet land capability requirements. Rehabilitation bond is not returned. Increased costs.	Soil balance has been quantified. Rehab management plan. Development and maintenance of soils inventory. Soil stripping and reinstatement procedures/protocols	Satisfactory	Minor	Unlikely	Very Low
Ecosystem Establishment	Lack of availability and quality of seed resources, including genetic integrity. Poor seed viability, seed dormancy.	Environment	Poor quality rehabilitation. Rehabilitation bond is not returned.	Native seed banking for use in rehabilitation Procedures for the collection of seed. Ongoing rehabilitation "trials" to determine seed viability. Planning of rehab.	Satisfactory	Minor	Possible	Low
Ecosystem Establishment	Lack of resources for rehabilitation maintenance.	Environment	Poor quality rehabilitation.	Adequate planning and funding for rehab maintenance.	Satisfactory	Minor	Unlikely	Very Low
Ecosystem Establishment	Weed infestations.	Environment	Poor quality rehabilitation.	Weed and pest management plan to be developed. Rehabilitation management plan includes weed management prior to topsoil stripping and reinstatement.	Satisfactory	Minor	Possible	Low
Ecosystem Establishment	Damage from fauna (e.g. kangaroos etc.).	Environment	Long-term environmental impacts. Rehabilitation bond is not returned.	Weed and pest management plan to be developed. Monitoring and control - trigger action response plan	Satisfactory	Minor	Possible	Low
Ecosystem Establishment and Land Use Development	Weather and climatic influences (e.g. drought; intense rainfall events; bushfire etc.).	Environment	Poor quality rehabilitation. Rehabilitation bond is not returned.	Bushfire management plan, fire breaks where necessary, slashing to remove fuel loads Reliance on seeding rather than tubestock, use of endemic species Water management plan and drainage works with sufficient capacity for intense rainfall events	Satisfactory	Minor	Unlikely	Very Low
Ecosystem Establishment and Land Use Development	Insects and plant disease.	Environment	Poor quality rehabilitation Rehabilitation bond is not returned.	Weed and pest management plan to be developed. Biodiversity management plan includes weed management prior to topsoil stripping and reinstatement.	Satisfactory	Minor	Possible	Low
Ecosystem and Land use Establishment	Lack of integration of native ecosystems with agricultural ecosystems.	Environment	Long-term environmental impacts. Rehabilitation bond is not returned.	Rehabilitation and Biodiversity management plans.	Satisfactory	Minor	Unlikely	Very Low
Ecosystem and Land use Establishment	Insufficient establishment of target species and limited species diversity.	Environment	Completion criteria not met. Offset requirements not met	Rehabilitation and Biodiversity management plans Consideration of timing around reseeding to allow best outcomes. Rehabilitation trials.	Satisfactory	Minor	Unlikely	Very Low
Ecosystem and Land use Establishment	Limited vegetation structural development.	Environment	Long-term environmental impacts. Rehabilitation bond is not returned.	Rehabilitation and Biodiversity management plans Consideration of timing around reseeding to allow best outcomes. Rehabilitation trials. Rehabilitation monitoring and TARP.	Satisfactory	Minor	Unlikely	Very Low
Ecosystem and Land use Establishment	Erosion and failure of drainage and water management / storage structures.	Environment	Poor quality rehabilitation.	Engineering design, construction design, maintenance	Satisfactory	Minor	Unlikely	Very Low
Ecosystem and Land use Establishment	Poor water quality and discharges.	Environment	Long-term environmental impacts.	No dirty water discharges offsite. Closed water management system. Water management plan and erosion and sediment control plan	Satisfactory	Minor	Remote	Very Low
Ecosystem and Land use Development	Vandalism and unauthorised access to rehabilitation areas.	Property Damage / Process loss	Impact to rehabilitation. Safety concern relating to unauthorised site access.	Site signage, Project site security and access. Training and awareness. Inductions	Satisfactory	Minor	Unlikely	Very Low

6. Rehabilitation domains

Rehabilitation domains are land management units which share similar rehabilitation requirements and final land uses. There are four rehabilitation domains identified for the Project in the EIS, being:

- Domain 1 - Non-linear infrastructure (e.g. well sites);
- Domain 2 - Linear infrastructure (e.g. roads);
- Domain 3 - Major facilities; and
- Domain 4 - Agricultural land.

6.1 Domain 1 - Non-linear infrastructure

Domain 1 includes (but is not limited to) exploration and production wells, small nodal compressor stations, water transfer tanks and small laydown areas. Domain 1 is largely made up of exploration and production well pads each with an area of approximately 1 ha each.

6.2 Domain 2 - Linear infrastructure

Domain 2 includes (but is not limited to) roads and tracks, gas and water gathering lines, low- and high-pressure gas and water pipelines, power lines and other services e.g. communications. The predominate usage of Domain 2 is for roads, gas and water pipelines.

6.3 Domain 3 - Major facilities

Domain 3 includes the existing Leewood and Bibblewindi facilities and Bibblewindi to Leewood infrastructure corridor. For Phase 1, no additional infrastructure is proposed or approved at these sites, and they will continue current operations as follows:

- Leewood:
  - a central water management facility including storage and treatment of produced water
  - irrigation pivot and associated infrastructure
  - beneficial reuse of amended treated produced water for irrigation
  - storage, amenities and parking areas
- Bibblewindi:
  - gas compressor and associated safety flare
  - produced water balance tank
  - storage, amenities and parking areas
- Bibblewindi to Leewood infrastructure corridor:
  - gas and water pipeline within a 10 m wide corridor.

Figure 6.1 - Aerial view of infrastructure at Bibblewindi

6.4 Domain 4 - Agricultural land

Domain 4 consists of areas of agricultural land across all other domains that is designated for post-production and rehabilitated for agricultural land use. This domain conforms to the NGP Rehabilitation Strategy presented in the EIS.

Domain 4 consists of former agricultural land that has been disturbed by the NGP. Rehabilitation methodology for Domain 4 will be developed in consultation with landholders with the aim of returning land to its former agricultural capability class and being suitable for long-term agricultural activities.

6.5 Final landform and land use

The final land use of disturbed areas will depend on their location, tenure and previous land use. The primary objective of the rehabilitation strategy is to return land to its original use including vegetation communities or former agricultural activity (grazing or cropping) and be suitable for transfer back to FCNSW, private ownership or other tenure as appropriate.

As production wells and other infrastructure are decommissioned, they will be progressively rehabilitated to pre-production vegetation condition. The potential impacts during Phase 1 of the Project on landform are expected to be relatively minor and limited to small scale surface disturbances only (e.g. grading of roads and well pads, and excavation of trenches).

Due to the relatively flat to gently undulating nature of the Project area, relatively minor grading is likely to be necessary to reconstruct pre-disturbance landforms. High quality datasets including contours and

digital elevation models will be utilised to ensure rehabilitation areas conform with the surrounding landscape and PCT's. Once subsoil and topsoil have been replaced and re-shaped, natural regeneration will be facilitated to minimise erosion and stabilise the landform. The replacement of retained woody material will assist this process by catching overland flow. Given the nature of the domains, they more broadly fall into two final landforms and land use:

1) native ecosystem; and
2) agricultural land.

Larger more complex rehabilitation will occur from longer-term ground disturbance such as major gas treatment and compression facilities, water treatment facilities, and construction/maintenance yards (if required) associated with Leewood and Bibblewindi sites. These areas will be subject to further review as part of the review and monitoring of performance, however likely to become a third landform and land use:

1) Commercial native forest.

Table 6.1 - Final landform and land use

Phase 1 - Project component	Relevant domain	Final landform and use
Proposed Dewhurst 34 (core)	Domain 1	Native ecosystem
Proposed Dewhurst 35 (core)	Domain 1 and 4	Agricultural land
Proposed Dewhurst 37 (appraisal well)	Domain 1	Native ecosystem
Proposed Dewhurst 42 (appraisal well)	Domain 1 and 4	Agricultural land
Proposed Dewhurst 40 (appraisal well)	Domain 1	Native ecosystem
Proposed Dewhurst 41 (appraisal well)	Domain 1 and 4	Agricultural land
Proposed Dewhurst 38 (appraisal well)	Domain 1	Native ecosystem
Proposed Dewhurst 39 (appraisal well)	Domain 1	Native ecosystem
Proposed Bibblewindi 31 (core)	Domain 1	Commercial native forest
Proposed Bibblewindi 30 (core)	Domain 1	Commercial native forest
Leewood facility	Domain 3 and 4	Agricultural land
Bibblwindi facility	Domain 3	Commercial native forest
Bibblewindi to Leewood buried gas pipeline	Domain 2	Commercial native forest
Tintsfield Pilot;	Domain 1 and 4	Agricultural land
Bibblewindi East Pilot;	Domain 1	Commercial native forest
Bibblewindi West Pilot;	Domain 1	Commercial native forest
Dewhurst North Pilot;	Domain 1	Commercial native forest

7. Rehabilitation objectives

7.1 Development consent SSD 6456

SSD 6456 provides a set of rehabilitation objectives for the Project, within CoC B81, Table 11. These rehabilitation objectives have been used in section 8 of this RMP to focus rehabilitation completion criteria and monitoring activities. These objectives have been presented previously, in Table 1.1 in section 1.3.

7.2 NGP Rehabilitation Strategy

Additionally, the rehabilitation objectives provided by the NGP Rehabilitation Strategy in the EIS have been incorporated into this document given that they formed part of the overall approval for the Project. These objectives are listed below.

- to ensure topsoil and subsoil is managed to conserve the seed bank, nutrients and to encourage the establishment of vegetation.
- disturbed areas are to be rehabilitated to their pre-production condition. Forested land will be rehabilitated to its former vegetation community and agricultural land will be rehabilitated to meet the former agricultural class.
- ensuring rehabilitation works comply with relevant regulatory requirements.
- establishment of a set of indicators and a rehabilitation monitoring program to ensure successful rehabilitation.
- establishment of agreed criteria where rehabilitation is deemed successful by relevant authorities and stakeholders.

8. Rehabilitation phases

Rehabilitation will be undertaken across a number of phases (refer to Table 8.1), each with objectives and completion criteria relevant to the phase of the rehabilitation. A domain is considered to have reached a rehabilitation completion once all the required completion criteria have been met for all areas of that domain.

Table 8.1 - Rehabilitation phases

Phase	Description
1	Active Project – Activities undertaken prior to, during and after operations to enhance rehabilitation, such as salvaging and managing soil resources, salvaging habitat resources, and native seed collection.
2	Decommissioning – removing infrastructure, hardstands, plant, equipment, and other structures and all contaminated and hazardous materials. Includes works to make safe or fit for purpose any retained infrastructure.
3	Landform and Land Use Establishment – the process of forming the final landform including the process of establishing the final land use following the construction of the final landform. This phase includes all earthworks required to construct the final landform into the desired surface profile. It includes preparing a substrate with the desired physical and chemical characteristics for vegetated areas. This will consist of seeding, planting and transplanting plant species. It incorporates management actions such as weed and feral pest control to achieve species establishment and habitat augmentation.
4	Land Use Sustainability – ongoing establishment of land uses and ecosystems within rehabilitated areas. This phase generally includes ongoing monitoring of rehabilitated areas, and implementation of remedial actions identified during monitoring or site inspections to ensure that the rehabilitation areas continue to progress towards achievement of rehabilitation completion criteria.
5	Rehabilitation Completion - completion criteria for rehabilitation are met and the land is determined to be suitable for the intended final land use and the rehabilitated areas can be handed back over to the final land user.

9. Rehabilitation completion criteria

9.1 Completion criteria

Completion criteria provide targets or values assigned to a variety of performance indicators (i.e. slope, species diversity, groundcover etc.), which can be measured against to demonstrate the progress and ultimate success of rehabilitation. As such, they provide a defined criterion which can be used to confirm that rehabilitation has been successful. Completion criteria have been developed considering site specific risks and final land use objectives for each phase of rehabilitation so that the rehabilitation success can be quantitatively tracked throughout the life of the Project, refer Table 9.1.

The achievement (or otherwise) of the completion criteria will be monitored and reported within the annual reports to be submitted to relevant government agencies.

Performance indicators and completion criteria, which provide the framework for the RMP are underpinned by a range of documents that relate to land management, including industry standards and other Project management plans and procedures. The rehabilitation performance indicators and completion criteria will be reviewed and may be updated during the Annual Review and RMP revision process or as a result of monitoring to align with any changes to the Project or incorporate any recommended measures to improve the environmental performance of the Project.

Completion criteria for rehabilitation objectives associated with Phases 2 to 4 of the Project will be developed upon revision of the RMP prior to commencement of each Phase.

Due to the time periods required for vegetation to achieve a mature structure, monitoring of rehabilitation aims to demonstrate the rehabilitation is on a clear trajectory that will eventually result in the rehabilitation approaching the condition of surrounding lands not directly impacted by the Project. Achievement of completion criteria will demonstrate that rehabilitated areas can be relinquished from Santos' responsibility and returned to former land uses in a sustainable condition. Progressive relinquishment will be undertaken as each rehabilitation area achieves completion criteria.

Table 9.1 - Rehabilitation completion criteria

Rehabilitation domain	Final land use goal	Rehabilitation objectives	Completion criteria	Validation method	Activity in TARP
Domain 1	Native Ecosystem	All infrastructure not to be utilised as part of the future intended land use is to be decommissioned and removed, unless the Resources Regulator agrees otherwise	All surface infrastructure including water management, erosion and sediment control infrastructure have been removed	Site records and reports Survey reports and plans; Written approval for the retention of infrastructure from appropriate regulatory authority	NA
			All exploration plant, equipment and tools have been removed		NA
			Agreements are in place from the Resources Regulator for any surface infrastructure retained		NA
		Exploration infrastructure is to be progressively decommissioned and rehabilitated in accordance with: - the *Exploration Code of Practice: Rehabilitation* (2022, as may be updated or amended); and - the *Code of Practice: Construction, operation and decommissioning of petroleum* (2023, as may be updated or amended). Well cementing is to include sub-vertical and horizontal well sections, where reasonable and feasible	All drill holes, petroleum wells, excavations and boreholes have been decommissioned, sealed and rehabilitated in accordance with departmental guidelines.	Sealing records; Site records and reports	NA
			Well cementing has included sub-vertical and horizontal sections where reasonable and feasible		NA
			Statutory notification/reporting (as required) of any unsealed parts of any boreholes or petroleum wells, or any tools lost down boreholes/wells has been completed.		17
		All hazardous and contaminated materials (including carbonaceous materials) have been appropriately removed, remediated or managed.	Any contaminated areas have been identified and remediated to a standard which supports the intended final land use	Contamination assessment/report; Hazardous materials assessments; Certificates of disposal; Site records	NA
			All drill cores and cuttings have been removed from site and stored or disposed of appropriately		NA
			Hazardous materials have been identified and removed from site or appropriately managed		NA
			All rubbish and waste materials have been removed from site		NA
		Final landform is safe, stable and non-polluting and fit for the intended post-mining land use/s.	Landform survey verifies that the constructed final landform is safe and stable and is generally in accordance with the approved final landform design.	Final landform survey report/s; Visual inspections; Rehabilitation records	NA
			Rehabilitated areas are free draining except where specific water management structures have been constructed and to be retained with the final land use. Structures in place will not be undermined in the long term		3
			Final landform drainage structures including drains, banks, are constructed in accordance with Blue Book requirements.		NA
		Ensure public safety	Appropriate security measures have been implemented to minimise the potential for unauthorised access during the active operation, decommissioning and for the intended final land use	Site records and reports	NA
			Security measures used to minimise the risk of injury to people and/or animals does not compromise rehabilitation outcomes.		NA
		Bushfire controls have been implemented to mitigate risks to the public and to rehabilitation	Appropriate bushfire hazard controls have been implemented in accordance with the FMP and any advice from relevant authorities	Rehabilitation monitoring records	15
		Aboriginal cultural heritage sites have been identified and protected or salvaged	Aboriginal cultural heritage sites remain demarcated / protected or salvaged in accordance with the ACHMP	Site records and reports	19
		Erosion does not present a safety hazard or compromise the post project land capability or landform stability	Erosion and sediment control measures have been implemented (if necessary) in accordance with the ESCP	Visual inspections; Site records and reports; Rehabilitation records;	NA
			There are no active erosion features (greater than 200mm depth or width) or visible sedimentation issues that compromise land capability or the intended final land use		2

Rehabilitation domain	Final land use goal	Rehabilitation objectives	Completion criteria	Validation method	Activity in TARP
		Water retained in the project area is fit for the intended post-mining land use/s; and Water discharged from the development is suitable for receiving waters and fit for aquatic ecology and riparian vegetation	The quality and quantity of water used within the project area conforms to the performance criteria established in the WMP	Ongoing water monitoring program and reporting, which will be defined in the WMP	4
			The quality, quantity and release conditions of water discharged offsite conforms to the performance criteria established in the WMP		4
		The impact of the project on flora and fauna is minimised	Prior to clearance of vegetation, pre-clearance surveys have been undertaken in accordance with the pre-clearance survey process detailed in the BMP.	Pre-clearance records; Visual inspections; Rehabilitation records	NA
			Prior to clearing taking place, flora and fauna that have the potential to be disturbed as a result of clearing activities have been identified, and where possible relocated as detailed in the BMP.		NA
			Prior to any disturbance, the limits of clearing have been marked either by high visibility tape on trees or metal/wooden pickets, fencing or an equivalent boundary marker.		NA
			Disturbance has been restricted to the delineated area and no stockpiling of equipment, machinery, soil or vegetation has occurred beyond this boundary.		NA
		Materials from areas disturbed (including topsoils, substrates and seeds) are to be recovered, managed and used as rehabilitation resources, to the greatest extent practicable.	Habitat features such as rocks, logs and small stumps have been recovered during vegetation clearance activities, salvaged and stockpiled and used for final rehabilitation to the greatest extent possible.	Pre-clearance records; Site records and reports; Topsoil inventory; Rehabilitation monitoring records	NA
			Topsoils and subsoils stripped during the construction of infrastructure have been stockpiled, managed, and used for final rehabilitation to the greatest extent possible		13,14
			Seed has been collected from the local area for a diversity of species. Seed has been dried, sorted and refrigerated in accordance with Appendix F of the BMP.		NA
			Seeds collected from native vegetation have been used in final rehabilitation to the greatest extent possible		NA
		Progressive rehabilitation has been undertaken	Disturbed areas no longer required for mining-related operations have been rehabilitated as soon as practicable to ensure that the total area of disturbance is minimised.	Site records and reports	NA
		Each plant community type, establish self-sustaining native woodland ecosystems that meet the performance and completion criteria approved under the Rehabilitation Management Plan; and For each threatened flora species, establish a self-sustaining population that meets the performance and completion criteria approved under the Rehabilitation Management Plan; and For each threatened fauna species, establish self-sustaining habitat that meets the performance and completion criteria approved under the Rehabilitation Management Plan.	Topsoil and subsoil have been reinstated to the depth for the proposed final land use	Rehabilitation records; Soil balance	NA
			Soil profile development has occurred in rehabilitated areas (e.g. development of organic layer, litter layer)		NA
			Where required, appropriate soil ameliorants (e.g. gypsum, fertilisers, mulch) have been applied at the recommended rate per hectare based on soil analysis.		NA
			Native plant species richness in rehabilitated areas is comparable to reference sites.	Planting/seeding records; Rehabilitation monitoring records and reports; Biodiversity monitoring reports	7
			Groundcover diversity is restored to within 75% of reference condition in rehabilitated areas		7
			Canopy cover, midstory cover and groundcover is comparable to reference sites		6
			There are no significant weed infestations and weed presence is no greater in rehabilitated areas than at reference sites		10
			Feral and pest animal species are controlled in accordance with relevant legislation and the Pest Plan		11
			Monitoring verifies evidence of natural regeneration in the long term		NA
			Monitoring verifies that litter coverage increases.		NA
			Monitoring verifies that the number of trees with hollows that are visible from the ground increases to at least 50% of local reference site average in the long term		NA
			Monitoring verifies the length of fallen logs over 10 cm in diameter increases to at least 50% of local reference site average in the long term		NA

Rehabilitation domain	Final land use goal	Rehabilitation objectives	Completion criteria	Validation method	Activity in TARP
			There is representation of a range of species characteristics from each faunal assemblage group (e.g. reptiles, birds, mammals), present in the ecosystem type, based on pre-Project fauna lists and sighted within the three-year period		NA
					NA
		Restore native woodland ecosystems using species found in the local area and complement the areas proposed for ecological rehabilitation. Establish areas of self-sustaining: riparian vegetation, within any diverted and/or re-established creek lines and retained water features habitat resources for threatened flora and fauna species Vegetation connectivity and wildlife corridors, as far as is reasonable and feasible.	Revegetated native species mix in rehabilitated areas is representative of analogue sites	Planting/seeding records; Rehabilitation monitoring records and reports; Biodiversity monitoring reports	7
			There are no significant weed infestations and weed presence is no greater in rehabilitated areas than at analogue sites		10
			Seeds collected from the local area or appropriate species for planting have been used in final rehabilitation if assisted revegetation is required		NA
			Riparian revegetation species diversity and cover on a trajectory towards reference sites.		NA
			Habitat features for threatened flora and fauna present in locations identified to be re-established in accordance with advice from a suitably qualified ecologist.		NA
			Fauna habitat complexity increases and on a trajectory towards reference sites, leading to return and survival of established species.		NA
			Rehabilitation reconnects habitat where it has been fragmented by the Project		NA
Domain 2	Native Ecosystem	All infrastructure not to be utilised as part of the future intended land use is to be decommissioned and removed, unless the Resources Regulator agrees otherwise	All services including power, water, data and telephone communication connected on site have been isolated, disconnected, terminated and removed, where possible	Site records and reports Survey reports and plans; Written approval for the retention of infrastructure from appropriate regulatory authority	NA
			All surface infrastructure including water management, erosion and sediment control infrastructure have been removed		NA
			Agreements are in place from the Resources Regulator for any surface infrastructure retained		NA
		Any infrastructure to remain as part of the future intended land use is decommissioned and made safe and is not a hazard to the public.	The location of service infrastructure left in situ has been surveyed and marked on the record tracings and a suitable caveat developed to provide that they are readily identifiable for future land holders	Site records and reports; Survey reports and plans; Engineering report	NA
			Potential hazards from retained infrastructure (i.e. electrical, mechanical etc.) have been identified and effectively isolated		NA
		All hazardous and contaminated materials (including carbonaceous materials) have been appropriately removed, remediated or managed.	Any contaminated areas have been identified and remediated to a standard which supports the intended final land use	Contamination assessment/report; Hazardous materials assessments; Certificates of disposal; Site records	NA
			Hazardous materials have been identified and removed from site or appropriately managed		NA
			All rubbish and waste materials have been removed from site		NA
		Final landform is safe, stable and non-polluting and fit for the intended post-mining land use/s.	Landform survey verifies that the constructed final landform is safe and stable and is generally in accordance with the approved final landform design.	Final landform survey report/s; Visual inspections; Rehabilitation records	NA
			Rehabilitated areas are free draining except where specific water management structures have been constructed and to be retained with the final land use. Structures in place will not be undermined in the long term		3
			Final landform drainage structures including drains, banks, are constructed in accordance with Blue Book requirements.		NA
		Ensure public safety	Appropriate security measures have been implemented to minimise the potential for unauthorised access during the active operation, decommissioning and for the intended final land use	Site records and reports	NA
			Security measures used to minimise the risk of injury to people and/or animals does not compromise rehabilitation outcomes.		NA
		Bushfire controls have been implemented to mitigate risks to the public and to rehabilitation	Appropriate bushfire hazard controls have been implemented in accordance with the FMP and any advice from relevant authorities	Rehabilitation monitoring records	15

Rehabilitation domain	Final land use goal	Rehabilitation objectives	Completion criteria	Validation method	Activity in TARP
		Aboriginal cultural heritage sites have been identified and protected or salvaged	Aboriginal cultural heritage sites remain demarcated / protected or salvaged in accordance with the ACHMP	Site records and reports	19
		Erosion does not present a safety hazard or compromise the post project land capability or landform stability	Erosion and sediment control measures have been implemented (if necessary) in accordance with the ESCP	Visual inspections; Site records and reports; Rehabilitation records;	NA
			There are no active erosion features (greater than 200mm depth or width) or visible sedimentation issues that compromise land capability or the intended final land use		2
		Water retained in the project area is fit for the intended post-mining land use/s; and Water discharged from the development is suitable for receiving waters and fit for aquatic ecology and riparian vegetation	The quality and quantity of water used within the project area conforms to the performance criteria established in the WMP	Ongoing water monitoring program and reporting, which will be defined in the WMP	4
			The quality, quantity and release conditions of water discharged offsite conforms to the performance criteria established in the WMP		4
		The impact of the project on flora and fauna is minimised	Prior to clearance of vegetation, pre-clearance surveys have been undertaken in accordance with the pre-clearance survey process detailed in the BMP.	Pre-clearance records; Visual inspections; Rehabilitation records	NA
			Prior to clearing taking place, flora and fauna that have the potential to be disturbed as a result of clearing activities have been identified, and where possible relocated as detailed in the BMP.		NA
			Prior to any disturbance, the limits of clearing have been marked either by high visibility tape on trees or metal/wooden pickets, fencing or an equivalent boundary marker.		NA
			Disturbance has been restricted to the delineated area and no stockpiling of equipment, machinery, soil or vegetation has occurred beyond this boundary.		NA
		Materials from areas disturbed (including topsoils, substrates and seeds) are to be recovered, managed and used as rehabilitation resources, to the greatest extent practicable.	Habitat features such as rocks, logs and small stumps have been recovered during vegetation clearance activities, salvaged and stockpiled and used for final rehabilitation to the greatest extent possible.	Pre-clearance records; Site records and reports; Topsoil inventory; Rehabilitation monitoring records	NA
			Topsoils and subsoils stripped during the construction of infrastructure have been stockpiled, managed, and used for final rehabilitation to the greatest extent possible		13,14
			Seed has been collected from the local area for a diversity of species. Seed has been dried, sorted and refrigerated in accordance with Appendix F of the BMP.		NA
			Seeds collected from native vegetation have been used in final rehabilitation to the greatest extent possible		NA
		Progressive rehabilitation has been undertaken	Disturbed areas no longer required for mining-related operations have been rehabilitated as soon as practicable to ensure that the total area of disturbance is minimised.	Site records and reports	NA
		Each plant community type, establish self-sustaining native woodland ecosystems that meet the performance and completion criteria approved under the Rehabilitation Management Plan; and	Topsoil and subsoil has been reinstated to the depth for the proposed final land use	Rehabilitation records; Soil balance	NA
			Soil profile development has occurred in rehabilitated areas (e.g. development of organic layer, litter layer)		NA
			Where required, appropriate soil ameliorants (e.g. gypsum, fertilisers, mulch) have been applied at the recommended rate per hectare based on soil analysis.		NA
		For each threatened flora species, establish a self-sustaining population that meets the performance and completion criteria approved under the Rehabilitation Management Plan; and	Native plant species richness in rehabilitated areas approximates 75% of that in reference sites.	Planting/seeding records; Rehabilitation monitoring records and reports; Biodiversity monitoring reports	7
			Groundcover diversity is restored to within 75% of reference condition in rehabilitated areas		7
		For each threatened fauna species, establish self-sustaining habitat that meets the performance and completion criteria approved under the Rehabilitation Management Plan.	Canopy cover, midstory cover and groundcover is comparable to reference sites.		7
			There are no significant weed infestations and weed presence is no greater in rehabilitated areas than at reference sites		10
			Feral and pest animal species are controlled in accordance with relevant legislation and the Pest Plan		11

Rehabilitation domain	Final land use goal	Rehabilitation objectives	Completion criteria	Validation method	Activity in TARP
			Monitoring verifies evidence of natural regeneration in the long term		NA
			Monitoring verifies that litter coverage increases.		NA
			Monitoring verifies that the number of trees with hollows that are visible from the ground increases to at least 50% of local reference site average in the long term		NA
			Monitoring verifies the length of fallen logs over 10 cm in diameter increases to at least 50% of local reference site average in the long term		NA
			There is representation of a range of species characteristics from each faunal assemblage group (e.g. reptiles, birds, mammals), present in the ecosystem type, based on pre-Project fauna lists and sighted within the three-year period		NA
			Achievement of target prior to elapsing of period to be assessed as development against the target trajectory (as determined through consultation with the Resource Regulator)		NA
		Restore self-sustaining native woodland ecosystems using species found in the local area and complement the areas proposed for ecological rehabilitation. Establish areas of self-sustaining: riparian vegetation, within any diverted and/or re-established creek lines and retained water features habitat resources for threatened flora and fauna species Vegetation connectivity and wildlife corridors, as far as is reasonable and feasible.	Revegetated native species mix in rehabilitated areas is representative of analogue sites	Planting/seeding records; Rehabilitation monitoring records and reports; Biodiversity monitoring reports	7
			There are no significant weed infestations and weed presence is no greater in rehabilitated areas than at analogue sites		10
			Seeds collected from the local area or appropriate species for planting have been used in final rehabilitation if assisted revegetation is required		NA
			Riparian revegetation species diversity and cover on a trajectory towards reference sites.		NA
			Habitat features for threatened flora and fauna present in locations previously identified is re-established in accordance with advice from a suitably qualified ecologist.		NA
			Fauna habitat complexity increases and on a trajectory towards reference sites, leading to return and survival of established species.		NA
			Rehabilitation reconnects habitat where it has been fragmented by the Project		NA
Domain 3	Native Ecosystem	All infrastructure not to be utilised as part of the future intended land use is to be decommissioned and removed, unless the Resources Regulator agrees otherwise	All services including power, water, data and telephone communication connected on site have been isolated, disconnected, terminated and removed, where possible	Site records and reports Survey reports and plans; Demolition records; Written approval for the retention of infrastructure from appropriate regulatory authority	NA
			All surface infrastructure including water management, erosion and sediment control infrastructure have been removed		NA
			All exploration plant, equipment and tools have been removed		NA
			All demolition work has been carried out in accordance with *AS2601-2001: The Demolition of Structures* or its latest version.		NA
			Agreements are in place from the Resources Regulator for any surface infrastructure retained		NA
		Any infrastructure to remain as part of the future intended land use is decommissioned and made safe and is not a hazard to the public.	The location of service infrastructure left in situ has been surveyed and marked on the record tracings and a suitable caveat developed to provide that they are readily identifiable for future land holders	Site records and reports; Survey reports and plans; Engineering report	NA
			Potential hazards from retained infrastructure (i.e. electrical, mechanical etc.) have been identified and effectively isolated		NA
			The structural integrity of retained infrastructure has been inspected by a suitably qualified engineer and determined to be suitable and safe as part of the intended final land use.		NA
		Exploration infrastructure is to be progressively decommissioned and rehabilitated in accordance with: - the *Exploration Code of Practice: Rehabilitation* (2022, as may be updated or amended); and - the *Code of Practice: Construction, operation and*	All drill holes, petroleum wells, excavations and boreholes have been decommissioned, sealed and rehabilitated in accordance with departmental guidelines.	Sealing records; Site records and reports	NA
			Well cementing has included sub-vertical and horizontal sections where reasonable and feasible		NA
			Statutory notification/reporting (as required) of any unsealed parts of any boreholes or		17

Rehabilitation domain	Final land use goal	Rehabilitation objectives	Completion criteria	Validation method	Activity in TARP
		decommissioning of petroleum (2023, as may be updated or amended). Well cementing is to include sub-vertical and horizontal well sections, where reasonable and feasible	petroleum wells, or any tools lost down boreholes/wells has been completed.		
		All hazardous and contaminated materials (including carbonaceous materials) have been appropriately removed, remediated or managed.	Any contaminated areas have been identified and remediated to a standard which supports the intended final land use	Contamination assessment/report; Hazardous materials assessments; Certificates of disposal; Site records	NA
			All drill cores and cuttings have been removed from site and stored or disposed of appropriately		NA
			Hazardous materials have been identified and removed from site or appropriately managed		NA
			All rubbish and waste materials have been removed from site		NA
		Final landform is safe, stable and non-polluting and fit for the intended post-mining land use/s.	Landform survey verifies that the constructed final landform is safe and stable and is generally in accordance with the approved final landform design.	Final landform survey report/s; Visual inspections; Rehabilitation records	NA
			Rehabilitated areas are free draining except where specific water management structures have been constructed and to be retained with the final land use. Structures in place will not be undermined in the long term		3
			Final landform drainage structures including drains, banks, are constructed in accordance with Blue Book requirements.		NA
		Ensure public safety	Appropriate security measures have been implemented to minimise the potential for unauthorised access during the active operation, decommissioning and for the intended final land use	Site records and reports	NA
			Security measures used to minimise the risk of injury to people and/or animals does not compromise rehabilitation outcomes.		NA
		Bushfire controls have been implemented to mitigate risks to the public and to rehabilitation	Appropriate bushfire hazard controls have been implemented in accordance with the FMP and any advice from relevant authorities	Rehabilitation monitoring records	15
		Aboriginal cultural heritage sites have been identified and protected or salvaged	Aboriginal cultural heritage sites remain demarcated / protected or salvaged in accordance with the ACHMP	Site records and reports	19
		Erosion does not present a safety hazard or compromise the post project land capability or landform stability	Erosion and sediment control measures have been implemented (if necessary) in accordance with the ESCP	Visual inspections; Site records and reports; Rehabilitation records;	NA
			There are no active erosion features (greater than 200mm depth or width) or visible sedimentation issues that compromise land capability or the intended final land use		2
		Water retained in the project area is fit for the intended post-mining land use/s; and Water discharged from the development is suitable for receiving waters and fit for aquatic ecology and riparian vegetation	The quality and quantity of water used within the project area conforms to the performance criteria established in the WMP	Ongoing water monitoring program and reporting, which will be defined in the WMP Water monitoring results	4
			The quality, quantity and release conditions of water discharged offsite conforms to the performance criteria established in the WMP		
		The impact of the project on flora and fauna is minimised	Prior to clearance of vegetation, pre-clearance surveys have been undertaken in accordance with the pre-clearance survey process detailed in the BMP.	Pre-clearance records; Visual inspections; Rehabilitation records	NA
			Prior to clearing taking place, flora and fauna that have the potential to be disturbed as a result of clearing activities have been identified, and where possible relocated as detailed in the BMP.		
			Prior to any disturbance, the limits of clearing have been marked either by high visibility tape on trees or metal/wooden pickets, fencing or an equivalent boundary marker.		
			Disturbance has been restricted to the delineated area and no stockpiling of equipment, machinery, soil or vegetation has occurred beyond this boundary.		

