Australia Pacific LNG Project

Volume 2: Gas Fields

Chapter 24: Environmental Management Plan

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24. Environmental management plan

24.1 Introduction

24.1.1 Objectives and scope

This environmental management plan (EM Plan) has been developed from the findings of Volume 2 of the Environmental Impact Statement (EIS) for the construction, operation and decommissioning of the Australia Pacific LNG Project gas fields in the Surat Basin in southern central Queensland. It has been developed in accordance with the terms of reference issued for the Project and aims to meet the requirements for EM Plans as specified in section 310D of the *Environmental Protection Act 1994 (*EP Act). It has been designed to be read as a stand-alone document and in doing so:

- Summarises the management strategies for the gas fields identified in the EIS
- Details the proposed performance criteria and implementation strategies to prevent or minimise environmental impacts
- Provides the government authorities and stakeholders with evidence that the environmental management for the Project is acceptable through demonstrating how Australia Pacific LNG environmental protection commitments will be achieved.

Once in place the EM Plan will be a dynamic document. It will be updated to incorporate:

- Further information
- Changes in environmental management measures further to information that becomes available during detailed design
- Changes to legislative requirements.

24.1.2 EM Plan format

Three EM Plans have been developed as part of the Australia Pacific LNG EIS; gas fields, gas pipeline and LNG facility. This EM Plan addresses the construction, operation, decommissioning and rehabilitation of the gas fields. Management measures have been developed for the following elements:

- Land management
- Terrestrial ecology
- Aquatic ecology
- Groundwater
- Surface water
- Associated water
- Air quality
- Greenhouse gases
- Noise and vibration

- Waste management
- Traffic and transport
- Indigenous cultural heritage
- Non-Indigenous cultural heritage
- Social
- Hazard and risk management.

The above elements are addressed in terms of performance criteria, implementation strategies, monitoring, auditing, reporting, and corrective actions, as detailed in Table 24.1.

Table 24.1 Environmental plan structure

Element/issue	• Aspect of construction or operation to be managed (as it affects environmental values)
Operational policy	• The operational policy or management objective that applies to the element
Performance criteria	• Measurable performance criteria (outcomes) for each element of the operation
Implementation strategy	• The strategies, tasks or action program (to nominated operational design standards) that would be implemented to achieve the performance criteria
Monitoring	• The monitoring requirements to measure actual performance (i.e. specified limits to pre-selected indicators of change)
Auditing	• The auditing requirements to demonstrate implementation of agreed construction and operation environmental management strategies and compliance with agreed performance criteria
Reporting	• Format, timing and responsibility for reporting of auditing and monitoring results
Corrective action	• The action (options) to be implemented in case a performance requirement is not reached and the person(s) responsible for action (including staff authority and management structure)

24.2 Project description and petroleum activities

Australia Pacific LNG proposes to develop a world scale long-term coal seam gas (CSG) to liquefied natural gas (LNG) project in Queensland. The 30 year Project has the following objectives:

- Development of the Walloons gas fields in the Surat Basin in southern central Queensland with up to 10,000 CSG wells
- Construction and operation of a 450km main gas transmission pipeline ('the gas pipeline') to connect the Walloons gas fields with the LNG facility near Laird Point
- Construction and operation of an LNG facility near Laird Point on Curtis Island near Gladstone for production and export of approximately 18Mtpa of LNG.

This EM Plan covers the gas fields which will be constructed and operated by Origin Energy Limited (Origin) on behalf of Australia Pacific LNG Pty Limited (Australia Pacific LNG). The gas fields cover an

area of approximately 570,000ha and are located in three regional councils; Maranoa, Toowoomba, and Western Downs.

The gas fields include the construction and operation of the following infrastructure:

- Up to 10,000 wells
- Underground gas and water gathering networks
- Water transfer stations (WTS)
- Gas processing facilities (GPF)
- Water treatment facilities (WTF)
- Brine ponds
- Underground high pressure gas pipelines and water transfer pipelines
- Warehouses, accommodation facilities and administration buildings.

Gas wells

Up to 10,000 gas wells will be drilled across the gas fields with approximately 5,000 drilled by 2021 and the remainder by 2046. The wells are typically 600m to 1000m deep and will produce both gas and associated water.

The typical surface facilities associated with the wells consist of the following components:

- A wellhead through which the gas and associated water is brought to the surface
- A wellhead separator with associated control devices
- A motor to drive the sub-surface pump that lifts the associated water to the surface, as necessary
- A power supply to drive the sub-surface pump.

Each well lease is presently approximately 1ha during the construction phase and reduced to approximately 0.02ha during operations.

Gas and water gathering networks

Following separation of the gas and water at the wellhead separator, the low pressure gas flows into a network of low pressure buried pipelines made of high density polyethylene (HDPE) pipe. These connect the wells operating in an area to form the gas gathering network which direct the gas to the nearest GPF.

The associated water flows into a similar buried HDPE gathering network. Water may either flow directly to the nearest WTF or to a WTS.

Where possible, the gas and water pipelines will be co-located and installed next to existing infrastructure such as access roads or fences.

Water transfer station

Up to 33 WTSs will be constructed across the gas fields which will consist of a pond (lined), a pump and small power generator. WTSs are required in areas of elevation change to assist in pumping the water to the nearest WTF.

Gas processing facilities

GPFs collect the gas from the gathering system, boost the pressure and lower the moisture content for transmission to the LNG facility in Gladstone. Up to 23 GPFs will be constructed across the gas fields ranging from 75TJ/d to 225TJ/d. Each GPF will be comprised of:

- Inlet separation – removes water from the gas stream
- Compression units - a combination of rotary screw compressors to provide the initial pressure boost, followed by reciprocating compressors to meet the required transport pressures
- Dehydration units - to remove water in the gas so it meets the required specification for transmission in the pipeline
- Power generation
- Flare facilities - safe combustion of coal seam gas during short-term periods of compression outage or unscheduled stoppage of the entire gas processing facility
- Administration, maintenance and warehousing facilities.

Water treatment facilities

WTFs consist of lined associated water feed ponds, reverse osmosis facilities, lined storage ponds for high salinity reject water (brine ponds) and power generation.

Associated water from gathering networks flows into the feed pond at the WTF. The pond serves as the inlet collection system for the facilities and provides buffer storage capacity, some cooling, and separation of coarse suspended solids. The water is pumped from the feed pond to the reverse osmosis unit, where it is pre-treated using very fine filtration before being directed to the actual reverse osmosis system.

Two streams are produced from the treatment, treated water ('permeate') and brine. The brine is routed to the brine pond. The preferred option at this stage from a social and environmental perspective is to use the permeate in reasonable proximity to the location of the WTF.

Opportunities for beneficial use of the permeate are being evaluated and include but are not limited to:

- Environmental flows
- Irrigation of crops
- Urban water supply
- Industrial use
- Injection into aquifers
- Aggregation of coal seam gas industry water for regional beneficial uses.

Brine ponds

Up to four brine ponds may be constructed in the gas fields ranging in size from 140ha to 280ha (including the existing 70ha Talinga pond) depending on opportunities for beneficial use. The brine ponds will be lined and allow the brine stream to concentrate via evaporation. Final salt disposal options are still under investigation however they could potentially include:

- Production of potentially saleable salt products

- Salt crystallisation and the burial of salts in approved waste management facilities
- Injection of high concentration brines into deep, hydraulically isolated geological reservoirs.

High pressure gas pipelines and water transfer pipelines

High pressure gas pipelines will connect the GPFs to the main gas transmission pipeline. Approximately 800km of steel pipeline will be constructed underground including connection to the existing Spring Gully gas plant and connection to the Darling Downs Power Station pipeline.

Water transfer pipelines will connect the WTSs, WTFs and brine ponds. Approximately 1,020km of underground steel pipeline will be constructed throughout the gas fields.

Associated infrastructure

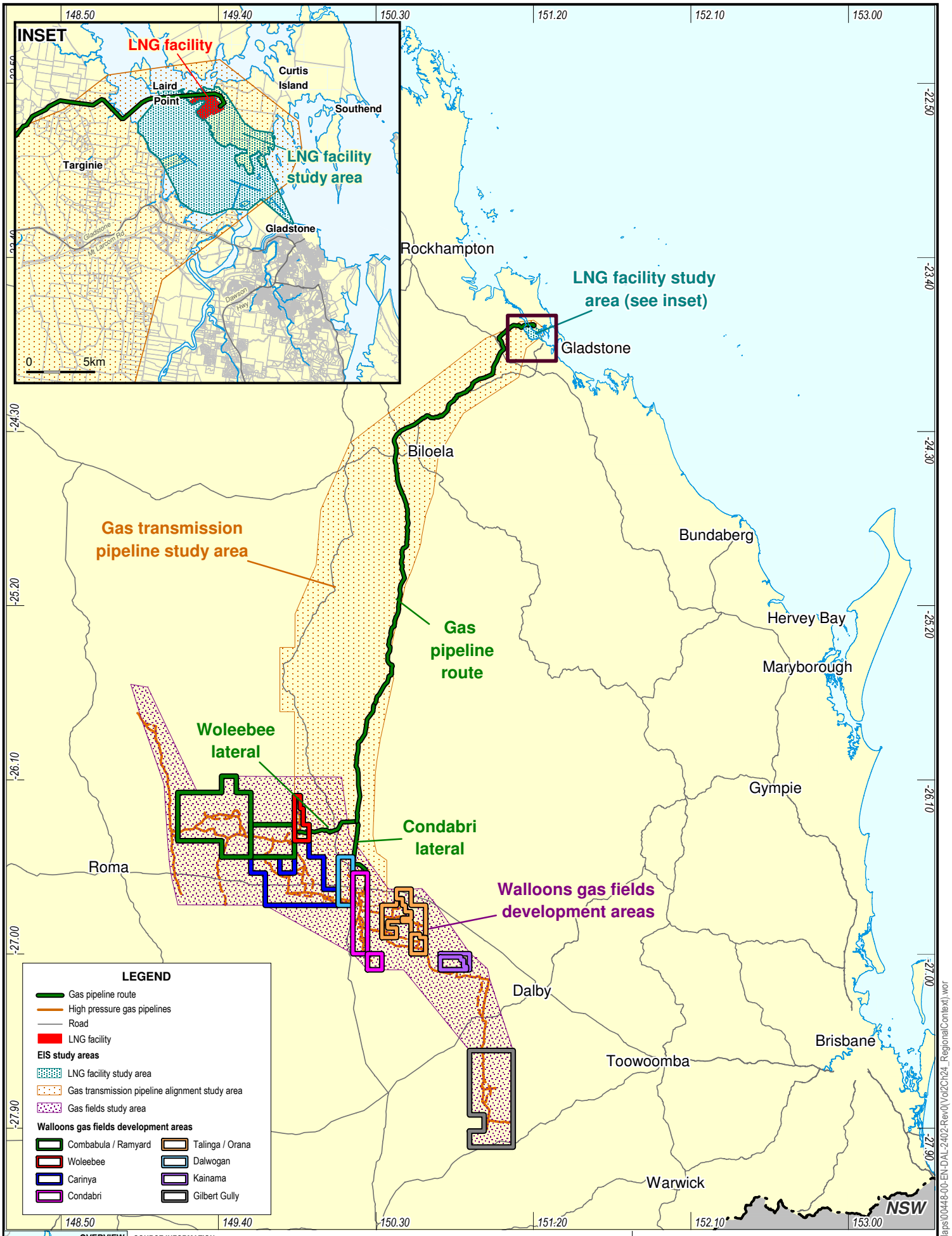
Associated infrastructure required for the Project includes access roads, laydown areas, telecommunications, sewage infrastructure, warehouses, administration buildings and temporary and permanent accommodation facilities.

Gas fields tenements

The gas fields comprise the tenements listed in Table 24.2 and shown on Figure 24.1.

Table 24.2 Gas fields tenements

Name	Tenement
Combabula/ Ramyard	PLA 297
	ATP 606
	ATP 972 (application)
Woleebee	PL 209
Carinya	ATP 973 (application)
Condabri	ATP 702
	PLA 265
	PLA 266
	PLA 267
Talinga/Orana	PLA 272
	PLA 215
	PL 226
	ATP 692
Dalwogan	PLA 216
	ATP 692
Kainama	PLA 225
	PLA 289
	ATP 692
Gilbert Gully	ATP 663



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24.3 Origin Health, Safety and Environment Management System

24.3.1 Introduction

As mentioned in section 24.2, Origin will operate the gas fields for Australia Pacific LNG. Origin operates under an established Health, Safety and Environment Management System (HSEMS) to minimise and manage the impacts on employees, contractors, the environment and the communities in which the company operates. The HSEMS has been developed with reference to Australian/New Zealand Standard ISO 14001 - Environmental Management Systems. The framework for the HSEMS 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 and support the Health, Safety and Environment (HSE) Policy. The HSE Policy is provided in Figure 24.2.

24.3.2 Standards

The objectives of Origin's HSE Management Standards are to:

- Set and formalise expectations for the progressive development and implementation of more specific requirements within Origin Business Units
- Provide auditable criteria against which the HSE Management System can be measured
- Provide a basis from which to drive continual improvement.

The 20 HSE Standards define what must be achieved rather than how to achieve it. Therefore Business Units have the flexibility to meet the requirements of the standards while maintaining consistency across the Company.

The system also provides assurance of diligence, so that in the event of a failure, it can be demonstrated that all reasonable and foreseeable steps have been taken to avoid the failure.

Origin's HSE Management Standards are mandatory and form the basis for the development and application of HSE Plans at all levels of the company. The content of the Standards and structure of Origin's HSEMS are fully described at http://www.originenergy.com.au/1780/HSE-Policy

origin

Policy

Health, Safety & Environment

At Origin Energy, 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 arising from our activities, products or services.

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

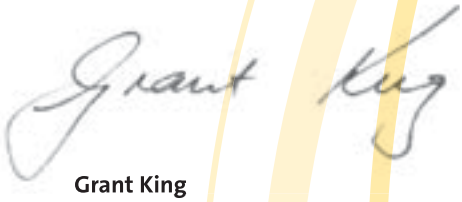
- Identify and manage risks to as low as reasonably practicable where they have the potential to cause an accident, injury or illness to people, or unacceptable impacts on the environment or the community;
- Provide safe work places and systems of work, empower employees and contractors to address unsafe 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;
- Ensure compliance 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 Energy.

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
September 2007

Review Date: September 2009

Health Safety and Environment
HSE ms
Management System

24.3.3 HSE plans

A requirement of Origin's HSEMS is to prepare a Health, Safety and Environment Plan (HSE Plan). The structure of the HSE Plan is outlined in Figure 24.3 . Each plan is comprised of a HSE Management Plan and a HSE Action Plan. The management plan describes how compliance with the HSEMS is achieved and identifies personnel responsible and accountable for its implementation. The action plan specifies the activities that must be undertaken to achieve compliance including monitoring, reporting, auditing and timeframes in which the activities must be completed. The outcomes from the action plan are fed into the HSE Management Plan to ensure continual improvement is achieved.

The HSE Plan describes how the assessed risks are controlled and provides processes for assessing new risks. It provides processes for corporate and external reporting, close out of audit findings, licence condition compliance, audit and inspection schedules, training requirements etc.

HSE Plans will be developed for all parts of the operations and will focus on the following:

- Continual improvement of petroleum activities and operations and assessment of new technologies
- Training of employees and contractors on environment and cultural heritage aspects relevant to their roles and responsibilities (Section 24.3.5 provides further detail)
- Monitoring of key potential impacts based on risk such as surface and groundwater, weeds, erosion and success of rehabilitation with follow up actions conducted when necessary
- Reporting internally to promote continual improvement of HSE systems by routinely collecting and communicating HSE performance information
- Reporting externally to relevant authorities (such as the annual return) and the public in the Sustainability Report
- Rehabilitation of disturbances following construction to as close to previous landuse as practical
- Environmental auditing both internally and externally of HSE Plan implementation, compliance with environmental authorities, and other key health, safety and environmental aspects (Section 24.3.8 provides further detail)

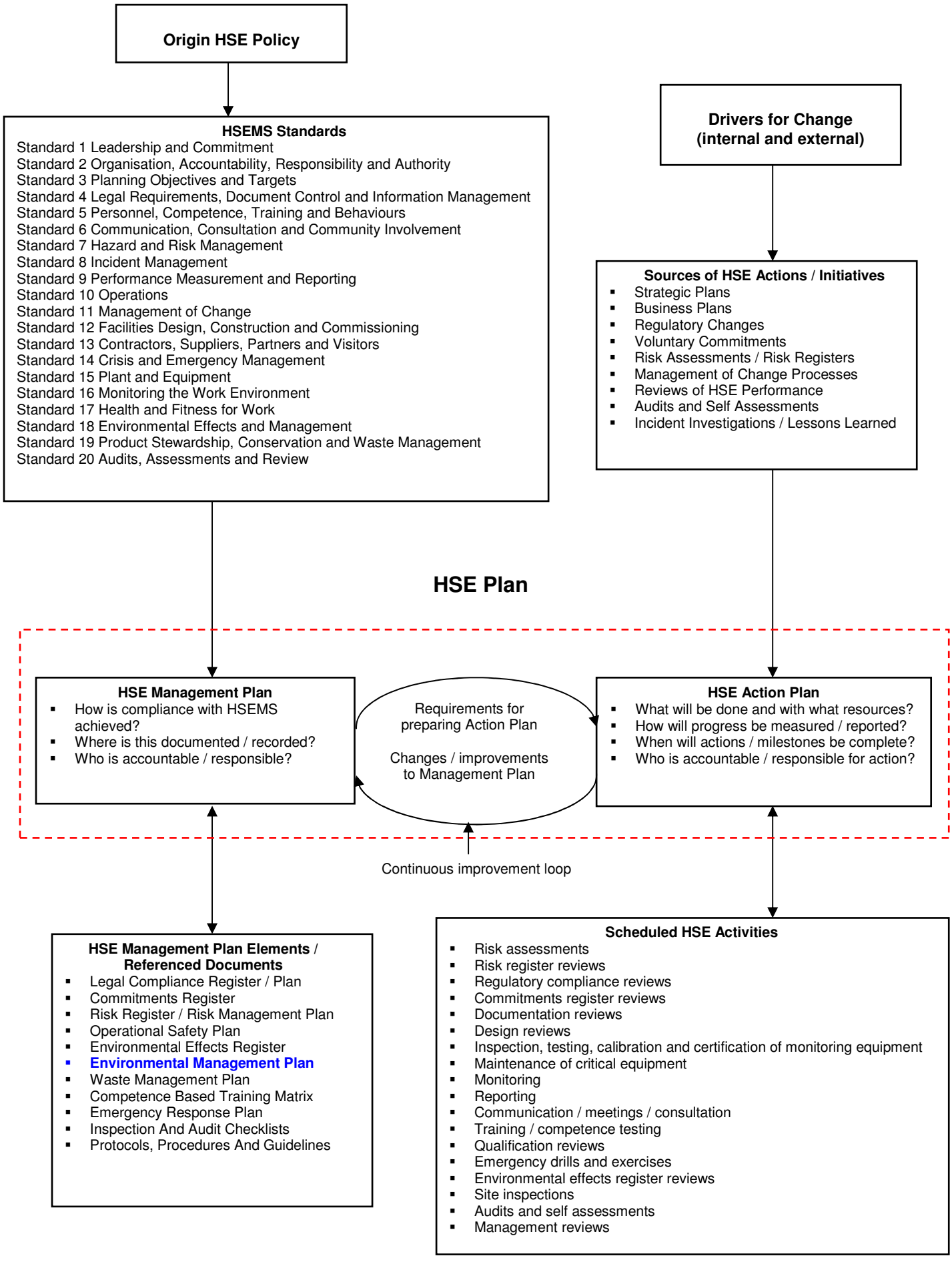


Figure 24.3 HSE Plan structure

24.3.4 Roles and responsibilities

All employees during the course of their activities are required to adhere to the general environmental duty as specified under Section 391 of the Queensland *Environmental Protection Act 1994* "A person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm. Employee responsibilities include:

- Complying with the requirements of applicable environmental legislation and environmental authorities
- Undertaking all activities in an environmentally responsible manner
- Conducting activities in accordance with this EM Plan and HSE Plans
- Participating in environment and cultural heritage training relevant to roles and responsibilities.

Specific roles and responsibilities for this Project are provided in Table 24.3.

Table 24.3 Roles and responsibilities

Role	Responsibilities
Construction/Operations Manager	• Ensure the necessary resources and processes are in place for implementation of the EM Plan • Ensure non-conformances are identified, recorded and reported • Work with the environmental group in planning and implementing environmental requirements • Ensure legal compliance
Site Supervisor	• Ensure the EM Plan requirements are implemented and maintained • Ensure non-conformances are identified, recorded and reported • Drive implementation of corrective actions • Work with the environmental group in planning and implementing environmental requirements
Site Operator	• Carry out the activities in accordance with the EM Plan • Carry out the necessary monitoring and reporting requirements • Identify and report non conformances • Implement corrective actions • Work with the environmental group in planning and implementing environmental requirements
Environment Group	• Develop and implement the environmental management manuals/procedures • Monitor the implementation and effectiveness of the EM Plan • Review and update the EM Plan • Conduct environmental auditing, monitoring and training

Role	Responsibilities
	• Complete environmental statutory reporting requirements • Provide advice on environmental matters and corrective actions as requested • Review statutory compliance and ensure all approvals in place

Origin has an environmental group dedicated to coal seam gas activities. This group identifies ecological constraints and specifies control measures to protect environmental values and minimise impacts. This group will be responsible for supporting compliance with statutory obligations, environmental commitments and this EM Plan to minimise impacts on the environmental values of the project area.

This group consists of two key components:

- Brisbane based environmental team - focused on long-to-medium term planning including working with engineering divisions to integrate environmental management, monitoring, systems development, auditing, external approvals, system and licence compliance
- Field based team - focused on medium to short term planning such as compliance monitoring of work zones and subcontractors, internal approvals, assisting employees during construction and operations, training, and providing advice on field activities.

The teams are structured to allow for growth as development expands, with specialist consultants supporting a core group of permanent environmental professionals.

24.3.5 Inductions and training

Origin has in place a hierarchy of training modules that dovetail with specific project roles and responsibilities.

The Australia Pacific LNG workforce is required to complete an e-induction prior to commencing work on any worksite. The e-induction introduces the workforce to Origins standards and environmental management requirements. In particular, the induction addresses:

- Environmental responsibilities and duties
- Noise and dust management
- Land disturbance procedures
- Flora and fauna
- Waste
- Weeds
- Landholder relations
- Cultural heritage
- Rehabilitation.

A site level induction is also required before commencing work on each particular worksite. The site induction provides more site specific information on environmental issues for that particular area. Formal training in environmental issues such as weed management, vegetation protection and soil

management will also be conducted for specific employees or contractors whose roles have the potential to affect these key aspects of the environment.

A kick off meeting is held with the workforce prior to work beginning in a new area. The kickoff meeting includes information on site specific environmental management requirements for that work area which were identified in the internal approval process such as erosion and sediment control, management of flora and fauna values and water management.

Regular tool box meetings are held which include a discussion on environmental aspects, recent incidents and observations and possible improvements in procedures. These meetings reinforce the training and promote greater awareness of specific issues. Site based environmental advisors will regularly interact with employees and contractors across work areas sharing knowledge and providing feedback on environmental management requirements.

Visitors receive an HSE induction appropriate to the nature of their visit and the site hazards to which they may be exposed.

24.3.6 Monitoring and reporting

Monitoring program

Origin's existing monitoring program will be adapted to include monitoring required for this Project. The management tables in Sections 24.7 to 24.21 identify element-specific monitoring.

Routine visual monitoring will be conducted, where specified in the management tables, and reported by exception only.

All instruments, equipment and measuring devices used for measuring or monitoring will be calibrated, operated and maintained effectively. Laboratory analysis and tests will be carried out by a National Association of Testing Authorities (NATA) accredited laboratory and monitoring will be conducted by a suitably qualified person.

Monitoring will be conducted to check compliance with licence condition limits and identify moderate (or higher) environmental risks.

Monitoring, management systems and programs detailed in this EM Plan will be reviewed on an annual basis and amended or refined on the basis of auditing and monitoring results.

Monitoring results will be compiled and kept for a minimum of five years.

An annual monitoring report will be prepared and provided to the administering authority when requested and will include:

- A summary of 12 months monitoring results and a comparison of the results against the limits set in the environmental authority and relevant previous results
- An evaluation/explanation of the data derived from any monitoring programs
- A summary of any quantities of releases
- An outline of actions taken or proposed to minimise the risk of environmental harm from any condition or contaminant level identified by the monitoring or recording programs.

