



# Bibblewindi Gas Exploration Pilot Expansion

## Environmental Impact Statement (EIS)

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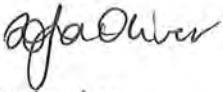
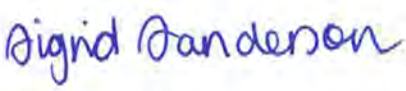
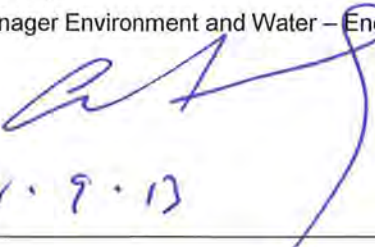
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**Approval for Issue**

| Name             | Signature                                                                           | Date    |
|------------------|-------------------------------------------------------------------------------------|---------|
| Sigrid Sanderson |  | 11/9/13 |

## Contact Information and Declaration

|                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Applicant:                           | <p>Proponent: Santos NSW (Eastern) Pty Ltd, as the CSG operator, on behalf of the titleholders of PAL 2, Santos NSW Pty Ltd and EnergyAustralia Narrabri Gas Pty Ltd.</p> <p>Address: Level 16<br/>40 Creek Street<br/>Brisbane QLD 4000</p> <p>Contact Name: Sofia Oliver<br/>Position: Regulatory Approvals Co-ordinator</p> <p>Signature: </p> <p>Date: 11/9/13</p>                                                                          |
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| Application Subject<br>Land Address: | Little Tighes Gully Road, Bibblewindi State Forest, Narrabri                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Declaration:                         | <p>I declare that this Environmental Impact Statement:</p> <p>(a) contains all available information that is relevant to the environmental assessment of the proposed activity to which this statement relates, and</p> <p>(b) that the information contained in this statement is neither false nor misleading.</p> <p>Name: Alan Feely<br/>Position: Manager Environment and Water – Energy NSW</p> <p>Signature: </p> <p>Date: 11.9.13</p> |

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## Executive Summary

### Overview

Santos NSW (Eastern) Pty Ltd (Santos), as the coal seam gas (CSG) operator of Petroleum Assessment Lease 2 (PAL 2), is seeking consent to drill two additional pilot wells within the existing Bibblewindi Multi-Lateral Pilot and operate the expanded pilot for up to three years (the proposed activity). The Bibblewindi Multi-Lateral Pilot is located in the Bibblewindi State Forest, approximately 40 kilometres south of Narrabri, north western NSW. The proposed activity would be conducted on behalf of the titleholders of PAL 2, Santos NSW Pty Ltd and EnergyAustralia Narrabri Gas Pty Ltd.

The proposed activity is classified as State Significant Development (SSD) under the State Environmental Planning Policy (State and Regional Development) 2011 (SRD SEPP). Under schedule 1 of the SRD SEPP development for the purpose of drilling or operating petroleum exploration wells, not including 'a set of 5 or fewer wells that is more than 3 kilometres from any other petroleum well (other than an abandoned petroleum well) in the same petroleum title is SSD.'

The development of the proposed activity is for the purpose of drilling and operating more than five wells within a three kilometre radius within PAL 2 and is therefore deemed to be SSD under the SRD SEPP.

RPS Australia East Pty Ltd (RPS) has prepared this Environmental Impact Statement (EIS) to assess the potential environmental impacts of the proposed activity, in accordance with section 78A(8A) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

### The proposed activity

The proposed activity includes:

- construction: site preparation activities at existing well leases, establishment of necessary equipment, temporary structures and facilities on the lease areas to enable drilling; drilling one vertical pilot well (Bibblewindi 31) and one lateral pilot well (Bibblewindi 32) and connection to the Bibblewindi Multi-Lateral Pilot.
- operation: operating the existing Bibblewindi Multi-Lateral Pilot with the new Bibblewindi 31 and 32 wells, management of the water and gas produced during operation for up to 3 years and general maintenance activities.
- post operation and rehabilitation: decommissioning and rehabilitation of pilot wells and ancillary infrastructure or suspension of wells for potential future use.

The footprint for the proposed new wells (Bibblewindi 31 and 32) will be contained on the existing well leases for Bibblewindi 14 and 19H respectively and construction access will be along existing access tracks. There will be no new disturbance beyond the lease areas and access tracks.

The proposed activity forms part of the Energy NSW CSG Exploration and Appraisal Program (E&A Program). The program consists of a series of CSG exploration and appraisal activities including recommencing operation of a number of existing pilot wells, drilling and operating new pilot wells and constructing and operating water and gas management facilities to support the program.

The E&A Program is necessary for the ongoing exploration, appraisal and evaluation of the CSG hydrocarbon potential in PEL 238 and PAL 2. It will assist in gaining further knowledge of coal fines, gas composition and flow rates, the deliverability of the reservoir, and investigating well design, drilling and completion technologies. This information is essential to determine whether a commercial gas production

project is viable and would be used in development planning for a potential commercial gas production project within the areas of PEL 238 and PAL 2.

### **Assessment under Part 4 of the EP&A Act**

As the proposed activity is SSD under the SRD SEPP Division 4.1 of Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) applies to the proposed activity.

This EIS assesses the potential environmental impacts of the proposed activity in accordance with clauses 6 and 7 of Schedule 2 of the NSW *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and the Director-General's Requirements (DGRs) issued by the NSW Department of Planning and Infrastructure (DP&I) on 20 May 2013. The DGRs were issued in accordance with clause 3 of Schedule 2 of the EP&A Regulation.

### **Benefits of the proposed activity**

The proposed activity is consistent with *NSW 2021: A Plan to Make NSW Number One* (NSW Government, 2011) (NSW State Plan 2021), the *New England North West Regional Action Plan* (NSW Government, 2012), the *Strategic Regional Land Use Policy* (SRLUP) (DP&I, 2012) and the *Energy White Paper 2012* (Commonwealth Department of Resources, Energy and Tourism, 2012).

The proposed activity, as part of the E&A Program, has the potential to play a role in the delivery of a secure supply of domestic gas for NSW, as well as alleviate potential gas supply shortages which may expose NSW to significant energy price increases.

The local and regional economy will benefit through direct and indirect employment opportunities. Approximately 7.6 equivalent full time jobs (5.6 during construction and 2 during operation) will be created. The proposed activity will also create an economic multiplier effect for the local and wider economy estimated to be \$5.3 to \$5.5 million or the creation of up to an additional 16 indirect jobs. This is based on a capital investment of \$8.1 to \$8.3 million.

### **Environmental impact assessment**

The DGRs together with the results of an environmental risk assessment, guided the preparation of the EIS. An overview of the key environmental issues assessed in the EIS is provided below.

#### Land resources

The site is located within the Bibblewindi State Forest which is bordered by the Pilliga State Forest to the east, west and south and rural properties to the north. The nearest residences are over seven kilometres from the site.

Surface geology mapping indicates that the location of the proposed activity is underlain by a single geological formation known as Orallo formation. Soil characteristics of the site indicate moderate to severe limitations with low plant-available water capacity, low nutrient levels and sodicity that all limit agricultural production.

The site is not located on or near Biophysical Strategic Agricultural Land (BSAL) and/or a Critical Industry Cluster (CIC) as defined in the SRLUP. The nearest mapped BSAL is approximately 15 kilometres from the site and no CIC has been identified in the New England North West Region.

The proposed activity is considered low risk and will not have an adverse impact on the current or future agricultural production capacity or land resources in the Narrabri local government area (LGA). There will be little change to the surface area and erosion and sediment control measures will remain in place during operation. Drilling activities will produce drilling fluid and drill cuttings. These materials are unlikely to present an erosion hazard as drilling fluid and cuttings will be contained appropriately.

## Water Resources

### *Groundwater*

During operation, the expected groundwater extraction is estimated as 285,110 m<sup>3</sup> over three years for the Bibbiewindi Multi-Lateral Pilot. The maximum rate of extraction is expected to be approximately 581 m<sup>3</sup> / day with the average 260 m<sup>3</sup>/day. The target coal seam is located at a depth of approximately 900 to 1000 metres.

A cumulative groundwater impact assessment for the E&A Program was undertaken assuming concurrent operation of all existing and proposed pilot wells. Negligible aquifer interference to the alluvial groundwater sources of the Upper and Lower Namoi alluvium (NSW Upper and Lower Namoi groundwater source water sharing plan) or the Great Artesian Basin (GAB) Surat Pilliga Sandstone (NSW GAB groundwater source water sharing plan) is indicated by the modelling of the CSG water extraction activities.

A groundwater monitoring program will be implemented as part of the E&A Program.

### *Surface water*

No surface water will be utilised for the proposed activity nor will any produced water be discharged into receiving waters. Potential impacts posed by soil erosion will be managed with the implementation of a range of erosion and sediment control mitigation measures.

### *Ongoing monitoring*

A water monitoring program (surface and groundwater) is in the process of being implemented and will continue for the duration of the E&A Program. For groundwater it will include sampling and testing at registered bores as well as the installation of a number of both deep and shallow monitoring bores. Once installed, the aquifer monitoring bores will measure groundwater pressure and temperature within various strata and enable groundwater levels and flows to be monitored.

Surface water baseline data samples are collected monthly (when flows are present and sampling is possible) at a range of locations within the Upper Namoi Catchment both upstream and downstream of the proposed activity.

## Biodiversity

No additional vegetation clearing or disturbance will be undertaken as part of the proposed activity. No threatened flora, fauna or migratory species listed under the *Threatened Species Conservation Act 1995* (TSC Act) or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded within proximity of the existing lease areas or are considered likely to be directly or indirectly impacted by the proposed activity.

### Air quality

Dust generated during construction will have the greatest potential impact on air quality and will be managed through the implementation of appropriate mitigation measures. Other emissions would occur from the exhaust of plant equipment required for drilling. These emissions are generally considered to be too low to generate any significant pollutant concentrations in the vicinity of the site and will not impact the nearest sensitive receiver located over seven kilometres from the site.

Emissions of carbon monoxide (CO) and nitrogen dioxide (NO<sub>2</sub>) can be expected from the combustion and flaring of gas intermittently during operation when gas cannot be accepted at the Wilga Park Power Station. However these emissions are significantly below targets outlined in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW Department of Environment and Conservation, 2005) and impacts on air quality are predicted to be insignificant.

### Greenhouse gases

The proposed activity will generate Scope 1 (direct) and Scope 3 (indirect) greenhouse gas (GHG) emissions as defined by *GHG Protocol Corporate Standard* (WBCSD and WRI 2004). These will occur both during construction and operation. During construction 568 Tonnes CO<sub>2</sub><sup>e</sup> Scope 1 emissions will be produced whilst during operation 10,046 Tonnes CO<sub>2</sub><sup>e</sup>/year will be produced.

Scope 3 emissions are very minor during construction (<35 Tonnes CO<sub>2</sub><sup>e</sup>) and during operation, 84,867 Tonnes CO<sub>2</sub><sup>e</sup>/year is expected. The use of produced gas in the Wilga Park Power Station is the dominant Scope 3 emissions source during operation. It is noted however that the use of gas in power stations has a significantly lower emissions profile compared to more traditional coal fired power stations (an emissions intensity of 51.33 kg CO<sub>2</sub><sup>e</sup>/GJ compared to 88.43 kg CO<sub>2</sub><sup>e</sup>/GJ for coal). Substituting gas for coal equates to an annual emissions reduction in the order of 68,500 tonnes of GHG for 20 MW of power. The Bibblewindi Multi-Lateral Pilot is estimated to generate around 1.2 MW of power.

Likely greenhouse gas emissions from the proposed activity are not considered to have significant impact on State or National emissions reduction targets. In addition, ongoing emissions associated with the proposed activity will be formally monitored and reported in accordance with legislative requirements

### Noise

Noise impacts associated with drilling of Bibblewindi 31 and 32 and operation of the Bibblewindi Multi-Lateral Pilot are considered to be negligible and will not be audible at any of the closest five residences. Noise impacts from traffic generated by the proposed activity are considered negligible and will meet the *EPA Environmental Criteria for Road Traffic Noise* (NSW Environmental Protection Agency, 1999).

### Traffic and transport

It is anticipated that there would be a minor increase (average 16 vehicles per day) in local traffic during the construction phase of the activity as a result of delivery and collection of plant, equipment and materials and personnel transport. Operational traffic movements will be minimal, with one vehicle arriving and departing the site each day.

These anticipated traffic volumes would present a negligible impact on existing traffic using State Forest roads and the Newell Highway and will not impact the capacity, functionality, efficiency or safety of the local road network.

### Waste

The main wastes generated during construction will be drilling fluid (approximately 400 m<sup>3</sup>) and drill cuttings (approximately 195 m<sup>3</sup>). Drilling fluids will be transported to the proposed Santos operated Fluid Treatment Facility (FTF) in Narrabri for treatment and storage for future re-use in subsequent drilling activities. Should the FTF not be approved, drilling fluids would be transported to an alternative licensed facility.

Waste generated during operation of the Bibblewindi Multi-Lateral Pilot will consist predominantly of produced water. This will be stored at the Leewood Produced Water Facility for future treatment.

Waste management measures implemented for the proposed activity will encourage efficient resource use alternatives, re-use and recycling. Waste that cannot be re-used or recycled will be disposed of in accordance with statutory requirements.

### Hazards

The proposed activity will require the use of chemicals, fuels and oils, particularly during drilling activities. All chemicals used during drilling will be non-toxic. No chemicals with added benzene, toluene, ethyl benzene, and xylenes (BTEX) will be used, nor will any fracking take place.

Diesel will be stored temporarily on site for use during drilling. Diesel is classed as an Australian Dangerous Goods Code 3 and as such is subject to the requirements under State Environmental Planning Policy 33 (SEPP 33). However given the relatively small volumes, the proposed activity is not defined as a potentially hazardous or offensive activity or industry.

Any impacts associated with hazardous materials are expected to be minor.

### Social and Economic

The proposed activity will result in a number of positive economic impacts for the local, regional and State economies. This includes a mix of both local and fly in fly out jobs over the course of the proposed activity. The development of the proposed activity is in line with the goals and outcomes of both the *Narrabri Shire Economic Development Strategy* (Narrabri Shire, 2011) and the SRLUP for New England and the North West.

Santos is implementing a comprehensive community and stakeholder engagement program. This has involved a range of activities including: government and stakeholder forums, site tours, information sessions, establishment of a community consultation committee, one on one meetings and formal correspondence. Community feedback on the proposed activity has informed the development of the EIS.

Santos holds a Permit to Occupy the site in Bibblewindi State Forest from the Forestry Corporation of NSW (as the landowner).

### Other impacts

A range of other impacts were considered during the impact assessment. This included cultural and European heritage, water quality, impacts to stygofauna and bushfire impacts. Impacts associated with all of these issues were considered negligible.

### Cumulative impacts

The proposed activity has been assessed in conjunction with other activities proposed as part of the E&A Program within PAL 2 and Petroleum Exploration Lease 238 (PEL 238). In the case of biodiversity, this has also included consideration of previous CSG activities within the Pilliga and Bibblewindi Forests over the previous ten years.

For all environmental aspects the E&A Program is expected to have a negligible to minimal impact on the environment.

### **Conclusion**

The proposed activity is temporary and minor in scale. The site of the proposed activity has been selected to avoid significant environmental constraints, and to minimise impacts to the surrounding community. The potential impacts of the proposed activity have been assessed and can be managed through the identified mitigation measures. On balance, the proposed activity will have a negligible to low adverse impact on the environment and the community however will contribute to the local and regional community through job creation and economic activity.

## PART A

### I.0 Introduction

#### I.1 Proposed activity overview

Santos NSW (Eastern) Pty Ltd (Santos), as the coal seam gas (CSG) operator of Petroleum Assessment Lease (PAL 2), is seeking consent to drill two additional pilot wells and operate the expanded Bibbiewindi Multi-Lateral Pilot for up to three years (proposed activity). The Bibbiewindi Multi-Lateral Pilot is located within the Bibbiewindi State Forest, approximately 40 kilometres south of Narrabri, north western NSW.

The proposed activity includes the construction and drilling of Bibbiewindi 31 and 32 pilot wells on the existing Bibbiewindi 14 and Bibbiewindi 19H well leases respectively, installation of surface infrastructure to connect the two wells to the existing Bibbiewindi Multi-Lateral Pilot and operation of the Bibbiewindi Multi-Lateral Pilot.

The EIS, prepared in accordance with Part 4 of the *Environmental Planning and Assessment (EP&A) Act*, addresses the impacts associated with the following proposed activity:

- construction: site preparation of the well leases and establishing necessary equipment, temporary structures and facilities on the existing lease areas to enable drilling; drilling one vertical pilot well (Bibbiewindi 31) and one lateral pilot well (Bibbiewindi 32) and connection to the Bibbiewindi Multi-Lateral Pilot
- operation: operating the existing Bibbiewindi Multi-Lateral Pilot with the new Bibbiewindi 31 and 32 wells, management of the water and gas produced during operation for up to 3 years and general maintenance activities
- post operation and rehabilitation: decommissioning and rehabilitation of pilot wells and ancillary infrastructure or suspension of the wells.

The EIS does not include the assessment of establishing the lease areas, the water and gas gathering system, access tracks and partial rehabilitation of the lease areas. These works were previously approved under Part 5 of the *EP&A Act* by the former NSW Department of Primary Industries (DPI), which approved drilling and operation of Bibbiewindi 12 to 19H on 8 August 2008 and Bibbiewindi 21H and 27–29 on 20 July 2009.

#### I.2 Assessment under Part 4

The proposed activity is “State Significant Development” to which Division 4.1 of Part 4 of the *EP&A Act* applies in accordance with the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP).

The EIS considers the potential environmental impacts of the proposed activity in accordance with clauses 6 and 7 in Schedule 2 of the NSW *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and the Director-General's Requirements (DGRs) issued by DP&I on 20 May 2013. The DGRs were issued in accordance with clause 3 of Schedule 2 of the EP&A Regulation. Appendix 1 provides a summary of the DGRs and cross references where each is addressed within the EIS.

#### I.3 Proponent

The proponent for the proposed activity is Santos NSW (Eastern) Pty Ltd, as the CSG operator, on behalf of the titleholders of PAL 2, Santos NSW Pty Ltd and EnergyAustralia Narrabri Gas Pty Ltd.

## 1.4 Background

Santos Limited is an Australian petroleum company established in 1954, which has been supplying natural gas to NSW since 1976. Santos Limited and its subsidiary companies have been involved in CSG activities in Queensland for 20 years and commenced CSG exploration in the north-west of NSW in 2008.

In November 2011, Santos Limited acquired Eastern Star Gas Limited (ESG) who was the operator of Petroleum Exploration Lease (PEL) 238, PAL 2 and Petroleum Production Lease (PPL) 3. Santos (the proponent), then became the operator of these tenements.

At the time of the acquisition, ESG's operations included six appraisal pilots, including the Bibbiewindi Multi-Lateral Pilot in PAL 2, numerous water storage ponds, the Bibbiewindi Water Treatment Facility, Wilga Park Power Station, and ancillary infrastructure in and around the Pilliga and Bibbiewindi State Forests.

Following the acquisition, Santos carried out a full review of ESG's operations which identified a number of substandard practices and infrastructure. Santos suspended operations and commenced a program of decommissioning and rehabilitation works. These works included plugging and abandoning wells no longer needed, decommissioning and rehabilitating water storage ponds, decommissioning the reverse osmosis plant at the Bibbiewindi Water Treatment Facility (now known as the Bibbiewindi Water Transfer Facility) and commencing rehabilitation of approximately 30 hectares of land.

Santos purchased a property, known as Leewood, outside of the Pilliga forest for the purpose of developing a new water management facility. The new facility will have the best available technology, monitoring and environmental protection systems. The Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) approved the Leewood Produced Water Facility in March 2013 under Part 5 of the *EP&A Act*. The approval included construction of a water storage facility and associated infrastructure, transfer of produced water and brine stored at the Bibbiewindi Water Treatment Facility to Leewood, and ongoing operation of the facility to store water from future exploration and appraisal activities.

Santos plans to continue exploration, appraisal and evaluation of the CSG hydrocarbon potential in PEL 238 and PAL 2 and has developed the Energy NSW CSG Exploration and Appraisal Program (E&A Program). The E&A Program will assist in gaining further knowledge of coal fines, gas composition, flow rates and deliverability, well design, drilling and completion technologies. The E&A Program will be conducted over the next two to three years and will include the proposed activity and:

- operation of the existing Bibbiewindi West Pilot
- operation of the existing Tintfield Pilot
- operation of the existing Dewhurst 13-18H Pilot and the construction, drilling and operation of additional lateral wells from well casing within Dewhurst 16H, 17H and 18H
- construction, drilling and operation of the Dewhurst 22-25 Pilot
- construction, drilling and operation of the Dewhurst 26-31 Pilot
- construction of the Dewhurst Northern Water and Gas Flow Lines and operation the Dewhurst Northern Water Flow Line
- construction of the Dewhurst Southern Water and Gas Flow Lines and operation of the Dewhurst Southern Water Flow Line
- construction and operation of the Leewood Produced Water Facility and ancillary infrastructure
- gas and water management during operation of the E&A Program.

These activities are subject to separate environmental assessment and approval processes.

## 1.5 Structure of the EIS

The EIS has been structured into three sections as follows:

- Part A (Chapters 1-7). This section introduces the activity, justification and need and summarises consultation and legislative requirements. It provides background and context and describes in detail each element of construction, operation and post operation and rehabilitation.
- Part B (Chapters 8-19). This section provides an overview of the potential impacts of the proposed activity across a range of environmental issues identified in the DGRs, an environmental risk assessment and other issues raised through consultation. It describes the base line conditions, identifies the magnitude and scale of impacts and lists proposed mitigation measures. Assessment has been undertaken for the proposed activity and cumulatively for the E&A Program.
- Part C (Chapters 20-21). This section provides a concluding statement for the activity and a draft Statement of Commitments.
- Appendices (Appendix 1-7). This section provides the DGRs including a cross reference to where each DGR is addressed within the EIS, as well as the specialist assessments undertaken to support the EIS.

## 2.0 Need and Justification

### 2.1 Energy needs in NSW

NSW meets most of its energy demands from non-renewable sources including coal, petroleum and gas. Figure 2-1 compares energy consumption by sector and fuel type. Energy consumption is expected to grow in all sectors however it is expected that the mix of fuel types will change moving away from a reliance on coal (NSW EPA, 2012). According to forecasts developed by the Australian Energy Market Operator (AEMO, 2011a), gas is increasingly being used for electricity generation and the fuels share of electricity generation could increase from around 11% to 37% by 2030-31.

NSW currently sources 95% of its gas from interstate with contracted supplies falling from 2014 and reaching significantly low levels in 2017 due to a combination of factors including a strong demand for gas in other states, decreasing reserves and constraints on infrastructure.

