Origin Energy Ironbark Project

Initial Advice Statement

Review Record

Rev	Date	Reason for Issue	Prepared	Checked	Approved
1	28/10/2011	Issued for ToR process	TH	IP	IP

Table of Contents

Figures

Tables

1. Introduction

1.1 The Project

Origin Energy ATP 788P Pty Limited (Origin) proposes a project to develop the coal seam gas (CSG) resources within Authority to Prospect (ATP) 788P, also known as 'Ironbark' near Tara in south central Queensland. The Ironbark Project (the Project) comprises the development of the CSG field within ATP 788P by the installation of up to 600 CSG wells and construction of up to two gas plants with field compression. First production of sales gas from the Project is targeted for 2014 at a rate of 50-60TJ/day with the potential to increase sales gas production to a maximum rate of 120TJ/day.

A sales gas pipeline will be constructed to connect gas plant infrastructure to the existing Darling Downs Pipeline (DDPL) in order to supply Origin Energy's portfolio of domestic customers including the Origin Energy owned Darling Downs Power Station (DDPS), near Dalby. The sale of gas from the Project to liquefied natural gas ventures which are currently proposed for Queensland is also possible.

Figure 2-2 illustrates the Project's development concept.

1.2 Project proponent

Origin Energy ATP 788P Pty Limited is a wholly owned subsidiary of Origin Energy Limited (Origin Energy). Origin Energy is the largest integrated energy company operating across Australia and New Zealand. Listed in the ASX top 20, the company has more than 4,000 employees. Origin Energy is a leading producer of gas in eastern Australia, the largest owner and developer of gas-fired electricity generation in Australia and a leading wholesaler and retailer of energy. The company services more than three and a half million electricity, natural gas and liquefied petroleum gas customers across Australia, New Zealand and the Pacific.

Origin Energy recently secured its position as the leading Australian integrated energy company, by agreeing to acquire the retail businesses of the NSW government-owned Integral Energy and Country Energy, and enter into GenTrader arrangements with Eraring Energy. Following completion of the transaction, Origin Energy will have 4.6 million customers and ownership and contractual rights to more than 5,800 MW of generation capacity. Origin Energy will be Australia's largest energy retailer, with one of Australia's largest and most diverse generation portfolios.

Origin Energy has a strong focus on ensuring the sustainability of its operations. Origin Energy is the largest green energy retailer in Australia with more than 500,000 green energy accounts. The company also has significant investments in renewable energy, including geothermal, wind and solar technologies.

Origin Energy has been a leading developer of coal seam gas in Australia. The company acquired its first CSG interest over 14 years ago making Origin Energy arguably the most experienced CSG producer in Australia.

In September 2008, Origin Energy announced a joint venture with ConocoPhillips to develop a CSG to Liquefied Natural Gas (LNG) project using Origin Energy's CSG reserves and resources in Queensland and ConocoPhillips' Optimized Cascade® Process technology. To facilitate the project a joint venture company, Australia Pacific LNG Pty Ltd (Australia Pacific LNG), was formed. The Queensland Coordinator-General issued a report on the environmental impact statement for the

Australia Pacific LNG project in November 2010. Environmental approvals are now being sought from the Federal Government. On behalf of Australia Pacific LNG, Origin Energy operates the Spring Gully and Peat CSG fields in the Bowen Basin, and the Talinga CSG field in the Surat Basin. Origin Energy also undertakes exploration on behalf of Australia Pacific LNG in the Bowen Basin, the Surat Basin (covering the Walloon Coal Measures) and the Gallilee BasinOrigin Energy has a significant position in Queensland having already invested around A$5 billion in power generation, gas exploration and production and energy retailing. Origin Energy currently retails natural gas, electricity and liquefied petroleum gas to more than one million customers in Queensland alone.

In addition to its interests in CSG, Origin Energy has an extensive conventional gas exploration and production portfolio which includes acreage in the Otway, Bass, Cooper/Eromanga, Surat, Bowen, Perth and Bonaparte basins in Australia, the Taranaki, Northland and Canterbury basins of New Zealand, and various interests in South East Asia and Kenya.

As well as operating a number of onshore exploration and production areas, Origin Energy has three major offshore developments being the BassGas development in the Bass Basin, the Otway Gas Project in the Otway Basin and the Kupe development in the Taranaki Basin, New Zealand.

Origin Energy operates six power stations in Australia and has interests in a portfolio of co-generation plants which supply electricity and steam under long-term contracts. Origin Energy is continuing to develop additional power plants that will see its total capacity increase to 2,800 megawatts (MW).

1.2.1 Environmental management

Origin Energy operates under an established health, safety and environment (HSE) management system to minimise and manage impacts on employees, contractors, the environment and the communities in which the company operates. The HSE management system has been developed with reference to Australian/New Zealand Standard ISO 14001 Environmental Management Systems.

The framework for the HSE management system is based on the continual improvement methodology of 'commit-plan-do-check and review.' The elements of the continual improvement loop are executed through a set of standards which interpret, support and provide further details to the requirements of the HSE policy (Appendix A).

Origin Energy strives towards an environmentally, socially and culturally acceptable business. Origin Energy seeks to advance sustainable practices, as described in the company's purpose statement:

We will be the leading, most trusted and admired energy provider in Australia and New Zealand. We will find opportunities across the energy supply chain. We will create more value through realising the benefits of integration. We will be at the forefront of sustainable practices, contributing to a positive future for our customers, our communities, our investors and ourselves. Together we can make a difference. ™

Origin Energy's commitments, principles, values and objectives seek to advance this purpose. Origin Energy expresses its commitments to key stakeholders as embracing the delivery of market leading performance across the energy supply chain, delivering value to customers, creating and maintaining a rewarding workplace and respecting the rights and interests of the communities in which it operates, being attentive to environmental and social impacts.

Origin Energy's commitment, progress and leadership in sustainability were recognised when it received the Ethical Investor Magazine's 'Sustainable Company of the Year' award for 2007.

Specifically, the success of Origin Energy's commitment to the environment in CSG has been demonstrated publicly through Origin Energy being awarded the Australian Petroleum Production & Exploration Association Environmental Award in 2007, for the design and implementation of a reverse osmosis CSG water treatment facility at its Spring Gully Development. This project was also nominated as a finalist in the Queensland Environment Protection Agency's Sustainability Awards in 2008. Annually, Origin Energy reports against the environmental performance of all operations and activities through sustainability and annual reporting (available at www.originenergy.com.au).

1.3 Project rationale

The Project can contribute to the reduction of Queensland's greenhouse gas intensity through the production of CSG which will be available for domestic electricity generation, and can substitute for higher greenhouse gas intensive fuels. The Project will also generate jobs and further investment in Queensland.

Governments world-wide are supporting the use of gas as a transitional fuel to meet energy needs as the world moves towards a carbon-constrained economy. As such, demand for gas is expected to rise in domestic and international markets. The Australian Bureau of Agricultural and Resource Economics (ABARE, 2009) has estimated the ultimate potential CSG resource in eastern Australia could be 250 trillion cubic feet, which is more than sufficient to meet domestic and international needs. The Australian Government's Energy White Paper seeks to deliver energy security to Australia whilst at the same time realising Australia's potential as a global energy producer in the 21st Century. Origin Energy, with its strong reserves position, is well-placed to respond to such policy platforms coupled with the growing demand for gas.

The Project will provide CSG to meet increasing demand for gas-fired electricity generation and other uses. The Project represents a capital investment of at least $1.5 billion dollars and will contribute to the State's economic base and generate about 200 jobs in the peak construction phase and a further 40 jobs in the operational phase.

The demand for, and acceptance of, CSG as a significant and viable long-term resource in Australia has undergone a dramatic shift in recent years due to:

- The Queensland Gas Scheme, whereby the Queensland Government mandated that Queensland electricity retailers are required to source a percentage of their electricity from gas-fired generation
- The acceptance of gas as the key transitional fuel to a lower carbon intensity economy
- Growth in domestic demand for gas, particularly through the development of gas-fired power stations
- The scale and economic viability of the CSG resource becoming more apparent as ongoing drilling programs have demonstrated substantial increases in reserves and identified other resources, particularly in Queensland

1.4 Document Purpose and Scope

The purpose of this Initial Advice Statement (IAS) is to provide information to:

- Support an application to the Chief Executive of the Department of Environment and Resource Management (DERM) for approval to prepare a voluntary environmental impact statement (EIS) for the Project under Section 71 of the Environment Protection Act 1994 (EP Act)
- Assist in the preparation of a draft terms of reference (TOR) for an EIS for the proposed Project
- Enable stakeholders to determine the nature and level of their interest in the proposal.

The IAS has been developed to provide a preliminary overview of the nature and extent of the potential social, economic and environmental impacts that may be associated with the Project as far as they can be foreseen at the concept stage of project planning.

1.5 Project description

The Project is located in southeast Queensland approximately 300 km west of Brisbane and 150km west of Toowoomba, within the Western Downs Regional Council area. Nearby towns include Tara to the south, Dalby to the east and Chinchilla to the north. ATP 788P, which covers an area of 64,140 ha, is within the southern section of the Undulla Nose CSG province and is adjacent to both Origin Energy and Queensland Gas Company existing developments within the Walloon Fairway (refer to Figure 2-5). Notably, the Australia Pacific LNG Condabri gas field (PLA 266) adjoins the north-western section of ATP 788P

The Project has the objective of developing the gas field within ATP 788P and exporting gas to the DDPL to meet increasing demand for gas-fired electricity generation and other uses. A corridor for the sales gas pipeline that seeks to minimise social and environmental impacts has been identified and extends from the north west of ATP 788P in a northerly direction to the DDPL. The final alignment of an easement of up to 30m width for the sales gas pipeline within this corridor and the layout of the gas field and associated infrastructure will be determined as part of the EIS process using an options analysis framework with consideration for social, environmental, engineering and economic considerations. As such, the study area to be investigated for the EIS is defined as ATP 788P and the sales gas pipeline corridor (Figure 2-2); a total area of 72,300ha.

1.5.1 Gas field and sales gas pipeline

It is proposed to progressively develop the gas field over a timeframe of up to 40 years, which will ultimately require the following infrastructure:

- Up to 600 wells
- Underground gas and water gathering networks
- Up to two gas plants with field compression
- A sales gas pipeline

- Warehouses and administration buildings
- CSG water management infrastructure
- Temporary and permanent accommodation facilities

Related infrastructure includes access roads, telecommunications, and sewerage infrastructure.

Gas Wells and Gathering System

Drilling and completion activities will be required for the development of up to 600 wells. Typically, the well spacing will be based on a 750 metres (m) grid. However, there will be areas where social and environmental constraints, the gas production profile and drilling techniques may require the well spacing to be varied. Optimisation of the gas field will be ongoing over the life of the Project.

Before the drilling rig is mobilised, the drilling site or 'well lease' is prepared to meet operational requirements of the drilling operation. This requires clearing of the lease area of vegetation. An access road may also need to be constructed if there are no existing tracks in the area available for use. Topsoil is removed and stockpiled, and the lease is levelled over an operational area of approximately 1 ha.

The drilling rig and supporting infrastructure is then set up on the lease to drill the well bore to the required depth. Typically, it takes five to ten days to drill a well to a depth of 600m to 1,000m, after which the drilling rig is demobilised. A workover and completions rig is then set up on the lease to install equipment required to operate the gas well. As part of completing a well, hydraulic fracture stimulation or cavitation may be required. Typical drilling and workover rigs are shown in Figure 1-1.

Figure 1-1 Typical CSG drilling rig and workover rig

Once well construction is complete the lease area is generally reduced to approximately a 10m x 10m fenced compound, with the surrounding area of disturbance subject to rehabilitation. Typical surface facilities which remain within the fenced compound at the well surface are:

- A wellhead through which the gas and CSG water is brought to the surface
- A pump that lifts the CSG water to the surface
- A micro turbine, hydra pack or other power supply to drive the pump
- A wellhead separator with associated control devices.

In most cases, CSG wells will produce both methane gas and CSG water as a two phase mixture that will be separated at the well site by the well head separator. An underground network of low pressure gathering lines will transfer gas and water from wells to the gas plant for processing.

Figure 1-2 Typical CSG wellhead separator and an operating Australia Pacific LNG gas well following rehabilitation of the well lease

Gas Plants and Gas Product

Gas produced from the field will be transferred via the gathering network to at least one but possibly two gas plants with a maximum aggregate sales gas production rate of 120 TJ/day. The final location for gas plants will be identified during development of the EIS with consideration for social and environmental constraints and optimisation of the gas field. If two gas plants are required a trunk pipeline to connect the gas plants will also be necessary.

The primary function of a CSG gas plant is to remove any remaining water from the gas stream and compress the gas for delivery to the sales gas pipeline. Gas plants also act as control centres for activities in the gas field. Typical gas plants are shown in Figure 1-3.

Figure 1-3 Australia Pacific LNG's existing Strathblane and Spring Gully gas plants

Sales gas pipeline

A sales gas pipeline will be required to deliver gas from gas plant infrastructure to the existing DDPL. The construction method for the sales gas pipeline will typically be as follows:

- Construction preparation works
- Right Of Way establishment along an approved construction easement of up to 30m in width
- Clearing of vegetation
- The delivery of pipe to laydown areas
- Pipeline trenching
- Pipeline assembly, (welding) and lowering into the trench
- Backfill and pipeline burial
- Reinstatement of the land
- Testing and commissioning of the pipeline.