Incidents

The existing Origin HSE incident reporting system is discussed in Section 24.3.7. Monitoring in response to an incident will be undertaken within a reasonable and practical timeframe to investigate reports of potential environmental harm or licence exceedence. The following spills of contaminants will be reported to the administering authority:

- Release of any volume of contaminants to water
- Release of volumes of contaminants greater than 200L of hydrocarbon or 2,000L of associated water to land
- Release of any volumes of contaminants where potential serious or material environmental harm has occurred or may occur.

The notification of emergencies or incidents will include the following information:

- The environmental authority number and name
- The name and telephone number of the designated contact person
- The location of the emergency or incident
- The date and time of the release
- The time the authority holder became aware of the emergency or incident
- The estimated quantity and type of any substances involved in the incident
- The actual or potential suspected cause of the release
- A description of the effects of the incident including any environmental harm that has occurred or may occur as a result of the release
- Any sampling conducted or proposed, relevant to the emergency or incident
- Actions taken to prevent any further release and mitigate any environmental harm caused by the release.

A written report will be provided to the administering authority within 14 days following the initial notification of an emergency or incident or receipt of monitoring results. The report will include:

- Results and interpretation of samples taken at the time of the incident and analysed
- Outcomes of actions taken at the time of the incident to prevent or minimise environmental harm
- Proposed actions to prevent a recurrence of the emergency or incident.

A written report on the results of any such monitoring will be provided to the administering authority within six weeks.

Complaints

Complaints received from external stakeholders will be investigated. The results of the investigation will be communicated back to the complainant within a reasonable timeframe with a record of the complaints and any actions taken recorded in the complaints database.

For complaints received from the administering authority, the results of the investigation (including an analysis and interpretation of any monitoring results) and abatement measures implemented will be

provided to the administering authority within 14 days of completion of the investigation or receipt of the monitoring results.

If any monitoring conducted to investigate a complaint indicates that emissions exceed the limits specified in the environmental authority or are causing environmental nuisance, then the following will be undertaken:

- Address the complaint including the use of alternative dispute resolution services if required; and/or
- As soon as practicable implement abatement or attenuation measures so that light, dust, particulate or odour emissions from the authorised activities do not result in further environmental nuisance.

The existing Origin complaints database, consistent with Australian Standards ISO 10002:2006 - Customer Satisfaction – Guideline for complaints handling in organisations will be used to record any issues raised by stakeholders.

The following will be recorded for received complaints:

- Name, address and contact number for complainant
- Time and date of complaint
- Reasons for the complaint as stated by the complainant
- Investigations undertaken in response to the complaint
- Conclusions formed
- Actions taken to resolve complaint
- Any abatement measures implemented to mitigate the cause of the complaint
- Name and contact details of the person responsible for resolving the complaint.

A record of complaints, incidents of environmental harm, and actions taken in response to the complaint or incident will be maintained and retained for five years.

24.3.7 Incidents and emergencies

The existing Origin HSE incident reporting system will be used for field activities conducted by the workforce. Environmental incidents and observations will be reported using the HSE Alert process. This process helps ensure appropriate attention to the incident or observation for prioritisation of any follow up action. The process also provides for field improvement opportunities and suggestions to minimise the existing or future environmental risk.

The reporting system has an incident and action tracking process to facilitate timely and effective close out of any identified actions arising from the incident.

The workforce is encouraged to report incidents and observations to support continual improvement. External environmental incident/spill reporting will be in accordance with current regulatory guidelines and the environmental authority. The process for reporting environmental incidents/spills to the DERM, as described in Section 24.3.6, will be displayed in Project site offices.

Processes, including risk assessment, are in place to identify hazards and potential emergency situations and their impacts. Emergency Response Plans are developed for sites and they document and communicate the actions to be taken including the interaction with Emergency Services.

Emergency response equipment is made available where required and maintained in good order. Minimum competence and training requirements are established and drills/simulations are periodically conducted including the involvement of external stakeholders. Plans are updated to incorporate learnings from previous incidents, incident investigations, drills and exercises and audit outcomes.

Incidents include monitoring results that identify environmental harm, a high risk of causing harm, or an exceedence of licence condition limits. Action will include:

- Confirming the exceedence and investigation process
- Taking necessary steps to rectify the situation
- Notifying the administering authority of the issue and taking actions to rectify the situation.

24.3.8 Inspections, reviews and audits

HSE inspections and reviews are scheduled and conducted at appropriate frequencies to assist with evaluating performance and compliance with the HSE management system and the environmental authority. These reviews address HSE management standard performance requirements and specific items such as commitments made in this EM Plan. The adherence to established schedules, scopes and corrective actions resulting from the inspections/reviews are monitored by Origin Corporate HSE.

Origin's Corporate HSEMS audit is conducted annually and provides an independent assessment against Origin's Corporate HSE standards. Each business unit is audited under this process at least every second year with the results of the audit and action plans monitored by senior management. The initial audit for this Project will be undertaken within a year from commencement of construction. An HSE audit program at a business unit level checks that each aspect of the business is operating under Origin's internal HSEMS and any external legislative requirements including the environmental authority.

Pre-qualification, selection and retention processes are applied to contractors and suppliers. Major Project Contractors are required to prepare an EM Plan that complies with HSE requirements such as the Project EM Plan and the environmental authority. The Contractor includes a draft EM Plan with the tender documentation and the final document is negotiated and approved prior to the commencement of work. HSE requirements are written into the contracts and audits of subcontracting companies' compliance are conducted regularly and in response to any incidents.

When third parties are performing services on behalf of Origin at a defined Origin controlled site, their HSE performance is considered to be within the overall Origin HSE performance.

24.3.9 Document control and records management

Systems are in place to ensure that HSE records are established and maintained and are accurate, legible and identifiable. HSE documents have established retention times consistent with legal requirements. Systems are in place to establish which documents are to be controlled with current versions readily available.

24.4 Project and field planning

24.4.1 Field development plan

Field development planning involves refining the location of major infrastructure and identifying suitable locations for wells, access tracks and flowlines. This planning usually commences 18 months

to two years out from commencement of the works for larger facilities. For initial exploration works where environmental impacts are much less project planning may commence 6-12 months from the activities commencing.

Once a field development plan has been conceptualised by the engineering disciplines, environmental constraints analysis from this EIS will be used to assess the various environmental and social values of the particular area. This planning identifies aspects which require additional, more detailed assessment via field studies, monitoring or modelling and refines the plan.

Results of additional studies and consultation with landholders and other external stakeholders will be used to further refine the development plan. Documents will be updated with the revised information and further external approvals obtained, as required (such as environmental authority amendments).

24.4.2 Detailed field planning and internal approval process

Detailed field planning examines individual construction zones or work areas and assesses the site specific impacts of that work area. Planning includes a risk based constraints analysis addressing environmental, social and cultural heritage issues.

The internal approval process starts with a desktop review of existing constraints mapping to identify the level of environmental risk from the proposed activity, potential locations of any protected flora and fauna as well as sensitive receptors. Constraint mapping uses aerial photography, ecological constraints mapping and erosion risk. An broad-scale overview of key constraints is provided in Figure 24.4. A review of initial studies and monitoring relevant to specific sites will also be undertaken as part of the desktop review. Environmental Protection and Biodiversity Conservation (EPBC) information obtained from the EIS will be used. The desktop review will also include a review of the environmental authority and EM Plan commitments.

The risk based constraints analysis identifies key risks at a site level and ensures that sufficient controls measures are incorporated into the internal disturbance approval, design documentation or tender specifications. The level of detail involved in field planning is based on risk. Low risk construction zones will generally be cleared areas with low erosion risk and set back from residences and watercourses. Risk generally increases with the number and level of constraints.

For lower risk sites (i.e. where environmental impacts are assessed by the desktop review as being low risk), an internal approval document which details standard conditions for construction compliance, combined with the desktop review summary will form the basis of the internal approval.

For high and medium risk sites more detailed studies including further field assessments may be required. These will be initiated well in advance of construction commencing and will ensure that any environmental risks are mitigated and adequate controls in place. Mitigation measures might include, for example, relocation of works, designing infrastructure to include additional controls or negotiating agreements with landholders.

Major infrastructure sites including GPF, WTF or accommodation facilities will require more detailed assessment and potentially additional background monitoring and predictive modelling at this stage. A document detailing environmental controls for construction will be produced.

The internal approval document is prepared by environment personnel in parallel with cultural heritage and the stakeholder relations representatives and signed off by the Senior Manager for the CSG asset before construction can commence.

The need for a presence of environmental personnel during construction is assessed by risk. Field environmental personnel can attend the site at various times during construction including:

- Initial kick off meeting
- Toolbox meetings (held regularly before each shift)
- Site inspections or audits
- In response to a request from site personnel
- In response to an incident, observation or community concern.

Larger developments or major infrastructure sites will generally have a higher presence during construction. For example, the existing Spring Gully and Talinga projects presently have dedicated environmental team members available at each site.

24.5 Risk assessments

Risk assessment is a process that evaluates the likelihood (probability and exposure) and consequences (magnitude) of positive and negative environmental effects occurring as a result of exposure to one or more hazards.

Risks associated with developing and operating the Australia Pacific LNG gas fields have been assessed using a well-established approach to identification and evaluation. These assessments have been conducted in accordance with Australian Standards and industry guidelines. This methodology includes the following continual processes:

- Establish the context
- Identify risks and hazards
- Analyse risks
- Evaluate risks
- Treat risks
- Monitor and review.

Where mitigation measures are required to reduce the risk to a tolerable level, controls have been identified within the management tables in Sections 24.7 to 24.21.

24.6 Financial assurance

The *Environmental Protection Act 1994* requires the holder of an environmental authority to provide a financial assurance in the amount and form required by the Department of Environment and Resource Management (DERM). This financial assurance is held as a security to cover the likely costs and expenses associated with rehabilitation of disturbed areas.

During the application stage for the environmental authority, Australia Pacific LNG will calculate the financial assurance for the construction and operation of the gas fields. The calculation will be in accordance with the DERM guidelines at the time.

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Mapping not refined within this area

Taroom Roma Wandoan Guluguba Wallumbilla Yuleba Jackson Dulacca Drillham Miles Chinchilla Burncluith Brigalow Kogan Macalister Dalby Condamine Surat Undulla Meandarra Moonie Cecil Plains Turallin

Battle Creek, Dawson River, Juandah Creek, Burrombah Creek, Bungaban Creek, Goodiaroo Creek, Leichhardt Highway, Taroom Road, Roma Taroom Road, Warrego Highway, Wallumbilla South Road, Wallumbilla Yuleba Road, Yuleba Creek, Tchamby Creek, Jackson Dulacca Road, Dulacca Creek, Cattle Creek, Blyth Creek, Wandoan Road, Jackson Drillham Road, Channing Creek, Woleebee Creek, Horse Creek, Guluguba Road, Isaac Highway, Dogwood Creek, Auburn River, Burncluith Road, Chinchilla Wondai Road, Burbaburn Creek, Challenge Creek, Jandowae Chinchilla Creek Road, Warra - Canaga Creek Road, Connection Road, Cooranga Creek, Condamine River, Dogwood Creek, Balonne River, Condamine Road, Meandarra Road, Undulla Creek, Surat Dev Road, Chinchilla Tara Road, Tara Kogan Road, Kogan Creek, Dalby - Kogan Road, Moonie River, Moonie Weir, Western Creek, Wilkie Creek, Meandarra - Talwood Road, Leichhardt Highway, Cecil Plains Turallin Road, Toowoomba Cecil Plains Road, Gore Highway

0 10 20km
SCALE - 1 : 1,000,000 (at A3)
Latitude/Longitude
Geocentric Datum of Australia 1994
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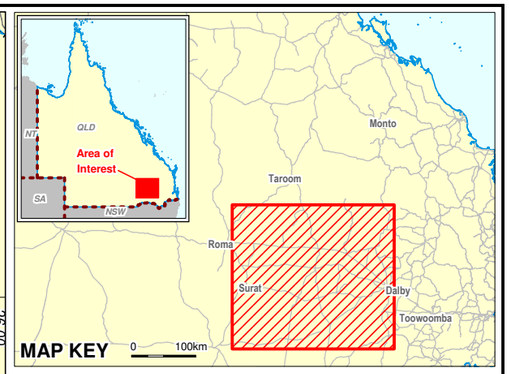

LEGEND

- Mapped artesian spring communities
- Major drainage
- Road
- Study area
- Railway
- Walloons gas fields development areas

Refined Bioregional Corridor

- Corridor Boundary

Environmentally Sensitive Areas

- Endemic threatened species
- Confirmed population of Weeping Myall
- Predicted critical habitat for BL 12
- Predicted critical habitat for BL 13
- Known significant ecological features
- 11.3.16 Eucalyptus Largiflorens
- Confirmed population of Yakka Skink

Terrestrial Ecology Sensitivity Ranking

- 1 Extremely
- 2 Highly
- 3 Sensitive

Erosion Hazard

- Very high
- Severe

Source Information

Environmentally sensitive areas
Biodiversity Assessment and Management Pty Ltd 2009

Queensland Wetland Data Version 1.2 - Springs
Queensland Herbarium, Environmental Protection Agency 2008

Refined bioregional corridor mapping
Biodiversity Assessment and Management Pty Ltd 2009

Erosion hazard
Created by WorleyParsons November 2009 from 25m DEM (Queensland Department of Natural Resources Mines and Water 2007) and Soil groupings/types combined and interpreted from Land Resource Data (Queensland Department of Natural Resources and Water 2008) by WorleyParsons October 2009.

Queensland Wetland Data Version 1.2 - Springs
Queensland Herbarium, Environmental Protection Agency 2008

AUSTRALIA PACIFIC LNG PROJECT

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Figure 24.4 - Summary of ecological constraints

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24.7 Land management

24.7.1 Environmental values

Geology

The gas fields soils and rocks are associated with the Bowen and Surat Basins. Structural geological features identified within the Bowen and Surat Basins consist of faults and folds, indicative of a regional compression towards west-south-west.

The Bowen Basin covers an area of approximately 160,000km^2 extending from the vicinity of Townsville, Queensland to central northern New South Wales (NSW). The Surat Basin overlies the southern half of the Bowen Basin and occupies an area of approximately 300,000km^2, extending from the southern part of central southern Queensland to central northern NSW.

The geological units across the study area are detailed in Table 24.4 below.

Table 24.4 Geological units

Geological unit	Age	Lithology summary	Dominant rock
Late Cainozoic floodout and residual sand, soil and gravel	Cainozoic	Sand, soil and gravel	Miscellaneous unconsolidated sediments
Quaternary alluvium and lacustrine deposits	Quaternary	Sand, silt, mud and gravel	Alluvium
Palaeocene-Oligocene sediments	Tertiary	Sandstone, mudstone, conglomerate	Sedimentary rock
Tertiary volcanics, mainly basalt	Tertiary	Volcanics, mainly basalt	Basalt
Wallumbilla Formation	Early Cretaceous	Mudstone and siltstone with calcareous concretions	Mudrock
Bungil Formation, Gubberamunda Sandstone, Hooray Sandstone, Kumbarilla beds, Longsight Sandstone, Mooga Sandstone, Orallo Formation, Southlands Formation	Jurassic – Cretaceous	Glauconitic, labile to quartzose, siltstone, mudstone; sandstone, minor conglomerate, siltstone; coal	Arenite
Injune Creek Group, Mulgildie Coal Measures, Walloon Subgroup	Jurassic	Sandstone, siltstone, mudstone, coal, conglomerate	Sedimentary rock
Evergreen Formation, Hutton Sandstone, Marburg Formation (in part), Precipice Sandstone	Jurassic	Siltstone, mudstone, sandstone, oolitic ironstone, coal	Arenite-mudrock
Texas Beds	Carboniferous	Greywacke, mudstone, slate, local phyllite; subordinate jasper, chert, conglomerate, limestone	Sedimentary rock

Topography and geomorphology

The gas fields study area is predominantly flat, with gentle undulations and rises (with slopes generally between 1% and 10%), as well as plateaus, low sandstone hills and lateritic scarps. Hills are generally in the order of 10% slope, and in some instances up to 20%. The gas fields study area is also transected by numerous water courses of varying channel size.

Soils

A range of soil types have been identified within the gas fields study area. Predominant soils were identified as shallow texture contrast soils (Sodosols, Kurosols and Chromosols) with significant areas of deep, dark cracking and non-cracking clays (Vertosols and Dermosols). The shallow texture contrast soils are predominantly used for grazing on improved and native pastures while shallow soils with a predominance of stone are used for forestry activities or rough grazing on native pastures. The cracking and non-cracking clays (particularly of alluvial origin) are the most productive soils in the region and are used for dry land and irrigated cropping and improved pasture. The texture contrast soils in particular were identified as commonly having highly sodic and dispersive subsoil.

Good quality agricultural land

Approximately 58% (331,187ha) of the gas fields has been identified as good quality agricultural land (GQAL). The best agricultural land (Class A) is mainly associated with the deep dark clay soils identified above and is located mainly on the alluvial plains formerly associated with Brigalow vegetation.

Land contamination

The gas fields are generally anticipated to be free form widespread adverse concentrations of contaminants, with only localised contamination expected form cattle dips, spray races and unauthorised waste dumps.

Landscape and visual amenity

The broader regional landscape, including the gas fields development area is characterised by gently undulating rural lands broken by localised forest covered ranges and mountains. These features provide visual variety to the landscape, with a mosaic of agricultural crops and pastures throughout the region. Networks of tracks, both sealed and gravel public roads, provide access to residences distributed throughout the area. Many road reserves throughout the study area frequently include roadside vegetation, often remnant, which provides visual screening to distant landscapes. Townships and rural settlements are dispersed throughout this landscape. Although the regional landscape is dominated by agricultural land uses, well-vegetated areas of closed and open forest are present throughout, particularly within state forest areas. Other common structures in the landscape include water tanks, sheds, silos and stockyards.

24.7.2 Potential impacts

The potential impacts are as follows:

- Changes to topography
- Changes to local drainage patterns and visual character
- Destabilisation of soils

- Loss of GQAL
- Disruption to farming operations
- Increase in soil compaction
- Alteration to overland flow
- Localised slope instability
- Local changes to stream morphology
- Loss of topsoil quantity and quality
- Increase in soil erosion including stream bank erosion
- Downstream sedimentation
- Increased dust generation including bulldust
- Increased salinisation of soils
- Soil and water contamination
- Undermining of structure (roads, buildings, fences)
- Visual intrusions on the landscape
- Lighting impacts on the landscape.

24.7.3 Land management

Table 24.5 Geomorphology, geology, soils, land use and land contamination – construction

Element/issue	Geomorphology, topography geology, soils, land use and land contamination – construction
Operational policy	To minimise impacts on geomorphology, topography, geology, soils and land use during the construction of the gas fields
Performance criteria	No contamination of land from construction activities All pre existing contaminated sites are identified prior to construction No significant failures of erosion and sediment control measures
Implementation strategy	Pre-construction surveillance will be undertaken by a suitably trained and qualified person to identify potential contamination where practicable Excavated material will be reused onsite, where practicable Major facilities, including GPFs, WTFs, WTSs and brine and water storage ponds, will be sited on relatively level sites (where practicable) for ease of landform rehabilitation following gas field completion Site assessments will be undertaken prior to disturbance to determine the appropriate topsoil stripping depth Timing of site clearance and rehabilitation will be coordinated with landholders, to minimise disruption to their farming operations

Element/issue	Geomorphology, topography geology, soils, land use and land contamination – construction
	Vegetation clearance will be minimised as far as reasonably practicable to reduce the potential for soil erosion
	Vegetation will be chipped and used as a protective mulch layer to facilitate revegetation and minimise erosion
	Nutrients (specifically nitrate and phosphorous) will be applied in some areas to improve topsoils, stabilise the subsoils and support vegetation regrowth during stockpiling and rehabilitation
	Stripped topsoil will be reused by application to areas where a similar soil type is required for rehabilitation. Where this is not possible, the topsoil will be stockpiled
	Height of the stockpiles will generally be limited to 2m to avoid damaging the topsoil and maintain fertility. Topsoils stockpiled for extended periods will be vegetated and the stockpile turned over and mixed prior to replacement
	Care will be exercised when stripping topsoils to minimise mixing soil types.
	Subsoils will be replaced at depth and covered with topsoil
	Progressive rehabilitation and stockpiling of soils near the site of excavation will be carried out to minimise potential blending between non-saline and highly saline soils
	Drilling fines will be isolated in sumps, buried and the site rehabilitated
	Site specific geotechnical investigations of areas with reactive soils will be undertaken during the front end engineering design phase
	Erosion and sediment control devices are to be constructed with reference to the Engineers Australia, Queensland Division guidelines; “Soil Sediment and Erosion Control Engineering Guidelines for Queensland Construction Sites”
	Erosion and sediment control measures (contour banks) will be placed at frequent intervals along flow paths, and directed to discharge at multiple locations at low velocities and volumes. This will avoid channelling runoff to a central point, which may exacerbate erosion
	Discharges will be into stable waterways and/or drainage lines. Engineering controls such as scour protection and flow velocity limits will be implemented
	Stockpiles and/or exposed soil areas (such as unsealed access tracks) which are exposed for prolonged periods or have been identified as problem soils (erosive/dispersive) will be stabilised as required using surface stabilisers or physical alternatives (crushed rock)
	Diversion, sediment and erosion control devices will be installed prior to construction commencing. These will remain in place until the area has been effectively rehabilitated
	Roads and tracks will be constructed across slopes where possible. Where tracks go down slopes, contour banks will be used at intervals appropriate to the slope to

Element/issue	Geomorphology, topography geology, soils, land use and land contamination – construction
	control the flow of surface water so as to minimise erosion Where pipes go down slopes, trench breakers will be installed in the backfill at intervals appropriate to the steepness of the slope to prevent water tunnelling along the buried pipe. On the surface, contour banks will be used to divert water off the disturbed areas Sediment basins will be constructed on the downhill side of major facility sites, when facilities are near sensitive water courses Topsoil will be re-spread over the bank it was removed from, and areas of disturbance will be seeded Any disturbed creeks will be rehabilitated to a condition consistent with the contours of the channel at the time of construction Revegetation will be conducted as soon as practicable after construction Landholders will be consulted where Project infrastructure is to be established in areas of GQAL, particularly to ensure timing of the works does not unduly affect farming operations. Where practicable, access tracks and flowlines will use or follow existing tracks, fence lines and road reserves Disturbed areas will be rehabilitated to vegetation types consistent with the surrounding environment If excavation works uncover unexpected contamination, work in proximity of the contamination will cease, and an inspection and assessment of contamination levels will be carried out. Remediation measures will then be recommended and implemented before construction continues Permanent fuel and chemical stores, and maintenance and refuelling areas will have secondary containment. Spill kits will be located throughout the construction site and training will be provided to the workforce Chemical, fuel and waste handling procedures will be implemented Infrastructure will be sited to minimise impacts to GQAL Ongoing assessments will be undertaken so potential impacts can be mitigated and GQAL mapping will be updated Fire prevention, fire watch and fire response procedures will be adapted to include the Project and implemented, particularly within forested areas Emergency response plans will be developed and tailored to individual project component situations
Monitoring	Bushfire weather forecasting and forewarning system will be monitored Routine visual monitoring including erosion and sediment control measures, will be undertaken to assess their effectiveness Routine visual monitoring of chemical and fuel storage facilities will be undertaken to assess the effectiveness of containment systems

Element/issue	Geomorphology, topography geology, soils, land use and land contamination – construction
	Monitoring will be undertaken in accordance with the HSEMS, as summarised in Section 24.3.8 and the requirements of the environmental authority
Auditing	The effectiveness of the land management implementation strategies and monitoring will be assessed during HSEMS and compliance auditing as described in Section 24.3.8
Reporting	Monitoring results, complaints, incidents/near misses and auditing results will be reported to demonstrate compliance with performance criteria, the environmental authority and the HSEMS as described in Section 24.3.6. Reporting will also identify opportunities for improvement in accordance with the HSEMS Results of monitoring will be included in the annual monitoring report for the administering authority where appropriate
Corrective action	Corrective actions will be undertaken in the event of a complaint or incident and based on the results of monitoring and auditing. The form of action will be aspect-specific but may include: Increased frequency of monitoring Improved bunding or enclosure of storage areas Rehabilitation of erosion controls Training and awareness programs. Confirmed and potential contamination of land as a result of an incident will be reported. The following actions may include but not limited to: An investigation into the cause(s) of the incident A qualitative assessment of the incident's extent and severity, and any impacts to environmental values, which may require input by persons that are suitably qualified under Section 381 of the EP Act Notification of the DERM if the incident is significant, as required in Section 371 of the EP Act A detailed contamination investigation following relevant guidelines existing at the time of the incident The detailed contamination investigation will determine the need for subsequent remediation and validation, or management to retain the environmental values of the affected area

Table 24.6 Geomorphology, geology, soils, land use and land contamination – operation

Element/issue	Geomorphology, topography, geology, soils, land use and land contamination – operation
Operational policy	To minimise impacts on geomorphology, topography, geology, soils and land use during the operations of the gas fields

Element/issue	Geomorphology, topography, geology, soils, land use and land contamination – operation
Performance criteria	No contamination of land from operation activities No significant failures of erosion and sediment control measures
Implementation strategy	Sediment and erosion control procedures will be developed and implemented to minimise concentrated flows and sediment runoff Detailed sediment and erosion control measures will be implemented in areas designated as having a high to severe erosion hazard Erosion and sediment control devices are to be constructed with reference to the Engineers Australia, Queensland Division guidelines; "Soil Sediment and Erosion Control Engineering Guidelines for Queensland Construction Sites" Discharges will be into stable waterways and/or drainage lines. Engineering controls such as scour protection and flow velocity limits will be implemented Sediment basins will be constructed on the downhill side of major facility sites, when facilities are near sensitive watercourses Permanent fuel and chemical stores, and maintenance and refuelling areas will have secondary containment Chemicals and fuels (including wastes) will be stored and handled in accordance with relevant Australian standards (such as AS1940:2004, AS3833:2007, AS3780:1994) and regulatory requirements Spill kits will be located throughout the site and workforce training will be provided Chemical, fuel and waste handling procedures will be implemented In the event of fire, identified contamination will be assessed and where appropriate remediated or managed in accordance with relevant legislation and guidelines Fire prevention, fire watch and fire response procedures will be developed and implemented, particularly within forested areas
Monitoring	Bushfire weather forecasting and forewarning system will be monitored Routine visual monitoring including erosion and sediment control measures and discharge areas, will be undertaken to assess their effectiveness Routine visual monitoring of chemical and fuel storage facilities will be undertaken to assess the effectiveness of containment systems Monitoring will be undertaken in accordance with the HSEMS, as summarised in Section 24.3.6 and the requirements of the environmental authority
Auditing	The effectiveness of the implementation strategies and monitoring programs for geology, topography, geomorphology, soils, land use and land contamination will be assessed during HSEMS and compliance auditing as described in Section 24.3.8
Reporting	Monitoring results, complaints, incidents/near misses and auditing results will be reported to demonstrate compliance with performance criteria, the environmental

Element/issue	Geomorphology, topography, geology, soils, land use and land contamination – operation
	authority and the HSEMS as described in Section 24.3.6. Reporting will also identify opportunities for improvement in accordance with the HSEMS Results of monitoring will be included in the annual monitoring report for the administering authority where appropriate
Corrective action	Corrective actions will be undertaken in the event of a complaint or incident and based on the results of monitoring and auditing. The form of action will be aspect-specific but may include: • Increased frequency of monitoring • Improved bunding or enclosure of storage areas • Rehabilitation of erosion controls • Training and awareness programs.