The NSW government recognises the importance of a domestic gas supply and the need to access affordable gas through the development of the State's reserves. In its submission on the Commonwealth's Energy White Paper the NSW Government stated:

*'further delay in gas developments in NSW will contribute to a supply shortfall as early as 2014 and could have a direct impact on the State's consumers, through gas supply challenges and higher energy costs'.*

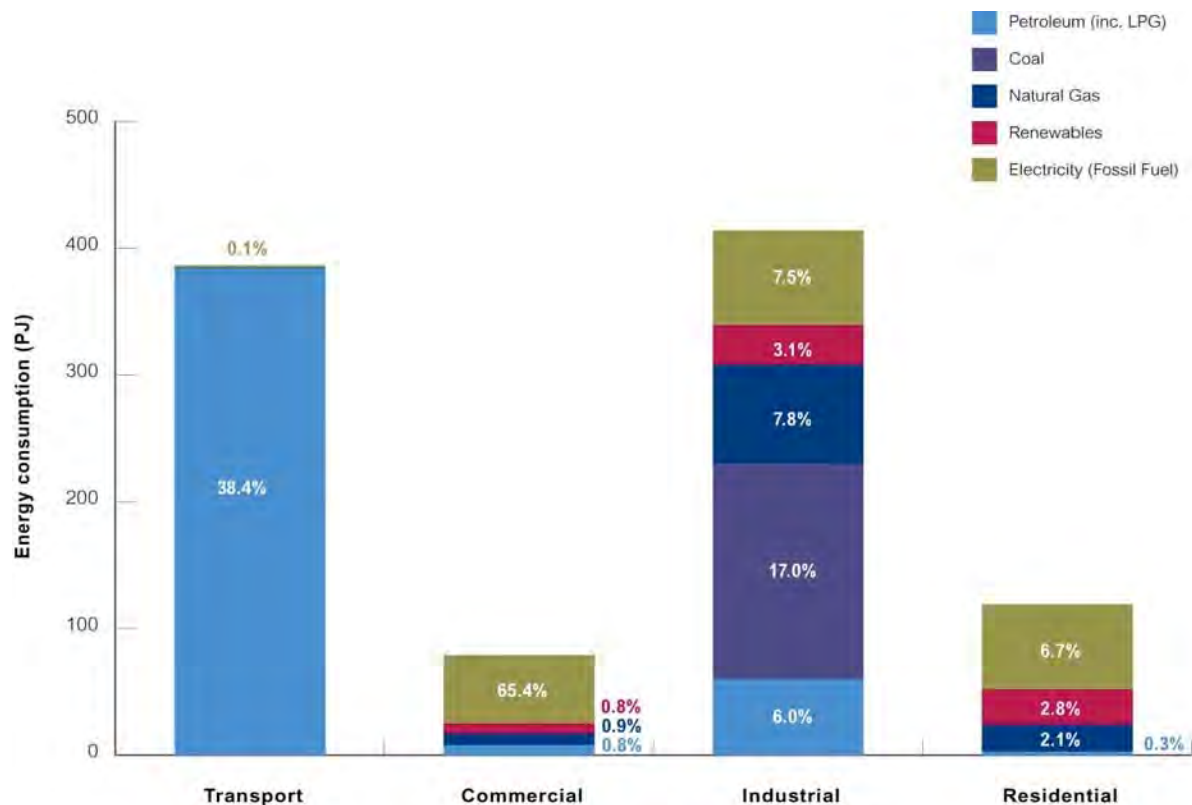


Figure 2-1 Fuel consumption in NSW

Source: NSW Statement of the Environment 2012

## 2.2 Interaction with key strategic planning and policy documents

### 2.2.1 NSW 2021

NSW 2021: A Plan to Make NSW Number One (NSW Government, 2011) (NSW 2021) presents the NSW Government's strategy to move the State forward over the next ten years and is based on five principal strategies with underlying goals. The five strategies are:

- rebuilding the economy
- returning quality services to NSW
- renovating infrastructure
- restore accountability to government
- strengthening the local environment and community.

Included in the Government's NSW 2021 plan are 19 regional action plans. These plans were created to support the action plan by identifying key priorities to be addressed and implemented across all 19 regions.

The New England North West Regional Action Plan (NSW Government, 2012) includes the Gunnedah and Narrabri LGAs. The communities within the region identified six priorities. Two of these priorities include the need to focus on growth and diversity of the region's economy and investment in regional and local infrastructure.

The development of the proposed activity within the Narrabri LGA would support these strategies and goals by providing both capital investment and economic benefits. It will provide a financial injection for the local economy both directly and indirectly and as part of the broader E&A Program.

The local and regional economy will benefit through direct employment opportunities as well as indirect employment with an estimated spend of \$150,000 per employee per annum. The proposed activity will see approximately 7.6 full time equivalent jobs (5.6 during construction and 2 during operation) created and an additional eight full time equivalent jobs created in the local and wider economy.

An economic multiplier of \$5.3 to \$5.5 million is expected that could lead to the creation of a further 16 indirect jobs.

During the construction phase it is expected that some materials will be purchased and supplied locally. By sourcing local materials and contractors for the proposed activity it is estimated that a further \$0.8 million will be spent locally on goods and services including vehicle hire, maintenance and fuel. This expenditure is likely to contribute both to the Narrabri and the wider northwest NSW region economy.

### 2.2.2 Commonwealth Energy White Paper 2012

The *Energy White Paper 2012* (DRET, 2012) sets out a strategic policy framework to address the challenges in Australia's energy sector and position it for long term transformation in the way we produce and use energy.

The policy framework is based on building a secure, resilient and efficient energy system that:

- provides accessible, reliable and competitively priced energy for all Australians
- enhances Australia's domestic and export growth potential
- delivers clean and sustainable energy.

The proposed activity as part of the E&A Program has the potential to play a role in the delivery of a secure supply of domestic gas for NSW, as well as alleviate potential gas supply shortages which will likely expose NSW to significant energy price increases.

In addition, further benefits can be realised through the use of gas in power stations. Gas has a significantly lower emissions profile compared to more traditional coal fired power stations (an emissions intensity of 51.33 kg CO<sub>2</sub><sup>e</sup>/GJ compared to 88.43 kg CO<sub>2</sub><sup>e</sup>/GJ for coal). Substituting coal for gas equates to an annual emissions reduction in the order of 68,500 tonnes of GHG for 20 MW of power. The Bibblewindi Multi-Lateral Pilot is estimated to generate around 1.2 MW of power through the Wilga Park Power Station.

### 2.2.3 Strategic Regional Land Use Policy

The NSW Government's *Strategic Regional Land Use Policy* (SRLUP) sets out a range of initiatives to better balance growth in the CSG industry with the need to protect important agricultural land and water resources. The *Strategic Regional Land Use Plan* (DP&I, 2012) for the New England North West region identifies the key challenges in the region and clear actions to address these challenges.

Strategic Agricultural Land (SAL) is highly productive land that has both unique natural resource characteristics as well as socio-economic value (DP&I, 2012a). Based on this definition there are two categories of SAL: Critical Industry Clusters (CIC) and Biophysical Strategic Agricultural Land (BSAL).

According to SAL mapping (DP&I, 2012a), Bibblewindi 31 and 32 and its surrounds are not classified as BSAL, with the closest mapped BSAL located 15 km from the site. No CIC has been identified in the New England North West Region.

The proposed activity is consistent with the SRLUP objectives.

A site verification report has been prepared and is provided in conjunction with this EIS. Advice from DP&I states that as the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) amendments are yet to be enacted, there is no statutory framework to apply for and receive a Site Verification Certificate. Therefore, Santos may lodge the site verification report (to satisfy the DGRs) as part of the overall EIS submission. The DP&I will then undertake the site verification assessment as part of the overall assessment.

## 2.3 Need for an exploration and appraisal program

CSG exploration and appraisal is required to inform the production planning process. As shown in Figure 2-2, there are many stages before a gas supply is proven and gas reaches the domestic market.

The E&A Program that has been developed for PEL 238 and PAL 2 is necessary for the ongoing exploration, appraisal and evaluation of the CSG hydrocarbon potential within the tenements. The E&A Program will assist in gaining further knowledge of coal fines, gas composition and flow rates, the deliverability of the reservoir, and investigating well design, drilling and completion technologies. This information is essential to determine whether commercial gas production is viable and would be used in development planning for a potential commercial gas production project within PEL 238 and/or PAL 2.

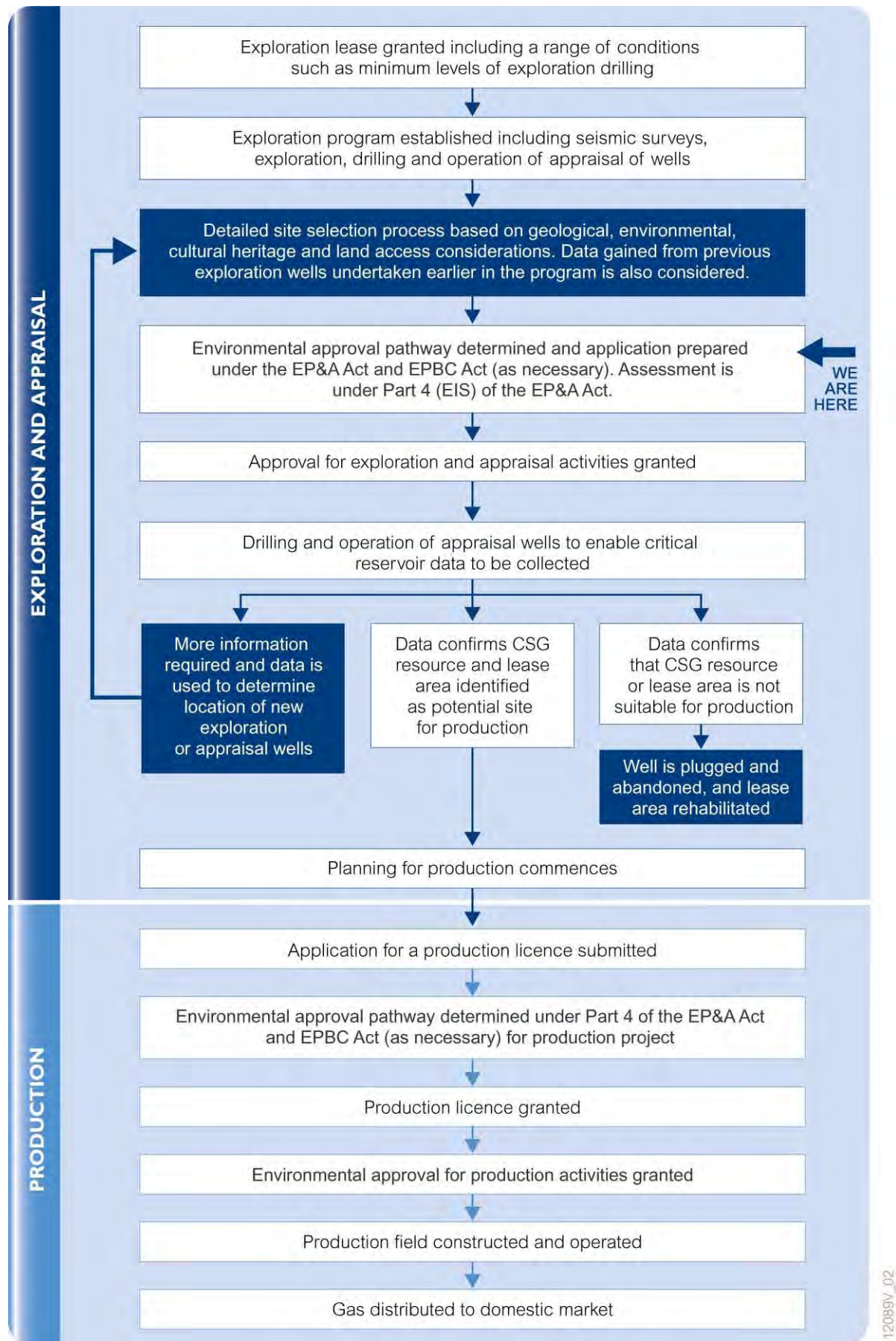


Figure 2-2 Stage of proposed activity with CSG exploration, appraisal and production planning process

## 2.4 Justification

The location (within existing lease areas) and operation (as part of the Bibblewindi Multi-Lateral Pilot) of the proposed activity balances the objectives of providing sufficiently accurate data in the right location and minimising surface footprint and environmental impact.

The wells will be designed and drilled in accordance with the *NSW Code of Practice for Coal Seam Gas Well Integrity* (DTIRS, 2012). This will ensure that appropriate measures are in place to ensure well operations are carried out safely, without risk to health and without detriment to the environment.

The addition of two wells as part of the Bibblewindi Multi-Lateral Pilot improves the efficiency of water and gas recovery and enables the water and gas to be managed through existing infrastructure or new infrastructure proposed to support the E&A Program.

Safety and potential hazards for the activity will be managed through Santos standard risk and safety protocols including the Santos Emergency Response Plan.

The proposed activity is consistent with the principles of ecologically sustainable development (ESD) as describe in Table 2-1. ESD is a primary objective of the *EP&A Act* and is defined under section 4 of the *EP&A Act* as having the same meaning as section 6(2) of the *Protection of the Environment Administration Act 1991*.

**Table 2-1 Consistency of proposed activity with ESD principles**

| Principle                                                     | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Precautionary principle                                       | <p>A precautionary approach was taken during the site selection process. Use of an existing lease area sought to avoid significant environmental constraints, thereby minimising the risk of serious or irreversible harm to the environment as a result of the proposed activity.</p> <p>Based on an environmental risk assessment and in combination with the DGRs, the EIS includes investigation into a range of issues to determine the full potential impacts of the proposed activity. This included commissioning groundwater, ecological, air quality, noise, traffic and economic and social technical studies, and drawing on information from technical specialists including geologists, drilling engineers and process engineers. Conservative 'worst case' scenarios are considered as part of the EIS.</p> <p>A range of mitigation measures will be put in place to minimise or prevent any environmental degradation as described in Chapter 20.</p> |
| Intergenerational equity                                      | <p>The proposed activity will not consume significant quantities of non-renewable resources or produce significant quantities of waste that will lead to long term environmental implications. Groundwater will be extracted but modelling indicates that this will have no impact on the upper aquifers including the Pilliga sandstone, registered bore users or groundwater dependent ecosystems. Drilling fluids, where possible, will be recycled for use at other drilling sites.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Conservation of biological diversity and ecological integrity | <p>No clearing of vegetation is required to be removed for the proposed activity. Minimal short-term impacts are associated with the proposed activity, during both construction and operational activities. The primary potential impacts are indirect, as the proposed activity will be carried out within existing disturbance areas. No threatened species populations or ecological communities (or their habitats) listed under the TSC Act or the EPBC Act will be significantly impacted.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Improved valuation, pricing and incentive mechanisms          | <p>While clear and widely accepted standards have not yet been established for the application of this principle, Santos acknowledges and accepts the financial costs associated with all the measures required for the proposed activity to avoid, minimise, mitigate and manage potential impacts of the proposed activity.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## 2.5 Alternatives considered

Alternatives considered for the proposed activity included do nothing, alternative drilling locations but with operation as part of the Bibbiewindi Multi-Lateral Pilot or establishment of a new pilot. On balance the proposed activity best meets the needs of the E&A Program whilst reducing surface disturbance. Each of these alternatives are briefly discussed below.

### 2.5.1 Do nothing

To date there has not been enough background information produced from the Bibbiewindi Multi-Lateral Pilot to adequately assess the potential gas resource of the pilot. Doing nothing would not achieve the objectives of proposed activity or the overall E&A Program and is not a viable option.

### 2.5.2 Establishment of a new pilot

Establishment of a new pilot would require the establishment of lease areas (approximately one hectare in size), access tracks and supporting gas and water management facilities. This would require vegetation clearing and potential impacts on biodiversity and heritage.

### 2.5.3 Alternative location within the Bibbiewindi Multi-Lateral Pilot

ESG originally proposed to add three new wells to the Bibbiewindi Multi-Lateral Pilot. These wells were proposed to be located on new well leases to be established on vegetated areas adjacent to the existing well leases.

Since purchasing ESG, Santos has redesigned the proposal to avoid further surface disturbance and reduce potential impacts to biodiversity, heritage and the environment generally. This has included reducing the number of additional wells from three to two and siting the proposed new wells on existing well leases within the pilot. This requires the need for directional drilling and a small 'S' shape in the vertical Bibbiewindi 31 well. This process will increase the cost of drilling however avoids the need for additional clearing for a new well lease.

By connecting the wells to the existing infrastructure servicing the existing Bibbiewindi Multi-Lateral Pilot additional surface disturbance is avoided.

## 3.0 The Site and Context

### 3.1 Overview

#### 3.1.1 Site footprint

The Bibblewindi 14 and 19H lease areas, where Bibblewindi 31 and 32 respectively will be drilled (the site) is located on Little Tighes Road. Access to the site will be via the Newell Highway, X-Line Road, Tighes Gully Road and Little Tighes Gully Road.

The construction footprint for the proposed new wells (Bibblewindi 31 and 32) will be contained on the existing well leases for Bibblewindi 14 and 19H (see Figure 3-1 and Figure 3-2) respectively with no new disturbance or vegetation clearing outside of the existing well leases proposed.

The approximate location of the wells is shown in Table 3-1 with the final co-ordinates confirmed on site during construction.

**Table 3-1 Approximate well locations**

| Well           | Easting   | Northing   | Lot description         |
|----------------|-----------|------------|-------------------------|
| Bibblewindi 31 | 754466.68 | 6603944.41 | Crown Land State Forest |
| Bibblewindi 32 | 753647.23 | 6604983.47 | Crown Land State Forest |

Plates 3.1 and 3.2 show existing conditions of the existing well leases.



**Plate 3-1 Existing Bibblewindi 14 lease area**



**Plate 3-2 Existing Bibblewindi 19H lease area**





Figure 3-1 Bibblewindi 31 lease area



Figure 3-2 Biblewindi 32 lease area

### 3.1.2 Bibblewindi Multi-Lateral Pilot

The existing Bibblewindi Multi-Lateral Pilot consists of 12 wells (Bibblewindi 12, 13, 14, 15, 16, 17, 18H, 19H, 21H, 27, 28H and 29). Each well is situated on a well lease area of approximately 0.8 hectares (100 by 80 metres). Surface infrastructure at the lease area includes well heads, skids, separators, generators and remote telemetry units. The well lease areas are connected via a series of access tracks branching off Little Tighes Road. The existing Bibblewindi Multi-Lateral and Bibblewindi 31 and 32 are shown in Figure 3-3.

Subsurface infrastructure comprises of a water and gas gathering system which follows the existing access tracks and collects at Bibblewindi 19H.

### 3.1.3 Natural features of the site

#### 3.1.3.1 Topography

Topography of the site (see Figure 3-4) can be described as gentle with elevations ranging between 280 and 295 metres. Individual topographic characteristics of the existing lease areas are as follows:

- Bibblewindi 14 lease area – generally slopes in a north-west direction, with elevations ranging between approximately 286 and 288 metres (AHD)
- Bibblewindi 19H lease area – generally slopes in a north-west direction, with elevations ranging between approximately 278 and 281 metres (AHD).

#### 3.1.3.2 Drainage

No watercourses intersect the site. The nearest watercourse is an unnamed ephemeral tributary of Mount Pleasant Creek located approximately 50 metres north east of the Bibblewindi 19H lease area (Bibblewindi 32). The closest watercourse to Bibblewindi 14 lease area (Bibblewindi 31) is the ephemeral Mount Pleasant Creek, located approximately 500 metres to the west.

#### 3.1.3.3 Stratigraphy

The site is located in the central portion of the Gunnedah Basin where Jurassic and Cretaceous Surat Basin sediments unconformably overlie Permo Triassic Gunnedah Basin sediments.

Surface geology mapping of the site shows it to be underlain by a single geological formation known as Orallo formation with the dominate lithology being sandstone, which formed during the Mesozoic Cretaceous period.

The stratigraphy of the Gunnedah Basin is illustrated in Figure 3-5.

#### 3.1.3.4 Vegetation

The existing well leases are clear of vegetation. A minimal amount of native and exotic grasses have recolonised small patches of the lease areas and some rehabilitation has occurred, however the existing lease areas can be characterised as cleared areas. Stockpiles exist on both lease areas.