Rehabilitation domain	Final land use goal	Rehabilitation objectives	Completion criteria	Validation method	Activity in TARP
		Materials from areas disturbed (including topsoils, substrates and seeds) are to be recovered, managed and used as rehabilitation resources, to the greatest extent practicable.	Habitat features such as rocks, logs and small stumps have been recovered during vegetation clearance activities, salvaged and stockpiled and used for final rehabilitation to the greatest extent possible.	Pre-clearance records; Site records and reports; Topsoil inventory; Rehabilitation monitoring records	NA
			Topsoils and subsoils stripped during the construction of infrastructure have been stockpiled, managed, and used for final rehabilitation to the greatest extent possible		13,14
			Seed has been collected from the local area for a diversity of species. Seed has been dried, sorted and refrigerated in accordance with Appendix F of the BMP.		NA
			Seeds collected from native vegetation have been used in final rehabilitation to the greatest extent possible		NA
		Progressive rehabilitation has been undertaken	Disturbed areas no longer required for mining-related operations have been rehabilitated as soon as practicable to ensure that the total area of disturbance is minimised.	Site records and reports	NA
		Each plant community type, establish self-sustaining native woodland ecosystems that meet the performance and completion criteria approved under the Rehabilitation Management Plan; and For each threatened flora species, establish a self-sustaining population that meets the performance and completion criteria approved under the Rehabilitation Management Plan; and For each threatened fauna species, establish self-sustaining habitat that meets the performance and completion criteria approved under the Rehabilitation Management Plan.	Topsoil and subsoil has been reinstated to the depth for the proposed final land use	Rehabilitation records; Soil balance	NA
			Soil profile development has occurred in rehabilitated areas (e.g. development of organic layer, litter layer)		NA
			Where required, appropriate soil ameliorants (e.g. gypsum, fertilisers, mulch) have been applied at the recommended rate per hectare based on soil analysis.		NA
			Native plant species richness in rehabilitated areas approximates 75% of that in reference sites.	Planting/seeding records; Rehabilitation monitoring records and reports; Biodiversity monitoring reports	7
			Groundcover diversity is restored to within 75% of reference condition in rehabilitated areas		7
			Canopy cover, midstory cover and groundcover is comparable to reference sites		7
			There are no significant weed infestations and weed presence is no greater in rehabilitated areas than at reference sites		10
			Feral and pest animal species are controlled in accordance with relevant legislation and the Pest Plan		11
			Monitoring verifies evidence of natural regeneration in the long term		NA
			Monitoring verifies that litter coverage increases.		NA
			Monitoring verifies that the number of trees with hollows that are visible from the ground increases to at least 50% of local reference site average in the long term		NA
			Monitoring verifies the length of fallen logs over 10 cm in diameter increases to at least 50% of local reference site average in the long term		NA
			There is representation of a range of species characteristics from each faunal assemblage group (e.g. reptiles, birds, mammals), present in the ecosystem type, based on pre-Project fauna lists and sighted within the three-year period		NA
			Achievement of target prior to elapsing of period to be assessed as development against the target trajectory (as determined through consultation with the Resource Regulator)		NA
		Restore self-sustaining native woodland ecosystems using species found in the local area and complement the areas proposed for ecological rehabilitation. Establish areas of self-sustaining: riparian vegetation, within any diverted and/or re-established creek lines and retained water features habitat resources for threatened flora and fauna species	Revegetated native species mix in rehabilitated areas is representative of analogue sites	Planting/seeding records; Rehabilitation monitoring records and reports; Biodiversity monitoring reports	7
			There are no significant weed infestations and weed presence is no greater in rehabilitated areas than at analogue sites		10
			Seeds collected from the local area or appropriate species for planting have been used in final rehabilitation if assisted revegetation is required		NA
			Riparian revegetation species diversity and cover on a trajectory towards reference sites.		
			Habitat features for threatened flora and fauna present in locations previously identified are re-established in accordance with advice from a suitably qualified ecologist.		

Rehabilitation domain	Final land use goal	Rehabilitation objectives	Completion criteria	Validation method	Activity in TARP
		Vegetation connectivity and wildlife corridors, as far as is reasonable and feasible.	Fauna habitat complexity increases and on a trajectory towards reference sites, leading to return and survival of established species.		
			Rehabilitation reconnects habitat where it has been fragmented by the Project		
Domain 4	Agricultural Land	All infrastructure not to be utilised as part of the future intended land use is to be decommissioned and removed, unless the Resources Regulator agrees otherwise	All services including power, water, data and telephone communication connected on site have been isolated, disconnected, terminated and removed, where possible	Site records and reports Survey reports and plans; Demolition records; Written approval for the retention of infrastructure from appropriate regulatory authority	NA
			All surface infrastructure including water management, erosion and sediment control infrastructure have been removed		NA
			All exploration plant, equipment and tools have been removed		NA
			All demolition work has been carried out in accordance with *AS2601-2001: The Demolition of Structures* or its latest version.		NA
			Agreements are in place from the Resources Regulator for any surface infrastructure retained		NA
		Any infrastructure to remain as part of the future intended land use is decommissioned and made safe and is not a hazard to the public.	The location of service infrastructure left in situ has been surveyed and marked on the record tracings and a suitable caveat developed to provide that they are readily identifiable for future land holders	Site records and reports; Survey reports and plans; Engineering report	NA
			Potential hazards from retained infrastructure (i.e. electrical, mechanical etc.) have been identified and effectively isolated		NA
			The structural integrity of retained infrastructure has been inspected by a suitably qualified engineer and determined to be suitable and safe as part of the intended final land use.		NA
		Exploration infrastructure is to be progressively decommissioned and rehabilitated in accordance with: - the *Exploration Code of Practice: Rehabilitation* (2022, as may be updated or amended); and - the *Code of Practice: Construction, operation and decommissioning of petroleum* (2023, as may be updated or amended). Well cementing is to include sub-vertical and horizontal well sections, where reasonable and feasible	All drill holes, petroleum wells, excavations and boreholes have been decommissioned, sealed and rehabilitated in accordance with departmental guidelines.	Sealing records; Site records and reports	NA
			Well cementing has included sub-vertical and horizontal sections where reasonable and feasible		NA
			Statutory notification/reporting (as required) of any unsealed parts of any boreholes or petroleum wells, or any tools lost down boreholes/wells has been completed.		17
		All hazardous and contaminated materials (including carbonaceous materials) have been appropriately removed, remediated or managed.	Any contaminated areas have been identified and remediated to a standard which supports the intended final land use	Contamination assessment/report; Hazardous materials assessments; Certificates of disposal; Site records	NA
			All drill cores and cuttings have been removed from site and stored or disposed of appropriately		
			Hazardous materials have been identified and removed from site or appropriately managed		
			All rubbish and waste materials have been removed from site		
		Final landform is safe, stable and non-polluting and fit for the intended post-mining land use/s.	Landform survey verifies that the constructed final landform is safe and stable and is generally in accordance with the approved final landform design.	Final landform survey report/s; Visual inspections; Rehabilitation records	NA
			Rehabilitated areas are free draining except where specific water management structures have been constructed and to be retained with the final land use. Structures in place will not be undermined in the long term		3
			Final landform drainage structures including drains, banks, are constructed in accordance with Blue Book requirements.		NA
		Ensure public safety	Appropriate security measures have been implemented to minimise the potential for unauthorised access during the active operation, decommissioning and for the intended	Site records and reports	NA

Rehabilitation domain	Final land use goal	Rehabilitation objectives	Completion criteria	Validation method	Activity in TARP
			final land use		
			Security measures used to minimise the risk of injury to people and/or animals does not compromise rehabilitation outcomes.		NA
		Bushfire controls have been implemented to mitigate risks to the public and to rehabilitation	Appropriate bushfire hazard controls have been implemented in accordance with the FMP and any advice from relevant authorities	Rehabilitation monitoring records	15
		Aboriginal cultural heritage sites have been identified and protected or salvaged	Aboriginal cultural heritage sites remain demarcated / protected or salvaged in accordance with the ACHMP	Site records and reports	19
		Erosion does not present a safety hazard or compromise the post project land capability or landform stability	Erosion and sediment control measures have been implemented (if necessary) in accordance with the ESCP	Visual inspections; Site records and reports; Rehabilitation records;	NA
			There are no active erosion features (greater than 200mm depth or width) or visible sedimentation issues that compromise land capability or the intended final land use		2
		Water retained in the project area is fit for the intended post-mining land use/s; and Water discharged from the development is suitable for receiving waters and fit for aquatic ecology and riparian vegetation	The quality and quantity of water used within the project area conforms to the performance criteria established in the WMP	Ongoing water monitoring program and reporting, which will be defined in the WMP	4
			The quality, quantity and release conditions of water discharged offsite conforms to the performance criteria established in the WMP		
		The impact of the project on flora and fauna is minimised	Prior to clearance of vegetation, pre-clearance surveys have been undertaken in accordance with the pre-clearance survey process detailed in the BMP.	Pre-clearance records; Visual inspections; Rehabilitation records	NA
			Prior to clearing taking place, flora and fauna that have the potential to be disturbed as a result of clearing activities have been identified, and where possible relocated as detailed in the BMP.		NA
			Prior to any disturbance, the limits of clearing have been marked either by high visibility tape on trees or metal/wooden pickets, fencing or an equivalent boundary marker.		NA
			Disturbance has been restricted to the delineated area and no stockpiling of equipment, machinery, soil or vegetation has occurred beyond this boundary.		NA
		Materials from areas disturbed (including topsoils, substrates and seeds) are to be recovered, managed and used as rehabilitation resources, to the greatest extent practicable.	Habitat features such as rocks, logs and small stumps have been recovered during vegetation clearance activities, salvaged and stockpiled and used for final rehabilitation to the greatest extent possible.	Pre-clearance records; Site records and reports; Topsoil inventory; Rehabilitation monitoring records	NA
			Topsoils and subsoils stripped during the construction of infrastructure have been stockpiled, managed, and used for final rehabilitation to the greatest extent possible		13,14
			Seed has been collected from the local area for a diversity of species. Seed has been dried, sorted and refrigerated in accordance with Appendix F of the BMP.		NA
			Seeds collected from native vegetation have been used in final rehabilitation to the greatest extent possible		NA
		Progressive rehabilitation has been undertaken	Disturbed areas no longer required for mining-related operations have been rehabilitated as soon as practicable to ensure that the total area of disturbance is minimised.	Site records and reports	NA
		Establish/restore agricultural areas to support sustainable agricultural activities	Topsoil and subsoil have been reinstated to the required depth of the proposed final land use in rehabilitated areas	Planting/seeding records; Rehabilitation monitoring records and reports; Biodiversity monitoring reports	NA
			If required, appropriate soil ameliorants (e.g. gypsum, fertilisers, mulch) have been applied at the recommended rate per hectare based on soil analysis		NA
			Soil profile development has occurred in rehabilitated areas (e.g. development of organic layer, litter layer)		NA
			Pasture species mix establishment in rehabilitated areas is representative of analogue sites		9
			Approved pasture species mix is sown at the specified rate per hectare as specified in		NA

Rehabilitation domain	Final land use goal	Rehabilitation objectives	Completion criteria	Validation method	Activity in TARP
			Appendix D of this RMP.		
			Vegetative cover in rehabilitated areas is representative of analogue sites.		8
			There are no bare patches of ground in rehabilitated areas		5
			There are no significant weed infestations and weed presence is no greater in rehabilitated areas than at analogue sites		10
			Feral and pest animal species are controlled in accordance with relevant legislation and the Pest Plan		11
		No reduction in land and soil capability (LSC) class	Soil survey and land capability assessment undertaken in accordance with relevant guidelines and Australian Standards verifies that post disturbance land meets the nominated land capability classes	Soil survey and land capability assessment	NA

10. Rehabilitation methods

Santos has undertaken extensive rehabilitation activities at its existing operations, which has provided a thorough understanding of successful rehabilitation methods in the Project area. This section describes Santos' approach to rehabilitation from predevelopment through to final rehabilitation for Phase 1 activities and major facilities at Bibblewindi and Leewood, taking into consideration relevant conditions, rehabilitation guidelines and existing rehabilitation experience in the Project area.

10.1 General measures

10.1.1 Prior to disturbance

A number of avoidance and mitigation measures have been included in the design of the Project to minimise potential disturbance and impacts. These include:

- minimising surface disturbance using a stacked lateral well design and multiple wells on a well pad;
- maximising the use of previously cleared areas for seismic survey;
- centralising much of the major fixed facilities at the Leewood site outside of the Pilliga forest to minimise vegetation clearing;
- co-locating linear infrastructure such as gas and water gathering systems and access tracks with existing roads, access tracks and disturbance corridors, and placing major facilities in previously cleared areas, where practicable. Further micro-alignment may be undertaken to minimise impacts on known ecological constraints such as threatened species and hollow-bearing trees, where practicable.
- implementing the Field Development Protocol for siting Project infrastructure. The Protocol ensures that the planning, design and construction phases of the field infrastructure are undertaken in accordance with approval conditions;
- preparing and implementing in-field micro-siting to identify the most suitable areas for proposed field infrastructure to be positioned in order to maximise avoidance of sensitive biodiversity values (refer Figure 10.1);
- a clearing procedure to further reduce the Project's impact on flora and fauna, including threatened and migratory species, populations and ecological communities;
- progressive partial rehabilitation of cleared areas;
- implementation of a Pest Plant and Animal Control Protocol, provided as Attachment 3 to the BMP; and
- documentation and analysis of pre-disturbance conditions including PCTs and existing landform to inform rehabilitation re-shaping of natural ground surface.

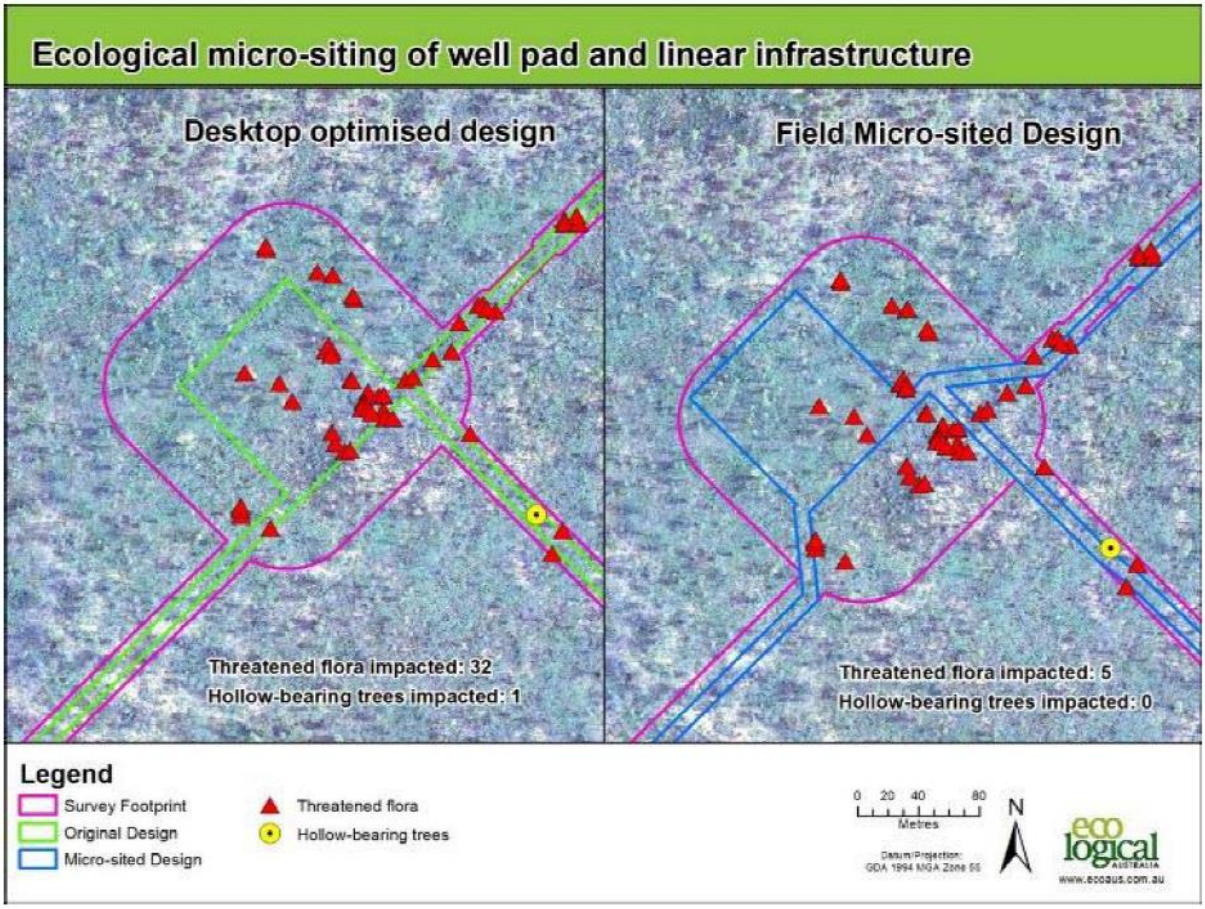

Figure 10.1 - Example of ecological micro-siting to minimise impacts to threatened species.

10.1.2 During disturbance

The following actions will be undertaken during ground disturbance works:

- slashing/mulching of vegetation;
- scalping and storage of topsoil/subsoil or use of protective mats to minimise topsoil compaction;
- management of topsoil following procedures described in Appendix C; and
- salvage and storage of materials including logs and hollows.

10.1.3 Post disturbance

The following actions will be undertaken following ground disturbance works and during operations:

- management of soils and woody materials following procedures described in Appendix C;
- application to land of rock-based drill cuttings, generally referred to as residual drilling materials (**RDM**), approved under EPL 20350 condition L3.4 and in accordance with the protocols and procedures for testing and management as presented in Appendix F;
- respread of soils where the disturbance area is no longer required for operational purposes (e.g. partial rehabilitation of well pads following commissioning);
- respread of salvaged materials;

- monitoring of partial rehabilitation and stored soils; and
- management of remaining soil until required for final rehabilitation, including interim stabilisation and temporary revegetation.

The coordinates of any areas of State forest where RDM has been incorporated into the ground surface will be provided to FCNSW.

10.1.4 Final rehabilitation

The following actions will be undertaken as final rehabilitation activities:

- installation and maintenance of sediment and erosion control devices appropriate to the site;
- temporary retention of perimeter fencing where need determined to exclude herbivores;
- removal of all infrastructure including fencing when trees and shrubs are sufficiently mature to withstand herbivory;
- replacement of subsoil, surface contouring through ploughing and the creation of 'hummock' and low relief features similar to the surrounding area, and partially compacting;
- placing topsoil uniformly across the well pads and grading to natural levels;
- regeneration with native species contained within the seed bank;
- spreading of salvaged materials to provide sites for seed germination and habitat for fauna;
- restricting vehicular access to minimise disturbance and to maximise natural regeneration;
- implementing a weed and feral animal control program; and
- on-going monitoring of rehabilitation progress through comparison to identified reference sites and regional datasets.

Topsoil management procedures are provided in Appendix C and procedures for regeneration, direct seeding and planting are provided in Appendix D.

Assisted revegetation will utilise species that:

- are locally available to eliminate the introduction and establishment of foreign species from other areas of the Pilliga and/or exotic weeds;
- will reduce erosion by wind or water through the development of root mass in rehabilitated soils;
- provide microenvironments for further natural species ingress into the rehabilitated areas, especially tree species which require some immediate low-level shelter, soil moisture and organic content; and
- provide wildlife habitat in the rehabilitated areas.

Appropriate species for revegetation for each PCT are provided in Table E1 in Appendix E, however these will be confirmed at the time of rehabilitation with a suitably qualified ecologist or botanist. Seed treatments and genera suitable for direct seeding will be determined through advice from a suitably qualified ecologist or botanist. Seed collection will be undertaken in accordance with procedures developed for the BMP.

Within areas of State forest, the FCNSW will be consulted to provide advice on preparation techniques and the management of resultant regeneration to encourage vegetation communities compatible with FCNSW land use objectives for the area.

10.2 Domain 1 - Non-linear infrastructure

10.2.1 Prior to disturbance

Prior to construction activities, the location of infrastructure will be determined through micro-siting of infrastructure in accordance with the Field Development Protocol and Biodiversity Management Plan. An analysis and documentation of pre-disturbance landform and PCTs will be undertaken to inform the reshaping and rehabilitation of the final landform.

The pre-clearing procedure will be used to minimise impacts or risk to fauna during vegetation removal. The purpose of the procedure is to identify and demarcate fauna and fauna habitat occurrence in the proposed clearing area, encourage fauna to relocate prior to habitat clearing and safely relocate fauna during clearing activities. The pre-clearance and clearing procedure provides guidance on the methods and steps to be taken to achieve the minimisation, such as demarcation of the clearing areas, describing the types of significant fauna habitat features to be flagged and the process for allowing resident fauna to naturally vacate the area wherever reasonable and feasible. For non-relocatable fauna detected in the clearing area works may be rescheduled to allow time for the individuals to self-relocate where reasonable and feasible.

A detailed clearing procedure is provided in the BMP. A summary of the key steps to be followed from this procedure are:

- planning, habitat mark-up and walk-through;
- slash shrub and ground layer (under scrubbing);
- tap or agitate hollow-bearing trees the day prior to felling and leave overnight;
- remove hollow-bearing trees; and
- positive communication is maintained throughout the clearing process.

Lessons learnt from previous tree-felling operations have highlighted a number of potential risks that highlight the imperativeness of following the procedure accurately, including:

- positive communication is required to minimise the risk to personnel entering the exclusion zone and prevent fauna injury during the clearing process;
- adequate time between slashing vegetation, hollow-bearing tree tapping and hollow-bearing tree removal can reduce the occurrence of fauna during felling operation; and
- allowing adequate time for felled hollow-bearing trees to remain undisturbed is required and can reduce the risk to fauna.

During construction activities, logs, hollows and woody debris will be salvaged and stored. Vegetation will be slashed/mulched with organic material left onsite. FCNSW may salvage saleable timber if it is practical to do so.

Where topsoil is required to be removed, it will be scraped and stored in accordance with the procedures described in Appendix C.

10.2.2 Partial rehabilitation

The rehabilitation aims to reduce the disturbance area used for construction of well pads with progressive rehabilitation, whilst enabling ongoing access for maintenance of the well. This will be undertaken within six months after well installation has been completed.

Spreading topsoil that contains a soil seedbank will be the primary source of natural regeneration. Procedures for topsoil management to be followed are described in Appendix C. Assisted regeneration through planting or direct seeding will be used as a contingency measure. Direct seeding and planting will be undertaken following procedures provided in Appendix D.

Weeds will be managed to facilitate natural regeneration in accordance with the Biodiversity Management Plan and completion criteria. Brush-matting using previously stored woody debris and vegetative material may be applied at this time to assist natural regeneration.

Well pads that contain other infrastructure such as water balance tanks will not be partially rehabilitated at this stage and will remain at approximately 1 ha in area. Periodic maintenance equipment including workover rigs may be required from time to time. They would utilise the remaining cleared area of the well pad plus approximately 0.2 ha for equipment laydown and to meet safety considerations. Vegetation will be allowed to naturally regenerate on topsoil bunding during the well operation. This will act to stabilise the bund and preserve the seedbank for the life of the well before final rehabilitation can take place.

10.2.3 Final rehabilitation

The non-linear infrastructure rehabilitation will occur following decommissioning of infrastructure and removal of equipment and materials from well pads, water storage facilities and laydown areas. This stage will occur within 6 months of decommissioning.

Spreading topsoil that contains a soil seedbank will be the primary source of natural regeneration. Procedures for topsoil management to be followed are outlined in Appendix C. Where required by the FCNSW Access Arrangement, disturbed areas will be seeded with local native forest timber species. Assisted regeneration through planting will be used as a contingency measure. Direct seeding and planting will be undertaken following procedures given in Appendix D.

Weeds will be managed to facilitate natural regeneration in accordance with the Biodiversity Management Plan and completion criteria. Brush-matting using previously stored woody debris and vegetative material may be applied to assist natural regeneration

10.3 Domain 2 - Linear infrastructure

10.3.1 Prior to disturbance

Prior to construction activities, the location of infrastructure will be determined through micro-siting of infrastructure in accordance with the Field Development Protocol and Biodiversity Management Plan. An analysis and documentation of pre-disturbance landform and plant community types will be undertaken to inform the reshaping and rehabilitation of the final landform.

The pre-clearing procedure will be used to minimise impacts or risk to fauna during vegetation removal. The purpose of the procedure is to identify and demarcate fauna and fauna habitat occurrence in the proposed clearing area, encourage fauna to relocate prior to habitat clearing and safely relocate fauna during clearing activities. The pre-clearance and clearing procedure provides guidance on the methods and steps to be taken to achieve the minimisation, such as demarcation of the clearing areas, describing the types of significant fauna habitat features to be flagged and the process for allowing resident fauna to naturally vacate the area wherever reasonable and feasible. For non-relocatable fauna detected in the clearing area works may be rescheduled to allow time for the individuals to self-relocate where reasonable and feasible.

A detailed clearing procedure is provided in the BMP. A summary of the key steps to be followed from this procedure are:

- planning, habitat mark-up and walk-through;
- slash shrub and ground layer (under scrubbing);
- tap or agitate hollow-bearing trees the day prior to felling and leave overnight;
- remove hollow-bearing trees; and
- positive communication is maintained throughout the clearing process.

Lessons learnt from previous tree-felling operations have highlighted a number of potential risks that highlight the imperativeness of following the procedure accurately, including:

- positive communication is required to minimise the risk to personnel entering the exclusion zone and prevent fauna injury during the clearing process;
- adequate time between slashing vegetation, hollow-bearing tree tapping and hollow-bearing tree removal can reduce the occurrence of fauna during felling operation; and
- allowing adequate time for felled hollow-bearing trees to remain undisturbed is required and can reduce the risk to fauna.

During construction activities, logs, hollows and woody debris will be salvaged and stored. Vegetation will be slashed/mulched with organic material left onsite. FCNSW may salvage saleable timber if it is practical to do so.

Topsoil will be scraped and stored following procedures detailed in Appendix C. Alternatively, protective mats or similar may be used to minimise soil compaction.

10.3.2 Partial rehabilitation

The rehabilitation for linear infrastructure involves partial regeneration of pipeline areas that are not required for infrastructure operation and maintenance such as access to tracks, buried gas and water gathering systems and positioning of pipeline signage at line-of-sight intervals.

Replacing the topsoil that contains an intact soil seedbank will be the primary source of natural regeneration. Procedures for topsoil management to be followed are outlined in Appendix C. Natural regeneration of shrubs, grasses and herbs will be encouraged through the spreading of woody material and management of weeds in accordance with the Biodiversity Management Plan. Partial rehabilitation will comprise shrubs and grasses only, with overstorey trees that germinate being selectively removed in order to allow access over roadside pipelines and to prevent damage to pipes or infrastructure.

10.3.3 Final rehabilitation

The linear infrastructure rehabilitation will occur during decommissioning of infrastructure. During decommissioning of infrastructure, gas and water gathering systems will be left in situ and natural regeneration will proceed without disturbance. Within 6 months of decommissioning, unutilised access tracks will be closed, and soils will be ripped to reduce compaction and encourage natural regeneration. Weeds will be managed to facilitate natural regeneration in accordance with the Biodiversity Management Plan. Brush-matting using previously stored woody debris and vegetative material may be applied to assist natural regeneration

Final rehabilitation of access tracks and gas and water gathering systems will include minor re-shaping of tracks to mimic natural ground surface and reduce areas of compacted soil, the spreading of woody material and weed management. The overstorey (if present in surrounding lands) will be allowed to regenerate over time to mimic surrounding landscape and vegetation communities. It is to be noted that under the Access Arrangement, FCNSW has the option to retain any access tracks rather than these being rehabilitated by Santos.

Replacing the topsoil that contains an intact soil seedbank will be the primary source of natural regeneration. Procedures for topsoil management to be followed are outlined in Appendix C. Where required by the FCNSW Access Arrangement, disturbed areas will be seeded with local native forest timber species. Assisted regeneration through planting will be used as a contingency measure. Direct seeding and planting will be undertaken following procedures provided in Appendix D.

Weeds will be managed to facilitate natural regeneration in accordance with the Biodiversity Management Plan and completion criteria.

10.4 Domain 3 - Major facilities

10.4.1 Partial rehabilitation

The rehabilitation for major facilities involves partial regeneration of areas that are not required for ongoing operation and maintenance. Replacing the topsoil that contains an intact soil seedbank will be the primary source of natural regeneration. Procedures for topsoil management to be followed are outlined in Appendix C. Natural regeneration of shrubs, grasses and herbs will be encouraged through the spreading of woody material and management of weeds in accordance with the Biodiversity Management Plan. Partial rehabilitation will comprise shrubs and grasses only, with overstorey trees that germinate being selectively removed in order to allow access over roadside pipelines and to prevent damage to pipes or infrastructure.

10.4.2 Ongoing exploration activities

Exploration activities within the exploration area are undertaken in accordance with the Field Development Protocol and addressed in the management and rehabilitation of the disturbed land. Exploration activities are likely to continue through the life of the Project.

10.4.3 Decommissioning

Decommission and remove of surface infrastructure from the site, unless the Resources Regulator agrees otherwise. At the end of the operational life of the Project, Santos will decommission and remove all surface infrastructure and associated facilities as part of the closure process. All infrastructure will be removed unless there is an agreement with appropriate regulatory authorities for it to remain in situ.

The Project is approved to operate until 31 December 2045; therefore, closure will not occur for several decades. The preparation of a detailed closure plan will commence at least five years prior to the anticipated Project closure date with the closure plan to be finalised at least two years prior to the end date. This closure plan will specifically address the major aspects of decommissioning and rehabilitation and define future rehabilitation care and maintenance requirements for the site, and ongoing monitoring and management.

This RMP assumes that all buildings and other infrastructure are demolished and removed from the Project area despite the potential for them being used after (subject to the landholder's requirements).

It is considered likely that at least some aspects of the existing infrastructure will be used; however, they are not able to be specifically identified at this time. These options will be considered in greater detail during stakeholder engagement, which will be undertaken closer to final Project closure.

A conceptual overview of the activities associated with the Domain 3 decommissioning is provided in the following sections and considered when developing completion criteria.

Site services

All services including power, water, data and telephone on the site will be isolated, disconnected and terminated to make them safe. All underground services will be decommissioned and removed, unless approved otherwise. Overhead power lines should be removed and the materials (i.e. poles and wire) recovered for potential re-sale or recycling as applicable.

