Australia Pacific LNG Project
Environmental Impact Statement

Creating cleaner energy for future generations

AUSTRALIA PACIFIC LNG

Executive Summary

origin ConocoPhillips

APLNG is a CSG to LNG Joint Venture between Origin and ConocoPhillips.

carbon neutral

australian made

Image: Bottle Tree on Nixon property, Drillham, QLD

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Preamble

These notes have been prepared to assist the reader understand the intent, structure and content of this executive summary document.

The purpose of the Executive Summary is to convey the principle findings of the environmental impact statement (EIS) prepared for the Australia Pacific LNG Project (the Project) in a concise and readable form. The document has been prepared to meet a key requirement of the statutory EIS process.

The document focuses on the key issues to enable the reader to obtain a clear understanding of the Project and its potential adverse and beneficial environmental, social and economic impacts and the management measures Australia Pacific LNG will implement to mitigate residual risks to people and the environment. The document does not slavishly follow the structure of the EIS to make it more readable and to highlight the important findings from the various studies.

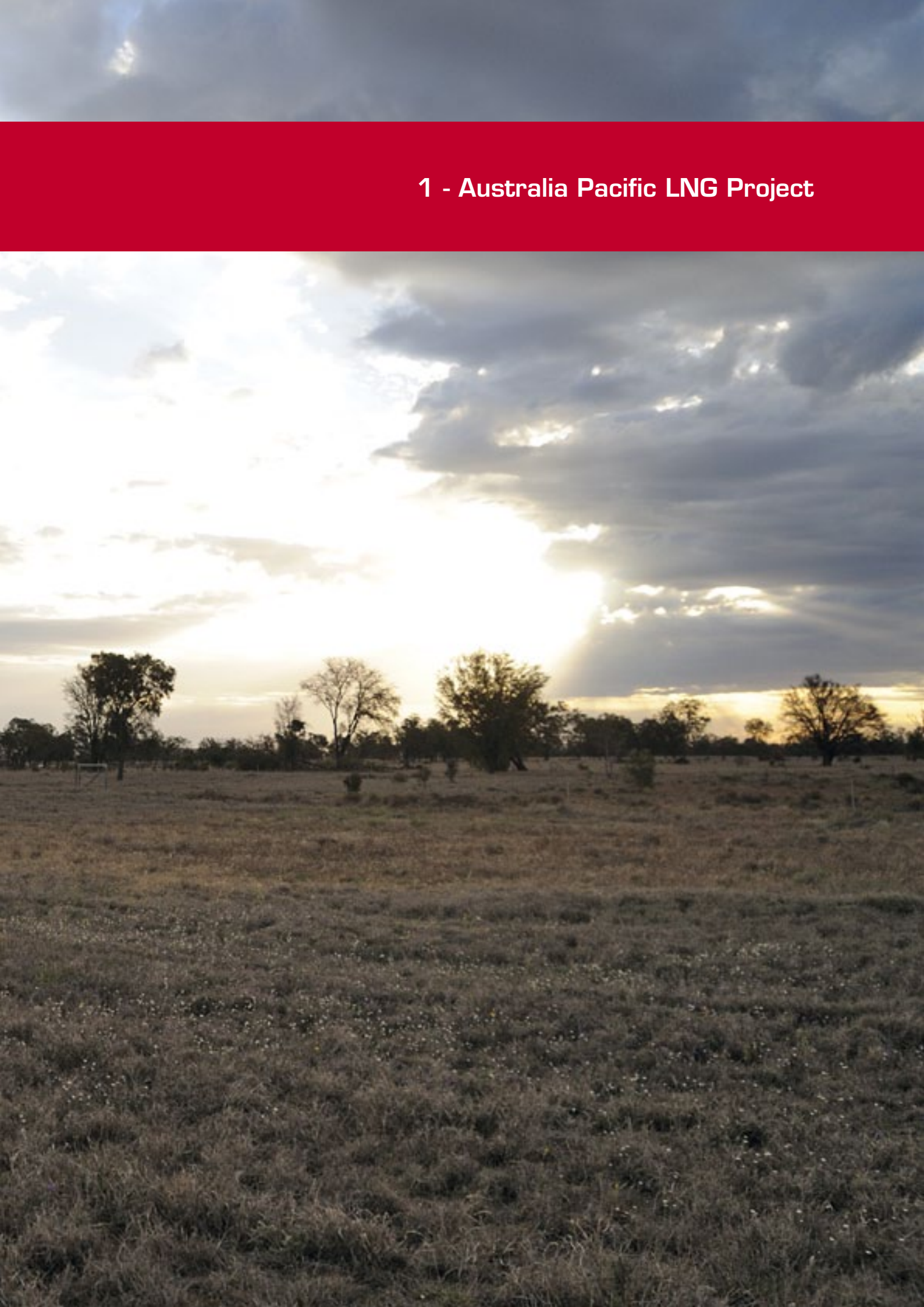
The impact assessment section has been arranged generally from the areas of greatest risk and is presented from the perspective of the whole project. To avoid repetition, separate discussion is only provided for individual project elements where the findings have particular relevance or significance.