Table 24.7 Landscape and visual amenity – construction and operation

Element/issue	Landscape and visual amenity – construction and operation
Operational policy	Minimise short term and long term visual impacts of construction and operation of the gas fields on sensitive receptors
Performance criteria	Minimal complaints from the community during construction and operation No complaints from sensitive receptors during operation of the gas fields
Implementation strategy	Sensitive receptors within 1,000m of GPFs, 400m of WTFs and brine ponds, 300m of gas wells and 800m of accommodation facilities will be assessed. Where required, strategies will be implemented to screen or integrate the infrastructure into the landscape, in consultation with the landholder. The colours of infrastructure will be considered to minimise the contrast with the surrounding landscape **Gas Wells** Landscape works will be carried out adjacent to the well or around the sensitive receptor to achieve visual screening. For residences, landscape treatment would be undertaken in consultation with the landowner The extent of vegetation clearing for well pads and access roads will be minimised The amount of cut and fill to establish the pad will be minimised consistent with achieving gentle batter slopes for rehabilitation and land use post construction The pre-construction landscape characteristics of disturbed areas will be recreated to maximise visual integration where reasonable **Gas processing facility** The area of earthworks for the GPF and associated facilities will be minimised Separate pads for auxiliary facilities will be created on an 'as needed' basis

Element/issue	Landscape and visual amenity – construction and operation
	Lighting direction and lux will be assessed to avoid direct light effects on sensitive receptors Detailed analysis of the visual catchment of each GPF will be undertaken to establish if there are any sensitive receptors within 1,000m of the facility. Where needed, vegetation planting strategies will be established to screen or integrate the GPF into the landscape A landscape planting layout will be prepared for each GPF and a tree planting program will be implemented using treated water to establish tree belts around and through the various facility areas to achieve higher visual integration as seen from distant views Landscape treatment will be implemented at sensitive receptor viewer locations (as needed) **Water treatment facility** Vegetation clearing beyond building footprints and retention ponds will be minimised Earth works will be minimised, consistent with achieving gentle batters for rehabilitation purposes A tree planting strategy will be implemented to achieve visual integration Landscape treatment will be implemented at sensitive receptor viewer locations, as needed Protective fencing will be appropriately finished and signage co-located **Accommodation Facilities** Earth works will be minimised and, if needed, multiple terraces will be created rather than one large cut and fill pad. Landscape treatments will be developed and implemented to provide appropriate screening and or integration planting at sensitive receptor viewer locations, as needed **Microwave towers** Microwave towers will be removed once they are no longer required for communication purposes
Monitoring	Visual monitoring will be conducted following completion of the infrastructure to verify that new infrastructure is unlikely to cause light nuisance at any sensitive or commercial place and that landscaping treatments are located appropriately
Auditing	HSEMS and compliance auditing, as described in section 24.3.8, will include the assessment of the adequacy of visual amenity treatments
Reporting	Monitoring and auditing results and complaints will be reported, as described in section 24.3.6 in accordance with the HSEMS
Corrective action	Corrective action will be actioned based on the results of monitoring and auditing.

Element/issue	Landscape and visual amenity – construction and operation
	The form of action will be aspect-specific but may include: Increased density of plantings and Irrigation of plantings

24.8 Terrestrial ecology

24.8.1 Environmental values

The gas fields' falls within the Brigalow Belt South (BBS) bioregion and is a highly modified landscape, through which large, remnant tracts of vegetation persist. These larger remnant areas are primarily associated with higher altitude, less fertile lands supporting ecosystems that are well-represented regionally and are mostly incorporated within the State forest network.

The more fertile, lower altitude lands are intensively grazed, with smaller, isolated patches of remnant vegetation remaining. These patches are subject to grazing, changed fire regimes and introduced pasture grasses. Fauna species reliant on these ecosystems are also affected by their fragmentation, cattle damage and fire regimes.

Terrestrial flora

Based on the results of the literature review, expert opinion and ground surveys, 33 flora species of special conservation significance are known or considered possible occurrences within the study area, including 15 species listed as threatened under the EPBC Act, 25 listed as endangered, vulnerable or rare (EVR) or near threatened species under the *Nature Conservation Act 1992* (NC Act) and six listed as non-EVR priority species for the BBS bioregion.

Certified regional ecosystem (RE) mapping also indicates that the study area supports approximately 14,470ha (about 1% of the study area) of Essential Habitat for flora and fauna species listed under the provisions of the NC Act. Only 45ha of freshwater wetland communities are currently mapped, revealing the dry character of the local landscape.

Based on the refined vegetation mapping, 21 terrestrial vegetation communities of special conservation significance occur within the study area, 11 of which are analogous to endangered ecological communities under the EPBC Act and 13 and nine of which are listed as endangered according to their biodiversity status and *Vegetation Management Act 1999* status, respectively.

Nineteen exotic weed species were identified in the study area, none of which is of national significance; however, seven species are declared under the *Land Protection (Land and Stock Route Management) Act 2002* and 15 are recognised environmental weeds.

Terrestrial fauna

Following field survey and expert review, 98 species of special conservation significance are known or considered possible occurrences within the study area, including 14 species listed (or pending listing) as threatened and 28 species listed as migratory under the EPBC Act, 32 listed as EVR or near threatened species under the NC Act and 38 listed as non-EVR priority species for the BBS bioregion. Seventeen feral terrestrial vertebrate species are known from surveys and databases. Six of these species are recognised as Class 2 pests under the *Land Protection (Land and Stock Route Management) Act 2002*.

24.8.2 Potential impacts

The potential direct and indirect impacts to terrestrial flora and fauna are as follows:

- Clearing leading to habitat loss, edge effects and fragmentation
- Barriers to movement and entrapment in trenches or other open excavations
- Direct mortality of fauna
- Increased weed species
- Increase in feral predators
- Decreased prey abundance due to possible increased predation by feral species
- Increased competition for roosting sites and tree hollows used for nesting with other species displaced by clearing
- Altered behaviour of nocturnal species
- Erosion and sedimentation
- Altered surface and groundwater environment
- Soil and water contamination from oil, fuel or chemicals
- Salinisation of areas downslope of clearing
- Noise, dust, vibration and lighting
- Increased animal/vehicle collisions
- Increased frequency of fires

24.8.3 Terrestrial ecology management

Table 24.8 Terrestrial ecology – construction

Element/issue	Terrestrial ecology – construction
Operational policy	To construct the gas fields in a manner that minimises impacts to the abundance and distribution of terrestrial fauna and flora
Performance criteria	The risk of injury, harm, or entrapment to fauna and livestock will be minimised Land disturbance will be minimised including no clearing of sensitivity category area 1 No unauthorised clearing of native vegetation No unauthorised disturbance of EVR flora and the habitat of EVR fauna Implementation of vegetation management offsets strategy No uncontrolled outbreaks of declared weeds as a result of the Project activities No introduction of pest species as a result of the Project construction activities
Implementation strategy	An assessment of the condition, type and ecological value of the vegetation in new disturbance areas will be undertaken by a suitably qualified person based on risk prior to commencing construction

Element/issue	Terrestrial ecology – construction

Clearing management guidelines will be developed for sensitivity categories 2 to 5 aiming to reduce potential effects on fauna and adjacent habitats. Guidelines will include pre-development surveys for communities, REs and species of special conservation significance

Habitat management guidelines will be developed where any works are likely to occur within 200m of endangered ecological communities, endangered regional ecosystems, of concern regional ecosystems, Sensitivity Category 1,2 and 3 areas, and known habitat for EPBC Act and NC Act endangered or vulnerable species. These guideline will define measures to protect these areas from indirect impacts

Individual (or like-group) threatened species management guidelines will be prepared to identify management measures for known habitats to minimise potential impacts on their habitats and resources

Field assessments and impact mitigation measures will be developed and implemented for:

- Rock pavements within the Gurulmundi area
- Proposed telecommunications tower locations
- The Brigalow Woodland Snail (Camaenidae BL 12).

Ecological fire management guidelines will be developed and implemented to minimise potential impacts

Clearing in areas of high biodiversity value will be limited, particularly for:

- Category 1 areas – these areas will be avoided and protected with 'no go' zones and a buffer area established in accordance with the approved habitat management guidelines
- Categories 2 and 3 – in these areas, unless otherwise approved, all activity on undisturbed land will follow approved habitat management guidelines, infrastructure will be positioned along existing disturbed areas, and active rehabilitation will be implemented.

The Government and the community will be engaged to develop sustainable regional land use strategies that combine the interests of gas production, agriculture and biodiversity values

Topsoil will be removed and stockpiled in a manner that will preserve its biological and chemical properties

Workforce will be made aware of the location of any Sensitivity Categories 1 to 5 and the requirements of the clearing guidelines

Cleared vegetation will be stockpiled in a manner that facilitates respreading or salvaging and will not impede vehicle, stock or wildlife movements

Fauna management procedures will be developed and implemented to prevent or minimise harm or the potential risk of causing harm to fauna

Fauna management procedures will take into account the Australian Pipeline

Element/issue	Terrestrial ecology – construction
	Industry Association Code of Environmental Practice – Onshore Pipelines" and will also include the training of the workforce Planned fauna handling will be undertaken by suitably qualified persons A pest management program will be developed and implemented and include: • The identification of pest species and infestation areas • Measures to prevent and/or minimises the introduction and/or spread of pests • The control and management of pest outbreaks as a result of petroleum activities. The biosecurity management program will take into account the "Petroleum Industry (including coal seam methane gas) Minimising Pest Spread Guidelines" Weed wash down facilities will be constructed near Miles to support gas field construction and operations A vegetation offsets program will be developed that includes: • Developing offsets for each hectare of conservation significant vegetation removed for the Project • Considering ecological values at a regional and landscape scale when identifying locations for compensatory offset • Targeting offsets to enhance biodiversity corridors where practical • Using a third party provider to manage delivery of the regional program, supplemented with contributions to an administered fund • Developing and providing offsets to respond to a disturbance inventory. Guidelines for rehabilitation of areas to be disturbed during construction will be prepared and implemented. These will include the selection of suitable offset locations, protection and enhancement of regrowth vegetation and revegetation of currently cleared lands for offset purposes Progressive rehabilitation of disturbed areas will commence as soon as practicable following the completion of construction works
Monitoring	Routine visual monitoring of dust, weeds and the status of rehabilitation will be undertaken, particularly in areas supporting conservation significant species, to assess the effectiveness of control measures. Monitoring of rehabilitation and weed species will be undertaken in accordance with the HSEMS, as summarised in section 24.3.6 and a rehabilitation monitoring program and translocation plans
Auditing	The effectiveness of the terrestrial ecology control strategies will be assessed during HSEMS and compliance auditing as described in section 24.3.8
Reporting	Monitoring results, complaints, incidents and auditing results will be reported as described in section 24.3.6

Element/issue	Terrestrial ecology – construction
Corrective action	Actions will be specific to the impacts and may include: • Additional toolbox sessions to raise issues and reinforce controls • Further weed or pest control measures or rehabilitation as identified by investigations • Further reduced speed limits in area as identified by investigation

Table 24.9 Terrestrial ecology – operation

Element/issue	Terrestrial ecology – operation
Operational policy	To operate the gas fields in a manner that minimises impacts to the abundance and distribution of terrestrial fauna and flora
Performance criteria	No unauthorised clearing of native vegetation Minimal disturbance of EVR flora and the habitat of EVR fauna Implementation of vegetation management offsets strategy Minimise and control outbreaks of declared weeds as a result of the Project activities
Implementation strategy	Guidelines for management of clearing, threatened species, fire, measures for management of habitat and a plan for biosecurity as identified in Terrestrial Ecology – Construction (Table 24.8) will be implemented Progressive rehabilitation of disturbed areas will commence as soon as practicable following the completion of operational works A vegetation offsets strategy, as identified in Terrestrial Ecology – Construction (Table 24.8) will be established for each hectare of conservation significant vegetation removed for the Project
Monitoring	Routine visual monitoring of weeds and the status of rehabilitation will be undertaken, particularly in areas supporting conservation significant species, to assess the effectiveness of control measures. Monitoring of rehabilitation, and weed species will be undertaken in accordance with the HSEMS, as summarised in section 24.3.6 and a rehabilitation monitoring program and translocation plans
Auditing	The effectiveness of the terrestrial ecology control strategies will be assessed during HSEMS and compliance auditing as described in section 24.3.8
Reporting	Monitoring results, complaints, incidents and auditing results will be reported as described in section 24.3.6
Corrective action	Actions may include: • Additional training and education of construction teams • Further weed or pest control measures or rehabilitation as identified by investigations

Element/issue	Terrestrial ecology – operation
	• Further reduced speed limits in area as identified by investigation • Additional rehabilitation

24.9 Aquatic ecology

24.9.1 Environmental values

The gas fields are principally within the Condamine-Balonne and Dawson River catchments, with a portion of the southern gas fields' component (Gilbert Gully) within the Border Rivers catchment. Waterways across this region typically contain little or no flow for much of the year except for the summer, wet months (December-March).

There are no declared Wild Rivers within the gas fields.

Water quality

Waterways in the Condamine-Balonne catchment typically have elevated sediment and nutrients levels. Additionally, introduction of weed species and a decline in riparian condition, wetland condition and water quality have been identified as major environmental issues in the catchment.

The Fitzroy catchment has been impacted by stock, loss of riparian vegetation, diffuse pollution numerous dams and weirs leading to modified flow regimes and reduced water quality. Water quality within the catchment is generally characterised by low to moderate conductivity, high turbidity and suspended solids, high nutrients and elevated levels of metals.

The Border Rivers catchment has low conductivity, moderate turbidity and moderate Chlorophyll a. Total phosphorus and NOx varies from low to moderate within the catchment.

Macroinvertebrates

Reasonably diverse assemblages of mostly tolerant species (generalist feeders) were recorded from gas fields sampling sites during dry season surveys. None of the sites surveyed during the dry season contained macroinvertebrate communities that would typically reflect good water quality/habitat conditions.

Aquatic habitat, macrophytes and wetlands

Aquatic habitats in the Condamine, Balonne, Dawson and Border rivers were mostly of poor to very poor quality. However, some areas within the Condamine-Balonne catchment and one in the Upper Dawson River had good quality aquatic habitat. Additionally, one area located on Dogwood Creek had high quality aquatic habitat.

There was a limited presence of macrophytes in the catchments during dry season surveys. None of the few macrophytes recorded are notable species.

Several wetlands of national importance occur within the Condamine-Balonne river catchment, of which only two – Lake Broadwater (located 25km south-west of Dalby) and the Balonne River Floodplain complex, including the Ramsar listed Narran Lakes in the lower Balonne – are relevant to the study area.

Numerous Great Artesian Basin spring wetlands are also located within and adjacent to the gas field tenements and could potentially be affected by the proposed gas fields' development.

Geomorphology

The Condamine River in the study area exhibited in-channel ingressions (increased sediment supply and reduced bed variability) which may be a consequence of water extractions and land-use practices. Most reaches surveyed had limited channel diversity due to sediment accumulation on the channel bed. The reaches that flowed through or adjacent to the study area were generally highly disturbed. These disturbed conditions were less pronounced in the southern Condamine tributaries within the Gilbert Gully region.

The Dawson catchment watercourses within the study area exhibited increased erosion from waterway banks, increased sediment loads and resultant channel ingressions and decreased geomorphic variability.

All reaches surveyed in the Border Rivers catchment were highly disturbed with major in-filling evident at most sites.

24.9.2 Potential impacts

The potential impacts from the construction of the gas fields are:

- Increased delivery of sediments and nutrients to watercourses
- Disturbance to notable fish species
- Disturbance to threatened artesian spring communities
- Temporary diversion of watercourses
- Direct removal of flora
- Chemical or wastewater contamination
- Increased bank erosion
- Trenching and re-laying of bank and bed sediments
- Enhanced breeding of mosquitoes

The potential impacts from the operation of the gas fields are as follows:

- Alteration of flow regimes
- Elevated contaminant concentrations in streams into which permeate is discharged
- Low calcium concentrations in streams into which permeate is discharged
- Erosion of exposed surfaces at permeate discharge points
- Disturbance of threatened artesian spring communities
- Erosion from exposed surfaces
- Contamination of Lake Broadwater
- Chemical or wastewater contamination
- Brine pond overflows

- Creek bed and bank instabilities
- Altered low flow hydrology/hydraulics
- Enhanced breeding of mosquitoes.

24.9.3 Aquatic ecology management

Table 24.10 Aquatic ecology – construction

Element/issue	Aquatic ecology – construction
Operational policy	To minimise direct and indirect impacts to aquatic biota water quality, aquatic habitat and geomorphology during construction of the gas fields
Performance criteria	No deterioration of water quality, aquatic biota and waterway geomorphology as a result of construction activities No unauthorised release of contaminants directly or indirectly into watercourses
Implementation strategy	Watercourse crossings will be designed to not impede flow and therefore the passage of fish and other organisms An adaptive water quality and aquatic biota monitoring program will be developed and implemented for the discharge of permeate Erosion and sediment control devices will be designed and implemented according to regulatory requirements (Queensland Guidelines for Erosion and Sediment Control) Construction will be undertaken with consideration of wet weather Erosion and sediment control measures will be implemented to minimise any increase in water turbidity due to carrying out petroleum activities in the bed or banks of a watercourse or wetland, or a spring Appropriate management protocols will be implemented to prevent the introduction or translocation of aquatic or riparian weed and pest species Construction areas within the bed or banks of a watercourse, wetland or spring, will be rehabilitated to a condition that maintains the ongoing physical integrity and the natural ecosystem values of the site upon completion of construction activities Chemicals and fuels will be stored and handled in accordance with relevant standards and regulatory requirements including provision for spill response Sewage treatment facilities will be designed to prevent contamination of waterways Horizontal directional drilling for sensitive creek crossings will be considered The clearing of riparian vegetation will be minimised Clearing of vegetation or the placement of fill will not be conducted within 200m of a natural significant wetland, 100m from any natural wetland, lake or spring or 100m from the high bank of a watercourse with the exception of clearing required for roads and pipelines

Element/issue	Aquatic ecology – construction
	Ponds will be designed to address potential dam failure scenarios to minimise potential impacts to watercourses
Monitoring	Routine, regular and frequent visual monitoring will be undertaken while carrying out construction work and/or any maintenance of completed works in a watercourse, wetland or spring Water quality monitoring, prior, during and post construction upstream and downstream of creek crossings will be conducted based on risk. Geomorphic processes will be monitored upstream and downstream of watercourse crossings following construction
Auditing	The HSEMS and compliance auditing, as described in section 23.3.8, will include the assessment of the adequacy of control measures, aquatic monitoring, information assessment and any remedial measures
Reporting	Monitoring of results will be reviewed and assessed by suitably qualified personnel. Reports will be prepared in accordance with the HSEMS as described in Section 23.3.6, to accompany the results and to recommend actions as required
Corrective action	Corrective action will be conducted based on the results of monitoring and auditing. The form of action will be aspect-specific but may include: Modifications to stormwater controls Improved techniques for the construction of creek crossings If water turbidity increases in the watercourse, wetland or spring outside contained areas, due to the petroleum activities, works will cease and the sediment control measures will be rectified to limit turbidity before activities recommence

Table 24.11 Aquatic ecology – operation

Element/issue	Aquatic ecology – operation
Operational policy	To minimise impacts to aquatic biota, water quality, aquatic habitat and geomorphology during operation of the gas fields
Performance criteria	No deterioration of water quality, aquatic biota and waterway geomorphology as a result of construction activities No unauthorised release of contaminants directly or indirectly into watercourses
Implementation strategy	Discharges to watercourses will be designed to mimic the variability of natural flows to the best extent practicable, and meet regulatory requirements (recognising the practicalities and timing of establishing beneficial use) Discharges will be managed in accordance with the Adaptive Associated Water Management Plan Suitable permeate triggers percentage and associated monitoring program will be developed to protect aquatic biota in consultation with regulatory agencies (DERM).

Element/issue	Aquatic ecology – operation
	The permeate discharge will be amended where required to meet agreed water quality criteria, such as the application of calcium Appropriate management protocols will be implemented to minimise the potential for introduction or translocation of aquatic or riparian flora and fauna Mosquito management measures related to Project activities will be developed and implemented in accordance with the Mosquito Management Code of Practice for Queensland (Queensland Health 2002) Chemicals and fuels will be stored and handled accordance with relevant standards and regulatory requirements including provision for spill response An adaptive water quality and aquatic biota monitoring program will be developed and implemented Erosion and sediment control devices in accordance with Queensland Guidelines for Sediment and Erosion Control will be implemented and maintained Permeate discharge points will be located within geomorphologically stable reaches
Monitoring	Monitoring of flow, aquatic biota, geomorphology and water quality upstream and downstream of discharges will be undertaken Permeate discharge (timing, volume and quality) will be monitored to evaluate compliance with regulatory requirements. Monitoring results will be reviewed and assessed by suitable qualified personnel The channel, bed and bank stability will be monitored annually upstream and downstream of discharges. Bed and bank will be stabilised as required Watercourse crossings will be inspected at the end of each wet season until rehabilitation is successful Disturbed areas will be visually monitored for ponded, stagnant water
Auditing	The HSEMS and compliance auditing as described in Section 24.3.8, will include the assessment of the adequacy of activities associated with aquatic ecosystems and the control measures
Reporting	Monitoring results will be reviewed and assessed by suitable qualified personnel in accordance with the HSEMS as described in section 24.3.6. Reports will be prepared on at least an annual basis to accompany the results and to recommend actions as required
Corrective action	Corrective action will be taken based on the results of monitoring and auditing. The form of action will be aspect-specific but may include: Changes to the volume or water quality associated with environmental flow of permeate Modifications to stormwater controls

24.10 Groundwater

24.10.1 Environmental values

The Surat Basin is an elongate basin with a thickness of sediments reaching up to approximately 2,500m. The Surat Basin is hydrogeologically connected to the Clarence-Morton and Eromanga basins (to the east and west, respectively), and is one of the major basins comprising the Great Artesian Basin (GAB). The southern extent of the Bowen Basin underlies the Surat Basin.

The groundwater beneath the gas fields originates from rainfall and is marginally alkaline with median salinities below 1,500mg/L total dissolved solids. The Walloon Coal Measures tend to contain groundwater of higher salinity, with total dissolved solids values averaging approximately 4,000 mg/L.