The sales gas pipeline trench will be dug to the minimum depth of cover, as required by AS2885 Pipelines – Gas and Liquid Petroleum. Cathodic protection cable will be installed and connected to the pipe at regular intervals. Surface signs will be provided along the pipeline easements to advise of the presence of a buried gas pipeline in accordance with Australian standards.

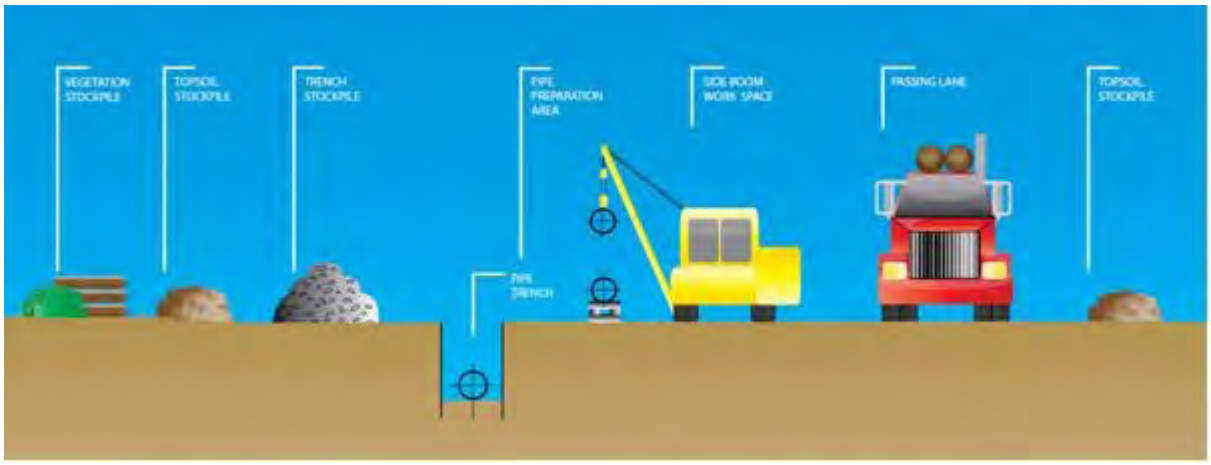


Figure 1-4 Indicative Gas pipeline right of way construction cross section

Management of CSG Water

The process of releasing CSG for production involves the extraction of water from the coal seams (CSG water). Such CSG water typically contains variable concentrations of salts.

In accordance with the Queensland Government's Coal Seam Gas Water Management Policy (DERM, 2010) water not used as part of the primary activity will be treated at a central location, typically using an integrated membrane system, for beneficial use in the environment, agriculture or industry.

Opportunities for co-location or sharing of existing water management infrastructure with adjoining Australia Pacific LNG assets will be investigated as part of the EIS process. If such co-location or sharing is determined to not be feasible, then the construction of water management infrastructure within ATP 788P, including water treatment facilities (WTF's) and brine ponds, will also be required as part of the Project.

The beneficial use of treated CSG water may include a combination of several options, including:

- Irrigation of agricultural crops
- Agro-forestry and tree cropping including the production of legume trees where the oil rich seed is processed for conversion to biodiesel
- Urban and industrial uses
- Interim or occasional discharge of treated water to local river systems
- Reinjection into suitable aquifers.

The brine water which is produced during the water treatment process will initially be contained in ponds. Any brine ponds required for the Project will be designed and constructed in accordance with applicable DERM standards.

A number of options for treatment and recovery of salts produced during the water treatment process will be investigated. Options for disposal of salt in brine from water treatment may include:

- Salt recovery - investigations are continuing into the recovery and separation of commercially valuable salts, such as sodium bicarbonate;
- Brine injection – studies are being conducted on the injection of water into salty underground aquifers; and
- Reinjection into depleted gas wells.

The Queensland Government's Coal Seam Gas Water Management Policy identifies injection of CSG water into aquifers as one of a number of preferred management options for CSG water if a detrimental impact is unlikely. Further research and consultation will be undertaken to determine if water can be safely reinjected.

Power Supply

The Project is likely to generate its own power using the CSG as fuel for the generation equipment. However, the option of using electricity as the energy source for gas plants and any water treatment facilities will also be investigated as part of the EIS. Diesel generators will also be used for mobile plant and emergency equipment.

Water

Water is required for construction, dust mitigation, irrigation, drinking water and domestic purposes.

The selection of water sources will depend on the identification of suitable sources and determined through detailed studies during the EIS. The feasibility of recycling water generated during pilot programs for construction activities will also be investigated.

Transportation

In most cases the access road leading to individual wells will be situated within a cleared right of way. Roads leading to major infrastructure such as gas plants and water treatment facilities will require all weather access.

The capacity of existing transport infrastructure to support the Project will be assessed during detailed planning for the Project with details to be provided in the EIS.

Workforce Accommodation

The gas field will be developed incrementally over a period of up to 40 years, requiring a workforce of approximately 200 people during peak construction times. It is anticipated that a single construction camp will be established on ATP 788P to service well development activities and to provide accommodation for the various construction teams.

The operation of the gas field will require a peak operational workforce of around 40 people when the field is fully developed. It is proposed to construct a permanent camp will be installed in the vicinity of a gas plant to accommodate the operational workforce. Examples of temporary and permanent camps are shown in Figure 1-5.

Figure 1-5 Temporary camp and permanent accommodation at Australia Pacific LNG's Spring Gully facility

Communication Towers

Installation of a 50m telecommunication tower in the study area may be required to ensure adequate communications capability for the Project. The ground disturbance area for such a tower should not exceed 70m by 70m, with the tower as a central point. The area will be a fenced compound to maintain security and safety requirements, as it includes the anchor points used to stabilise the tower. The location of a telecommunication tower, if required, will be determined by social, environmental and technical constraints identified during the EIS process. An example of an existing telecommunication tower at the Australia Pacific LNG Talinga operation is shown in Figure 1-6.

Figure 1-6 Existing communication tower at Talinga

1.5.2 Exploration and appraisal

Prior to development of a CSG field, exploration and appraisal activities are undertaken in order to better define the CSG resource. Exploration generally begins with seismic or other geophysical surveys, to determine the geological setting of the area. This is followed by corehole drilling to obtain cores from the coal seam. These cores provide information on coal seam thickness, gas content and quality, and volumes of water likely to be extracted during field development.

Production pilots are then used to determine the production potential of the coal seams. Each production pilot involves drilling, completing and operating a group of approximately six wells. The production and geological data obtained from production pilots are used to determine if the area is suitable for development and production.

Coring activities are currently being undertaken by Origin on ATP 788P and drilling of wells for pilot programs commenced during late 2010. Data generated by the programs will be used to determine the viability and final design of the Project. These activities are approved under Environmental Authority Permit Number PEN100262908 and, as such, will be excluded from the EIS.

1.5.3 Social and economic benefits and costs of the Project

Origin's capital expenditure for the Project of in excess of $1.5 billion is expected to generate benefits at the regional and State level including:

- Increases to the Queensland economy (Gross State Product)
- Higher employment in Queensland during operations of the Project with 200 jobs expected to be generated in the peak construction phase and a further 40 jobs during the operational phase
- Opportunities to increase local skills capacity via apprenticeships, scholarships and vocational training and training programs.

There is a potential for social and economic impacts associated with the Project, and from the cumulative impact of multiple CSG projects in the region. These impacts could include:

- Rises in wages and input costs for businesses, including commercial and industrial property prices and rents
- Skills shortages in critical occupations
- Potential increases in noise, vibration, dust and light spill in the study area impacting on rural and rural residential landholders
- Pressures on local infrastructure, including roads, airports, health and community services, child and educational facilities, police and emergency services and utilities facilities (water, electricity, gas)
- Potential higher housing and rent prices. The housing market in the gas fields region could experience an increase. In the gas fields region, this will depend on whether the operational workforce chooses to move out of the temporary accommodation facilities and reside locally.

Comprehensive social and economic assessments will completed for the Project as part of the EIS process.

1.6 Project timeframe

First production of sales gas from the Project is targeted for 2014 at a rate of 50-60TJ/day with the potential to increase sales gas production to a maximum rate of 120TJ/day. The timing and ultimate sequencing of the Project will depend on the optimisation of the gas field development and commercial demand.

1.7 Co-location and shared infrastructure opportunities

Co-location or sharing of infrastructure can reduce environmental and social impacts and maximise the use of resources. The proximity of ATP 788 to existing Australia Pacific LNG developments, and the expected similarities in development processes, provides potential options for co-location or shared use of infrastructure. Such co-location opportunities will be assessed during the EIS process.

1.7.1 Sales Gas Pipeline

As part of the development of the Australia Pacific LNG project, it is proposed to construct high pressure pipelines to connect gas plants with the existing domestic high pressure gas pipeline network, wherever possible. This will enable ramp up gas produced from the CSG fields prior to commissioning of the LNG plant to be used within the existing gas network. For the Condabri gas field, which adjoins ATP 788P, it is proposed to build a network of high pressure pipelines to connect gas plants in this tenure to the DDPL.

As such, one option for the transfer of gas from ATP 788P to the DDPL is to connect to the high pressure pipeline network proposed for the Condabri field. Depending on the final location of the gas plant infrastructure for the Project, connection to the Condabri high pressure pipeline network may provide a solution for the transfer of gas from ATP 788P to the DDPL which minimises environmental and social impacts. The pipeline connection from the ATP 788P gas field to the DDPL will be investigated as part of the EIS.

1.7.2 Water Treatment Infrastructure

A low pressure gas and water gathering network will be required throughout ATP 788P to transport gas and CSG water respectively. Where practicable, the full length of the gas network is proposed to be co-located with the water network, with both pipelines constructed simultaneously within the same right of way. This approach will reduce the overall disturbance footprint, allow for efficient use of resources including materials and workforce and reduce impacts on landholders.

Options for use of CSG water generated by the Project that will be investigated as part of the EIS process include

- Treatment of CSG water within ATP 788P prior to beneficial use, reinjection or controlled discharge
- Transfer of untreated CSG water to water treatment plants at adjoining Australia Pacific LNG sites for treatment prior to beneficial use or controlled discharge

1.8 Relationship to other projects

The DDPL and DDPS are existing assets operating under approved environmental authorities. As the Project will not necessitate a material change in use, or increase the intensity of use, for these assets they will be excluded from the EIS for the Project.

The transfer of Ironbark CSG water to water treatment plants at adjoining Australia Pacific LNG sites for treatment is an option that will be investigated as part of the EIS. Such an option would only be considered if the treatment of Ironbark CSG water could be accommodated within existing approval conditions applicable to the relevant Australia Pacific LNG sites, and did not result in a material change in use, or an increase in the approved intensity of use of Australia Pacific LNG water management infrastructure.

The focus of the Project is the development of the CSG resource within ATP 788P. Social and environmental benefits may be realised if arrangements can be made to utilise the existing infrastructure of other projects, such as the Australia Pacific LNG project. Efforts to reduce the Project's social and environmental footprint will be a continual process during the EIS

1.9 The environmental impact assessment process

This section identifies key legislation and other documents and guidelines relevant to the environmental impact assessment process for the Project. Due consideration of the likely environmental impacts of the Project under various Commonwealth, State and Local legislation, guidelines and policies will be undertaken as part of the EIS process.

1.9.1 Commonwealth Government

Environment Protection and Biodiversity Conservation Act 1999

At the Commonwealth level, the Environment Protection and Biodiversity Conservation Act, 1999 (EPBC Act) applies to those actions that are likely to have a significant impact on matters of National Environmental Significance (NES). Matters of NES include World Heritage properties, National Heritage List places, wetlands listed under the Ramsar Convention as wetlands of international importance, nationally threatened species and ecological communities listed under the EPBC Act, migratory species listed under the EPBC Act, and the Commonwealth marine environment.

The Project will be referred to the Federal Environment Minister to seek a determination on whether the Project would constitute a 'controlled action', and therefore require formal assessment, under the EPBC Act.

The Australian Government has a bilateral agreement in place with the Queensland Government which accredits the environmental assessment process under the EP Act. This allows a single assessment process to occur, should it be determined that the Project is a controlled action, thus avoiding duplication.

Native Title Act 1993

The Native Title Act, 1993 (NTA) provides for the recognition and protection of Aboriginal and Torres Strait Islanders' rights and interests over their land and waters. It establishes ways in which future dealings affecting Native Title may proceed and provides a mechanism for determining native title claims. Native Title agreements, such as agreements under section 31 of the NTA or Indigenous Land Use Agreements, may be required to address native title rights over land subject to Native Title.

Other Regulations

There are various other Commonwealth requirements such as the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) and Australian standards for storing Dangerous Goods (such as flammables, combustibles, toxics, corrosives, etc) with which Origin will comply.

1.9.2 State Government

Environmental Protection Act 1994

Origin is seeking to have the Project assessed through the voluntary Environmental Impact Statement (EIS) process under Section 71 of the Environmental Protection Act, 1994 (EP Act). Origin is seeking to apply the voluntary EIS process to ensure that the Project is subject to thorough impact assessment and stakeholder consultation processes.