Infrastructure and buildings

All items of equipment will be de-oiled, degassed, depressurised, and isolated and all hazardous materials removed from the site. All buildings, including the administration building, workshop will be demolished and removed from the site. Where possible assets may be re-used or sold to other Projects. The remaining items will be demolished, removed, and transported from the Project area as required. All recoverable scrap steel will be sold and recycled; with the remaining non-recyclable wastes either being taken to a licensed landfill. Prior to disposal, all wastes will be assessed and classified in accordance with the *Waste Classification Guidelines*.

All concrete will be broken up to at least 1.5 m below the surface. The waste concrete will be crushed to produce an aggregate that can either be re-used or sold for some other beneficial use beyond the Project closure. All areas will then be reshaped, deep ripped, topsoiled, and seeded in accordance with the RMP.

Water management infrastructure

Any water management structures, including sediment dams, which assist in the water flow from the final rehabilitated landform will be retained following Project closure.

10.4.4 Final rehabilitation

The rehabilitation will occur during decommissioning of infrastructure and post. All areas will be ripped to reduce compaction and encourage natural regeneration. Weeds will be managed to facilitate natural regeneration in accordance with the Biodiversity Management Plan. Brush-matting using previously stored woody debris and vegetative material may be applied to assist natural regeneration

Final rehabilitation will include re-shaping to mimic natural ground surface and reduce areas of compacted soil, the spreading of woody material and weed management. The overstorey (if present in surrounding lands) will be allowed to regenerate over time to mimic surrounding landscape and vegetation communities.

Replacing the topsoil that contains an intact soil seedbank will be the primary source of natural regeneration. Procedures for topsoil management to be followed are outlined in Appendix C. Where required by the FCNSW Access Arrangement, disturbed areas will be seeded with local native forest timber species. Assisted regeneration through planting will be used as a contingency measure. Direct seeding and planting will be undertaken following procedures provided in Appendix D.

Weeds will be managed to facilitate natural regeneration in accordance with the Biodiversity Management Plan and completion criteria.

10.5 Domain 4 - Agricultural land

Domain 4 consists of former agricultural land that has been disturbed by the Project. The rehabilitation strategy conforms to the Rehabilitation Management Plan in the EIS and will be developed in consultation with landholders with the aim of returning land to its former LSC class and being suitable for long-term agricultural activities. Rehabilitation methods can interact with the infrastructure domains 1, 2 and 3 depending on the type of disturbance (e.g. gathering system, well pads or more permanent infrastructure). The methodology includes the following steps:

- prior to disturbance
  - pre-disturbance documentation of existing land use and landform.
  - where required, subsoil and topsoil will be excavated and stored as per measures described in Appendix C.
- during operations - soil stockpiles to be managed as per measures described in Appendix C.
- upon completion of activities:
  - infrastructure decommissioned and removed rehabilitated in accordance with the *Code of Practice: Construction, operation and decommissioning of petroleum wells (2023,* as may be updated or amended*)*.
  - temporary fencing to exclude native and feral herbivores and stock may be installed where monitoring identifies the need.
  - topsoil and subsoil will be reinstated.
  - following the reinstating of topsoil, areas designated for post-production agriculture will be sown with a mixture of pasture species in consultation with the landowner.
  - implement weed management measures in accordance with the Biodiversity Management Plan.
  - following establishment of vegetation, it is anticipated agricultural activities will continue as per the pre-production land use.

11. Progressive rehabilitation and schedule

Rehabilitation activities will be undertaken progressively and as early as practicable to ensure the total disturbance from the project at a point in time is minimised. The ability to progressively rehabilitate areas of the NGP, initially following construction and then as they are decommissioned (at the end of their economic life) is an important component of the rehabilitation strategy.

Benefits of progressive rehabilitation include:

- an ability to learn from early rehabilitation actions, and if required, to adapt and improve the procedures used as the project progresses,
- an ability to trial various options and demonstrate rehabilitation outcomes to the wider community,
- demonstration of a commitment to stakeholders and employees that Santos is effectively managing their environmental impacts,
- reduction of the final closure cost,
- reduction of the risk of rehabilitation failure, and
- progressive reduction of rehabilitation security.

11.1 Rehabilitation schedule

The proposed timelines for the rehabilitation for a single disturbance area will be influenced by the time required to commence and finalise exploration activities, and the potential for ongoing use of these sites for gas production should Phase 2 proceed.

The proposed timeline for the rehabilitation for a single disturbance area within each domain type is dependent on the productivity of each well. An estimate of timing is outlined in Table 11.1 to Table 11.4 and is based on an assumption that wells will not be required for on-going production purposes.

Specific details regarding the forecasted 3 year progress of disturbance and rehabilitation will be presented annually in the Annual Rehabilitation Report which will detail a rolling 3-year rehabilitation implementation schedule.

11.1.1 Domain 1 - Non-linear infrastructure

Table 11.1 - Rehabilitation schedules for non-linear infrastructure (Domain 1)

Process	Estimated timing
Where drill pads are greater than 3% slope, each well pad and construction area (approximately 1 ha) cleared of vegetation, topsoil and subsoil stripped to minimum depth required for construction and stored separately. All well pads to have vegetation slashed and mulched with some tree trunks and branches stockpiled for fauna habitat reconstruction.	Approximately 1 month.
Topsoil either: • protected with temporary soil protection • topsoil and subsoil stripped and stored separately.	Approximately 1 month Soil not used in partial rehabilitation activities, stockpiled until decommissioning of infrastructure.

Process	Estimated timing
Stage 1 rehabilitation of well pads including spreading of subsoil and topsoil and rehabilitation to approximately 50% of each well pad.	Where practical within 6 months from completion of construction.
Weed management and rehabilitation monitoring.	Until site achieves agreed completion criteria.
Decommissioning of infrastructure - wells plugged and decommissioned. All above-ground infrastructure, fill and other imported material removed.	Within 12 months of end of well life.
Spreading of subsoil and topsoil, spreading of retained woody material and final rehabilitation (including direct seeding or planting where required), weed management and monitoring.	Within 12 months of decommissioning.

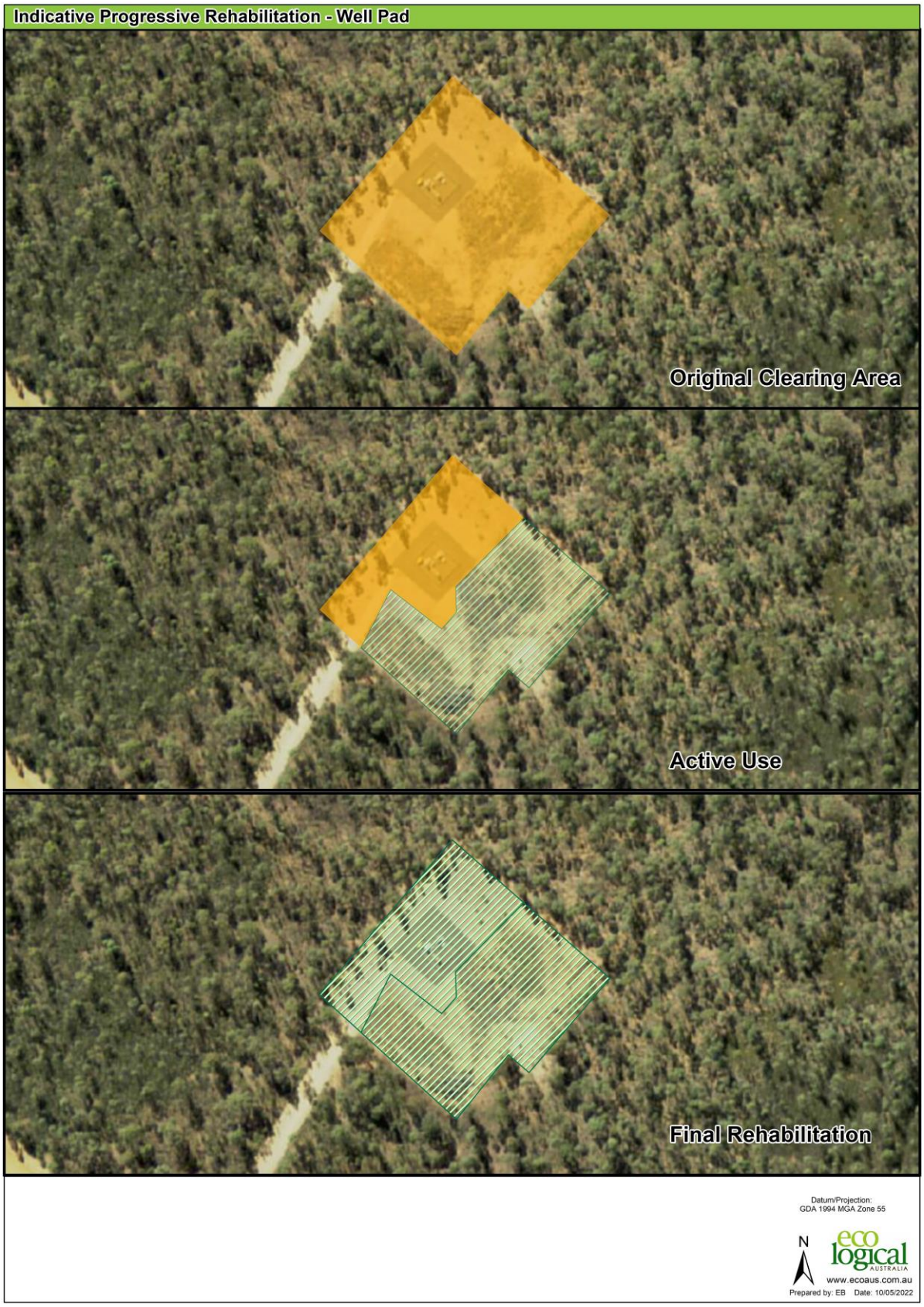

Figure 11.1 - Conceptual domain rehabilitation – Domain 1

11.1.2 Domain 2 - Linear infrastructure

Table 11.2 - Rehabilitation schedule for linear infrastructure (Domain 2)

Process	Estimated timing
Vegetation slashed and mulched with some tree trunks and branches stockpiled for fauna habitat reconstruction.	Within approximately 1 month of clearing for linear infrastructure.
Construction of pipelines and backfilling of subsoil and topsoil within a construction right of way up to 12 m	Within approximately 1 month of laying pipelines.
Stage 1 rehabilitation of linear infrastructure corridor that are not required for infrastructure operation and maintenance.	Within approximately 6 month of construction of pipeline and backfilling of topsoil.
Blocking tracks and ripping soils to reduce compaction and encourage regeneration (access tracks) including spreading of subsoil and topsoil where required.	Within approximately 6 months of decommissioning
Spreading of retained woody material and final rehabilitation (including direct seeding or planting where required), weed management and rehabilitation monitoring	Within approximately 12 months of decommissioning. Monitoring and management continued until site achieves agreed completion criteria.

Figure 11.2 . Conceptual domain rehabilitation – Domain 2

11.1.3 Domain 3 - Major facilities

Table 11.3 - Rehabilitation schedule for major facilities infrastructure (Domain 3)

Process	Estimated timing
Decommissioning and removal of infrastructure.	Within approximately 12 months of end of life.
Rehabilitation - replacement of subsoil and topsoil, spreading of retained woody material and final rehabilitation (including direct seeding or planting where required), weed management and monitoring.	Commenced within approximately 12 months of decommissioning and continued until site reaches agreed completion criteria

11.1.4 Domain 4 - Agricultural land

Table 11.4 - Rehabilitation schedules for agricultural land (Domain 4)

Process	Estimated timing
Topsoil either: • Topsoil and subsoil stripped and stored separately.	Within 1 month of completion of construction activities.
Stage 1 rehabilitation of well pads including spreading of subsoil and topsoil and rehabilitation.	Where practical within 6 months from completion of construction
Direct seeding of disturbed areas using preferred pasture species for the region/season or as requested by the landholder	Within 1 month of spreading of subsoil and topsoil.
Weed management and rehabilitation monitoring.	Until site achieves agreed completion criteria.
Decommissioning - wells plugged and decommissioned. All above-ground infrastructure, fill and other imported material removed.	Within 12 months of end of well life.
Restoration of subsoil and topsoil and final rehabilitation (including direct seeding using preferred pasture species), weed management and monitoring.	Within 12 months of decommissioning. Monitoring and management continued until site achieves agreed completion criteria.

12. Rehabilitation monitoring

Monitoring provides a means to quantitatively assess the status of rehabilitation performance and allow for adaptive management to continuously improve rehabilitation practices. The initial scale of the monitoring program will reflect the nature of disturbance and rehabilitation and will increase commensurately during works to incorporate new areas of disturbance and rehabilitation. The monitoring program has been developed for rehabilitation areas, incorporating the most appropriate indicators and methods that:

- provide an assessment of achievement of completion criteria to demonstrate achievement of rehabilitation objectives;
- are reproducible;
- use scientifically recognised techniques; and
- are cost-effective.

Monitoring and inspections will be conducted by independent, suitably skilled and qualified persons at locations representative of the range of conditions on the rehabilitation areas. Monitoring results, any required maintenance activities and any refinements of rehabilitation methods will be reported as required by the requirements of CoC B81-B83.

Using a systems-based approach provides a standardised method to monitoring using stable and independent benchmark data. Reference sites allow for inference or comparison between control and treatment sites for the effects of other non-Project related influences while benchmarks can be used for tracking the overall progress of the sites towards the “optimal” condition. Progress of the rehabilitation sites compared to the controls and the benchmark data will be achieved through regular annual monitoring (see Biodiversity Management Plan for further details). The spatial data of the reference sites will be provided to FCNSW to allow consideration as part of prescribed burn planning.

12.1 Annual rehabilitation walkover inspections

An annual walk-through of all rehabilitated areas will be undertaken by a suitably qualified person to assess the general progress of completed rehabilitation and to identify areas where corrective action is necessary. This walk-through assessment will identify any issues such as:

- presence and severity of active erosion areas (e.g. rill, gully and tunnel erosion);
- stability of landforms;
- function and condition of existing erosion and sediment control structures and landform features, including water management structures etc. (where applicable);
- visual assessment of ground protection and vegetation cover, vegetation health and growth rates (high level assessment);
- areas of significant weed incursion;
- evidence of presence/impact of vertebrate pests; and
- any other disturbance factors or features which may impact on site safety, such as presence of waste, track disturbance, damaged fences etc.

12.2 General plot design and monitoring frequencies

Monitoring will be conducted annually by independent, suitably skilled, and qualified persons at locations which will be representative of the range of conditions on the rehabilitating areas. Annual reviews of monitoring data to assess trends and monitoring program effectiveness will be conducted. The outcome of these reviews will be included in the Annual Review.

In developing the rehabilitation monitoring program, the following aspects were taken into consideration:

- replicate monitoring sites are needed in representative rehabilitation areas of different ages. Analogue (comparative) monitoring plots should be established on undisturbed adjacent land and should be as representative as possible of final land use PCT; and

A standard monitoring plot design shown in Figure 12.1 with conceptual monitoring locations shown in Figure 12.2. The design includes:

- transect on contour, running through the centre of the plot.
- a minimum of three control and three impact sites per representative plant community type will be used to track the progress of rehabilitation during Phase 1.
- existing plot locations from previous flora surveys will be used where possible.

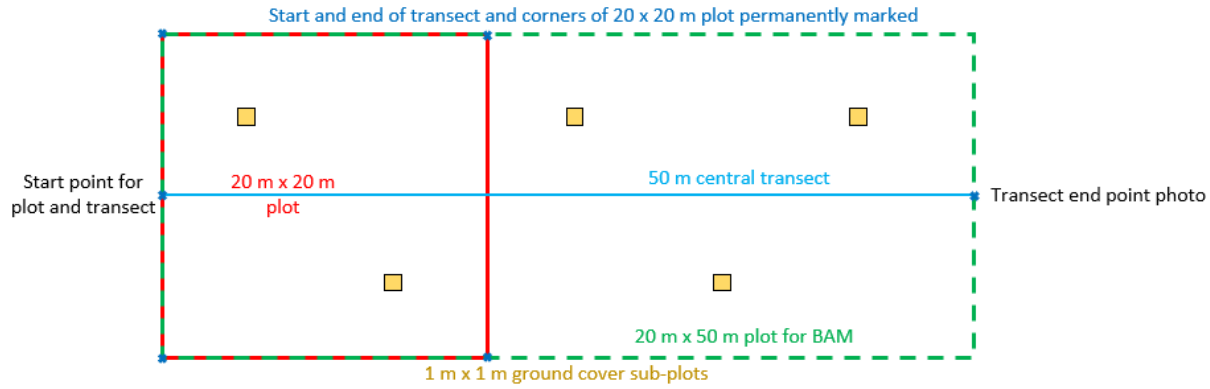

Figure 12.1 - Example of rehabilitation monitoring plot configuration

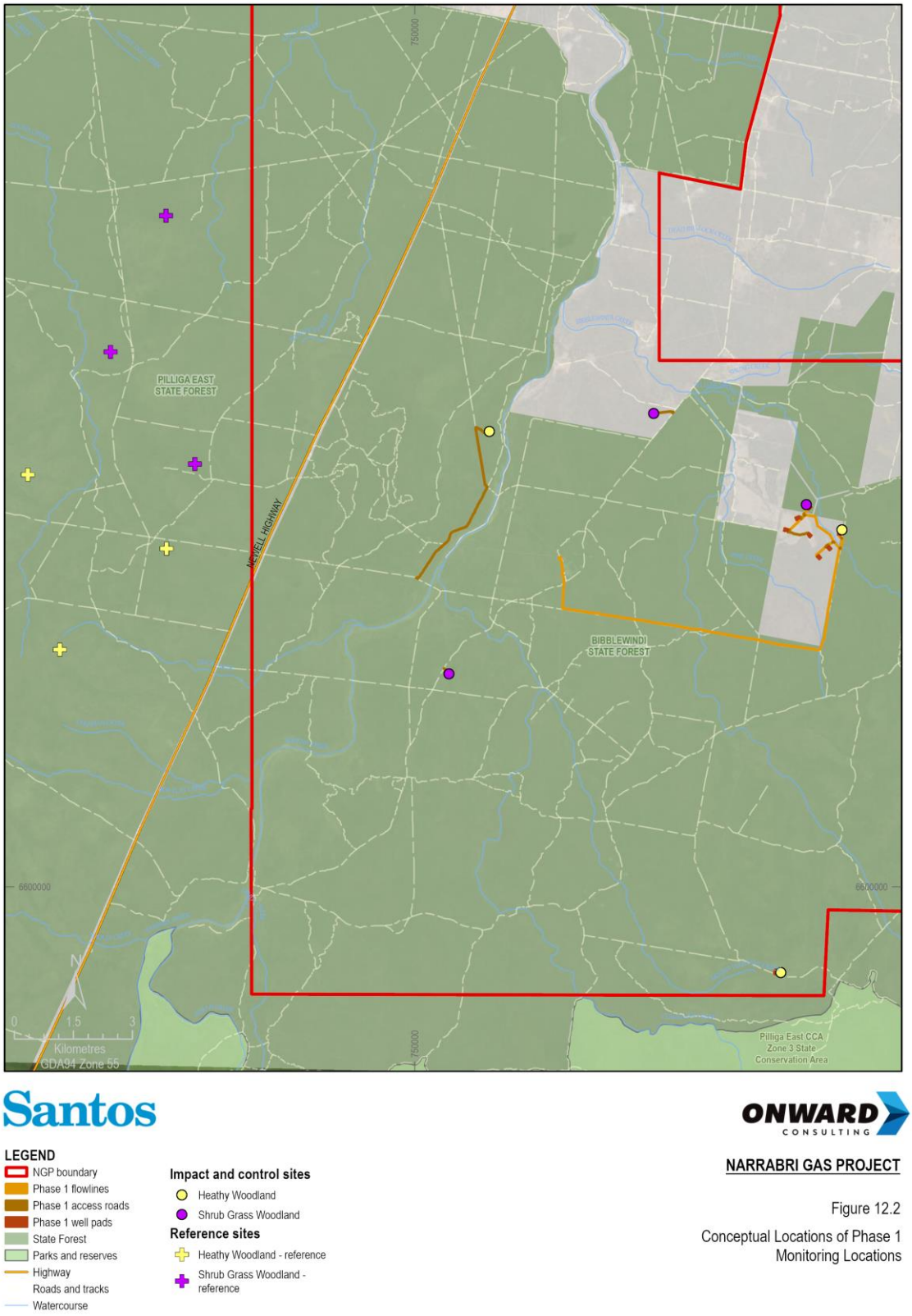

Figure 12.2 - Conceptual locations of Phase 1 monitoring locations

12.3 Domain 4 Monitoring

For areas rehabilitated with pasture, it is proposed that transects be established across 'typical' sections of rehabilitation and monitored for pasture cover, pasture species diversity, weed occurrence, percentage of bare ground, extent and type of erosion, rock presence, topsoil presence/absence and other factors likely to influence rehabilitation development and compared to reference sites.

12.4 Monitoring survey timing

RMP monitoring surveys will be conducted in Spring which represents the highest activity period for most fauna species, and the highest diversity for native plant communities (including weeds).
Following closure and rehabilitation of a well pad or linear infrastructure areas, monitoring will continue until in accordance with the BMP until the completion criteria is met.

12.5 Rehabilitation maintenance

Where rehabilitation monitoring indicates that rehabilitation is not progressing, maintenance measures may be implemented. The maintenance measure/s implemented will be dependent on the issue identified during the rehabilitation monitoring program. Maintenance activities may include (but not limited to):

- weed and pest animal control;
- repair of or additional erosion and sediment control works or drainage;
- re-seeding/planting of failed rehabilitation areas (e.g. through lack of germination, high plant mortality rate);
- watering and fertilising of rehabilitation plantings; and/or
- repair of fence lines, access tracks and other general related land management activities.

The Trigger Action Response Plan for the rehabilitation is provided in section 13.2. Maintenance measures are identified in the first and second tier trigger responses.

13. Adaptive management

13.1 Threats to rehabilitation

Where rehabilitation performance is not trending to the nominated completion criteria this may indicate that there is a threat to long term rehabilitation success. Threats to rehabilitation, as in Table 13.1, may include events such as periods of drought, bush fire events, or pressures from weeds and feral animals.

Where rehabilitation monitoring indicates that there is a significant threat to rehabilitation, Santos will undertake adaptive management in accordance with the Rehabilitation Trigger Action Response Plan (Rehabilitation TARP).

Table 13.1 - Threats to rehabilitation

Threat	Cause
Erosion and sediment control	• Rainfall events. • Lack of appropriate vegetation cover. • Failure of water management structures.
Soil type(s) and suitability	• Inadequate topsoil available. • Poor topsoil quality. • Weed infested topsoil. • Poor recovery of topsoil leading to loss of biological resources.
Water	• Saline runoff and erosion resulting in a surface water trend of salinity increase. • Saline seepage of groundwater resulting in localised impacts. • Drought and/or extreme heat resulting in insufficient ground moisture.
Spontaneous combustion	• Poor management of materials with propensity for spontaneous combustion.
Flora	• Not considering requirements in rehabilitation planning. • Failure to manage weeds. • Pest species / grazing pressures (kangaroos, etc.). • Insufficient or unavailable target seed stock. • Biodiversity targets (offsets) not maintained.
Geotechnical	• Geotechnical failure.
Geology and geochemistry	• Poor knowledge of material and its geochemistry. • Inappropriate placement of materials.
Contaminated land	• Long term use of the site. • Spills, leaks etc.
Bushfire	• Regional fire. • Lightning strike.

13.2 Trigger action response plan

The following trigger action response plan (**TARP**) has been developed for rehabilitation and site relinquishment to identify the required management actions in the event of impacts on rehabilitation, or where rehabilitation outcomes are not achieved in an acceptable timeframe. Where necessary, rehabilitation activities will be amended accordingly with the aim of continually improving rehabilitation standards. Santos will notify the Resources Regulator and other relevant stakeholders will be notified of any exceedances which may result in impacts to rehabilitation.

The responses specified within the TARP have been based upon the rehabilitation completion criteria developed during the preparation of the RMP and the current rehabilitation monitoring program in the Petroleum Operations Plan (**POP**). The rehabilitation monitoring program will trigger response actions, as specified in the TARP to ensure that risks to rehabilitation do not become unmanageable.

This RMP has been prepared on a staged basis in accordance with condition A23 and specifically addresses the activities proposed during Phase 1 of the Project only. Final rehabilitation will be undertaken following decommissioning of infrastructure and removal of equipment and materials from well pads, water storage facilities and laydown areas.

The TARP for rehabilitation has been developed to identify required management actions in the event of impacts to rehabilitation, or where rehabilitation outcomes are not achieved in an acceptable timeframe. The TARP will be implemented as soon as practicable following the identification of any Condition Amber or Condition Red triggers.

13.2.1 Amber trigger

First tier triggers are intended to detect early indications that rehabilitation is not trending toward desired preliminary completion criteria. The monitoring program is to establish and monitor first tier triggers to identify, for example:

- deteriorating vegetation health in rehabilitation areas;
- variability in total biomass and vegetation density in vegetation communities; and
- changes in soil properties without disturbance.

A variation in monitoring results, or a significant overall decline in vegetation health, will trigger further assessments to confirm any adverse impacts, and early intervention management responses.

13.2.2 Red trigger

Trigger values have been developed based on monitoring program outcomes, including rehabilitation areas and selected areas. These will be monitored annually, and the results reported in the Annual Review. The TARP is provided in Table 13.2 and will be reviewed for subsequent Project phases prior to work commencing.

Table 13.2 - Trigger action response plan

Completion criteria	Aspect	Trigger / response	Green	Amber	Red	Responsibility
Rehabilitated areas are free draining except where specific water management structures have been constructed and to be retained with the final land use. Structures in place will not be undermined in the long term	Landform drainage and stability	T	Monitoring indicates rehabilitated landforms are free draining and stable	Monitoring indicates rehabilitated landforms are exhibiting minor drainage or stability issues.	Monitoring indicates rehabilitated landforms are exhibiting significant drainage or stability issues, threatening or causing rehabilitation failure.	HSER to undertake inspections of any required water infrastructure changes. HSER to engage suitably qualified persons to recommend remediation for water drainage or stability issues.
		R	No response required. Continue monitoring program.	An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to address issues. Remediate as appropriate.	Suitably trained person to undertake a review of the drainage design or stability issues and provide recommendations to appropriately remediate the area. Remediate as soon as practicable. Liaison with appropriate regulatory authorities including the Resources Regulator.	
Appropriate bushfire hazard controls have been implemented in accordance with the FMP and any advice from relevant authorities	Bushfire management	T	Monitoring indicates fuel loads and fire breaks have been maintained and there is firefighting access across rehabilitation areas and water resources available for fighting fires.	Monitoring indicates fuel loads and fire breaks have not been maintained. In the event of a fire, this would result in firefighters not being able to access the site or water resources.	A fire on site damages rehabilitated areas.	HSER and/or Project Manager to coordinate maintenance of fire trails and/or reduction in fuel loads. HSER to update Bush Fire Management Plan.
		R	No response required. Continue monitoring program.	Reduce fuel loads and ensure access tracks are cleared. Inspect water sources are and ensure sufficient water is available.	Review and update (if required) the Bush Fire Management Plan to ensure monitoring and maintenance is completed for fuel loads and access tracks. Liaison with appropriate regulatory authorities including the NSW Rural Fire Service.	
Aboriginal cultural heritage sites remain demarcated / protected or salvaged in accordance with the ACHMP	Cultural Heritage	T	Monitoring or auditing shows all CH sites identified and managed in accordance with the ACHMP	Monitoring or auditing shows CH sites identified but not protected or artefacts not salvaged in accordance with the ACHMP on a single occasion	Monitoring or auditing shows CH sites identified but not protected or artefacts not salvaged in accordance with the ACHMP on more than one occasion	HSER to coordinate response in conjunction with the Aboriginal Cultural Heritage Advisory Group
		R	No Action required	Undertake investigation in accordance with ACHMP. Conduct toolbox talk.	Review all procedures related to protection of cultural heritage and training and make changes as required. Ensure additional training is conducted before work resumes.	
There are no active erosion features (greater than 200mm depth or width) or visible sedimentation issues that compromise land capability or the intended final land use	Erosion	T	No gully or tunnel erosion. No rilling present.	Minor gully or tunnel erosion present and/or rilling <200mm deep.	Significant active gully or tunnel erosion present and/or rilling >200mm deep.	HSER to engage a suitably trained person to undertake necessary inspections and remediation actions.
		R	No response required. Continue monitoring program.	An inspection of the site will be undertaken by a suitably trained person. Investigate opportunities to install water management infrastructure to address erosion. Remediate as appropriate.	Undertake a review of the drainage of the area and provide recommendations to appropriately remediate the erosion. Remediate as soon as practicable. Liaison with appropriate regulatory authorities including the Resources Regulator.	
The quality and quantity of water used within the project area conforms to the performance criteria established in the WMP	Surface water quality	T	Water quality of surface runoff or produced water used on site is within performance criteria established within the WMP.	Water quality of surface runoff or produced water used on site exceeds performance criteria established within the WMP but does not indicate a long-term rehabilitation issue	Water quality of surface runoff or produced water used on site exceeds performance criteria established within the WMP and indicates a significant or long-term issue.	HSER to undertake inspections of any required water infrastructure or land management changes.

Completion criteria	Aspect	Trigger / response	Green	Amber	Red	Responsibility
		R	No response required. Continue monitoring program.	Review and investigation of water quality monitoring and management where appropriate. Implement relevant remedial measures where required.	Reporting as per all statutory reporting requirements. Implement relevant responses and undertake immediate review to determine source of issues and implement remediation measures identified as soon as practicable. Liaison with appropriate regulatory authorities including the Resources Regulator and BCS.	
Disturbance has been restricted to the delineated area and no stockpiling of equipment, machinery, soil or vegetation has occurred beyond this boundary.	Rehabilitation timeframes	T	Monitoring or auditing shows disturbance has occurred within delineated boundary and habitat resources salvaged	Monitoring or auditing shows accidental disturbance within delineated boundary or habitat resources lost on a single occasion	Monitoring or auditing shows accidental disturbance within delineated boundary or habitat resources lost on more than three occasions	HSER to coordinate response and engage ecologists where necessary to recommend remediation options.
		R	No action required	Additional disturbance remediated within 3 months. Conduct Toolbox talks	Additional disturbance remediated within 3 months. Review pre-clearing and clearing procedure and review method for marking the limited of disturbed areas and implement changes as required. Conduct additional training.	
Topsoils and subsoils stripped during the construction of infrastructure have been stockpiled, managed, and used for final rehabilitation to the greatest extent possible	Soil management	T	Monitoring indicates topsoil/subsoil stockpiles are free of weed species	Monitoring indicates >10% but <25% cover of undesirable species present in topsoil stockpile vegetation cover	Monitoring indicates >25% cover of undesirable species present in topsoil stockpile vegetation cover	HSER to coordinate weed management personnel (either inhouse or contract).
		R	No response required. Continue monitoring stockpiles for weed presence.	Review monitoring records to identify the nature of the weeds present and recommendations from monitoring report. Employ weed management practices if required.	Engage a weed management contractor to remove noxious and problematic weeds from the site as soon as practicable. Investigate cover crop species to minimise the emergence of undesirable weed species. Liaison with appropriate regulatory authorities including the Resources Regulator and BCS.	
Disturbed areas no longer required for mining-related operations have been rehabilitated as soon as practicable to ensure that the total area of disturbance is minimised.	Rehabilitation within timeframes	T	Monitoring and auditing shows that after infrastructure decommissioning, rehabilitation objectives are being met within the timeframes outlined in this document for the relevant domain.	Monitoring and auditing shows that after infrastructure decommissioning, rehabilitation objectives have not been met within the timeframes outlined in this document for the relevant domain on one occasion.	Monitoring and auditing shows that after infrastructure decommissioning, rehabilitation objectives have not been met within the timeframes outlined in this document for the relevant domain on several occasions.	HSER to coordinate response to occurrences.