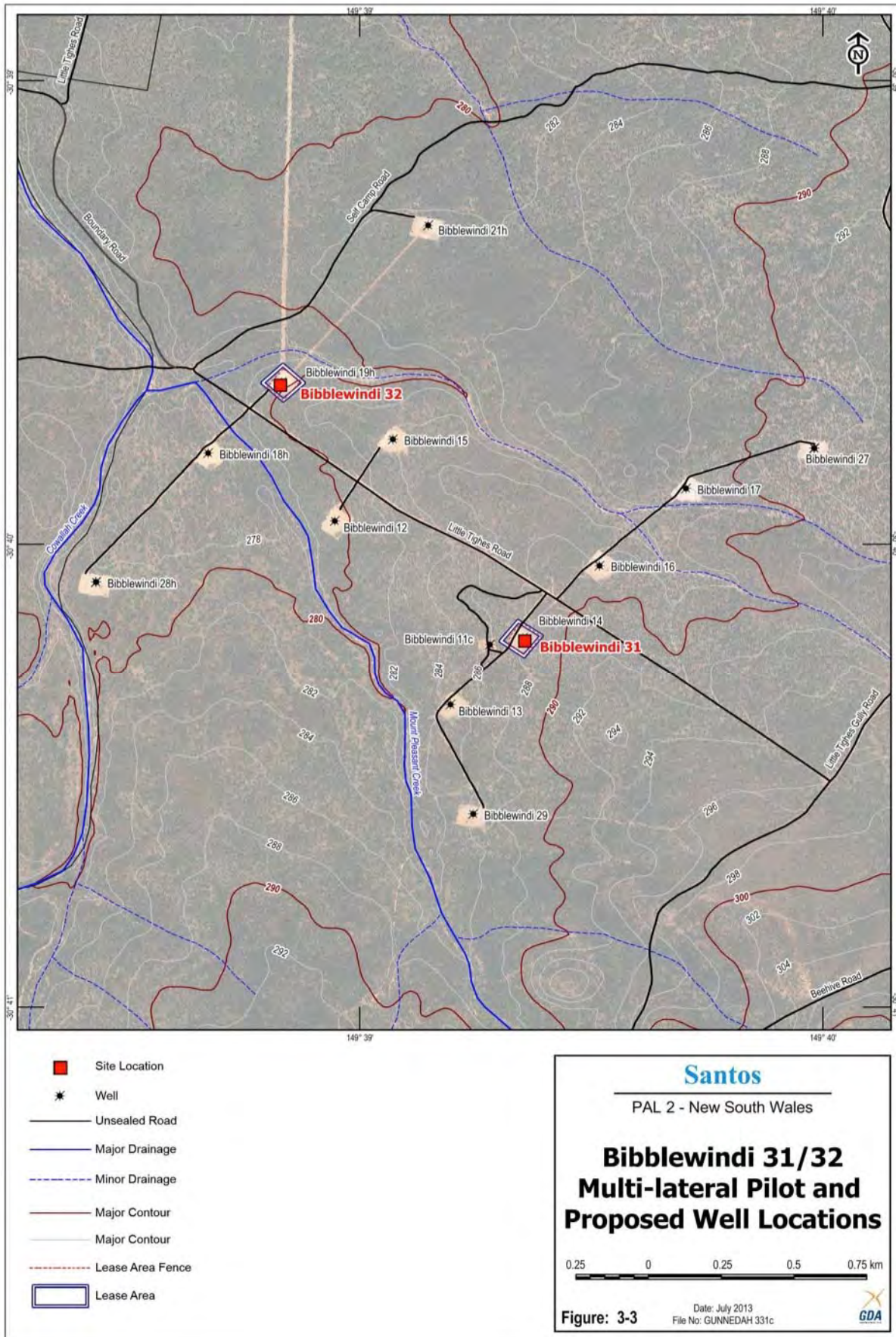


Figure 3-3 Bibblewindi Multi-Lateral Pilot and proposed wells

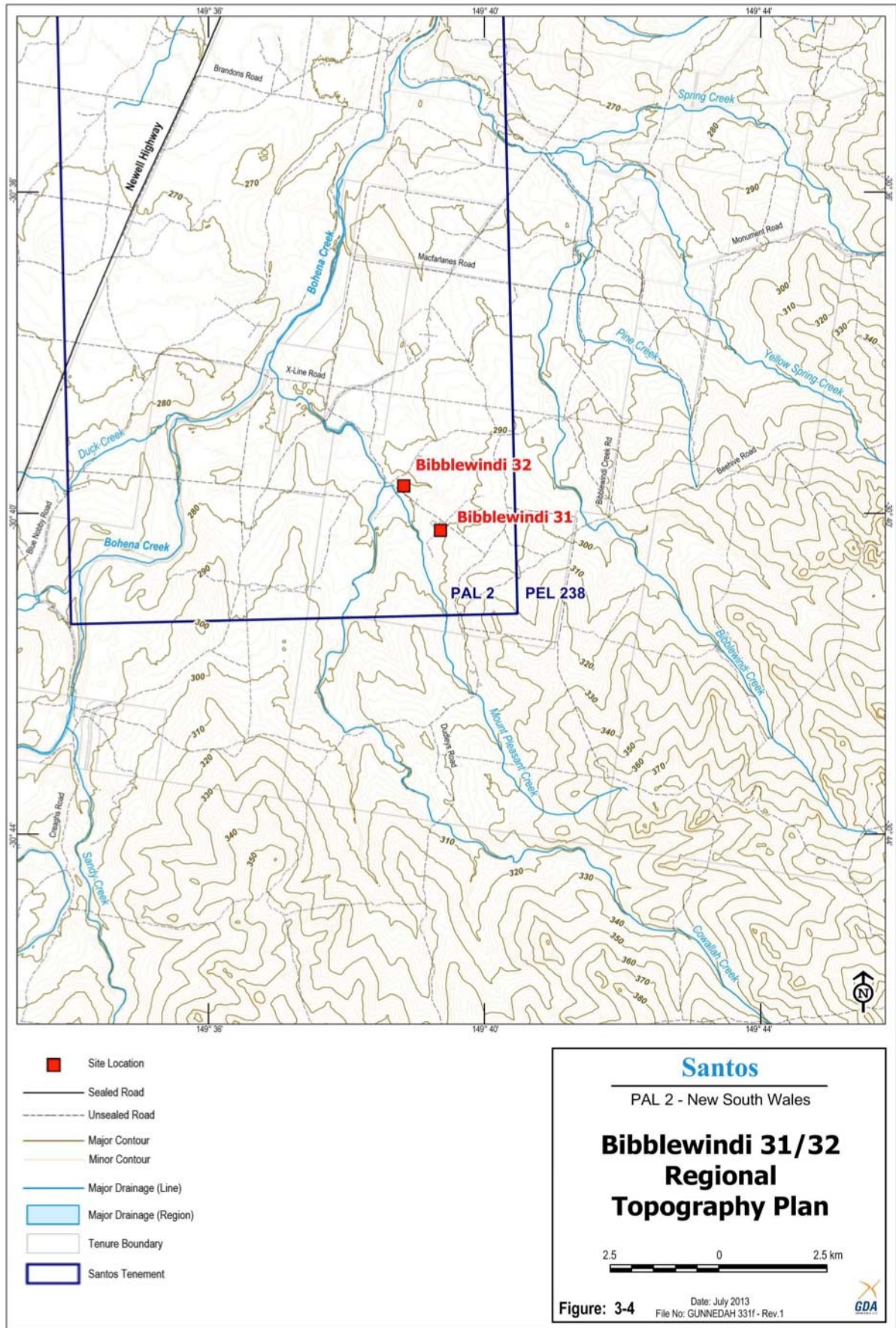


Figure 3-4 Regional Topography

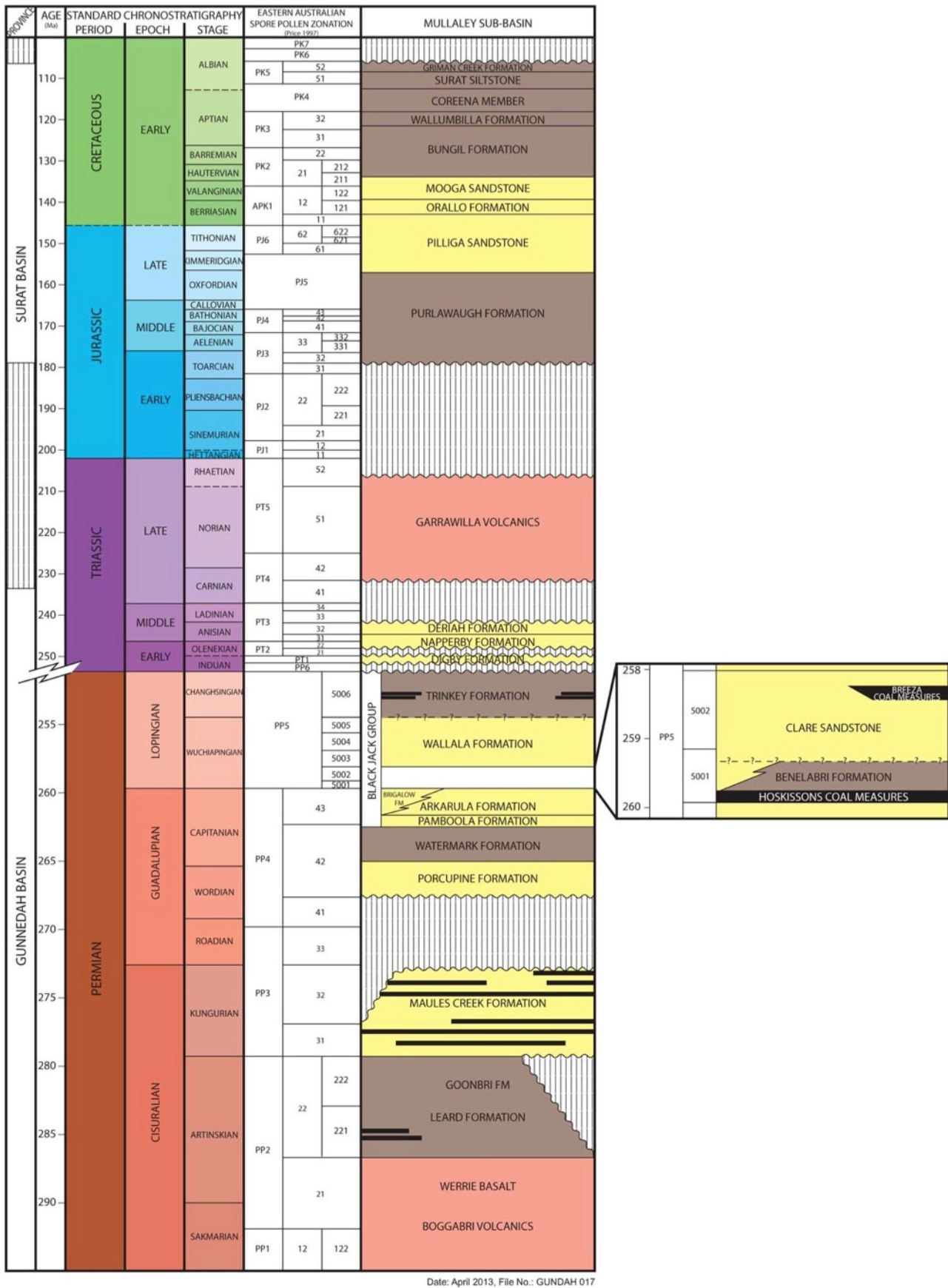


Figure 3-5 Stratigraphy of the Gunnedah Basin

### 3.2 Regional context

The site is located within the Narrabri LGA, which is located on the northwest slopes of NSW. The site is approximately nine kilometres from the Newell Highway, a major transport router connecting Coonabarabran with Narrabri.

The site is located within the central portion of the Bibbiewindi State Forest approximately 40 kilometres south of Narrabri (see Figure 3-6). It is bordered by the Pilliga State Forest to the east, west and south. The nearest residences are over seven kilometres from the site and are shown in Table 3-2 and Figure 3-7.

The Bibbiewindi State Forest is a 7,135 hectare area and forms part of a larger area of remnant vegetation known as the Pilliga Scrub. The Pilliga Scrub takes in numerous protected areas including the Pilliga Nature Reserve, Pilliga East State Forest, Pilliga East State Conservation Area, Jacks Creek State Forest, Rutley State Forest, Kerringle State Forest and Willala Aboriginal Area.

**Table 3-2 Distance to nearest sensitive receptors**

| Resident ID / Sensitive receptor | Distance from the nearest lease area (km) |
|----------------------------------|-------------------------------------------|
| R1                               | 8.3                                       |
| R2                               | 9.2                                       |
| R3                               | 9.5                                       |
| R4                               | 8.2                                       |
| R5                               | 7.5                                       |

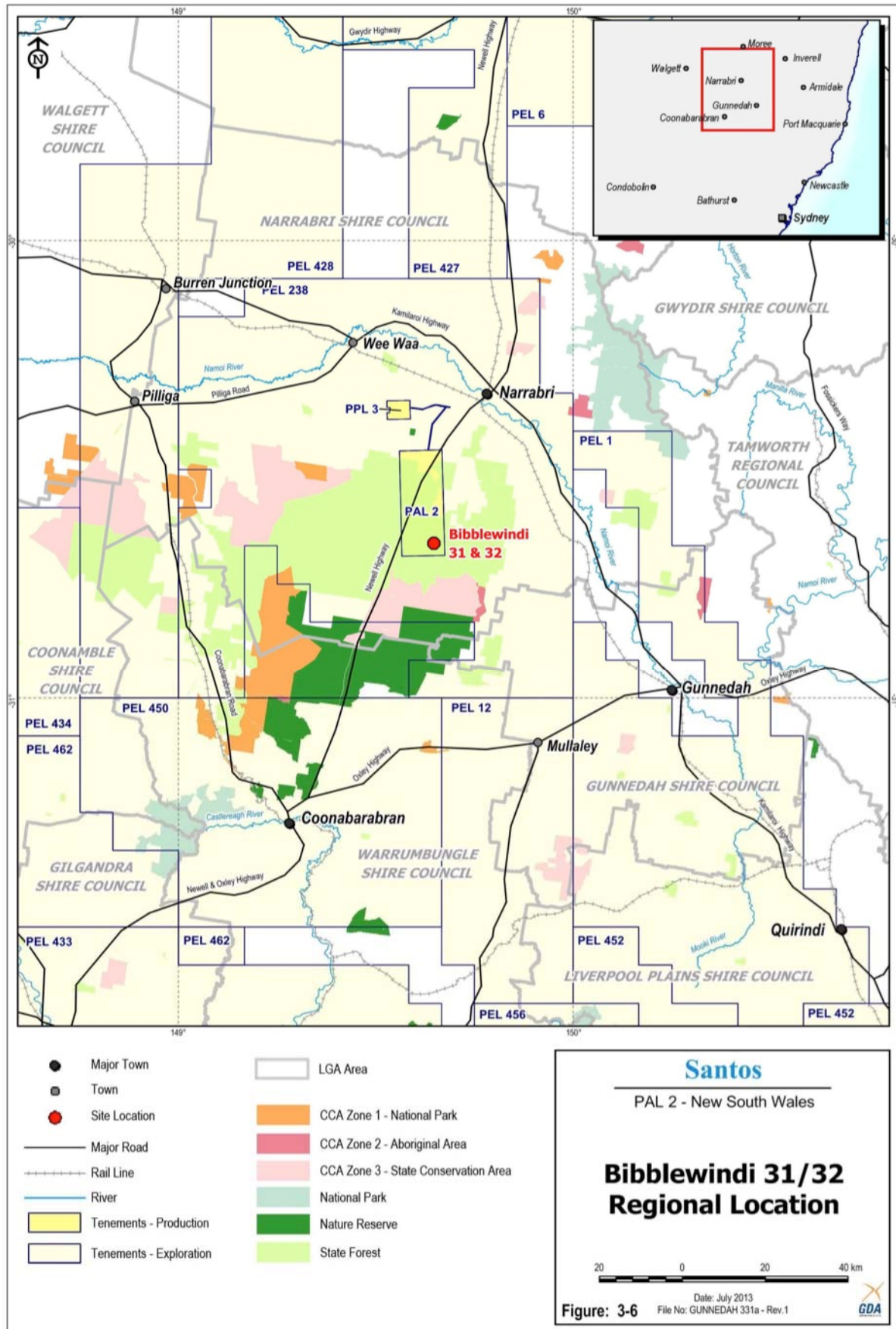


Figure 3-6 Regional location

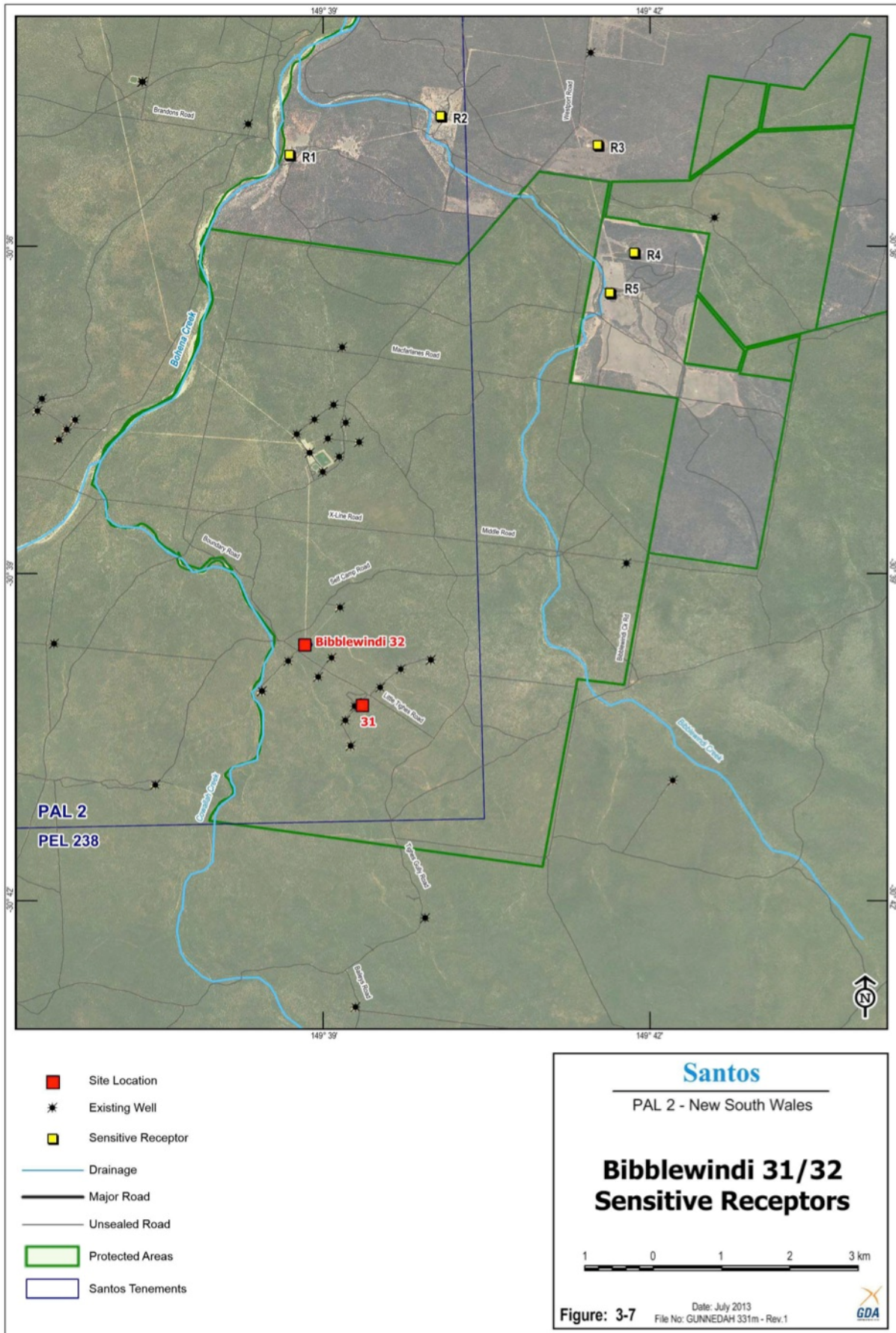


Figure 3-7 Sensitive receptors

### 3.2.1 Regional CSG infrastructure

Regional CSG infrastructure consists of a series Pilots, plugged and abandoned wells and water and gas management facilities. CSG infrastructure in PEL 238 and PAL 2 that relates to the proposed activity is described below with Figure 3-8 indicating infrastructure proximate to the proposed activity.

#### 3.2.1.1 Existing water and gas flow lines

Existing water flow lines connect the Bibblewindi Multi-Lateral Pilot to the Bibblewindi Water Transfer Facility whilst gas flow lines connect to the Wilga Park Power station via the Bibblewindi Water Transfer Facility. Water and gas produced during operation will flow via these existing flow lines.

An existing flare is located at the Bibblewindi Water Transfer Facility that is used to manage gas supplied to the Wilga Park Power Station.

#### 3.2.1.2 Bibblewindi water transfer and Leewood produced water facilities

The approved but not yet constructed Bibblewindi Water Transfer Tank, located at the Bibblewindi Water Transfer Facility, has been sized to accept water from the Bibblewindi Multi-Lateral including Bibblewindi 31 and 32. The Water Transfer Tank provides a short buffer (24 hours) period before produced water is transferred to the Leewood Produced Water Facility.

The two 300 megalitre ponds at the Leewood Produced Water Facility will be double lined and have a leak collection system. The liner system will comprise a primary polyethylene geomembrane liner, underlain by a leak detection system, underlain by a secondary liner. The secondary liner will be underlain by 300 millimetre of smooth clayey sub grade, free from obstructions or protrusions.

The proposed leak collection system will transfer any produced water collected below the liner directly back into the pond. The system will include an alarm to notify operational staff of any sudden changes in pump operational trends. The water level of each pond will be monitored continuously. Level sensors will be installed for management of pump controls and to provide protection against pond overflow. It is expected the sensor system will be monitored by means of telemetry. Similarly, this has been sized to accept water from the Bibblewindi Multi-Lateral including Bibblewindi 31 and 32.

#### 3.2.1.3 Wilga Park Power Station

Wilga Park Power station is located north of the Pilliga Forest approximately 12 kilometres from Narrabri. Development consent for the construction and operation of the Wilga Park Power Station was issued to Narrabri Power Limited by Narrabri Shire Council in 2002. In 2008 approval was granted to expand the capacity of the power station to 40 Megawatts. The power station, when operating, supplies electricity to the local 66kv network through a substation located adjacent to the power station.

#### 3.2.1.4 Narrabri Operations Centre

The Narrabri Operations Centre (NOC) is located five kilometres west of the Narrabri town centre at 300 Yarrie Lake Road, Narrabri. Development consent for the construction and operation of the NOC was issued to Santos by Narrabri Shire Council in 2007. In April 2013 development approval was granted to expand the existing operations to include a warehouse, storage building and additional office space, a hardstand pipe casing wash and storage area. The NOC will also include the Fluids Treatment Facility (FTF) subject to planning approval and obtaining an Environmental Protection Licence (EPL). The FTF will treat and store drilling fluids for future re-use in drilling activities.