The flow direction is to the south-west, and is generally a subdued reflection of the regional topography and basin structure. Locally, shallow groundwater flow may be towards surface water features, where these intersect subcropping or outcropping units. The average lateral groundwater flow velocities are estimated to range from 0.35m per year up to 5m per year.

Recharge to the groundwater regime predominantly occurs through infiltration of rainfall at intake beds exposed in outcrops or subcrops within the elevated northern and eastern margins of the Surat Basin. Estimated groundwater ages in the study area range from recent to more than 25,000 years.

Discharge from the confined aquifers in the Surat Basin occurs by way of outflow from spring complexes, subsurface outflow into neighbouring basins, baseflow to rivers and as artificial discharge by means of free artesian flow or controlled flow from water bores accessing these aquifers.

Springs and areas of seepage are abundant in the marginal regions of the GAB, particularly in the southern, south-western and northern areas. Many springs occurring in the GAB are recognised as having unique cultural and ecological values. Groundwater dependant ecosystems are commonly with springs and are classified as ecosystems which have their species composition and their natural ecological processes determined by and reliant on groundwater (ANZECC/ARMCANZ 2000).

A total of 877 groundwater extraction licenses have been recorded within the vicinity of the gas fields. The majority of the licensed groundwater use is for agricultural purposes with smaller amounts used for industrial water use and town water supply. Unlicensed bores also exist in the region for stock and domestic use (approximately 6,480 according to DNR records).

The applicable environmental values for groundwater in the region are:

- Biological integrity of an unmodified, highly-valued or modified aquatic ecosystem
- Suitability for primary, secondary and visual recreational use
- Suitability for supply as drinking water
- Suitability for agriculture, aquaculture and industrial use
- Suitability for producing aquatic food for human consumption
- Cultural and spiritual values of the water.

24.10.2 Potential impacts

Potential impacts associated with the construction and operation of the gas fields are groundwater drawdown and changes to groundwater quality.

Potential impacts associated with the projected groundwater level drawdown include:

- Inter-aquifer leakage
- Reduction of groundwater production rates in existing bores
- Changes to the groundwater-surface water connectivity
- Changes in the groundwater levels in proximity to groundwater dependent ecosystems
- Fugitive gas migration
- Aquifer compaction and differential land subsidence
- Existing or new production bores providing an artificial connection between aquifers

Potential hydrogeological impacts from associated water and waste stream management include:

- Uncontrolled discharge of associated water and/or wastewater from storage ponds impacting shallow groundwater resources
- Altered surface water quality and flow from discharge of treated associated water to watercourses
- Altered groundwater flow and quality from injection of blended treated and untreated associated water to aquifers within the Surat Basin
- Altered groundwater flow and quality from injection of brine concentrate into isolated geological formations.

Potential hydrogeological impacts associated with the construction and operation of infrastructure proposed for the gas fields include:

- A reduction of groundwater recharge due to surface alterations
- Groundwater quality impacts from leakage or spills
- Inter-aquifer leakage or water level changes due to poorly constructed wellbores
- Localised water level drawdown due to groundwater extractions for construction and operational activities

24.10.3 Groundwater management

Table 24.12 Groundwater – construction and operation

Element/issue	Groundwater – construction and operation
Operational policy	To minimise the impacts to the groundwater quality and groundwater levels
Performance criteria	Minimal impacts to the groundwater quality from gas field activities Minimal drawdown impacts to landholders Minimal impact to groundwater dependent ecosystems
Implementation strategy	Gas migration studies will be conducted if required and control measures will be developed Drilling fluids will be water based and biodegradable An agreed investigation trigger of available drawdown will be developed. Breach of the trigger will initiate an investigation

Element/issue	Groundwater – construction and operation
	The CSG production well design minimises potential for inter-aquifer leakage and pressure transmittal through pressure cementing of annuli and sacrificing of higher risk coal seams. Wells will be constructed in accordance with this standard and will maintain hydraulic isolation between discrete water-bearing formations Community groups will be involved in the implementation of an ongoing monitoring program Alternative water management technologies including the injection of treated and blended associated water back into GAB aquifers will be actively investigated Storage ponds will be appropriately designed, constructed and operated to reduce leakage and prevent overtopping Impacts from water extractions will be assessed over the life of the project
Monitoring	Collaboration with the Queensland government and other CSG operators in the region will occur to develop an agreed approach to regional-scale monitoring and cumulative effects assessment. Processes to assess and apportion of the 'make good' responsibility will be agreed. Australia Pacific LNG will participate in studies into the long term sustainable water supply options for the region and support programs for water conservation within the region A performance monitoring and management system will be implemented to verify model projections on drawdown and potential quality effects. Monitoring will be conducted through a DERM-approved groundwater management framework, based on the principles of adaptive management **Groundwater quality monitoring** Groundwater quality monitoring will be established. The objectives of the local monitoring are as follows: • An appropriately located and designed monitoring network to address spatial and temporal needs • Development of a high-quality dataset of background conditions against which potential impacts can be assessed • Timely identification and mitigation of potential impacts from local-scale activities. Monitoring bores will be installed in the immediate vicinity of Project infrastructure. Water quality indicators will be selected based on the natural hydrochemical conditions of the aquifer and potential chemical compounds associated with CSG development. Sampling methodologies will be in accordance with established protocols including the Water Quality Sampling Manual (Environmental Protection Agency 1999), or as revised A groundwater monitoring schedule will provide for a frequency of testing necessary to detect impacts taking into account local and regional scale

Element/issue	Groundwater – construction and operation

hydrogeology

Groundwater level monitoring

Regional monitoring of aquifer water levels will be established. Data obtained from regional monitoring will be compared to agreed trigger thresholds and model projections as part of a verification process. Significant deviation from agreed trigger thresholds will provoke further investigation using information and data acquired during the period

The objective of the regional monitoring are as follows:

- Identify long-term water level trends and potential cumulative effects from current and future CSG development
- Detect any potential large-scale groundwater quality effects from CSG development
- Provide good regional coverage and establish baseline groundwater conditions
- Gain further understanding of aquifer interactions and how the groundwater system is connected to surface environments
- Verify and refine understanding of the regional hydrogeology
- Gain a better understanding of natural variability in the regional aquifers
- Identify higher risk areas that may require monitoring or additional monitoring
- provide information to differentiate effects between operating gas fields and other sources of groundwater variability
- Provide information to help better understand natural groundwater recharge and discharge in the region
- Generate data against which projections made through groundwater modelling can be verified
- Gather high quality data to develop target and threshold values for key indicator parameters within each major aquifer in the development areas (using an adaptive management process)
- Interpret and communicate the results of the monitoring efforts to stakeholders.
- Involve community groups in the implementation of the groundwater monitoring program.

Automated water level/pressure monitoring devices will be used to record water levels at agreed intervals

General monitoring requirements

Monitoring bores will be installed prior to, or simultaneously with construction activities, to facilitate baseline monitoring prior to commissioning of CSG

Element/issue	Groundwater – construction and operation
	production activities.
Auditing	The effectiveness and adequacy of groundwater monitoring, information assessment and any investigations/remedial measures will be assessed during HSEMS and compliance auditing as described in section 24.3.8 In addition, the complaints management system will be queried annually to identify any trends regarding groundwater issues; this will act as an independent check and provide an independent perspective
Reporting	All monitoring data will be stored in a database which will facilitate the monitoring system review and model validation process A report will be submitted to the approving regulatory authority on an annual basis in accordance with the requirements of the *Petroleum and Gas (Production and Safety) Act 2004* The report will identify and comment on: • Changes to the proposed monitoring network from the previous report for example, new monitoring bores brought online • Most recent and historical monitoring results, trends, and any changes in trends compared to interim or adopted triggers and thresholds • Comparisons between monitoring results and model projections • Histories and management of complaints lodged by private water bore owners • the proposed response plan for investigation of events or conditions outside the established control conditions • the annual monitoring report for the environmental authority will include groundwater monitoring data and the associated assessment of the results to determine the nature and extent of any environmental impact. If groundwater monitoring indicates that any significant changes in groundwater quality is detected, then information will be reported to DERM within 14 days of receipt of the analysis indicating these changes, including any proposed actions to mitigate the changes in groundwater quality.
Corrective action	Further studies will be made to evaluate the potential for gas migration during CSG production Breach of the agreed investigation trigger of available drawdown will initiate an investigation. If required, 'make good' provisions will be provided in consultation with the affected party, such as the following: • Lowering of the owner's pump to increase the available drawdown • Deepening the bore within the same aquifer if the current construction allows • Installing a replacement bore at a location less affected by the CSG operations or into a different aquifer

Element/issue	Groundwater – construction and operation
	• Injection (of treated water (of similar quality to the native groundwater) • Monetary compensation for the increased cost of pumping, or for the effects of impaired capacity • Provision of an alternative water source

24.11 Surface water

24.11.1 Environmental values

The gas fields are located with three catchments; Condamine, Dawson River and Border Rivers catchment. The watercourses within the catchments exhibit signs of in-channel ingressions (increased sediment supply and reduced bed variability) as a result of water extractions and land-use practices.

The Condamine River is the major watercourse within the gas fields study area which experiences major flooding every two years on average. Major floods generally only occur in the first half of the year although records indicate that they may also occur in late spring (Bureau of Meteorology 2009).

Areas of significant inundation are typically adjacent to watercourses with large contributing catchments and high flow rates (such as Dogwood Creek and the Condamine River), or where poorly defined waterways with expansive floodplains were evident. Most local roads are predicted to be inundated at waterway crossings due to the crossing style.

Existing water quality within the gas fields is generally in a degraded condition, with a rating of moderate to poor. Typically, the water contains high levels of elevated nutrients, turbidity, suspended solids and metals.

Many watercourses throughout the region are ephemeral. The Condamine River experiences the majority of flow during summer (45%) and autumn (30%). It is expected that the seasonal variation observed at the Condamine River will be consistent across the watercourses within the study area.

Permeate discharge locations at the various tributaries are likely to exist under no flow conditions for between 55% and 70% of the time.

24.11.2 Potential impacts

There will be negligible impacts on peak flood levels within the Condamine River systems from the construction of the major infrastructure. Eleven proposed major infrastructure sites are predicted to be partially located within the existing regional flood extents. Inundation of these sites will occur during the ten year average recurrence interval.

Stormwater generated from the sites could potentially have the following impacts:

- Increase runoff scouring sediment from site causing increase sedimentation of watercourses
- Spills degrading the aquatic habitat and water quality
- An increase in the impervious areas causing scour/erosion in watercourses and loss of aquatic habitat
- Increased volumes of contaminated stormwater.

The potential impact from the failure of water storages is not predicted to impact any residential dwellings. It may increase the erosion of watercourses and increase turbidity.

Discharge of associated water to watercourses could potentially have the following impacts:

- Change in the natural flow regime causing erosion of watercourses, increased turbidity and impacts on aquatic ecology
- Changes to the water quality and resulting impacts on the aquatic ecology
- Alteration of the hydraulic and geomorphic characteristics of the watercourses (including bank and channel stability and sediment transport)
- Impacts to downstream users (including licensed water users and the environment).

The potential impacts resulting from the disposal of hydrotest water are:

- Contamination of surface waterways and/or groundwater
- Residual toxicity impacting flora and fauna
- Soil erosion, scour and sedimentation of surface watercourses.

24.11.3 Surface water management

Table 24.13 Surface water – construction

Element/issue	Surface water – construction
Operational policy	To construct the gas fields in a manner that has minimal impact to the surface water hydrology, geomorphology, water quality and aquatic ecology
Performance criteria	Minimal impacts to the natural flow patterns, geomorphology, water quality and aquatic ecology Minimal impacts to downstream users No unauthorised release of contaminants directly or indirectly into watercourses
Implementation strategy	Major infrastructure will be designed to be located outside of the existing flood inundation extents and not over tributaries and flow paths where practicable. Alternatively, re-alignment of infrastructure areas will be considered to avoid impacts on natural flow regimes or filling in areas that will not unduly affect overland flow Sediment basins will be designed and constructed at major facilities to capture runoff and remove sediment and to release water slowly to avoid scour and erosion due to increased runoff Stormwater management plans for each major facility will be developed and implemented Major facilities design will incorporate upstream flow diversion and retention measures to reduce the impact of surface water flow Investigations and implementation of alternative beneficial use and disposal options for associated water will be undertaken in accordance with the Adaptive Associated Water Management Plan

Element/issue	Surface water – construction
	Feed ponds (at WTFs) and brine ponds will be designed, constructed and operated in accordance with appropriate Queensland guidelines and regulations (relevant codes of compliance) including an appropriate freeboard (space above the normal level)
	Hydrotest water will be managed according to a hierarchy of options ranging from beneficial use to disposal in evaporation ponds or temporary hydrotest water dams. The water quality analysis will be used as a key decision-making factor in the hydrotest water procedure. The procedure will include consultation with landowners
	Biocides and oxygen scavengers (if necessary) for hydrotest water will be selected which can be neutralised, are biodegradable, or do not bio-accumulate in the soil
	Where suction pumps are required for the extraction of water from watercourses (for hydrotest water), the location will avoid significant vegetation and will be located above the watercourse bed. Fish screens will be used on intakes
	Erosion control measures will be constructed at hydrotest discharge locations
	The hazard category of any dam will be determined by a suitably qualified and experienced person, prior to its design and construction, upon any change in its purpose or its stored contents, and at least once in each two year period after its construction
	Prior to the construction of a hazardous dam, a design plan will be prepared and submitted in accordance with regulatory requirements. Following the construction of a hazardous dam, the 'as constructed' drawings will be kept in accordance with regulatory requirements
	A register of Regulated Dams will be maintained for each regulated dam on site. Prior to the construction of a dam or modifications to an existing dam determined to be in the high hazard or significant hazard category in accordance with the "Manual for Assessing Hazard Categories and Hydraulic Performance of Dams" the required details will be entered into the Regulated Dam Register
	All Regulated Dams will be designed by and constructed under the supervision of a suitably qualified and experienced person
	Regulated dams will be designed to have suitable control measures (such as fencing, bunding, escape arrangements) for the protection of livestock or wildlife
	Erosion and sediment control will be implemented in accordance with the Queensland Guidelines for Sediment and Erosion Control
	Fuels and chemicals will be stored in accordance with relevant standards such as Australian Standards 1940:2004 - The storage and handling of flammable and combustible liquids

Element/issue	Surface water – construction
	Maintenance and cleaning of vehicles and any other equipment or plant will be conducted in areas which prevent the resultant contaminants from being released into watercourses, roadside gutters or stormwater drainage system Associated water used for dust suppression will meet statutory water contaminant release limits
Monitoring	Routine visual monitoring of erosion and sediment controls and dam freeboard will be undertaken to assess the effectiveness of implementation measures
Auditing	HSEMS and compliance auditing as described in Section 24.3.8, will include the assessment of the surface water control measures The contracts for Construction Contractors will include the provision for an audit under their Construction HSE Management Plan and the effectiveness of the construction phase surface water protection measures
Reporting	Monitoring results, incidents and auditing results will be reported as described in section 24.3.6.
Corrective action	Complaints received will be acted on as soon as practical. Where investigations reveal an impact, corrective action will be implemented to mitigate the impact, for example: Increased frequency of maintenance for sedimentation ponds Rehabilitation of any damaged erosion control structures.

Table 24.14 Surface water – operation

Element/issue	Surface water – operation
Operational policy	To operate the gas fields in a manner that has minimal impact to the surface water hydrology, geomorphology, water quality and aquatic ecology
Performance criteria	Minimal impacts to the natural flow patterns, geomorphology, water quality and aquatic ecology Minimal impacts on downstream users No unauthorised release of contaminants directly or indirectly into watercourses
Implementation strategy	Stormwater management structures implemented during the construction phase will be maintained throughout the operational phase Appropriate pond freeboard will be maintained A register of Regulated Dams will be maintained for each regulated dam on site. Regulated Dams will be maintained and operated in a manner that is consistent with the design plan and the certified 'as constructed' drawings for the duration of its operational life and until decommissioned Regulated dams will be inspected annually by a suitably qualified and experienced person Fuels and chemicals will be stored in accordance with relevant standards such

Element/issue	Surface water – operation
	as AS1940:2004 – The storage and handling of flammable and combustible liquids Chemical treatment will be minimised and the chemicals used will be selected to have a low potential to harm the environment Discharges of treated water will be conducted in a manner that meets environmental flow objectives and mimics pre development stream flows where practicable (recognising the practicalities and timing of establishing beneficial use)
Monitoring	Existing monitoring programs will be augmented to cater for construction of new facilities and this will include water quality testing upstream and downstream of discharge locations Monitoring will comply with DERM's Water Quality Sampling Manual and will be performed by a person with appropriate experience and qualifications Pond freeboard measurements and other routine monitoring will be facilitated by a checklist system of data gathering and reporting
Auditing	Regulated dams will be inspected annually by a suitably qualified and experienced person The effectiveness of the operational phase surface water protection measures will be assessed during HSEMS and compliance auditing as described in Section 24.3.8
Reporting	Monitoring results, incidents and auditing results will be reported as described in section 24.3.6 with associated water quality results reported in the annual monitoring report
Corrective action	Complaints received will be acted on as soon as practical. Where investigations reveal an impact, corrective action will be implemented to mitigate the impact, for example: Increased frequency of maintenance for sedimentation ponds Rehabilitation of any damaged erosion control structures.

24.12 Associated water

24.12.1 Environmental values

Coal seam gas is predominantly methane stored within coal seams by adsorption to the surface of coal particles. In the Walloons coal seams, pressure from the enclosing water keeps the gas adsorbed as a thin film on the surface of the coal. In order to extract the gas, the water pressure needs to be sufficiently reduced to enable desorption of the gas. This is achieved by transferring the associated water to the surface. Moreover transfer of water can be managed to modify the gas pressure, therefore optimising the rate of gas production.

The amount of associated water produced during the coal seam gas extraction is difficult to predict and varies both with the location and stage of the production cycle. Likewise, the quality of the

associated water is highly variable, but it frequently contains elevated quantities of salt and other contaminants.

Table 24.15 provides a summary of the key water quality parameters at four fields within the Walloons development areas and the adjacent Spring Gully gas field.

Table 24.15 Walloons development and Spring Gully associated water quality

Property	Development Field				
	Combabula	Talinga	Orana	Condabri	Spring Gully
Total dissolved solids (mg/L)	6,534	2,540	2,450	3,693	7,500
pH	8.3	8.7	8.8	8.3	9
Total suspended solids (mg/L)[1]	38	39	9	80	65
Sodium adsorption ratio	115	160	135	138	170
Residual alkalinity (meq/L)	13.6	37.4	30.5	29.0	43.0
Fluoride by ISE (mg/L)	0.9	3.9	3.3	1.9	5.9
Boron (mg/L)	0.50	0.72	0.66	0.40	3.1

Notes: [1] Solids may be entrained sediments from wells, or of microbiological origin.

The water profile developed in response to the EIS investigations has a maximum associated water production peak around 170ML/day.

Refer to Sections 24.11.1 and 24.10.1 for surface water and groundwater environmental values respectively.

24.12.2 Potential impacts

Discharge of associated water to watercourses could potentially have the following impacts:

- Change in the natural flow regime causing erosion of watercourses, increased turbidity and impacts on aquatic ecology
- Changes to the water quality and resulting impacts on the aquatic ecology
- Alteration of the hydraulic and geomorphic characteristics of the watercourses (including bank and channel stability and sediment transport)
- Impacts to downstream users (including licensed water users and the environment).
- Erosion of exposed surfaces at permeate discharge points

24.12.3 Associated water management

Table 24.16 Associated water – construction and operation

Element/issue	Associated water
Operational policy	To manage associated water in a manner that optimises commercial and beneficial

Element/issue	Associated water
	use and minimises adverse impacts on the environment
Performance criteria	No unauthorised release of contaminants directly or indirectly into watercourses Associated water and brine ponds to be designed, constructed and operated in compliance with the *"Manual for Assessing Hazard Categories and Hydraulic Performance of Dams"* and the environmental authority Associated water used for domestic or stock purposes to meet the ANZECC 2000 Water Quality guidelines or as agreed with the regulatory authority
Implementation strategy	Field development and operational planning will consider the use of associated water (either treated or untreated) to meet the water requirements of the Project The number and size of ponds will be minimised. Ponds for the storage of associated water and brine will be lined Associated water and brine ponds will be designed, constructed and operated in accordance with the DERM *"Manual for Assessing Hazard Categories and Hydraulic Performance of Dams"* and the conditions of the environmental authority Authorised releases of permeate to the environment will meet the following limits or as agreed with the regulatory authority:

Water quality characteristics	Units	Limit	Limit type
pH	pH Units	6.0 to 9.0	range
Total suspended solids	mg/L	30	maximum
Total dissolved salts	mg/L	2000	maximum

The commercial and beneficial use of associated water will be optimised through an adaptive approach including:

Water which can be reliably supplied to commercial customers under long term contracts

Investigation of opportunities for water to be managed in conjunction with other producers including water aggregation.

Associated water will be treated to the appropriate quality for the intended use or disposal options

Use options will include implementation of appropriate surface water controls. For example, agricultural irrigation will involve sustainable land management practices, including and stormwater and erosion control measures

An approval under the *Environmental Protection (Waste Management) Regulation 2000*, where required, will be sought prior to the beneficial use of associated water

An adaptive associated water management plan (AAWM Plan) for authorised petroleum activities will be developed and implemented for treating, beneficially reuse and/or disposing of associated water

Element/issue	Associated water
	Studies into the long-term sustainable water supply options and programs for water conservation within the region will be supported Alternative water management technologies including aquifer reinjection will be actively investigated Actively investigate improved water management technologies to address brine beneficial use Affected landholders, near to the water pipeline network, will be offered the opportunity to access water on commercial terms or as a compensation offset, subject to availability and relevant approvals
Monitoring	Associated water monitoring will be undertaken in accordance with the HSEMS, as summarised in section 24.3.6 and the requirements of the environmental authority Routine monitoring will be conducted to determine the compliance of associated water with water quality requirements. Where necessary, additional monitoring and control measures will be developed on a risk based approach Monitoring will be in accordance with the most recent edition of the DERM Water Quality Sampling Manual, and carried out on samples that are representative
Auditing	The results of associated water monitoring will be assessed during HSEMS and compliance auditing as described in section 24.3.8
Reporting	Monitoring results, incidents and auditing results will be reported as described in section 24.3.6 with associated water quality results reported in the annual return
Corrective action	In the event that associated water management does not comply with performance criteria, corrective action will be dependent on the nature of the issue but may include: Ceasing the use of associated water until the issue can be resolved Review, investigation, rehabilitation, improved procedures and an increased frequency of monitoring Toolbox presentations to reinforce associated water management requirements.

24.13 Air quality

24.13.1 Environmental values

The environmental values to be enhanced or protected are:

- The health and biodiversity of ecosystems
- Human health and wellbeing
- The aesthetics of the environment, including the appearance of buildings structures and other property
- Agricultural use of the environment.

The existing air quality in the region is expected to be fairly good due to the predominantly agricultural land use. The most significant sources of air pollutants to the existing regional air quality are the power stations and dust from agricultural activities. The effects from power stations on the existing environment are expected to be relatively minor within the gas fields due to the significant distances between, and geographical locations of, these facilities.

The existing infrastructure at the Talinga gas processing facility includes twelve rich-burn engines that have relatively high local emissions of oxides of nitrogen (NO_X).

24.13.2 Potential impacts

Emissions generated during construction and decommissioning activities are likely to consist of engine exhausts from vehicles and diesel generators and dust generated by earthworks and vehicle movements on unsealed roads. The composition of engine exhaust emissions is expected to be primarily NO_X and carbon monoxide (CO) with small quantities of hydrocarbons.

Operation of the gas fields is likely to emit the following key air pollutants are:

- Oxides of nitrogen (NO_X), primarily as nitrogen dioxide (NO_2)
- Sulphur dioxide (SO_2)
- Carbon monoxide (CO)
- Particulate matter with an aerodynamic diameter less than ten microns (PM_{10})
- Hydrocarbons.

Potential impacts that may arise from the emissions during construction, operation and decommissioning of the gas fields include:

- Localised decrease in human, terrestrial flora and fauna health
- Community dust nuisance
- Localised decrease in agricultural production.