Completion criteria	Aspect	Trigger / response	Green	Amber	Red	Responsibility
		R	No response required. Continue monitoring program.	Once notified, investigate rehabilitation status for the occurrence and devise a plan to achieve missed objectives as soon as practicable. Once achieved, continue monitoring program.	Once notified, investigate rehabilitation status for the occurrence and devise a plan to achieve missed objectives as soon as practicable. Once achieved, continue monitoring program. Review procedures and practices to determine the reasons for rehabilitation timeframes not being met. Provide recommendations and conduct additional training if required.	
Native plant species richness in rehabilitated areas is on a trajectory towards reference sites	Native Ecosystem (Domain 1-3) species composition	T	Following revegetation to woodland, the number of native plant species for each form group is at least: 25% of local reference site average in the short (0-5 years) and medium term (5-15 years); 75% of local reference site average in the long term (>15- 25 years)	Following revegetation to woodland, the number of native plant species for each form group is: >10 but <25% of local reference site average in the short (0-5 years) and medium term (5-15 years); >50 but <75% of local reference site average in the long term (>15-25 years).	Following revegetation to woodland, the number of native plant species for each form group is at least: <10% of local reference site average in the medium term (5-15 years); <50% of local reference site average in the long term (>15-25 years).	HSER to obtain advice from an ecological consultant.
		R	No response required. Continue monitoring program.	Review native seed mix and amend accordingly. Consider remedial actions such as tubestock planting or re-seeding to achieve required species composition.	An inspection of the site will be undertaken by a suitably trained person. Investigate remedial options to achieve required species composition. Liaison with appropriate regulatory authorities including the Resources Regulator and BCS.	
Canopy cover, midstory cover and groundcover is comparable to reference sites	Species cover	T	Following revegetation to woodland, total cover for each form group in rehabilitated areas is: >10% of local reference site average in the medium term (0- 5 years); >20% of local reference site average in the medium term (5- 15 years); >50% of local reference site average in the long term (>15- 25 years).	Following revegetation to woodland, total cover for each form group in rehabilitated areas is: <10% of local reference site average in the short term (0-5 years); >10% but< 20% of local reference site average in the medium term (5-15 years); >25% but <50% of local reference site average in the long term (>15-25 years).	Following revegetation to woodland, total cover for each form group in rehabilitated areas is: <10% of local reference site average in the medium term (5-15 years); <25% of local reference site average in the long term (>15-25 years).	HSER to obtain advice from an ecological consultant.
		R	No response required. Continue monitoring program.	Review rehabilitation procedures where required to increase vegetation cover	A suitably trained person to inspect the site. Investigate use of appropriate management options to remediate. Remediate as appropriate. Liaison with appropriate regulatory authorities including the Resources Regulator and BCS.	

Completion criteria	Aspect	Trigger / response	Green	Amber	Red	Responsibility
There are no significant weed infestations and weed presence is no greater in rehabilitated areas than at reference sites	Weed occurrence	T	Monitoring indicates there are no priority weeds present in pasture, and no priority weeds or high threat exotic weeds in woodland. Monitoring indicates that weed cover is no greater than at reference sites	Monitoring indicates there are priority weeds present in pasture, or priority weeds or high threat exotic weeds in woodland, and/or that weed cover is up to 25% greater than of that at reference sites.	Monitoring indicates there are priority weeds present in pasture, or priority weeds or high threat exotic weeds in woodland, and/or that weed cover is more than 25% greater than that at reference sites	HSER to coordinate weed management personnel (either inhouse or contract).
		R	No response required. Continue monitoring program.	Review monitoring report to identify the nature of the weeds present and recommendations from monitoring report. Engage a weed management contractor to remove noxious and problematic weeds if required.	Engage a weed management contractor to remove noxious and problematic weeds from the site as soon as practicable. Investigate management measures to assist native plant establishment including use of ameliorants and implement as appropriate. Liaison with appropriate regulatory authorities including the Resources Regulator and BCS.	
Feral and pest animal species are controlled in accordance with relevant legislation and the Pest Plan	Pest Management	T	Monitoring records indicate that feral and pest animal species are controlled in accordance with relevant legislation and do not present a risk to rehabilitation.	Monitoring records indicate that one feral and/or pest animal species is not being controlled in accordance with relevant legislation and/or presents a risk to rehabilitation.	Monitoring records indicate that more than one feral and pest animal species are not being controlled in accordance with relevant legislation and/or present a risk to rehabilitation.	HSER to coordinate pest animal management personnel (either inhouse or contract).
		R	No response required. Continue monitoring program.	Review pest animal monitoring report and consider recommendations. Engage a pest animal control contractor to re-establish compliance with relevant legislation or to remove risk to rehabilitation.	Review pest animal monitoring report and consider recommendations. Engage a pest animal control contractor to re-establish compliance with relevant legislation or to remove risk to rehabilitation.	
Monitoring verifies that the number of trees with hollows that are visible from the ground increases to at least 50% of local reference site average in the long term	Habitat feature establishment	T	In native ecosystem land uses, from 15 years after rehabilitation, the number of hollow bearing trees and fallen logs >10cm in diameter is > 50% of that at reference sites	In native ecosystem land uses, from 15 years after rehabilitation, the number of hollow bearing trees and fallen logs >10cm in diameter is >25% but <50% of that at reference sites	In native ecosystem land uses, from 15 years after rehabilitation, the number of hollow bearing trees and fallen logs >10cm in diameter is <25% of that at reference sites	HSER to engage an ecologist if necessary and coordinate response.
		R	No response required. Continue monitoring program.	Review other vegetation indicators and assess if vegetation community is not conforming in any other criteria. If not, engage an ecologist to review the site. Continue monitoring program.	Engage an ecologist to review the site and recommend remedial actions or conduct additional assessment, if necessary. Continue monitoring program.	
Rehabilitation reconnects habitat where it has been fragmented by the Project	Habitat connectivity	T	Monitoring indicates corridors are successfully established and consistent with the desired vegetation community composition and are suitable for fauna species movement.	Habitat corridors are successfully established and consistent with the desired vegetation community composition however are not suitable for fauna species movement (size, habitat complexity)	Monitoring indicates that vegetation corridors do not contain the desired vegetation community composition and are not likely to become suitable for the movement of fauna species.	HSER to seek advice from an ecologist.
		R	No response required. Continue monitoring program.	Investigate whether sufficient habitat features (rock piles, felled hollow bearing trees, nest boxes etc.) are available and have been incorporated into the corridors. Undertake remedial action if necessary.	Engage ecologist to recommend remedial rehabilitation works such as additional planting or seeding, soil amelioration, or weed reduction. Ensure sufficient habitat features are available for fauna. Liaison with appropriate regulatory authorities including BCS.	

Completion criteria	Aspect	Trigger / response	Green	Amber	Red	Responsibility
Pasture species mix establishment in rehabilitated areas is representative of analogue sites	Agricultural land (Domain 4) species composition	T	From two years following revegetation to grassland, species composition in pasture consists of >75% of those within the reference site or which are suitable for grazing	From two years following revegetation to grassland, species composition in pasture consists of >50% but <75% of those within the reference site or which are suitable for grazing	From two years following revegetation to grassland, species composition in pasture consists of <505% of those within the reference site or which are suitable for grazing	HSER to seek advice from an agronomist.
		R	No response required. Continue monitoring program.	Investigate additional weeding and re-seeding where required and ensure that the seed mix utilised is consistent with desired species composition.	An inspection of the site will be undertaken by a suitably trained person. Investigate remedial options to achieve required species composition. Liaison with appropriate regulatory authorities including the Resources Regulator.	
Vegetative cover in rehabilitated areas is representative of analogue sites	Agricultural land (Domain 4) ground cover	T	From twelve months following the revegetation of pasture, ground cover is >75% of local reference site average.	From twelve months following the revegetation of pasture, ground cover is >50% but <75% of local reference site average.	From twelve months following the revegetation of pasture, ground cover is <50% of local reference site average.	HSER to seek advice from an agronomist.
		R	No response required. Continue monitoring program.	Review procedures where required to increase vegetation cover.	An inspection of the site will be undertaken by a suitably trained person. Investigate use of appropriate management options to remediate. Remediate as appropriate. Liaison with appropriate regulatory authorities including the Resources Regulator, Local Land Services and BCS.	
There are no bare patches of ground in rehabilitated areas	Bare Ground Occurrences	T	No bare patches of rehabilitation indicating poor soil/spoil quality.	Some small patches of bare ground, or poor vegetation growth indicating a potential issue with soil quality.	Large areas (>400 m^2) of bare ground, or poor vegetation growth indicating a potential issue with soil quality.	HSER (in conjunction with specialist external consultant, if necessary) to determine root cause of poor vegetative outcomes. HSER to arrange any necessary soil rework.
		R	No response required. Continue monitoring program.	Conduct investigation and take samples of soil to determine the need for ameliorants or other management options.	Engage a consultant to assist with recommendations to appropriately remediate soil quality and depth. Remediate as soon as practicable. Liaison with appropriate regulatory authorities including the Resources Regulator, and BCS.	

14. Record keeping

Santos has a data management plan for the NGP that outlines the policies and procedures that will be implemented to ensure that data is managed in a consistent, efficient and effective manner in order to provide accurate records of activity operations and enhance the value of the data collected.

Santos uses a number of systems and platforms to manage the documentation and data associated with the activities under this RMP. These include Sharepoint for management plans, procedures and laboratory reports; Santos' EHS Toolbox for capturing inspections and field assessments; and EQuIS[4], an advanced environmental data management and decision support system, for capturing all data and any laboratory results.

Details of data collection, inspection and maintenance key records associated with this RMP that are stored and managed include:

- inspection and monitoring records, including the following:
  - photographs of the baseline conditions of disturbed areas, disturbance caused by exploration activities and showing completed rehabilitation works
  - records of actual methodologies used to rehabilitate a site (e.g. species utilised, fertiliser rate, details of ripping and scarifying, timing of sowing, sowing rates, seedling planting density, origin of seed, rainfall etc.); and
  - records of care and maintenance activities undertaken on rehabilitation areas; and
  - Records of surveying, sealing and decommissioning of boreholes and petroleum wells;
- operational monitoring and performance data, including environmental incident reports, corrective and preventative actions;
- assessments of rehabilitation performance against the nominated rehabilitation objectives and completion criteria
- sampling and any laboratory analytical reports (if required);
- calibration records for field instruments and continuous monitoring systems;
- annual inspection reports and/or certifications; and
- records of any review and revision of the RMP.

Monitoring data is subject to quality assurance and quality control protocols and procedures that ensure that data is accurate and usable. Data is subjected to consistent validation and verification procedures. Any data that fails QA and QC procedures is rejected for future use.

Records will be kept in a legible form for production to any inspector for a period of at least four years following the expiry or termination of a prospecting title, in accordance with sections 97D and 97E of the PO Act.

[4] EQuIS (Environmental Quality Information System) is a proprietary software application.

15. Incidents, non-compliances and complaints

15.1 Incidents and non-compliances

Incident reporting and non-compliance notification will be in accordance with CoC D6 and D7 respectively, as described in section 6 of the EMS. In the event of an environmental incident or non-compliance with the Project Approval, Santos will initiate an investigation. The incident will be reported immediately after Santos becomes aware of an incident causing material environmental harm. Any notification will describe the location and nature of the incident that occurred, and will be provided to the DPHI and any other relevant agencies immediately via the Major Projects Portal.

Within 7 days of becoming aware of a non-compliance with the CoC, Santos will notify the DPHI of the non-compliance via the Major Projects Portal. This notice will set out the non-compliance, the reasons for the non-compliance (if known) and what actions have been taken, or will be taken, to address the non-compliance. A non-compliance which has been notified as an incident will not be notified as a non-compliance.

Where incidents or non-compliances associated with this rehabilitation activities are identified, Santos will:

- take all reasonable and feasible steps to ensure that the incident or non-compliance ceases and does not reoccur;
- consider all reasonable and feasible options for remediation (where relevant) and submit a report to the relevant department(s) describing options and any preferred remediation measures or other courses of action; and
- implement remediation measures as directed by the relevant department(s).

15.2 Complaint management

Santos has a documented *Complaint Management Procedure* that is communicated to all relevant staff members. Complaints can be directed to Santos via phone or email 24 hours a day, 7 days a week. Contact details are publicly available on the Project website and are presented in Appendix D of the EMS.

All complaints are logged on a complaint form which includes the following details:

- date and time of the complaint;
- complainant details;
- details of the issue or complaint;
- actions taken to remediate the issue, if any;
- follow up actions required, if any;
- details of further liaison with complainant, if any; and
- closure date and time of the issue.

As per CoC D13, Santos maintains a complaint register which is updated as required and available on the Project website.

16. Reporting, evaluation and review

16.1 Annual Review

In accordance with condition D8 and as further described in section 6 of the EMS, Santos will review the performance of its rehabilitation management for the previous calendar year and report the relevant results within the Annual Review, to the satisfaction of the Planning Secretary. The Annual Review will be submitted to the Department via the Major Projects Portal by the end of March each year and will at a minimum provide the following information:

- the rehabilitation conducted in the previous year; and the proposed rehabilitation for the following year;
- identify any trends in the rehabilitation monitoring data.

Further, the annual review under consent condition D8 will include a review and assessment of the items summarised below:

- monitoring results and complaints;
- non-compliances and incidents;
- compliance with performance measures, criteria and operating conditions;
- discrepancies between predicted and actual impacts; and the cause of any significant discrepancies; and
- measures to be implemented to improve environmental performance of the rehabilitation activities and measures.

The Annual Review may also make recommendations for any additions, changes or improvements to the rehabilitation management strategies and processes.

16.2 Independent environmental audit

In accordance with condition D9 and D10, within one year of commencement of Phase 1 and every three years thereafter, Santos will facilitate an independent environmental audit (**IEA**) to ensure compliance with the following:

- implementation consistent with the Field Development Protocol and Plan;
- conditions of all relevant approvals, permits, licences and plans;
- relevant State and Commonwealth legislation;
- management plans; and
- any annual compliance review obligations for the period.

Requirements within this RMP will be assessed during the IEA for compliance.

16.3 Revision of this RMP

As required by CoC D4, Santos will review the suitability of the RMP within two months of:

- the submission of an incident report;
- the submission of an Annual Review;
- the submission of an Independent Environmental Audit;
- the submission of a Field Development Plan;

- the submission of a Groundwater Model Update; or
- the approval of any modification of the SSD.

This is to ensure the RMP is updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the Project.

In view of the various conditions requiring annual reviews, suitability assessments and performance evaluations, this RMP will be reviewed and, if necessary, updated in at least the following circumstances:

- in accordance with any direction from the NSW EPA or the Minister administering the PO Act;
- due to any significant change to the design or operation of the management processes as described herein. If there is ambiguity in relation to whether there is a significant change, Santos will consult with the Planning Secretary to determine whether the RMP must be reviewed; and
- otherwise at intervals of no longer than one year.

The review history table in the front of this Plan provides the details of each review, conducted in accordance with condition D4.

Consent condition D5 in turn states that if the review under condition D4 determines that the RMP requires revision - to either improve the environmental performance of the development, cater for a modification or comply with a direction - then Santos will submit a revised RMP to the Planning Secretary for approval within 6 weeks of the review.

During a review, the status of rehabilitation works will be undertaken. If it is considered that completion criteria have been obtained in any rehabilitation areas, applications will be made for progressive relinquishment in accordance with *Form ESF2 Rehabilitation completion and/or review of rehabilitation cost estimate and/or notification of mine or petroleum site closure*.

Further details on the reporting, evaluation and review of the RMP is provided in section 8 of the EMS.

16.4 Improvement measures

Consent condition D3(g) requires that this RMP includes a program to investigate and implement ways to improve the environmental performance of the Project over time; and CoC D3(i) states that the Plan is to include a protocol for the periodic review. The protocol for review is set out by consent conditions D8, D4 and D5, which have been addressed in sections 16.1 and 16.3 above.

Measures to improve the environmental performance of the Project that will be implemented following review and evaluation include the following:

- audits of the rehabilitation measures and processes, and a review of any changes or amendments that have been made to the rehabilitation monitoring;
- identification of potential improvements in the rehabilitation activities.

In accordance with CoC D13 and as described in section 6 of the EMS, all relevant monitoring data and associated reports will be made available on the Project website, for the duration of the Project. This information will be kept up to date.

17. References

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18. Glossary

Term	Definition[5]
Access track	Cleared and graded track constructed where existing tracks are not available
Alignment	The line or lines that describe a linear-infrastructure route; it defines how linear infrastructure (such as a road, access track or pipeline) will be located in relation to the features encountered along the route
Approved disturbance area	The disturbance areas shown in the EIS as modified by any approved Field Development Plan
Completion criteria	Agreed standards or levels of performance that indicate the success of rehabilitation and enable an operator to determine when its liability will cease
Council	Narrabri Shire Council
Department	NSW Department of Planning, Housing and Infrastructure (DPHI)
Ecosystem	An interconnected biological community of organisms that interact with each other and their physical environment.
EIS	The Environmental Impact Statement titled NGP Environmental Impact Statement, dated 31 January 2017, submitted with the development application, including the response to submissions and supplementary response to submissions, and the additional information provided to the Department in support of the application
Exploration well	A petroleum well that is drilled to: a) Explore for the presence of petroleum or natural underground reservoirs suitable for storing petroleum, or b) obtain stratigraphic information for the purpose of exploring for petroleum. For clarity, an exploration well is not a production well
Feasible	Means what is possible and practical in the circumstances
Gas field infrastructure	All Project-related infrastructure, excluding the Leewood facility, Bibblewindi facility and the road upgrades required under SSD 6456
Gas well	Pilot wells and production wells
Gathering lines	Pipelines used to transfer gas and produced water from wells
Incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance
Linear infrastructure	Project related infrastructure of a linear nature including gas and water gathering lines, gas and water pipelines, access tracks, power lines, communication lines and other service lines
Major facilities	Leewood facility and Bibblewindi facility
Minimise	Implement all reasonable and feasible mitigation measures to reduce the impacts of the Project
Mitigation	Activities associated with reducing the impacts of the development
Non-compliance	An occurrence, set of circumstances or development that is a breach of the SSD 6456 consent
Petroleum Assessment Lease 2 (PAL 2)	A PAL is required to hold the exclusive right to prospect for petroleum and to assess any petroleum deposit over a specified area of land in NSW. A lease allows the holder to maintain a title over a potential area, without having to commit to further exploration. The holder can, however, continue prospecting operations and to recover petroleum in the course of assessing the viability of commercial mining. PAL 2 is held by Santos NSW Pty Ltd.
Petroleum Exploration Licence 238	Before exploring for minerals or petroleum in NSW, an explorer must first obtain a Petroleum Exploration Licence (PEL) under the *Petroleum (Onshore) Act 1991*. An exploration licence gives the licence holder exclusive rights to explore for petroleum or

[5] The majority of the definitions are as provided in the Development Consent for SSD 6456

Term	Definition[5]
(PEL 238)	specific minerals within a designated area but it does not permit mining, nor does it guarantee a mining or production lease will be granted. PEL 238 is held by Santos NSW Pty Ltd.
Petroleum Production Lease 3 (PPL 3)	A petroleum production lease gives the holder the exclusive right to extract petroleum within the production lease area during the term of the lease. PPL 3 is held by the following titleholders: • Santos QNT Pty Ltd; • Santos NSW (Hillgrove) Pty Ltd; and • Santos NSW (Eastern) Pty Ltd.
Petroleum production lease application (PPLA)	A petroleum production lease gives the holder the exclusive right to extract petroleum within the production lease area during the term of the lease. Development consent under the *Environmental Planning and Assessment Act 1979* must be in place before a petroleum production lease can be granted. Santos, on behalf of its then joint venture partner lodged four petroleum production lease applications under the PO Act in May 2014 for the Project area, being PPLAs 13, 14, 15 and 16. The ownership of the application is now held by Santos NSW Pty Ltd; and
Pilot well	A well for gas and water extraction, for the purpose of exploration, appraisal and assessment of the gas field potential
Planning Secretary	Planning Secretary under the EP&A Act, or nominee
Production well	A well for gas and water extraction, for the purpose of commercial gas production and/or use
Project area	The area of approximately 95,000 ha that encompasses the Project
Project footprint	The area of surface expression being about 1,000 ha occupied by the infrastructure components of the NGP
Project-related infrastructure	All infrastructure and other structures associated with the development. This includes linear infrastructure and non-linear infrastructure, surface infrastructure and subsurface infrastructure, major facilities, wells and well pads and other gas field infrastructure
Reasonable	Means applying judgement in arriving at a decision, considering mitigation benefits, cost of mitigation versus benefits provided, community views and the nature and extent of potential improvements
Rehabilitation	The restoration of land disturbed by the development to ensure it is safe, stable and non-polluting over the short, medium and long term
Well	Pilot wells and production wells
Well pad	An area of up to 1 hectare in size upon which the gas wells are to be located, with the area decreasing to no more than 0.25 hectares following rehabilitation[6], or other area as may be approved in the Field Development Plan

[6] Workover activities will be contained within the operational area of the well pad area of around 0.2 ha, with an additional laydown area that could be approximately 0.2 ha in size.

Appendix A - Consultation records

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Management Plan Consultation Feedback Form

DOCUMENT TITLE:	**Rehabilitation Management Plan**
STAKEHOLDER:	North West Planning - Biodiversity Conservation and Science Directorate (BCS)
CONSULTATION RELEASE DATE:	**5 November 2021**
COMMENTS DUE DATE:	**30 December 2021**

General Feedback	
Key Issues	There are inconsistencies between the Table A1 of the Biodiversity Management Plan (BMP) and Table B2 of the Rehabilitation Management Plan (RMP). This includes the BMP referring the reader to the RMP when addressing the following consent conditions: • *Consent condition B49* • *Consent Condition B51 (H) (I, iii and iv)* • *Consent Condition B51 (I) (ii, iii, vii, xii)* However, the above-mentioned consent conditions are not referred to in Table B2 of the RMP. In addition, BCS notes that some of these consent conditions have not been addressed in the content of the RMP, for example consent condition B51 (H)(iii) states: "*describe the measures to be implemented within approved disturbance areas in the Project area to: maximise the salvage, transplanting and/or propagation of any threatened flora found during pre-clearance surveys, in accordance with the Guidelines for the Translocation of Threatened Plants in Australia (Vallee et al., 2004), where reasonable and feasible*". The measures to be implemented for the translocation of threatened flora has not been addressed. BCS recommends that the RMP is reviewed and reconciled with the conditions of consent and Table A1 of the BMP.

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Management Plan Consultation Feedback Form

General Feedback	
	Consent condition B83(g) requires that the RMP includes: *"Detailed performance and completion criteria for evaluating the performance of the rehabilitation of the project area, and for triggering remedial actions".* However, Section 4.3 of the RMP only provides performance indicators i.e. indicators that remediation efforts are performing according to expectations or on a trajectory towards success. BCS consider preliminary performance indicators important for measuring trajectory towards completion, via monitoring, however this does not preclude the need for completion criteria i.e. a defined quantifiable target representing that rehabilitation efforts have achieved success. As an example, a completion criterion for remediation activities may be "*remediation efforts have resulted in a self-sustaining ecosystem indicated by [X value compositional, structural and functional attributes being measured], no further remediation actions required*". BCS recommend that Section 4.2 is updated to address the requirement of consent condition B83(g) for completion criteria. All completion criteria should include tailored, quantitative performance measures and targets which adhere to SMART principles (specific, measurable, achievable, realistic, timely). BCS also note that the preliminary performance indicators do not contain triggers for remedial action. Triggers for remedial action should form a key aspect of the preliminary performance indicator table. BCS recommends this Section 4.2 is updated with tailored, quantitative trigger points for corrective action which adhere to the SMART principles.
Suggestions for improvement	Section 7 details the rehabilitation monitoring which is proposed to be undertaken for the project. This Section mentions assessing the status of rehabilitation and completion criteria, however the relationship between the monitoring activities proposed and the performance indicators and completion criteria within Section 4.3 of the RMP are unclear. BCS recommends that monitoring for the RMP should be informed by and measured according to the performance indicators and completion criteria detailed within Section 4.2 of the RMP.
	Section 4 details the assisted natural regeneration methods proposed to be undertaken for the project. BCS suggest that for certain domains which will require the removal of native vegetation i.e. linear and non-linear domains, brush-matting using recently felled vegetative material may be an effective assisted natural regeneration method worth considering.

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Management Plan Consultation Feedback Form

Plan	Section	Specific Feedback *Detail specific issues with certain sections in the document*
RMP	4.5	Section 4.5 of the RMP details the rehabilitation activities which would be conducted in specific domains. All domains include reference to the salvage and storage of logs, hollows and woody debris. However, the circumstances and timing of the re-installation of these salvaged materials are not clearly articulated within each domain's detailed rehabilitation activities. BCS recommends that this is detailed in the RMP. Appendix D of the RMP states that procedures for natural regeneration will include: *"Spreading of woody debris including hollows and logs across rehabilitation area. Logs can be positioned across slopes to reduce erosion."* Condition B51(i) of the development consent for Narrabri Gas states the Biodiversity Management Plan must: *"Describe the measures to be implemented in the project area to:* *(i) Minimize impacts on fauna habitat resources such as hunting and foraging areas, habitat trees, fallen timber and hollow-bearing trees* *(ii) Enhance the quality of vegetation, vegetation connectivity and wildlife corridors including through the assisted regeneration and/or targeted revegetation of appropriate canopy and sub-canopy, understory and ground strata* *(iii) Introduce naturally scarce fauna habitat features such as nest boxes and salvaged tree hollows and promote the use of these introduced habitat features by threatened species."* Section 6.4 of the Project Commitments made by Santos states that: *"The removal of hollow-bearing trees with a hollow of greater than 300mm in diameter will be offset by a 1:1 replacement."* Given the above, BCS recommend that the RMP clearly details the method proposed for the reinstallation of salvaged hollows into retained trees within adjacent vegetation.

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Management Plan Consultation Feedback Form

Plan	Section	Specific Feedback *Detail specific issues with certain sections in the document*
RMP	9	The RMP states that: *"Data collected from rehabilitation sites will be compared to data collected in reference sites. The use of paired sites enables comparison of impact sites with pre-production vegetation and allows for the effects of other non-project related influences (e.g. drought conditions)".* *"A minimum of three control and three impact sites per representative plant community type will be used to track the progress of rehabilitation during Phase 1. Existing plot locations from previous flora surveys will be used where possible."* When reviewing Section 4.1 of the biodiversity assessment report for Narrabri Gas it can be understood that a majority of the flora plots previously undertaken within the project area to inform the EIS were sampled either during or not long after the break of the Millennium Drought (between 2005-2013). BCS recommends that if Santos propose to use data from previous plots undertaken within the project site to inform control or baseline conditions that this does not include data from any plots which were sampled during drought.

Santos

Management Plan Consultation Feedback Form

DOCUMENT TITLE:	**Rehabilitation Management Plan and the Residual Drilling Material Protocol**
STAKEHOLDER:	**FCNSW**
CONSULTATION RELEASE DATE:	**1 December 2021**
COMMENTS DUE DATE:	**14 January 2022**

General Feedback	
Key Issues	
Suggestions for improvement	

Section	**Type**	**Specific Feedback** *Detail specific issues with certain sections in the document*
eg Section 2	*Legislative + Regulatory reqs./ Readability / Usability /*	*Further detail is required about when a report is required and how the report is to be submitted.*
3.1.3		Santos have agreed to use gravel from State forest in lieu of other sources of material (section 10.2 *Access Arrangement 2020*). If the residual drilling material (RDM) is being used for practical purposes it shall be accounted for as per Schedule 3 *Access Arrangement 2020*.
Table 4.1	Surface infrastructure	Santos have agreed to remove all Facilities from State forest unless agreed with FCNSW (section 6.1.2 *Access Arrangement 2020)*
4.4	Methodology of natural regeneration	The definition of Plug and Abandon *(Access Arrangement 2020)* describes areas disturbed by Santos as having to be seeded with local timber species.
4.4.3	Application of RDM	Please send FCNSW the coordinates of areas of State forest where RDM has been incorporated into ground surface
4.4.4	Retention of fencing	What is the measure that determines when fencing shall be removed from rehabilitation works (i.e. tree height, stem diameter, number of stems etc)?

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Management Plan Consultation Feedback Form

Section	Type	Specific Feedback *Detail specific issues with certain sections in the document*
4.4.4	Hummock and low relief features	Engineered surface contours should be compatible with timber harvesting equipment. If not leveling of relief shall be necessary at relinquishment.
4.5.1	Saleable timber	FCNSW may salvage saleable timber if it is practical to do so.
4.5.3	Seed bank	As per comment of 4.4 – seeding is necessary, not a contingency. Also note, some species seed will not persist the life of the well. These species shall need assistance.
4.6.3	Decommissioned access tracks	Section 6.1 *Access Arrangement 2020* outlines FCNSW option to retain access tracks rather than rehabilitation by Santos.
7	Rehabilitation monitoring	Please send FCNSW the spatial data of these control sites so that they may be considered as part of prescribed burn planning.
Appendix C	Buried infrastructure (final dot point)	Sections 6.1.2 and 6.1.3(c) *Access Arrangement 2020* requires removal of all Facilities and underground infrastructure unless agreed with FCNSW.

This information is provided by Narrabri Shire Council

Our Reference:	DLA:MH:1950357
Your Reference:	SSD-6456-PA-22
Contact Name:	Donna Ausling

Ms Cassie Hay
Senior Environmental Advisor – Onshore Oil and Gas
Santos Ltd
32 Turbot Street
BRISBANE QLD 4000

Email: Cassie.Hay@santos.com

NARRABRI SHIRE
DISCOVER THE POTENTIAL

explore NARRABRI region

Thursday, 27 January 2022

Re: Narrabri Gas - Post Approval (SSD-6456-PA-22) – Produce Salt Beneficial Reuse and Disposal Study; Waste Management Plan; Rehabilitation Management Plan- Council Feedback

Dear Ms Hay

Thank you for the opportunity to provide comment on the abovementioned Plans. Council's consolidated feedback in this regard is provided herewith:

Produced Salt Beneficial Reuse and Disposal Study

It is noted that the submitted report identifies a number of businesses that will support to waste management activities that are currently located outside of the Region. These businesses are therefore encouraged, wherever reasonably practicable, to establish site operations within the Narrabri Local Government Area (LGA).

Transportation of waste materials (to be reused) does not appear to have been identified in previous Transport Management Plans for Santos. Consequently, any model to utilise the nominated by-product materials may be subject to a separate approvals process.

The Report mentions several negotiations with local Councils to dispose of waste. The particulars of these consultations have not been included in Appendix A, with details currently 'blank'. Since project inception there have been a number of changes to staff within the waste area across the Region, including within the Narrabri Shire Council. On this basis, Santos is encouraged to conduct routine and regular consultations with relevant Council personnel to ensure that lines of communication are maintained and available technical expertise can appropriately inform project decision-making processes.

Narrabri Shire Council
46 - 48 Maitland Street
PO Box 261, Narrabri NSW 2390

P. (02) 6799 6866
F. (02) 6799 6888

E. council@narrabri.nsw.gov.au
www.narrabri.nsw.gov.au

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Council is also currently investigating opportunities to increase the capacity of the Narrabri Landfill. As a consequence, ongoing communication with Council's Waste Division is recommended.

Council has been consistent in endeavouring to diversify the economy of the Narrabri Shire. It is considered that the gas industry would add the existing agriculture, mining and education industries to broaden and strengthen the economic base of the Shire. Council is in the process of developing an industrial estate titled the 'Northern NSW Inland Port' (N2IP) and is currently working with the NSW government as it investigates Narrabri Shire as a Special Activation Precinct (SAP).

With the commencement of a gas industry, N2IP and the SAP would welcome the attraction and arrival of a range of ancillary businesses that either use gas as a feedstock, or for the provision of cheaper base energy. Similarly, ancillary businesses able to use by-product generated from the extraction of gas is an industry category that both Council is committed to attracting to the Narrabri Shire. Council is of the opinion that ancillary industries such as algae farming, a zirconium processing facility and sodium bicarbonate would prosper in Shire, particularly given proximity to the source of the by-product. Therefore, strong consideration should be given to the establishment of any business that requires gas for energy, feedstock or any specialist by-product reuse ancillary organisation.

Waste Management Plan (Phase 1)

As detailed above, given the dynamic nature of waste management and associated environmental requirements, ongoing and routine liaison is needed with Council's Waste and Water Divisions. This approach will ensure that Council's Water Treatment and Waste Facilities can appropriately manage the volume and product type that will be disposed offsite. It is acknowledged that such premises have been identified throughout the Report as the receiving facility.

Rehabilitation Plan (Phase 1)

It is noted that the objectives of this Plan are:

- To ensure rehabilitation works address relevant regulatory requirements;
- To present the final end land-uses and preliminary completion criteria;
- To describe rehabilitation works proposed during Phase 1;

- To provide guidance on how topsoil and subsoil is managed to conserve the seed bank, nutrients and to promote the natural establishment of vegetation that will be self-sustaining in the long-term; and
- To establish a rehabilitation monitoring program to track progress of rehabilitation.

In relation to section 4.7 of the Plan, your attention is drawn to the NSW Department of Primary Industries (DPI) State Significant Agricultural Land (SSAL) Mapping Project. Further information in relation to this initiative is available from https://www.dpi.nsw.gov.au/agriculture/lup in the event that the development footprint intersects SSAL land.

Sections 6 - 7 of the draft Plan (pp.27 - 29) currently contains a series of referencing errors which require attention.