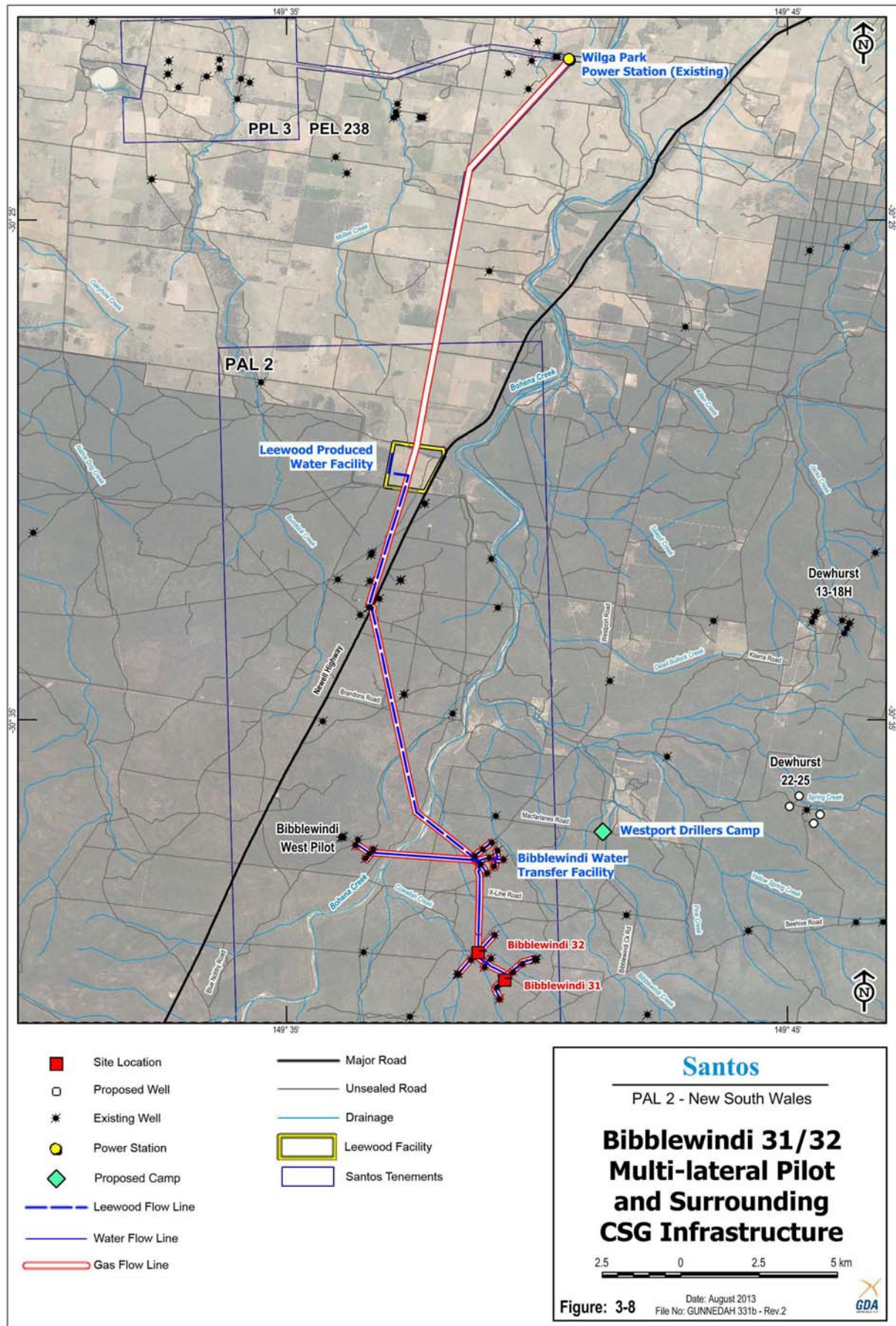


Figure 3-8 Pilot and surrounding CSG infrastructure

### 3.2.1.5 Westport Drillers Camp

Westport driller's camp is located approximately 30 kilometres south west of Narrabri and approximately seven kilometres north of the site. Development approval was issued in December 2012. The camp will accommodate between 24 and 64 persons at the site for up to 4 years. The camp will be used as needed for any proposed activities to occur as part of the E&A Program.

### 3.2.1.6 Other Pilots within the E&A Program

Other pilots within the E&A Program located near the Bibbiewindi Multi-Lateral Pilot include:

- Bibbiewindi West Pilot, approximately 5 kilometres west
- Dewhurst 13-18H Pilot, approximately 15.5 kilometres north
- Dewhurst 22-25 Pilot, approximately 10.5 kilometres north east
- Dewhurst 26-31 Pilot, approximately 3.5 kilometres south.

### 3.2.2 **Land ownership**

The proposed activity is located entirely on land managed by the Forestry Corporation of NSW. Santos holds a Permit to Occupy from Forestry Corporation of NSW and the State of NSW. The permit to occupy outlines a range of environmental mitigation strategies that Santos must implement as part of the agreement.

## 4.0 Description of the Proposed Activity

### 4.1 Overview

The proposed activity involves the expansion of the Bibblewindi Multi-Lateral Pilot through the drilling of two new wells (Bibblewindi 31 and 32) on existing well pads (Bibblewindi 14 and 19H respectively), installing surface infrastructure to connect the wells to the existing network of wells and associated water and gas gathering system and operating the expanded Bibblewindi Multi-Lateral Pilot including the management of water and gas produced during operation. All activities will occur on the existing lease areas and access tracks for Bibblewindi 14 and Bibblewindi 19H.

The proposed activity includes:

- construction: site preparation of the well leases and establishing necessary equipment, temporary structures and facilities on the existing lease areas to enable drilling; drilling one vertical pilot well (Bibblewindi 31) and one lateral pilot well (Bibblewindi 32) and connection to the Bibblewindi Multi-Lateral Pilot
- operation: operating the existing Bibblewindi Multi-Lateral Pilot with the new Bibblewindi 31 and 32 wells, management of the water and gas produced during operation for up to 3 years and general maintenance activities
- post operation and rehabilitation: decommissioning and rehabilitation of pilot wells and ancillary infrastructure or suspended.

The works proposed during each stage, and estimated timing, are summarised in Table 4-1.

**Table 4-1 Approximate duration of drilling and site activities**

| Activity                                 | Approximate duration                                                                                               | Estimated timing                      |
|------------------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| <b>Construction</b>                      |                                                                                                                    |                                       |
| Site preparation                         | 20 days                                                                                                            | Q2 2014                               |
| Drilling and completion                  | 35 days                                                                                                            | Q2 2014                               |
| Surface facilities                       | 50 days                                                                                                            | Q2/3 2014                             |
| <b>Operation</b>                         |                                                                                                                    |                                       |
| Operation of the pilot                   | up to 3 years                                                                                                      | 2014 to 2017                          |
| <b>Post operation and Rehabilitation</b> |                                                                                                                    |                                       |
| Post operation/rehabilitation            | approximately six months after well abandonment where practicable and considering external factors such as weather | on completion of appraisal activities |

The proposed activity does not include the assessment of the existing site establishment and construction activities for clearing and preparation of the lease areas, the water and gas gathering system, access tracks and partial rehabilitation of the lease areas, as these are the subject of existing approvals.

## 4.2 Pilot well design

### 4.2.1 Bibblewindi 31 and 32 wells

Bibblewindi 31 and 32 will be designed and constructed in accordance with the *NSW Code of Practice for Coal Seam Gas Well Integrity* (DTIRIS 2012b).

Bibblewindi 31 will be constructed as a generally vertical well with a below ground level of approximately 1100 metres and a measured depth of approximately 1150 metres. The measured depth is slightly longer than the below ground level as the bottom of the well will have a slight incline and the well design includes a slight s-bend.

Bibblewindi 32 will be a single-lateral well and will have a below ground level of approximately 900–1000 metres vertically and a measured depth of approximately 2100 metres. The ‘build zone’, where the initially vertically drilled well is inclined to penetrate the Bohena coal seam laterally, will be between 930 and 990 metres below ground level. From here, the well will continue laterally in-seam for a distance of approximately 900 metres, where it will intercept Bibblewindi 31, including a short distance past Bibblewindi 31.

Table 4-2 summaries the key design criteria for each of the wells.

**Table 4-2 Well design parameters**

| Design criteria    | Bibblewindi 31                                                      | Bibblewindi 32              |
|--------------------|---------------------------------------------------------------------|-----------------------------|
| Direction          | Vertical <sup>1</sup>                                               | Lateral                     |
| Approximate Depth  | 1100 m                                                              | 930-990 m                   |
| Well type          | Appraisal pilot                                                     | Appraisal pilot             |
| Target coal seam   | Bohena                                                              | Bohena                      |
| Drilling technique | rotary drilling and coring                                          | rotary drilling             |
| Horizontal length  |                                                                     | Approximately 900 m         |
| Well head pump     | progressive cavity pump or electrical submersible pump <sup>2</sup> | electrical submersible pump |

Notes

<sup>1</sup>The vertical well includes a slight “S” shape to enable drilling on the existing Bibblewindi 14 lease area

<sup>2</sup>The pump type is to be confirmed based on the deviation of the well and recommendations from pump vendors.

Figure 4-1 shows the interaction between the two wells. Bibblewindi-31 is the red “S”-shaped well.

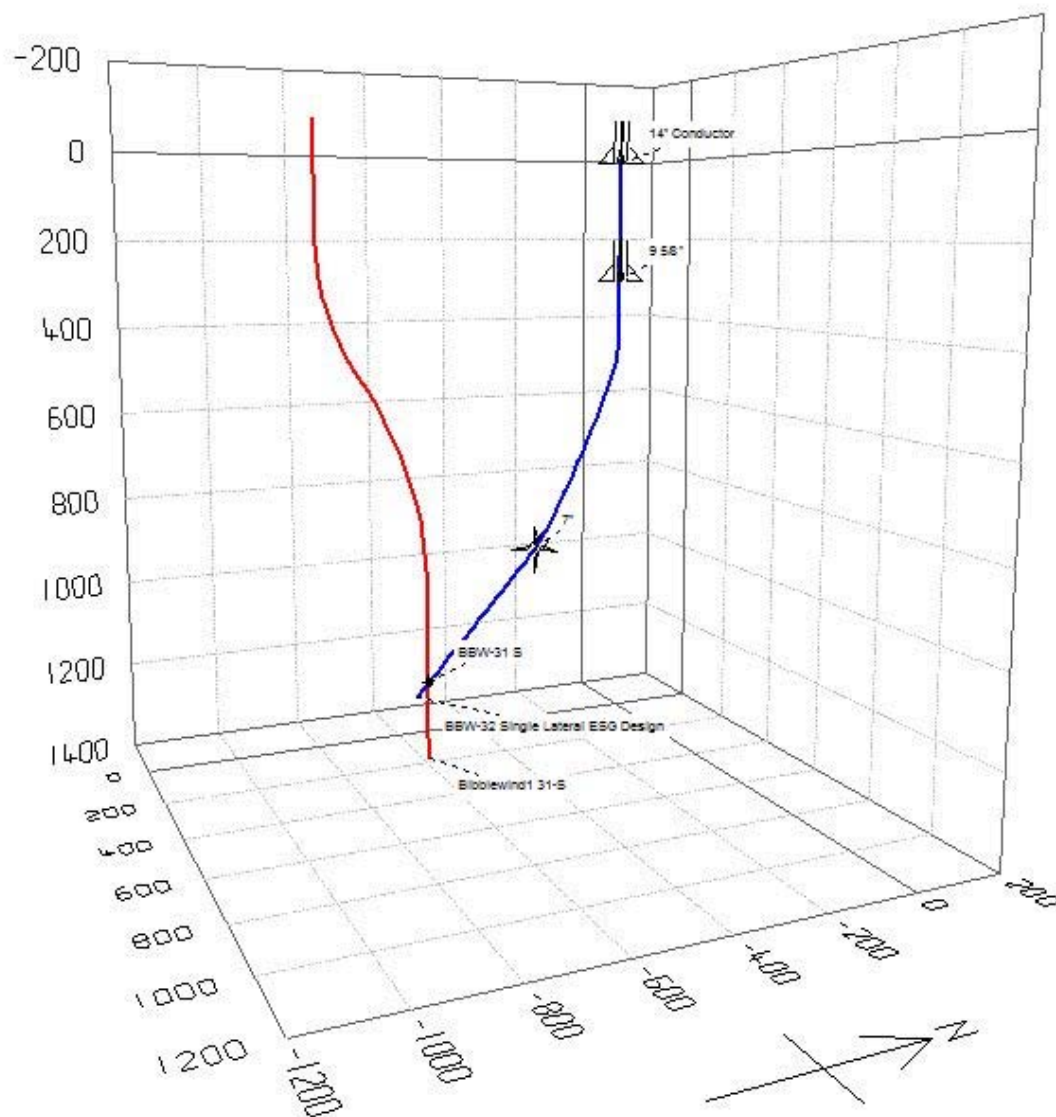


Figure 4-1 Well schematic showing intersection of the wells (units in metres)

#### 4.2.2 Surface facilities

A wellhead separator and metering skids with associated power generation equipment (gas and diesel), motor control centre, pump and telemetry units will be installed at each pilot well. The wellhead separator at each pilot will be connected to the existing water and gas gathering system for the Biblewindi Multi-Lateral Pilot. The tie-in point to the existing buried gathering system will be on the existing Biblewindi 14 and 19H lease areas. There is sufficient capacity within the existing gathering system to carry additional water and gas produced by Biblewindi 31 and 32.

A typical wellhead separator and metering skid is shown in Plate 4-1.



**Plate 4-1 Typical wellhead separator and metering skid**

## **4.3 Construction activities**

### **4.3.1 Site preparation**

Various works would be undertaken to prepare the site for the proposed activity, including minor clearing of grasses that have established within the existing lease areas, re-establishing temporary buildings, above-ground storage tanks and other facilities on the lease areas, excavating a cellar pit and drill cuttings pit and positioning the drill rig.

The drill cuttings pit will be lined with heavy grade impermeable plastic sheeting.

Temporary venting and flaring facilities would be located at each site during drilling and pump testing, but would be removed at the end of drilling activities.

Figure 4.3 shows a typical layout for a lease area during drilling.

The primary plant, equipment and temporary buildings to be used during drilling activities will include:

- drilling rig and supporting equipment (such as pipe handler and mud pump)
- surface tanks
- metal bins, baskets, skids and sea containers to house equipment
- mechanical vibrating screens
- power generator units
- lighting towers
- site offices.

The vent tank would be installed to capture fluids and gas from the wells if required. This tank is a re-enforced steel container, with internal baffles and piping to allow for the separation of gas and liquids. The tank will be designed to contain any fluids vented. This captured and contained fluid will be removed, as required, and disposed of by a licensed waste disposal company. Minor volumes of methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>) may be emitted from the vent tank from time to time.

Other equipment will be required on site during the course of the drilling activities, including wire line trucks, cementing trucks and service company vehicles.

#### **4.3.2 Site access for construction**

Access routes to the lease areas would be via existing roads as shown in Figure 4-3. For the majority of vehicles and equipment access to the site would be from the Newell Highway via X line Road, Tighes Gully Road and Little Tighes Road, which are all unsealed roads within the Forest.

Employees based at the drillers camp would also access the site from Forest roads including Middle Road, Macfarlane's Road, Garlands Road, Bibbiewindi Creek Road, Self Camp Road and Tighes Gully Road.

Travel to and from Narrabri and the NOC/FTF will be via the Newell Highway, Mooloolbar Street and Yarrie Lake Road once within Narrabri.

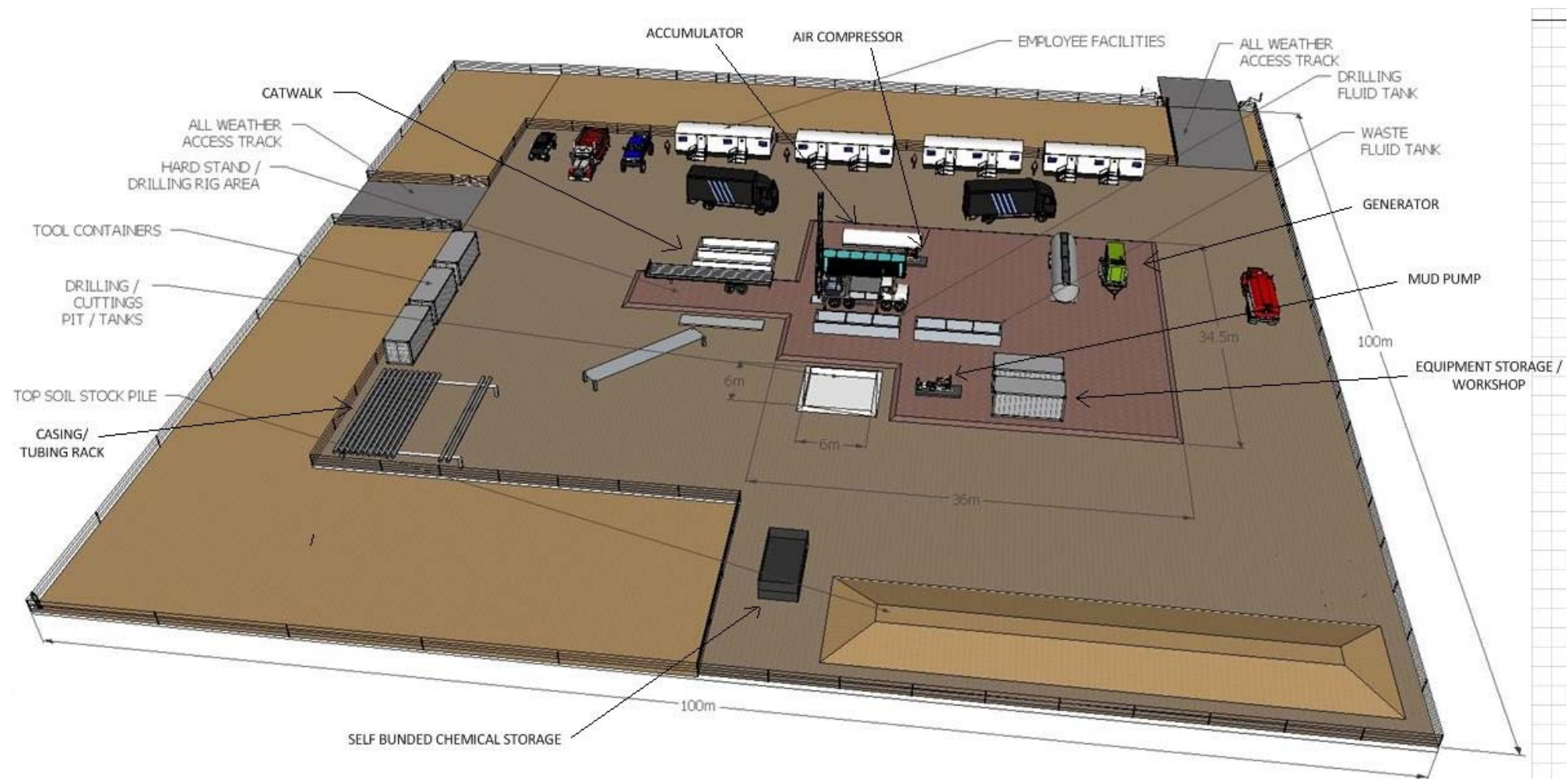


Figure 4-2 Conceptual lease layout during drilling

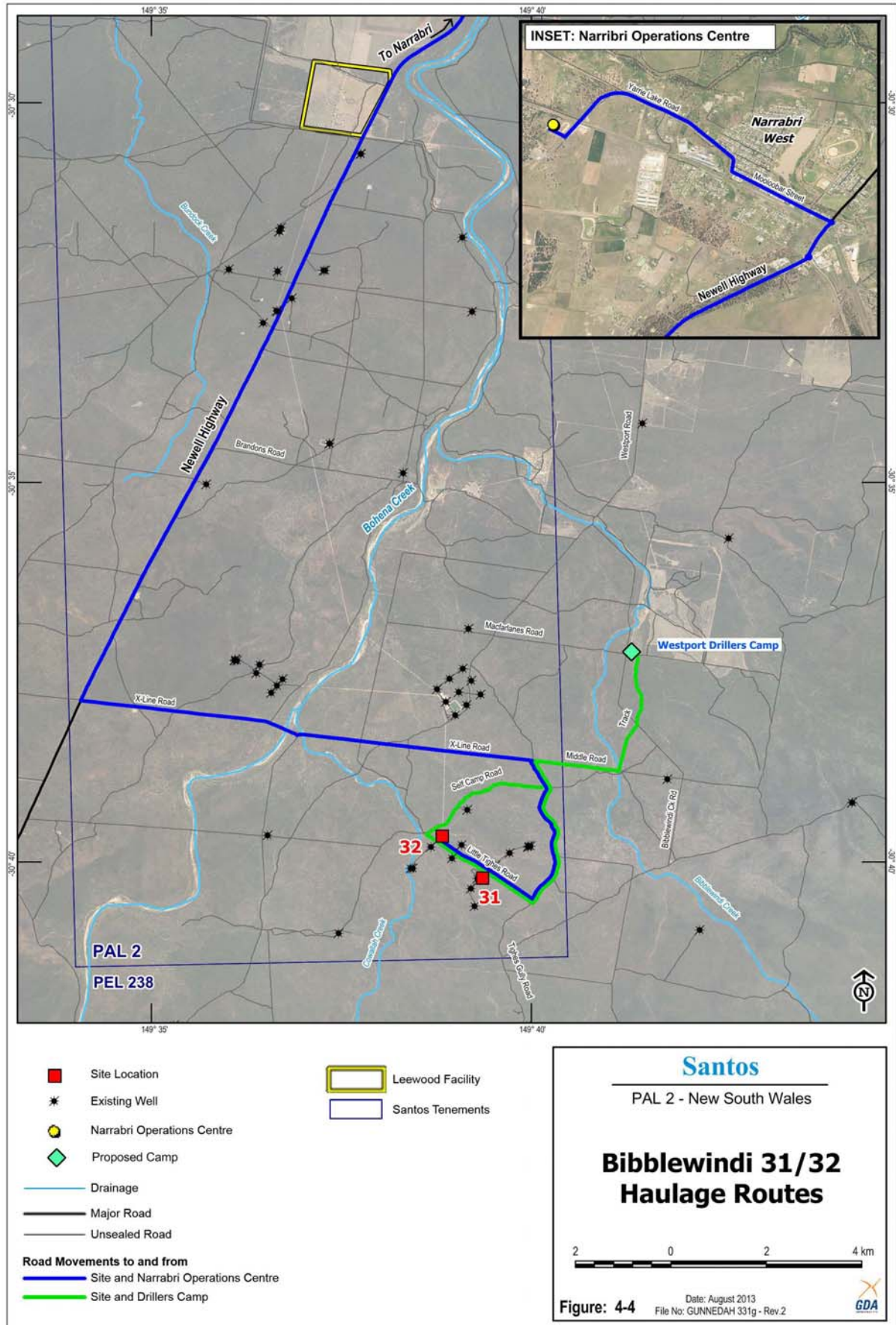


Figure 4-3 Biblewindi 31 and 32 haulage routes

### 4.3.3 Drilling

#### 4.3.3.1 Drilling process

Bibbiewindi 31 will be drilled first, followed by Bibbiewindi 32. Drilling and construction of the two wells will involve:

- drilling an open hole with an approximate diameter of 12¼ inches through alluvial and/or weathered rock material into competent rock (Purlawaugh Formation)
- installing 9½ inches steel casing and cementing in place back to surface. The surface casing would be set 290 to 330 metres below ground level
- installing a Blow Out Preventer (BOP) on top of the casing, drilling out the casing shoe using an 8½ inches rotary drilling assembly and drilling to the planned depth. During drilling, the circulating drilling fluid will establish a wall cake and maintain pressure on the various aquifers intercepted. This will prevent the ingress of groundwater to the pilot well and discharge of groundwater to the surface. It will also limit the ingress of drilling fluid into the aquifers in the immediate vicinity of the pilot well.
- installing production casing to the planned total depth just above the Bohena coal seam.

#### 4.3.3.2 Drilling fluid and additives

Drilling fluids used for drilling of the two wells will be predominantly water-based and made up of two main drilling additives, salts and gels. Salts such as potassium sulphate ( $K_2SO_4$ ) are used as a weighting agent to help control swelling clays, while gels such as CR-650 are used to lubricate and increase the viscosity of the drilling fluid.