An EIS provides the general public and relevant stakeholders with information on the need for the Project and its potential social and environmental effects. An EIS provides a process for demonstrating how a project has been planned and can be managed to protect and enhance environmental and social values.

Following the completion of the EIS process, Origin will be required to make a series of development applications to relevant State Government bodies and to Councils where approvals for material change of use, building or operational works are required under the Sustainable Planning Act 2009. The assessment of such applications may be informed by the findings of the EIS assessment report.

It is expected that the Project will require the following approvals:

- Conversion of the authority to prospect to a petroleum lease for the gas fields and a survey licence and pipeline licence for the sales gas pipeline, both required under the Petroleum and Gas (Production and Safety) Act, 2004
- An environmental authority (petroleum activity) for the pipeline licence and petroleum lease under the Environmental Protection Act, 1994 (EP Act) to allow some or all of the following level 1 petroleum activities under Schedule 5A of the Environmental Protection Regulation 2008.
    - Schedule 5, No. 6
        - a petroleum activity carried out on a site containing a high hazard dam or a significant hazard dam
    - Schedule 5, No. 8
        - 8(3A) Chemical storage 10m^3 to 500m^3 of chemicals or dangerous goods Class 3 or Class C1 or C2 combustible liquids under AS1940
        - 8(3B) Chemical storage more than 500m^3 of dangerous goods Class 3 or Class C1 or C2 combustible liquids under AS1940
        - 10 Gas producing - manufacturing, processing or reforming hydrocarbon gas: 200t/yr or more
        - 15 Fuel burning – fuel burning operation using equipment capable of burning at least 500kg/hr of fuel
        - 60 (1D) Waste disposal facility (any combination of regulated waste, general waste and limited regulated waste – and <5t untreated clinical wastes if in a scheduled area) >200,000 t/yr
        - 63(2B) Sewage treatment 100-1500 equivalent persons (EP)

The Project will also be subject to the requirements of other State acts, policies and regulations including:

- Aboriginal Cultural Heritage Act, 2003
- Vegetation Management Act, 1999
- Nature Conservation Act, 1992
- Land Act, 1994
- Queensland Heritage Act, 1992
- Fisheries Act 1994
- Forestry Act 1959
- Transport Infrastructure Act, 1994
- Water Act, 2000
- Water Supply (Safety and Reliability Act) 2008
- Land Protection (Pest and Stock Route Management) Act, 2002
- Soil Conservation Act, 1986
- Dangerous Goods Safety Management Act, 2001
- Environmental Protection (Waste Management) Regulation, 2000
- Explosives Act 1999.

1.9.3 Local Government

The project is within Western Downs Regional Council area. The primary components of the Project will be authorised under the Petroleum and Gas (Production and Safety) Act, 2004 and thus will be exempt from assessment under Local Government planning schemes. The project will however be subject to relevant Local Government Local Laws. Western Downs Regional Council will be consulted through the EIS process and local planning scheme requirements will be addressed during the preparation of the EIS.

2. Existing Environment and Potential Impacts

This Section provides an overview of the nature and extent of the potential environmental and socioeconomic impacts that may be associated with the construction and operation of the Project. A detailed assessment will be provided in the EIS.

2.1 Biogeographical Setting

The study area is predominantly within the Tara Downs and Inglewood Sandstone Subregions of the Brigalow Belt South Bioregion (Thackway and Cresswell, 1995) (Figure 2-3). This bioregion is principally characterised by brigalow *Acacia harpophylla* which forms forest and woodlands on clay soils. Large areas of the bioregion also include other ecosystems including eucalypt forest and woodland, grassland, dry rainforest, cypress pine woodland and riparian communities. Extensive historical clearing for agriculture has left a poor representation of the native vegetation.

The south western section of the study area is predominantly within the Tara Downs subregion. This subregion is characterised by a gently undulating landscape formed by deep weathering, erosion and deposition of the cretaceous Griman Creek formation to produce extensive clay plains interspersed with scattered laterised residuals. Soils are predominantly cracking grey clays, with areas of lateritic earths and coarse textured sands. Vegetation on the clay plains has been predominantly cleared for agriculture but originally comprised open forest of brigalow and or belah *Casuarina cristata*. Poplar box *Eucalyptus populnea* forests occurred adjacent to drainage lines which dissect the clay plains (Young *et al* 1999).

The north eastern section of the study area is within the Inglewood Sandstones Subregion. This subregion consists of undulating to low hilly country on deeply weathered and lateritised Jurassic-Cretaceous sandstone, with associated colluvial lower slopes and alluvial plains. Major vegetation types include narrow-leaved ironbark *E. crebra* on hillsides; narrow-leaved ironbark, cypress pine *Callitris glaucophylla* and bulloak *Allocasuarina luehmannii* on solodic soils in gently undulating parts; and poplar box on lower slopes and flats. There are also minor areas of brigalow-belah vegetation (Young *et al* 1999).

2.1.1 Climate

Regional meteorological data indicate that the climate of the study area can be broadly characterised as sub-tropical with cool winters and warm, wetter summers (Figure 2-1). The annual average rainfall across the region ranges between 558mm at Roma, 649mm at Miles and 676mm at Dalby, with a summer dominated rainfall pattern. Rainfall is highly variable with drought and flooding important features of the regional climate.

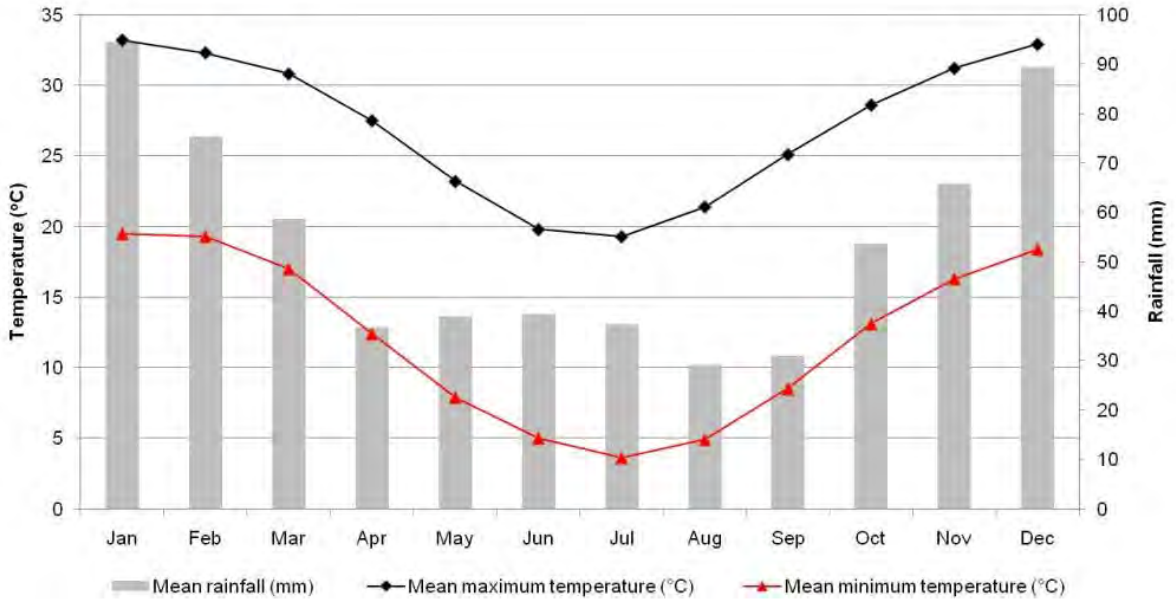


Figure 2-1 Temperature and Rainfall Data for Miles Post Office (BOM Station No. 042023), approximately 30km north of the study area. Data are monthly means from 1885 to June 2010.

2.2 Terrain

2.2.1 Existing Environment

Geology

The study area lies within the Surat Basin, which covers an area of approximately 300,000 km^2, extending from the southern part of central southern Queensland to central northern NSW. The geological development of the Surat Basin involved a series of depositional events from river, lake, swamp and marine environments between 200 and 110 million years ago. As a result of the depositional conditions and subsequent geological history, the basin sediments have lithified to form a succession of sedimentary rocks including mudstone, siltstone, sandstone and conglomerate. These sediments have subsequently been overlain in areas by tertiary and quaternary sediments. Some recent volcanic rock (basalt) is also present in the basin.

Organic material deposited in swamp environments has been transformed over geological time into the coal seams that are presently accessed for coal and coal seam gas production in the basin. Exploration and production of coal seam gas is focussed on the Walloons Coal Measures, a Jurassic aged formation characterised by layers of carbonaceous mudstone, siltstone, minor sandstone and coal.

The dominant geological units throughout the study area are described below and shown in Figure 2-3.

- Czs - Late Cainozoic floodout and residual sand, soil and gravel
- JKb – Kumbarilla Beds. Late Jurassic to early Cretaceous sandstone, siltstone, mudstone and conglomerate.

Topography and Soils

Land resource area's within the study area and surrounding landscape (Maher, 1996) are described in Table 2.1 and displayed in Figure 2-4.

The landforms of the south western section of the study area are dominated by flat to gently undulating clay plains with shallow to deep gilgai. The north eastern section of the study area is a mixture of plateaus and low sandstone hills and flat to gently undulating plains derived from weathered sandstone, with some isolated areas of clay plains (Maher, 1996) (Figure 2-4).

The soils on the clay plains are dominated by deep, grey cracking clays. Gilgai patterns and depth can vary considerably. Soil pH is generally neutral to alkaline at the surface, becomes strongly alkaline with depth and grading to strongly acid deep subsoils. Subsoils are also sodic and saline.

Soils in sandstone areas vary from bleached sands over mottled yellowish brown or brown and red clays to very shallow, gravelly red soils and shallow gravelly texture contrast soils.

A band of texture contrast soils is present adjacent to Undulla Creek. These soils comprise bleached hardsetting clay loams over brown or greyish brown clay subsoils. Subsoils are strongly sodic and saline.

2.2.2 Potential Impacts

Topography, Geology and Soils

Ground disturbance will be required during the construction phase of the Project in order to construct infrastructure such as gas plants, wells and the gathering system. Such disturbance has the potential to induce soil erosion and dispersion if not managed effectively. Impacts on the productivity of soils used for cropping are also possible.

To mitigate these potential impacts a terrain analysis will be undertaken and used to assess suitable locations for key infrastructure through identification of constraints and risks. Soil studies will be undertaken to confirm soil characteristics and the potential impact the Project may have on soil resources, and impacts soil conditions may have on project infrastructure.

Environmental management measures during construction and operation will aim to minimise soil disturbance and erosion. These may include root stock retention, and vehicle movement restriction to existing disturbed areas. Sediment control devices (such as contour banks) may be installed to minimise erosion and sediment loading to local waterways. Issues that require particular attention during ground disturbance activities in the study area include management of topsoils in areas of gilgai, management of sodic and saline grey clay subsoils and management of shallow topsoils in sandstone areas.

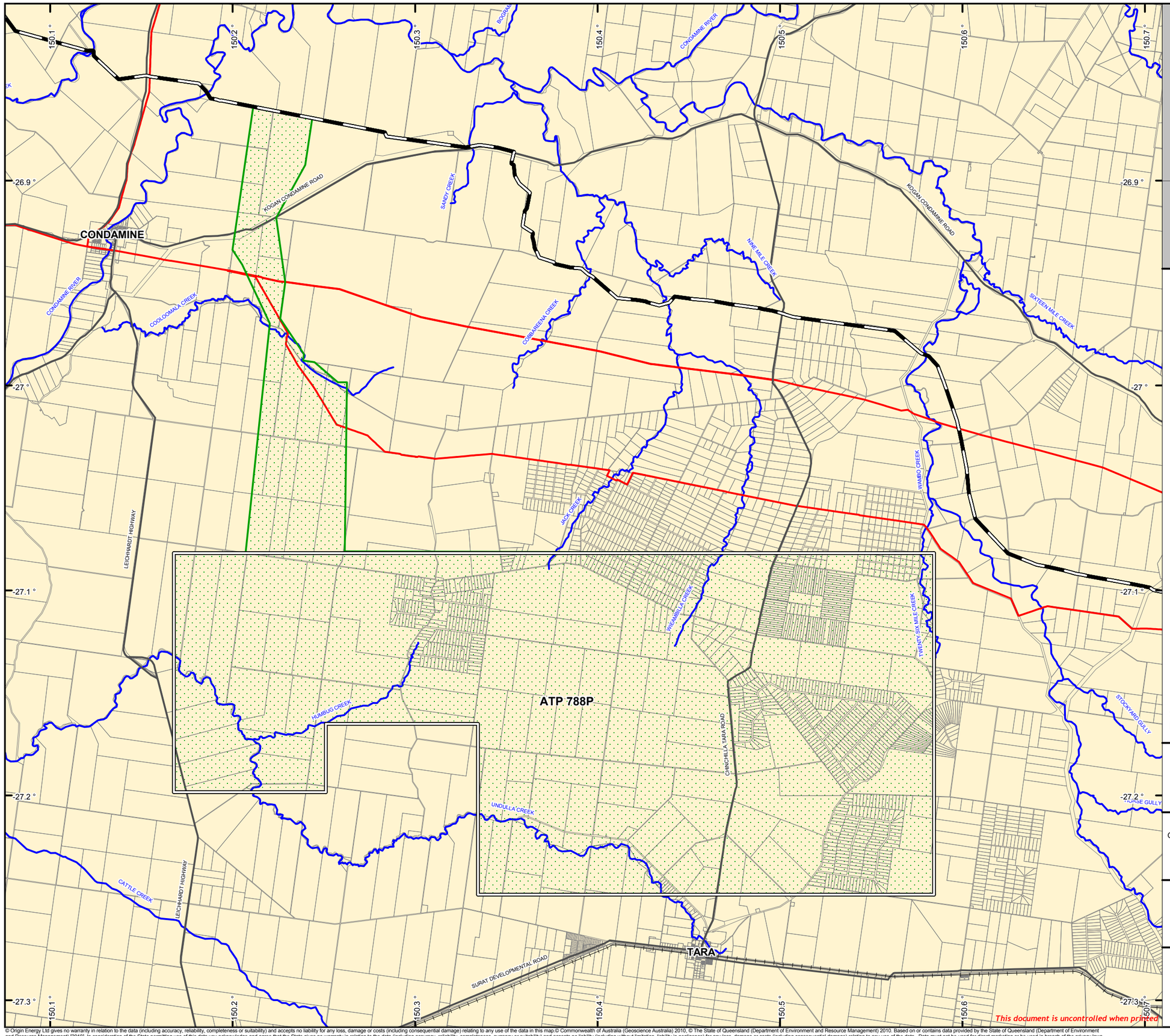
Issues relating to land management of farming properties covered by the Project will also be addressed and strategies developed prior to construction to ensure the ongoing productivity of this land and to reduce erosion and weed dispersal.