Thank you for the opportunity to provide feedback. Should you require any additional information or clarification in relation to this matter you are invited to contact Council's Strategic Planning Team or the undersigned on (02) 6799 6866, or by emailing council@narrabri.nsw.gov.au.

Yours faithfully

Donna Ausling
A/Director Planning, Strategy & People

Santos

Management Plan Consultation Feedback Form

DOCUMENT TITLE:	**Rehabilitation Management Plan (Condition B83)**
STAKEHOLDER:	**DPIE Water**
CONSULTATION RELEASE DATE:	**1 December 2021**
COMMENTS DUE DATE:	**Mid Jan 2022**

General Feedback	
Key Issues	Nil
Suggestions for improvement	DPE Water have reviewed the draft Rehabilitation Management Plan and have no concerns to raise.

Section	**Type**	**Specific Feedback** *Detail specific issues with certain sections in the document*

Santos

Management Plan Consultation Feedback Form

DOCUMENT TITLE:	**Rehabilitation Management Plan (Condition B83)**
STAKEHOLDER:	**Regional NSW - Mining, Exploration and Geoscience (MEG)**
CONSULTATION RELEASE DATE:	**1 December 2021**
COMMENTS DUE DATE:	**Mid Jan 2022**

General Feedback	
Key Issues	This assessment is for the Resources Regulator to conduct, not MEG.
Suggestions for improvement	

Section	**Type**	**Specific Feedback** *Detail specific issues with certain sections in the document*

Rehabilitation Management Plan - BSC comments received on Revision A (draft)

Item	Section #	Section heading	Existing text	Comment	Final response
1	Appendix A	Consent conditions	No specific text reference	There are inconsistencies between the Table A1 of the Biodiversity Management Plan (BMP) and Table B2 of the Rehabilitation Management Plan (RMP). This includes the BMP referring the reader to the RMP when addressing the following consent conditions: • Consent condition B49 • Consent Condition B51(h) (i, iii and iv) • Consent Condition B51(i) (ii, iii, vii, xii) However, the above-mentioned consent conditions are not referred to in Table B2 of the RMP. BCS recommends that the RMP is reviewed and reconciled with the conditions of consent and Table A1 of the BMP. In addition, BCS notes that some of these consent conditions have not been addressed in the content of the RMP, for example consent condition B51(h)(iii) states: "*describe the measures to be implemented within approved disturbance areas in the Project area to: maximise the salvage, transplanting and/or propagation of any threatened flora found during pre-clearance surveys, in accordance with the Guidelines for the Translocation of Threatened Plants in Australia (Vallee et al., 2004), where reasonable and feasible".* The measures to be implemented for the translocation of threatened flora has not been addressed. BCS recommends that the RMP is reviewed and reconciled with the conditions of consent and Table A1 of the BMP.	CoC B49 relates to ecological rehabilitation credit offsets, and the CoC Tables 8, 9 and 10. A brief section is included in the Biodiversity Offset Strategy (BOS) describing how ecological offset credits may be obtained through rehabilitation (as detailed in the condition). CoC B51(h)(i) relates to minimising the amount of clearing, and is described in section 6 of the BMP. The cross-reference to the RMP has been deleted. CoC B51(h)(iii) relates to salvage, transplanting and/or propagation of threatened flora during pre-clearance surveys. This is described in section 6 of the BMP and the cross-reference to the RMS has been deleted. CoC B51(h)(iv) relates to maximising the salvage of resources, including tree hollows, vegetation and soil resources, for beneficial reuse, including fauna habitat enhancement. This has been described in section 6 of the BMP and the cross-reference to the RMP has been removed. CoC B51(i)(ii) relates to the enhancement of the quality of vegetation, vegetation connectivity and wildlife corridors. This has been described in sections 6.1 and 6.2 of the RMP, with a cross-reference to the RMP provided in the BMP. CoC B51(i)(iii) relates to the introduction of naturally scarce fauna habitat features. This has been described in section 6 of the BMP and the cross-reference to the RMP has been removed. CoC B51(i)(vii) relates to the collection and propagation of seed from the local area. This has been described in Appendix 6.3 and 6.6 of the BMP and the cross-reference to the RMP has been removed. CoC B51(i)(xii) relates to controlling access to vegetated and revegetated areas. This has been described in section 6.3 of the BMP, and in section 9 and Appendix D of the RMP.
2	4.2 4.3	Rehabilitation domains	No specific text reference	Consent condition B83(g) requires that the RMP includes: "*Detailed performance and completion criteria for evaluating the performance of the rehabilitation of the project area, and for triggering remedial actions*". However, Section 4.3 of the RMP only provides performance indicators i.e. indicators that remediation efforts are performing according to expectations or on a trajectory towards success. BCS consider preliminary performance indicators important for measuring trajectory towards completion, via monitoring, however this does not preclude the need for completion criteria i.e. a defined quantifiable target representing that rehabilitation efforts have achieved success. As an example, a completion criterion for remediation activities may be "*remediation efforts have resulted in a self-sustaining ecosystem indicated by [X value compositional, structural and functional attributes being measured], no further remediation actions required*". BCS recommend that Section 4.2 is updated to address the requirement of consent condition B83(g) for completion criteria. All completion criteria should include tailored, quantitative performance measures and targets which adhere to SMART principles (specific, measurable, achievable, realistic, timely).	As specified in section 1.2, this RMP has been prepared on a staged basis in accordance with CoC A23 and specifically addresses the activities proposed during Phase 1 of the Project only. No facilities are proposed to be decommissioned during Phase 1 and as such this version of the RMP is for the purpose of partial and progressive rehabilitation of new exploration and appraisal works only. Final rehabilitation will be undertaken following decommissioning of infrastructure and removal of equipment and materials from well pads, water storage facilities and laydown areas. Table 9.1 has been updated to provide completion criteria, however it is to be noted that only very limited partial and progressive rehabilitation will be undertaken as part of Phase 1. Note that the rehabilitation schedule is provided in section 11.

Item	Section #	Section heading	Existing text	Comment	Final response
3	4.3	Rehabilitation objectives,	No specific text reference	BCS also note that the preliminary performance indicators do not contain triggers for remedial action. Triggers for remedial action should form a key aspect of the preliminary performance indicator table. BCS recommends this Section 4.2 is updated with tailored, quantitative trigger points for corrective action which adhere to the SMART principles.	A two-tiered trigger action response plan (TARP) has been included as a new section 13.2. The first tier provides early indications of trends, with the second tier providing qualitative and quantitative triggers. The TARP will be updated and revised for Phase 2, to be specific to the rehabilitation activities required for each of the Project operational sites.
4	7	Rehabilitation monitoring	No specific text reference	Section 7 details the rehabilitation monitoring which is proposed to be undertaken for the project. This Section mentions assessing the status of rehabilitation and completion criteria, however the relationship between the monitoring activities proposed and the performance indicators and completion criteria within Section 4.3 of the RMP are unclear. BCS recommends that monitoring for the RMP should be informed by and measured according to the performance indicators and completion criteria detailed within Section 4.2 of the RMP.	As specified in section 1.2, this RMP has been prepared on a staged basis in accordance with CoC A23 and specifically addresses the activities proposed during Phase 1 of the Project only. No facilities are proposed to be decommissioned during Phase 1 and as such this version of the RMP is for the purpose of partial and progressive rehabilitation of new exploration and appraisal works only. The rehabilitation monitoring program will be based on the pre-disturbance conditions, and the results and findings of the biodiversity monitoring program at the infrastructure sites. Once these details are available, the rehabilitation monitoring program can be further developed and adapted. In turn, the performance indicators and completion criteria can be finalised to achieve the required outcomes.
5	4	Rehabilitation management	No specific text reference	Section 4 details the assisted natural regeneration methods proposed to be undertaken for the project. BCS suggest that for certain domains which will require the removal of native vegetation i.e. linear and non-linear domains, brush-matting using recently felled vegetative material may be an effective assisted natural regeneration method worth considering.	The following text has been added to the non-linear and linear infrastructure sections 10.2 and 10.3 respectively: *Brush-matting using previously stored woody debris and vegetative material may be applied to assist natural regeneration*.
6	4.5	Domain 1 Non-linear infrastructure	No specific text reference	Section 4.5 of the RMP details the rehabilitation activities which would be conducted in specific domains. All domains include reference to the salvage and storage of logs, hollows and woody debris. However, the circumstances and timing of the re-installation of these salvaged materials are not clearly articulated within each domain's detailed rehabilitation activities. BCS recommends that this is detailed in the RMP.	The circumstances and timing of re-installation of retained woody material are detailed in section 11, in tables 11.1-11.3.
7	Appendix D	Regeneration, seeding and planting	No specific text reference	Appendix D of the RMP states that procedures for natural regeneration will include: "*Spreading of woody debris including hollows and logs across rehabilitation area. Logs can be positioned across slopes to reduce erosion*." Condition B51(i) of the development consent for Narrabri Gas states the Biodiversity Management Plan must: "*Describe the measures to be implemented in the project area to:* *(i) minimise impacts on fauna habitat resources such as hunting and foraging areas, habitat trees, fallen timber and hollow-bearing trees* *(ii) enhance the quality of vegetation, vegetation connectivity and wildlife corridors including through the assisted regeneration and/or targeted revegetation of appropriate canopy and sub-canopy, understory and ground strata* *(iii) introduce naturally scarce fauna habitat features such as nest boxes and salvaged tree hollows and promote the use of these introduced habitat features by threatened species*." Section 6.4 of the Project Commitments made by Santos states that: "*The removal of hollow-bearing trees with a hollow of greater than 300mm in diameter will be offset by a 1:1 replacement*." Given the above, BCS recommend that the RMP clearly details the method proposed for the reinstallation of salvaged hollows into retained trees within adjacent vegetation.	The CoC requires the BMP to describe the measures to be implemented in relation to nest boxes and salvaged tree hollows. The BMP is currently silent on nest boxes and replacement of hollows. Once these details are available, the RMP will be updated to incorporate the relevant information in the rehabilitation performance indicators, completion criteria and the associated monitoring program.

Note:
The numbering of the sections and appendices between the draft and final version of the document may have changed.

Rehabilitation Management Plan - FCNSW comments received on Revision A (draft)

Item	Section #	Section heading	Existing text	Comment	Final response
1	3.1.3	EPL 20350	No specific text reference	Santos have agreed to use gravel from State forest in lieu of other sources of material (section 10.2 *Access Arrangement 2020*). If the residual drilling material (RDM) is being used for practical purposes it shall be accounted for as per Schedule 3 *Access Arrangement 2020*.	As discussed at the meeting of 22 March 2022, residual drill cuttings are a by-product of well construction and are proposed to be beneficially reused in rehabilitation of well leases, as permitted under Environment Protection Licence (EPL) 20350, instead of disposing of offsite. The cuttings are not quarry products and are not being extracted for the purpose of building roads or other hardstand areas and therefore should not be account as per Schedule 3 of the Access Arrangement.
2	Table 4.1	Rehabilitation objectives	No specific text reference	Santos have agreed to remove all Facilities from State forest unless agreed with FCNSW (section 6.1.2 *Access Arrangement 2020)*	The text in Appendix C has been amended by an additional dotpoint, as follows: • all facilities and underground infrastructure will be removed from State forests, unless agreed with FCNSW.
3	4.4	Rehabilitation methods	Rehabilitation during Phase 1 of the Project will principally follow natural regeneration methods with assisted regeneration methods used as necessary (excluding domain 4 on agricultural land). Natural regeneration is considered appropriate for this environment and this approach is supported by FCNSW.	The definition of Plug and Abandon *(Access Arrangement 2020)* describes areas disturbed by Santos as having to be seeded with local timber species.	The text in sections 10.2, 10.3 and 10.4 has been amended as follows: *Rehabilitation during Phase 1 of the Project will principally follow natural regeneration methods with assisted regeneration methods used as necessary (excluding domain 4 on agricultural land). Where required by the FCNSW Access Arrangement, disturbed areas will be seeded with local native forest timber species.*
4	4.4.3	Post ground disturbance works / during rehabilitation	No specific text reference	Please send FCNSW the coordinates of areas of State forest where RDM has been incorporated into ground surface	The text in section 10.1.3 has been amended as follows: *The coordinates of areas of State forest where RDM has been incorporated into ground surface will be provided to FCNSW.* Santos will provide FCNSW spatial information for RDM incorporation locations, historic heritage sites, rehabilitation sites and proposed monitoring sites.
5	4.4.4	Final rehabilitation	Within areas of State forest, the FCNSW will be consulted to provide advice on preparation techniques and the management of resultant regeneration to encourage vegetation communities compatible with FCNSW land use objectives for the area.	What is the measure that determines when fencing shall be removed from rehabilitation works (i.e. tree height, stem diameter, number of stems etc)?	Santos will consult with FCNSW to agree on the revegetation standards and to determine when rehabilitation objectives have been achieved. Fencing will remain until the rehabilitation is accepted and signed off by the Resources Regulator.
6	4.4.4	Final rehabilitation	The following actions will be undertaken as final rehabilitation activities: • replacement of subsoil, surface contouring through ploughing and the creation of 'hummock' and low relief features similar to the surrounding area, and partially compacting; • placing topsoil uniformly across the well pads and grading to natural levels;	Engineered surface contours should be compatible with timber harvesting equipment. If not leveling of relief shall be necessary at relinquishment.	Santos will grade the well pads to natural levels prior to final rehabilitation, and construct surface contours similar to the surrounding area.
7	4.5.1	Domain 1 - Non-linear infrastructure Prior to disturbance	During construction activities, logs, hollows and woody debris will be salvaged and stored. Saleable timber will be salvaged and stored for FCNSW.	FCNSW may salvage saleable timber if it is practical to do so.	The text has been amended as follows: *During construction activities, logs, hollows and woody debris will be salvaged and stored. Saleable timber will be salvaged and stored for FCNSW. FCNSW may salvage saleable timber if it is practical to do so.*
8	4.5.3	Domain 1 - Non-linear infrastructure Stage 2 - Final rehabilitation	Assisted regeneration through planting or direct seeding will be used as a contingency measure.	As per comment of 4.4 - seeding is necessary, not a contingency. Also note, some species seed will not persist the life of the well. These species shall need assistance.	The text has been amended as follows: *Where required by the FCNSW Access Arrangement, disturbed areas will be seeded with local native timber species. Assisted regeneration through planting will be used as a contingency measure.*

Item	Section #	Section heading	Existing text	Comment	Final response
9	4.6.3	Domain 2 - Linear infrastructure Stage 2 - Final rehabilitation	Final rehabilitation of access tracks and gas and water gathering systems will include minor re-shaping of tracks to mimic natural ground surface and reduce areas of compacted soil, the spreading of woody material and weed management. The overstorey (if present in surrounding lands) will be allowed to regenerate over time to mimic surrounding landscape and vegetation communities.	Section 6.1 *Access Arrangement 2020* outlines FCNSW option to retain access tracks rather than rehabilitation by Santos.	The following text has been added to the paragraph: *It is to be noted that under the Access Arrangement, FCNSW has the option to retain any access tracks rather than these being rehabilitated by Santos.*
10	7	Rehabilitation monitoring	Progress of the rehabilitation sites compared to the controls and the benchmark data will be achieved through regular annual monitoring (see Biodiversity Management Plan for further details).	Please send FCNSW the spatial data of these control sites so that they may be considered as part of prescribed burn planning.	The following text in section 12 has been added to the paragraph: *The spatial data of the control sites will be provided to FCNSW to allow consideration as part of prescribed burn planning.* Santos will provide FCNSW spatial information for RDM incorporation locations, historic heritage sites, rehabilitation sites and proposed monitoring sites
11	Appendix C	Topsoil management and rehabilitation	Where services are buried (e.g. gas and water gathering systems classified as Domain 2), infrastructure will be left in situ to avoid further disturbance. This will only be appropriate where the infrastructure will not affect final land use. Locations must be surveyed and mapped for identification by future land holders.	Sections 6.1.2 and 6.1.3(c) *Access Arrangement 2020* requires removal of all facilities and underground infrastructure unless agreed with FCNSW.	The text in Appendix C has been amended as follows: • *all facilities and underground infrastructure will be removed from State forests, unless agreed with FCNSW*. Where services are buried (e.g. gas and water gathering systems classified as Domain 2), infrastructure *may be best* left in-situ to avoid further disturbance. This will only be appropriate where the infrastructure will not affect final land use *and as agreed with FCNSW*. Locations must be surveyed and mapped for identification by future land holders.

Note:
The numbering of the sections and appendices between the draft and final version of the document may have changed.

Rehabilitation Management Plan - NSC comments received on Revision A (draft)

Item	Section #	Section heading	Existing text	Comment	Final response
1	General	N/A	No specific text reference	It is noted that the objectives of this Plan are: • To ensure rehabilitation works address relevant regulatory requirements; • To present the final end land uses and preliminary completion criteria; • To describe rehabilitation works proposed during Phase 1; • To provide guidance on how topsoil and subsoil is managed to conserve the seed bank, nutrients and to promote the natural establishment of vegetation that will be self-sustaining in the long-term; and • To establish a rehabilitation monitoring program to track progress of rehabilitation.	No response required
2	4.7	Domain 4 – Agricultural land	No specific text reference	In relation to section 4.7 of the Plan, your attention is drawn to the NSW Department of Primary Industries (DPI) State Significant Agricultural Land (SSAL) Mapping Project. Further information in relation to this initiative is available from https://www.dpi.nsw.gov.au/agriculture/lup in the event that the development footprint intersects SSAL land.	The SSAL mapping program is currently in a very early draft stage, however any SSAL will be taken into consideration during Project development. Where relevant, the SSAL process will be fully detailed in the Field Development Plan.
3	6	Final land use and landform design	No specific text reference	This section of the draft Plan currently contains a series of referencing errors which require attention	The reference error has been corrected.
4	7	Rehabilitation monitoring	No specific text reference	This section of the draft Plan currently contains a series of referencing errors which require attention	The reference error has been corrected.

Note:
The numbering of the sections and appendices between the draft and final version of the document may have changed.

Rehabilitation Management Plan - EPA comments received on Revision A (draft)

Item	Section #	Section heading	Existing text	Comment	Final response
1	N/A	N/A	No specific text reference	The plan can be strengthened by replacing loose language and indeterminate terms, such as, ‘should, where reasonable, may’, as these words point at best practice but are not definitive or binding.	The whole document has been reviewed, and where applicable, the terms ‘should’, ‘would’, ‘where reasonable’ and ‘may’ have been strengthened. Note that the terms ‘should’, ‘would’, ‘where reasonable’ and ‘may’ are used extensively in the consent conditions. Where the relevant conditions have been reproduced in full in this document, in these instances the above terms have not been removed.
2	N/A	N/A	No specific text reference	There are no transparent and auditable thresholds or ‘completion’ targets outlined in the Plan which presents a risk of not delivering adequate environmental outcomes.	Rehabilitation completion criteria have been developed and are presented in Table 9.1.

Note:
The numbering of the sections and appendices between the draft and final version of the document may have changed.

Appendix B - Compliance conditions relevant to this Plan

Table B1 - SSD 6456 consent conditions directly relevant to this RMP

SSD 6456 consent conditions directly relevant to this RMP	Section reference
Consent condition A1 In meeting the conditions of this consent, the Applicant must implement all reasonable and feasible measures to prevent and, if prevention is not reasonable and feasible, minimise any material harm to the environment that may result from the construction, operation or rehabilitation of the development.	Section 1.2
Consent condition A5 The Applicant may only undertake the development in the following stages:	
(a) Phase 1, comprising ongoing exploration and appraisal activities;	Section 1.1.2 Section 1.2
(b) Phase 2, comprising construction activities for production wells and related infrastructure;	
(c) Phase 3, comprising gas production operations; and	
(d) Phase 4, comprising gas well and infrastructure decommissioning, rehabilitation and mine closure.	
Consent condition A23 With the approval of the Planning Secretary, the Applicant may:	
(a) prepare and submit any strategy, plan or program required by this consent on a staged basis (if a clear description is provided as to the specific stage and scope of the development to which the strategy, plan or program applies, the relationship of the stage to any future stages and the trigger for updating the strategy, plan or program	Section 1.2
(b) combine any strategy, plan or program required by this consent (if a clear relationship is demonstrated between the strategies, plans or programs that are proposed to be combined);	No combination proposed as part of this Plan
(c) update any strategy, plan or program required by this consent (to ensure the strategies, plans and programs required under this consent are updated on a regular basis and incorporate additional measures or amendments to improve the environmental performance of the development); and	Section 1.2 Section 16.3
(d) combine any strategy, plan or program required by this consent with any similar strategy, plan or program required by a consent	No combination proposed as part of this Plan
Consent condition B49 If the Applicant meets the ecological rehabilitation completion criteria in the Rehabilitation Management Plan to the satisfaction of BCD [BCS], then the Applicant may use the rehabilitated land to offset the relevant ecosystem and/or species credit liability for the 'Residual Credits' in Tables 8, 9 and 10. Ecological rehabilitation credits may be offset at a rate of: (a) 12 credits per hectare for plant community types in Table 8; (b) 7.1 credits per individual for relevant flora species in Table 9; and (c) 7.1 credits per hectare of suitable habitat for relevant fauna species in Table 10. Ecological rehabilitation credit offsets may only be sought for: • plant community types in Table 8; • flora and fauna species identified as 'Yes' to ecological rehabilitation in Tables 9 and 10; and • flora and fauna species identified as 'Potential' to ecological rehabilitation in Tables 9 and 10, subject to the Applicant demonstrating that the relevant species is suitable for ecological rehabilitation, to the satisfaction of the BCD	Not applicable to Phase 1.

<table>
<tr><td>[BCS].</td><td></td></tr>
<tr><td>

Consent condition B81

The Applicant must rehabilitate all areas of the project area affected by the development to the satisfaction of the Resources Regulator and EPA. This rehabilitation must be generally consistent with the proposed rehabilitation activities described in the document/s listed in condition A2(c), and comply with the objectives in Table 11.

<table>
<tr><td>All areas of the project area affected by the development</td><td>• Safe, stable and non-polluting; and
• Fit for the intended post-mining land use/s.</td></tr>
<tr><td>Areas proposed for Ecological Rehabilitation</td><td>• For each plant community type, establish self-sustaining native woodland ecosystems that meet the performance and completion criteria approved under the Rehabilitation Management Plan;
• For each threatened flora species, establish a self-sustaining population that meets the performance and completion criteria approved under the Rehabilitation Management Plan; and
• For each threatened fauna species, establish self-sustaining habitat that meets the performance and completion criteria approved under the Rehabilitation Management Plan.</td></tr>
<tr><td>Areas proposed for native woodland</td><td>• Restore self-sustaining native woodland ecosystems using species found in the local area and complement the areas proposed for Ecological Rehabilitation;
• Establish areas of self-sustaining:
– riparian vegetation, within any diverted and/or re-established creek lines and retained water features;
– habitat resources for threatened flora and fauna species; and
– vegetation connectivity and wildlife corridors, as far as is reasonable and feasible.</td></tr>
<tr><td>Areas proposed for agricultural land</td><td>• Establish/restore agricultural areas to support sustainable agricultural activities; and
• No reduction in land and soil capability class.</td></tr>
<tr><td>Surface infrastructure</td><td>• To be decommissioned and removed, unless the Resources Regulator agrees otherwise.</td></tr>
<tr><td>Wells and gas field infrastructure</td><td>• Wells to be progressively decommissioned and rehabilitated in accordance with the Code of Practice for Coal Seam Gas Well Integrity (2012, as may be updated or amended);
• Well cementing to include sub-vertical and horizontal well sections, where reasonable and feasible; and
• Gas field infrastructure to be progressively decommissioned and rehabilitated in accordance with the Exploration Code of Practice Rehabilitation (2017, as may be updated or amended).</td></tr>
</table>

</td><td>Rehabilitation objectives in Table 1.1
Rehabilitation domains in section 6
Objectives in Section 7.1 and 7.2
Completion criteria in section 9.1</td></tr>
</table>

Rehabilitation materials	• Materials from areas disturbed under this consent (including topsoils, substrates and seeds) are to be recovered, managed and used as rehabilitation resources, to the greatest extent practicable.	
Water quality	• Water retained in the project area is fit for the intended post-mining land use/s; and • Water discharged from tile development is suitable for receiving waters and fit for aquatic ecology and riparian vegetation.	
Community	• Ensure public safety; and • Minimise adverse socio-economic effects associated with petroleum development closure.	
***Note**: The rehabilitation objectives detailed in Table 11 apply to the entire Project area, including all landforms constructed under either this consent or previous consents.*		
Consent condition B82 The Applicant must rehabilitate the development progressively, that is, as soon as reasonably practicable following disturbance. All reasonable steps must be taken to minimise the total unrehabilitated disturbed area. Interim stabilisation and temporary vegetation strategies must be employed when areas prone to dust generation, soil erosion and weed incursion cannot be permanently rehabilitated.		Section 10 Section 11
Consent condition B83 Prior to the commencement of Phase 1, the Applicant must prepare a Rehabilitation Management Plan for the development to the satisfaction of the Resources Regulator. This plan must:		This document
(a)	be prepared by a suitably qualified and experienced person/s;	Section 1.3
(b)	be prepared in consultation with the Department, EPA, DCCEEW Water, FCNSW, BCD [BCS], MEG and Council;	Section 1.5 and Appendix A
(c)	be prepared in accordance with any relevant MEG code of practice and/or guideline;	Section 3.2.1
(d)	describe how the rehabilitation of the project area would achieve the objectives identified in Table 11 of the CoC and be integrated with the measures in the Biodiversity Management Plan;	Table 1.1 Section 6 Section 9 Table 9.1
(e)	include detailed petroleum mining plan closure and final landform designs;	Sections 6.5
(f)	include a detailed plan for the reinstatement and review of the proposed:	
(i)	ecological rehabilitation and native woodland areas, including a protocol for progressive reviews to demonstrate that the target vegetation communities are being achieved; and	Section 9.1 and BMP
(ii)	agricultural land rehabilitation;	Section 9.1 and BMP Section 6.4 Section 10.5
(g)	include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the project area, and for triggering remedial action;	Section 9.1
(h)	include protocols and procedures for testing and management of drill cuttings used for rehabilitation of well pads to ensure the materials are fit for purpose to achieve rehabilitation objectives;	Appendix F - RDM Protocol
(i)	describe the measures to be implemented to ensure compliance with the relevant conditions of this consent, and address all aspects of rehabilitation including closure and final land use/s;	Section 10

(j)	include a program to monitor, independently audit and report on the effectiveness of the measures in paragraph (i), and progress against the detailed performance and completion criteria in paragraph (g);	Section 12 Section 16.1
(k)	to the greatest extent practicable build on and integrate with the other management plans required under this consent; and	Extensive integration with relevant plans: ESCP (Table 9.1, RDM) Waste MP (sections 3.1.3, 10.4.3.1, Table 9.1) BMP (Table 9.1)
(l)	include detailed scheduling for progressive rehabilitation to be initiated, undertaken and/or completed over the next 3 years.	Section 11
Consent condition B84 The Applicant must implement the Rehabilitation Management Plan once approved by the Planning Secretary.		This document
Consent condition D3 The Applicant must ensure that (where relevant) the management plans required under this consent include:		
(a)	a summary of relevant background or baseline data;	Section 4
(b)	details of:	
(i)	the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 3
(ii)	any relevant limits or performance measures and criteria; and	Section 9
(iii)	the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	Section 9
(c)	any relevant commitments or recommendations identified in the documents that together comprise the NGP EIS;	Section 3
(d)	a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria;	Section 10
(e)	a program to monitor and report on the:	
(i)	impacts and environmental performance of the Project; and	Section 12
(ii)	effectiveness of the management measures set out pursuant to paragraph (d);	Section 12
(f)	a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 13
(g)	a program to investigate and implement ways to improve the environmental performance of the development over time	Section 16.4
(h)	a protocol for managing and reporting any:	
(i)	incident, non-compliance or exceedance of any impact assessment criterion and performance criterion;	Section 15 .1
(ii)	complaint; or	Section 15.2
(iii)	failure to comply with other statutory requirements; and	Section 15.1
(i)	a protocol for periodic review of the plan.	Section 16.3
Consent condition D4 Within 2 months of:		Section 16.3

(a) the submission of an incident report; (a) the submission of an Annual Review; (b) the submission of an Independent Environmental Audit; (c) the submission of a Field Development Plan; (d) the submission of a Groundwater Model Update; or (e) the approval of any modification of the conditions of this consent, the Applicant must review the suitability of existing strategies, plans and programs required under this consent.:	
Consent condition D5 If the review determines that the strategies, plans and programs required under this consent require revision – to either improve the environmental performance of the development, cater for a modification or comply with a direction - then the Applicant must submit the revised document to the Secretary for approval within 6 weeks of the review. ***Note***: *This is to ensure strategies, plans and programs are updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the development.*	Section 16.3
Consent condition D6 The Applicant must notify the Department and any other relevant agencies via the Major Projects Portal immediately after it becomes aware of the incident. This notice must describe the location and nature of the incident.	Section 15.1
Consent condition D7 Within 7 days of becoming aware of a non-compliance with the conditions of this consent, the Applicant must notify the Department of the non-compliance via the Major Projects Portal. This notice must set out the non-compliance, the reasons for the non-compliance (if known) and what actions have been taken, or will be taken, to address the non-compliance. ***Note***: *A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance*	Section 15.1
Consent condition D8 By the end of March each year, unless the Planning Secretary agrees otherwise, the Applicant must submit an Annual Review of the environmental performance of the development to the Department via the Major Projects Portal.	Section 16.1
Consent condition D9 Within one year of commencement of Phase 1 and every 3 years thereafter, unless the Planning Secretary directs otherwise, the Applicant must commission and pay the full cost of an Independent Environmental Audit of the development.	Section 16.2
Consent condition D13 From the commencement of Phase 1, until the completion of all rehabilitation required under this consent, the Applicant must:	
(a) make copies of the following information publicly available on its website: ▪ the document/s listed in condition A2(c); ▪ current statutory approvals for the development; ▪ approved strategies, plans and programs; ▪ detailed plans for the Phases of the development; ▪ minutes of CCC and Advisory Group meetings; ▪ regular reporting on the environmental performance of the development in accordance with the reporting requirements in any plans or programs approved under the conditions of this consent; ▪ a comprehensive summary of the monitoring results of the development,	Section 1.8 Section 15.2 Section 7.4

reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs; ▪ a summary of the current phase/s and progress of the development; ▪ contact details to enquire about the development or to make a complaint; ▪ a complaint register, updated monthly; ▪ a record of all incidents and non-compliances; ▪ the Annual Reviews of the development; ▪ audit reports prepared as part of any Independent Environmental Audit of the development and the Applicant's response to the recommendations in any audit report; and any other matter required by the Planning Secretary; and	
(b) keep such information up to date.	Section 1.8 Section 16.4

Table B2 - Mandatory requirements of Exploration Code of Practice: Rehabilitation

Mandatory requirement	Section reference
1. Prior to the commencement of an activity, the title holder must conduct a risk assessment to evaluate the range of potential threats and opportunities associated with rehabilitating disturbed areas to a condition that can support the intended final land use(s).	Section 5
2. No later than 14 days prior to the commencement of any surface disturbance activity associated with an assessable prospecting operation, the title holder must provide to the Secretary[7]: (a) a copy of clear, specific, achievable and measurable rehabilitation objectives and completion criteria for activities associated with that activity, developed in consultation with relevant landholders, and (b) if associated with higher-risk prospecting operations, a copy of a Rehabilitation Management Plan which provides for the effective rehabilitation of areas disturbed by that activity.	Section 7, 8 and 9
3. The title holder must develop, implement and complete a rehabilitation program (which includes a monitoring program) to rehabilitate disturbed areas to a condition that can support the intended final land use(s).	Section 12 Section 14
4. For prospecting titles issued under the *Mining Act 1992*, the title holder must commence rehabilitation of a site as soon as reasonably practicable following the completion of activities on that site, or as otherwise directed by the Minister.	Not applicable
5. For prospecting titles issued under the *Petroleum (Onshore) Act 1991*, the title holder must commence rehabilitation of a site as soon as practicable following the completion of activities on that site.	Section 11
6. The title holder must keep and maintain the records set out in the following table (as applicable).	Section 1.8 Section 14
• Rehabilitation risk assessments, and any updates made from time to time to improve the effectiveness of risk controls during the term of a prospecting title	Section 5
• Rehabilitation requirements agreed to by landholders	Section 6.4 Section 10.5
• Photographs of the baseline conditions of disturbed areas, disturbance caused by exploration activities and showing completed rehabilitation works • Records of actual methodologies used to rehabilitate the site (e.g. species utilised, fertiliser rate, details of ripping and scarifying, timing of sowing, sowing rates, seedling planting density, origin of seed, rainfall etc.) • Environmental incident reports, corrective and preventative actions • Records of care and maintenance activities undertaken on rehabilitation areas • Outcomes of rehabilitation inspections and monitoring programs • Assessments of rehabilitation performance against the nominated rehabilitation objectives and completion criteria • Records of surveying, sealing and decommissioning of boreholes and petroleum wells	Section 6.4 Section 10 Section 12 Section 14

[7] The Secretary of the Department of Regional NSW.