Potential sources of make-up water for the drilling fluid include the Narrabri's town water supply, produced formation water from an operational pilot well in the region, or local industrial licensed water bores. The quality of make-up water will depend on the final source.

Chemicals will be mixed with the drilling fluid at the FTF prior to being transported to site (subject to planning approval and obtaining an EPL for the FTF). This will reduce the volume of chemicals required to be stored on site during drilling. The drilling fluid will be transported to the site in a trailer prior to the commencement of drilling and stored in surface tanks on site. Any chemicals on site will be stored in an elevated, bunded trailer for protection in the event of heavy rains or site flooding.

Chemicals that may be used in the drilling process or held on site during the drilling process and their purpose is summarised in Table 4-3.

**Table 4-3 Drilling chemical additives**

| Chemical trade name                         | Description                                                                 | Purpose                                                                                                      |
|---------------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| K2S04, Potassium Sulphate                   | Sulphuric Dipotassium Salt, Sulphate of Potash, Potash of Sulphur, Arcanite | Helps to keep the drilled clays dry and less sticky                                                          |
| Calcium Chloride 74-77%, Calcium Dichloride | Calcium Chloride                                                            | To speed up setting of cement and reduce waiting time                                                        |
| Xanthan Gum P, Flowzan                      | Corn Based biopolymer (polysaccharide)                                      | Thickens the mud so it can carry the drilled rock out of the hole                                            |
| Quickseal Medium, Kwikseal                  | Cellophane/wood /nutshells                                                  | Lost Circulation Material. Deposits against the wall of the hole to prevent or reduce mud lost down the hole |

| Chemical trade name                                                             | Description                                                      | Purpose                                                                                                                                  |
|---------------------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Rheopac, Rheopac-RD, Rheopac-LV, Rheopac-R, Drispac-R, Drispac-SL, PAC-R, PAC-L | Poly Anionic Cellulose                                           | Reduces the amount of fluid seepage from the mud into the ground which can cause the hole to become sticky, unstable and less productive |
| JK – 261 / JK-161, CR-650, JK-261 LV, JK-161 LV                                 | PHPA (Partially Hydrolised Poly Acrylamide)                      | Helps to keep the drilled clays dry and less sticky                                                                                      |
| Idcide – 20                                                                     | Tetrakis Hydroxymethyl Phosphonium Sulphate (THPS)               | To prevent micro-organisms from attacking the mud and generating odours when stored                                                      |
| Sodium Bicarbonate                                                              | Sodium Hydrogen Carbonate (NaHCO <sub>3</sub> )                  | Treatment against cement contamination of the drilling mud                                                                               |
| Citric Acid                                                                     | Citric Acid                                                      | To reduce pH                                                                                                                             |
| Soda Ash                                                                        | Sodium Carbonate (Na <sub>2</sub> CO <sub>3</sub> )              | Control of Calcium Hardness                                                                                                              |
| Fracseal – Fine                                                                 | Micronised Cellulose fibre                                       | Deposits against the wall of the hole to prevent or reduce mud lost down the hole                                                        |
| Sodium Formate                                                                  | Formic Acid, Sodium Salt                                         | To provide weight in the fluid and provide some clay inhibition                                                                          |
| DEFOAM – E                                                                      | Polyoxyethylene polyoxypropylene block copolymer                 | Prevent foaming of mud and problems with pumps                                                                                           |
| Barite, Rheobar, Aus-Bar                                                        | Barite, Barium Sulphate. Naturally occurring, insoluble mineral. | To prevent hole collapsing and high pressure gas or water from escaping. Legal requirement for well control                              |

The Materials Safety Data Sheets (MSDS) for these chemicals are provided on the Santos website: <http://www.santos.com/exploration-acreage/nsw-csg/reports-and-publications.aspx>.

During drilling, the drilling fluid will mix with naturally occurring rock and soil (referred to as drill cuttings) and return these to the surface. The drilling fluid will pass through mechanical vibrating screens to separate out drill cuttings. The liquid component of the drilling fluid will flow into surface tanks for recirculation throughout the drilling process. Drill cuttings will be stored on site until drilling is completed.

Table 4-4 outlines the expected drilling fluids required for each well.

**Table 4-4 Estimated drilling fluid transported to and from site**

|                                                                                   | Bibbiewindi 31 | Bibbiewindi 32 |
|-----------------------------------------------------------------------------------|----------------|----------------|
| Drill cuttings generated (m <sup>3</sup> )                                        | 140            | 300            |
| Drilling fluid transported to site (m <sup>3</sup> )                              | 225            | 250            |
| Drilling fluid transported from rig to Fluid Treatment Facility (m <sup>3</sup> ) | 100            | 150            |

Losing drilling fluid is undesirable as it is the primary means of controlling the drilled hole. In the event that losses are detected, a lost circulation material (LCM) will be mixed into the fluid to prevent further losses. LCM is made of cellulose or other natural material and works by blocking the pores in the permeable/fractured rock.

#### 4.3.3.3 Treatment of drilling fluid

Once drilling of the wells is complete, Santos is proposing to transport and treat drilling fluid at the proposed FTF. The FTF will treat and store drilling fluids for future re-use in subsequent drilling activities. If required drill cuttings will be tested to determine the appropriate management and disposal methods.

It is expected that the FTF will be licenced and operational by the time Bibbiewindi 31 and 32 is drilled. Drilling fluids will be mixed at the FTF and then transported to site. Approximately six tankers will be required to transport the drilling fluid to site prior to drilling each well.

In the event that the drilling fluids treatment facility at the Narrabri Operations Centre is not approved or operational, drilling fluid will be mixed in tanks on the well lease sites prior to drilling. Make-up water will be transported to the site from a licensed source in the area. Additives (potassium sulphate or potassium chloride, and polymers) will be transported to site from the supplier's warehouse in Roma or Brisbane. Approximately six tankers will be required to truck the make-up water from its source to the site prior to drilling each well. One truck will be required to transport drilling additives from the warehouse to site at the start of drilling each well.

Additional tankers will be required to truck either drilling fluids or make-up water throughout the drilling of each well (equivalent to approximately three to seven tankers, well design dependant, over the drilling period).

#### 4.3.4 **Cementing**

Cementing operations will be in compliance with Section 4.3 of the *NSW Code of Practice for Coal Seam Gas Well Integrity* (DTIRIS 2012b) so as to:

- prevent groundwater migration paths and isolate the targeted zone from other formations
- protect beneficial aquifers from contamination
- maintain aquifer pressures and quality
- obtain and maintain well integrity
- protect the casing from corrosion.

The cementing of casing strings will be performed by a recognised professional cementing company who will provide bulk cement facilities, high pressure cementing pumps and mixing pumps to mix and pump the slurries required. The equipment will be operated in a manner that will minimise any spills. Pressure tested steel lines will connect the cementing unit to the well to allow fluids to be pumped to the well and these fluids will be positioned in the well following correctly formulated engineering design and good oilfield practice.

To ensure compliance with the Code of Practice, all casing strings will be cemented to surface. All batches of cement used in the cementing operation and associated chemicals for the recipe are tested prior to use in the wells to ensure that the cement has the right properties (i.e. setting time and compressive strength).

All cementing programs are designed, reviewed and signed-off by senior Santos drilling personnel and submitted, as part of the Well Drilling Program (Notification to Drill), to the Office of Coal Seam Gas (OCSG) for approval at least 30 days before the well can be commenced.

In addition, cementing reports, including all materials and compressive strength versus time graphs, cement pump charts and pressure records, logging reports and details of centraliser placing must be completed and submitted to the OCSG with the Well Completion Reports.

Following completion of cementing, excess fluids and cement slurries will be segregated in steel waste tanks and removed and disposed of by a licensed waste disposal company.

#### **4.3.5 Casing the well**

Once each well has reached the total depth, geophysical wire-line logs would be run over the length of the hole (or as far as practicable in Bibblewindi 32) to identify major stratigraphic units, intersected coal seam depth and seam thickness. Further well testing may follow after completion of logging.

At near vertical in Bibblewindi 31, a combination of steel and fiberglass casing would be run in the hole and pressure cemented ensuring total isolation of the well bore to the surrounding coal seams and any potential aquifers. The combination casing design allows fiberglass to be placed over potential future lower Maules Creek coal seams whereas steel casing isolates all other non-target rock types in the upper section of the well including shallower, potentially mineable coal seams including the Hoskisson coal measure. The horizontal hole drilled from Bibblewindi 32 will intercept the fiberglass casing in the vertical well over the target coal sequences.

In Bibblewindi 32, steel casing will be run in the 8½ inch hole section to total depth at approximately 1130 metres measured depth. Steel casing will be used over the upper coal seams. The horizontal hole section will be left open and uncased.

All casing design shall comply with the Santos Drilling Operations Manual in accordance with Santos (and other) oil industry standards to cater for potential casing failure mechanisms.

#### **4.3.6 Well completion**

The wells will be completed using a work over rig. This involves installing the down hole pump assembly and hydraulic drive head (wellhead) with additional support equipment.

#### **4.3.7 Construction staff and hours**

The number of employees present on the site at any one time is expected to be approximately 20 with short peaks during shift changeover. Drillers will be based at the Westport driller's camp with travel to and from site by minibus.

Construction hours will be up to 24 hours per day, seven days per week. Personnel movements to and from site will be minimised outside of a single shift change per day but may be necessary during specific activities or in the event of an incident.

#### **4.3.8 Site water requirements**

Approximately 0.02 megalitres per day of potable water will be required for facilities on each lease. This will be sourced from Narrabri's town water supply or local industrial licensed water bores and trucked to the site.

## 4.4 Operation of the pilot

### 4.4.1 Pilot testing

During the pilot test, pressures, water volumes, water levels, compositions and gas rates will be monitored. These will be reported in accordance with regulatory obligations.

Data collected on site from the well head and gathering system will be transmitted via a Remote Telemetry Unit (RTU) through the Next G network to Santos offices to enable operations personnel to remotely monitor and control the surface facilities. Security measures will also be installed.

The pilot wells will have automated shutdown systems that are triggered by pre-set operating envelopes. These operating envelopes are designed to minimise or prevent environmental, health or safety incidents.

### 4.4.2 Water management

A qualitative site water balance assessment was undertaken as there is no onsite water demand during general operation of the Bibblewindi Multi-Lateral pilot. There will be some minimal onsite water demand during work overs, as discussed below. For the majority of the time, the only water onsite will be the groundwater lifted from the wells during operation of the pilots.

For the vertical wells, a progressive cavity pump (PCP) will be installed just above the coal seam to transfer water to the surface through the well tubing. For the horizontal wells, an electrical submersible pump (ESP) will be located just above the depth of the target coal seams.

In order to conduct the pilot, water will be extracted from the target seams from all the (14) pilot wells simultaneously. The lifted water will be captured at each well head and will be disposed of from site through a network of pipes and treated. There will be no discharge to local receiving waters.

The water extraction rate is raised steadily over the first 30 days of the trial in order to protect the integrity of the well bore and casing. The estimated volumes of groundwater lifted at the Bibblewindi Multi-Lateral pilot is outlined in Table 4-5.

**Table 4-5 Estimated groundwater extraction rates for the Bibblewindi Multi-Lateral pilot**

| Pilot                           | Total Extraction (m <sup>3</sup> ) | Max Extraction (m <sup>3</sup> /day) | Average Extraction (m <sup>3</sup> /day) |
|---------------------------------|------------------------------------|--------------------------------------|------------------------------------------|
| Bibblewindi Multi-Lateral Pilot | 285,110                            | 581                                  | 260                                      |

Table 4-6 shows the likely produced water composition based on existing water sampling data from existing wells drilled within Maules Creek Formation coal seams in the Narrabri region. As a baseline, rainwater typically has 20 milligrams per litre or less total dissolved solids (TDS). Fresh water from lakes, rivers, and groundwater is more variable, with TDS ranging from 20 milligrams per litre to approximately 1,000 milligrams per litre. Brackish water is, by definition, water with TDS exceeding 1,000 milligrams per litre and ranging as high as that of seawater, at approximately 35,000 milligrams per litre. The below results indicate that CSG water would be considered in the high brackish range and unsuitable for irrigation or drinking water without treatment.

**Table 4-6 Quality of formation water within the Maules Creek Formation coal seams (based on data taken from existing wells within PEL 238 and PAL 2)**

| Parameter                    | Units | Minimum | Average | Maximum |
|------------------------------|-------|---------|---------|---------|
| Total Dissolved Solids (TDS) | mg/L  | 9,000   | 16,000  | 23,000  |
| Temperature                  | ° C   | 22.5    | 22.8    | 23.4    |
| pH                           |       | 7.1     | 7.5     | 8.0     |

The only onsite water demand during operation will potentially occur during work overs associated with maintenance activities, when the well is first killed (flushed with higher density fluid to prevent water rising), and then during the actual work over activities. Approximately three to four trailer-loads (75 to 100 cubic metres) of weighted brine from the FTF may be required to kill the well. The additional water will be sourced from the Narrabri's town water supply, local industrial licensed water bores or the Leewood Produced Water Facility and trucked to the site.

Approximately three to five trailer-loads (75 to 125 cubic metres) of groundwater may also be lifted during work over activities. This produced water will be trucked to the Leewood Produced Water Facility.

#### 4.4.2.1 Water transfer and treatment

The water transfer and treatment process will be as follows:

- At each well, the lifted water produced will be pumped through the water gathering system to Bibblewindi Water Transfer Facility, via the existing flow line.
- The Bibblewindi Water Transfer Tank located at the Bibblewindi Water Transfer Facility will be used to provide a short buffer (up to 24 hours) prior to the produced water being pumped to the Leewood Produced Water Facility via the Leewood Water Pipeline.
- Once at the Leewood Produced Water Facility, produced water will be stored in one of the 300 megalitre ponds.

#### 4.4.3 **Gas management**

Recovered gas from the wells will flow up the well annulus (separate to the water) with the gas stream entering the wellhead separator to remove any entrained water. Gas will collect at a central location at Bibblewindi 19H. A portion of the produced gas will be diverted for conditioning and use within the well site power generators (approximately 10%).

The remainder of the gas will be transferred via the existing flow line to the compressor station and flare located at the Bibblewindi Water Transfer Facility. Gas would then join the existing gas flowline and transfer to Wilga Park Power Station subject to approval for the gas to be consumed at Wilga Park Power Station.

Where gas volumes exceed demand at the Wilga Park Power Station, or in the event that approval is not granted, gas will be flared at the Bibblewindi Water Transfer Facility. Provided approval for the gas to be consumed at Wilga Park Power Station is gained, it is expected that this would be less than 5–10% of the gas produced.

#### 4.4.4 **Partial Rehabilitation of lease areas**

Once the drilling activities are complete, any surplus lease area is proposed to be rehabilitated to an area of approximately twenty by twenty metres around each well head with appropriate mitigation measures and environmental safeguards implemented to minimise potential impacts. All rehabilitation works will be undertaken with maximum regard to environmental protection and rehabilitation, vegetation, subsoil and

topsoil management, weed control, erosion and sedimentation management and revegetation in accordance with the relevant statutory requirements.

#### 4.4.5 Maintenance activities

Well maintenance and work over activities will occur from time to time at the wells for corrosion monitoring, mechanical repairs or other interventions as required. Work over activities could include maintenance of completion equipment, well cleanouts and/or repairs.

#### 4.4.6 Maintenance staff and hours

During operation, staff movements to the site will be minimal. It is expected that the site will be visited by up to one vehicle per day for monitoring and minor maintenance. During well work over activities, an increase in staff would occur for a short period if a work over rig were required.

Generally monitoring and maintenance will occur during daylight hours although in some instances or should an incident occur, 24 hour operations may be required.

### 4.5 Post Operation and final rehabilitation

On completion of operations, wells and ancillary infrastructure would either be decommissioned with lease areas rehabilitated or wells will be suspended. Options considered include:

- Suspension for future use: exploration and appraisal activities confirm the CSG resource as commercially viable. If this occurred, production activities would be subject to further environmental assessment and government approvals. In the event that Santos decides to seek approval for a production project, the wells would be suspended until determination of the role, if any, the wells would play in a commercial gas production project
- decommissioning and rehabilitation: This would occur in the event that Santos does not pursue commercial gas production, or a well or supporting infrastructure is not a part of a commercial gas production activity for which approval is sought. In this scenario the wells and supporting infrastructure would be decommissioned and rehabilitated.

#### 4.5.1 Pilot well decommissioning and lease area rehabilitation

Decommissioning of the wells would also be in accordance with the *NSW Code of Practice for Coal Seam Gas Well Integrity* (DTIRIS, 2012b). This includes:

- sealing the wells from bottom to top by plugging with cement in approximately 200 metre increments
- pressure testing the cement plug across the surface casing shoe to ensure the wells are sealed
- removing the well heads and casing at a depth of greater than 1.5 metres below surface and installing a well head marker.

Surface infrastructure would be removed. Buried surface infrastructure, including the gathering systems, would be flushed, capped at each end and left in-situ in accordance with legislative requirements.

A rehabilitation strategy will be developed in conjunction with the landowner, Forest Corporation of NSW, and taking into consideration the conditions within the Permit to Occupy. The final landuse would be consistent with the surrounding area as state forest.

#### 4.5.1.1 Rehabilitation objectives

The objectives for the rehabilitation program are to:

- stabilise the site to minimise erosion
- return the disturbed areas to a self-sustaining native forest condition, typical of adjacent reference forest ecosystems
- rehabilitate the disturbed areas to the satisfaction of the landholder (Forestry Corporation of NSW).
- facilitate natural re-vegetation

EcoLogical Australia recently conducted a review of the success of natural revegetation approach to rehabilitation. As part of the review, six sites were identified along the Wilga Park Gas Flow Line route that was constructed in 2007/8 and four lease areas (Dewhurst 2, Dewhurst 19, Bibbiewindi 25 and Jacks Creek 1). The effectiveness of rehabilitation was measured in 2012 and again in 2013. At all locations, the number of native species increased over the year and were generally within 30% of the numbers observed in the reference sites. This demonstrates the rehabilitated areas are capable of sustaining reproducing populations of the species necessary for its continued stability and development within relatively short timeframes.

#### 4.5.1.2 Rehabilitation methodology

The proposed rehabilitation methodology includes:

- identification of reference sites to assist in monitoring success
- removing perimeter fencing and all other infrastructure
- replacing sub-soil across the well leases, contouring to the landscape and partially compacting
- placing top-soil uniformly across the well leases
- revegetating well leases with native species from existing seed bank within top soil
- surface contouring, through ploughing and the creation of “hummock” and low relief features similar to the surrounding area
- spreading of retained woody material
- blocking of access tracks with timber to minimise disturbance of the site by vehicles and to maximise natural regeneration
- controlling weeds
- ongoing monitoring of success through comparison to identified reference sites.

Assisted planting would be considered in the event that natural regeneration is unsuccessful, in accordance with the criteria in the table below. Any 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 weeds
- reduce erosion of sediment by wind or water by root mass created in rehabilitated soils
- enhance the speed of plant colonisation of rehabilitated soils beyond that expected from surrounding areas alone
- provide microsites for further natural species ingress into the rehabilitated areas, especially tree species which require some immediate low-level shelter, soil moisture and organic content
- provide wildlife habitat in the rehabilitated areas.

#### 4.5.1.3 Rehabilitation completion criteria

Rehabilitation success will be assessed by establishing and assessing monitoring sites with reference to the existing (pre-disturbance) vegetation characteristics, outlined in Table 4-7 (referred to as the reference condition).

**Table 4-7 Vegetation characteristics (reference condition)**

| Description                     | Corresponding community                                            | Characteristics                                                                                                                                      |                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 |                                                                    | Canopy                                                                                                                                               | Shrub                                                                                                                                                                                                                                                                       | Ground                                                                                                                                                                                                                                                                                                                                                                           |
| Narrow leaved ironbark woodland | Ironbark Shrubby Woodland of the Pilliga Area, Brigalow Belt South | 15 to 19 metres – a patchy to moderate 15 – 50% projected foliage cover. The dominant species was <i>Eucalyptus crebra</i> (Narrow-leaved Ironbark). | Variable height of 0.1 to 1.7 metres, 80 to 95% cover. Dominated by <i>Acacia caroleae</i> (Wattle) and, to a lesser extent, <i>Acacia spectabilis</i> (Mudgee Wattle), <i>Callistemon linearis</i> (Narrow-leaved Bottlebrush), and <i>Cassinia arcuata</i> (Sifton Bush). | Variable height of 0.1 to 0.8 metres, 50 to 65% cover. The ground layer was scattered and sparse and was dominated by <i>Dianella revoluta</i> (Blue Flax-lily), <i>Lomandra filiformis</i> (Wattle Mat-rush), <i>Aristida ramosa</i> (Purple Wire Grass), <i>Eragrostis brownii</i> , <i>Aristida vagans</i> (Threeawn Speargrass) and <i>Cheilanthes sieberi</i> (Mulga Fern). |

Rehabilitation performance criteria and rehabilitation completion criteria for the E&A program have been developed based on PAL 2 conditions and the Permit to Occupy. These are summarised in Table 4-8 and Table 4-9.