24.13.3 Air quality management

Table 24.17 Air quality – construction

Element/issue	Air quality – construction
Operational policy	To construct the gas fields in a manner that has minimal impact on the existing air quality.
Performance criteria	Minimal air quality complaints from sensitive receptors
Implementation strategy	Vehicles and machinery will be fitted with appropriate emission control equipment and routinely maintained Facilities will be designed to meet the air quality objectives of the Environmental Protection (Air) Policy 2008 (EPP Air) Vehicles travelling within the worksites will be limited to appropriate speed limits. Speed limits will be reduced on unpaved roads and tracks adjacent to dwellings to reduce the generation of dust from vehicles where practicable

Element/issue	Air quality – construction
	Vegetation or other waste materials generated by petroleum activities will not be burnt on-site
	Construction activities will give consideration to adverse weather conditions
	Areas and duration of disturbance will be minimised as far as practicable through project planning
	The generation of bull-dust on access roads will be minimised through route selection to avoid vulnerable soil types, where practicable
	Dust generating materials will be covered prior to transportation
	Water trucks will be used to minimise dust emissions on access tracks and unsealed roads
	Trees will be trimmed and retained rather than removed at the edge of areas to be cleared, where possible
	Root stock will be retained in the ground, where practicable, to reduce erosion and to facilitate rapid rehabilitation
	The soil type and terrain will be considered during construction activities
	Controlled blasting will be conducted only where conventional excavation, rock hammering or trenching equipment is ineffective
	Controls will be implemented that will aid in the minimisation of dust emissions from controlled blasting, such as watering of the blast area
	Blasting activities will be conducted according to regulations and with appropriate dust control measures
	Rehabilitation will be carried out as soon as reasonably practicable to restrict areas exposed to wind erosion
Monitoring	Routine visual monitoring of dust will be undertaken to assess the effectiveness of the dust control measures
	If directed to by the administering authority in response to a valid dust complaint, monitoring of dust will be undertaken in accordance with the HSEMS, as summarised in section 24.3.6 and the requirements of the environmental authority
Auditing	The effectiveness of dust controls and vehicular maintenance will be assessed during HSEMS and compliance auditing as described in section 24.3.8
Reporting	Monitoring results, complaints, incidents and auditing results will be reported as described in section 24.3.6
Corrective action	Complaints received will be acted on as soon as practical. Where investigations reveal an impact, corrective action will be implemented to mitigate the impact. Actions will be specific to the impacts and may include:
	Increasing watering of unpaved roads, access tracks and exposed construction areas as appropriate

Element/issue	Air quality – construction
	Reducing speed limits on unpaved roads and tracks adjacent to dwellings Limiting dust-generating activities

Table 24.18 Air quality – operation

Element/issue	Air quality – operation
Operational policy	To operate the gas fields in a manner that has minimal impact on the existing air quality
Performance criteria	Minimal air quality complaints from sensitive receptors Emissions not to exceed the maximum ground level concentration criteria below:

Contaminant	Concentration	Units	Averaging time
NO_x as nitrogen dioxide	250	mg/m^3	1 hour
	33	mg/m^3	1 year
Carbon monoxide	11	mg/m^3	8 hour

Implementation strategy	Facilities will be designed and operated to meet the air quality objectives within the EPP Air Micro-turbines at gas wellheads will be used wherever practicable Alternative low emission technologies will be investigated and used where appropriate As part of the Condabri and/or an expansion of the Talinga facilities, conduct further investigation into technologies or options and implement accordingly to meet the air quality criteria Vehicles and machinery will be fitted with appropriate emission control equipment and routinely maintained Lean-burn gas-fired engines with lower NO_x emissions will be used wherever practicable Venting of gas at wellheads will be restricted to emergency situations and periodic maintenance activities Flaring at GPFs will be minimised by implementing suitable control strategies A register of fuel burning or combustion equipment at GPFs and WTFs will be developed and maintained
Monitoring	Monitoring of stack emissions for nitrogen dioxide will be undertaken in accordance with the HSEMS, as summarised in section 24.3.6 and the requirements of the environmental authority Representative stack emission monitoring program for nitrogen dioxide in areas that

Element/issue	Air quality – operation
	are greater than 50% of the guideline will be in accordance with the most recent editions of Australian Standard AS4323.1 Stationary source emissions method 1: Selection of sampling provisions and the latest edition of the administering authority's Air Quality Sampling Manual Representative monitoring from each unit type will be conducted with emissions from remaining units estimated using burn efficiency data. The following tests will be performed for each sample taken: Gas velocity, volume flow and mass emission rate Temperature Water vapour concentration (for non-continuous sampling) Samples will be representative of the contaminants discharged when operating under maximum operating conditions The production rate and plant status will be recorded during sampling
Auditing	The results of stack emission monitoring will be assessed during HSEMS and compliance auditing as described in section 24.3.8
Reporting	Monitoring results, complaints, incidents and auditing results will be reported as described in section 24.3.6 with stack emission results reported in the annual return Annual reporting to the National Pollution Inventory
Corrective action	Should stack emission results exceed the performance criteria, corrective action may include: • adjustment of operational settings and maintenance programs • replacement or retrofitting of equipment

24.14 Greenhouse gas

24.14.1 Environmental values

Emissions of greenhouse gases (GHG) like carbon dioxide, methane and nitrous oxide have been strongly linked to climate change. Australia's net GHG emissions across all sectors in 2007 were reported as 597Mt CO_2-e (approximately 2% of global GHG emissions).

The scopes of GHG emissions are:

- Scope 1 GHG emissions are produced directly from combustion and fugitive sources in the gas fields
- Scope 2 GHG emissions arise from purchased electricity, heat and steam. These emissions are generated outside of the Project boundary. Note that the Project will purchase negligible amounts of electricity, heat or steam therefore scope 2 GHG emissions are negligible
- Scope 3 GHG emissions are related to the activities of the reporting entity but arising from sources beyond the reporting boundary – for example, extraction, processing and transport of purchased fuels.

24.14.2 Potential impacts

CSG combustion by stationary equipment, particularly compressors, is expected to be the main source of scope 1 emissions. This is followed by CSG combustion for power generation during the operation of GPFs, WTFs, WTSs and well sites. CSG flaring is the third biggest source of emissions.

Maximum GHG emissions will occur between 2021 and 2024, coinciding with the projected maximum gas fields output. The scope 1 GHG emissions in 2023 are predicted to be approximately 3.3Mt CO_2-e. This represents approximately 1.81% of GHG emissions for Queensland and 0.55% for Australia.

The scope 3 GHG emissions are relatively minor at approximately 3.2% of the gas fields' GHG inventory over the Project lifetime at 2.85Mt CO_2-e.

24.14.3 Greenhouse gas management

Table 24.19 Greenhouse gases – construction

Element/issue	Greenhouse gases – construction
Operational policy	To minimise greenhouse gas emissions from construction of the gas fields
Performance criteria	Biodiversity offset strategy to be implemented GHG management measures to monitor and assess GHGs from the Project on an ongoing basis to be implemented. Compliance with National Greenhouse and Energy Reporting System
Implementation strategy	Develop ongoing processes (such as a regular review of new technologies) for minimising energy consumption and GHG emissions within the Project The use of electric drives for production equipment or energy efficiency processing equipment will be investigated The biodiversity offset strategy, which will take into account GHG offsets will be implemented Australia Pacific LNG will work with Government to develop measures to address greenhouse gas emissions Transport logistics will be optimised to minimise energy consumption and use the most fuel efficient vehicles and machinery The implementation of high efficiency gas compressors that produce less GHG emissions will be investigated The installation of waste heat recovery units on gas compressor exhaust stacks to meet process heat requirements will be investigated The use of less energy intensive construction materials will be considered during design phase of the Project Cleared areas will be progressively rehabilitated as described in Table 24.8 Terrestrial Ecology – Construction
Monitoring	Greenhouse gas emissions will be monitored in accordance with the *National Greenhouse and Energy Reporting Act 2007.* Monitoring will be undertaken in accordance with the HSEME as described in section 24.3.6

Element/issue	Greenhouse gases – construction
Auditing	The effectiveness of the greenhouse gas management measures will be assessed during HSEMS and compliance auditing as described in section 24.3.6 Periodic energy audits will be undertaken to assist in improving energy efficiency
Reporting	Report greenhouse gas emissions in accordance with the National Greenhouse and Energy Reporting Act 2007
Corrective action	If annual reporting shows greater than expected greenhouse gas emissions the following corrective actions will be undertaken: • Review current GHG management measures • Research means to reduce emissions for example newer technologies.

Table 24.20 Greenhouse gases – operation

Element/issue	Greenhouse gases – operation
Operational policy	To minimise greenhouse gas emissions from the operation of the gas fields
Performance criteria	Flaring during normal operations to be at 1% or less of CSG produced, on average, per day GHG management measures to monitor and assess GHGs from the Project on an ongoing basis have been implemented Compliance with National Greenhouse and Energy Reporting System
Implementation strategy	Develop ongoing processes for minimising energy consumption and GHG emissions within the Project, by: • Improve the energy efficiency of gas compression through better technology • Minimise operational coal seam gas flaring and venting • Work with Government on developing measures to address greenhouse gas emissions • Optimise transport logistics to minimise energy consumption and use the most fuel efficient vehicles and machinery • Implement automatic well control to allow turn down of gas field production in the event of process upsets and maintenance • Re-route CSG via low pressure pipelines if a GPF is off-line due to process upsets and maintenance • Develop and implement a leak detection and repair program to reduce venting Investigate implementation of high efficiency gas compressors that produce less GHG emissions • Investigate the installation of waste heat recovery units on gas compressor exhaust stacks to meet process heat requirements • Promote liquefied natural gas as a cleaner fuel

Monitoring	• Monitoring of greenhouse gas emissions will be conducted in accordance with the National Greenhouse and Energy Reporting Act 2007. Flaring and the CSG produced will be monitored and compared quarterly. Monitoring will be undertaken in accordance with the HSEME as described in section 24.3.6
Auditing	The effectiveness of the greenhouse gas management measures will be assessed during HSEMS and compliance auditing as described in section 24.3.8 Periodic energy audits will be undertaken to assist in improving energy efficiency
Reporting	Report greenhouse gas emissions in accordance with the National Greenhouse and Energy Reporting Act 2007. Relevant information is also reported externally through the Sustainability Report and through APPEA
Corrective action	If annual reporting shows greater than expected greenhouse gas emissions, the following corrective actions will be undertaken: • Review current GHG management measures • Research means to reduce emissions e.g. through newer technologies.

24.15 Noise and vibration

24.15.1 Environmental values

The environmental values to be enhanced or protected are the acoustic environment conducive to the following:

- The health and biodiversity of ecosystems
- Human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to sleep, study or learn, be involved in recreation, relax and converse
- The amenity of the community.

In relation to vibration, the structural and cosmetic integrity of non-indigenous cultural heritage sites and dwellings is to be protected.

In general, the acoustic environment during winter months is relatively quiet at all times of the day or night, except for bird calls at dawn and dusk, rustling vegetation associated with winds, and the intermittent sound of passing vehicles at locations within 'earshot' of major roadways. Night-time background noise levels were consistently below the 15dB(A) detection threshold of the monitoring instrumentation, with the exception of monitoring sites relatively close to major roadways.

During the warmer months, the ambient acoustic environment often contains significant additional sustained insect noise from cicadas and crickets, particularly following rainfall. This results in significant increases in standard baseline noise for the warmer months.

Daytime noise showed variability due to the proximity of instrumentation to vegetation and stock and transportation routes. Noise from vegetation normally follows a diurnal cycle associated with daytime breezes and still conditions at night.

24.15.2 Potential impacts

Noise will be generated through the construction and operation of the gas fields. Significant noise sources will be generated by the following activities:

- construction of gas wells, typically on a continuous 24-hour basis, including diesel and hydraulic drivers, air compressors, air drillings, cementing the well casing and fraccing or cavitation
- significant road traffic and heavy vehicle transportation during the construction phase
- power, gas compression and cooling equipment of the GPFs
- operation of multiple pumped gas wells causing a low-frequency hum

Drilling of wells may result in adverse noise at dwellings, particularly where they are located within 2km.

Construction of the gas and water gathering network, high pressure gas pipelines and water transfer pipelines, GPFs, WTFs, accommodation facilities and other infrastructure is not expected to result in adverse noise impacts on nearby sensitive receptors.

Noise emissions from the majority of construction activities are unlikely to impact terrestrial fauna and avifauna. Cavitation will be the only potentially significant disturbance. The likely response of terrestrial animals and birds to cavitation noises would be flight from the area or to remain in shelters such as tree hollows or burrows. Given the short duration and transient nature, the impacts are considered low.

Operational noise from GPFs with noise attenuation equipment is not expected to result in significant adverse noise impacts.

WTFs engines will be housed in fully enclosed acoustic structures and are not expected to result in significant adverse noise impacts.

The analysis of noise impacts has been based on a worst case scenario of flat terrain. Substantially improved attenuation between noise sources and a receptor may occur where site selection is able to achieve intervening ridges/hills, and where significant forest occurs close to the source and/or receiver. This will reduce the buffer distances and/or noise attenuation equipment required.

The use of rock-breakers and rock-saws or even blasting of hard rock has the potential to affect the structural and cosmetic structures of dwellings and non-indigenous cultural heritage sites.

24.15.3 Noise and vibration management

Table 24.21 Noise and vibration – construction

Element/issue	Noise and vibration – construction
Operational policy	To construct the gas fields in a manner that has minimal noise and vibration impacts on the surrounding residences and businesses
Performance criteria	Minimal complaints from residences and businesses All noise and vibration management measures agreed with potentially affected residences and businesses applied
Implementation strategy	Out-of-hours (6.30pm to 6.30am) construction activities within 2km of sensitive receptors will be restricted, unless alternative arrangements have been agreed with the potentially affected residents. Noise management measures will be developed

Element/issue	Noise and vibration – construction

and implemented for out-of-hours construction activities (6.30pm- 6.30am).

Construction deliveries between 6.30pm and 6.30am will be avoided whenever possible

A traffic management plan will be developed prior to construction to identify suitable routes and times of travel to minimise disturbances to residents and traffic conditions.

Major plant sites, including GPFs and WTFs, will be located as far as practicable from sensitive noise receptors and to maximise natural noise attenuation from terrain and vegetation.

Blasting will be designed to meet Section 440ZB Blasting requirements under the *Environmental Protection Act 1994*

Drilling

Consultation will occur with affected residents located within 2km of proposed well sites and noise management measures will be developed, where necessary. Residents not previously exposed to well drilling noise will be informed of the process and field inspections will be arranged, where practicable.

The following controls will be implemented at drilling sites near potentially affected residents and businesses as required:

- modular screens to reflect noise away from dwellings
- flare-pit noise barriers, if used, will have a length of approximately 10m, located 5m upstream of the flare-line end
- orientation of well-head flare lines away from the nearest sensitive dwelling

Cavitation will only be used for stimulation if other methods are unsuitable. If required, cavitation will be conducted during day time hours (6.30am to 6.30pm) where practicable. Noise management measures will be developed and implemented in consultation with potentially affected residents

Gas and water gathering network and high pressure gas pipelines

Residents and/or businesses within 200m of non-standard trenching operations (such as rock sawing and rock-hammering) will be notified prior to commencing activities which are scheduled during day time hours (6.30am to 6.30pm).

Gas and water gathering network and the high pressure gas pipelines will be located at least 100m from sensitive receptors

Blasting will not be conducted within 100m of identified cultural heritage sites

GPFs

GPFs will be located, orientated and designed (using noise mitigation treatments) to be in accordance with planning noise levels at noise sensitive receptors

Electric drive motors will be investigated for GPFs, WTFs, WTSs and wells

Noise attenuation barriers (sound walls) will be constructed to minimise directional noise emissions to the nearest sensitive receptors where required

Element/issue	Noise and vibration – construction
	The driver and compressor will be housed in an acoustic enclosure with lower noise cooling fans, where required GPFs will be designed to address the 28dB(A) planning noise level using a combination of acoustic enclosures for the driver-compressor and standard or low noise fans for air-cooling. Variable speed electric drives will enable slower fan speeds (and noise levels) to be applied during the evening and night when less cooling is necessary **WTF** WTFs will be designed using existing noise controls to meet the 28dB(A) planning noise level **Accommodation facilities** Accommodation facilities will be located at appropriate distances from sensitive receptors.
Monitoring	If directed by the administering authority in response to a valid noise complaint, monitoring will be undertaken in accordance with the HSEMS, as summarised in Section 24.3.6 and the requirements of the environmental authority. Noise monitoring will be undertaken in accordance with the latest edition of administering authority's *Noise Measurement Manual* or the most recent version of AS1055 Acoustics – description and measurement of environmental noise Noise monitoring and recording will include the following descriptor, characteristics and matters: • $L_{AN,T}$ (where N equals the statistical levels of 1, 10 and 90 and T = 15 mins). • background noise $L_{A90,T}$ • the level and frequency of occurrence of impulsive or tonal noise and any adjustment and penalties to statistical levels • atmospheric conditions including temperature, relative humidity and wind speed and directions • effects due to any extraneous factors such as traffic noise. • location, date and time of monitoring. • If a complaint concerns low frequency noise, Max $L_{PZ,15\ min}$. • If a complaint concerns low frequency noise, one third octave banc measurements in dB(LIN) for centre frequencies in the 10 – 200 Hz range for both the noise source and the background noise in the absence of the noise source Vibration monitoring will be conducted at potentially affected residences, businesses or heritage sites during blasting activities, as required.
Auditing	The effectiveness of the noise abatement measures and complaint monitoring, if conducted, will be assessed during HSEMS and compliance auditing as described in

Element/issue	Noise and vibration – construction
	Section 24.3.8
Reporting	Monitoring results, complaints, incidents and auditing results will be reported in accordance with the HSEMS as described in Section 24.3.6 Noise complaints and non conformances will be recorded and forwarded to administrating authority on request
Corrective action	Corrective actions will be undertaken in accordance with the outcomes of assessments, monitoring results or advice given by the relevant administering authority In the event of a valid complaint about noise nuisance, noise management measures will be submitted to the administering authority within the reasonable and practicable timeframe Following implementation of the noise management measures, noise monitoring will be undertaken to ensure applicable criteria are met. A report will be subsequently submitted to the administering authority to confirm compliance

Table 24.22 Noise and vibration – operation

Element/issue	Noise and vibration – operation			
Operational policy	To operate the gas fields in a manner that has minimal noise and vibration impacts on the surrounding residences			
Performance criteria	Minimal complaints from landowners In the event of a noise complaint from project activities, noise levels are not to exceed the following criteria:			
	Receiver areas	**Design planning noise level ($L_{Aeq,1hour,adj}$ – dBA)**		
		Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
	Residence with negligible transportation noise	28	28	28
	Residences within 1km of major transportation corridor	35	28	28
Implementation strategy	A traffic management plan will be implemented for field development, as required, to identify suitable routes and times of travel to minimise disturbances to residents and traffic conditions Operation deliveries between 6.30pm and 6.30am will be avoided whenever possible Gas-fired power electricity facilities will be operated in acoustic enclosures as required Well head acoustic barriers will be employed such as a portable, free-standing noise screen/barrier, where required Accommodation facilities will be located at appropriate distances from sensitive receptors			

Element/issue	Noise and vibration – operation
Monitoring	In response to valid noise complaint as described in the Noise and vibration - construction Table 24.21
Auditing	The effectiveness of the noise abatement measures and complaint monitoring, if conducted, will be assessed during HSEMS and compliance auditing as described in Section 24.3.8
Reporting	Monitoring results, complaints, incidents and auditing results will be reported in accordance with the HSEMS as described in Section 24.3.6 and the environmental authority. Noise complaints and non conformances will be recorded and forwarded to administrating authority on request
Corrective action	Corrective actions will be undertaken in accordance with the outcomes of inspections, monitoring results or advice given by the relevant administering authority In the event of a valid complaint about noise nuisance, noise management measures will be submitted to the administering authority within the reasonable and practicable timeframe In response to a complaint and subsequent implementation of the noise management measures, noise monitoring will be undertaken to ensure applicable criteria are met. A report will be subsequently submitted to the administering authority to confirm compliance

24.16 Waste

24.16.1 Environmental values

The environmental values to be protected and enhanced are:

- Life, health and well-being of people.
- Diversity of ecological processes and associated ecosystems.
- Land use capability, having regard to economic considerations.
- Management of finite resources.

Liquid, solid and gaseous wastes will be generated throughout the construction, operation, decommissioning and rehabilitation phases of the gas fields. Generated wastes include regulated, general, recyclable and inert waste.

24.16.2 Potential impacts

Environmental impacts from waste will only occur as a result of poor management. The potential impacts include the following:

- Land and water (surface water and groundwater) contamination from inappropriate storage, handling and disposal of solid and liquid wastes
- Land and water (surface water and groundwater) contamination from spills during handling and transportation

- Land and water contamination (surface water and groundwater) from spills/overflows from extreme rainfall events
- Increased populations of vermin from inappropriate storage and handling of waste
- Visual amenity impacts due to poor housekeeping
- Inefficient use of resources
- Adverse effects to flora and fauna.

24.16.3 Waste management

Table 24.23 Waste management – construction and operation

Element/issue	Waste management – construction and operation
Operational policy	To implement the waste management hierarchy of avoid, re-use, recycle and disposal To construct and operate the gas fields in a manner that minimises adverse environmental and social impacts from waste
Performance criteria	No land and water contamination as a result of inappropriate waste management No verified complaints from landowners regarding waste management Waste minimisation strategy established
Implementation strategy	Work with local councils to determine the current landfill capacities and accepted waste types Work with councils to assist with the planning of expansion and upgrade of landfills to ensure wastes generated from the Project can be accommodated if required Waste management guidelines will be regularly reviewed including the marketability of wastes and the results of waste audits to improve waste management within the gas fields Detailed waste management guidelines will be developed and implemented and include the principles of the waste management hierarchy and cleaner technology Contracts with companies will be established encouraging sustainable waste management practices Procurement of pre-fabricated materials will be encouraged to reduce the quantity of waste where practicable Wastes will be appropriately segregated and sealed within designated temporary waste management areas Waste will be transported by a licensed contractor to a recycling facility or suitable licensed landfill Bins and/or drums for regulated wastes will be sealed, labelled and stored within appropriately bunded areas in accordance with standards and regulatory requirements and located within temporary waste management areas Liquid wastes will be stored separately to solid wastes to maximise recycling opportunities

Element/issue	Waste management – construction and operation
	Spill kits will be located at GPFs and WTFs during both the construction and operational phases as required Package sewage treatment facilities will be appropriately designed and include alternative storage and disposal options during times of system failure and in conditions that prevent discharge to land (that is during rain events) Hydrotest water will be appropriately managed to minimise land and water contamination and erosion Weeds to be managed in a manner consistent with the appropriate weed classification and recognised Queensland weed management strategy Vegetation material (including mulching) will be used on-site during rehabilitation where appropriate Stockpiles of vegetation will be located within cleared areas and away from drainage lines Segregation of wastes will occur to maximise re-use and recycling opportunities Local business will be encouraged to take advantage of opportunities for re-use and recycling, if available or initiate opportunities, if unavailable Contracts with companies (for the supply of materials) will be established to encourage sustainable waste management practices
Monitoring	Monitoring results, complaints, incidents and auditing results will be reported as described in Section 24.3.6. Specifically, sewage treatment facilities will be regularly monitored to ensure wastewater discharge meets regulatory requirements Annual reporting to the National Pollution Inventory will be conducted Regular reviews of the waste management register will be conducted to monitor the implementation of the waste management hierarchy Routine visual inspections will be carried out at work areas and at temporary and permanent accommodation facilities
Auditing	The effectiveness of waste management measures will be assessed during HSEMS and compliance auditing as described in Section 24.3.8 including: • Potential impacts from wastes • Waste transportation records • Implementation of the principles of waste management hierarchy.
Reporting	Monitoring results, complaints, incidents and auditing results will be reported in accordance with the HSEMS as described in Section 24.3.6. Specifically: • Regulated waste tracking records will be kept on site and provided to the administering authority as required • Reporting to the National Pollution Inventory (NPI).
Corrective action	Any spillage or release of waste that may potentially harm the environment will be

Element/issue	Waste management – construction and operation
	contained and/or cleaned up as soon as practicable Recommendations/corrective actions will be undertaken in accordance with the outcomes of monitoring, audits and investigations

24.17 Traffic and transport

24.17.1 Environmental values

Road

Thirteen key state-controlled roads and numerous local roads occur within the study area which will be used to carry construction and/or operational traffic throughout the life of the project. These include the Leichhardt Highway, Warrego Highway and Jackson-Wandoan Road.

There are four bridges which have been identified on state-controlled roads within the gas fields. These bridges are either load limited or in poor condition.

There are several road links within the gas fields that have been identified as having high to very high crash risks. The number of accidents on these roads is low, but the roads are rated high due to the low traffic volumes.

Within the gas fields, the existing state and local government road infrastructure crosses a number of watercourses and/or is located in a floodplain and is therefore susceptible to flooding.

The public transport in the study area includes school bus services and a limited taxi service in some towns. Due to the limited road network and the dispersed nature of residents in relation to schools, the majority of the roads to be used by Project traffic are school bus routes.

A number of stock routes have been identified within the gas fields. Stock routes enable pastoralists to move livestock without the use of trucks and other transport methods. These are typically roads, reserves, unallocated State land and pastoral leases.

Rail

The rail network servicing the gas fields is the Western System which includes the line west of Ipswich, operating between Toowoomba and Roma. This line carries a mix of long distance passenger trains, grain trains, and general freight, livestock, and coal trains.