Appendix C - Topsoil management and rehabilitation

For the purposes of this rehabilitation strategy, 'topsoil' is considered to be the 'O' and 'A' horizons of the soil profile. Reference is also made in the sections below to 'subsoil', which for the purposes of this document is considered to be all soil horizons below the A horizon. Subsoil will be stockpiled separately to topsoil. Whilst both topsoil and subsoil will need to be managed appropriately, greater emphasis is placed on the management of topsoil as this soil layer is of particular importance to achieving rehabilitation objectives.

It is recommended to keep a database of topsoil information, including volume, locations and quality of stockpiled topsoil, applied treatments (e.g. weed control) and the topsoil volume required for rehabilitation. Use photographs, written descriptions and GIS to record information. This will greatly assist with the rehabilitation effort after extended periods of time.

The procedures and guidelines listed below are partially adapted from *Managing Urban Stormwater: Soils and Construction - Volume 1* (Landcom, 2004), more commonly known as the 'Blue Book', *and Volume 2E - Mines and Quarries*, both of which should be referred to for further information. Further guidance is also provided in the Erosion and Sediment Control Plan.

Prior to ground disturbance works

Micro-siting of infrastructure will be undertaken in accordance with the Field Development Protocol and Ecological Scouting Framework. Micro-siting refers to the practise of precisely locating a piece of field infrastructure to maximise avoidance of the most sensitive features and minimise impacts. Details of micro-siting procedures are provided in the Field Development Protocol.

Undertake documentation and analysis using photographs of site landforms to inform re-shaping of natural ground surface.

During ground disturbance works

- undertake topsoil and subsoil stripping and handling when soils are moist to minimise deterioration of soil structure;
- topsoils and subsoils should be stockpiled separately to prevent cross contamination;
- stockpiles should be stored according to PCT, allowing the rehabilitation of correct species in the designated vegetation type;
- retain felled woody materials (hollows, logs, branches and woody debris) for use in native rehabilitation, temporary groundcover or incorporation back into soils;
- store stockpiles of soil 2-5 m away from highly trafficked areas, concentrated water flows and existing vegetation, and preferably on flat areas to minimise erosion and soil loss. Position stockpiles 2-3 m high to encourage biological activity. Construct on the contour as low, flat, elongated mounds where necessary;
- consider matting on soil stockpiles or vegetating stockpile with a sterile cover crop, to reduce compaction, soil loss and weed infestation; and
- consider installing signage on stockpiles to identify the area and minimise unauthorized disturbance.

During operational phase

- monitor soil stockpiles for weed infestations and erosion and undertake treatment as necessary;

During rehabilitation works

- if rehabilitation activities are delayed due to unsuitable seasonal conditions, consider temporary erosion and sediment control measures such as sterile cover crops;
- consider site specific constraints including topsoil availability and quality, and presence of weeds required to achieve the nominated Rehabilitation Objectives and Completion Criteria;
- prior to applying topsoil, ensure all weed infestations are controlled on stockpiles to minimise the spread of weeds to rehabilitation areas and adjacent vegetation;
- replace subsoil, contouring to the landscape and partially compacting;
- if severe erosion or compaction has occurred, consider scarifying or ripping the rehabilitation area in parallel with the contour;
- prior to direct seeding, rip rehabilitation surfaces parallel with contours to provide an adequate seed bed;
- if topsoil shortages are identified, alternatives such as organic growth mediums may be used to supplement natural topsoil. This option should be avoided and any risks to the establishment of the target PCT should be considered;
- leave areas that have been respread with a scarified surface to reduce soil erosion and encourage water infiltration; and
- all facilities and underground infrastructure will be removed from State forests, unless agreed with FCNSW. Where services are buried (e.g. gas and water gathering systems classified as Domain 2), infrastructure may be best left in situ to avoid further disturbance. This will only be appropriate where the infrastructure will not affect final land use and as agreed with FCNSW. Locations must be surveyed and mapped for identification by future land holders.

Appendix D - Regeneration, seeding and planting

Procedures for natural regeneration

- retain existing fencing where appropriate to protect regeneration from native and feral animal herbivory. Consider installing temporary fencing in areas with no existing fencing or pest animal control in accordance with the Biodiversity Management Plan;
- all fencing will be removed once vegetation reaches maturity and can withstand grazing impacts;
- treat any weeds in accordance with the Biodiversity Management Plan;
- replace topsoil on site following procedures for topsoil management in Appendix C;
- spread woody debris including hollows and logs across rehabilitation area. Logs can be positioned across slopes to reduce erosion; and
- monitor weed incursions and treat as necessary following the Pest Plant and Animal Management Plan.

Procedures for direct seeding

- ripping of areas to be direct seeded should be undertaken during dry soil conditions, following control of all weeds in accordance with the Biodiversity Management Plan;
- direct seeding has the best chance of success if undertaken during the optimum period of growth for the majority of species being seeded;
- undertake direct seeding as soon as possible after ripping or scarifying. Re-ripping may need to be undertaken if seeding is delayed breaking up any crusting that has occurred; and
- monitor weed incursions and treat as necessary in accordance with the Biodiversity Management Plan.

Procedures for tubestock planting

- improved aeration and infiltration of water into the soil can be achieved through deep ripping. Ripping can be done with a bulldozer, or three-point linkage rippers on a tractor (or similar). Planting lines should be ripped to a depth of at least 300 mm if possible;
- any required ripping should be conducted after rain if possible;
- planting of seedlings should be undertaken during winter or spring to minimise stress and encourage strong root development;
- supplementary watering may be required for the first six weeks following planting, depending on rainfall and other climatic conditions;
- if watering is required beyond six weeks, plants should be watered infrequently with a large amount of water to encourage deep root establishment; and
- tubestock should be supplied in Hiko tubes where possible in preference to Forestry tubes. Hiko tubes provide survival rates comparable to Forestry tubes at a reduced cost for supply and installation.
- control weeds and pest animals prior to planting in accordance with the Biodiversity Management Plan;
- space plants according to target PCT vegetation formation. This information will be based on PCT benchmark data. Spacing will approximate the following densities:
    - groundcover 2-4 plants per m^2
    - shrub / midstorey: 1 plant per 2 m^2
    - canopy: 1 plant per 10 m^2
- contractors for planting should be reputable with a demonstrable history of successful revegetation;
- dig a hole using a heavy-duty planting spade or mattock, approximately 3 times larger than

the seedling pot;

- remove plastic pot with care to reduce disturbance to seedling roots. Plant seedling below soil level and back-fill the hole with soil taken from the hole and replace surrounding mulch;
- ensure stems are upright and soil is compressed, with enough compaction so the seedling can withstand being lifted out with a gentle pull. Ensure soil is not piled around the seedling as this will allow water to run off;
- create a small dam around the stem to encourage water to pool and enter around the base of seedling into the root zone; and
- tree guards are not appropriate for this environment as they are ineffective against large herbivores including kangaroos.

Appendix E - Species appropriate for use in revegetation

Species appropriate for use in revegetation were based on PCT descriptions from the BioNet Vegetation Classification database (OEH, 2019). Following exploration activities and finalisation of impact area, seed amounts and species mix for each PCT will be determined. Species mix will be informed by benchmark data from the respective PCT and vegetation formation. For example, large canopy species will be planted at lower densities per hectare in woodland compared to dry sclerophyll forest where they will be planted at higher densities.

Table E1 - Species appropriate for use in revegetation

PCT ID	Plant Community Type	Dominant species for revegetation	Potential midstorey species for revegetation
27	Weeping Myall open woodland of the Darling Riverine Plains Bioregion and Brigalow Belt South Bioregion	*Acacia pendula* *Casuarina cristata* *Capparis mitchelii*	*Geijera parviflora* *Rhagodia spinescens* *Capparis lasiantha* *Acacia oswaldii* *Acacia salicina*
35	Brigalow - Belah open forest / woodland on alluvial often gilgaied clay from Pilliga Scrub to Goondiwindi, Brigalow Belt South Bioregion	*Acacia harpophylla* *Casuarina cristata (clay soil areas)* *Eucalyptus populnea subsp. bimbil (sandy soil areas)* *Eucalyptus pilligaensis (Eucalyptus woollsiana) (sandy soil areas)*	*Geijera parviflora* *Eremophila desertii* *Apophyllum anomalum* *Enchylaena tomentosa* *Pittosporum angustifolium* *Capparis mitchellii* *Eremophila mitchellii* *Citrus glauca* *Rhagodia spinescens* *Maireana decalvans* *Sclerolaena spp*
55	Belah woodland on alluvial plains and low rises in the central NSW wheatbelt to Pilliga and Liverpool Plains regions.	*Casuarina cristata* *Eucalyptus largiflorens*	*Myoporum montanum* *Rhagodia spinescens* *Alectryon oleifolius* *Eremophila mitchellii* *Apophyllum anomalum* *Capparis mitchellii* *Ventilago viminalis* *Maireana enchylaenoides* *Eremophila maculata* *Eremophila deserti*

PCT ID	Plant Community Type	Dominant species for revegetation	Potential midstorey species for revegetation
78	River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion	*Eucalyptus camaldulensis* *Angophora floribunda* *Eucalyptus melliodora* *Casuarina cunninghamiana*	*Callistemon sieberi* *Acacia deanei* *Leptospermum polygalifolium* *Leptospermum brachyandrum* *Notelaea microcarpa var. microcarpa* *Eremophila mitchellii* *Geijera parviflora* *Myoporum montanum* *Eremophila deserti* *Acacia deanei* *Acacia hakeoides* *Maireana microphylla* *Dodonaea viscosa subsp. cuneata* *Psydrax oleifolia* *Acacia homalophylla* *Santalum acuminatum* *Senna form taxon 'petiolaris'* *Acacia spectabilis* *Exocarpos aphyllus* *Eremophila longifolia*
88	Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	*Eucalyptus pilligaensis (Eucalyptus woollsiana)* *Callitris glaucophylla* *Allocasuarina luehmannii* *Eucalyptus populnea subsp. bimbil*	*Eremophila mitchellii* *Geijera parviflora* *Myoporum montanum* *Eremophila deserti* *Acacia deanei* *Acacia hakeoides* *Maireana microphylla* *Dodonaea viscosa subsp. cuneata* *Psydrax oleifolia* *Acacia homalophylla* *Santalum acuminatum* *Senna form taxon 'petiolaris'* *Acacia spectabilis* *Exocarpos aphyllus* *Eremophila longifolia*

PCT ID	Plant Community Type	Dominant species for revegetation	Potential midstorey species for revegetation
141	Broombush - wattle very tall shrubland of the Pilliga to Goonoo regions, Brigalow Belt South Bioregion	*Melaleuca uncinata* *Acacia burrowii*	*Calytrix tetragona* *Lissanthe strigosa* *Westringia cheelii* *Acacia triptera* *Melaleuca diosmatifolia* *Acacia tindaleae* *Acacia carolae* *Acacia mariae* *Micromyrtus sessilis* *Allocasuarina diminuta subsp. diminuta* *Mirbelia pungens* *Phebalium nottii* *Harmogia densifolia*
202	Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion	*Eucalyptus conica* *Eucalyptus blakelyi* *Eucalyptus melliodora* *Callitris glaucophylla* *Eucalyptus populnea subsp. bimbil* *Eucalyptus pilligaensis (Eucalyptus woollsiana)*	*Acacia deanei* *Geijera parviflora* *Dodonaea viscosa subsp. spatulata* *Acacia implexa* *Cassinia laevis* *Jasmine lineare* *Lomandra longifolia* *Lomandra filiformis*
256	Green Mallee tall mallee woodland on rises in the Pilliga - Goonoo regions, southern Brigalow Belt South Bioregion	*Eucalyptus viridis* *Callitris glaucophylla* *Eucalyptus pilligaensis (Eucalyptus woollsiana)* *Eucalyptus crebra*	*Dodonaea viscosa subsp. cuneata* *Melichrus urceolatus* *Cassinia arcuata* *Acacia hakeoides* *Acacia mariae* *Acacia triptera* *Prostanthera howelliae* *Dodonaea viscosa subsp. spatulata* *Phebalium squamulosum subsp. gracile* *Melaleuca uncinata* *Melaleuca erubescens* *Acacia deanei subsp. deanei* *Senna form taxon 'zygophylla'*

PCT ID	Plant Community Type	Dominant species for revegetation	Potential midstorey species for revegetation
379	Inland Scribbly Gum - White Bloodwood - Red Stringybark - Black Cypress Pine shrubby sandstone woodland mainly of the Warrumbungle NP - Pilliga region in the Brigalow Belt South Bioregion	*Eucalyptus rossii* *Corymbia trachyphloia subsp. amphistomatica* *Eucalyptus macrorhyncha* *Angophora floribunda* *Callitris endlicheri* *Eucalyptus crebra*	*Bossiaea rhombifolia subsp. rhombifolia* *Melichrus erubescens* *Persoonia cuspidifera* *Acrotriche rigida* *Cassinia quinquefaria* *Pultenaea cinerascens* *Acacia implexa* *Olearia elliptica subsp. elliptica* *Melichrus urceolatus* *Leucopogon muticus* *Daviesia pubigera* *Bursaria spinosa* *Macrozamia polymorpha* *Hibbertia obtusifolia* *Monotoca scoparia* *Grevillea floribunda* *Xanthorrhoea acaulis* *Boronia glabra*
397	Poplar Box - White Cypress Pine shrub grass tall woodland of the Pilliga - Warialda region, Brigalow Belt South Bioregion	*Eucalyptus populnea subsp. bimbil* *Callitris glaucophylla* *Allocasuarina luehmannii* *Eucalyptus melanophloia* *Eucalyptus crebra* *Atalaya hemiglauca* *Eucalyptus pilligaensis (Eucalyptus woollsiana)*	*Geijera parviflora* *Notelaea microcarpa* *Acacia ixiophylla* *Dodonaea viscosa subsp. spatulata* *Maireana microphylla* *Myoporum montanum* *Psydrax odorata* *Santalum acuminatum* *Capparis mitchellii* *Hakea tephrosperma* *Alectryon oleifolius subsp. elongatus* *Ventilago viminalis* *Acacia oswaldii* *Maytenus cunninghamii* *Eremophila longifolia*

PCT ID	Plant Community Type	Dominant species for revegetation	Potential midstorey species for revegetation
398	Narrow-leaved Ironbark - White Cypress Pine - Buloke tall open forest on lower slopes and flats in the Pilliga Scrub and surrounding forests in the central north Brigalow Belt South Bioregion	*Eucalyptus crebra* *Callitris glaucophylla* *Allocasuarina luehmannii (may be absent in northern stands)*	*Acacia spectabilis* *Westringia cheelii* *Cassinia arcuata* *Cassinia laevis* *Acacia culriformis* *Persoonia sericea* *Acacia tindaleae* *Acacia deanei subsp. paucijuga* *Solanum parvifolium* *Lissanthe strigosa subsp. strigosa* *Acacia ixiophylla* *Geijera parviflora*
399	Red gum - Rough-barked Apple +/- tea tree sandy creek woodland (wetland) in the Pilliga - Goonoo sandstone forests, Brigalow Belt South Bioregion	*Eucalyptus chloroclada* *Eucalyptus blakelyi* *Eucalyptus camaldulensis* *Angophora floribunda* *Callitris glaucophylla* *Casuarina cristata* *Allocasuarina luehmannii*	*Leptospermum polygalifolium subsp. transmontanum* *Acacia deanei subsp. Paucijuga* *Acacia seriformis* *Callistemon linearis* *Cassinia arcuata*
401	Rough-barked Apple - Blakely's Red Gum - Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region	*Angophora floribunda* *Callitris endlicheri* *Eucalyptus blakelyi* *Eucalyptus chloroclada*	*Acacia spectabilis* *Hibbertia obtusifolia* *Cassinia arcuata* *Aotus subglauca var. filiformis* *Correa glabra var. glabra* *Acacia tindaleae* *Dodonaea peduncularis* *Hibbertia obtusifolia* *Sannantha cunninghamii* *Micromyrtus sessilis* *Brachyloma daphnoides subsp. pubescens*
402	Mugga Ironbark - White Cypress Pine - gum tall woodland on flats in the Pilliga forests and surrounding regions, Brigalow Belt South Bioregion	*Eucalyptus sideroxylon* *Callitris glaucophylla* *Eucalyptus chloroclada* *Eucalyptus crebra*	*Acacia deanei subsp. paucijuga* *Acacia spectabilis* *Acacia verniciflua* *Westringia cheelii*

PCT ID	Plant Community Type	Dominant species for revegetation	Potential midstorey species for revegetation
404	Red Ironbark - White Bloodwood +/- Burrows Wattle heathy woodland on sandy soil in the Pilliga forests	*Eucalyptus fibrosa* *Corymbia trachyphloia* *Eucalyptus crebra* *Eucalyptus dwyeri* *Callitris glaucophylla* *Callitris endlicheri*	*Acacia burrowii* *Allocasuarina diminuta* *Phebalium squamulosum subsp. gracile* *Homoranthus flavescens* *Cryptandra amara var. floribunda* *Philotheca ciliata* *Calytrix tetragona* *Hibbertia covenyana* *Hibbertia incana* *Acacia deanei subsp. paucijuga* *Solanum ferocissimum* *Acacia triptera* *Persoonia sericea* *Hibbertia circumdans* *Hibbertia riparia* *Dodonaea falcata*
406	White Bloodwood - Motherumbah - Red Ironbark shrubby sandstone hill woodland / open forest mainly in east Pilliga forests	*Corymbia trachyphloia subsp. amphistomatica* *Eucalyptus fibrosa* *Eucalyptus fibrosa subsp. nubilis (Eucalyptus nubila)* *Callitris endlicheri*	*Lomandra filiformis subsp. coriacea* *Allocasuarina diminuta* *Philotheca salsolifolia subsp. salsolifolia* *Persoonia sericea* *Bertya opponens* *Philotheca ciliata* *Hibbertia circumdans* *Leptospermum parvifolium* *Hibbertia incana* *Cassinia arcuata* *Calytrix tetragona* *Homoranthus flavescens* *Boronia bipinnata* *Phebalium squamulosum subsp. gracile* *Ricinocarpos bowmanii* *Prostanthera granitica* *Grevillea floribunda* *Dodonaea falcata*

PCT ID	Plant Community Type	Dominant species for revegetation	Potential midstorey species for revegetation
408	Dirty Gum (Baradine Gum) - Black Cypress Pine - White Bloodwood shrubby woodland on of the Pilliga forests and surrounding region	*Eucalyptus chloroclada* *Callitris endlicheri*	*Brachyloma daphnoides subsp. daphnoides* *Hibbertia obtusifolia* *Dodonaea spp.* *Phebalium squamulosum subsp. squamulosum* *Homoranthus flavescens* *Cassinia arcuata* *Persoonia sericea* *Boronia glabra* *Acacia gladiiformis* *Acacia spectabilis* *Lomandra multiflora subsp. Multiflora*
418	White Cypress Pine - Silver-leaved Ironbark - Wilga shrub grass woodland of the Narrabri-Yetman region, Brigalow Belt South Bioregion	*Callitris glaucophylla* *Eucalyptus melanophloia* *Eucalyptus chloroclada* *Eucalyptus albens* *Eucalyptus blakelyi* *Eucalyptus populnea subsp. bimbil* *Angophora leiocarpa*	*Callitris glaucophylla* *Acacia leiocalyx* *Geijera parviflora* *Alstonia constricta* *Pimelea neo-anglica* *Acacia decora* *Notelaea microcarpa var. microcarpa* *Cassinia laevis* *Acacia deanei subsp. paucijuga*
425	Spur-wing Wattle heath on sandstone substrates in the Goonoo - Pilliga forests, Brigalow Belt South Bioregion	*Acacia triptera* *Eucalyptus fibrosa* *Eucalyptus fibrosa subsp. nubilis (Eucalyptus nubila)* *Eucalyptus viridis* *Eucalyptus dwyeri* *Callitris endlicheri*	*Calytrix tetragona* *Grevillea floribunda* *Harmogia densifolia* *Boronia bipinnata* *Acacia caroleae* *Dodonaea falcata* *Dodonaea heteromorpha* *Solanum ferocissimum* *Hibbertia riparia* *Cryptandra amara var. amara*
428	Carbeen - White Cypress Pine - Curracabah - White Box tall woodland on sand in the Narrabri - Warialda region of the Brigalow Belt South Bioregion	*Corymbia tessellaris* *Callitris glaucophylla* *Acacia leiocalyx* *Allocasuarina luehmannii* *Eucalyptus albens* *Eucalyptus crebra*	*Acacia deanei* *Pimelea microcephala subsp. microcephala* *Pittosporum angustifolium* *Notelaea microcarpa var. microcarpa* *Dodonaea viscosa subsp. angustifolia* *Geijera parviflora* *Santalum lanceolatum* *Melichrus urceolatus* *Carissa ovata*

Appendix F - RDM Management Protocol

Santos

NARRABRI GAS PROJECT

Residual Drilling Material Management Protocol

PHASE 1

Date	Revision	Reason for Issue	Author	Checked	Approved
18 November 2022	0A	For approval	Onward Consulting	LD	TD

Santos

Prepared by:

Title	Name	Signature	Date
Senior Environmental Manager	S. van der Meulen Onward Consulting		18 November 2022
Director	Mark Vile Onward Consulting		18 November 2022

Reviewed by:

Title	Name	Signature	Date
Team Leader Environment - Approvals	[redacted]		18 November 2022

Approved by:

Title	Name	Signature	Date
Development Manager NSW	[redacted]		18 November 2022

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ONWARD CONSULTING

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1. Introduction

Drilling operations for installation of exploration, appraisal, observation / monitoring and production wells generate drill cuttings, also referred to as residual drilling materials (**RDM**). Rock-based RDM include naturally occurring earth and rock conveyed to the surface by drilling fluids ('drilling muds') used in the drilling process. The RDM generally referred to in this document is rock-based, rather than coal-based cuttings.

As an alternative to disposing RDM at suitably licenced facilities as a waste product, the land application of RDM to well pads to assist in rehabilitation efforts is considered international best practice, and has been developed by the American Petroleum Institute and undertaken in the US and Canada since 1997. Land application of RDM has been successfully used in Queensland by the major CSG operators for a number of years and is regulated by the QLD Government.

Santos, through comprehensive technical studies completed across its onshore operations, has developed a sustainable reuse option for RDM generated during the vertical drilling component. While drilling is being undertaken, drill materials are stored on the well pad with appropriate environmental measures in place such as erosion and sediment controls. When drilling is complete, the stored drill materials are mechanically applied to the well pad area.

This localised management of RDM by land application results in reduced heavy vehicle movements, a reduction in third-party disposal and provides positive environmental outcomes such as improved soil conditions in some instances, which will assist the rehabilitation process.

As provided in section 1 of the Rehabilitation Management Plan (**RMP**), the Phase 1 scope is planned to include the construction and operation of:

- 4 coreholes;
- 6 pilot wells;
- 2 deep reservoir monitoring bore (converted coreholes);
- new shallow water monitoring bores;
- associated linear infrastructure;
- seismic surveys (length and location to be determined); and
- continued operation of Santos' existing exploration and appraisal activities.

It is expected that up to approximately 100 to 120 m^3 of RDM will be generated per pilot well, corehole and deep monitoring well during the vertical or near-vertical drilling process.

This RDM Management Protocol (the **Protocol**) also describes the RDM application to subsequent well pads, as detailed in the NGP Waste Management Plan.

2. Objective

The predominant objective of this Protocol is to identify RDM that may be used for rehabilitation of well sites to ensure the materials are fit for purpose to achieve rehabilitation objectives. It also describes the recommended methodologies for RDM sampling, analysis and application and refers to relevant documents that contain rehabilitation monitoring and assessment criteria that will apply to RDM land application sites.

This Protocol satisfies SSD 6456 consent condition B83(h) and supports the RMP by providing details about the testing and management of RDM used for rehabilitation of well pads to ensure the materials are fit for purpose to achieve rehabilitation objectives.

3. Regulatory framework

RDM is considered a waste, as defined by the dictionary within the *Protection of the Environment Operations Act 1997* (**POEO Act**). However, EPL 20350 condition L3.4 states that Santos may transport rock-based drill cuttings from any of the well pads to other well pads and apply these to land, in accordance with the RMP (and therefore this Protocol) and the approved Waste Management Plan. All transport of RDM between well pads will occur within the same EPL premises.

4. RDM generation and storage

It is proposed that RDM generated by drilling activities will be collected during the drilling process, and transported and placed temporarily on any subsequent well pad, either in a stockpile, in skip bins, in concrete rings or in a cuttings pit. Storage of RDM on a subsequent well pad is required to ensure sufficient area is available for the safe execution of all appraisal and exploration drilling activities on the active well pad, including when drilling of coreholes and monitoring bores.

All RDM storage on a subsequent well pad will be undertaken in accordance with the site-specific Erosion and Sediment Control Plan (**ESCP**). The estimated cuttings volume from a single well is typically 100-120 m^3, which equates to a stockpiled area with approximate dimensions of 12 m x 10 m x 1 m (length x width x height). If a cuttings pit is used, indicative dimensions will generally be 12 m x 50 m.

5. RDM sampling and analysis

Santos has not drilled any wells in NSW since 2014, and as such has not generated RDM since that time. However, based on extensive and comprehensive technical studies completed across its onshore operations, Santos has previously employed land application as a sustainable reuse option for RDM generated during the vertical and near-vertical drilling component of pilot wells and coreholes.

For Phase 1, it is proposed to apply the sampling and analysis regime as prescribed in the Excavated Natural Material (**ENM**) Resource Recovery Exemption and Resource Recovery Order to classify the rock-based RDM. This will involve the collection of a minimum of 3 representative discrete samples for each well or corehole, with the volume of RDM typically between 100-120 m^3. As detailed in the RDM Land Application Rate Assessment provided in Appendix A, each sample will be analysed for the following:

- electrical conductivity;
- metals;
- total petroleum hydrocarbons;
- benzene, toluene, ethylbenzene, and xylenes; and
- polycyclic aromatic hydrocarbons.

Chloride is not considered to be a contaminant of concern as the RDM will be incorporated into the soil profile (thus no potential for foliar injury) and no crops are being planted on the well pads (no concerns associated with additional cadmium uptake).

Most of NSW, has very little or no potential to host naturally occurring asbestos (**NOA**). Areas of identified potential cover about 0.83% of NSW which have been mapped on a high-, medium- and low potential basis. Ground disturbing activities, particularly in areas assessed as having high and medium potential (about 0.27% of NSW) should be managed to prevent exposure to NOA. (NSW Government, 2005). Santos has reviewed operational project areas against current risk maps published by the Department of Regional New South Wales. The planned exploration, appraisal and development activity are located within regions that are not of risk.

Testing of the RDM will be undertaken at a certified laboratory to determine its chemical composition and suitability for rehabilitation purposes. The results will be analysed by a suitably qualified person who will provide advice on the RDM's suitability for rehabilitation purposes and any suggested additional application or management measures. Phase 1 will be used to gather performance data that will be reviewed for Phase 2 and beyond.

Note that as specified in the Waste Management Plan, all coal-based cuttings will be sampled and classified in accordance with the Waste Classification Guidelines, and transported to a facility that can lawfully accept the waste.

6. RDM application

Site-specific assessment of appropriate application areas and storage methods for RDM within well pad areas will be conducted during construction planning, taking into consideration the following:

- well pad design and construction (slope and site-specific conditions); and
- well pad available area (i.e. drilling rig layout, existing infrastructure restricting total application area).

Storage of RDM prior to application will be managed in accordance with the ESCP as detailed in section 4. In general, the whole well pad area is used for land spreading with a 5 m exclusion area around operational equipment, such as the wellhead/s.

6.1 Application equipment

The aim of RDM application is to achieve a relatively even spreading of the cuttings across the land application area to allow it to then mix into the soil structure over time. The following equipment types have been implemented, but other alternatives can be considered which provide for the same results:

- agricultural equipment such as a tractor and manure spreader;
- earth moving equipment, including a skid steer loader, wheel loader, excavator, backhoe, bobcat or tractor, fitted with appropriate spreading attachments (e.g. spreader bar, blade), or use of back blading techniques; or a grader.

Equipment will be selected based on its suitability for the land area. Drainage channels or areas where overland flow is possible will be avoided.

6.2 Application methodology

The assessment of past RDM samples is detailed in the RDM Land Application Rate Assessment provided in Appendix A, as is the determination on rate. The appropriate land application method is *Method 1 - Surface application and mixing into soils in top 150 mm of soil column*.

The following general approach to applying RDM will be followed:

- the land application area is identified within the fenced well pad area (as per construction planning);
- the cuttings are spread using the selected method to ensure a relatively uniform coverage of the land application areas within the well pad area;
- to achieve a suitably uniform coverage, consideration of the approach may include use of multiple passes (rather than one larger application) or using equipment (e.g. backhoe with a spreader bar/blade) to push and spread the cuttings around the designated well pad area;
- the application rate to be aimed for is 100 m^3/ha (with a maximum allowable application rate of 150 m^3/ha). Therefore, the average cuttings volume of 120 m^3 can be applied over an available 0.8 ha area within the maximum application rate:

$$120\ m^3 / 8{,}000\ m^2 = 0.015\ m \text{ (i.e. 1.5 cm thick)}$$

NOTE: the lowest practicable application rate should be targeted based on the area available. Any additional cuttings remaining onsite (which cannot be applied because they exceed the maximum application rate noted above) need to be transported to an alternate location for management or disposal or additional suitable areas to be utilised for spreading activities within the Project approval conditions.

6.3 Key management methods and controls

When undertaking land application of RDM, the following steps shall be followed:

- a buffer/exclusion area of at least 5 m will be implemented around existing infrastructure, identifying this in advance with suitable markers (e.g. coloured marker paint/pegs);
- where required, relevant advice will be sought from a suitably qualified person regarding the most appropriate management measures to be implemented; and
- land application extent, volume and rate will be recorded for each well pad, as will be the source of the RDM. All data will be managed in accordance with section 9 of the RMP.

7. Monitoring and reporting

7.1 Weather conditions

In planning for and managing the application of RDM to land during wet weather, the following conditions are relevant:

- RDM must not be applied to land during or after any rainfall event until surface conditions permit;
- if temporary storage in a cuttings pit is required due to a pending rainfall event, the temporary storage must be lined; and
- where RDM has been land applied, minimum erosion and sediment controls must be implemented prior to a forecast rainfall event.

To ensure minimal impacts from weather:

- RDM must be ploughed in within 14 days of the first application; or
- when there is a 70% chance or greater than 10 mm of rainfall, RDM must;
  - be ploughed in prior to the rainfall event; or
  - a biodegradable soil polymer must be applied to the entire RDM application area prior to the rainfall event as an interim measure.

7.2 Monitoring

Monitoring of RDM land application areas will be conducted in accordance with the RMP. The results of the rehabilitation monitoring will compare these sites against area without RDM applied to identify if there are any further management measures required to meet rehabilitation objectives.

Appropriate erosion and sediment controls for well pads will be inspected as part of the regular erosion and sediment control inspections.

Post application sampling of the RDM land application area will occur within 6 months of application, and each sample analysed for the parameters listed in section 5. The laboratory analysis results will be compared to the pre-application testing results.

7.3 Reporting

All laboratory analysis results will be retained and made available to government agencies as required. The sampling regime will be reviewed and discussed with the EPA prior to commencement of Phase 2.

This Protocol will be reviewed prior to Phase 2.

Appendix A - RDM land application rate assessment

MEMO

To: [redacted] Santos Limited

From: Chrissy Peterson, EHS Support LLC

CC: Nigel Goulding, EHS Support LLC
Bill Frez, EHS Support LLC
Chris Pratt, EHS Support LLC

Date: March 2, 2021

Re: Narrabri Gas Project Residual Drilling Materials Land Application Rate Assessment

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Introduction

This memorandum provides an assessment of land application of residual drilling materials (RDMs) to well pads as part of the Narrabri Gas Project (NGP). The assessment compared a range of methods (which align with standard industry practices) that may be employed for the management of RDM including:

- Method 1 – Thin spreading or spraying at surface and use of equipment and/or natural processes to incorporate into the upper 150 millimetres (mm) of the soil profile.
- Method 2 – Spreading and deeper incorporation into the soil profile (up to 0.5 metres [m]) using mechanical processes.
- Method 3 – Mix bury cover with a minimum of 0.5 m of surface cover to eliminate (human health) direct contact and provide native soils for germination and establishment of shallow-rooted vegetation.
- Method 4 – Deep Burial (burial below 1.5 m) where potential ecological exposures to burrowing organisms are eliminated based on the depth of burial.