**Table 4-8 Rehabilitation performance criteria**

| Action                                           | Outcome                                                                          | Target                                                                                                                                                                                                                                    | Timing                                                         |
|--------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| Decommissioning of site infrastructure           | Cleared site                                                                     | All plant, equipment, containers, waste materials and temporary buildings removed from the site. Fencing removed.                                                                                                                         | Within 6 months of abandonment                                 |
|                                                  | Gathering system                                                                 | Pipes flushed and capped each end.                                                                                                                                                                                                        | Within 6 months of abandonment                                 |
| Landform establishment                           | Topography to mimic the micro topographical undulations of the surrounding area. | Site graded and reshaped to reinstate, as far as practicable, the original contour and drainage. Erosion and sediment control implemented to minimise runoff channelling/erosion                                                          | Within 6 months of abandonment                                 |
| Restoration activities by natural rehabilitation | Restored native plant diversity                                                  | Restore native plant species richness, and native canopy, mid-storey and grass cover to within 75% of reference condition. Achievement of target prior to elapsing of period to be assessed as development against the target trajectory. | Canopy: 15 years<br>Midstory: 10 years<br>Groundcover: 5 years |

| Action                                                                                                                       | Outcome                            | Target                                                                                                                                                                             | Timing                                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Assisted restoration by seeding and/or planting where natural rehabilitation does not meet requirements within stated period | Restored native plant diversity    | Restore native plant species richness, and native canopy, mid-storey and grass cover to within 75% of reference condition.                                                         | Ground cover: Where natural regeneration has produced no evidence of soil stabilisation after 6 months of rehabilitation.<br>Midstorey: Where natural regeneration has produced less than 25% cover of reference condition after 2 years of rehabilitation. |
| Fauna habitat components reinstated (fallen logs and bush rock)                                                              | Increased fauna habitat complexity | Restore lengths of fallen logs and woody debris in accordance with advice from a suitably qualified ecologist.                                                                     | 3 months.                                                                                                                                                                                                                                                   |
| Weed management                                                                                                              | Management of weed cover           | Infestations of noxious weeds in right of way managed in accordance with requirements of Noxious Weeds Act 1993.                                                                   | Until ground cover achieves target rehabilitation performance criteria, as per above.                                                                                                                                                                       |
| Monitoring and reporting                                                                                                     | Reporting to regulator             | Report to be submitted to OCSG within DTIRIS following the completion of all rehabilitation activities (civil works, waste removal, etc.) in accordance with condition 3 of PAL 2. | At completion of rehabilitation.                                                                                                                                                                                                                            |

Table 4-9 Rehabilitation completion criteria

| Aspect/requirement                                                                            | Objectives                                                                                                                                                                    | Completion criteria                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ploughed in gathering system infrastructure                                                   | Gathering infrastructure to remain <i>in situ</i> on decommissioning                                                                                                          | Decommissioning in accordance with APIA Code of Practice, Upstream PE Gathering Networks – CSG Industry, Version 2.0                                                                   |
| Trenched gathering system infrastructure                                                      | Gathering infrastructure to remain <i>in situ</i> on decommissioning                                                                                                          | Decommissioning in accordance with APIA Code of Practice, Upstream PE Gathering Networks – CSG Industry, Version 2.0                                                                   |
| The proposed activity will be maintained in a stable and non-polluting condition at all times | The final landform is stable and not prone to slumping, mass movement or significant erosion                                                                                  | No areas of instability or slumping.                                                                                                                                                   |
|                                                                                               | The proposed activity will not be a source of pollutants                                                                                                                      | No areas of active erosion.                                                                                                                                                            |
| Landform development consistent with final land use (i.e. Forestry)                           | Landform suitable for final land use and compatible with surrounding landscape as sustainable native ecosystem<br>Area accomplishes and remains as a healthy native woodland. | Rehabilitation in accordance with Table 2<br>Established species survive and/or regenerate after disturbance.<br>Weeds do not dominate native species after disturbance or after rain. |

## 5.0 Community and stakeholder consultation

### 5.1 Consultation objectives

Santos understands the importance of proactive and effective engagement with communities and stakeholders and is well established within the local community, with a local office and resident employees. Santos has commenced implementing a consultation strategy for the E&A Program.

Through this consultation, Santos aims to:

- increase overall awareness and understanding of the CSG industry and in particular the proposed activity
- Identify and keep informed landholders, neighbours, residents, and relevant local and state government agencies
- Build and maintain effective relationships with stakeholders and communities based on open communication, trust and understanding of the E&A Program
- ensure the interests of stakeholders are considered in the proposed activity design and implementation
- Provide timely, accurate and credible information to stakeholders and the broader community
- Identify potential issues and/or risks and strategies for mitigation and resolution.

Targeted consultation with the landowner for the proposed activity commenced in June 2013.

### 5.2 The consultation and community involvement process

Santos has developed a community engagement and consultation framework to specifically target the different needs and requirements of stakeholders and the community to inform and consult on the E&A Program and the CSG industry more broadly.

To achieve the consultation objectives, the framework is based on the following approach:

- program initiation and communication
- ongoing identification and profiling of key stakeholders and review and evaluation of those relationships
- risk management
- monitoring of stakeholder issues and responses
- adherence to relevant legislative framework requirements.

There are four levels of targeted engagement and consultation:

- Inform – Aimed at community, business and industry in the broader regional and state-wide context.
- Involve – Aimed at community groups, industry, business and residents not directly involved but living and operating within the local area. This includes residents of Narrabri, Gunnedah, Boggabri, Wee Waa and surrounding villages; landholders, government departments; non-government organisations, local industry and business.
- Consult – Aimed at key stakeholder groups directly involved. This includes neighbouring landholders; government departments listed as referral agencies; non-government organisations; community groups; local contractors and businesses.
- Collaborate – Aimed at individuals and entities that are directly impacted by the project and/or involved in project decisions. This includes landholders; government departments responsible for assessments and approvals; Narrabri Shire Council; native title claimant groups; and community consultative committees.

### 5.3 Stakeholder identification and communication tools

Santos uses a wide range of consultation tools to engage with various stakeholders as part of its overall consultation program. Implementation has included the provision of general information through the Santos website and media announcements; shopfronts at Narrabri and Gunnedah; monthly community site tours; information stands at local agricultural shows and community events; and implementation of a sponsorship program which supports community and sporting groups.

Questions and concerns raised by the broader community have been addressed through telephone contact (both through the Santos community 1800 line and by individual telephone calls made to the Narrabri Office staff), formal correspondence and on-site meetings where required.

Table 5-1 identifies relevant stakeholder groups and the consultation tools utilised.

**Table 5-1 Stakeholder identification and consultation tools**

| Stakeholder                                                        | Consultation tools |             |                     |                            |                 |                       |                                          |                                  |
|--------------------------------------------------------------------|--------------------|-------------|---------------------|----------------------------|-----------------|-----------------------|------------------------------------------|----------------------------------|
|                                                                    | website            | 1800 number | one on one meetings | project information centre | agency workshop | formal correspondence | information sessions and community tours | community consultation committee |
| Government Agencies                                                | ●                  |             | ●                   |                            | ●               | ●                     | ●                                        |                                  |
| Landowner (Forestry Corporation of NSW)                            | ●                  |             | ●                   |                            | ●               | ●                     | ●                                        |                                  |
| Adjacent landowners                                                | ●                  | ●           | ●                   |                            |                 | ●                     | ●                                        |                                  |
| Indigenous community                                               | ●                  | ●           |                     |                            |                 | ●                     | ●                                        |                                  |
| Special interest groups (e.g. environment and conservation groups) | ●                  | ●           |                     |                            |                 |                       | ●                                        | ●                                |
| Local business and contractors                                     | ●                  | ●           | ●                   |                            |                 |                       |                                          | ●                                |
| Broader community                                                  | ●                  | ●           |                     | ●                          |                 |                       | ●                                        | ●                                |

#### 5.3.1 Santos project website

Santos maintains a project website which identifies its activities in NSW – <http://www.santos.com/exploration-acreage/nsw-csg.aspx>. The website is regularly updated with general project information, photos and frequently asked questions.

### 5.3.2 Santos project 1800 number and email address

Santos maintains a free information and enquiries line and project email address: 1800 071 278.

The number of calls recorded between February and June 2013 is shown in Figure 5-1.

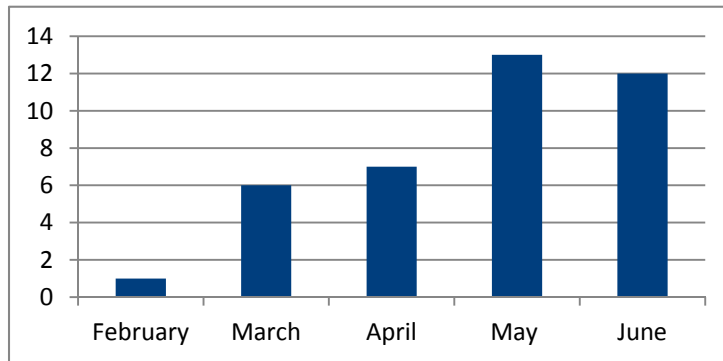


Figure 5-1 Record of calls to 1800 line (Feb – Jun 2013).

### 5.3.3 Santos Narrabri office and project information centre

Santos has an office and project information centre at 125 Maitland Street, Narrabri, which members of the community can visit and request information about the E&A Program. The office is attended from 9am to 5pm Monday to Friday.

### 5.3.4 Stakeholder and government agency workshops

Regular meetings are held with key stakeholders to provide information on current and ongoing activities. Meetings and workshops held in 2013 include:

#### 5.3.4.1 Government Agencies

- Government Information Forum in Narrabri on 20 June 2013.

Santos presented general information on the potential production project with specific information on the activities within the E&A Program. The presentation was followed by a field tour to the Leewood Produced Water Facility; and the Bibbiewindi Water Transfer Facility. 25 government officers were in attendance, the majority of whom were locally or regionally based, with representation from:

- » Office of Coal Seam Gas
- » NSW Environment Protection Authority
- » Roads and Maritime Services
- » NSW Rural Fire Service
- » NSW Forestry Corporation
- » NSW Department of Trade and Investment (Crown Lands)
- » NSW Department of Primary Industries
- » NSW Office of Water
- » Namoi Catchment Management Authority
- » North West Livestock Health and Pest Authority
- » Narrabri Shire Council.

The Land and Water Commissioner also attended the Forum as well as industry representatives from the Australian Petroleum Production and Exploration Association (APPEA). An invitation was issued to NSW Health and the NSW Parks and Wildlife Service but a representative was unable to attend due to prior commitments. Both agencies indicated an interest in attending future Forums that may be held.

- Government Agency workshop in Sydney on 5 July 2013.

Santos provided information on the E&A Program with a question and answer session following the presentation. This was attended by; The Department of Planning and Infrastructure, NSW Health, Office of Coal Seam Gas, The NSW Office of Water, Roads and Maritime Services, NSW Environment Protection Authority and Office of Environment and Heritage.

- Site visit with the NSW Office of the Chief Scientist and Engineer on 10 July 2013.

The Chief Scientist attended the tour, accompanied by three staff from her office and a representative from the NSW Environment Protection Authority. The purpose of this meeting was specifically to inspect rehabilitation activities within the Pilliga Forest, however the briefing also provided information on the E&A Program.

- Site visit with Narrabri Shire Council on 19 July 2013.

Whilst the purpose of the site visit was to inspect the proposed northern and southern flowlines, the meeting also provided opportunity to discuss the E&A Program.

- Site visit with OCSG and DP&I on 13 August 2013

The site visit included the Bibbiewindi Transfer Facility and existing well leases Bibbiewindi 14 and 19H.

#### 5.3.4.2 Indigenous Community

- Indigenous community forum held in Narrabri on 17 January 2013.

Santos provided information on the CSG industry and the principles and approach to the E&A Program with a question and answer session following the presentation. The forum was attended by the Narrabri Local Aboriginal Land Council, 13 of the 19 native title applicants and NTSCORP Ltd (the Native Title Service Provider for Aboriginal Traditional Owners in NSW).

- Site tour on 13 March 2013

A site tour was conducted for the Narrabri Local Aboriginal Land Council including the Leewood site and the Wilga Park power station to provide information on the E&A Program.

- Meetings held with the Narrabri Local Aboriginal Land Council on 19 July 2013 and 5 August 2013.

The meeting discussed the issue of establishing a MOU between Narrabri Local Aboriginal Land Council and Santos around the sharing of cultural heritage information as it relates to Santos work in the Narrabri area.

#### 5.3.4.3 Industry Groups

- Site tour on 3 July 2013.

A field trip was undertaken with four representatives from NSW Farmers to inspect the Leewood Produced Water facility, rehabilitation areas within the forest and the Bibbiewindi Water Transfer Facility. The purpose of this meeting was to provide information and answer questions in relation to the E&A Program and rehabilitation of sites within the forest.

### 5.3.5 Community information sessions and forums

Monthly site visits are held for the general community to present information on the E&A Program. Site tours are advertised in the local newspaper and the number of attendees each month is usually between 20 – 30 people. To date, there has been a broad representation of local business owners, landholders, community groups and other interested residents.

In addition, a farmer's forum was held in Narrabri on 23 May 2013 to brief on the potential gas development project as well as the E&A Program. Attendance at the Forum was limited to fourteen attendees due to weather conditions.

A Contractor Information Forum was held on 16 July 2013 for local businesses and contractors to provide information on the E&A Program and the rehabilitation of sites within the forest. There were approximately 85 business and contractor representatives in attendance. Santos has a commitment to work with local contractors, businesses and community groups where possible to ensure that economic benefits from project investment are realised by the communities in which Santos has operations.

### 5.3.6 Community consultation committee (CCC)

Santos has an independently chaired Community Consultative Committee that meets on a monthly basis in Narrabri with representation from a cross-section of interested parties within the community. Minutes and action items arising from these meetings are uploaded to the Santos website and also distributed by participants across their networks for broader community dissemination.

Meetings to date have focused on providing information relevant to the E&A Program with an emphasis on the overview of the CSG industry; drilling activities including well integrity, the environmental assessment process; activities that form part of the E&A Program and hydrogeological information. There has been extensive information dissemination and discussion in relation to water management.

### 5.3.7 Landowner meetings

Regular meetings have been held with the Forestry Corporation of NSW since 2011. Weekly and monthly reports are sent to Forestry representatives to provide information on activities proposed in the Forest.

A field trip was undertaken with two representatives of NSW Forestry Corporation to inspect the proposed activity site on 4 July 2013 and a meeting was held with senior officers of NSW Forestry Corporation on 1 May 2013 in Sydney to brief on planned activities in the Pilliga and Bibbiewindi Forests.

### 5.3.8 Other

Meetings have also been held with the Commonwealth Department of Sustainability, Environment, Water, Population and Communities regarding the E&A Program.

## 5.4 Summary of issues raised during consultation

### 5.4.1 Government Agencies and Stakeholders

Key issues raised by government agencies and stakeholders are summarised in Table 5-2.

Table 5-2 Summary of issues raised by government agencies and councils

| Agency                                                                   | Corresp. | Workshops | Issue Raised                                                                                                      | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Location of further information         |
|--------------------------------------------------------------------------|----------|-----------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Office of Agricultural Sustainability and Food Security                  | ●        |           | Water use and impact on agriculture                                                                               | AIS prepared, NSW Office of Water consulted on water requirements, WAL to be sought                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Section 6.2.3, Section 8.2.1 Appendix 2 |
| Department of Primary Industries (Fisheries NSW and NSW Office of Water) | ●        |           | Need for an aquatic assessment including a description of waterways, habitat and any identified impacts.          | The proposed activity will not impact on any waterways and there will be no removal of any riparian or aquatic habitat. The nearest waterway is an ephemeral unnamed tributary of Cwallah Creek located approximately 125 metres from Bibblewindi 32 and 580 metres from Bibblewindi 31. During operation, there is a small risk of a leak or spill that may impact on surrounding waterways however measures will be implemented (pressure gauges and automatic shutdowns) to limit any impact to the immediate area.                                                                                                                                                                                                                                      | Section 11.3.3 and 11.5.3               |
|                                                                          | ●        | ●         | Need to comply with relevant legislation, policies and guidelines                                                 | The EIS has considered all relevant legislation for the proposed activity.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Chapter 6                               |
|                                                                          | ●        |           | Impact on water sharing plan                                                                                      | The Bohena sub-catchment forms the Bohena Creek Water Source under the Water Sharing Plan for the Namoi Unregulated and Alluvial Water Sources. A search of the NSW Office of Water's website indicated that there are currently no records of any Water Access Licences under the <i>Water Management Act 2000</i> within this water source (NOW, 2013).                                                                                                                                                                                                                                                                                                                                                                                                   | Section 9.4                             |
| NSW Environment Protection Authority                                     | ●        |           | Waste Management – water minimisation and opportunities to reuse and recycle                                      | Santos has plans to develop a FTF at its existing operations centre in Narrabri. Drilling fluids will be mixed at the FTF and then transported to site. This would reduce wastes associated with mixing chemicals on site (such as chemical containers).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Section 16.4.1                          |
| Hunter New England Local Health District                                 | ●        | ●         | Groundwater and the management of produced water. The need for appropriate mitigation measures to prevent spills. | <p>The water management process will be as follows:</p> <ul style="list-style-type: none"> <li>At each well, water produced will be pumped through the water gathering system to the Bibblewindi Water Transfer Facility, via the existing flow line.</li> <li>The Bibblewindi Water Transfer Tank located at the Bibblewindi Water Transfer Facility will be used to provide a short buffer (up to 24 hours) prior to the produced water being pumped to the Leewood Produced Water Facility via the Leewood Water Pipeline.</li> <li>Once at the Leewood Produced Water Facility, produced water will be stored in one of the 300 megalitre ponds.</li> </ul> <p>A range of mitigation measures are proposed to minimise any environmental incidents.</p> | Section 4.4.2, Chapter 9 and Chapter 10 |

| Agency                             | Corresp. | Workshops | Issue Raised                                                                                                                       | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Location of further information |
|------------------------------------|----------|-----------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
|                                    | ●        |           | Impact of chemicals used in drilling                                                                                               | Chemicals that may be used in the drilling process have been identified in the EIS. No chemicals with added benzene, toluene, ethylbenzene, and xylenes (BTEX) will be used.                                                                                                                                                                                                                                                                                                                                       | Section 4.3.3.2                 |
|                                    | ●        |           | Noise impacts on sensitive receivers given 24 hour drilling.                                                                       | A noise impact assessment has been prepared and there will be no impact on any sensitive receivers.                                                                                                                                                                                                                                                                                                                                                                                                                | Chapter 14 and Appendix 6       |
|                                    | ●        |           | Psychological impacts associated with the perception of the proposed activity representing a significant expansion of the industry | The proposed activity is relatively minor in scale                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                 |
|                                    | ●        |           | Effectiveness of consultation                                                                                                      | Santos is implementing a consultation program                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Chapter 5                       |
| Office of Environment and Heritage | ●        |           | Cultural heritage                                                                                                                  | No Aboriginal objects, sites, places of significance or culturally modified trees were identified within the site or immediate surrounds. No evidence of Aboriginal objects or sites were identified along the tributary of Cowallah Creek. No Aboriginal objects or places recorded on the AHIMS were identified within 10 kilometres of the site. The potential for any previously unidentified Aboriginal objects or sites to be located within the site or immediate surrounds is considered to be nil to low. | Chapter 19                      |
|                                    | ●        |           | Biodiversity and the need for the assessment to consider the bio-banking assessment methodology                                    | There will be no vegetation removed as part of the proposed activity                                                                                                                                                                                                                                                                                                                                                                                                                                               | Chapter 11                      |
| Roads and Maritime Services        | ●        |           | Traffic impacts during construction and operation including internal movements within the forest.                                  | Impacts to the road network are considered negligible given the very low volumes of traffic generated by the proposed activity. No upgrade works will be required.                                                                                                                                                                                                                                                                                                                                                 | Chapter 15<br>Appendix 7,       |

| Agency                                                                   | Corresp. | Workshops | Issue Raised                                                                                                                                                    | Response                                                                                                                                                                                                                                                                                                 | Location of further information              |
|--------------------------------------------------------------------------|----------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Narrabri Shire Council                                                   | ●        |           | Environmental performance of the CSG industry, the size of the industry, number of environmental incidents and any controls put in place to minimise incidents. | A range of mitigation measures are proposed for the proposed activity. Santos is committed to minimising any environmental impacts associated with CSG and is in the process of implementing a comprehensive rehabilitation program. Water management facilities have been relocated outside the Forest. | Chapter 20                                   |
|                                                                          | ●        |           | Hazards and risks associated with drilling chemicals and fuel                                                                                                   | An assessment against SEPP 33 has been undertaken.                                                                                                                                                                                                                                                       | Chapter 17                                   |
| Raised by more than one agency or in general discussion during workshops | ●        | ●         | Cumulative impacts                                                                                                                                              | Cumulative impacts have assessed as part of the EIS and to support the E&A Program. The E&A Program will not have a significant impact. Discussion is included in each chapter of Part B of the EIS.                                                                                                     | Chapter 8 to 19                              |
|                                                                          | ●        | ●         | Impacts on local aquifers and details on monitoring program.                                                                                                    | CH2M Hill has completed a groundwater impact assessment and flow model for the proposed activity. This has concluded that there will be no impact on local bore users or GDEs. A surface and groundwater monitoring program is being implemented as part of the E&A Program.                             | Appendix 3, Section 9.5.3 and Section 10.1.4 |
|                                                                          | ●        | ●         | Surface water impacts                                                                                                                                           | An assessment of water impacts surface water has been undertaken and there will be minimal impacts.                                                                                                                                                                                                      | Chapter 10                                   |
|                                                                          |          | ●         | Timing of stage 2 of Leewood addressing water treatment                                                                                                         | The Leewood ponds (under construction) have a total storage capacity of 600 ML, being 2 ponds with 300 ML storage each. The total predicted groundwater extraction for the E&A Program is just over 1400 ML. Options for the treatment of the water are still being investigated by Santos.              |                                              |
|                                                                          |          | ●         | The provision of offsets                                                                                                                                        | Offsets are currently being investigated by Santos however the cumulative impact assessment has concluded that there will be no significant impact on any listed species.                                                                                                                                |                                              |
|                                                                          | ●        |           | Air Quality                                                                                                                                                     | An air quality and greenhouse gas impact assessment has been undertaken. Air quality at sensitive receptors will remain below guideline levels. Greenhouse gases produced represent less than 0.002 per cent and 0.007 per cent of the National and State emissions profiles respectively.               | Chapter 12 and 13 and Appendix 5             |

## 5.4.2 Community

Key issues raised during the consultation process are summarised in Table 5-3.

**Table 5-3 Summary of issues raised by the community**

| Use                                                                                                                                             | Response                                                                                                                                                                                                                                                                                                                                              | EIS chapter with further information         |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Chemicals used during drilling and potential for loss into the aquifer                                                                          | Chemicals that may be used in the drilling process have been identified in the EIS. No chemicals used are toxic. There will be no chemicals with added benzene, toluene, ethylbenzene, and xylenes (BTEX) will be used.                                                                                                                               | Section 4.3.3.2                              |
| Potential for fluid loss into the aquifers during drilling                                                                                      | Losing drilling fluid is undesirable as it is the primary means of controlling the drilled hole. In the event that losses are detected, a lost circulation material (LCM) will be mixed into the fluid to prevent further losses. LCM is made of cellulose or other natural material and works by blocking the pores in the permeable/fractured rock. | Section 4.3.3                                |
| Risks of loss of drilling fluid in upper section of core hole                                                                                   | All wells will be drilled in accordance with the <i>NSW Code of Practice for Coal Seam Gas Well Integrity</i> (DTIRIS 2012b) and accepted practices in the oil, gas and water well industries.                                                                                                                                                        | Section 4.3.3                                |
| Contamination of groundwater sources that are used for stock and domestic purposes                                                              | CH2M Hill has completed a groundwater impact assessment and flow model for the proposed activity. This has concluded that there will be no impact on local bore users or groundwater dependent ecosystems (GDEs). A detailed surface and groundwater monitoring program has been / will be implemented.                                               | Appendix 3, Section 9.5.3 and Section 10.1.4 |
| The need for the location of wells and lease areas to be better communicated                                                                    | Locality maps will be prepared for the proposed activity and the E&A Program.                                                                                                                                                                                                                                                                         |                                              |
| Asset protection zones within the forest to assist in managing bushfire risks                                                                   | Following completion of drilling, only partial rehabilitation of the lease area will occur. A bushfire management plan will be implemented.                                                                                                                                                                                                           | Section 17.3.2                               |
| Is there a possibility for hydrant rises being installed along the fresh water pipe to allow greater water availability during fire operations. | This will be considered during design and in the context of the bushfire management plan.                                                                                                                                                                                                                                                             |                                              |
| Area impacted for an exploration well                                                                                                           | The proposed activity will occur on already cleared lease areas however lease areas are typically one hectare in size.                                                                                                                                                                                                                                |                                              |

## 5.5 Future and ongoing consultation

### 5.5.1 EIS Exhibition

The EIS will be on public exhibition for a minimum of 30 days in accordance with the requirements of Part 4 of the *EP&A Act*.