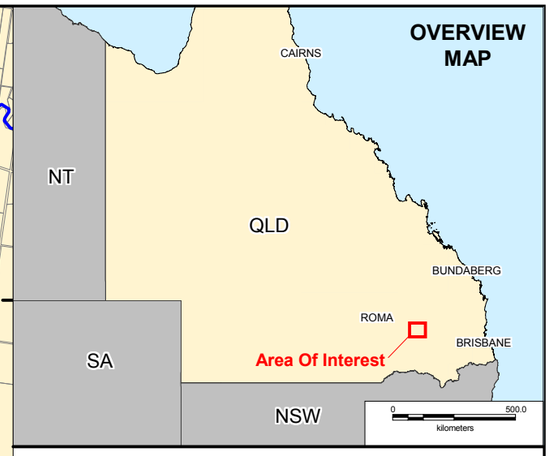
A land contamination assessment will also be undertaken to specifically identify key areas of potential contamination that may pose a risk to the environment and will need to be considered during detailed design of the Project.

Table 2.1: Land Resource Areas present within the study area and surrounding landscape

LRA		Description
Clay Alluvial Plains	1a	Older, elevated alluvial plains of the Condamine River with many drainage lines. Very open grassy woodland of poplar box.
	1b	River terraces, channels and associated plains of the Condamine River which are subject to periodic flooding. Coolabah, river red gum open forest and woodland fringe the drainage lines, whilst poplar box grassy woodland occurs on the flat plains.
	1c	Flat plains of basaltic alluvium modified in places with deposits from weathered shale and sandstone. Few defined drainage lines. Poplar box grassy woodland.
Poplar Box Flat Plains	2a	Flat plains and stream terraces of shale and sandstone alluvium. Poplar box shrubby woodland to open forest or poplar box and false sandalwood shrubby woodland. Associated species include wilga, false sandalwood, sally wattle, limebush, bull oak and belah.
	2b	Gently undulating to flat plains. Woodland of poplar box and bull oak or of poplar box. Associated species include narrow-leaved ironbark, false sandalwood, cypress pine and molly box.
Cypress Pine Sands	3a	Flat to gently undulating sandy alluvial plains. On the sandier soils cypress pine, tumbledown gum and rough-barked apple predominate, with poplar box or bull oak woodland occurring on the heavier soils. Moreton Bay ash, rusty gum, sally wattle and wilga may also occur.
	3b	Flat sand plains raised above the level of the surrounding clay plains. Open forest of tumbledown gum and cypress pine on very deep sands and an open forest of bull oak, poplar box, cypress pine and tumbledown gum on texture contrast soils.
Brigalow Plains	4a	Flat to gently undulating clay plains. Very shallow to moderately deep gilgai may occur. Brigalow, belah, wilga forest and associated black teatree, molly box woodland and poplar box shrubby woodland intermixed with brigalow forest at the edges of the plains.
	4b	Flat clay plains, moderately deep to deep gilgai. Brigalow, belah, wilga forest and associated false sandalwood, with black teatree forest, molly box woodland and poplar box shrubby woodland intermixed with brigalow forest on the poorer drained areas.
Brigalow Rises	5a	Gently undulating rises and plains on sandstone and shale. Very shallow gilgai may occur. Shrubby open forest of brigalow, belah and wilga with associated molly box and a shrubby open forest of belah, wilga and poplar box also occurs.

LRA		Description
	5b	Undulating rises. Brigalow, belah, wilga shrubby forest with associated false sandalwood, and belah forest, poplar box shrubby woodland may occur on lower slopes.
Rolling Downs	6a	Undulating siltstone and mudstone rises. Poplar box grassy open woodland.
Ironbark/bull oak Forests	7a	Flat to gently undulating plains derived from weathered sandstone. May be associated with lower slopes of lateritised sandstone remnants. Open forest of bull oak, bull oak and cypress pine or bull oak and narrow-leaved ironbark with associated rusty gum, tumbledown gum, wattles and molly box. Poplar box and cypress pine occur along drainage lines
Poplar Box Rises	8a	Gently undulating plains to rises associated with the edges of the brigalow plains or the dissected lateritised sandstone remnants. Includes some local creek alluvia. Poplar box, false sandalwood shrubby woodland, but mixed poplar box, silver-leaved ironbark, false sandalwood, limebush shrubby woodland also occurs. Brigalow, belah forest is common on the upper slopes where these rises border the brigalow plains.
	8b	Gently undulating plains to undulating rises on sandstone. Layered forest and shrubby woodland of poplar box, false sandalwood and some myall. Also occurring is a shrubby open forest of narrow-leaved ironbark, cypress pine, poplar box and false sandalwood.
Light Forests	9a	Undulating plains and rises, often lateritised. Shrubby woodland and layered open forest of ironbarks, bull oak, wattles, cypress pine and Queensland peppermint with poplar box occurring on the deeper soils. Associated species include rusty gum and tumbledown gum.
	9b	Plateaus and low sandstone hills to undulating plains. Lateritic scarps are common. Layered open forest of ironbarks and wattles, with spotted gum, lancewood, rusty gum, Queensland peppermint, yellow jacket, bull oak and cypress pine.





Legend

Tenure

- EIS Study Area
- ATP 788P
- Cadastral Parcel

Infrastructure

- Darling Downs Pipeline
- High Pressure Gas Pipeline
- Railway
- Major Road
- Drainage Line

Study Area Version: 4
Date: 02/11/2010

N

2 0 2 4 6 8 km

Scale (A3): 1 : 200,000 - Lat Long GDA94

DATA SOURCE INFORMATION

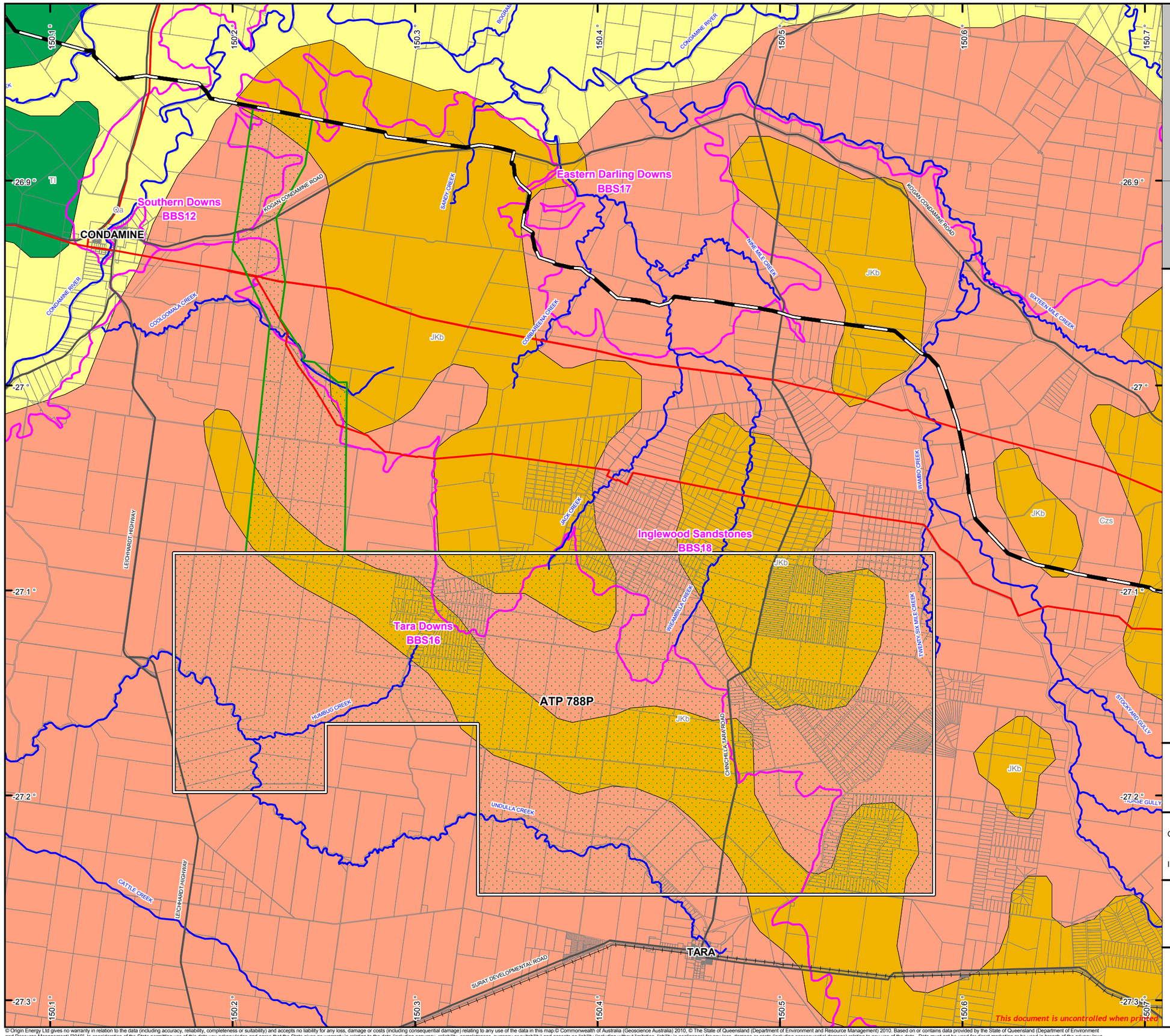
Gas Pipelines: GPInfo (Pitney Bowes Software Pty Ltd, 2010)

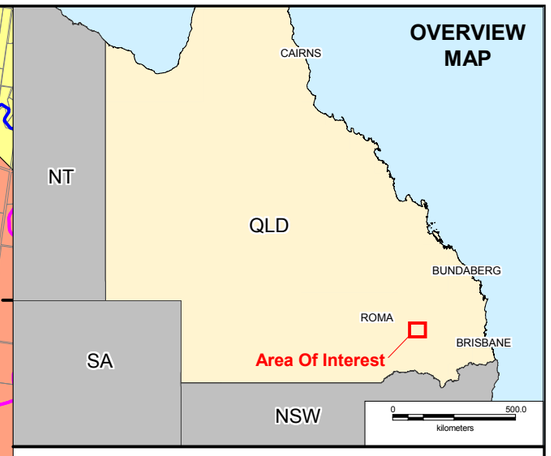
origin

IRONBARK PROJECT

Initial Advice Statement
Figure 2.2 - Project Overview

This document is uncontrolled when printed





Legend

Tenure

- EIS Study Area
- ATP 788P
- Cadastral Parcel

Infrastructure

- Darling Downs Pipeline
- High Pressure Gas Pipeline
- Railway
- Major Road
- Drainage Line