The assessment process used recent and historical data and assessments of the drilling muds, chemical constituents, and soils relevant to the local area. In terms of the process of drilling and chemicals used in drilling muds, a full Chemical Risk Assessment (EHS Support, 2016) was completed for the drilling mud systems and geogenic constituents contained within the drilling mud. This chemistry is further evaluated below in terms of development of methodologies for management of RDM on the well pad site. This risk assessment should be referenced for Safety Data Sheets (SDSs), chemical dossiers and derived predicted no effect concentrations (PNECs) for soil ($PNEC_{soil}$) for all the chemicals used with the mud system.

In terms of assessment of geogenic constituents within the RDMs, the above referenced chemical risk assessment includes an assessment of historic sampling results; more recent data is discussed and evaluated in the section below using screening levels. In accordance with the approach used in the Chemical Risk Assessment (EHS Support, 2016), the screening was conducted against relevant and applicable national and international screening levels. The following hierarchy was used for screening criteria and, where screening levels were not available in the first referenced source, screening criteria were sourced from subsequent sources:

- Human Health
  - Australian National Environmental Protection Council (NEPC) Assessment of Site Contamination Human Health Investigation Levels (HILs) and Health Screening Levels (HSLs) for Recreational Land Use (note, if a residential screening level was available for a contaminant; a recreational HIL or HSL was also available) (NEPC, 2013)
  - United States Environmental Protection Agency (USEPA) Regional Screening Levels for Residential Land Use (USEPA, 2020a)
- Ecological
  - NEPC Ecological Screening Criteria for Areas of Ecological Significance and Residential and Open Spaces (NEPC, 2013)
  - Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines (CEQGs), Soil Screening Guidelines for Agricultural and Residential and Open Spaces (CCME, 2020)
  - USEPA Ecological Soil Screening Levels (USEPA, 2020b)
- Soil Properties for Plant Growth
  - ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
  - ANZECC & ARMCANZ (2000) Fresh and Marine Water Quality for Protection of Aquatic Ecosystems and Stock Watering (ANZECC & ARMCANZ, 2000)

For the purposes of the assessment of salinity, the local native plants are considered to be tolerant to very tolerant. Salinity studies in the Brigalow Belt have shown that seeds have limited sensitivity to salt, and soils with a salinity below 20 deciSiemens per metre (dS/m) are suitable for regrowth (Arnold et al, 2014). This is consistent with guidance provided in ANZECC 2000 which shows electrical conductivity (EC) of 20 dS/m to not be deleterious to plant yield (**Figure 1**) for species that tolerant.

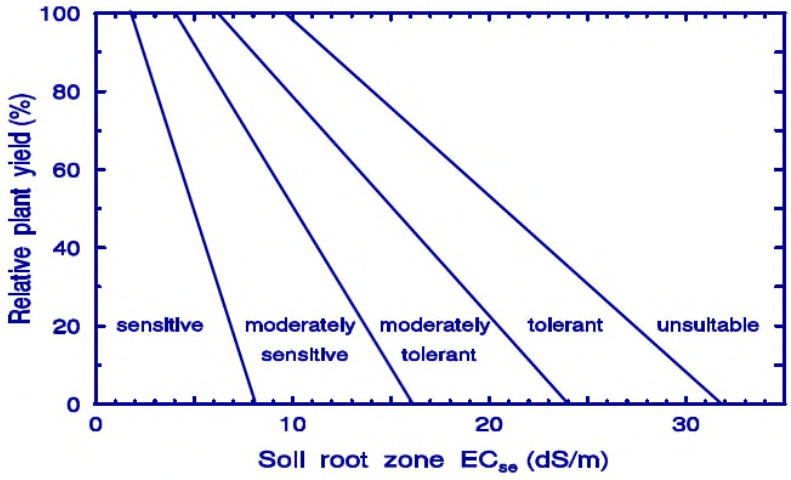

Figure 9.2.4 Relative crop yield in relation to soil salinity (EC_{se}) for plant salt tolerance groupings of Maas and Hoffman (1977). Note that 1 dS/m = 1000 µS/cm.

Figure 1 Relative Crop Yield in Relation to Soil Salinity (Source: ANZECC & ARMCANZ, 2000)

In the context of the land disposal method options described above, a conservative approach has been used where direct contact exposure pathways for human and ecological receptors have been

assumed to be complete for Methods 1 through 3. Only for deep burial (Method 4) has the direct contact exposure pathway been eliminated. In the context of the site setting and land use, the ecological exposure pathway is considered the most sensitive. Due to the presence of burrowing organisms, these conservative assumptions are considered appropriate for this screening level assessment.

Consistent with the analytical testing conducted on RDM and the likely geogenic and salt additives contained within the drilling mud, the geogenic assessment of chemicals was only conducted on:

- Metals
- Total petroleum hydrocarbons (TPH)
- Benzene, toluene, ethylbenzene, and xylenes (BTEX)
- Polycyclic aromatic hydrocarbons (PAHs)
- Electrical conductivity (EC)

Chloride is not considered to be a contaminant of concern as the materials will be incorporated into the soil profile (thus no potential for foliar injury) and no crops are being planted on the well pads (no concerns associated with additional cadmium uptake).

Residual Drilling Materials

The following sections present a discussion on RDM data used in this assessment to develop the land application mixing ratios.

Drilling Methods

Consistent with the description of drilling methods contained within the Chemical Risk Assessment (EHS Support, 2016) drilling muds will be recycled and primary drilling cuttings (containing predominantly native materials, including some coal fines) will be applied to land. Based on current methods, residual drilling mud content of the RDM is likely to be less than 10 percent of the total materials (i.e., RDM contains approximately 90 percent cuttings and 10 percent drilling mud). Volumes of RDM generated from drilling are anticipated to be on the order of 200 cubic metres (m^3) per well – 100 m^3 being generated from the vertical, above-seam drill component and 100 m^3 from the horizontal in-seam drill component. The Environmental Impact assessment [EIA] approval does not allow for the management of coal fines from the target coal seams on the well lease, as such only the vertical, above-seam component of the RDM is to be applied to land.

As part of recycling, drilling mud shakers and centrifuges will be used to separate solids from drilling muds with the solids (primarily cuttings) stockpiled for management after completion of well drilling activities. The materials will be stockpiled temporarily and then managed as part of the rehabilitation activities in accordance with one of the aforementioned methods. The rehabilitation of the well pad (establishment of vegetation and habitat) is anticipated to occur over several years; with recolonisation of the area by native fauna not anticipated to occur for one to three years post (commencement of) rehabilitation (M. Sullivan, Eco Logical Australia Pty Ltd personal communication, 22 December 2020). This is important as potential exposures will not occur until conditions are favourable for biological activity (e.g., foraging of the Pilliga mouse).

Chemical Composition of Drilling Muds

The chemical composition of the drilling muds calculated in the risk assessment is presented in **Table 1**, with the exposure point concentration (EPC) in the residual drilling muds reflecting the separation of muds and cuttings as described earlier. RDM contains only about 10 percent drilling mud with the rest made up of cuttings.

The chemical tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione is present in the initially injected material; however, due to rapid degradation, it hydrolyses and/or metabolizes to 100 percent methylisothiocyante (MITC) within three to five days. Therefore, the concentration of tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione within the muds is assumed to be 0 milligram per kilogram (mg/kg).

Table 1 Summary of Vendor Chemicals In Residual Drilling Materials

Constituent Name	CAS No.	Estimated Vendor Chemical Concentration In Drilling Muds (mg/kg)	Exposure Point Concentration in Residual Drilling Materials (10% of mud concentration) (mg/kg)
Copolymer of acrylamide and sodium acrylate	25085-02-3	702	70
Ethylene oxide/propylene oxide copolymer	9003-11-6	24	2.4
Glyoxal	107-22-2	31	3.1
Methanol	67-56-1	3	0.30
Methylisothiocyanate (MITC)	556-61-6	30	3.0
Pentanedial / Glutaraldehyde	111-30-8	300	30
Polyalkylene	9038-95-3	22,260	2,226
Polypropylene glycol	25322-69-4	48	4.8
Potassium chloride	7447-40-7	41,520	4,152
Silicic acid, potassium salt	1312-76-1	22,200	2,220
Sodium carbonate	497-19-8	78	7.8
Sodium carboxymethyl cellulose	9004-32-4	3,117	312
Sodium chloride	7647-14-5	45,600	4,560
Sodium hydroxide	1310-73-2	300	30
Sodium polyacrylate	9003-04-7	1,092	109
Starch	9005-25-8	3,058	306
Tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione	533-74-4	0	0.0
Xanthan gum	11138-66-2	3,060	306

Notes:
CAS = chemical abstract service
mg/kg = milligram per kilogram
% = percent

The EPCs presented in **Table 1** do not include degradation after being stockpiled adjacent to the drilling site or the degradation that will occur over time and before sufficient rehabilitation has occurred (greater than one year), at which time the area will be conducive for recolonisation by fauna. Should a chemical exceed the $PNEC_{soil}$, an application rate has been developed that accounts for stockpiling potential and rehabilitation timeframes. The likely timeframe at which habitat establishment and potential continuous exposures could occur to sensitive receptors is considered to be two years from the date of well drilling. This time frame reflects the total time expended from the date of drilling through well completion, well work-over and establishment of surface infrastructure, physical rehabilitation activities and the natural process of revegetation and ultimately fauna recolonisation.

A comparison of sulphate-based and chloride-based drilling muds was proposed. Since sulphate is a macronutrient and chloride is not a constituent of concern (as noted above) no further assessment was required. The chemical composition of the drilling mud assessed is chloride-based and the geogenic assessment is based on a sulphate-based mud system that contains the same organic constituents as the chloride-based mud.

Analytical Testing of Residual Drilling Materials and Background Soils

Analytical testing of RDM and background soils has been completed at the site as part of historical activities. Cuttings data was collected from December 2013 to December 2015 from the following wells within the project area: DWH24, DWH8A, DWH22, DWH23, DWH25, DWH26, DWH27, DWH27DW, DWH27DW1, DWHYDW2, DWH27DW2, DWH28 and DWH29.

The statistical summary of analytical (geogenic) results for RDM is provided as **Attachment A**, **Table A-1**. For the data evaluation, an assessment has been completed against the screening levels as described earlier.

A summary of background soil data within the NGP is provided in **Attachment A**, **Table A-2**. For a number of constituents, the background concentrations provided are higher than the screening levels. The salinity of soils in the area has been shown to be variable but generally low with a medium EC less than 50 microSiemens per centimetre (µS/cm). In this context, simple blending calculations have been conducted assuming no salt inputs from the native soil (as this is not material to the final soil salinity).

Evaluation Process

This RDM assessment was conducted in multiple phases. First, a screening level evaluation was conducted to identify chemicals of potential concern (COPCs) and develop blending and application ratios to satisfy applicable criteria. Next, to further refine the COPCs identified for geogenic constituents, an evaluation of historic RDM data was completed to address the presence of coal materials which cannot be managed on-site. This involved assessment of geologic information and calculation of coal fine content and associated hydrocarbon content in the RDM materials that can be applied on the well lease. Using the theoretical and empirical data, an evaluation of potential land application rates for the various management methods was developed. It should be noted that additional sampling of RDM materials is anticipated (specifically to evaluate petroleum hydrocarbon) to validate the calculations and assessment provided in this document.

Screening Level Evaluation

The baseline evaluation was partitioned into three steps to develop application rates and mixing ratios. The following sections present each step in the process and the application rates and mixing ratios based on the conservative EPCs.

Step 1 – Preliminary Screening and Selection of Chemicals of Potential Concern

Preliminary screening was conducted to determine COPCs and included comparison of empirical geogenic composition data of the RDM and theoretical chemical constituents of additives from drilling muds within the RDM against screening levels. For the purposes of the assessment, the drilling mud content (and associated chemicals) of RDM was assumed to be 10 percent (consistent with field observations). Only those chemicals which exceeded the screening level or chemical-specific $PNEC_{soil}$ were retained for further evaluation.

Attachment A, **Table A-1** presents the comparison of the empirical geogenic data to the human health and ecological screening levels discussed previously. **Attachment A**, **Table A-3** presents the comparison of the theoretical concentrations of the residual drilling chemicals in RDM compared to the $PNEC_{soil}$ derived in the Chemical Risk Assessment (EHS Support, 2016). Based on this evaluation of the data the following were selected as COPCs:

- Geogenic data:
  - EC
  - Cadmium
  - Nickel
  - >C10-C16 Fraction minus Naphthalene (F2)
  - >C16 – C34 Fraction
  - Benzo(b)fluoranthene
  - Benzo(b+j) fluoranthene
  - Benzo(k)fluoranthene
  - Benzo(b) & Benzo(k)fluoranthene
  - Benz(a)anthracene
  - Chrysene
  - Pyrene
- Residual drilling chemicals
  - Methylisothiocyante (MITC)
  - Pentanedial/glutaraldehyde
  - Polypropylene glycol
  - Sodium polyacrylate

Step 2 – Assessment of Blending Ratios to Achieve Criteria

For each COPC identified in Step 1, an assessment of blending ratios with native soils was conducted for each of the methodologies provided above. The blending ratio was estimated as the proportion predicted (chemical in drilling muds) or measured median/maximum concentrations (geogenic constituents) exceeding the respective screening criteria. The estimated blending ratios for all COPCs identified in Step 1 are provided in **Attachment A**, **Table A-4** and **Table A-5** for each of the screening levels for the geogenic chemicals and residual drilling chemicals, respectively.

Step 3 – Assessment of Application Ratios to Achieve Blending Criteria and Acceptance Criteria.

In terms of the methods that are described above, the application rate was calculated based on the volumes provided in **Table 2**. For Methods 1 and 2, the application rates have been developed based on a standard unit of 1 hectare (ha). Where smaller areas (and associated volumes of soil) are available, the calculated application rates in **Table 3** and **Table 4** (described further below) should be

adjusted accordingly (for example if only 0.5 ha is available, the values should be multiplied by 0.5 ha). The development of application rates based on a standard area enables easy calculation of application rates based on the specific area available for land application at each well pad.

Table 2 Summary of Land Application Methods

Method	Criteria that Apply	Volume of Soil Used for Blending	Estimated Application Rate
Method 1 – Surface application and mixing into soils in top 150 mm of soil column	Human Health (Direct Contact) Ecological Plant Growth	1 ha and 150 mm soil column = 1,500 m^3	1,500 m^3/required blending ratio for constituent. Lowest application rate retained as criteria.
Method 2 – Surface application and mixing into soils in top 0.5 m of soil column	Human Health (Direct Contact) Ecological Plant Growth	1 ha and 0.5 m soil column = 5,000 m^3	5,000 m^3/required blending ratio for constituent. Lowest application rate retained as criteria.
Method 3 – Mixed with soils and then buried with a minimum of 0.5 m of soil cover	Ecological Plant Growth	Mixing ratio only in materials such that criteria is met	Mixing ratio with volume of soil needed determined by volume of RDM
Method 4 - Mixed with soils and then buried with a minimum of 1.5 m of soil cover	Plant Growth	Mixing ratio only in materials such that criteria is met	Mixing ratio with volume of soil needed determined by volume of RDM

Notes:
ha = hectare
m = metre
m^3 = cubic metre
mm = millimetre
RDM = residual drilling material

As described above, a comparison of sulphate-based and chloride-based drilling muds was proposed but based on sulphate being a macronutrient and chloride not being a constituent of concern (as noted above) no further assessment was warranted.

Screening Level Evaluation and Mixing Ratios

Using the evaluation process discussed in the previous section, the proposed application and mixing ratios were calculated. **Attachment A**, **Table A-6** and **Attachment A**, **Table A-7** present the mixing ratios calculated for each method presented above for each COPC. **Table 3** presents a summary of the mixing ratios based on the median chemical concentrations from the geogenic chemicals and the residual drilling chemicals COPCs with a period of two years elapsing before recolonisation and potential exposure occurs. **Table 4** presents a summary of the mixing ratios based on the maximum chemical concentrations from geogenic chemicals and the residual drilling chemicals COPCs with an identical two-year period.

As described above, the application rates for Methods 1 and 2 have been developed for a standard unit of 1 ha. In the context of physical application in the field, areas less than 1 ha will be available and these numbers should be multiplied by the available area (for example multiply application rate

by 0.5 if 0.5 ha is the available area for application) to define application rates. Where specific risk driving chemicals (as noted in **Table 3** and **Table 4**) are not present, then higher application rates can be supported. The technical appendices should be referenced to determine these higher application rates.

Table 3 Summary of Application Rates/Mixing Ratios Based on Median Concentrations in RDM and Theoretical Chemical Concentrations from Drilling Mud

Mud Mixing Ratio	Application rate (m^3/ha)	Assumptions
Method 1 – Surface application and mixing into soils in top 150 mm of soil column	101	Materials will be temporarily stockpiled prior to application as part of rehabilitation activities. Management will involve mixing of the RDM into the top 150 mm of soil across the well pad (1 ha area). Two years will lapse between drilling commencement and rehabilitation/recolonization. Risk driver is >C10- C16 Fraction minus Naphthalene (F2) in sulphate-based mud geogenic data. **Note: driven by historical data which has elevated concentrations.**
Method 2 – Surface application and mixing into soils in top 0.5 m of soil column	338	Materials will be temporarily stockpiled and ultimately placed as part of the rehabilitation activities. Management will involve mixing of the RDM into the top 0.5 m of soil across the well pad (1-ha area). Two years will lapse between drilling commencement and rehabilitation/recolonization. Risk driver is >C10- C16 Fraction minus Naphthalene (F2) in sulphate-based mud geogenic data. **Note: driven by historical data which has elevated concentrations.**
Method 3 – Mixed with soils and then buried with a minimum of 0.5 m of soil cover	6.4:1 Mixing Ratio (Native soils to RDM)	Materials buried below ecological criteria and buried below 0.5 m. Covered by native soils. Risk driver is EC.
Method 4 – Mixed with soils and then buried with a minimum of 1.5 m of soil cover	6.4:1 Mixing Ratio (Native soils to RDM)	Materials buried greater than 1.5 m; therefore, no completed human or ecological pathways. Deep-rooted vegetation could be affected by EC. Risk driver is EC.

Notes:
EC = electrical conductivity
ha = hectare
m = metre
m^3/ha = cubic metres per hectare
mm = millimetre
RDM = residual drilling material

Table 4 Summary of Application Rates/Mixing Ratios Based on Maximum Concentrations in RDM and Theoretical Chemical Concentrations from Drilling Mud

Mud Mixing Ratio	Application rate (m^3/ha)	Assumptions
Method 1 – Surface application and mixing into soils in top 150 mm of soil column	35	Materials will be temporarily stockpiled and ultimately placed as part of rehabilitation activities. Management will involve mixing the RDM into the top 150 mm of soil across the well pad (1-ha area). Two years will lapse between drilling commencement and rehabilitation/recolonization. Risk driver is pyrene in sulphate-based mud geogenic data. **Note: driven by historical data which has elevated concentrations.**
Method 2 – Surface application and mixing into soils in top 0.5 m of soil column	116	Materials will be temporarily stockpiled and ultimately placed as part of rehabilitation activities. Management will involve mixing the RDM into the top 0.5 m of soil across the well pad (1-ha area). Two years will lapse between drilling commencement and rehabilitation/recolonization. Risk driver is pyrene in sulphate-based mud geogenic data. **Note: driven by historical data which has elevated concentrations.**
Method 3 – Mixed with soils and then buried with a minimum of 0.5 m of soil cover	10.2:1 Mixing Ratio (Native soil to RDM)	Materials buried below ecological criteria and buried below 0.5 m. Covered by native soils. Risk driver is EC.
Method 4 – Mixed with soils and then buried with a minimum of 1.5 m of soil cover	10.2:1 Mixing Ratio (Native soil to RDM)	Material buried greater than 1.5 m; therefore, no completed human or ecological pathways. Deep-rooted vegetation could be affected by EC. Risk driver is EC.

Notes:
EC = electrical conductivity
ha = hectare
m = metre
m^3/ha = cubic metres per hectare
mm = millimetre
RDM = residual drilling material

Refinement of Geogenic COPCs

In accordance with the commitments contained within the EIA for the project and regulatory approvals, Santos has committed to off-site disposal of all drilling cuttings from the target coal sequences. This includes materials from in-seam as well as the vertical well within the target zone.

Historical analysis of RDM sampling has been conducted on materials contained within the target coal sequences and, as a consequence, hydrocarbon content of the RDM is biased high. To further facilitate evaluation of potential risks and assessment of land application rates for above-seam (or Non-Target) material, an evaluation was conducted using boring log data (e.g., Dewhurst 8A) and compositional analysis data for the coals.

To facilitate the long-term management of materials it is proposed that the RDM materials be split into two functional groups based on the EIA commitments:

- Group 1 – Upper (Non-Target) Materials – These comprise materials within the upper 850 metres (m) of the formations encountered through drilling of the upper sections of the vertical section of the wells. The materials are primarily within non-hydrocarbon containing sandstones, claystones and siltstones with some fine interspersed (non-target) coal sequences. Review of the boring logs for wells in the area indicate thin seams which, in aggregate, do not exceed 16 m over the 850 m vertical sequence (in many cases significantly less than 16 m).
- Group 2 – Target Coal Sequences – This comprises the vertical interval between 850 m and 980 m where the target coal sequence is encountered. These comprise thicker seams of coal that can be targeted for in-seam placement of laterals (i.e., horizontal wells) which can be encountered at varying depths within this unit. The coal sequences are similarly contained within a sandstone and claystone dominant formation and, in aggregate, these coals make up 18 m of the 130 m vertical sequence.

In terms of this later grouping (i.e., Group 2), all of these materials (coal seams and overlying and underlying sandstone and mudstones) are to be transported off-site for disposal in accordance with EIA commitments and regulatory approvals. However further segregation may be considered whereby sandstones/claystones/siltstones from these materials are separated from the coal fines and also retained, tested and managed on-site.

Based on the compositional analysis of the sandstone/siltstone/claystones (which are non-hydrocarbon containing) and the chemical analysis of coal sequences, as well as other RDM materials, the relative ratios of hydrocarbon constituents in the Group 1 materials have been determined. Key assumptions and inputs are as follows:

- Group 1 coal content of RDM materials is 2 percent (rounded up from 1.885 based on 16 m of coal in 850 m of formation).
- Hydrocarbon composition of coals based on the RDM testing and maximum constituent concentrations results are presented in **Table 5**.

Table 5 Summary of Hydrocarbon Composition of Coals

Constituent with corresponding ESL	RDM no Silica Gel Cleanup (% of Total Hydrocarbons)	RDM with Silica Gel Cleanup (% of Total Hydrocarbons)
>C10 - C16 Extractable Hydrocarbons (no naphthalene)	8.5 %	1.39 %
> C16 - C34 Extractable Hydrocarbons	65.4 %	9.34 %
> C34 - C40 Extractable Hydrocarbons	6.3 %	2.40 %
PAHs that failed preliminary screening of PAHs		
Benzo(a)anthracene	0.018 %	NA
Benzo (b) fluoroanthene	0.019 %	NA
Benzo (b+j) fluoroanthene	0.009 %	NA
Pyrene	0.041 %	NA
Chrysene	0.058 %	NA

Notes:
% = percent
ESL = ecological screening level
NA = not applicable
PAHs = polycyclic aromatic hydrocarbons
RDM = residual drilling materials

On the basis of the above, the potential concentration in RDM can be estimated as a composite of mixing non-hydrocarbon containing sandstone/siltstone/claystone and the coals. **Table 6** presents the estimated concentrations for Group 1 materials.

Table 6 Estimated Concentration in RDM

Chemical Component	Ecological Criteria	Estimated Chemical Concentration in RDM (% coal multiplied by Constituent Concentration in Coals)	
		RDM no Silica Gel Cleanup (mg/kg)	RDM with Silica Gel Cleanup (mg/kg)
Group 1 (0 to 850 m)			
>C10 - C16 (no naphthalene)	25	16.92	2.8
> C16 - C34	300	130.81	18.7
> C34 - C40	2800	12.63	4.8
Benzo(a)anthracene	0.1	0.035354	NA
Benzo (b) fluoroanthene	0.1	0.037879	NA
Benzo (b+j) fluoroanthene	0.1	0.017677	NA
Pyrene	0.1	0.08586	NA
Chrysene	1.1	0.116162	NA

Notes:
% = percent
m = metres
mg/kg = milligrams per kilogram
NA = not applicable
RDM = residual drilling material

In the context of the mass calculations provided above, petroleum hydrocarbon concentrations (including PAHs) can be eliminated as COPCs for Group 1 materials. This assumption is further supported as the ecological screening levels (ESLs) and Eco-Tox generic screening values used in this assessment were highly conservative (i.e., are not site-specific/receptor specific).

Group 1 Application and Mixing Ratios

Using the evaluation process discussed in the Screening Level Evaluation and Mixing Ratio section, the proposed application and mixing ratios were calculated for the refined Group 1 COPCs. **Attachment A**, **Table A-8** and **Attachment A**, **Table A-9** present the mixing ratios calculated for Method 1 and Method 2 for the refined Group 1 COPCs. **Table 7** presents a summary of the mixing ratios based on the median chemical concentrations from the geogenic chemical, the calculated hydrocarbon content after exclusion of materials from the target coal seams and the residual drilling chemical COPCs, allowing for biodecay over the time period required for rehabilitation/recolonisation. Calculated application rates using the maximum geogenic concentrations were the same as those calculated based on the median concentrations. Additionally,

as EC is the risk driver for Method 3 and Method 4, a new mixing ratio was not calculated for the Group 1 COPCs.

As described above, the application rates for Methods 1 and 2 were developed for a standard unit of 1 ha. In the context of physical application in the field, areas smaller than 1 ha will be available and these numbers should be multiplied by the available area (for example multiply application rate by 0.5 if 0.5 ha is the available area for application) to define application rates. Where specific risk driving chemicals (as noted in **Table 7**) below are not present, then higher application rates can be supported. The technical appendices should be referenced to determine these higher application rates.

Table 7 Summary of Application Rates/Mixing Ratios For Group 1 COPCs

Mud Mixing Ratio	Application rate (m^3/ha)	Assumptions
Method 1 – Surface application and mixing into soils in top 150 mm of soil column	234	Materials will be temporarily stockpiled and ultimately placed as part of rehabilitation activities. Two years will lapse between drilling commencement and rehabilitation/ recolonization. Management will involve mixing of RDM into the top 150 mm of soil across the well pad (1 ha area). Risk driver is EC.
Method 2 – Surface application and mixing into soils in top 0.5 m of soil column	781	Materials will be temporarily stockpiled and ultimately placed as part of the rehabilitation activities. Management will involve mixing the RDM into the top 0.5 m of soil across the well pad (1-ha area). Two years will lapse between drilling commencement and rehabilitation/ recolonization. Risk driver is EC.

Notes:
EC = electrical conductivity
ha = hectare
m = metre
m^3/ha = cubic metres per hectare
mm = millimetre
RDM = residual drilling material

Target concentrations for the RDM were calculated using dilution ratios for Methods 1 and 2 and are included in **Attachment A**, **Table A-10.** This table presents the target RDM COPC concentrations developed for Method 1 and Method 2 for application rates of 200 m^3/ha, 225 m^3/ha and 250 m^3/ha. The values provided in the table are for RDM prior to mixing.

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Attachment A Tables

Table A-1

Summary Statistics of Geogenic Data
Narrabri Gas Project

			Statistical Summaries						Human Health Evaluation		Ecological Evaluation	
METHOD	Chemicals	Units	Minimum	Maximum	Mean	Median	Stadard Deviation	Detection Frequency	Human Health Screening Level	Maximum Detection Exceed Human Health SL?	Ecological Screening Level	Maximum Detection Exceed Ecological SLs
APHA_2510_B_1:5	Electrical Conductivity @ 25°C	µS/cm	383	7250	3948.1304	4570	1994.00389	23 / 23	NSL	NO	50 Site-specific	Yes
APHA_3112_CV_FIMS	Mercury	mg/kg	< 0.1	0.2	NR	NR	NR	1 / 27	80 HIL	NO	6.6 CEQG	No
USEPA_3060A	Hexavalent Chromium	mg/kg	< 0.5	< 0.5	NR	NR	NR	0 / 5	300 HIL	NO	0.4 CEQG	No
USEPA_6010	Arsenic	mg/kg	< 5	7	6.33	6	0.47	3 / 12	300 HIL	NO	40 EIL/ESL	No
USEPA_6010	Beryllium	mg/kg	< 1	< 1	NR	NR	NR	0 / 5	90 HIL	NO	4 CEQG	No
USEPA_6010	Cadmium	mg/kg	< 0.4	< 0.4	NR	NR	NR	0 / 6	90 HIL	NO	1.4 CEQG	No
USEPA_6010	Cadmium	mg/kg	< 1	< 1	NR	NR	NR	0 / 6	90 HIL	NO	1.4 CEQG	No
USEPA_6010	Chromium	mg/kg	10	16	13	12	2.20	7 / 7	300 HIL	NO	140 EIL/ESL	No
USEPA_6010	Copper	mg/kg	8	52	28	29	12.67	7 / 7	17000 HIL	NO	85 EIL/ESL	No
USEPA_6010	Lead	mg/kg	7	17	12	12.5	3.61	10 / 12	600 HIL	NO	470 EIL/ESL	No
USEPA_6010	Molybdenum	mg/kg	< 2	< 2	NR	NR	NR	0 / 5	390 RSL	NO	5 CEQG	No
USEPA_6010	Nickel	mg/kg	3	31	13.64	8	9.49	11 / 12	1200 HIL	NO	50 EIL/ESL	No
USEPA_6010	Selenium	mg/kg	< 5	0	NR	NR	NR	0 / 5	700 HIL	NO	1 CEQG	No
USEPA_6010	Silver	mg/kg	< 2	0	NR	NR	NR	0 / 5	390 RSL	NO	20 CEQG	No
USEPA_6010	Zinc	mg/kg	15	72	41.71	49	20.80	7 / 7	30000 HIL	NO	230 EIL/ESL	No
USEPA_6020	Arsenic	mg/kg	< 5	26	9.25	6	6.57	8 / 21	300 HIL	NO	40 EIL/ESL	No
USEPA_6020	Cadmium	mg/kg	< 0.4	2.4	NR	NR	NR	1 / 21	90 HIL	NO	1.4 CEQG	Yes
USEPA_6020	Chromium	mg/kg	4	74	19.38	14	16.89	21 / 21	300 HIL	NO	140 EIL/ESL	No
USEPA_6020	Copper	mg/kg	5	56	29.43	27	15.25	21 / 21	17000 HIL	NO	85 EIL/ESL	No
USEPA_6020	Lead	mg/kg	< 5	22	12.44	12	4.87	18 / 21	600 HIL	NO	470 EIL/ESL	No
USEPA_6020	Nickel	mg/kg	3	71	20.71	16	17.79	21 / 21	1200 HIL	NO	45 CEQG	Yes
USEPA_6020	Zinc	mg/kg	6	109	48.67	57	26.67	21 / 21	30000 HIL	NO	230 EIL/ESL	No
USEPA_8015	>C10 - C16 Fraction	mg/kg	< 50	2240	409	180	518	19 / 24	3800 HSL	NO	NSL	No
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	50	670	363	370	253	3 / 3	NSL	NO	25 EIL/ESL	Yes
USEPA_8015	>C10 - C40 Fraction (sum)	mg/kg	< 50	5910	1745	1130	1691	22 / 24	NSL	NO	NSL	No
USEPA_8015	>C16 - C34 Fraction	mg/kg	< 100	5180	1429	1005	1291	20 / 24	5300 HSL	NO	300 EIL/ESL	Yes
USEPA_8015	>C34 - C40 Fraction	mg/kg	< 100	500	255	230	123	8 / 24	7400 HSL	NO	2800 EIL/ESL	No
USEPA_8015	C10 - C14 Fraction	mg/kg	< 50	650	211	145	190	12 / 24	NSL	NO	NSL	No
USEPA_8015	C10 - C36 Fraction (sum)	mg/kg	< 50	5680	1705	1035	1638	22 / 24	NSL	NO	NSL	No
USEPA_8015	C15 - C28 Fraction	mg/kg	< 100	4770	1379	775	1368	22 / 24	NSL	NO	NSL	No
USEPA_8015	C29 - C36 Fraction	mg/kg	< 100	740	331	220	203	14 / 24	NSL	NO	NSL	No
USEPA_8015_SG	>C10 - C16 Fraction	mg/kg	< 50	110	NR	NR	NR	1 / 5	3800 HSL	NO	NSL	No
USEPA_8015_SG	>C10 - C40 Fraction (sum)	mg/kg	< 50	1040	657	690	327	3 / 5	NSL	NO	NSL	No
USEPA_8015_SG	>C16 - C34 Fraction	mg/kg	< 100	740	557	690	225	3 / 5	5300 HSL	NO	300 EIL/ESL	Yes
USEPA_8015_SG	>C34 - C40 Fraction	mg/kg	< 100	190	NR	NR	NR	1 / 5	7400 HSL	NO	2800 EIL/ESL	No
USEPA_8015_SG	C10 - C14 Fraction	mg/kg	< 50	< 50	NR	NR	NR	0 / 5	NSL	NO	NSL	No
USEPA_8015_SG	C10 - C36 Fraction (sum)	mg/kg	< 50	890	657	800	269	3 / 5	NSL	NO	NSL	No
USEPA_8015_SG	C15 - C28 Fraction	mg/kg	< 100	570	417	550	203	3 / 5	NSL	NO	NSL	No
USEPA_8015_SG	C29 - C36 Fraction	mg/kg	< 100	340	240	230	77.89	3 / 5	NSL	NO	NSL	No
USEPA_8260	Benzene	mg/kg	< 0.2	0.3	NR	NR	NR	1 / 24	120 HSL	NO	8 EIL/ESL	No
USEPA_8260	C6 - C10 Fraction	mg/kg	< 10	67	30	23	18.81	7 / 13	5100 HSL	NO	NSL	No
USEPA_8260	C6 - C10 Fraction minus BTEX (F1)	mg/kg	< 10	66	34.4	23	19.37	5 / 8	NSL	NO	125 EIL/ESL	No
USEPA_8260	C6 - C9 Fraction	mg/kg	< 10	19	14.75	14.5	3.34	4 / 13	NSL	NO	NSL	No
USEPA_8260	Ethylbenzene	mg/kg	< 0.5	0	NR	NR	NR	0 / 24	5300 HSL	NO	1.5 EIL/ESL	No
USEPA_8260	meta- & para-Xylene	mg/kg	< 0.5	1	NR	NR	NR	1 / 24	550 RSL	NO	NSL	No
USEPA_8260	Naphthalene	mg/kg	< 1	< 1	NR	NR	NR	0 / 8	1900 HSL	NO	10 EIL/ESL	No
USEPA_8260	ortho-Xylene	mg/kg	< 0.5	< 0.5	NR	NR	NR	0 / 24	650 RSL	NO	NSL	No
USEPA_8260	Sum of BTEX	mg/kg	< 0.2	3.3	1.14	0.6	1.08	5 / 24	NSL	NO	NSL	No
USEPA_8260	Toluene	mg/kg	< 0.5	2	0.88	0.6	0.56	5 / 24	18000 HSL	NO	10.5 EIL/ESL	No
USEPA_8260	Total Xylenes	mg/kg	< 0.5	1	NR	NR	NR	1 / 24	17000 HSL	NO	10 EIL/ESL	No
USEPA_8260_VOC	Benzene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 5	120 HSL	NO	8 EIL/ESL	No
USEPA_8260_VOC	Ethylbenzene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 5	5300 HSL	NO	1.5 EIL/ESL	No