Sea

Australia Pacific LNG has identified the Port of Brisbane as a possible port which may be used to import one-off construction items.

Air

Miles aerodrome is located approximately 12km south of Miles and is classified as an aircraft landing area. It is not registered or certified, there are no Regular Passenger Transport services, and it is currently only used occasionally by eight-seater aircraft but is capable of accepting larger aircraft. There is an apron capacity for two aircraft and a small terminal.

Western Downs Regional Council administers the aerodrome and there are currently no plans to upgrade the facility.

The Roma airport is a commercially operating airport, administered by Maranoa Regional council. Qantas Link operates approximately 17 flights a week, which equates to around two to three flights a day. This airport has the capacity for a Dash 8-300 which seats 50 passengers. There is apron capacity for two of these on the ground, with 18 parks for light planes.

There are currently no plans to upgrade the Roma airport.

24.17.2 Potential impacts

The traffic associated with the construction and operation of the gas fields may have the following impacts:

- Increased traffic on some of the local roads within the gas fields
- Increased turning movements at intersections of state-controlled roads with council-controlled roads
- Accelerated deterioration of some road pavements within the gas fields
- Increased traffic on high or very high crash risk roads
- Increased volume of oversized and/or overweight vehicles on state-controlled and council-controlled roads
- Increased traffic along roads also used as school bus routes
- Disruption, severance or increase risk of accidents for users on stock routes
- Increased dust, noise, spread of weeds and pests, and spills
- Increased traffic through Miles aerodrome and Roma airport

24.17.3 Traffic and transport management

Table 24.24 Traffic and transport – construction

Element/issue	Traffic and transport – construction
Operational policy	The gas fields will be constructed with minimal impact to the wellbeing of the local community and businesses
Performance criteria	Minimal impact on road safety Minimal increase in road congestion Participation in company-provided transportation for construction workforce movements Participation in safe driving courses
Implementation strategy	Traffic management and logistics plans will be developed to reduce total vehicular travel distance and risk of accidents from project construction Australia Pacific LNG will work with government and industry with respect to infrastructure modifications which may be required to meet the increased demands on the regional and local transport network. Modifications may include access road construction, flood mitigation measures, intersection and road modifications, pavement rehabilitation and road maintenance

Element/issue	Traffic and transport – construction
	Road and rail infrastructure crossings will utilise, as far as practical, construction techniques such as a boring Transport, for example buses, will be provided to and from key construction sites from designated pick up areas or local airports Journey management plans will be developed and implemented and these will incorporate fatigue management Road safety will be maintained using clear road signage, improved road alignments and intersection geometry Driver safety training programs will be offered to employees and contractors Measures, including project-based speed limits, will be implemented to reduce, as far as practicable, the generation of dust by project vehicles during construction Pro-active weed management will be undertaken, including working closely with regional councils
Monitoring	Routine HSE monitoring will provide data on near-misses and traffic accidents (incident reporting system) Data will be compiled on participation in, and influence of, the provision of transportation to reduce low occupancy vehicle use
Auditing	The contracts for construction contractors will include the provision for an audit under their construction HSE management plan
Reporting	Data will be gathered and communicated through existing HSE reporting systems. Independent reports will be produced for any investigations triggered by a complaint or an audit finding
Corrective action	Corrective actions will depend on the nature of the issue, for example: For excessive congestion of a particular route, alternative routes will be investigated and logistics plan altered as required and/or traffic monitoring will target the particular route If journey management plans are insufficient or incorrectly completed, then toolbox talks will be prepared to reinforce the training.

Table 24.25 Traffic and transport – operation

Element/issue	Traffic and transport – operation
Operational policy	The gas fields will be operated with minimal impact to the wellbeing of the local community and businesses
Performance criteria	Minimal impact on road safety Minimal increase in road congestion Participation in company-provided transportation for construction workforce movements

Element/issue	Traffic and transport – operation
	Participation in safe driving courses
Implementation strategy	Traffic management and logistics plans will be developed (based on those for construction) to reduce total vehicular travel distance and risk of accidents from project operations Australia Pacific will work with government and industry with respect to infrastructure maintenance or modifications which may be required to meet the increased demands on the regional and local transport network Transport, for example buses, will be provided to and from key operational sites from designated pick up areas or local airports Journey management plans will be developed and implemented and these will incorporate fatigue management Driver safety training programs will be offered to employees and contractors Measures, including project-based speed limits, will be implemented to reduce, as far as practicable, the generation of dust by project vehicles Pro-active weed management will be undertaken, including working closely with regional councils Access roads to temporary facilities, such as laydown yards, will be decommissioned unless relevant government agencies or landholders agree to retain the roads
Monitoring	Routine HSE monitoring will provide data on near-misses and traffic accidents (incident reporting system) Data will be compiled on participation in and influence of the provision of transportation to reduce low occupancy vehicle use
Auditing	The effectiveness of the traffic and transport mitigation measures will be assessed during HSEMS and compliance auditing as described in Section 24.3.8
Reporting	Monitoring results, complaints and auditing results will be reported as described in Section 24.3.6
Corrective action	Where investigations reveal an impact, corrective action will be implemented to mitigate the impact, for example: For excessive congestion of a particular route, alternative routes will be investigated and logistics plan altered as required and/or traffic monitoring will target the particular route If journey management plans are insufficiently or incorrectly completed, then toolbox talks will be prepared to reinforce the training.

24.18 Indigenous cultural heritage

24.18.1 Environmental values

Under Queensland's *Aboriginal Cultural Heritage Act 2003*, assessment of Indigenous cultural heritage significance is a matter solely for the Aboriginal Parties involved. Sites listed on International or National Heritage Registers (because of joint Indigenous/non-indigenous values), can be partially assessed for significance using the principles in the Burra Charter (Marquis-Kyle and Walker 1992). Significant indigenous sites and places in the gas field will be addressed in Cultural Heritage Management Plans (CHMP) negotiated with each Aboriginal Party.

A small number of Indigenous cultural heritage sites located within the gas fields study area are listed on local, state and Federal heritage registers.

Two Indigenous places within the gas fields' area were identified as being registered on the National Estate. These are:

- Indigenous Place, Kogan ID: 13810, ceremonial site
- Indigenous Place, Kogan ID: 13812, ceremonial site.

No listed World Heritage or National Trust of Queensland Heritage areas were identified in the gas fields.

A total of 274 sites listed on the Queensland Heritage Database and Register are found within 2km of proposed infrastructure (pipelines, water pipelines, compressor station sites) in the gas fields. These include a large number of scarred trees and hatchet head grinding grooves located in the Condamine River site province. Of these sites, 199 are found within 1km and seven within 100m of planned facilities.

There is a strong likelihood that cultural heritage places and sites, particularly isolated stone artefacts and artefact scatters, scarred trees, shell middens and hearths will be found throughout the gas fields.

The entire gas fields' area is covered by the following Aboriginal parties:

- Iman People # 2 (QC 97/55)
- Mandandanji People (QC 08/10)
- Mandandanji People 2 (QC 97/50)
- Barunggam People (QC 99/5)
- Western Wakka Wakka People (QC 99/4)
- Bigambul People (QC 09/02)

These parties are currently registered, or previously registered, Native title claim groups. The Aboriginal parties identified above were endorsed as Aboriginal parties in January 2010.

24.18.2 Potential impacts

No listed Indigenous cultural heritage is likely to be impacted by construction of planned infrastructure in the gas fields. Items of unrecorded Indigenous cultural heritage may occur near proposed infrastructure developments and without appropriate site management initiatives, may be threatened by construction impacts.

24.18.3 Indigenous cultural heritage management

Table 24.26 Indigenous cultural heritage – construction and operation

Element/issue	Indigenous cultural heritage – construction and operation
Operational policy	To construct and operate the gas fields with minimal impacts to Indigenous cultural heritage values
Performance criteria	An approved CHMP for each endorsed Aboriginal Party Compliance to approved CHMPs No unauthorised impacts to Indigenous artefacts
Implementation strategy	Site protection and management will be undertaken through the development and implementation of an agreed CHMP, recognising the primary role of Indigenous people in the custodianship of their heritage. CHMP procedures may include: • Avoidance of certain highly sensitive areas • Further detailed field investigations • Relocation of cultural heritage items. A primary component of the CHMPs will be managing Cultural Heritage. The CHMPs will include: • Procedures for the identification and management of cultural heritage objects, areas and values. This may include additional assessment or material or sites. • Management measures during construction may include: – Cultural heritage induction for the workforce and monitoring or specific construction activities – Procedures for unexpected finds – Procedures for the discovery of human remains – Processes for the management of the CHMP such as conflict resolution process. • Post-construction heritage management may include: – Following completion of the project, cultural heritage items recovered prior to construction and items identified and salvaged during construction may require management and curation. Issues relating to the storage of items of cultural heritage will be agreed upon and specified in the CHMP.
Monitoring	Any monitoring will be in accordance with agreed CHMPs
Auditing	Compliance auditing against the requirements of the CHMP will be undertaken
Reporting	Reporting will be undertaken in accordance with the requirements of the agreed CHMPs
Corrective action	Corrective action measures will be development and implemented in accordance with the agreed CHMPs

24.19 Non-indigenous heritage

24.19.1 Environmental values

Within the gas fields' study area there are no cultural heritage sites registered on the World Heritage List, Commonwealth Heritage List or the National Heritage List. Jimbour Station Homestead (32km east of the study area) and the Boonarga Cactoblastis Memorial Hall (1.6km east of the study area) are listed on the Register of the National Estate. Neither site will be affected by the proposed project.

Two sites of state heritage significance are found in the study area and are listed on the Queensland Heritage Register. These are the Digger Statue in Chinchilla and the Nostalgic Queens Theatre in Wallumbilla. These sites will not be affected by development in the gas fields.

Fifty sites of local heritage significance have been identified during field studies and research and are

- Listed in local heritage registers and planning schemes
- Listed by the National Trust of Queensland
- Others recorded in local histories.

An additional 54 heritage sites may be located within the gas fields which have been identified as a result of the review of existing reports.

24.19.2 Potential impacts

Eight identified sites are located within 1km of proposed high pressure gas pipelines and water transfer pipelines and may be impacted by the construction and operation of the gas fields.

The location of some infrastructure required for the Project is not currently known including gas wells, gas and water gathering networks and access roads. There is the potential for previously undetected sites occur within these areas to be impacted during construction.

24.19.3 Non-indigenous heritage management

Table 24.27 Non-indigenous heritage – construction and operation

Element/issue	Non-indigenous cultural heritage – construction and operation
Operational policy	Preservation of existing heritage sites of local, state and national significance during construction and operation of the gas fields
Performance criteria	No unauthorised impacts to non-Indigenous cultural heritage sites
Implementation strategy	Previously recorded non-Indigenous heritage sites will be avoided wherever practicable through careful placement of infrastructure Field investigations will be conducted prior to construction to document any non-Indigenous heritage sites likely to be impacted Although not expected, where heritage items are identified in the disturbance footprint, appropriate approvals and disturbance conditions will be obtained and implemented A Heritage Management Plan will be prepared and implemented to manage potential impacts and risks to sites. Heritage Management Plans will be prepared in

Element/issue	Non-indigenous cultural heritage – construction and operation
	consultation with relevant stakeholders, including the DERM as required Assessment of non-Indigenous site significance will be carried out using the criteria established under the *Queensland Heritage Act 1992*, to determine the appropriate protection measures for identified sites Procedures will be put in place to provide for the timely reporting and protection of heritage items and archaeological artefacts discovered during construction, consistent with requirements under the *Queensland Heritage Act 1992* The workforce will be inducted on the importance of non-Indigenous heritage sites and the procedures to be followed upon the discovery of their discovery The following actions will be implemented should a previously undetected non-Indigenous heritage site be discovered: • All work in the vicinity of the suspected heritage site will cease and a temporary buffer of at least 50m will be established to ensure that impacts are avoided • The Australia Pacific LNG Project Manager and Cultural Heritage Department Manager shall be notified • The Australia Pacific LNG Project's cultural heritage personnel shall be advised of the finding, and will inspect the suspected heritage items to assess them and ensure that the provisions of the *Queensland Heritage Act 1992* in relation to non-Indigenous archaeological sites are met • The Australia Pacific LNG Project Manager or Cultural Heritage Manager will liaise with officers of DERM, to ensure heritage items are properly recorded, their significance assessed and appropriate management measures implemented. These measures may include the protection and avoidance of the site; investigation and recording of the heritage items; removal of the heritage items, advise the relocation of facilities; or excavation of the historical items and the removal for safekeeping.
Monitoring	All historical sites identified as potentially being impacted by Project activities will be monitored in accordance with the relevant approval and permit conditions
Auditing	The effectiveness of the implementation strategies and complaint monitoring, if conducted, will be assessed during HSEMS and compliance auditing as described in Section 24.3.8
Reporting	The results of monitoring and implemented abatement measures will be reported to the administering authority as required.
Corrective action	Corrective actions may include: • Cease work in the immediate area and investigate • Fence off additional buffer • Relocate infrastructure.

24.20 Social impact management plan

The Queensland State Government is working through a process for developing Social Impact Management Plans (SIMP) which is to be applied to all resource projects in Queensland. A draft SIMP has been developed for the Project to establish and define Australia Pacific LNG's management of social performance throughout the life of the Project. This is a work in progress and will continue to be developed in consultation with the government, community and other stakeholders over the life of the Project. The draft Project SIMP framework identifies and develops the strategies required to implement the proposed mitigation measures and opportunities for enhancement. The framework has four sections: Project Summary, Community Engagement Strategy, Implementation and Monitoring and the Plan. Impact identification and assessment, mitigation strategies, responsibility, timing and performance measures are included in the Plan.

24.20.1 Project summary

Table 24.28 outlines the project summary in relation to development of the draft SIMP.

Table 24.28 Project summary

Reference		Project summary
1.1	Location of Project	Refer to Volume 1, Chapter 3
1.2	Brief summary of the project	Refer to Volume 1, Chapter 3
1.3	Description of the project's social and cultural area of influence	Refer to SIA (Volume 2, Chapter 20) Social Baseline Summary, Appendix B
1.4	Key social baseline study issues and statistics	Refer to SIA (Volume 2, Chapter 20) Social Baseline Summary, Appendix B
1.5	Potential contribution to regional development	Refer to Economic Assessment (Volume 2, Chapter 21)
1.6	Overview of SIA community engagement strategy including: • key stakeholders * • issues and concerns • community views, attitudes and aspirations	Refer to SIA (Volume 2, Chapter 20) – Sections 3 and 5
1.7	Overview of proposed workforce profile (construction and operations) including workforce accommodation proposals	Refer to SIA (Volume 2, Chapter 20) – Section 4

* Refer to Community and Stakeholder Engagement Chapter (Volume 2, Chapter 2)

24.20.2 Community engagement strategy

Table 24.29 outlines the community engagement strategy in relation to development of the draft SIMP.

Table 24.29 Community engagement strategy

Reference		Community Engagement (CE) Strategy
2.1	List of key stakeholders key interests including Indigenous stakeholders and interests	Refer to SIA (Volume 2, Chapter 20) Section 3 Refer to Community and Stakeholder Engagement Chapter (Volume 2, Chapter 2)
2.2	Description of proposed CE strategy that promotes active and ongoing role for stakeholders throughout the project life cycle	Australia Pacific LNG's community engagement strategy is guided by our Project Sustainability Framework, having particular regard to the following sustainability principles: • Engaging regularly, openly and transparently with people affected by our activities, considering their views in our decision–making and striving for positive social outcomes. Working cooperatively with communities, governments and other stakeholders to achieve positive social and environmental outcomes, seeking partnership approaches where appropriate. Australia Pacific LNG's CE strategies to address these principles include: • Consulting early, openly and regularly with community stakeholders, including landholders and affected communities, non-government organisations, businesses and indigenous groups. • Keeping community stakeholders informed of proposed project developments or activities pre-emptively through regular community briefings, including one-on-one discussions, open forum consultations newsletters and media activities. Ensuring that consultation processes enable the participation of social equity target group representatives. Establishing participative processes that consider community ideas in key decision making outputs relating to construction, operations and decommissioning. Establishing shopfronts at Chinchilla and Miles to provide opportunities for people to seek information about the Project. Continuation of a 1800 dedicated telephone hotline to receive public enquiries and complaints. Providing dedicated liaison officers to manage all enquiries and complaints . Investing in activities in partnership with local communities and government.

Reference		Community Engagement (CE) Strategy
		Planning and implementing social infrastructure investments through partnerships and collaborative arrangements between government, industry, educational and community organisations. Developing community programs in conjunction with members of the local community.
2.3	Management strategies to integrate CE strategy into project implementation at site level, and at local regional and state levels.	**Site level** Australia Pacific LNG is committed to integrating community engagement objectives into site level construction, operations and decommissioning activities. The following strategies and activities are proposed to ensure site level integration: Ensuring key site level staff and contractors have a working knowledge of relevant Australia Pacific LNG's community engagement policies and protocols. Ensuring employees and contractors have an awareness and understanding of the Australia Pacific LNG's stakeholder engagement strategy, Indigenous engagement strategy and landowner protocol and receive community cultural awareness training and briefings. Regular liaison between site management and corporate office to understand the results of community baseline and impact assessments and monitoring and identified communities of interest, including near neighbours and landowners. Ensuring that identified communities are as fully informed as practically possible about site level activities and their possible effects. Developing and maintaining a register of key stakeholders and of complaints at site level. Tracking complaints from community members and the follow-up and sign-off by relevant managers. Ensuring early referral of difficult or unresolved complaints to Corporate Communications. Participation of relevant site level managers in key community engagement activities; including community forums and any reference groups or Community Consultative Committee meetings that may be implemented. Ensuring that internal decision making processes at site level consider the potential effects and opportunities of its activities on impacted communities.

Reference		Community Engagement (CE) Strategy
		Local, regional and State level As part of its community engagement strategy, Australia Pacific LNG is committed to ensuring that Project implementation is integrated with broader local, regional and state level activities. The following strategies and activities are proposed to ensure that broader integration occurs: Meeting with and regularly updating Mayors, CEOs and relevant officers of Regional Councils regarding operational issues and progress towards project milestones. Maintaining regular dialogue with government agencies on key issues concerning relevant portfolios; including health, education, environment, infrastructure planning and transport. Participating in regional assessments and planning processes.
2.4	Mechanisms to support a regular review of the CE strategy's effectiveness	Australia Pacific LNG will develop a monitoring and reporting framework that will incorporate mechanisms to regularly review community engagement strategies (see Social Impact Management Plan Implementation and Monitoring below).

24.20.3 Implementation and monitoring

Assessment of impacts

Potential impacts were assessed through a four stage process in accordance with the draft guidelines for Social Impact Management Plans received from the Queensland Department of Infrastructure and Planning in November 2009. It should be noted that this methodology was adopted to ensure consistency with the draft guidelines, is consistent across the gas fields, LNG facility and main gas transmission pipeline Social Impact Assessments, and that it differs to that adopted elsewhere in the EIS. The key stages in assessing potential impacts are summarised below.

Stage one explains each of the potential impacts, describing why these are regarded as an impact and demonstrating clearly whether the impact is positive or negative, direct or indirect, long-term or short-term, local or widespread and if it is reversible or irreversible.

Stages two and three qualify each impact based upon two assessment characteristics. These characteristics include an assessment of the probability of the impact occurring and an assessment of the actual result and scale of effect of an impact if it were to happen (that is, potential consequences).

Occurrence

The probability of occurrence for each impact is rated between 'low' and 'high,' as follows:

- High (81-100%)
- Medium (31-80%)
- Low (0-30%).

Consequence

The potential consequences may vary between 'low', 'medium' and 'high', and positive as follows:

- Low
  - Isolated issues or complaint that can be resolved via routine site procedures
  - Insignificant to minor social harm
  - No threat to social licence to operate.
- Medium
  - Repeated incidents or community complaints that require significant adjustment to overall site level and business level procedures
  - Moderate social harm
  - Medium threat to social license to operate.
- High
  - Significant, widespread and enduring community issue or dissent
  - Major to severe or irreversible social harm
  - Direct threat to social license to operate.
- Positive (+)

The fourth and final stage of the impact assessment process is to identify mitigation measures and opportunities for enhancement. The purpose of mitigation is to identify measures to safeguard the environment and the community affected by the Project. Where impacts are assessed to be positive, or where there is no, or only a minimal impact, opportunities for social enhancement are identified and measures for implementation are explained.

Implementation Responsibilities

Australia Pacific LNG recognises that it has a significant role to play in the management and mitigation of impacts. However, effective impact mitigation requires the participation and collaboration of a range of stakeholders due to the complexity of many of the issues involved.

In particular, government has a significant role in the planning and delivery of core services such as health, education, emergency services, transport and infrastructure, and employment and training initiatives. Where relevant, this draft SIMP nominates the appropriate State or Federal Government department which has a shared responsibility for the implementation and / or monitoring of a particular mitigation strategy.

The factors which contribute to the need for a shared approach to management and mitigation include:

- The scope of CSG to LNG activities
- The staging of activities (planning, construction, operations and decommissioning)
- The breadth of current and future LNG industry and broader resource sector participants (and therefore extent of risk for cumulative impacts)
- The diverse local, regional and broader governance contexts in which the Project components exist (upstream and downstream).

Accordingly, the draft SIMP sets out the areas of responsibility for implementation of identified mitigation strategies under the following broad stakeholder categories:

- Australian Pacific LNG (this includes joint-venture partners and contractors)
- Government (local, State and Federal) – primary departments
- Industry (Oil and Gas)
- Shared Responsibility could include other parties in addition to those listed above such as:
  - Other government agencies where relevant
  - Private Sector
  - Community.

The relevant Government Departments include but are not limited to:

- Federal Government:
  - Department of Education, Employment and Workplace Relations
  - Department of Infrastructure, Transport, Regional Development and Local Government.
- Queensland Government:
  - Department of Premier and Cabinet
  - Department of Communities
  - Department of Infrastructure and Planning
  - Department of Education and Training
  - Department of Employment, Economic Development and Innovation
  - Department of Environment & Resource Management
  - Queensland Police
  - Department of Community Safety
  - Department of Transport and Main Roads
  - Queensland Health.

Timing

The draft SIMP designates the anticipated commencement timing for the implementation of mitigation strategies under the following categories:

- Pre-construction (PC)
- Construction (C)
- Operations (O).

Mitigation strategies that continue throughout the Project lifecycle (including construction, operation and decommissioning) are further designated as Life of Project (LP).

Measures and Targets

Australia Pacific LNG has established a range of metrics, standards and qualitative criteria as measures or indicators of the relative performance of individual mitigation strategies. In selecting measures or indicators, consideration has been given to the following criteria:

- Relevance of the indicator to the impact being measured
- Measurability
- Reliability of data sources and ease of data collection
- Current availability of data or the resources and capacity to collect new data.

The list of measures included in the SIMP is not intended as a prescription for evaluating Australia Pacific LNG's ongoing performance. Rather, it is an aspirational starting point in an iterative process of implementation, review, modification and improvement. Australia Pacific LNG anticipates that, over time, different phases of the project may require different or modified performance measures and that some indicators may prove too difficult to measure or not as informative as originally anticipated. Not all indicators are intended for the public domain and the classification of performance measures in this regard will be guided by Australia Pacific LNG's monitoring and reporting framework (see below).

To assist in implementation of the SIMP, Australia Pacific LNG will develop appropriate targets against which to measure and report the performance of the SIMP over time. In setting targets, Australia Pacific LNG will take a broad and balanced approach, including consideration of:

- Baseline data
- Intended outcomes of individual mitigation strategies
- Australia Pacific LNG Project sustainability framework
- Industry standards
- Community expectations and aspirations
- Government requirements.

Targets will be periodically reviewed and updated to ensure ongoing relevance to impacts being measured.

Critically, the success of the Australia Pacific LNG's performance against many of the measures outlined in the SIMP depends on government, particularly State Government, delivery on measures of its' own departmental policies and plans. These include *Toward Q2: Tomorrow's Queensland,* which describes five ambitions for the State, covering the economy, environment and lifestyle, education and skills, health and community, *Blueprint for the Bush* and the *Blueprint for Queensland's LNG Industry* which provides an outline of how the State Government will facilitate the development of the LNG industry in Queensland and work with local communities to ensure that any development of LNG resources is beneficial. The targets and performance measures for these initiatives are described in the Social Baseline in Volume 5, Attachment 51.