DP&I is responsible for the public exhibition of the EIS. Concurrently, Santos will make available the EIS on its website and at the project information centres in Narrabri and Gunnedah.

### 5.5.2 Consultation during construction

Consultation during construction will include:

- newspaper advertisements
- community updates and newsletters
- fact sheets
- community information sessions and display materials
- stakeholder meetings
- continued operation of the project information line, website and email address
- regular project website updates
- written notification to landowners and neighbours
- traffic management notifications
- monthly Narrabri Community Consultation Committee meetings
- continued operation of the Narrabri Office and Information Centre.

Table 5-4 identifies specific consultation activities which will be carried out prior to the proposed activity commencing.

**Table 5-4 Specific consultation prior to commencement of proposed activity**

| Activity                                   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Planning timing                                                                                                                        |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Landowner<br>(Forestry Corporation of NSW) | Regular contact is maintained with the landholder and prior to the commencement of the proposed activity written advice will be provided to the landholder.                                                                                                                                                                                                                                                                                                                                                                                             | Advice to landholder will be provided 14 days prior to the proposed activity commencing                                                |
| Neighbouring landowners                    | In general, ongoing consultation is held with landholders where proposed activities are directly adjacent to their property. Given that the nearest residents are in excess of 7.5 km from the site, and impacts will be negligible, specific consultation will not occur for the proposed activity. If however, an activity during construction or operation may have an impact on nearby landholders, they will be advised in writing and a follow up phone call will be made to ensure that letters have been received and respond to any questions. | Advice will be provided to relevant landholders that may be impacted by the activity 14 days prior to the proposed activity commencing |
| Narrabri Shire Council                     | The Narrabri Shire Council will continue to be consulted, provided with regularly updates and a six monthly look-ahead schedule.                                                                                                                                                                                                                                                                                                                                                                                                                        | Monthly                                                                                                                                |
| Broader community                          | Updates on the proposed activity will be provided to the Narrabri Community Consultation Committee.                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Monthly                                                                                                                                |
| Advertisements                             | Advertisements will be placed in the local media of the up-coming exploration and drilling activities.                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Monthly                                                                                                                                |
| Notification to local police               | The local police will be notified of the proposed drilling activities and provided with a road traffic plan specifying the route, time and location of the drilling rig.                                                                                                                                                                                                                                                                                                                                                                                | 14 days prior to the drilling rig mobilising to site                                                                                   |

## 6.0 Planning and Statutory Framework

### 6.1 Assessment Framework

The overarching statutory framework for environmental planning approval in NSW is provided by the EP&A Act. Supporting this primary piece of legislation are the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) and a suite of environmental planning instruments, including State Environmental Planning Policies (SEPP) and Local Environmental Plans (LEPs).

#### 6.1.1 State significant development

Section 89C(2) of the EP&A Act provides that a SEPP may declare any development or any class or description of development, to be SSD. The *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) identifies development which is SSD for this purpose. Clause 8 of the SRD SEPP provides that development is SSD if the development is not permissible without development consent under Part 4 of the EP&A Act, and the development is specified in Schedule 1 or 2 of the SRD SEPP.

Under clause 7(2) of the Mining SEPP, development consent is required for the purposes of drilling or operating a set of more than five wells that is more than three kilometres from any other petroleum well (other than an abandoned petroleum well) in the same petroleum title.

Clause 6 of Schedule 1 of the SRD SEPP identifies 'Petroleum (oil and gas)' and classifies 'development for the purpose of drilling and operating petroleum exploration wells, not including... a set of five or fewer wells that is more than three kilometres from any other petroleum well (other than an abandoned petroleum well) in the same petroleum title' as SSD.

The proposed activity will result in more than five petroleum wells, other than abandoned wells, within a three kilometre radius within PAL 2 and is therefore SSD. Under section 89D of the EP&A Act, the Minister for Planning and Infrastructure is the consent authority.

#### 6.1.2 Director-General's requirements and Statement of Commitments

The Director General requirements (DGRs) for the proposed activity were issued on 20 May 2013 and are provided in Appendix 1 including cross references to sections within the EIS where each has been addressed. A draft Statement of Commitments is provided in Chapter 20.

The EIS process described in Division 4.1 of Part 4 of the EP&A Act is shown in Figure 6-1.

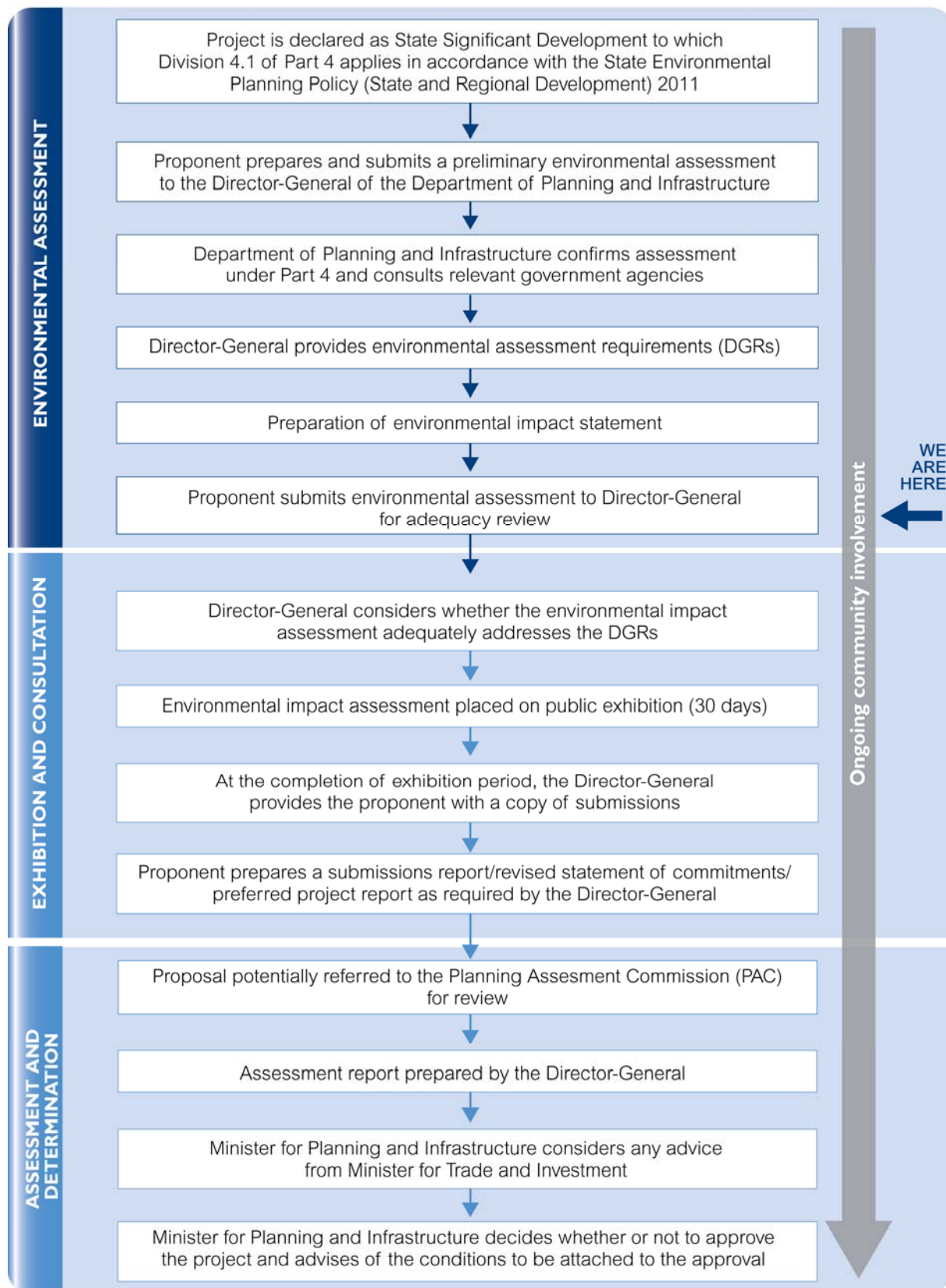


**Figure 6-1 The environmental impact assessment process**

### 6.1.3 Section 79C requirements

Section 79C of the EP&A Act applies to the determination of SSD and requires the consent authority to take into consideration a range of matters as identified in Table 6-1.

Development consent may not be granted if the development is wholly prohibited by an environmental planning instrument. The activity is not prohibited by any environmental planning instruments.

**Table 6-1 Matters for consideration under section 79C of EP&A Act**

| Matter for consideration                                                                                                                                                        | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>(i) any environmental planning instrument</i>                                                                                                                                | The EIS considers all relevant matters within applicable environmental planning instruments. These are discussed within this chapter.                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>(ii) any proposed instrument that is or has been the subject of public consultation under this Act and that has been notified to the consent authority</i>                   | Exhibition of draft amendments to the Mining SEPP ended in April 2013 with the amendment under consideration. Amendments include the establishment of a new Gateway process for State significant mining and petroleum activities located on Strategic Agricultural Land (SAL) under the SRLUP (DP&I 2012).<br><br>While the project is not located on SAL, as detailed under the draft amendments to the Mining SEPP, Santos has applied for a site verification certificate for the proposed activity in accordance with the DGRs. |
| <i>(iii) any development control plan</i>                                                                                                                                       | In accordance with Clause 11 of the SRD SEPP, development control plans do not apply to the activity as it is deemed to be SSD.                                                                                                                                                                                                                                                                                                                                                                                                      |
| <i>(iiia) any planning agreement that has been entered into under section 93F, or any draft planning agreement that a developer has offered to enter into under section 93F</i> | No planning agreements or draft planning agreements have been entered into or offered for the activity.                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <i>(iv) the regulations</i>                                                                                                                                                     | There are no relevant matters prescribed by the regulations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>(v) any coastal zone management plan (within the meaning of the Coastal Protection Act 1979), that apply to the land to which the development application relates</i>        | There are no coastal zone management plans relevant to the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>(a) the likely impacts of that development, including environmental impacts on both the natural and built environments, and social and economic impacts in the locality</i>  | Impacts of the proposed activity on natural and built environment, and social and economic impacts are assessed, and measures identified in Chapter 8 to 19.                                                                                                                                                                                                                                                                                                                                                                         |
| <i>(b) the suitability of the site for the development</i>                                                                                                                      | Justification for selecting the proposed site is provided in Section 2.4.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>(c) any submissions made in accordance with this Act or the regulations</i>                                                                                                  | Any submissions received during the statutory exhibition period would be considered by the Minister prior to determination of the application.                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>(d) the public interest.</i>                                                                                                                                                 | The public interest would be served through the application of all relevant planning controls and objectives.                                                                                                                                                                                                                                                                                                                                                                                                                        |

## 6.2 NSW legislation

### 6.2.1 Petroleum (Onshore) Act 1991

The *Petroleum (Onshore) Act 1991* (Petroleum Act) regulates the onshore exploration for and production of petroleum. Under the Petroleum Act, petroleum means:

- (a) any naturally occurring hydrocarbon, whether in a gaseous, liquid or solid state, or*
- (b) any naturally occurring mixture of hydrocarbons, whether in a gaseous, liquid or solid state, or*
- (c) any naturally occurring mixture of one or more hydrocarbons, whether in a gaseous, liquid or solid state, and one or more of the following, that is to say, hydrogen sulphide, nitrogen, helium, carbon dioxide and water,*

*and includes any substance referred to in paragraph (a), (b) or (c) that has been returned to a natural reservoir, but does not include coal or oil shale or any substance prescribed to be a mineral for the purposes of the Mining Act 1992.*

The holder of a petroleum assessment lease (PAL) has the right to prospect for, and to assess any, petroleum on the land within the lease area. If approved, the proposed activity would be undertaken within PAL 2 granted under the Petroleum Act. Activities allowed under PAL 2 are identified in a Petroleum Operations Plan (POP) that has been approved by the Director-General of NSW Trade & Investment (or delegated authority).

Within PAL 2, activities that are undertaken within an 'exempted area' as defined in Section 70 of the *Petroleum (Onshore) Act 1991* require further approval from the Minister prior to carrying out the activity. Land dedicated as State forest is defined as an 'exempted area'. As the proposed activity will be undertaken within an 'exempted area', Santos will require a Section 70 approval which applies to the proposed activity.

The proposed activity is allowed under the POP, but as identified in Section 6.1.1, the activity is deemed to be SSD and would require development consent under Part 4, Division 4.1, of the EP&A Act.

### 6.2.2 Environmental Planning and Assessment Act 1979

Section 89C(2) of the EP&A Act provides that a SEPP may declare any development or any class or description of development, to be SSD. The SRD SEPP identifies development which is SSD for this purpose. Clause 6 of Schedule 1 of the SRD SEPP identifies 'Petroleum (oil and gas)' and classifies 'development for the purpose of drilling and operating petroleum exploration wells, not including... a set of five or fewer wells that is more than three kilometres from any other petroleum well (other than an abandoned petroleum well) in the same petroleum title' as SSD.

The proposed activity will result in more than five petroleum wells, other than abandoned wells, within a three kilometre radius within PAL 2 and is therefore SSD. Under section 89D of Divisions 4.1 Part 4 of the EP&A Act, the Minister for Planning and Infrastructure is the consent authority for SSD.

Section 78(8A) of the EP&A Act requires an environmental impact statement (EIS) assessing the proposed activity to be submitted. This document has been prepared for the purpose of assessing the potential environmental impacts of the proposed activity.

### 6.2.3 Water Management Act 2000

The *Water Act 1912* (Water Act) and *Water Management Act 2000* (WMA) are the key pieces of legislation regulating access and impacts to surface and groundwater resources in NSW. Where a water sharing plan is in place, the WMA governs the issuing of water access licences (WALs) and water management and activity approvals. As water sharing plans are in place for the surface and groundwater sources at or surrounding the site, the WMA applies to the proposed activity.

#### 6.2.3.1 [Water sharing plans](#)

Water sharing plans (WSPs) are designed to provide long-term environmental protection and sustainability of the surface water and groundwater resources as well as directing how water will be allocated and shared among the various water users. WSPs apply the goals and principles of the *NSW State Groundwater Policy* (DLWC, 1998) at a local and regional level.

The *Water Management Act 2000* (WMA) provides for a system of assessment and licensing and approvals relating to the equitable take of water from water sources, in addition to works and activities occurring within or affecting these water sources. Each WSP sets out Water Sharing Rules and Management Rules for aquifer interference activities within each water source that operate under these water management principles.

The following WSPs apply to water sources beneath or in the vicinity of the site:

- NSW Great Artesian Basin (GAB) Groundwater Sources WSP
- NSW Murray-Darling Basin (MDB) Porous Rock Groundwater WSP
- NSW MDB Fractured Rock Groundwater WSP
- NSW Upper and Lower Namoi Groundwater Sources WSP
- NSW GAB Shallow Groundwater Sources WSP
- Upper Namoi and Lower Namoi Regulated River WSP.

The proposed activity will need to comply with the rules developed for the affected water sources within the relevant WSPs outlined above.

#### 6.2.3.2 [Water access licences](#)

Under Part 2 of Chapter 3 of the WMA, it is an offence to take water from a source regulated by the WMA unless in accordance with a WAL.

Water used for the construction and operation of the proposed activity will be sourced from Narrabri or Gunnedah's town water supply or local industrial licensed water bores and trucked to the site. Alternatively, production water from pilot wells will be used when available for the preparation of drilling fluid.

A WAL is also required for the taking of groundwater, whether for consumption or incidentally, unless an exemption applies. Any new mining and petroleum exploration activities that take more than three megalitres per year from groundwater sources will need to hold a WAL.

The volume of water to be abstracted during operation of the Bibbiewindi Multi-Lateral Pilot is estimated to be approximately 285 megalitres of groundwater over three years from the Gunnedah-Oxley Basin. Santos will obtain a WAL for this water take.

#### 6.2.3.3 Aquifer interference approvals

Under section 91F of the WMA, it is an offence to carry out an aquifer interference activity without an aquifer interference approval. Aquifer interference activities include any of the following:

- the penetration of an aquifer
- the interference with water in an aquifer
- the obstruction of the flow of water in an aquifer
- the taking of water from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations
- the disposal of water taken from an aquifer.

However, section 91F of the WMA does not currently apply. Section 88A provides that Part 3 of Chapter 3 (including section 91F) applies to each part of the State or each water source and each type or kind of approval that relates to that part of the State or that water source that is declared by proclamation.

At the time of the EIS, no proclamation has been made declaring that Part 3 of Chapter 3 of the Act applies in relation to aquifer interference approvals.

Accordingly, an aquifer interference approval will not be required for the proposed activity.

#### 6.2.3.4 Flood work approval

Under section 90 of the WMA, a flood work approval is required to construct and use flood work at a specified location. Flood work is defined within the WMA and includes a work (such as a barrage, causeway, cutting or embankment) in the vicinity of a river or within a floodplain (as declared under the *Water Management (General) Regulation 2011* (WM Regulation)) that is of such a size or configuration that it is likely to have an effect on the flow of water to or from a river or the distribution or flow of floodwater in times of flood. Clause 13 of Schedule 9 of the WMA provides that any land that was designated as a floodplain under Part 8 of the Water Act is taken to be a floodplain for the purposes of the WMA.

There are a number of floodplains declared under the Water Act located nearby but not on the site. The closest is the Namoi River, Karroll to Boggabri floodplain located approximately 37 kilometres to the east of the site. The proposed activity is considered unlikely to affect the flow of water to or from any river, or the distribution or flow of floodwaters. Therefore, a flood work approval is not required for the proposed activity.

#### 6.2.3.5 Controlled activity approval

Under section 91E of the WMA, it is an offence to carry out a controlled activity in, on or under waterfront land without a controlled activity approval for that activity. Waterfront land is taken to mean land within 40 metres of a water body. Controlled activities include the removal of vegetation or material, or deposition of material.

Clause 39 of the WM Regulation provides that activities specified in Part 2 of Schedule 5 of the regulation are exempt from requiring controlled activity approvals under the WMA. Part 2 of Schedule 5 includes any activity carried out in accordance with a right in force under the Petroleum Act. Therefore, a controlled activity approval is not required for the proposed activity.

#### 6.2.3.6 Water supply work approval

Under section 90 of the WMA, a water supply work approval is required to construct and use a specified water supply work at a specified location. Water supply works are defined within the WMA and includes works (such as a water pump or water bores) that are constructed or used for the purpose of taking water from a water source.

Under section 89J of the EP&A Act, a water supply work approval is not required for SSD for which development has been granted. Therefore a water supply work approval would not be required for the proposed activity.

#### 6.2.4 **Protection of the Environment Operations Act 1997**

One of the primary objectives of the *Protection of the Environment Operations Act 1997* (NSW) (POEO Act) is to 'protect, restore and enhance the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development'. The POEO Act requires environment protection licences (EPLs) be obtained for the carrying out of 'scheduled activities' or to pollute waters.

All CSG exploration, assessment and production titles and activities are required to hold an EPL. Santos is in the process of obtaining an EPL for the proposed activity.

#### 6.2.5 **Additional NSW legislation**

Additional NSW legislation that must be applied consistently to the proposed activity is presented in Table 6-2.