IBRA

- Sub Region

Geology

- Czs
- Qa
- JKb
- Tl

Study Area Version: 4
Date: 02/11/2010

N

2 0 2 4 6 8 km

Scale (A3): 1 : 200,000 - Lat Long GDA94

DATA SOURCE INFORMATION

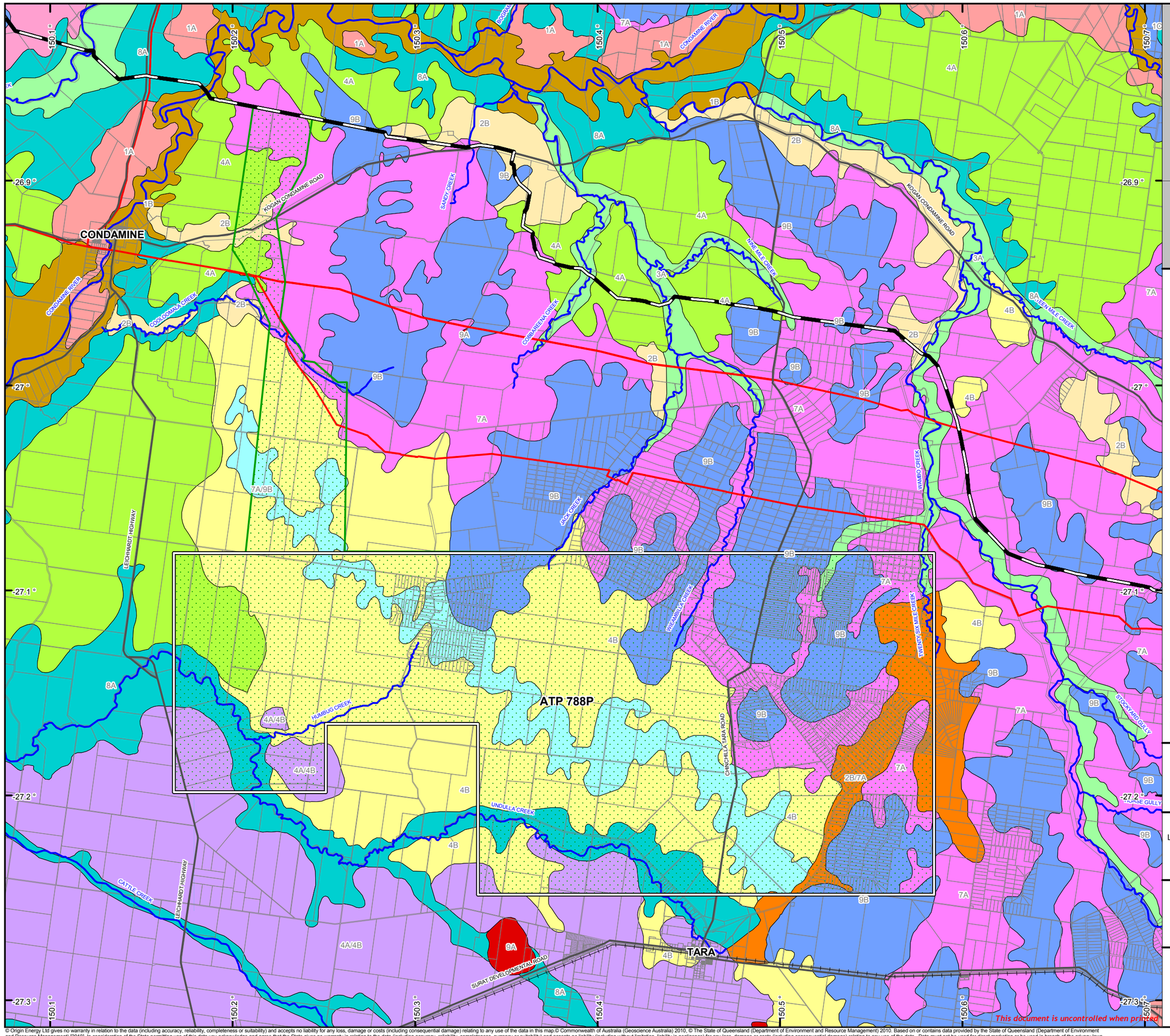
Geology:	Queensland geological 250k mapping data. (Department of Natural Resources, Mines and Energy 2004)
IBRA Subregions:	IBRA version 6.1 (Australian Government Department of the Environment, Water, Heritage and the Arts, 2004)

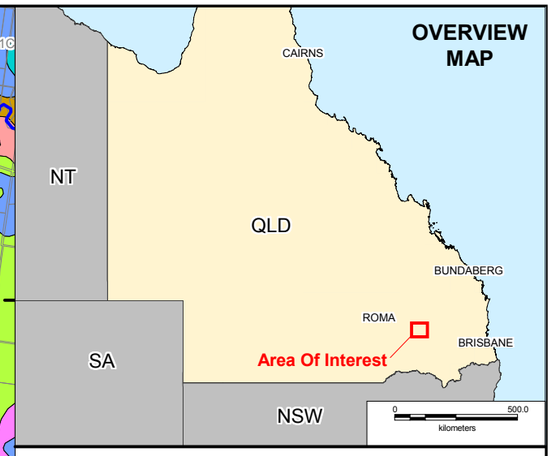
origin

IRONBARK PROJECT

Initial Advice Statement
Figure 2.3 - Biogeography and Geology

This document is uncontrolled when printed





Legend

Tenure

- EIS Study Area
- ATP 788P
- Cadastral Parcel

Infrastructure

- Darling Downs Pipeline
- High Pressure Gas Pipeline
- Railway
- Major Road
- Drainage Line

Land Resource Areas

1A	2B/7A	4B	8A
1B	3A	5A	8B
1C	3B	5B	9A
2A	4A	7A	9B
2B	4A/4B	7A/9B	

Study Area Version: 4
Date: 02/11/2010

N

2 0 2 4 6 8 km

Scale (A3): 1 : 200,000 - Lat Long GDA94

DATA SOURCE INFORMATION

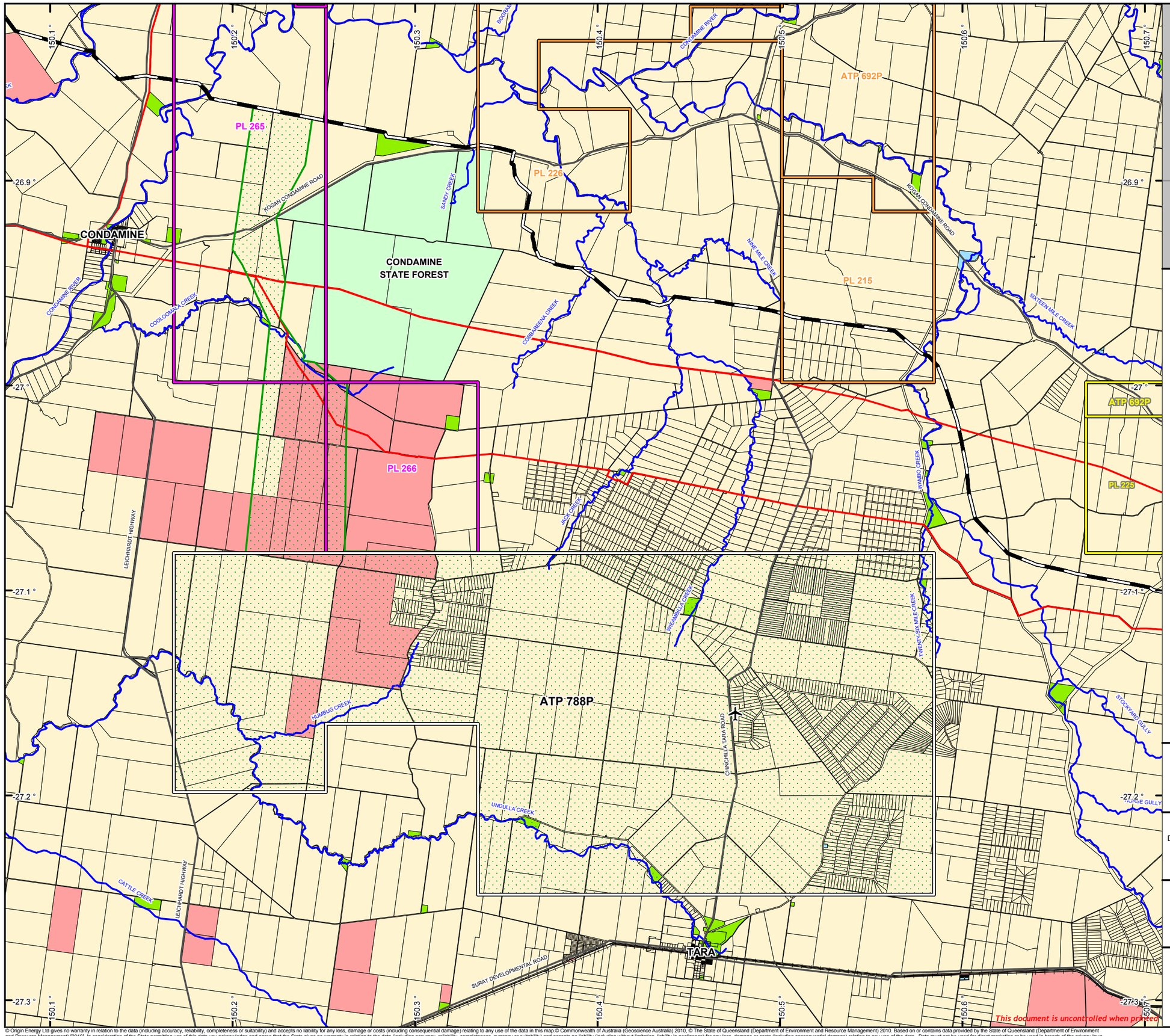
Land Resource Areas: Land Resources Data - MWD (Department of Environment and Resource Management, 2009)

origin

IRONBARK PROJECT

Initial Advice Statement
Figure 2.4 - Topography and Land Resource Areas

This document is uncontrolled when printed.



Legend

Tenure

- EIS Study Area
- ATP 788P
- Cadastral Parcel

Land Tenure

- Freehold
- Lands Lease
- Reserve
- State Forest
- State Land

APLNG Tenure

- Condabri
- Kainama
- Talinga / Orana

Infrastructure

- Airport
- DDPS
- High Pressure Gas Pipeline
- Railway
- Major Road
- Drainage Line

Study Area Version: 4
Date: 02/11/2010

N

2 0 2 4 6 8 km

Scale (A3): 1 : 200,000 - Lat Long GDA94

DATA SOURCE INFORMATION

DCDB: Digital Cadastral Database (Department of Environment and Resource Management, 2009)

origin

IRONBARK PROJECT

Initial Advice Statement
Figure 2.5 - Land Tenure and Infrastructure

This document is uncontrolled when printed

2.3 Land Use and Tenure

2.3.1 Existing Environment

The tenure of the land within the study area is predominantly freehold with some areas of leasehold and public land. An important land tenure feature of the study area is the presence of rural residential subdivisions in the northern and eastern sections of ATP 788P with around 940 land parcels of less than 30 ha present within the tenure (Figure 2-5).

Land use in the clay plain areas is dominated by dryland cropping and beef cattle grazing. Rural-residential development is a dominant land use on the sandstone rises in the north eastern section of the study area.

2.3.2 Potential Impacts

The development of CSG wells will result in a small area of land being temporarily unavailable for other land use activities such as cropping or grazing. Depending on the final design of the Project, direct impacts on rural residential holdings from development of CSG wells and gathering systems are also possible.

The construction of the gas wells, gathering systems and the construction of the sales gas pipeline will result in temporary and localised disruption of up to 24 months to land use activities. Following construction, the land will be rehabilitated and available for its existing use, with the exception of the footprint of the gas wells. Origin will implement a thorough landowner engagement process to address specific landowner requirements.

Visual impacts are generally considered to be low given established methods for design and rehabilitation. The EIS will discuss the visual impact of the construction and operation of the gasfield and sales gas pipeline, as it relates to the surrounding landscape, on particular panoramas and outlooks.

2.4 Air Quality

2.4.1 Existing Environment

Air emissions from existing activities will generally consist of dust generated from gravel roads, dust from cultivation and harvesting activities, exhaust emissions from farm machinery, and greenhouse gases from cattle grazing.

Several townships are located in the surrounding areas. These townships are expected to generate air emissions from motor vehicles as well as domestic industry and business activities.

2.4.2 Potential Impacts

Atmospheric dust (mainly from use of gravel roads, clearing, grading, trenching and backfill) as well as exhaust fumes from vehicles and machinery are expected to be the main impacts to air quality during the construction phase of the Project. These impacts are anticipated to be localised and short term and appropriate mitigation measures will be applied.

Given the size of the study area and isolated nature of potential emission generation, the impacts on air quality associated with construction activities are expected to be low. Potential operational impacts from the gas fields and pipeline are primarily associated with emissions from plant and equipment including gas plants and gas flaring during ramp up. Gas plants, in particular, can be associated with emissions of nitrogen oxides and carbon monoxide, which can have impacts on nearby sensitive receptors.

As part of the EIS process, an atmospheric dispersion model will be used to estimate air emissions from the Project. This model will enable air quality impacts from the Project, and cumulative impacts from CSG projects in the surrounding area, to be evaluated.

Wherever possible, gas field and pipeline infrastructure will be sited and/or engineered to minimise air emissions and their impacts. Measures to air reduce emissions will be also be identified through the EIS process and integrated into operational procedures as part of the EMP process. Greenhouse gas management for the Project will be based upon Origin Energy's existing management systems and will be the subject of site-specific energy efficiency and greenhouse gas management plans.

2.5 Noise and Vibration

2.5.1 Existing Environment

The existing noise environment throughout the study area is typical of sparsely populated, rural setting with low level ambient noise dominated by natural sources (e.g. wind, animals and insects). Human activities, such as rural and residential occupation and aircraft or road traffic noise, contribute to existing ambient noise levels. Existing ground vibration levels are expected to be negligible.