Table A-1

Summary Statistics of Geogenic Data
Narrabri Gas Project

			Statistical Summaries						Human Health Evaluation		Ecological Evaluation	
METHOD	Chemicals	Units	Minimum	Maximum	Mean	Median	Stadard Deviation	Detection Frequency	Human Health Screening Level	Maximum Detection Exceed Human Health SL?	Ecological Screening Level	Maximum Detection Exceed Ecological SLs
USEPA_8260_VOC	meta- & para-Xylene	mg/kg	< 0.5	0.6	0.55	0.55	0.05	2 / 5	17000 HSL	NO	10 EIL/ESL	No
USEPA_8260_VOC	ortho-Xylene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 5	17000 HSL	NO	10 EIL/ESL	No
USEPA_8270B_PAH	Acenaphthene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 25	Screen Sum of PAH	NO	29 ECO-SSL	No
USEPA_8270B_PAH	Acenaphthylene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 25	Screen Sum of PAH	NO	29 ECO-SSL	No
USEPA_8270B_PAH	Anthracene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 25	Screen Sum of PAH	NO	2.5 CEQG	No
USEPA_8270B_PAH	Benz(a)anthracene	mg/kg	< 0.5	1.4	1	0.8	0.28	3 / 25	Screen Sum of PAH	NO	0.1 CEQG	Yes
USEPA_8270B_PAH	Benzo(a)pyrene	mg/kg	< 0.5	0.7	0.63	0.6	0.05	3 / 25	3 HIL	NO	0.7 EIL/ESL	No
USEPA_8270B_PAH	Benzo(a)pyrene TEQ (Half LOR)	mg/kg	0.6	1.1	0.85	0.85	0.25	2 / 2	3 HIL	NO	NSL	No
USEPA_8270B_PAH	Benzo(a)pyrene TEQ (LOR)	mg/kg	1.2	1.4	1.3	1.3	0.1	2 / 2	3 HIL	NO	NSL	No
USEPA_8270B_PAH	Benzo(a)pyrene TEQ (zero)	mg/kg	< 0.5	1	0.87	0.8	0.09	3 / 25	3 HIL	NO	NSL	No
USEPA_8270B_PAH	Benzo(b)fluoranthene	mg/kg	< 0.5	1.5	1.45	1.45	0.05	2 / 23	Screen Sum of PAH	NO	0.1 CEQG	Yes
USEPA_8270B_PAH	Benzo(b+j)fluoranthene	mg/kg	< 0.5	0.7	NR	NR	NR	1 / 2	Screen Sum of PAH	NO	0.1 CEQG	Yes
USEPA_8270B_PAH	Benzo(g.h.i)perylene	mg/kg	< 0.5	1	0.8	0.8	0.16	3 / 25	Screen Sum of PAH	NO	1.1 ECO-SSL	No
USEPA_8270B_PAH	Benzo(k)fluoranthene	mg/kg	< 0.5	0.6	0.55	0.55	0.05	2 / 25	Screen Sum of PAH	NO	0.1 CEQG	Yes
USEPA_8270B_PAH	Chrysene	mg/kg	< 0.5	2.3	1.83	1.8	0.37	3 / 25	Screen Sum of PAH	NO	1.1 ECO-SSL	Yes
USEPA_8270B_PAH	Dibenz(a.h)anthracene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 25	Screen Sum of PAH	NO	0.1 CEQG	No
USEPA_8270B_PAH	Fluoranthene	mg/kg	< 0.5	2.1	1.47	1.4	0.49	3 / 25	Screen Sum of PAH	NO	50 CEQG	No
USEPA_8270B_PAH	Fluorene	mg/kg	< 0.5	3.6	2.43	2.1	0.85	3 / 25	Screen Sum of PAH	NO	29 ECO-SSL	No
USEPA_8270B_PAH	Indeno(1.2.3.cd)pyrene	mg/kg	< 0.5	< 0.5	NR	NR	NR	0 / 25	Screen Sum of PAH	NO	0.1 CEQG	No
USEPA_8270B_PAH	Naphthalene	mg/kg	0.6	2.5	1.0571429	0.6	0.65	7 / 25	Screen Sum of PAH	NO	10 EIL/ESL	No
USEPA_8270B_PAH	Pentachlorophenol	mg/kg	< 2	< 2	NR	NR	NR	0 / 2	120 HIL	NO	7.6 CEQG	No
USEPA_8270B_PAH	Phenanthrene	mg/kg	< 0.5	5.7	2.7	2.9	1.85	5 / 25	Screen Sum of PAH	NO	29 ECO-SSL	No
USEPA_8270B_PAH	Pyrene	mg/kg	< 0.5	2.1	1.33	1.3	0.55	4 / 25	Screen Sum of PAH	NO	0.1 CEQG	Yes
USEPA_8270B_PAH	Sum of polycyclic aromatic hydrocarbons (PAHs)	mg/kg	< 0.5	21.2	6.16	1.1	7.79	9 / 25	300 HIL	NO	NSL	No
USEPA_8270D	Acenaphthene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 3	Screen Sum of PAH	NO	29 ECO-SSL	No
USEPA_8270D	Acenaphthylene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 3	Screen Sum of PAH	NO	29 ECO-SSL	No
USEPA_8270D	Anthracene	mg/kg	< 0.5	0.6	NR	NR	NR	1 / 3	Screen Sum of PAH	NO	2.5 CEQG	No
USEPA_8270D	Benz(a)anthracene	mg/kg	< 0.5	2.1	NR	NR	NR	1 / 3	Screen Sum of PAH	NO	0.1 CEQG	Yes
USEPA_8270D	Benzo(a)pyrene	mg/kg	< 0.50	< 0.50	NR	NR	NR	0 / 3	3 HIL	NO	0.7 EIL/ESL	No
USEPA_8270D	Benzo(b) & Benzo(k)fluoranthene	mg/kg	< 0.5	1	NR	NR	NR	1 / 3	Screen Sum of PAH	NO	0.1 CEQG	Yes
USEPA_8270D	Benzo(g.h.i)perylene	mg/kg	< 0.5	1.1	NR	NR	NR	1 / 3	Screen Sum of PAH	NO	1.1 ECO-SSL	No
USEPA_8270D	Chrysene	mg/kg	< 0.5	4.6	NR	NR	NR	1 / 3	Screen Sum of PAH	NO	1.1 ECO-SSL	Yes
USEPA_8270D	Dibenz(a.h)anthracene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 3	Screen Sum of PAH	NO	0.1 CEQG	No
USEPA_8270D	Fluoranthene	mg/kg	< 0.5	3.7	NR	NR	NR	1 / 3	Screen Sum of PAH	NO	50 CEQG	No
USEPA_8270D	Fluorene	mg/kg	< 0.5	7.2	NR	NR	NR	1 / 3	Screen Sum of PAH	NO	29 ECO-SSL	No
USEPA_8270D	Indeno(1.2.3.cd)pyrene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 3	Screen Sum of PAH	NO	0.1 CEQG	No
USEPA_8270D	Naphthalene	mg/kg	< 0.5	1.9	NR	NR	NR	1 / 3	Screen Sum of PAH	NO	10 EIL/ESL	No
USEPA_8270D	Phenanthrene	mg/kg	< 0.5	9.8	NR	NR	NR	1 / 3	Screen Sum of PAH	NO	29 ECO-SSL	No
USEPA_8270D	Pyrene	mg/kg	< 0.5	4.3	NR	NR	NR	1 / 3	Screen Sum of PAH	NO	0.1 CEQG	Yes

Notes:

< = less than
°C = degrees Celsius
µS/cm = microSiemens per centimetre
BTEX = benzene, toluene, ethylbenzene, and xylene
CEQG = Canadian Environmental Quality Guidelines
ECO-SSL = ecological soil screening level
EIL = Ecological Investigation Level
ESL = Ecological Screening Level
HIL = Health Investigation Level
HSL = health Screening Level
LOR = limit of reporting
mg/kg = milligrams per kilogram
PAH = polycyclic aromatic hydrocarbon
NA = not applicable
NR = not reported
NSL = no screening level
RSL = regional screening level
TEQ = toxic equivalence quotient

Refer to text for sources of screening levels.

Table A-2

Summary of Background Soils Data within New South Wales
Narrabri Gas Project

								Human Health Evaluation			Ecological Evaluation		
CHEMICAL	UNITS	Min	Max	Mean	Median	Standard Deviation	Detection Frequency	Human Health Screening Level		Maximum Detection Exceed Human Health SL?	Ecological Screening Level		Maximum Detection Exceed Ecological SLs
Electrical Conductivity @ 25°C	µS/cm	7	1420	137.3	37.5	319.6	28 / 28	NSL		NO	50	CEQG	Yes
Mercury	mg/kg	<0.1	<0.1	NR	NR	NR	0 / 18	80	HIL	NO	6.6	CEQG	No
Arsenic	mg/kg	<5	<5	NR	NR	NR	0 / 18	300	HIL	NO	40	ESL	No
Cadmium	mg/kg	<0.4	<0.4	NR	NR	NR	0 / 18	90	HIL	NO	1.4	CEQG	No
Chromium	mg/kg	5	16	8.625	7.5	3.60	8 / 18	300	HIL	NO	140	ESL	No
Copper	mg/kg	6	41	25.4	35	15.55	5 / 18	17000	HIL	NO	85	ESL	No
Lead	mg/kg	5	8	6	6	0.87	8 / 18	600	HIL	NO	470	ESL	No
Nickel	mg/kg	2	36	9.07	3	12.06	15 / 18	1200	HIL	NO	50	ESL	No
Zinc	mg/kg	5	52	26	25.5	19.66	6 / 18	30000	HIL	NO	230	ESL	No
>C10 - C16 Fraction	mg/kg	<50	<50	NR	NR	NR	0 / 18	3800	HSL	NO	NSL		No
>C10 - C40 Fraction (sum)	mg/kg	130	320	197.5	170	75.62	4 / 18	NSL		NO	NSL		No
>C16 - C34 Fraction	mg/kg	130	320	197.5	170	75.62	4 / 18	5300	HSL	NO	300	ESL	Yes
>C34 - C40 Fraction	mg/kg	<100	<100	NR	NR	NR	0 / 18	7400	HSL	NO	2800	ESL	No
C10 - C14 Fraction	mg/kg	<50	<50	NR	NR	NR	0 / 18	NSL		NO	NSL		No
C10 - C36 Fraction (sum)	mg/kg	100	360	177.5	125	107.3	4 / 18	NSL		NO	NSL		No
C15 - C28 Fraction	mg/kg	100	230	160	150	53.54	3 / 18	NSL		NO	NSL		No
C29 - C36 Fraction	mg/kg	100	130	115	115	15	2 / 18	NSL		NO	NSL		No
Benzene	mg/kg	<0.2	<0.2	NR	NR	NR	0 / 18	120	HSL	NO	8	ESL	No
Ethylbenzene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	5300	HSL	NO	1.5	ESL	No
meta- & para-Xylene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	550	RSL	NO	NSL		No
ortho-Xylene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	650	RSL	NO	NSL		No
Sum of BTEX	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	NSL		NO	NSL		No
Toluene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	18000	HSL	NO	10.5	ESL	No
Total Xylenes	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	17000	HSL	NO	10	ESL	No
Acenaphthene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	29	ECO-SSL	No
Acenaphthylene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	29	ECO-SSL	No
Anthracene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	2.5	CEQG	No
Benz(a)anthracene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	0.1	CEQG	No
Benzo(a)pyrene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	3	HIL	NO	0.7	ESL	No
Benzo(a)pyrene TEQ (Half LOR)	mg/kg	0.6	0.6	0.6	0.6	0.00	8 / 8	3	HIL	NO	NSL		No
Benzo(a)pyrene TEQ (LOR)	mg/kg	1.2	1.2	1.2	1.2	0.00	8 / 8	3	HIL	NO	NSL		No
Benzo(a)pyrene TEQ (zero)	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	3	HIL	NO	NSL		No
Benzo(b+j)fluoranthene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 8	Screen Sum of PAH		NO	0.1	CEQG	No
Benzo(g.h.i)perylene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	18	ECO-SSL	No
Benzo(k)fluoranthene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	0.1	CEQG	No
Chrysene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	18	ECO-SSL	No
Dibenz(a.h)anthracene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	0.1	CEQG	No
Fluoranthene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	50	CEQG	No
Fluorene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	29	ECO-SSL	No
Indeno(1.2.3.cd)pyrene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	0.1	CEQG	No
Naphthalene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	10	ESL	No
Phenanthrene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	29	ECO-SSL	No
Pyrene	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	Screen Sum of PAH		NO	0.1	CEQG	No
Sum of polycyclic aromatic hydrocarbons (PAHs)	mg/kg	<0.5	<0.5	NR	NR	NR	0 / 18	300	HIL	NO	NSL		No

Notes:
Refer to text for sources of screening levels.
< = less than
°C = degrees Celsius
µS/cm = microSiemens per centimetre
BTEX = benzene, toluene, ethylbenzene, and xylene
CEQG = Canadian Environmental Quality Guidelines
ECO-SSL = ecological soil screening level
ESL = Ecological Screening Level
HIL = Health Investigation Level
HSL = health Screening Level
LOR = limit of reporting
mg/kg = milligrams per kilogram
NA = not applicable
NR = not reported
NSL = no screening level
PAH = polycyclic aromatic hydrocarbon
RSL = regional screening level
TEQ = toxic equivalence quotient

EHS Support

Table A-3

Comparison of Residiual Driling Chemicals to $PNEC_{soil}$
Narrabri Gas Project

Constituent Name	CAS No.	EPC (10% of mud concentration) (mg/kg)	$PNEC_{soil}$ (mg/kg)	EPC drilling muds >$PNEC_{soil}$?
Copolymer of acrylamide and sodium acrylate	25085-02-3	70	ND	NO
Ethylene oxide/propylene oxide copolymer	9003-11-6	2.4	ND	NO
Glyoxal	107-22-2	3.1	4.1E+00	NO
Methanol	67-56-1	0.30	1.0E+02	NO
Methylisothiocyanate (MITC)	556-61-6	3.0	2.8E-03	YES
Pentanedial / Glutaraldehyde	111-30-8	30	2.0E-02	YES
Polyalkylene	9038-95-3	2226	ND	NO
Polypropylene glycol	25322-69-4	4.8	5.0E-02	YES
Potassium chloride	7447-40-7	4152	ND	NO
Silicic acid, potassium salt	1312-76-1	2220	ND	NO
Sodium carbonate	497-19-8	7.8	ND	NO
Sodium carboxymethyl cellulose	9004-32-4	312	ND	NO
Sodium chloride	7647-14-5	4560	ND	NO
Sodium hydroxide	1310-73-2	30	ND	NO
Sodium polyacrylate	9003-04-7	109	2.5E+01	YES
Starch	9005-25-8	306	ND	NO
Tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione [a]	533-74-4	0.0	4.0E-03	NO
Xanthan gum	11138-66-2	306	ND	NO

Notes:
a/ Tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione hydrolizes/metabilizes to 100% MITC after 3-5 days based on degredation. Therefore, mass of Tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione in muds will be assumed to be 0 mg/kg.
CAS = Chemical Abstracts Service
EPC = exposure point concentration
mg/kg = milligrams per kilogram
ND = not derived
PNEC = predicted no effects concentration

Table A-4

Development of Blending Ratios Based on Geogenic COPCs
Narrabri Gas Project

			Statistical Summaries		Ecological Evaluation		Blending Ratio	
METHOD	Constituent Name	Units	Maximum	Median	Ecological Screening Level		Based on Maximum Detection	Based on Median Detection
APHA_2510_B_1:5	Electrical Conductivity @ 25°C	µS/cm	7250	4570	50	Site-specific	10.2	6.4
USEPA_6020	Cadmium	mg/kg	2.4	NR	1.4	CEQG	1.7	NA
USEPA_6020	Nickel	mg/kg	71	16	45	CEQG	1.6	0.4
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	mg/kg	670	370	25	EIL/ESL	26.8	14.8
USEPA_8015	>C16 - C34 Fraction	mg/kg	5180	1005	300	EIL/ESL	17.3	3.4
USEPA_8270B_PAH	Benzo(b)fluoranthene	mg/kg	1.5	1.45	0.1	CEQG	15.0	14.5
USEPA_8270B_PAH	Benzo(b+j)fluoranthene	mg/kg	0.7	NR	0.1	CEQG	7.0	NA
USEPA_8270B_PAH	Benzo(k)fluoranthene	mg/kg	0.6	0.55	0.1	CEQG	6.0	5.5
USEPA_8270D	Benz(a)anthracene	mg/kg	2.1	NR	0.1	CEQG	21.0	NA
USEPA_8270D	Benzo(b) & Benzo(k)fluoranthene	mg/kg	1	NR	0.1	CEQG	10.0	NA
USEPA_8270D	Chrysene	mg/kg	4.6	NR	1.1	ECO-SSL	4.2	NA
USEPA_8270D	Pyrene	mg/kg	4.3	NR	0.1	CEQG	43	NA

Notes:

°C = degrees Celsius

µS/cm = microSiemens per centimetre

CEQG = Canadian Environmental Quality Guidelines

ECO-SSL = ecological screening level

EIL = Ecological Investigation Level

ESL = Ecological Screening Level

mg/kg = milligrams per kilogram

NA = not applicable

NR = not reported

PAH = polycyclic aromatic hydrocarbon

Refer to text for sources of screening levels.

Table A-5

Development of Blending Ratios Based on Residual Drilling Chemical COPCs
Narrabri Gas Project

Constituent Name	CAS Number	EPC (10% of mud concentration) (mg/kg)	Soil Half-life (days)	EPC in Rehabiliated Well Pad soils after 2 years (mg/kg)[1]	Blending Ratio[1]
Methylisothiocyanate (MITC)	556-61-6	3.0	5 to 14	1.5E-149	5.4E-147
Pentanedial / Glutaraldehyde	111-30-8	30	1.7	0.0E+00	0.0E+00
Polypropylene glycol	25322-69-4	4.8	15	2.2E-139	4.3E-138
Sodium polyacrylate	9003-04-7	109	NA	109	4.4

Notes:

CAS = Chemical Abstracts Service

EPC = exposure point concentration

mg/kg = milligrams per kilogram

NA = not applicable

1/ Calculated EPC for pentanedial/gultaraldehyde degreaded to infinitesimally small concentration.
Therefore, EPC effectively 0 mg/kg and no blending required to satisfy screening level after 2 years.

Table A-6

Calculation of Land Application Ratios for Residual Drilling Material
(Median Geogenic Concentrations)
Narrabri Gas Project

GEOGENIC					
		METHOD 1 (m^3/ha)	METHOD 2 (m^3/ha)	METHOD 3 (m^3/ha)	Method 4 (m^3/ha)
Constituent Name	Dilution Ratio to Achieve Risk-Based Criterion	Volume that can be spread and naturally incorporated into top 150 mm of soil over 1 ha	Volume that can be mixed into 0.5 m column of soil and buried over 1 ha	Volume of soil to mix with residual drilling material, then bury with minimum of 0.5 m of soil cover	Volume of soil to mix with residual drilling material, then bury with minimum of 1.5 m of soil cover
Electrical Conductivity @ 25°C	6.4	234	781	6.40	6.40
Cadmium	NA	NA	NA	NA	NA
Nickel	0.4	4219	14063	NA	NA
>C10 - C16 Fraction minus Naphthalene (F2)	14.8	101	338	NA	NA
>C16 - C34 Fraction	3.4	448	1493	NA	NA
Benz(a)anthracene	8.0	188	625	NA	NA
Benzo(b)fluoranthene	14.5	103	345	NA	NA
Benzo(b+j)fluoranthene	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	5.5	273	909	NA	NA
Chrysene	1.6	917	3056	NA	NA
Pyrene	13.0	115	385	NA	NA
Benzo(b) & Benzo(k)fluoranthene	NA	NA	NA	NA	NA
GEOGENIC MIX/BLEND RATIO		101	338	6.4	6.4
CHLORIDE-BASED MUDS					
Methylisothiocyanate (MITC)	0	731416	2438052	2.1E-03	NA
Pentanedial / Glutaraldehyde	0.000	7.31E+47	2.4E+48	2.1E-45	NA
Polypropylene glycol	0.000366211	4096000	13653333	3.7E-04	NA
Sodium polyacrylate	4.4	343	1145	4.4	NA
CHLORIDE-BASED MUDS MIX/BLEND RATIO		343	1145	4.4	NA
FINAL RATIOS		101	338	6.4	6.4

Notes:
°C = degrees Celsius
ha = hectare
m = metre
m^3/ha = cubic metres per hectare
mm = millimetre
NA = not applicable

Table A-7

Calculation of Land Application Ratios for Residual Drilling Material
(Maximum Geogenic Concentrations)
Narrabri Gas Project

GEOGENIC					
		METHOD 1 (m^3/ha)	METHOD 2 (m^3/ha)	METHOD 3 (m^3/ha)	Method 4 (m^3/ha)
Constituent Name	Dilution Ratio to Achieve Risk Based Criteria	Volume that can be spread and naturally incorporated into top 150 mm of soil over 1 ha	Volume that can be mixed into 0.5 m column of soil and buried over 1 ha	Volume of soil to mix with residual drilling material, then bury with minimum of 0.5 m of soil cover	Volume of soil to mix with residual drilling material, then bury with minimum of 1.5 m of soil cover
Electrical Conductivity @ 25°C	10.2	148	493	10.2	10.2
Cadmium	1.71	875	2917	NA	NA
Nickel	1.58	951	3169	NA	NA
>C10 - C16 Fraction minus Naphthalene (F2)	26.80	56	187	NA	NA
>C16 - C34 Fraction	17.27	87	290	NA	NA
Benzo(b)fluoranthene	15.0	100	333	NA	NA
Benzo(b+j)fluoranthene	7.0	214	714	NA	NA
Benzo(k)fluoranthene	6.0	250	833	NA	NA
Benz(a)anthracene	21.0	71	238	NA	NA
Benzo(b) & Benzo(k)fluoranthene	10.0	150	500	NA	NA
Chrysene	4.2	359	1196	NA	NA
Pyrene	43.0	35	116	NA	NA
GEOGENIC MIX/BLEND RATIO		35	116	10.2	10.2
Chloride based mud					
Methylisothiocyanate (MITC)	0.0	731416	2438052	0.0	NA
Pentanedial / Glutaraldehyde	0.000	7.31E+47	2.44E+48	0.0	NA
Polypropylene glycol	0.0	4096000	13653333	0	NA
Sodium polyacrylate	4.4	343	1145	4	NA
CHLORIDE-BASED MUDS MIX/BLEND RATIO		343	1145	4	NA
FINAL RATIOS		35	116	10	10.2

Notes:
*C = degrees Celsius
ha = hectare
m = metre
m^3/ha = cubic metres per hectare
mm = millimetres
NA = not applicable

Table A-8

Calculation of Land Application Ratios for Residual Drilling Material for Group 1 Materials
(Median Geogenic Concentrations)
Narrabri Gas Project

GEOGENIC			
		METHOD 1 (m^3/ha)	METHOD 2 (m^3/ha)
Constituent Name	Calculate Median/ Screening Level	Volume that can be spread and naturally incorporated into top 150 mm of soil over 1 ha	Volume that can be mixed into 0.5 m column of soil and buried over 1 ha
Electrical Conductivity @ 25°C	6.4	234	781
Cadmium	NA	NA	NA
Nickel	0.4	4219	14063
GEOGENIC MIX/BLEND RATIO		234	781
CHLORIDE-BASED MUDS			
Methylisothiocyanate (MITC)	2.1E-03	731416	2438052
Pentanedial / Glutaraldehyde	2.1E-45	7.3E+47	2.4E+48
Polypropylene glycol	3.7E-04	4096000	13653333
Sodium polyacrylate	4.4	343	1145
CHLORIDE-BASED MUDS MIX/BLEND RATIO		343	1145
	FINAL RATIOS	234	781

Notes:
°C = degrees Celsius
ha = hectare
m = metre
m^3/ha = cubic metres per hectare
mm = millimetre
NA = not applicable

Table A-9

Calculation of Land Application Ratios for Residual Drilling Material
(Maximum Geogenic Concentrations)
Narrabri Gas Project

GEOGENIC			
		METHOD 1 (m^3/ha)	METHOD 2 (m^3/ha)
Constituent Name	Dilution Ratio to Achieve Risk Based Criteria	Volume that can be spread and naturally incorporated into top 150 mm of soil over 1 ha	Volume that can be mixed into 0.5 m column of soil and buried over 1 ha
Electrical Conductivity @ 25°C	10.2	148	493
Cadmium	1.71	875	2917
Nickel	1.58	951	3169
GEOGENIC MIX/BLEND RATIO		148	493
Chloride based mud			
Methylisothiocyanate (MITC)	2.1E-03	731416	2438052
Pentanedial / Glutaraldehyde	2.1E-45	7.3E+47	2.4E+48
Polypropylene glycol	3.7E-04	4096000	13653333
Sodium polyacrylate	4.4	343	1145
CHLORIDE-BASED MUDS MIX/BLEND RATIO		343	1145
FINAL RATIOS		148	493

Notes:
*C = degrees Celsius
ha = hectare
m = metre
m^3/ha = cubic metres per hectare
mm = millimetres
NA = not applicable

Table A-10

Calculation of Target Chemical Concentrations for Residutal Drillnig Material

Narrabri Gas Project

Applciation Rate of 200 m3/ha		
	METHOD 1 (m^3/ha)	METHOD 2 (mg/kg)
Constituent Name	Target Chemical Concentration that can be spread and naturally incorporated into top 150 mm of soil over 1 ha soil (mg/kg)	Target Chemical Concentration that can be mixed into 0.5 m column of soil and buried over 1 ha (mg/kg)
GEOGENIC		
Electrical Conductivity @ 25°C	375	1250
Cadmium	11	35
Nickel	338	1125
>C10 - C16 Fraction minus Naphthalene (F2)	188	625
>C16 - C34 Fraction	2250	7500
Benz(a)anthracene	0.75	2.5
Benzo(b)fluoranthene	0.75	2.5
Benzo(b+j)fluoranthene	0.75	2.5
Benzo(k)fluoranthene	0.75	2.5
Chrysene	8.25	28
Pyrene	0.75	2.5
Benzo(b) & Benzo(k)fluoranthene	0.75	2.5
CHLORIDE-BASED MUDS		
Methylisothiocyanate (MITC)	4.2E+147	1.4E+148
Pentanedial / Glutaraldehyde	NA	NA
Polypropylene glycol	8.4E+138	2.8E+139
Sodium polyacrylate	187.50	625

Applciation Rate of 225 m3/ha		
	METHOD 1 (mg/kg)	METHOD 2 (mg/kg)
Constituent Name	Target Chemical Concentration that can be spread and naturally incorporated into top 150 mm of soil over 1 ha soil (mg/kg)	Target Chemical Concentration that can be mixed into 0.5 m column of soil and buried over 1 ha (mg/kg)
GEOGENIC		
Electrical Conductivity @ 25°C	333	1111
Cadmium	9.3	31
Nickel	300	1000
>C10 - C16 Fraction minus Naphthalene (F2)	167	556
>C16 - C34 Fraction	2000	6667
>C16 - C34 Fraction	2000	6667
Benz(a)anthracene	0.67	2.2
Benzo(b)fluoranthene	0.67	2.2
Benzo(b+j)fluoranthene	0.67	2.2
Benzo(k)fluoranthene	0.67	2.2
Chrysene	7.3	24.4
Pyrene	0.67	2.2
Benz(a)anthracene	0.67	2.2
Benzo(b) & Benzo(k)fluoranthene	0.67	2.2
CHLORIDE-BASED MUDS		
Methylisothiocyanate (MITC)	3.7E+147	1.2E+148
Pentanedial / Glutaraldehyde	NA	NA
Polypropylene glycol	7.4E+138	2.5E+139
Sodium polyacrylate	1.7E+02	5.6E+02

Table A-10

Calculation of Target Chemical Concentrations for Residutal Drillnig Material

Narrabri Gas Project

Applciation Rate of 250 m3/ha		
	METHOD 1 (mg/kg)	METHOD 2 (mg/kg)
Constituent Name	Target Chemical Concentration that can be spread and naturally incorporated into top 150 mm of soil over 1 ha soil (mg/kg)	Target Chemical Concentration that can be mixed into 0.5 m column of soil and buried over 1 ha (mg/kg)
GEOGENIC		
Electrical Conductivity @ 25°C	300	1000
Cadmium	8.4	28
Nickel	270	900
>C10 - C16 Fraction minus Naphthalene (F2)	150	500
>C16 - C34 Fraction	1800	6000
>C16 - C34 Fraction	1800	6000
Benz(a)anthracene	0.6	2.0
Benzo(b)fluoranthene	0.6	2.0
Benzo(b+j)fluoranthene	0.6	2.0
Benzo(k)fluoranthene	0.6	2.0
Chrysene	6.6	22
Pyrene	0.6	2.0
Benz(a)anthracene	0.6	2.0
Benzo(b) & Benzo(k)fluoranthene	0.6	2.0
CHLORIDE-BASED MUDS		
Methylisothiocyanate (MITC)	3.4E+147	1.1E+148
Pentanedial / Glutaraldehyde	NA	NA
Polypropylene glycol	6.7E+138	2.2E+139
Sodium polyacrylate	150	500

Notes:
°C = degrees Celsius
ha = hectare
m = metre
m^3/ha = cubic metres per hectare
mg/kg = milligram per kilogram
mm = millimetre
NA = not applicable