**Table 6-2 Additional NSW legislation to be considered for the proposed activity**

| Legislation                                                               | Purpose                                                                                                                                                                                                                                                                                             | Application to proposed activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Brigalow and Nandewar Community Conservation Area (BNCCA) Act 2005</i> | The <i>BNCCA Act</i> was established to reserve forested land in the Brigalow and Nandewar area and provide for permanent conservation of land, protection of areas of natural and cultural heritage significance to Aboriginal people and sustainable forestry, mining and other appropriate uses. | The Biblewindi State Forest is included within Zone 4 – <i>Forestry, recreation and mineral extraction</i> , under the <i>BNCCA Act</i> . The strategic aims for this zone, as identified by the <i>Brigalow and Nandewar Community Conservation Area Agreement</i> , include 'Provide for exploration, mining, petroleum production and extractive industry in accordance with the Mining Act 1992 and the Petroleum (Onshore) Act 1991 and associated Regulations and guidelines'. The proposed activity is consistent with the intended use of Zone 4 land. |
| <i>Contaminated Land Management Act 2008</i>                              | To promote the better management of contaminated land.                                                                                                                                                                                                                                              | The proposed activity is not expected to be carried out on contaminated land.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>Crown Lands Act 1989</i>                                               | To provide for the administration and management of Crown land in NSW.                                                                                                                                                                                                                              | Santos has entered into a Permit to Occupy agreement with the Forestry Corporation of NSW.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Dangerous Goods (Road and Rail Transport) Act 2008</i>                 | To provide conditions for safety in the transport of dangerous goods by road and rail as part of the system of nationally consistent road and rail transport laws.                                                                                                                                  | Any dangerous goods will be transported according to regulatory requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| Legislation                                       | Purpose                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Application to proposed activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Fisheries Management Act 1994</i>              | To conserve key fish habitats including permanent and semi-permanent freshwater habitats.                                                                                                                                                                                                                                                                                                                                                                                   | <p>The proposed activity does not require any new creek diversions, crossings, access tracks or land clearing therefore there will be no direct impact on watercourses.</p> <p>The nearest creek is an ephemeral unnamed tributary of Cowallah Creek approximately 125m from Bibbiewindi 32. It does not support the endangered Murray Cod (<i>Maccullochella peelii</i>), as this species prefer slow flowing deep watercourses. The ephemeral nature of these creeks would likely only support common fish species during migration and breeding.</p>                                                                                                                                                                        |
| <i>Forestry Act 2012</i>                          | To provide for the dedication, management and use of State forests and other Crown-timber land for forestry and other purposes.                                                                                                                                                                                                                                                                                                                                             | Proposed works within the State forest will be undertaken in accordance with the existing Permit to Occupy held by Santos and administered by the Forestry Corporation of NSW.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Heritage Act 1977</i>                          | To encourage the conservation of the heritage of NSW.                                                                                                                                                                                                                                                                                                                                                                                                                       | No items of heritage significance listed under either the Narrabri LEP or on the NSW State Heritage Register occur on the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <i>Native Title (NSW) Act 1994</i>                | To provide for native title in relation to land or waters.                                                                                                                                                                                                                                                                                                                                                                                                                  | In the area of PAL 2 the relevant native title claimant is the Gomeroi People. Further details of Native Title are discussed in Section 6.3.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>National Parks and Wildlife (NPW) Act 1974</i> | The NPW Act provides that a person must not harm any animal that is a threatened species, population or ecological community, pick any plant which is part of a threatened species, population or ecological community, damage any critical habitat or damage any habitat of a threatened species, population or ecological community without a licence being obtained under the NPW Act or <i>Threatened Species Conservation Act</i> or unless another exception applies. | The NPW Act does not apply where an action was essential for the carrying out of an activity in accordance with an approval of a determining authority under Part 4 of the EP&A Act, where the determining authority has complied with Part 4. This EIS has been prepared to assist the determining authority to comply with Part 4 of the EP&A Act.                                                                                                                                                                                                                                                                                                                                                                           |
|                                                   | To conserve places, objects and features of significance to Aboriginal people.                                                                                                                                                                                                                                                                                                                                                                                              | <p>No Aboriginal objects, sites, places of significance or culturally modified trees were identified within the site or immediate surrounds. No evidence of Aboriginal objects or sites were identified along the tributary of Cowallah Creek. No Aboriginal objects or places recorded on the Aboriginal heritage Information Management System (AHIMS) were identified within 10 kilometres of the site. The potential for any previously unidentified Aboriginal objects or sites to be located within the site or immediate surrounds is considered to be nil to low.</p> <p>All staff will be made aware of their obligations under the NPW Act and Heritage Act with all works to comply with Part 6 of the NPW Act.</p> |
| <i>Native Vegetation (NV) Act 2003</i>            | To encourage revegetation and rehabilitation of land with appropriate native vegetation.                                                                                                                                                                                                                                                                                                                                                                                    | Under Section 25(m), the NV Act does not apply to any clearing authorised under the Petroleum Act.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

| Legislation                                           | Purpose                                                                                                                                                                                                                          | Application to proposed activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Noxious Weeds Act 1993</i>                         | To ensure that the Act is complied with within their boundaries, the landholder has an obligation under the Noxious Weeds Act to control any declared weed on their property.                                                    | No noxious weeds or introduced flora species were identified during the field survey as part of the Ecological Assessment.                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Roads Act 1993</i>                                 | To make provision with respect to the roads of New South Wales.                                                                                                                                                                  | The proposed activity does not involve any works in public roads.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Threaten Species Conservation Act 1995</i>         | To provide a framework for the listing of threatened species, populations and ecological communities, and key threatening processes in NSW, and the preparation and implementation of recovery plans and threat abatement plans. | The proposed activity does not involve any clearing as all works will be contained on existing lease areas and access tracks. A generalised application of the 7-part test concluded that the proposed activity is not likely to have a significant effect on the seven threatened ecological communities, seven threatened flora and 26 threatened fauna species listed under the TSC Act that are considered to have the potential to occur within the site and surrounding 20m buffer. Further details are provided in Chapter 11. |
| <i>Waste Avoidance and Resource Recovery Act 2001</i> | To provide a legal framework concerning the minimisation, recycling and reuse of waste in NSW.                                                                                                                                   | All wastes generated by the proposed activity will be collected, classified and removed from site for recycling or disposal at a licensed waste facility if required. Given the short term nature of the construction, only minor quantities of waste will be produced.                                                                                                                                                                                                                                                               |
| <i>Work Health and Safety Act 2011</i>                | To secure the health, safety and welfare of persons at work.                                                                                                                                                                     | The proposed activity will be carried out in accordance with all health and safety requirements.                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## 6.2.6 State environmental planning policies (SEPPs)

### 6.2.6.1 Strategic Regional Land Use Policy (SRLUP)

The SRLUP identifies and protects more than two million hectares of strategic agricultural land, protects valuable water resources, and provides greater certainty for companies wanting to invest in mining and coal seam gas projects in regional NSW.

As a result of this policy, all State significant mining and coal seam gas proposals that extend beyond an existing lease area on strategic agricultural land (SAL) must go through an independent, scientific assessment of their potential agricultural land and water impacts before a development application can be lodged.

Two types of SAL exist. The proposed activity is not located on BSAL or a CIC mapped under the *Strategic Regional Land Use Plan New England North West Region* and is unlikely to impact on agricultural resources.

A site verification report has been prepared and is provided in conjunction with this EIS. Advice from DP&I states that as the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP) amendments are yet to be enacted, there is no statutory framework to apply for and receive a Site Verification Certificate. Therefore, Santos may lodge the site verification report (to satisfy the DGRs) as part of the overall EIS submission. The DP&I will then undertake the site verification assessment as part of the overall assessment.

#### 6.2.6.2 Mining SEPP

The Mining SEPP aims 'to provide for the proper management and development of mineral, petroleum and extractive material resources for the social and economic welfare of [NSW]'. Clause 7 of the Mining SEPP relates to development that is permissible with development consent. As the proposed activity will result in more than 5 wells within 3 kilometres (other than an abandoned petroleum well) in the same petroleum title, Clause 7 applies and consent is required. As outlined above the proposed activity is classified as SSD (section 6.1.1), and requires development consent under Part 4, Division 4.1, of the EP&A Act.

The proposed activity will not be carried out on an environmentally sensitive area of State significance.

#### 6.2.6.3 Other SEPPS

Other SEPPs relevant to the proposed activity are summarised in Table 6-3.

**Table 6-3 Environmentally sensitive areas**

| SEPP/LEP                                    | Purpose                                                                                                      | Application to proposed activity                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SEPPS</b>                                |                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                    |
| SEPP 44 Koala habitat protection            | To support the conservation and management of koala habitat                                                  | No 'potential' koala habitat, as defined by SEPP 44, will be removed as part of the proposed activity – nor does any occur within close proximity to the site and immediate surrounding area.                                                                                                                                                                                      |
| SEPP 55 Remediation of Land                 | To ensure land is developed appropriately and contaminated land is managed.                                  | A search of the contaminated land record database maintained by the Environmental Protection Authority (EPA) indicated records of seven contaminated sites within the Narrabri Shire LGA. None of these contaminated sites are located near the site.                                                                                                                              |
| SEPP 33 Hazardous and Offensive Development | To presents a systematic approach to planning and assessing potentially hazardous and offensive development. | Diesel will be stored temporarily on site for use during drilling. Diesel is classed as an Australian Dangerous Goods Code 3 and is subject to the requirements under SEPP 33. However given the relatively small volumes, the proposed activity is not defined as a potentially hazardous or offensive activity or industry. Section 17.2 provides more detail on the assessment. |

#### 6.2.6.4 Narrabri Local Environmental Plan 2012

As the project is deemed SSD, development consent is granted under Part 4, Division 4.1, of the EP&A Act. Nevertheless, consideration has been given to the relevant land use zone objectives under the Narrabri LEP. The site is zoned RU3 Forestry zone.

The proposed activity is a non-forestry use that will not restrict the use of other land for forestry purposes. The natural resource base relied upon by the industry within the area will not be significantly affected by the proposed activity. The proposed activity will not affect the development of forestry or forestry-related enterprises in the area nor will it result in the fragmentation or alienation of resource lands. The proposed activity will not result in conflict between land uses within the RU3 Forestry zone or land uses within adjoining zones. Therefore, the proposed activity is considered to be a suitable activity within the RU3 Forestry zone.

## 6.3 Commonwealth legislation

### 6.3.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) provides for the protection of certain Matters of National Environmental Significance (MNES) listed under the Act, which include:

- World Heritage Areas
- National Heritage Places
- Ramsar wetlands of international importance
- Commonwealth listed threatened species and ecological communities
- listed migratory species
- Commonwealth marine areas
- Great Barrier Reef Marine Park
- nuclear actions.

Under the EPBC Act, Commonwealth approval is required from the Minister of Sustainability, Environment, Water, Population and Communities (Minister) for any action that will have or is likely to have a significant impact on a MNES, or on the environment of Commonwealth land or on the environment if the action is proposed to be taken by a Commonwealth agency (known as a 'controlled action').

A person proposing to take a controlled action must refer the proposed development to the Minister for determination. A person proposing to take an action that the person thinks is not a controlled action may refer the proposed development to the Minister for the Minister's decision whether or not the action is a controlled action.

An EPBC Act Protected Matters Search was undertaken using the online database to generate a list of those MNES species potentially occurring within the site and surrounding 20 metre buffer (SEWPaC 2013). This data, combined with other local knowledge and records, was used to assess whether the proposed activities will have, or are likely to have, a significant impact on MNES. The findings of this assessment are outlined in Table 6-4 and discussed further in Chapter 11.

**Table 6-4 Matters of national environmental significance**

| MNES                                                               | Overview                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| World Heritage Properties                                          | The proposed activity is not located in or within close proximity to a World Heritage area.                                                                                                                                                             |
| National Heritage Places                                           | The proposed activity is not located in close proximity to a National Heritage Place.                                                                                                                                                                   |
| Wetlands protected by international treaty (the RAMSAR convention) | The proposed activity is not located within a RAMSAR listed wetland area.                                                                                                                                                                               |
| Nationally listed threatened species and ecological communities    | No threatened species or ecological communities are present within the site and immediate surrounding areas, therefore no impacts to EPBC listed threatened species or ecological communities are likely to occur as a result of the proposed activity. |
| Migratory species                                                  | No EPBC Act listed migratory species are considered likely to be directly or indirectly impacted upon as a result of the proposed activity.                                                                                                             |
| Commonwealth marine areas                                          | The proposed activity will not impact any Commonwealth marine areas.                                                                                                                                                                                    |
| Great Barrier Reef Marine Park                                     | The proposed activity will not impact the Great Barrier Reef Marine Park.                                                                                                                                                                               |
| All nuclear actions                                                | The proposed activity does not involve a nuclear activity.                                                                                                                                                                                              |

| MNES            | Overview                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Water Resources | The findings of the cumulative groundwater impact assessment show that depressurisation of the target coal seam as a result of pilot activities indicate a negligible decline in water levels (less than 0.5 metres) within the Namoi Alluvium and the Pilliga Sandstone groundwater sources. Consequently there will be no impact on groundwater dependent ecosystems (GDEs), GDE terrestrial vegetation or registered water supply bores. |

Santos has made a Referral to the Commonwealth in June 2013 that included the proposed activity. The Referral included an assessment of MNES, across a number of exploration and appraisal activities that have occurred in the recent past or proposed in the future. The assessment concluded that there would not be a significant impact on MNES and that the activities would not constitute a controlled action.

The Referral is currently under assessment by SEWPaC (at the time of writing).

### 6.3.2 Native Title Act 1993

The objectives of the *Native Title Act 1993* (Native Title Act) are to:

- Recognise native title rights and sets out basic principles in relation to native title in Australia
- Provide for the validation of past acts which may be invalid because of the existence of native title
- Provide for a future act regime in which native title rights are protected and conditions imposed on acts affecting native title land and waters
- Provide a process by which native title rights can be established and compensation determined
- Provide processes for negotiations and determinations about whether future acts, including grants and activities carried out under those grants, can be done over native title land and waters
- Provides for a range of other matters, including the establishment of a National Aboriginal and Torres Strait Islander Land Fund.

In the area of PAL 2 the relevant native title claimant is the Gomeroi People (NSD2308/2011). PAL 2 was granted in 2007 and no further native title process is required for activities authorised under PAL 2. Should Santos apply for a production lease in the area of PAL 2, Santos understands that the Native Title Act requires completing the right to negotiate process under Subdivision P of Division 3 of Part 2 of the Act or concluding an Indigenous Land Use Agreement with the Gomeroi People.

## 6.4 Summary of approval requirements

The proposed activity requires the following approvals:

- Assessment and determination of the proposed activity including development consent under Part 4 of the EP&A Act
- An EPL under the *Protection of the Environment Operations Act 1997*
- A WAL under the *Water Management Act 2000*.
- An approval under section 70 of the *Petroleum (Onshore) Act 1991*.

## 7.0 Environmental risk analysis

### 7.1 Risk assessment methodology

A preliminary environmental risk assessment of the proposed activity was undertaken to identify and prioritise issues requiring further assessment in the EIS. Potential environmental issues associated with the proposed activity were identified based on desktop investigations, preliminary ecological and archaeological field investigations, knowledge of the statutory planning and regulatory requirements, and considering the nature and scale of the project.

The risk assessment was conducted by a multi-disciplinary project team in accordance with the Santos risk assessment framework. The focus is on the inter-relationship between people, equipment, methods of work, the environment and the community. Risks are identified from health and safety, natural environment, reputation and financial perspectives. In particular, environmental risks were identified for each environmental aspect during key stages of the project. Each risk was given an inherent risk ranking based on the likelihood and potential consequences of the risk with and without mitigation measures being applied.

The proposed wells have been located on existing well leases within the Bibbiewindi Multi-Lateral Pilot to avoid the need for further vegetation clearing or disturbance. Impacts associated with establishing the Bibbiewindi 14 and 19H well leases were assessed previously and have not been included.

Risks were considered in relation to the following aspects:

- Land resources
- Water resources
- Biodiversity
- Air quality
- Greenhouse gases
- Noise
- Traffic and transport
- Waste management
- Hazards to the community
- Social and economic environment
- Heritage

### 7.2 Environmental risk findings

Table 7-1 outlines the key risks during construction. Mitigation measures have been identified to address risks with the resultant risk rating shown in the table. The potential for a traffic accident and community and reputational risks associated with insufficient community engagement are considered the major risks for the proposed activity. All other risks can be mitigated to a risk rating of 2 or less based on detailed technical studies and implementation of the mitigation measures outlined in the following sections of this report.

Table 7-2 outlines key risks during operation. The main risk during operation is associated with bushfire. All other risks can be mitigated.

Table 7-1 Key identified risks during construction

| Risk Area                       | Cause                                                                                           | Impact                                                                  | Assessment            | Mitigation                                                                                                                                                                    | Risk Rating |
|---------------------------------|-------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Traffic and transport           | Increase in traffic on local road network                                                       | Reduced road safety for community/other road users leading to accidents | Chap 15 Appendix 7    | Traffic movements to be minimised, staff bussed to site                                                                                                                       | 3           |
| Other                           | Community not appropriately consulted                                                           | Poor community relations                                                | Chapter 5             | Implement community engagement program as outlined in Chapter 5.                                                                                                              | 3           |
| Land resources                  | Chemical, fuel or oil spills                                                                    | Soil contamination                                                      | Chapter 8 Appendix 2  | Amount of fuels and chemicals on site to be minimised, fuels and chemicals to be stored above ground, spill kits available and vacuum truck to be on standby during drilling. | 2           |
| Water resources – surface water | Saline water being released from the formation and discharging into drainage lines or waterways | Degradation of surface water                                            | Chapter 10            | Surface tanks will capture any fluids that are released during drilling, over balance drilling techniques to be adopted                                                       | 2           |
| Water resources – ground water  | Loss of drilling fluid into the formation                                                       | Reduction of groundwater quality                                        | Chapter 9 Appendix 3  | Wells to be drilled in accordance with <i>NSW Code of Practice for Coal Seam Gas Well Integrity</i> (DTIRIS 2012).                                                            | 2           |
| Biodiversity                    | Spread of weeds by construction activities                                                      | Weed infestation and loss of biodiversity                               | Chapter 11 Appendix 4 | Vehicles to be washed and cleaned where exposed to noxious weeds or unwanted plants.                                                                                          | 2           |
| Biodiversity                    | Drilling through aquifers where stygofauna may be present                                       | Impact to stygofauna                                                    | Appendix 3            | Wells to be drilled in accordance with <i>NSW Code of Practice for Coal Seam Gas Well Integrity</i> (DTIRIS 2012).                                                            | 2           |
| Traffic and transport           | Increase in traffic on local road network                                                       | Wear and tear on the road surface                                       | Chapter 15 Appendix 7 | Construction vehicles to utilise nominated routes                                                                                                                             | 2           |
| Traffic and transport           | Increase in traffic on local road network                                                       | Reduced road safety for community/other road users leading to fatality  | Chapter 15 Appendix 7 | Traffic movements to be minimised, staff bussed to site                                                                                                                       | 2           |
| Waste                           | Illegal dumping of waste or lack of suitable containment of waste                               | Pollution, contamination and/or littering of land or water              | Chapter 16            | All waste to be classified on site and if required disposed at a licenced facility                                                                                            | 2           |
| Waste                           | Generation and mismanagement of potentially hazardous wastes                                    | Contamination of land or water, human health effects                    | Chapter 16            | Amount of fuels and chemicals on site to be minimised, fuels and chemicals to be stored above ground, spill kits available and vacuum truck to be on standby during drilling. | 2           |

| Risk Area | Cause                                                            | Impact                                                                                                                                          | Assessment | Mitigation                                                                                                                                                                                                                                           | Risk Rating |
|-----------|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Hazards   | Accidental ignition during construction activities               | Bushfire resulting in loss of life, property or biodiversity                                                                                    | Chapter 17 | All vehicles to remain on cleared access tracks and lease area                                                                                                                                                                                       | 2           |
| Hazards   | Introduction of chemicals to the environment                     | Build-up of chemicals in groundwater, surface water, soils, flora or fauna, exposure of chemicals to humans and potential toxicological effects | Chapter 17 | Wells to be drilled in accordance with <i>NSW Code of Practice for Coal Seam Gas Well Integrity</i> (DTIRIS 2012).                                                                                                                                   | 2           |
| Heritage  | Disturbance of previously unidentified Aboriginal heritage items | Loss of heritage values                                                                                                                         | -          | A Preliminary Heritage Assessment has been prepared for the site, including a visual inspection (pedestrian survey) of the site undertaken on 27 November 2012. No objects, places, landscape features or culturally modified trees were identified. | 2           |
| Heritage  | Indirect impacts to identified Aboriginal heritage sites         | Loss of heritage values                                                                                                                         | -          | All staff are to be made aware of their obligations under the NPW Act and Heritage Act with all works to comply with Part 6 of the NPW Act.                                                                                                          | 2           |
| Other     | Disturbance beyond authorised area of impact                     | Non-compliance with approval                                                                                                                    | -          | Site will be fenced to clearly delineate work area                                                                                                                                                                                                   | 2           |

Table 7-2 Key identified risks during operation

| Risk Name                       | Cause                                                                               | Impact                                                                                                               | Assessment               | Mitigation                                                                                                                                                                   | Risk Rating |
|---------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Hazard and risk                 | Accidental ignition as a result of inadequate bushfire protection zones for flares. | Bushfire resulting in loss of life, property or biodiversity                                                         | Chapter 17               | Exclusion zone to be maintained at flare                                                                                                                                     | 3           |
| Land resources                  | Changing land use                                                                   | Incompatible land use with surrounding area.                                                                         | Chapter 8<br>Appendix 2  | On-going consultation with Forestry to identify and resolve any issues if they emerge                                                                                        | 2           |
| Land resources                  | Major infrastructure failure (pipes and tanks)                                      | Contamination of land, water, vegetation dieback                                                                     | Chapter 8<br>Appendix 2  | Pressure gauges and remote monitoring to measure any changes at the well head and transfer tanks. Remote shut down facilities to be incorporated into design.                | 2           |
| Water resources – surface water | Altered surface flows within drainage line adjacent to Bibblewindi 17 lease area    | Localised flooding, scouring or sediment deposit within the drainage line                                            | Chapter 10               | Sediment control measures will be implemented                                                                                                                                | 2           |
| Water resources – groundwater   | Water production during pilot operation                                             | Negative impacts on environmental values i.e. registered users and GDEs due to drawdown effects, water quality, etc. | Chapter 9<br>Appendix 3  | Water modelling has indicated that there will be no impact to GDE's and registered bore users. Ongoing monitoring program to be implemented                                  | 2           |
| Biodiversity                    | Ongoing habitat fragmentation and edge effects                                      | Longer term reduction in ecosystem functions.                                                                        | Chapter 11<br>Appendix 4 | Partial rehabilitation to occur where possible                                                                                                                               | 2           |
| Traffic and transport           | Increase in traffic on local road network                                           | Reduced road safety for community/other road users leading to fatality                                               | Chapter 15<br>Appendix 7 | Santos vehicles to be fitted with an in vehicle monitoring system to influence driver behaviour                                                                              | 2           |
| Waste                           | Illegal dumping of waste or lack of suitable containment of waste.                  | Pollution, contamination and/or littering of land or water                                                           | Chapter 16               | Produced water will be stored at the Leewood Produced Water Facility. Sufficient capacity exists within the ponds to accommodate expected volumes from the proposed activity | 2           |
| Hazards                         | Minor infrastructure failure (pipes and tanks) i.e. small leak                      | Contamination of land, water, vegetation dieback                                                                     | Chapter 17               | Pressure gauges and remote monitoring to measure any changes at the well head and transfer tanks. Remote shut down facilities to be incorporated into design.                | 2           |
| Community                       | Community not appropriately consulted                                               | Poor community relations; community backlash                                                                         | Chapter 5                | Ongoing consultation to occur through Santos's exploration and appraisal consultation program                                                                                | 2           |

### 7.3 Approach to assessment

Assessment of impacts as a result of the proposed activity has been based on a combination of key risks and the DGRs. The assessment has separated impacts associated with construction and drilling (approximately 105 days) and operation (up to 3 years) as the duration of activities is a key input to identifying the impacts.

Whilst the majority of impacts occur during drilling when the intensity of activity is greatest, this is a short term activity and generally confined to the lease area. Key issues during construction and drilling include:

- Potential spills of chemicals or fuels
- Minor earthworks during construction of the cellar pit and drill cuttings pit
- Drilling through multiple aquifers
- Use of chemicals during drilling
- Noise and emissions of vehicles and equipment
- Traffic movements
- Waste management
- Hazards and public safety

During operation, the intensity of activity is much less with the lease areas visited daily by one vehicle. Key issues include:

- Groundwater extraction and
- Greenhouse gas emissions

A cumulative impact assessment has been undertaken for the E&A Program described in Section 1.4 for all environmental aspects. Given that many of the impacts are localised and wells are dispersed (see Figure 7-1), cumulative impacts are generally minor and the discussion provided is brief. The exception is ground water, biodiversity and greenhouse gas emissions. A groundwater model has been developed and is described further in Section 9.2. Biodiversity impacts have been assessed based on vegetation cleared as a result of previous and proposed CSG activities. Given the proposed activity does not include any vegetation clearing, its contribution to cumulative impacts is negligible. Greenhouse gas emissions are discussed in section 13.4.

A range of mitigation measures including water quality monitoring programs are proposed to address identified potential impacts. These are outlined within each section and summarised in Chapter 20.