2.5.2 Potential Impacts

Gas well drilling operations, associated mobilisation of drill rigs and supporting plant are the primary potential sources of noise disturbance to residential locations. As gas drilling rigs normally operate with shift crews on a 24 hour basis the critical potential noise impacts typically relate to the night period.

Operation of a gas plant is associated with continued noise generation arising from the large gas powered reciprocating engines and compressors. Noise emissions, particularly in the low frequency, can cause annoyance to nearby sensitive receptors if not effectively attenuated. Construction activities will also temporarily increase noise levels in proximity to the gas field through the operation of vehicles and construction equipment.

The proposed sales gas pipeline is not anticipated to generate any ongoing noise impacts. Temporary noise impacts may occur near residential areas associated with pipeline construction activities if such activities are intended during night periods.

Because of relatively high population densities within the study area, management of noise impacts will be a very important consideration during project design. As such, a detailed acoustic impact assessment will be undertaken as part of the EIS process. Noise mitigation for the construction and operational phases of the Project will be the subject of detailed acoustical design, including appropriately locating gas plant infrastructure and implementing measures to ensure well drilling will comply with relevant regulatory criteria.

2.6 Water Resources

2.6.1 Existing Environment

Surface Water

The study area is within the Condamine-Balonne River catchment, in the north-eastern extremity of the Murray-Darling Basin. The Condamine-Balonne River catchment rises in the Great Dividing Range near Warwick and flows in a north-westerly direction as the Condamine before becoming the Balonne River downstream of the Dogwood Creek confluence.

The main watercourse draining ATP 788P is Undulla Creek, which flows in a westerly direction near the southern boundary of the ATP 788P. Humbug Creek, and several unnamed watercourses, flow to the south and south west through ATP 788P into Undulla Creek. Undulla Creek joins the Condamine River approximately 40km west of the study area. The north eastern section of ATP 788P drains in a northerly direction, via Weimballa Creek and Twenty Six Mile Creek, to the Condamine River ( ).

One notable surface water feature of ATP 788P is a small internally draining catchment in the central northern section of ATP 788P. This catchment drains to a water body defined and mapped as a palustrine system under the Queensland Wetland Program. The ecological condition of this waterbody will be investigated during the EIS. All surface water bodies in the study area are believed to be ephemeral.

Hydrogeology

The Ironbark gasfield is situated within the Surat Basin; a major sedimentary basin that forms an eastern limb of the Great Artesian Basin in Eastern Queensland. Broadly, groundwater in the Great Artesian Basin flows westward to the south-west throughout the study area with a groundwater flow rate in the order of 1 – 5 m per year.

The major aquifer units through the Surat Basin are the Bungil, Mooga, Gubberamunda, Hutton and Precipice aquifers. These sandstone aquifers are sufficiently permeable to conduct and yield significant quantities of groundwater. Recharge to the aquifers occurs by way of rainfall infiltration into the outcropping sandstone aquifers primarily on the western slopes of the Great Dividing Range.

The Walloon coal measures comprise the CSG target units within the Surat Basin. The Walloon coal measures comprise carbonaceous mudstone, siltstone, minor sandstone and coal. Groundwater in the Walloon coal measures is restricted to the coal seams and minor sandstone where the water is contained and transported in the cleats. The coal seams are relatively thin (up to 10 m) and are laterally discontinuous within a formation of predominantly siltstones and mudstones that restrict vertical flow of water between seams and overlying and underlying aquifer units. Within ATP788P the Walloon coal measures is located between 700m to 1100m below ground level.

There are currently twenty eight licenced groundwater bores within ATP 788P. Spring complexes, indicative of natural surface discharge of groundwater, are not known to occur in the study area.

2.6.2 Potential Impacts

Surface Water

Flooding is an infrequent but important climatic feature of the study area, which needs to be considered when locating project infrastructure. Flood modelling studies will be completed as part of the EIS process and will assess possible flood mitigation measures where necessary. Studies on surface water hydrology and water quality of major waterways within the study area will also be undertaken as part of the EIS.

Operations will be designed to ensure downstream impacts are limited and downstream requirements are met regarding the environment and the community. Water quality and flow regimes of waterways will be monitored to assess the impact of operations. Mitigation measures to maintain acceptable water quality especially during the construction phase but also during operation will be identified during the EIS process.

Overall the construction of the Project's components will have regard to the following:

- Reduction of erosion and sediment loading to waterways
- Minimisation of impacts arising from the establishment of Project's facilities on existing flood behaviour
- Prevention of water contamination
- Minimisation of disturbance to channels and waterways

Particular activities, such as the disposal of hydrostatic test water used during commissioning of the sales gas pipeline, will require careful management to ensure adjacent waters are not adversely impacted.

Wastewater, hazardous substances and other waste materials used and generated by the Project will be handled, stored and disposed in accordance with legislative requirements and applicable DERM guidelines. Principles for the management of these materials will be outlined as part of the EIS.

The design, route alignment and construction of the sales gas pipeline will include controls to minimise the potential environmental impact on surface water bodies and prevent any long-term modifications to watercourses.

Minimising the disturbances of channels and waterways will assist in preventing significant impacts to underlying aquifers.

Hydrogeology

Activities associated with the Project that may have the potential to impact groundwater quality and quantity in the study area includes:

- Unplanned contaminant releases
- Drawdown of aquifers to the due to hydrostatic pressure created by extraction of CSG water from the Walloon coal measures
- Hydraulic fracturing of the coal seams to increase permeability and reduce the number of wells required.

A detailed assessment of the potential impacts on groundwater will be undertaken as part of the EIS process. This will include risks to neighbouring users and ecosystems that may ensue from the Project.

A regional scale conceptual hydrogeological model, which incorporates the study area, has previously been generated for the Australia Pacific LNG Project. This model will be updated using estimates of CSG water production over the life of the Project to evaluate potential impacts on groundwater aquifers in the study area. A groundwater monitoring program will also be implemented to detect any changes in groundwater quality or quantity attributable to the extraction of CSG water. Origin will comply with the 'make good' provisions where required under legislation and, where relevant, will consult with stakeholders on strategies to 'make good‘.

2.7 Terrestrial Ecology

2.7.1 Existing Environment

Vegetation - Ecological Communities and Regional Ecosystems

The distribution of remnant vegetation in the study area has largely been determined by historical land use practices. Plains which previously supported brigalow communities have been extensively cleared for agricultural and pastoral development. Minor vegetation remnants persist in these areas as linear remnants adjacent to roadways and paddock boundaries. Linear remnants of poplar box woodlands also persist on the fringes of clay plains as riparian corridors adjacent to drainage lines.

The sandstone plateaus and low hills present in the study area have generally retained remnant vegetation due to the poor suitability of these areas for agricultural development. Vegetation in these sandstone areas is dominated by Ironbark (*Eucalyptus crebra*, *E. fibrosa, E. decorticans*) open forests, which form a vegetated band from the north east of ATP 788P to the Condamine State Forest. This band forms part of a bioregional corridor of state significance identified under DERM’s Biodiversity Planning Assessment (BPA) for the Brigalow Belt South bioregion, which was revised and updated in 2008 ().

Protection of remnant vegetation is provided by the EPBC Act and the Vegetation Management Act, 1999 (VM Act). The EPBC Act provides for the protection of Threatened Ecological Communities and the VM Act identifies Regional Ecosystems (RE) to describe relationships between major floral species and the environment at a bioregional scale. Endangered and Of Concern Regional Ecosystems have specific protection under the provisions of the VM Act. The study area and surrounding landscape is mapped as supporting 19 RE’s (BAAM 2010) of which six are listed as endangered under the EPBC Act, VM Act or the EP Act (Table 2.2).

Table 2.2: Vegetation communities recorded from the study area (BAAM, 2010)

RE	Management status[1]			EPBC Act description	Short RE description (REDD[2])	Area within Study Area (ha)	% of Study Area
	EPBC Act	VM Act	EP Act				
11.3.2	E[3]	OC	OC	Weeping Myall *Acacia pendula* Woodlands[3]	Poplar box *Eucalyptus populnea* woodland on alluvial plains	10	0.01%
11.3.3		OC	OC		Coolibah *Eucalyptus coolabah* woodland on alluvial plains	1	0.001%
11.3.4		OC	OC		Queensland blue gum *Eucalyptus tereticornis* and/or *Eucalyptus spp*. tall woodland on alluvial plains	<1	0.001%
11.3.17		OC	E		Poplar box *Eucalyptus populnea* woodland with brigalow *Acacia harpophylla* and/or belah *Casuarina cristata* on alluvial plains	3	0.004%
11.3.18		LC	NC		Poplar box *Eucalyptus populnea*, white cypress pine *Callitris glaucophylla*, bulloak *Allocasuarina luehmannii* shrubby woodland on alluvium	41	0.06%
11.3.25		LC	OC		Queensland blue gum *Eucalyptus tereticornis* or river red gum *E. camaldulensis* woodland fringing drainage lines	208	0.29%
11.3.26		LC	NC		Gum-topped Box *Eucalyptus molucanna* or Inland Grey Box *E. microcarpa* woodland to open forest on margins of alluvial plains	<1	0.001%

RE	Management status[1]			EPBC Act description	Short RE description (REDD[2])	Area within Study Area (ha)	% of Study Area
	EPBC Act	VM Act	EP Act				
11.4.3	E	E	E	Brigalow (*A. harpophylla* dominant and co-dominant)	Brigalow *Acacia harpophylla* and/or belah *Casuarina cristata* shrubby open forest on Cainozoic clay plains	410	0.57%
11.4.3a	E	E	E	Brigalow (*A. harpophylla* dominant and co-dominant)	Black tea-tree *Melaleuca bracteata* woodland fringing swamp associated with brigalow *Acacia harpophylla* communities	9	0.01%
11.4.10	E	E	E	Brigalow (*A. harpophylla* dominant and co-dominant)	Poplar box *Eucalyptus populnea* or narrow-leaved box *E. pilligaensis*, brigalow *Acacia harpophylla*, belah *Casuarina cristata* open forest to woodland on margins of Cainozoic clay plains	150	0.21%
11.4.12		E	E		Poplar box *Eucalyptus populnea* woodland on Cainozoic clay plains	180	0.25%
11.5.1		LC	NC		Narrow-leaved red ironbark *Eucalyptus crebra*, white cypress pine *Callitris glaucophylla*, smooth-barked apple *Angophora leiocarpa*, bulloak *Allocasuarina luehmannii* woodland on Cainozoic sand plains and remnant surfaces	3,935	5.44%
11.5.1a		LC	NC		Poplar box *Eucalyptus populnea* woodland with bulloak *Allocasuarina luehmannii* low tree layer on Cainozoic sand plains and remnant surfaces	567	0.78%
11.5.4		LC	NC		White cypress pine *Callitris glaucophylla* ± *Eucalyptus* spp. and *Corymbia* spp. woodland on Cainozoic sand plains and remnant surfaces	83	0.11%

RE	Management status[1]			EPBC Act description	Short RE description (REDD[2])	Area within Study Area (ha)	% of Study Area
	EPBC Act	VM Act	EP Act				
11.5.5		LC	NC		Silver-leaved ironbark *Eucalyptus melanophloia*, white cypress pine *Callitris glaucophylla* woodland on Cainozoic sand plains and remnant surfaces with deep sands	61	0.08%
11.5.20		LC	NC		Gum-topped Box *Eucalyptus moluccana* and/or Inland Grey Box *E. microcarpal* Narrow-leaved Box *E. pilligaensis* +/- Narrow-leaved red ironbark *E. crebra* woodland on Cainozoic sand plains	122	0.17%
11.7.4		LC	NC		Gum-topped ironbark *Eucalyptus decorticans* and/or *Eucalyptus* spp., *Corymbia* spp., *Acacia* spp., budgeroo *Lysicarpus angustifolius* on lateritic duricrust	4,121	5.70%
11.7.5		LC	NC		Shrubland on natural scalds on deeply weathered coarse-grained sedimentary rocks	1,212	1.68%
11.7.7		LC	NC		Tall dusky-leaved ironbark *E. fibrosa* ssp. *nubila* ± *Corymbia* spp. ± *Eucalyptus* spp. on lateritic duricrust	3,124	4.32%
Total						**14,239**	**19.69%**

[1] Where: E = endangered, OC = of concern, LC = least concern, NC = no concern at present, EP Act status is based on the 'biodiversity status' prescribed on DERM's Regional Ecosystem description database v6.

[2] REDD = DERM's Regional Ecosystem description database v6

[3] Only where weeping myall *Acacia pendula* occurs.

Threatened and Conservation Significant Flora and Fauna Species

Threatened flora and fauna species are those species listed under the EPBC Act and/or the Queensland Nature Conservation Act, 1992 (NC Act) as endangered, vulnerable or near threatened (EVNT). EVNT species listed on publicly available databases as recorded from the study area (BAAM 2010) are listed below**Error! Reference source not found.**.