Monitoring and Reporting

Australia Pacific LNG believes that effective monitoring of its activities is essential so that impacts can be accurately measured, mitigation measures assessed and meaningful reports provided to stakeholders. To this end Australia Pacific LNG will be developing a monitoring and reporting framework post EIS. The development of the framework will have regard to the following objectives:

- To build a sound understanding of the environmental, social and economic systems in which Australia Pacific LNG operates
- To share this knowledge with our communities of interest to assist in developing community capacity
- To assist in decision-making with respect to project design, delivery and investments throughout the project lifecycle
- To track progress towards performance targets
- To assist Australia Pacific LNG to contribute to local and regional planning activities
- To promote an emphasis on learning, improvement and accountability
- To ensure that adaptive management occurs as part of continuous improvement
- To establish roles and responsibilities for monitoring and reporting
- To identify relevant indicators for internal versus external reporting requirements
- To report with an emphasis on outcomes and impacts, including at an intermediate outcome stage
- To assist Australia Pacific LNG to report on its overall performance against the company's sustainability framework.

Links between Sustainability Framework and Social Impact Management Plan

Australia Pacific LNG aspires to be at the forefront of sustainable practices, contributing to a positive future for our customers, our communities, our investors and people, delivering a positive benefit to people, communities and the environment. The Social Impact Management Plan is guided by our Project Sustainability Framework, having particular regard to the following sustainability principles:

- Fostering the health and well-being of our workforce
- Respecting the rights, interests and diverse cultures of the communities in which we operate
- Engaging regularly, openly and transparently with people and communities affected by our activities, considering their views in our decision-making and striving for positive social outcomes
- Working cooperatively with communities, governments and other stakeholders to achieve positive social and environmental outcomes, seeking partnership approaches where appropriate
- Upholding exemplary ethical behaviour in all aspects of our business
- Identifying, assessing, managing, monitoring and reviewing risks to our workforce, our property, the environment and the communities affected by our activities.

Ensuring that all employees and contractors work consistently with our sustainability principles, commitments, values and systems

24.20.4 Draft SIMP

Table 24.30 Draft social impact management plan

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
Population								
Increase in regional population.	Cons Ops	H H	M M	• Australia Pacific LNG will provide housing for non-local construction staff and contractors in temporary accommodation facilities and will consult with stakeholders including the local councils as part of the site selection process. • Australia Pacific LNG will work with government, the community and other industries to plan for potential cumulative impacts and share information relating to potential impacts and mitigation measures. • Australia Pacific LNG will continue to participate in Local Government and regional planning processes and provide information about its Project to inform discussion and decision making in a timely manner. • Australia Pacific LNG will continue to use or develop methods to attract people local to the region to the workforce. • Australia Pacific LNG will continue to use or develop methods to attract under-represented groups to the workforce.	M L	Australia Pacific LNG Shared responsibility • Government – Department of Communities (Housing and Homelessness Services) • Department of Infrastructure and Planning	PC C	• Percentage of construction workforce sourced from the local area. • Number and percentage of persons employed by Australia Pacific LNG by social equity target group, occupation and position/seniority. • Functional working relationships are established with government, the community and other industries. • Evidence of joint stakeholder outputs (planning forums, communications, action plans etc.) to identify and mitigate potential cumulative impacts. • Relevant cumulative impact and regional planning strategies are acknowledged and reflected in Australia Pacific LNG planning documents and related communications. • Track and analyse community attitudes towards Project consultation processes and management of construction workforce issues.
Demographic Profile								
Change in community demographics due to construction workforce profile.	Cons Ops	H L	M L	• Australia Pacific LNG will continue to use or develop methods to attract people local to the region to the workforce. • Australia Pacific LNG will continue to use or develop methods to attract under-represented groups to the workforce.	L L	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and	PC C	• Percentage of construction workforce sourced from the local area. • Percentage of construction workers accommodated at the temporary accommodation

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
				• Australia Pacific LNG will uphold a high standard of behaviour and will communicate and strictly enforce its Code of Conduct for all employees and contractors. Refer to 'community health and safety' mitigation measures		Planning		facilities. • Number and percentage of persons employed by Australia Pacific LNG by social equity target group, occupation and position/seniority. • Track and analyse breaches of the Code of Conduct by incident type. • Track and analyse community attitudes towards Australia Pacific LNG's position and processes in relation to recruitment and workforce management. Also refer to 'community health and safety' performance measures.
Increase in the number of overseas workers in the community.	Cons	M	M	• Australia Pacific LNG will continue to use and develop methods to attract people local to the region to the workforce. • Australia Pacific LNG will continue to use and develop methods to attract under-represented groups to the workforce. Refer to 'facilities and services' mitigation measures.	L	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and Planning	PC C	• Percentage of construction workforce sourced from overseas. Also refer to 'facilities and services' performance measures.
Income and Affordability								
Increased cost of living due to inflationary pressure from higher average weekly incomes.	Cons Ops	M L	M M	• Australia Pacific LNG will provide housing for non-local construction staff and contractors in temporary accommodation facilities and will consult with stakeholders including the local council as part of the site selection process for these facilities. • Australia Pacific LNG will work through committees established under the Sustainable Resource Communities Policy to identify housing market issues, forecasts and possible responses. • To mitigate potential impacts on housing affordability and availability, Australia Pacific LNG's community programs will include working with Government and agencies that provide housing to people in housing distress.	L L	Australia Pacific LNG Shared responsibility • Government – Department of Communities (Housing and Homelessness Services) – Department of Infrastructure and Planning	PC O LP	• Percentage of construction workers accommodated at the temporary accommodation facility. • Functional working relationships established with local councils, State Government, relevant agencies and committees.

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
				• Refer to comm.. invest				
Social divide resulting from increased wage gap (that is, the 'haves' and 'have nots').	Cons Ops	M L	M M	• Australia Pacific LNG will continue to use or develop methods to attract people local to the region to the workforce. • Australia Pacific LNG will implement a local content strategy whereby we participate in or establish programs which assist qualified local and regional businesses with the opportunity to tender for provision of goods and services for the Project. • Australia Pacific LNG will continue to use and develop methods to attract under-represented groups to the workforce. • Australia Pacific LNG will aim to build collaborative partnerships with government and community organisations to enhance the capacity of employers to provide jobs and the capacity of locals to develop skills and secure jobs. For example through the Community Skills Scholarship program. • Australia Pacific LNG's community investment programs will support sustainable community development. • To mitigate potential impacts on housing affordability and availability, Australia Pacific LNG's community programs will include working with government and agencies that provide housing to people in housing distress.	L L	Australia Pacific LNG Shared responsibility • Government – Department of Education and Training • Department of Employment, Economic Development and Innovation • Department of Communities (Housing and Homelessness Services)	PC O LP	• Percentage of workforce sourced from the local area. • Number and percentage of persons employed by Australia Pacific LNG by age, gender, social equity target group, occupation and position /seniority. • Functional working relationships established with government and community organisations and evidence of partnership projects. • Evaluate community investment programs to assess the achievement of program goals and objectives. See also local content strategy and Employment and Training indicators under Employment, Training and Business impacts (below).
Employment Training and Business								
Opportunity to increase labour-force participation and increase local skills capacity.	Cons Ops	M M	+ +	• Australia Pacific LNG workforce strategy will address: • In-house training programs. • Analysis of ongoing labour requirements. • Training strategies targeted to local labour. • Targeted employment and training programs. • Methods to attract people local to the region to the workforce.	+ +	Australia Pacific LNG Shared responsibility • Government – Department of Education and Training Industry	PC O LP	**Employment** • Number of persons employed via government sponsored employment programs by length of time unemployed. • Number and percentage of persons employed by Australia Pacific LNG by social equity target group, occupation and position/seniority.

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
				• Methods to attract under-represented groups to the workforce. • Australia Pacific LNG will work with government, the community and other industries to plan for potential cumulative impacts and share information relating to potential impacts and mitigation measures. • Australia Pacific LNG will work together with the CSG/LNG industry through the CSG/LNG Skills Taskforce of Energy Skills Queensland to help address skill shortages by: • Raising awareness of the CSG/LNG industry in local communities. • Supporting vocational training. • Facilitating career advice and work readiness programs for new entrants and mature entrants from related industries. • Australia Pacific LNG will participate in CSG/LNG gateway programs with secondary schools in the Project region in partnership with providers such as the Queensland Minerals and Energy Academy to implement programs that promote career opportunities and facilitate employment in the CSG/LNG industry. • Australia Pacific LNG will continue to collaborate on programs with government, training and education groups that build the local skills base both to meet the specific needs of the industry and other impacted sectors. This will include further development of apprenticeship, traineeship, scholarship and higher education programs.				• Functional working relationships are established with other industries. • Evidence of joint industry outputs (planning forums, communications, action plans, etc.) to identify and mitigate potential cumulative impacts. **Training** • Number of local area residents participating in skills development programs offered by Australia Pacific LNG. • Number of local area residents participating in skills development programs offered by Australia Pacific LNG by social equity target group and occupation. • Number and percentage of apprentices and trainees starting, graduating and finding continuous employment with Australia Pacific LNG by occupation / operational area. • Evaluate community investment programs to assess the achievement of program goals and objectives • Number of students given work experience and/or receiving scholarship or financial support.
Opportunities for local and regional businesses to supply goods and services to the Project.	Cons Op	H M	+ +	• Australia Pacific LNG will implement a local content strategy whereby it participates in or establishes programs which assist qualified local and regional businesses to access opportunities to tender for provision of goods and services for the Project. • The local content strategy will include provision such as regular project updates, overview of goods and	+ +	Australia Pacific LNG Shared responsibility • Government – Department of Employment, Economic	PC O LP	• Percentage and dollar value of supplier contracts (Australia Pacific LNG and its contractors) awarded to businesses based in the local and regional area. • Track and analyse local business community attitudes towards the

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	Project Phase (Cons, Ops)*	Probability (H, M, L)**	Consequence (H, M, L)**	Management/mitigation strategies	H, M, L**			
				services packages, supply chain education. • Australia Pacific LNG will ensure contracts with suppliers and sub-contractors are aligned with Australia Pacific LNG's sustainability principles and objectives.		Development and Innovation		availability of supplier information and engagement with procurement of the local content strategy, including existing suppliers and non-suppliers.
Inflationary pressure on commercial real estate costs impacts on local businesses.	Cons Ops	L L	M M	• Australia Pacific LNG will continue to participate in Local Government and regional planning processes and provide information regarding demand for commercial real estate to allow for evaluation of future growth and due consideration for additional land release.	M M	Shared responsibility • Government • Department of Infrastructure and Planning	PC O LP	• Functional working relationships are established with government planning bodies and development industry stakeholders.
Impact to local and regional businesses losing employees to the Project.	Cons Ops	M L	M M	• Australia Pacific LNG will aim to build collaborative partnerships with government and community organisations to enhance the capacity of employers to provide jobs and the capacity of locals to develop skills and secure jobs. For example through the Community Skills Scholarship program. • Australia Pacific LNG will continue to collaborate on programs with government and training and education groups that build the local skills base both to meet the specific needs of the industry and other impacted sectors. This will include further development of apprenticeship, traineeship, scholarship and higher education programs.	L L	Australia Pacific LNG Shared responsibility • Government – Department of Education and Training	PC LP	• See employment and training and local content indicators above. • Functional working relationships established with government and community organisations and evidence of partnership projects. • Evaluate community investment programs to assess the achievement of program goals and objectives.
Impact to operation of agricultural businesses	Cons Ops	H H	M M	• Australia Pacific LNG will integrate and manage Project activities in consultation with landowners • Australia Pacific LNG will continue working with the Government's Land Access Group to inform the development of an industry wide code of conduct for working with landowners. • Vehicle inspection and cleaning facilities will be used by Australia Pacific LNG at appropriate locations to mitigate against the spread of weeds. • Australia Pacific LNG will bury pipeline infrastructure to ensure continuity of farming activities. • Australia Pacific LNG will 'make good' a decline in the water supply to an impacted water bore in	L L	Australia Pacific LNG Industry	PC O LP	• Track and analyse adherence to weed management procedures • Track and analyse landowner satisfaction with consultation procedures • Ability for agricultural activities to continue after pipeline construction and remediation. • Evaluate range of community investment programs supporting local agricultural values.

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
				accordance with requirements of the Petroleum and Gas (Production and Safety) Act 2004. • Australia Pacific LNG's community investment programs will support sustainable community development. Refer to Community and Stakeholder Engagement Chapter, Volume 2, Chapter 2, Refer to landuse chapter				
Opportunities for apprenticeships, scholarships and vocational training.	Ops Cons	H M	+ +	• Australia Pacific LNG will continue to collaborate on programs with government and training and education groups that build the local skills base both to meet the specific needs of the industry and other impacted sectors. This will include further development of apprenticeship, traineeship, scholarship and higher education programs. • Australia Pacific LNG will work with government, the community and other industries to plan for potential cumulative impacts and share information relating to potential impacts and mitigation measures. • Australia Pacific LNG will continue to participate in Local Government and regional planning processes and provide information about its Project to inform discussion and decision making in a timely manner. • Australia Pacific LNG will work closely with education providers to develop or utilise existing programs suitable for the industry including programs that recognise prior learning, reducing impact to local educational institutions.	+ +	Australia Pacific LNG Shared Responsibility • Government – Department of Education and Training • Department of Infrastructure and Planning	PC O LP	See employment and training indicators above. • Evaluate community investment programs to assess the achievement of program goals and objectives • Expenditure on training programs. • Number of apprenticeships and scholarships offered by the Australia Pacific LNG project.
Opportunity to support work readiness programs and pre-trade training concepts.	Ops Cons	H M	+ +	• Australia Pacific LNG will continue to develop or utilise existing local partnerships to assist students to transition from school to work or higher education. • Australia Pacific LNG will partner with local training providers to develop industry and employment skills. • Australia Pacific LNG will work together with the CSG/LNG industry through the CSG/LNG Skills Taskforce of Energy Skills Queensland to help address skill shortages by:	+ +	Australia Pacific LNG Industry Shared responsibility • Government – Department of Education and Training	PC O LP	• Functional working relationships established with training providers and industry groups. • Relevant cumulative impact and regional planning strategies are acknowledged and reflected in Australia Pacific LNG planning documents and related communications. • Track and analyse awareness

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
				• Raising awareness of the CSG/LNG industry in local communities. • Supporting vocational training. • Facilitating career advice and work readiness programs for new entrants and mature entrants from related industries. • Australia Pacific LNG will participate in CSG/LNG gateway programs with secondary schools in the Project region in partnership with providers such as the Queensland Minerals and Energy Academy to implement programs that promote career opportunities and facilitate employment in the CSG/LNG industry. • Australia Pacific LNG will expand competency based training and skills development programs for Production and Process Plant Operators.				levels of the CSG/LNG industry in Project areas • Level of growth in competency based training and skills development programs for Production and Process Plant Operators.
Primary and Secondary Education								
Inability of primary and secondary education facilities to meet demand.	Cons Ops	L L	M M	• Australia Pacific LNG will assist primary and secondary education institutions in forecasting future demand by providing relevant workforce data to relevant State Government departments • Australia Pacific LNG will work with government, the community and other industries to plan for potential cumulative impacts and share information relating to potential impacts and mitigation measures.	L L	Australia Pacific LNG Shared Responsibility • Government – Department of Education and Training – Department of Infrastructure and Planning	PC O LP	• Communication of workforce demand estimates to the State Government. • Functional working relationships are established with government, the community and other industries. • Evidence of joint stakeholder outputs (planning forums, communications, action plans etc.) to identify and mitigate potential cumulative impacts. • Relevant cumulative impact strategies are acknowledged and reflected in Australia Pacific LNG planning documents and related communications.
Housing and Accommodation								
Increase in housing and/or	Cons	H	H	• Australia Pacific LNG will provide housing for non-local construction staff and contractors in temporary	L	Australia Pacific LNG	PC	• Percentage of non-local workers accommodated in temporary

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
rental prices caused by increased demand and limited supply results in poor levels of housing affordability and an over-inflated market.	Ops	M	H	accommodation facilities and will consult with stakeholders including the local council as part of the site selection process for these facilities. • Australia Pacific LNG will provide temporary accommodation for personnel wishing to relocate until such time as housing stock becomes available. • Australia Pacific LNG will work with government, the community and other industries to plan for potential cumulative impacts and share information relating to potential impacts and mitigation measures. • Australia Pacific LNG will continue to participate in Local Government and regional planning processes and provide information about its Project to inform discussion and decision making in a timely manner. • Australia Pacific LNG will work through committees established under the Sustainable Resource Communities Policy to identify housing market issues, forecasts and possible responses. • To mitigate potential impacts on housing affordability and availability, Australia Pacific LNG's community programs will include working with Government and agencies that provide housing to people in housing distress.	M	Shared Responsibility • Government – Department of Communities (Housing and Homelessness Services) – Department of Infrastructure and Planning	O LP	accommodation facilities. • Worker accommodation completed ahead of project demand. • Functional working relationships are established with government, the community and other industries. • Evidence of joint stakeholder outputs (planning forums, communications, action plans etc.) to identify and mitigate potential cumulative impacts. • Relevant cumulative impact and regional planning strategies are acknowledged and reflected in Australia Pacific LNG planning documents and related communications.
Concerns that temporary accommodation facilities will foster anti-social behaviour and impact to host community.	Cons	M	H	• Australia Pacific LNG will continue consultation and engagement programs with communities and stakeholders to ensure their views are understood and considered throughout the life of the Project. • Australia Pacific LNG will uphold a high standard of behaviour and will communicate and strictly enforce its Code of Conduct for all employees and contractors. • Australia Pacific LNG will design and construct a high quality temporary accommodation facility with sufficient social and recreational facilities. • Australia Pacific LNG will continue to implement a community complaints procedure for communities and stakeholders to raise concerns, and in turn have them addressed in a timely manner.	L	Australia Pacific LNG	PC C	• Track and analyse breaches of the Code of Conduct by incident type. • Number and type of community complaints made to Australia Pacific LNG, its contractors, local councils and others. • Track and analyse complaint response time and resolution. • Track and analyse workforce attitudes towards the physical and operational standards of the accommodation facilities

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
Increased demand for hotel/motel accommodation presents challenges for competing local industry and businesses.	Cons	M	H	• Australia Pacific LNG will work with government, the community and other industries to plan for potential cumulative impacts and share information relating to potential impacts and mitigation measures. • Australia Pacific LNG will continue to participate in Local Government and regional planning processes and provide information about its Project to inform discussion and decision making in a timely manner. • Australia Pacific LNG will provide housing for non-local construction staff and contractors in temporary accommodation facilities.	L	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and Planning	PC C	• Timely communication of project and workforce demands. • Functional working relationships are established with government, the community and other industries. • Evidence of joint stakeholder outputs (planning forums, communications, action plans etc.) to identify and mitigate potential cumulative impacts. • Relevant cumulative impact and regional planning strategies are acknowledged and reflected in Australia Pacific LNG planning documents and related communications.
Community Health and Safety								
Community concern about health and safety impacts resulting from the Project.	Cons Ops	M M	H H	• Community health and safety practices and results of monitoring communicated through a range of channels including Australia Pacific LNG's shop-front, consultation sessions, media and meetings. • Australia Pacific LNG will continue to implement a community complaints procedure for community members and stakeholders to raise concerns, and in turn have them addressed in a timely manner. • Australia Pacific LNG will work with government, the community and other industries to plan for potential cumulative impacts and share information relating to potential impacts and mitigation measures. • Australia Pacific LNG will continue consultation and engagement programs with communities and stakeholders to ensure their views are understood and considered throughout the life of the Project.	L L	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and Planning	PC O LP	• Number and type of health, safety and environment (HSE) related complaints pertaining to Australia Pacific LNG and its contractors made to Australia Pacific LNG, its contractors, local council and others. • Track and analyse community attitudes towards Australia Pacific LNG and its contractors environmental, health and safety performance. • Number and percentage of HSE incidents by incident type. • Level of compliance with environmental legislative reporting requirements. • Functional working relationships are established with government, the community and other

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	Project Phase (Cons, Ops)*	Probability (H, M, L)**	Consequence (H, M, L)**	Management/mitigation strategies	H, M, L**			
								industries. • Evidence of joint stakeholder outputs (planning forums, communications, action plans etc.) to identify and mitigate potential cumulative impacts. • Relevant cumulative impact and regional planning strategies are acknowledged and reflected in Australia Pacific LNG planning documents and related communications. • Functional working relationships are established with environment related community groups.
Potential for socially unacceptable behaviour due to the increase in population and changed demographics.	Cons Ops	M L	M M	• Australia Pacific LNG will continue consultation and engagement programs with communities and stakeholders to ensure their views are understood and considered throughout the life of the Project. • Australia Pacific LNG will uphold a high standard of behaviour and will communicate and strictly enforce its Code of Conduct for all employees and contractors. • Australia Pacific LNG will uphold a high standard of behaviour. • Australia Pacific LNG will continue to implement a community complaints procedure for community members and stakeholders to raise concerns, and in turn have them addressed in a timely manner. • Health promotion programs relating to the 'Fit for Work' and 'Drug and Alcohol' policies will be implemented	L L	Australia Pacific LNG	PC O LP	• Track and analyse participation of Australia Pacific LNG employees and contractors in health promotion programs and safety training initiatives. • Track and analyse results of employees and contractors alcohol and drug tests at Australia Pacific LNG. • Track and analyse breaches of the Code of Conduct by incident type. • Number and type of behaviour related complaints relating to Australia Pacific LNG workers and contractors made to Australia Pacific LNG, its contractors, local council and others. • Track and analyse community attitudes towards the conduct of Australia Pacific LNG workers.
Increase in road, air and shipping movements	Cons Ops	H M	H H	• Australia Pacific LNG will work with the Federal, State and local government and industry in regard to potential upgrades required to meet the increase	M M	Australia Pacific LNG Shared responsibility	PC	• Number of employee, contractor and community participants completing road safety programs

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
impacting on road and maritime safety, and congestion.				demands on regional infrastructure. • Australia Pacific LNG will develop a logistics management plan to efficiently move people and materials and to reduce the impact of traffic and transport on communities by: • consolidation of material prior to transport to reduce truck movements • siting logistic hubs (warehouses and lay down facilities) that divert traffic flows around local towns • the use of buses for personnel site access during construction and operations • appropriate travel restrictions • development and implementation of safe transportation management practices to reduce the impact to the local environment. • avoid travel along school routes during set down pick up times • night time travel managed where routes pass sensitive sites, e.g. residential and schools • Speed restrictions especially next to sensitive sites – residential, schools or along unsealed roads to reduce dust creation • Vehicles lights and warning lights illuminated as appropriate • Implementation of driver training program • Safe transportation management practices with minimal impact to the local environment developed and implemented by Australia Pacific LNG. • Australia Pacific LNG will expand the Community Safety Awareness program in conjunction with industry partners, government and community groups to develop responses to community safety issues in the region. Refer to mitigation measures in traffic and transport section of EIS, Volume 2, Chapter 17.		• Government – Department of Infrastructure, Transport, Regional Development and Local Government – Department of Main Roads – Department of Infrastructure and Planning		• Number and type of traffic related incidents relating to Australia Pacific LNG workers and contractors. • Track and analyse community attitudes towards the project

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
Facilities and Services								
Increased demand on medical and health services.	Cons Ops	H M	H H	• Australia Pacific LNG will collaborate with government, industry and other providers to mitigate the impact to health services in local communities including providing the appropriate level of medical facilities for its temporary accommodation facilities and operating facilities. • Australia Pacific LNG will continue to participate in Local Government and regional planning processes and provide information about its Project to inform discussion and decision making in a timely manner. • Health promotion programs relating to the 'Fit for Work' and 'Drug and Alcohol' policies will be implemented	L L	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and Planning • Qld Health	PC O	• Timely communication of workforce demand estimates to Queensland Health and local councils within the region. • Number and type of lost workday cases related to illness. • Workforce participation rates for employee wellbeing program activities. • Number of work related visits to medical facilities outside of Australia Pacific LNG facilities.
Increased demand on emergency services	Cons Ops	L L	M M	• Australia Pacific LNG will continue to participate in Local Government and regional planning processes and provide information about its Project to inform discussion and decision making in a timely manner. • Australia Pacific LNG will collaborate with government, industry and other providers to mitigate the impact to health services in local communities including providing the appropriate level of medical facilities for its temporary accommodation facilities and facilities. *See Vol*ume 2, Chapter 22 for mitigation measures for hazard and risk as they relate to emergency services in the gas fields' area.	L L	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and Planning – Qld Health	PC C	• Participation in and active contribution to regional planning activities as evidenced through relevant planning outputs (reports, minutes, media communications) and subsequent commitments • Relevant cumulative impact and regional planning strategies are acknowledged and reflected in Australia Pacific LNG planning documents and related communications.
Increased demand for community support services and facilities (for example, child care, public transport, family services)	Cons Ops	L M	M M	• Australia Pacific LNG will collaborate with government industry and community partners regarding research programs to understand the social impacts and opportunities created by development in communities in which it operates. • Australia Pacific LNG's community investment programs will support sustainable community development by identifying and supporting programs that target community support services.	L L	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and Planning – Department of Communities	PC O LP	• Communication of estimated workforce demands to Local and State Government and community service providers. • Australia Pacific LNG's participation in and active contribution to social impact research programs as evidenced through relevant planning outputs

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	Project Phase (Cons, Ops)*	Probability (H, M, L)**	Consequence (H, M, L)**	Management/mitigation strategies	H, M, L**			
				• Australia Pacific LNG will work with government, the community and other industries to plan for potential cumulative impacts and share information relating to potential impacts and mitigation measures. • Australia Pacific LNG will provide orientation to employees moving to the region through the workforce induction program to alleviate pressure on existing support services. • Australia Pacific LNG will continue to participate in Local Government and regional planning processes and provide information about its Project to inform discussion and decision making in a timely manner. • See Volume 2, Chapter 17 for mitigation measures for impacts on traffic and transport services and infrastructure.				(reports, minutes, media communications). • Functional working relationships are established with government, the community and other industries to plan for cumulative impacts. • Evidence of joint stakeholder outputs (planning forums, communications, action plans etc.) to identify and mitigate potential cumulative impacts. • Relevant cumulative impact and regional planning strategies are acknowledged and reflected in Australia Pacific LNG planning documents and related communications. • Evaluate community investment programs to assess the achievement of program goals and objectives • Number of Australia Pacific LNG staff and contractors participating in community organisations, activities and events.
Increased pressure on utility services.	Cons Ops	L M	L M	• Australia Pacific LNG will work with government, the community and other industries to plan for potential cumulative impacts and share information relating to potential impacts and mitigation measures. • Australia Pacific LNG will continue to participate in Local Government and regional planning processes and provide information about its Project to inform discussion and decision making in a timely manner.	L L	Shared responsibility Government – Department of Infrastructure and Planning	PC	• Communication of workforce demand estimates to the Local and State Government.
Reduced access to recreational areas.	Cons Ops	L L	M M	• Australia Pacific LNG will continue consultation and engagement programs with stakeholders to ensure their views are understood and considered throughout the life of the Project.	L L	Australia Pacific LNG	PC O LP	• Communication of project works activities to affected stakeholders. • Track and analyse community attitudes towards the Project.