Table 2.3: EVNT Species recorded from the study area

Scientific Name	Common Name	Management status[1]	
		EPBC Act	NC Act
	Fauna		
Jalmenus eubulus	Pale Imperial Hairstreak		V
Cyclorana verrucosa	Rough Frog		NT
Strophurus taenicauda	Golden-tailed Gecko		NT
Paradelma orientalis	Brigalow Scaly-foot	V	V
Acanthophis antarcticus	Common Death Adder		NT
Hemiaspis damelii	Grey Snake		E
Geophaps scripta scripta	Squatter Pigeon	V	V
Grantiella picta	Painted Honeyeater		V
Nyctophilus corbeni	South-eastern Long-eared Bat	V	V
	Flora		
Acacia lauta	Tara Wattle	V	V
Eucalyptus virens	Shiny-leaved Ironbark	V	V
Philotheca sporadica		V	V

[1] Where: E = endangered, V = vulnerable, NT = near threatened.

Protected Areas

The study area does not support any World Heritage Area, or lands listed on the Register of the National Estate or Commonwealth Heritage List. No National Parks, Conservation Parks, Nature Refuges, Areas of Essential Habitat, State Forests, Wetlands of International Significance (Ramsar), or significant wetlands listed on the Directory of Important Wetlands (DOI Wetlands) are located within the study area. The study area is within the same catchment as the Narran Lakes Nature Reserve; a Ramsar wetland situated on the Lower Balonne floodplain some 380km south west of the study area.

2.7.2 Potential Impacts

Project activities, notably vegetation removal, have the potential to impact upon flora and fauna through direct loss or injury to species during construction activities and indirectly through the loss or degradation of habitat areas and habitat fragmentation. Construction activities may also impact upon fauna through increased disturbance from construction noise, vehicle movements and dust production.

Infrastructure required for the Project will be designed and positioned with regard to the ecological values of the study area. Impacts on areas of conservation significance will be managed through the alignment of project infrastructure with regard for these areas.

Rehabilitation programs will be developed and implemented to revegetate and regenerate native vegetation as necessary. Potential impacts will be further addressed through the EIS assessment process and management measures will be incorporated into the Project's EMP(s).

2.8 Aquatic Ecology

2.8.1 Existing Environment

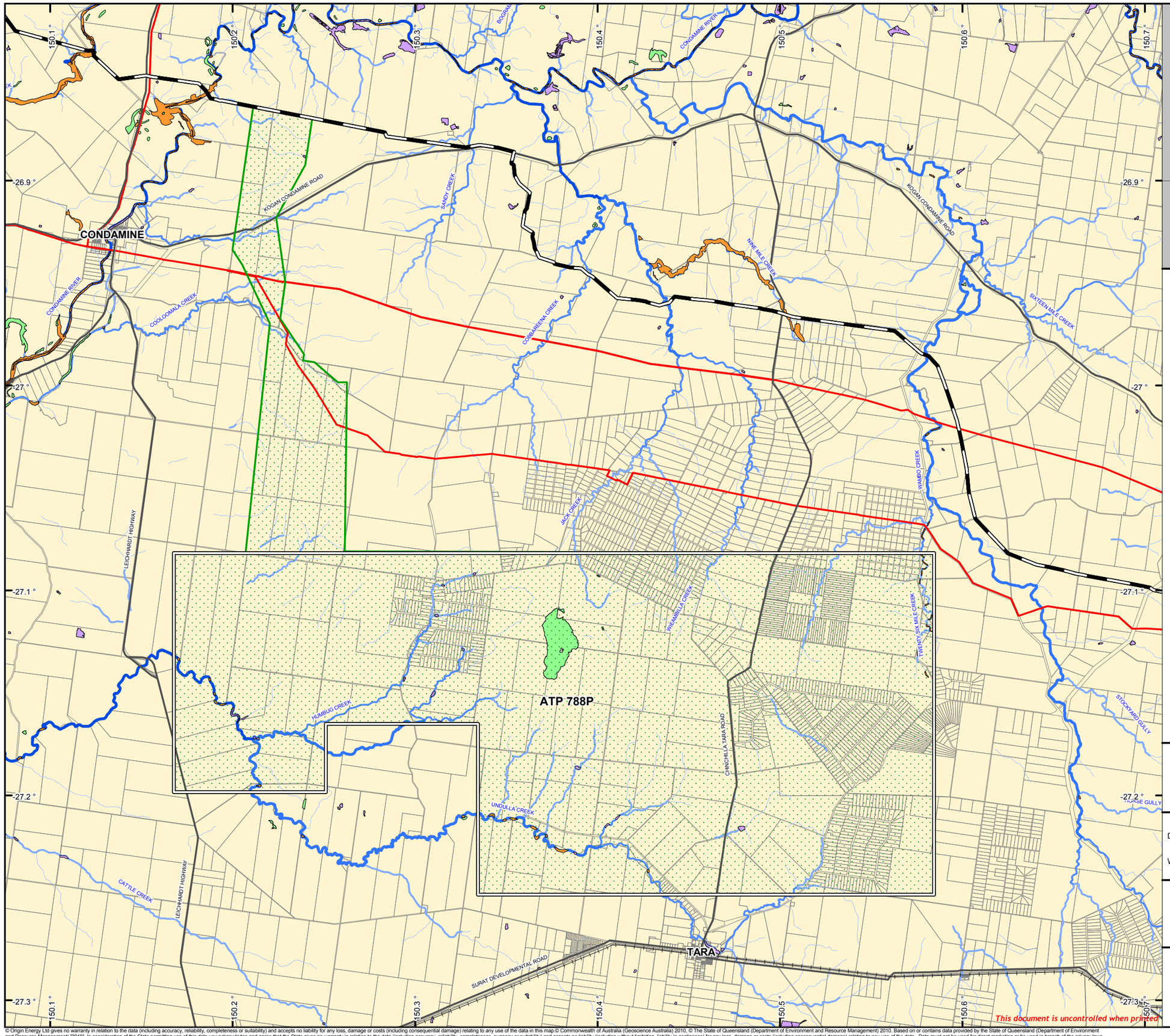
All waterbodies in the study area, which are described in Section 2.6, are ephemeral with fish passage and movement of other aquatic organisms only likely to occur during high rainfall events. Watercourses in the study area that drain sub-catchments with predominantly agricultural land uses generally demonstrate degraded riparian areas are likely to have elevated concentrations of suspended solids and nutrients.

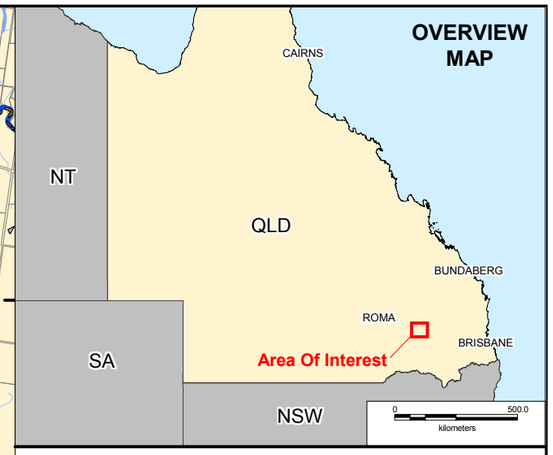
2.8.2 Potential Impacts

The potential impacts to aquatic ecology from the Project will be from either directly affecting habitat (during construction) or indirectly through water release, if required, during operation. During construction earthworks may increase the potential for sediment laden water to enter nearby waterbodies. The removal of vegetation can also cause erosion, so suitable control measures will need to be adopted for works near waterbodies.

The operational phase of the Project will produce CSG water. The volume of water, treatment requirements and the location and timing of any intended releases will be investigated during the EIS process to ensure that they would not have adverse impacts on aquatic flora and fauna.

The construction of the sales gas gas pipeline has the potential to impact on aquatic flora and fauna if watercourse crossings are required. This will be addressed as part of the EIS.





Legend

Tenure

- EIS Study Area
- ATP 788P
- Cadastral Parcel

Infrastructure

- Darling Downs Pipeline
- High Pressure Gas Pipeline
- Railway
- Major Road

Drainage by Stream Order

- 5
- 4
- 3
- 2
- 1

Wetlands

- Lacustrine
- Palustrine
- Riverine

Study Area Version: 4
Date: 02/11/2010

N

2 0 2 4 6 8 km

Scale (A3): 1 : 200,000 - Lat Long GDA94

DATA SOURCE INFORMATION

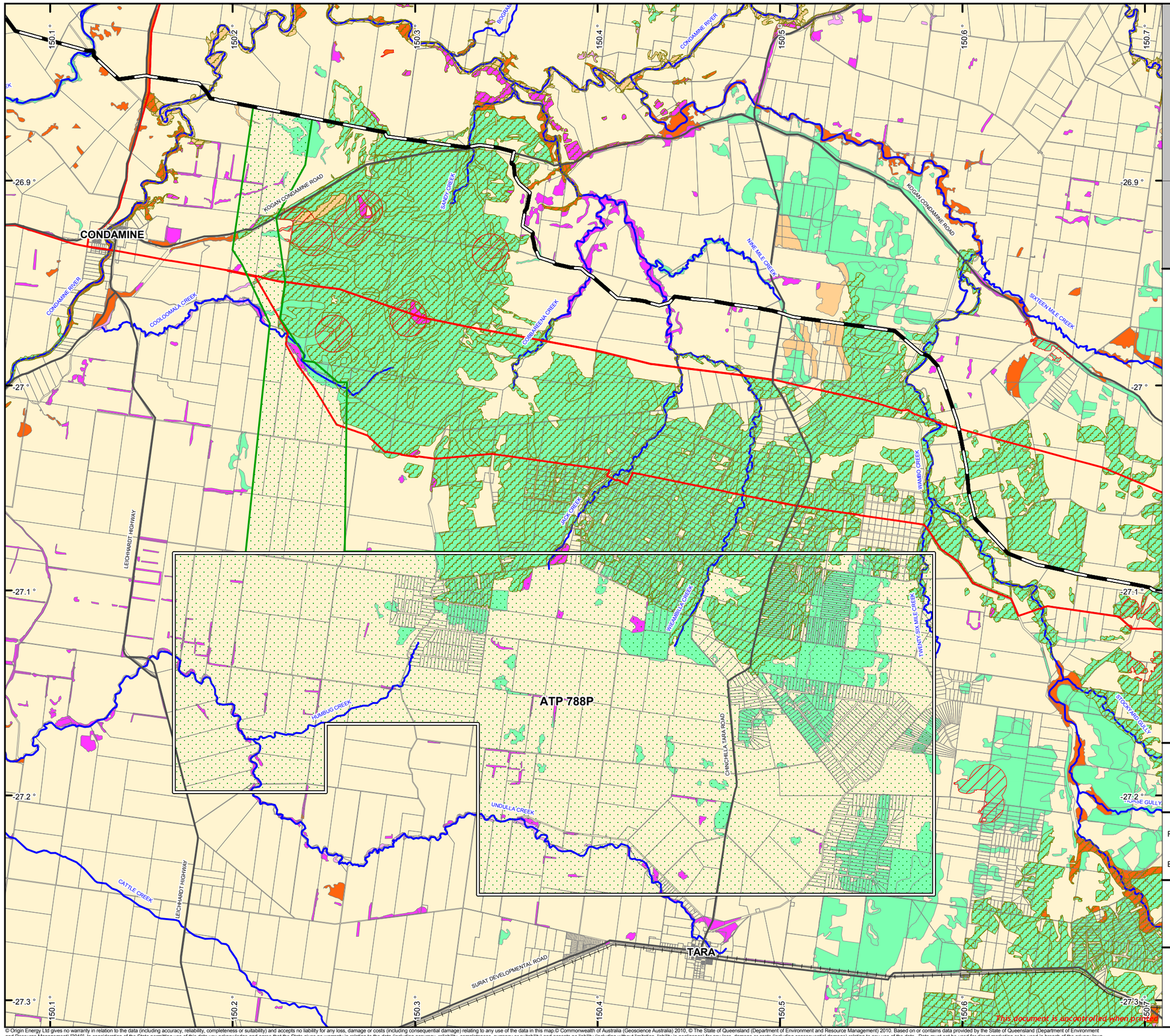
Drainage Lines:	IQATLAS QLD Remnant Drainage (Department of Environment and Resource Management, 2009)
Wetlands:	IQATLAS QLD Wetland System 100k (Department of Environment and Resource Management, 2009)

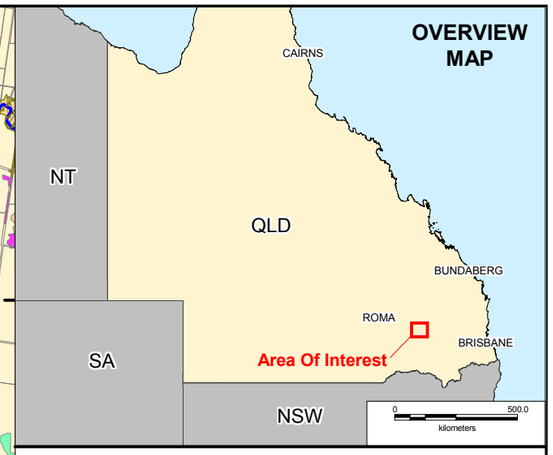
origin

IRONBARK PROJECT

Initial Advice Statement
Figure 2.6 - Surface Water Hydrology

This document is uncontrolled when printed





Legend

Tenure
- EIS Study Area
- ATP 788P
- Cadastral Parcel

Infrastructure
- Darling Downs Pipeline
- High Pressure Gas Pipeline
- Railway
- Major Road
- Drainage Line

Environment
- Bioregional Corridor
- Essential Habitat

Remnant Regional Ecosystem
- Endangered - Dom
- Endangered - Subdom
- Not of Concern
- Of Concern - Dom
- Of Concern - Subdom

Study Area Version: 4
Date: 02/11/2010

N

2 0 2 4 6 8 km

Scale (A3): 1 : 200,000 - Lat Long GDA94

DATA SOURCE INFORMATION

Regional Ecosystems: Regional ecosystems mapping v6 (Department of Environment and Resource Management, 2010)

Bioregional Corridor: Biodiversity Planning Assessment (Department of Environment and Resource Management, 2010)

origin

IRONBARK PROJECT

Initial Advice Statement
Figure 2.7 - Vegetation, Flora and Fauna

This document is uncontrolled when printed

2.9 Cultural Heritage

2.9.1 Existing Environment

Indigenous Heritage Values

The relevant Aboriginal parties for the study area are the persons who constituted the Registered Claimant on the former Barunggam and Western Wakka Wakka claims. As part of the Project Origin will build on relationships with these groups which have been established through other Origin Energy projects.