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
				• Australia Pacific LNG will continue to communicate the extent and timing of any impacts to affected stakeholders and schedule works around minimal disturbance. • Australia Pacific LNG will continue to implement community complaints procedure for community members and stakeholders to raise concerns, and in turn have them addressed in a timely manner.				• Number and type of community complaints made to Australia Pacific LNG, its contractors, local council and others. • Track and analyse complaint response time and resolution.
Community Values and Lifestyle								
The region's growth will impact local community values and residents' lifestyle patterns.	Cons Ops	H M	M M	• Australia Pacific LNG will collaborate with government, industry and community partners regarding research programs to understand the social impacts and opportunities created by development in communities in which it operates. • Australia Pacific LNG's community investment programs will support sustainable community development. • Australia Pacific LNG will ensure contracts with suppliers and sub-contractors are aligned with Australia Pacific LNG's sustainability principles and objectives. • Australia Pacific LNG will continue consultation and engagement programs with stakeholders to ensure their views are understood and considered throughout the life of the Project. • Australia Pacific LNG will uphold a high standard of behaviour and will communicate and strictly enforce its Code of Conduct for all employees and contractors.	L L	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and Planning – Department of Communities	PC O LP	• Australia Pacific LNG participation in and active contribution to social impact research programs as evidenced through relevant planning outputs (reports, minutes, media communications). • Evaluate community investment programs to assess the achievement of program goals and objectives. • Track and analyse community attitudes towards consultation processes and management of project impacts during construction and operational phases. • Track and analyse breaches of the Code of Conduct by incident type. • Number and type of community complaints made to Australia Pacific LNG, its contractors, local council and others. • Track and analyse community attitudes towards the conduct of staff and contractors. • Number of Australia Pacific LNG staff and contractors participating in community organisations, activities and events.

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
								• Track and analyse changes in community attitudes over time. For example, for example, social attitudes and experiences of community life, cultural diversity and social interactions.
Shift work employment decreases the time workers spend with their families and participating in community activities (including volunteering).	Cons Ops	M M	M M	• Australia Pacific LNG will collaborate with government industry and community partners regarding research programs to understand the social impacts and opportunities created by development in communities in which it operates. • Australia Pacific LNG will design flexible rosters.	M L	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and Planning – Department of Communities	PC O LP	• Australia Pacific LNG participation in and active contribution to social impact research programs as evidenced through relevant planning outputs (reports, minutes, media communications). • Number of Australia Pacific LNG staff and contractors participating in community organisations, activities and events.
Relationship between increased disposable income and how people spend it (for example, increased spend on gambling, alcohol or drugs) impacting on community values.	Cons Ops	L L	H H	• Australia Pacific LNG will uphold a high standard of behaviour and will communicate and strictly enforce its Code of Conduct for all employees and contractors. • Australia Pacific LNG will continue consultation and engagement programs with communities and stakeholders to ensure their views are understood and considered throughout the life of the Project. • Australia Pacific LNG's community investment programs will support sustainable community development. • Australia Pacific LNG will work with government, the community and other industries to plan for potential cumulative impacts and share information relating to potential impacts and mitigation measures. • Australia Pacific LNG will collaborate with government industry and community partners on research programs to understand the social impacts and opportunities created by development in communities in which it operates. • As part of the employee well-being program, Australia Pacific LNG will conduct regular education	L L	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and Planning – Department of Communities Industry	PC C	• Track and analyse breaches of the Code of Conduct by incident type. • Number and type of community complaints made to Australia Pacific LNG, its contractors, local council and others. • Track and analyse community attitudes towards the conduct of staff and contractors. • Track and analyse community attitudes towards consultation processes and management of project impacts during construction and operational phases. • Evaluate community investment programs to assess the achievement of program goals and objectives. • Evidence of joint stakeholder outputs (planning forums, communications, action plans etc.) to identify and mitigate potential

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
				campaigns such as 'Fit for Work' and 'Drug and Alcohol' polices.				cumulative impacts. • Relevant cumulative impact and regional planning strategies are acknowledged and reflected in Australia Pacific LNG planning documents and related communications. • Australia Pacific LNG participation in and active contribution to social impact research programs as evidenced through relevant planning outputs (reports, minutes, media communications). • Participation rates for employee well-being program activities.
Impact of lighting, dust, noise and traffic to community amenity and lifestyle.	Cons Ops	H M	M M	• Australia Pacific LNG will continue consultation and engagement programs with communities and stakeholders to ensure their views are understood and considered throughout the life of the Project. • Australia Pacific LNG will continue to participate in Local Government and regional planning processes and provide information about its Project to inform discussion and decision making in a timely manner. • Australia Pacific LNG will continue to implement a community complaints procedure for community members and stakeholders to raise concerns, and in turn have them addressed in a timely manner. See Volume 2, Chapter 7 for mitigation measures for potential visual amenity impacts. See Volume 2, Chapter 7 for mitigation measures for potential lighting related impacts. See Volume 2, Chapter 5 and 13 for mitigation measures for potential dust related impacts. See Volume 2, Chapter 17 for mitigation measures for potential traffic related impacts. See Volume 2, Chapter 15 for mitigation measures for potential noise related impacts.	L	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and Planning	PC O LP	• Functional working relationships are established with government, the community and other industries to plan for cumulative impacts. • Evidence of joint stakeholder outputs (planning forums, communications, action plans etc.) to identify and mitigate potential cumulative impacts. • Relevant cumulative impact and regional planning strategies are acknowledged and reflected in Australia Pacific LNG planning documents and related communications. • Number of community information sessions relating to environmental impacts. • Number of community information sessions and number of participants in community information sessions.

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
								• Track and analyse community attitudes towards consultation processes and management of project impacts during construction and operational phases. • Also refer to performance measures for the Environmental Management Plan.
Community concerns about the management of environmental, social or economic issues.	Cons Ops	H M	M M	• Australia Pacific LNG will continue consultation and engagement programs with communities and stakeholders to ensure their views are understood and considered throughout the life of the Project. • Australia Pacific LNG will collaborate with government industry and community partners regarding research programs to understand the social impacts and opportunities created by development in communities in which it operates. • Australia Pacific LNG's community investment programs will support sustainable community development.	L L	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and Planning – Department of Communities	PC O LP	• Track and analyse community attitudes towards Australia Pacific LNG and its contractors' management and communication of environmental, social and economic impacts. • Australia Pacific LNG participation in and active contribution to social impact research programs as evidenced through relevant planning outputs (reports, minutes, media communications). • Evaluate community investment programs to assess the achievement of program goals and objectives. • Functional working relationships are established with environment related community groups.
Indigenous Peoples								
Reduced ability to access to affordable housing for Indigenous Australians.	Cons Ops	H M	M M	• Australia Pacific LNG will work with government, the community and other industries to plan for potential cumulative impacts and share information relating to potential impacts and mitigation measures. • To mitigate potential impacts on housing affordability and availability, Australia Pacific LNG's community programs will include working with Government and agencies that provide housing to people in distress.	L M	Australia Pacific LNG Shared responsibility • Government – Department of Infrastructure and Planning – Department of Communities	PC O LP	NB: *Information regarding Indigenous heritage will be provided on a voluntary basis. • Number of Indigenous persons employed in construction and operational workforces by occupation and position/seniority. • Number of indigenous businesses or joint ventures engaged through Australia Pacific LNG project.

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	**Project Phase (Cons, Ops)***	**Probability (H, M, L)****	**Consequence (H, M, L)****	**Management/mitigation strategies**	**H, M, L****			
						– Department of Communities (Housing and Homelessness Services)		• Indigenous employee retention rates for construction and operational workforces. • Number of Indigenous residents participating in skills development programs supported by Australia Pacific LNG. • Number and percentage of Indigenous apprentices and trainees starting, graduating and finding continuous employment with Australia Pacific LNG by occupation / operational area. • Number of Indigenous apprenticeships, traineeships, work experience programs and scholarships supported by Australia Pacific LNG in non-LNG industries. • Functional working relationships established with local and regional Indigenous organisations. • Communication of estimated workforce demands to Local Government, State Government and Indigenous housing and other service providers. • Number of joint initiatives supported by Australia Pacific LNG and Indigenous organisations. • Number and percentage of Australia Pacific LNG employees and contractors completing cultural awareness training. • Number of Indigenous people participating in cultural heritage management and natural resource
Difficulty in securing and retaining employment on the Project for Indigenous Australians	Cons Ops	H H	M M	• Australia Pacific LNG will continue to use and develop methods to attract people local to the region to the workforce. • Australia Pacific LNG will continue to use and develop methods to attract under-represented groups to the workforce. • Australia Pacific LNG will aim to build collaborative partnerships with government and community organisations to enhance the capacity of employers to provide jobs and the capacity of locals to develop skills and secure jobs. For example through the Community Skills Scholarship program. • Australia Pacific LNG will develop an Indigenous engagement strategy to address recruitment and retention strategies specific to Indigenous Australians	L M	Australia Pacific LNG Shared responsibility • Government – Department of Education and Training – Department of Communities – Aboriginal and Torres Strait Islander Partnerships	PC O LP	
Lack of business development opportunities realised for Indigenous businesses.	Cons Ops	M M	M M	• Australia Pacific LNG will implement a local content strategy whereby we participate in or establish programs which assist qualified local and regional businesses with the opportunity to tender for provision of goods and services for the Project. • Australia Pacific LNG will ensure contracts with suppliers and sub-contractors are aligned with Australia Pacific LNG's sustainability principles. • Australia Pacific LNG will develop an Indigenous engagement strategy to identify business opportunities and programs for development.	L L	Australia Pacific LNG • Government – Department of Employment, Economic Development and Innovation – Department of Communities – Aboriginal and Torres Strait Islander Partnerships	PC O LP	
Lack of respect for Indigenous Australians	Cons Ops	L L	H H	• Australia Pacific LNG will continue to implement cultural awareness program. • Australia Pacific LNG will support Indigenous	L L	Australia Pacific LNG	PC O LP	

Identification		Assessment		Management	Residual assessment	Responsibility	Timing***	Performance measures
Impact	Project Phase (Cons, Ops)*	Probability (H, M, L)**	Consequence (H, M, L)**	Management/mitigation strategies	H, M, L**			
				stakeholders to participate in Caring for Country initiatives. • Australia Pacific LNG will engage with Indigenous Australians in a respectful and culturally appropriate way.				management initiatives directly related to the Australia Pacific LNG project. (*See also Cultural Heritage Management Plan).* • Track and analyse Indigenous community attitudes towards Australia Pacific LNG's position, processes and performance in relation to Indigenous development and Indigenous engagement.

* Cons = construction, Ops = operations

** H = high, M = medium, L = low, + = positive

*** PC = pre construction, C = construction, O = operation, LP = life of project

24.21 Hazard and risk management

24.21.1 Environmental values

The gas fields are primarily located within rural areas with numerous small towns and rural dwellings. The principle urban centres are: Chinchilla and Miles, with much smaller communities at Condamine, Kogan, Drillham and Dulacca.

24.21.2 Potential impacts

There will be potential hazards and risks during the following activities:

- Drilling and gas well construction
- CSG wellhead operations
- Construction and operation of the gas and water gathering network
- Construction and operation of the GPFs
- Construction and operation of the WTFs
- Construction and operation of the high pressure gas pipelines
- Natural hazards (seismic events, bushfire, floods, venomous animals and disease vectors)
- Traffic and transport activities for all phases of the Project.
- Storage and handling of hazardous substances including chemicals used at wells, GPFs and WTFs
- Potential accidents, spills and abnormal events during construction, operation and decommissioning including accidental release of hazardous goods, vehicle accidents, injuries and/or fatalities and fires.

24.21.3 Hazard and risk management

Table 24.31 Hazard and risk – construction and operation

Element/issue	Hazard and risk – construction and operation
Operational policy	Hazards and risks associated with the gas fields not to adversely affect people or the environment.
Performance criteria	Gas Field safety management plan in accordance with the requirements of the *Petroleum and Gas (Production and Safety) Act 2004* is implemented All bunding and storages to comply with relevant Australian standards
Implementation strategy	Gas fields will be operated under a formal safety management plan in accordance with the requirements of the *Petroleum and Gas (Production and Safety) Act 2004*, to be updated as required during operations Emergency response plans will be updated to reflect the scale of the Project Workforce will be informed of hazards and risks and the main control measures

Element/issue	Hazard and risk – construction and operation
	A traffic management plan will be maintained up to date. This plan will include: driver fatigue monitoring; driver education and training; enforced speed limits for project vehicles, use of buses to reduce private vehicle use; public access restrictions to work areas; and use of in-vehicle monitoring systems Active engagement with the relevant authorities will occur to identify particular risks and participate in ongoing campaigns to reduce the likelihood and consequences of vehicle accidents. The Civil Aviation Safety Authority and the Western Downs Regional Council Consult will be consulted on plans for the proposed gas processing facility near Miles aerodrome. Storages will be designed and maintained to prevent failure including: • Vessels constructed as per Australian Standards • Quality assurance of installed equipment • Inspection and condition SCADA monitoring program • Secure area around above ground infrastructure • Emergency shut down systems and response procedures • Standard operating procedures • Signage • Material safety data sheets and associated spill clean up equipment for chemicals • Personal protective equipment
Monitoring	Monitoring results, complaints, incidents and auditing results will be reported as described in section 24.3.6. Specifically, sewage treatment facilities will be regularly monitored to ensure wastewater discharge meets regulatory requirements
Auditing	The effectiveness of the Hazard and Risk control measures and Safety Management Plan will be assessed during HSEMS and compliance auditing as described in section 24.3.8
Reporting	Monitoring results, complaints, incidents and auditing results will be reported as described in section 24.3.6
Corrective action	High risk incidents will be reviewed by senior management to ensure adequate controls are in place to minimise the chance of reoccurrence Corrective actions will include a review and update to the safety management plan and any other related plans following completion of any incident investigation

24.22 Decommissioning and rehabilitation

Australia Pacific LNG will engage with stakeholders during the decommissioning and rehabilitation phase. This engagement will inform stakeholders of the:

- The process of decommissioning
- Activities that will take place
- The potential impacts on stakeholders in the affected area.

The proposed methodology for decommissioning and rehabilitating at the end of field life is firstly to plug and abandon remaining wells at the cessation of production. This process will also occur progressively during the life of a field as wells are depleted.

Following cessation of production, the connecting pipelines and process equipment are purged, vented and flushed with water. Equipment and materials are then made safe for removal from each gas processing facility and water treatment facility site. The permanent accommodation facilities, utilities and other related infrastructure would only be removed once facilities have been decommissioned.

The land, on which the assets were constructed, would be remediated and rehabilitated to a condition consistent with the surrounding area as far as practicable. It is anticipated that the assets would be decommissioned in phases as the gas field declines over the course of its life cycle.

24.22.1 Preparatory works

Preparatory works involve gathering necessary data for the detailed decommissioning and rehabilitation plan to be produced. These works may include, but are not limited to, the following:

- Preparing a detailed inventory of materials and equipment contained within the gas processing facilities, right of way and wellhead sites
- Carrying out environmental site assessment studies, which may include soil and groundwater analysis, to identify the presence of any potentially hazardous materials from either the original installation or from hydrocarbon production activities
- Undertake a formal decommissioning hazard identification (HAZID) process to finalise decommissioning and rehabilitation planning.

24.22.2 Well sites

Wells will be plugged with cement to isolate any porous formations and prevent further production. When this is completed, surface equipment will be decommissioned and removed. Earthworks will then be carried out to re-contour the lease to a condition consistent with the surrounding area as far as practicable.

24.22.3 Gas and water gathering networks

Decommissioning of the gas and water gathering networks would generally be undertaken before or in parallel with the GPF decommissioning. At cessation of production, the gathering system will be isolated at both the wellhead and coal seam gas processing facility connections.

The gathering system pipelines are made safe, isolated, drained, purged and vented.

The pipelines can then be flushed typically using water. Water generated from the gathering system pipeline flushing will be channelled to the water treatment facility. The cleaned gathering system pipelines would then be capped at the ends and left in situ.

24.22.4 High pressure gas pipelines and water transfer pipelines

In the event that a high pressure pipeline within the network is no longer required, it will be decommissioned via:

- **Moth-balling** This would involve depressurising the pipeline then capping and filling with an inert gas such as nitrogen or water with corrosion inhibiting chemicals. The cathodic protection would be maintained to prevent the pipe corroding, and
- **Abandonment** This could involve purging the pipe of natural gas, disconnecting it from the manifolds and removing above ground facilities. The pipe would be cut at intervals to prevent inadvertent transfer of groundwater from one area to another. The pipe would then be left to corrode in-situ. All of the above will have the potential for small scale temporary environmental impacts that will need to be carefully managed.

Removing the pipe from the ground is unlikely to be a commercially viable option and would result in significant and unnecessary environmental impacts. A detailed rehabilitation and monitoring program would be developed and implemented in consultation with landholders and the administering authority at the time of abandonment. The abandoned pipeline easement would be returned to its pre-pipeline vegetation or as negotiated with the landholder.

24.22.5 Equipment

Gas processing facility equipment

The gas processing facility equipment mainly consists of a raw gas inlet and separation system, a gas compression system, a gas dehydration system, and ancillary equipment.

Each of these components will be isolated following internal procedures, drained of accumulated liquids, then purged and vented to remove any traces of gas or other potentially hazardous materials. Interconnecting pipe work would be removed and dismantled into transportable lengths. The units would then be transported offsite in the largest practicable packages, depending on the availability of locally based cranes and transport vehicles.

The compressor and after-cooler packages and other process equipment will be disassembled and removed.

Ancillary equipment

Ancillary equipment installed at the gas processing facilities include power generation and distribution equipment, the plant air system, flare system, various tanks, and other utility systems. These systems will be individually isolated and secured before being disassembled and removed.

Electrical and control systems

The power supply to the gas processing equipment can be isolated ahead of gas generator decommissioning. This would first involve isolating the power distribution system to the process equipment, which would allow the cabling and trays to be removed safely.

Once the generators are no longer needed, the power input to the switchgear is isolated and both the generators and switchgears can be removed. The remaining earthing grid and any other buried cables would be removed during the site clearance operations.

Buildings

The buildings on the site commonly include the administration building, control room, workshop and warehouse, electrical control room and compressors enclosure. The buildings are constructed of steel frame with metal sheet cladding and concrete footings. Demounting and deconstructing these structures would be relatively straightforward if beneficial post-project uses are not identified, such as use as agricultural buildings.

Water treatment facilities

The majority of the equipment contained within the water treatment facilities is modular and can be removed as individual units. Equipment will be purged, vented and drained, including the bulk chemical above ground storage tanks before removal from site.

Storage ponds

The decommissioning of storage ponds can only be undertaken when the water used to flush the processing equipment and pipelines has been collected and treated by the water treatment facility.

Salts can be disposed of in a purpose built facility which, if required, would be designed, located and constructed according to administering authority requirements. This site would be a registered waste disposal facility and be managed accordingly. Alternatively, any remaining salts may be collected and reinjected into a hydraulically isolated aquifer.

Any aboveground concrete structures, such as pipe and pump footings, will then be broken up at ground level and removed. Site investigations would be completed to determine the requirements for soil treatment or removal, in consultation with the administering authority. This process will be conducted in accordance with the relevant legislative requirements in Queensland and the appropriate management measures identified based on site conditions. Finally, the ponds would be graded to be consistent with the surrounding landform contours, seeded and revegetated.

Permanent accommodation facilities

The permanent accommodation facilities and utility buildings will be constructed in modular and prefabricated modules. These modules can be removed from site as single units, and may be reused or sold. Other installations which cannot be reused or dismantled will be demolished and the waste material removed from site.

Services associated with permanent accommodation facilities such as roads, drainages, fences and underground utilities will be excavated and removed as required. The sewerage system will be pumped out by approved regulated waste transporters. Excavated materials will be reused onsite where possible or removed offsite for disposal.

24.22.6 Site rehabilitation, finishing earthworks and revegetation

When the process equipment, buildings, structures and imported material have been removed, it will then be necessary to return the site to a condition consistent with the surrounding area as far as practicable, unless otherwise approved under the environmental authority. This would entail remediating and rehabilitating any contaminated areas, then grading and revegetating the site to minimise wind and water erosion.

All internal roads including perimeter fencing would be removed. The main access road would be left in place if required by the landholder.

All excavations and pits resulting from the decommissioning process would be backfilled and graded to the original contours. The area, including gravel tracks, would then be spread with mulch and seeded with native vegetation.

24.22.7 Material and equipment removal and disposal

The decommissioning and rehabilitation methods applied will adhere to the internationally accepted good industry practice hierarchy for disposal of materials. Reuse is the preferred option, followed by recycling and, if unavoidable, then disposed to landfill or alternatively suitable regulated waste disposal facilities.

The material and equipment likely to be suitable for reuse includes process and chemical pumps, aboveground storage tanks, compressors and process equipment, gas and diesel engine power generators, and demountable and modular buildings.

The material and equipment likely to be suitable for recycling includes building steel frames and cladding, electrical switchgear, control systems equipment, pipelines, gathering network and manifolds, separators, deconstructed aboveground storage tanks, fencing and miscellaneous steelwork including recovered rebar, crushed concrete and electrical cabling.

The material and equipment likely to be unsuitable for reuse or recycling includes plastic and glass fibre reinforced plastic pipework and tanks, and sludge from pipelines and equipment. These would need to be properly disposed of to appropriate facilities.

24.22.8 Hazardous material treatment

Based on a review of the gas fields and associated plant processes, hazardous substances present onsite are likely to be limited to process chemicals such as anti-corrosives and lubricating oils. The likelihood of other hazardous materials, such as mercury, is low. However, the Project will conduct detailed studies and analyses as part of the pre-cessation of production surveys to determine the presence or absence of such materials at targeted locations.

24.22.9 Alternative uses of decommissioned assets

There may be some alternative uses for the decommissioned assets. However, the feasibility and suitability of the options presented will depend on actual field conditions, and would require additional studies.

As the neighbouring activities to the assets generally include pasture land for livestock and agriculture, it is possible that this could be returned to pasture and agriculture uses once surface impediments have been removed. Detailed studies will address human and grazing animal health concerns by identifying any soil and groundwater contamination.

These studies would establish guidelines relating, but not limited, to the types of vegetation suitable for growth at the site, the safety of food products derived from the grazing animals, and using groundwater for livestock watering and irrigation.

24.22.10 Issues identification and risk management

Desktop studies, carried out as part of the preparatory work discussed above, would identify most of the potential issues and risks associated with closure and decommissioning. Potential issues and risks will be analysed to help develop management and/or mitigation strategies.

Contingency planning will also be carried out. Where issues and risks involve stakeholders, such as environmental pollution, appropriate rehabilitation plans will be developed in consultation with the affected parties.

24.22.11 Final rehabilitation report

A final rehabilitation report and a decommissioning plan, including a contaminated land assessment, landowner commitments/agreements and rehabilitation status, will be prepared and submitted to the appropriate authorities for approval.

References

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