The study area forms part of a broader landscape where Indigenous Heritage has been located. Previously studies conducted across the western downs region have identified known sites including scarred trees, scatters of stone artefacts and shell middens.

Shared Heritage Values

There are currently no sites within the study area that are listed on the Queensland Heritage Register or the Australian Heritage Database. The study area, however, has a rich pastoral history and sites of local heritage significance are likely to be present. The shared heritage values of the study area will be investigated as part of the EIS.

2.9.2 Potential Impacts

Indigenous Heritage Values

Construction activities have the potential to disturb or damage significant areas or objects. Managing the impact of the Project on Aboriginal cultural heritage will be undertaken within the framework of the Aboriginal Cultural Heritage Act, 2003. Cultural heritage assessments of the study area will be undertaken with relevant Aboriginal parties to identify Aboriginal cultural heritage. Where not covered by existing plans, Cultural heritage management plans (CHMPs) will be negotiated with the relevant Aboriginal parties to establish protocols for managing potential impacts to Aboriginal cultural heritage during construction. This may also be done via native title agreements with the relevant parties for land subject to Native Title.

Shared Heritage Values

Construction activities have the potential to disturb or damage previously unrecorded and significant heritage sites and artefacts. Project facilities will be designed and located to minimise the potential impact on identified culturally significant areas listed under the Queensland Heritage Act, 1992.

Procedures will be put in place to identify, record and assess heritage items uncovered during construction, so that appropriate management of these items and sites can occur.

2.10 Waste

2.10.1 Existing Environment

The proposed development area is currently relatively undeveloped and is largely rural in character. The main existing waste disposal facilities comprise local Council landfills.

2.10.2 Potential Impacts

General Waste

During construction and operation of the gas plants and sales gas pipeline, the following general wastes are likely to be produced:

- General domestic garbage from onsite construction workers
- Paper, cardboard and timber from packaging
- Scrap steel and batteries
- Grey water and sewage from onsite amenities
- Waste hydrocarbons and oily rags from equipment maintenance and refuelling
- Non-hazardous wastes associated with mandatory maintenance shutdowns
- Process Wastes
- Gas Plant waste water.

Water Treatment Plant Wastes

Depending on the final design of the Project, a water treatment plant may be required to process CSG water. Water separation is undertaken at the well head with the CSG water being transferred to the water treatment plant holding / settlement ponds. A water treatment plant's primary function is to reduce the salts in the CSG water stream produced from CSG wells. Such plants typically contain an integrated membrane system (includes reverse osmosis and ion exchange filters) which produces highly saline brine (salt content in the order of 30,000 mg/L TDS). The brine is then directed to lined ponds for containment. The treated water is then available for commercial and beneficial reuse, as discussed in Section 1.5.1.

2.11 Traffic and Transport

2.11.1 Existing Environment

Major highways in the area are likely to be used to deliver materials for the construction phase and to transport supplies and equipment needed for the operational phase of Project. The major highways relevant to the Project are the Moonie, Warrego and Leichhardt highways. The Surat Development Road and the Chinchilla Tara Road also run through the study area. There is also an operational railway which connects Tara to Brisbane via Dalby. This may also be used for the transportation of

supplies and equipment. There are a number of smaller locally controlled roads which will be used during construction and operational phases of the Project by on site staff and contractors.

2.11.2 Potential Impacts

The Project is expected to result in existing roads being upgraded and new access roads being constructed in some locations. The locations for these roads and any required upgrades will be assessed during the Project's detailed design phase and the EIS process. The establishment of new and upgraded roads will involve stakeholder consultation, including landowners.

2.12 Socio-Economic Environment

2.12.1 Existing Environment

The study area is entirely within the Western Downs Regional Council area. The largest towns close to the study area, and their respective populations, are as follows (ABS, 2006):

- Tara - 819
- Miles - 1,164
- Chinchilla - 3,682
- Dalby - 9,778.

Communities within and adjacent to the study area and broader region are facing significant opportunities and challenges due to regional development led by the resources sector.

2.12.2 Potential Impacts

As part of the EIS, a comprehensive socio-economic assessment of the development area, including development of a Social Impact Management Plan, will be conducted to understand any adverse effects on people, their livelihoods and lifestyles, and the economy in the area, and to ensure that any impacts are properly managed and positive effects are enhanced. Potential socio-economic impacts may include, but not be limited to:

- Increase in employment and service and supply opportunities boosting the local economy
- Increased demand for construction and operational workforce resulting in shortage of skilled and unskilled labour
- Impact on community values and lifestyle as a result of changed regional dynamics
- Increase in demand on social services such as schools, leisure and recreation, medical support, hospitals and police
- Road safety compromised if increased traffic movements are not managed effectively
- Competing demand for land resource (e.g. agriculture versus resource use).

Rural residential residents in the Tara area have previously raised concerns about the impact of CSG projects within or adjacent to areas of rural residential development. These concerns mainly relate to

land access, noise, air quality, safety and perceived health impacts associated with CSG extraction. The concerns of rural residential residents will be considered as part of community consultation to be undertaken for the Project and mitigation measures will be identified as part of the EIS process.

2.13 Hazard and Risk Assessment

Risk assessments, consistent with Australian / New Zealand Standard for Risk Management AS4360:2004 and AS2885, will be conducted to identify and assess potential risks during the construction, operational and decommissioning phases of the Project.

Hazard identification studies will be carried out during the EIS process to identify the nature and scale of hazards which have the potential to occur if not properly managed. This would examine such items as:

- Construction accidents
- Pipeline, processing unit or storage vessel rupture or loss of containment, and explosions and fires associated with such incidents
- Release of liquid gaseous or particulate pollutants or any other hazardous material used, produced or stored on the site
- The extent of thermal dispersion and resulting hazard / ignition zones following accidental or deliberate release
- Natural events such as cyclones, earthquakes, bushfires or local flooding.

Risk analyses and draft risk management plans will be provided in the EIS for the construction, operational and decommissioning phases of the Project.

3. Stakeholder Engagement

3.1 Stakeholder Engagement Principles and Objectives

Origin Energy recognises the sustainability of its business necessitates being mindful of, and attentive to, the potential environmental and social impacts of its operations. Accordingly, Origin will implement principles and practices of stakeholder engagement and consultation with the Project's stakeholders. Origin is committed to respecting the rights and interests of individual citizens, relevant organisations and the communities in which the Project will operate.

3.2 Stakeholder Engagement Objectives

The key objectives of the stakeholder engagement program will be to:

- Raise awareness about the Project, its potential impacts and timelines amongst stakeholders
- Engage as early as possible in the assessment process to ensure stakeholders have sufficient time to consider the Project's potential impacts and potential mitigation strategies
- Explain the environmental impact assessment (EIS) process and provide an understanding of the regulatory approval process
- Actively listen to seek an understanding of potential stakeholder concerns, issues and interests
- Encourage stakeholder involvement and participation in the decision-making process to facilitate enhanced outcomes
- Foster regular and ongoing communication with stakeholders to ensure issues are captured and project information is made available
- Indentify opportunities to work together with stakeholders to develop recommended strategies that maximise project benefits and minimise adverse impacts.

A key objective of the engagement process is to build long-term, positive relations between Origin and stakeholders throughout all stages of the Project including planning, options analysis, construction, commissioning, operations and final decommissioning.

3.3 Stakeholder Engagement Process

As part of the process for environmental impact assessment under the EP Act, stakeholders have the opportunity to comment about the Project at two critical points in the assessment process.

These are at the release of the EIS terms of reference and Draft EIS report. However, Origin is keen to hear from interested stakeholders at any time.

The stakeholder consultation process shall involve a range of on-going activities to raise awareness about the Project and to seek stakeholder participation in the decision-making process. Relevant

stakeholders with an interest in the Project shall be identified and consulted to ensure information is provided to meet their specific interests.

Relevant agencies across the three tiers of government will be consulted in order to strengthen existing relationships or to establish new relationships, and to facilitate the identification of project approval requirements. This would include consulting with head office staff and also representatives of regional offices. Such meetings will cover a range of health, safety and environmental aspects related to the approvals phase, and construction and operational phases.

Engagement shall also be undertaken with the Project's other key stakeholders including individual landholders, Traditional Owner groups, rural lobby groups, and environmental and non-government organisations.

A range of two-way communication tools will be implemented to inform stakeholders and to elicit their input into the assessment process. These may include:

- Public meetings and/or information sessions
- One-on-one meetings
- Brochures, posters and/or fact sheets
- Media (print, radio, TV and internet)
- Establishment of community liaison groups.

As the Project gains momentum, consultation will also be undertaken with other operators and industries in the area to understand potential cumulative effects and identify synergies for input to the EIS process.

4. References

ABS. 2006. Census Data. http://www.abs.gov.au/websitedbs/d3310114.nsf/Home/census census stats. Accessed 6th July 2010. Last updated 29 January 2010. Australian Bureau of Statistics. Canberra.

Australian Bureau of Agricultural and Resource Economics (ABARE) 2009, Australian commodities: June quarter 09.2, vol. 16, no. 2, June quarter, ISSN 1321-7844, Australian Bureau of Agriculture and Resource Economics, Canberra.

BAAM. 2010. Terrestrial Ecology Desktop Assessment – Ironbark Project Southern Queensland. Draft Report prepared for Origin Energy. Biodiversity Assessment and Management Pty Ltd.

DERM. 2010. *Coal Seam Gas Water Management Policy*. Department of Environment and Resource Management. Brisbane.

DERM. n.d. *Information sheet: Summary of annual fees for environmentally relevant activities (ERA's)*. Department of Environment and Resource Management. Brisbane.

Maher J.M. (ed.) 1996, *Understanding and Managing Soils in the Murilla, Tara and Chinchilla Shires*, Department of Primary Industries Training Series QE96001, Brisbane.

Thackway, R. and Cresswell, I.D. 1995. *An interim biogeographic regionalisation for Australia: a framework for setting priorities in the National Reserves System Cooperative Program*, Version 4.0. Australian Nature Conservation Agency, Canberra.

Young, P. A. R., Wilson, B. A., McCosker, J. C., Fensham, R. J., Morgan, G. and Taylor, P.M. (1999). 'Brigalow Belt.' In: P Sattler and R Williams (eds), *The Conservation Status of Queensland's Bioregion al Ecosystems*. Environmental Protection Agency, Brisbane.

Appendix A - Origin Energy HSE Policy

Health Safety & Environment

Policy

ORG-HSE-POL-01

At Origin, we value the wellbeing of our employees, contractors, customers, the communities in which we operate and the environment. We are committed to responsible management practices that minimise any adverse health, safety or environmental impacts, and enhance benefits associated with our activities, products or services.

We have in place a Health, Safety and Environment management system for our activities that drives continual improvement. The HSE Management System outlines accountabilities to implement this Policy and requires that we:

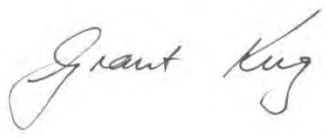
- Identify hazards and reduce risks to as low as reasonably practicable where there is potential to cause injury or illness to people, or to adversely impact the environment or the community
- Provide safe work places and systems of work, empower employees and contractors to address unsafe or hazardous situations and carry out their work in a manner that does not present a risk to themselves, others or the environment
- Support the recovery and rehabilitation of employees in the event of work related injury or illness
- Set objectives and targets which promote the efficient use of energy and resources, the minimisation of wastes and emissions and the prevention of pollution
- Comply with relevant HSE legal requirements and other commitments
- Require Contractors to manage HSE using standards and practices that accord with this Policy
- Regularly review and report HSE performance.

In implementing this Policy we will engage with our employees, contractors, suppliers, business partners, customers and Government and communicate expectations to all persons working with or on behalf of Origin.

Accountabilities

The Board is responsible for establishing and overviewing the Company's commitment to manage HSE in accordance with this Policy and for monitoring the performance of the Company with respect to its implementation.

The Managing Director is responsible for the implementation of the HSE Management System to ensure the commitments made in this Policy are being met.



Grant King
Managing Director
March 2010