The objective of the document, as written, is to engage the reader, encourage them to seek further information in the main body of the EIS and supporting technical reports, and invite them to make a submission on the EIS.

The EIS is available as a web-based, interactive document to facilitate ease of access and review at: **http://www.aplng.com.au/eis**

Image: Grazing land, on the way to Spring Gully

1 - Australia Pacific LNG Project



This document summarises the principle findings of the environmental impact statement (EIS) prepared for the Australia Pacific LNG Project (the Project).

Australia Pacific LNG Pty Limited (Australia Pacific LNG) is a 50:50 joint venture between Australia's largest integrated energy company Origin Energy (Origin), and US-based company ConocoPhillips, which is one of the largest coal seam gas (CSG) producers in North America and has assets and operations in nearly 40 countries.

1.1 Description

Australia Pacific LNG proposes to develop a world-scale, long-term coal seam gas (CSG) to liquefied natural gas (LNG) project in Queensland. The Project is anticipated to spend approximately A$35 billion through to 2020. The Project has a life of at least 30 years, and is made up of three primary elements:

- The further development of Australia Pacific LNG's gas fields in south central Queensland
- A high pressure gas pipeline from the gas fields to Gladstone in central Queensland
- An LNG facility on Curtis Island at Gladstone.

A project overview map is provided in **Figure 1**. This illustrates the locations of the three elements and their study areas, which have been examined in this EIS.

On behalf of Australia Pacific LNG, Origin will be responsible for construction and operation of the gas fields and pipeline, and ConocoPhillips will be responsible for construction and operation of the LNG facility.

Australia Pacific LNG is well-placed to realise the benefits of CSG development in Queensland. The proposed Australia Pacific LNG Project draws on the experience of two companies, which together have over 25 years of leading and extensive expertise in CSG development, proven production interests and technological know-how.

Australia Pacific LNG has more than 17,000km2 of coal seam gas acreage in the Surat Basin and Bowen Basin, and an additional 18,000km2 in the emerging Galilee Basin. This will provide the potential coal seam gas production capacity required to feed the LNG facility for decades.

ConocoPhillips is a leading developer and operator of LNG projects around the world. Their Optimised Cascade® process technology is generally considered to be the best suited for LNG production from coal seam gas.

The knowledge, expertise and assets which Origin and ConocoPhillips bring to the Project will underpin ongoing development throughout the life of the Project.

Both Origin and ConocoPhillips are committed to sustainable development, and engaging with the communities in which they operate in an ethical and responsible way. Both companies have developed community investment programs which aim to deliver long-lasting social benefits to communities. Australia Pacific LNG will build on these programs and initiate new ones to ensure the communities impacted by this Project share in its benefits.

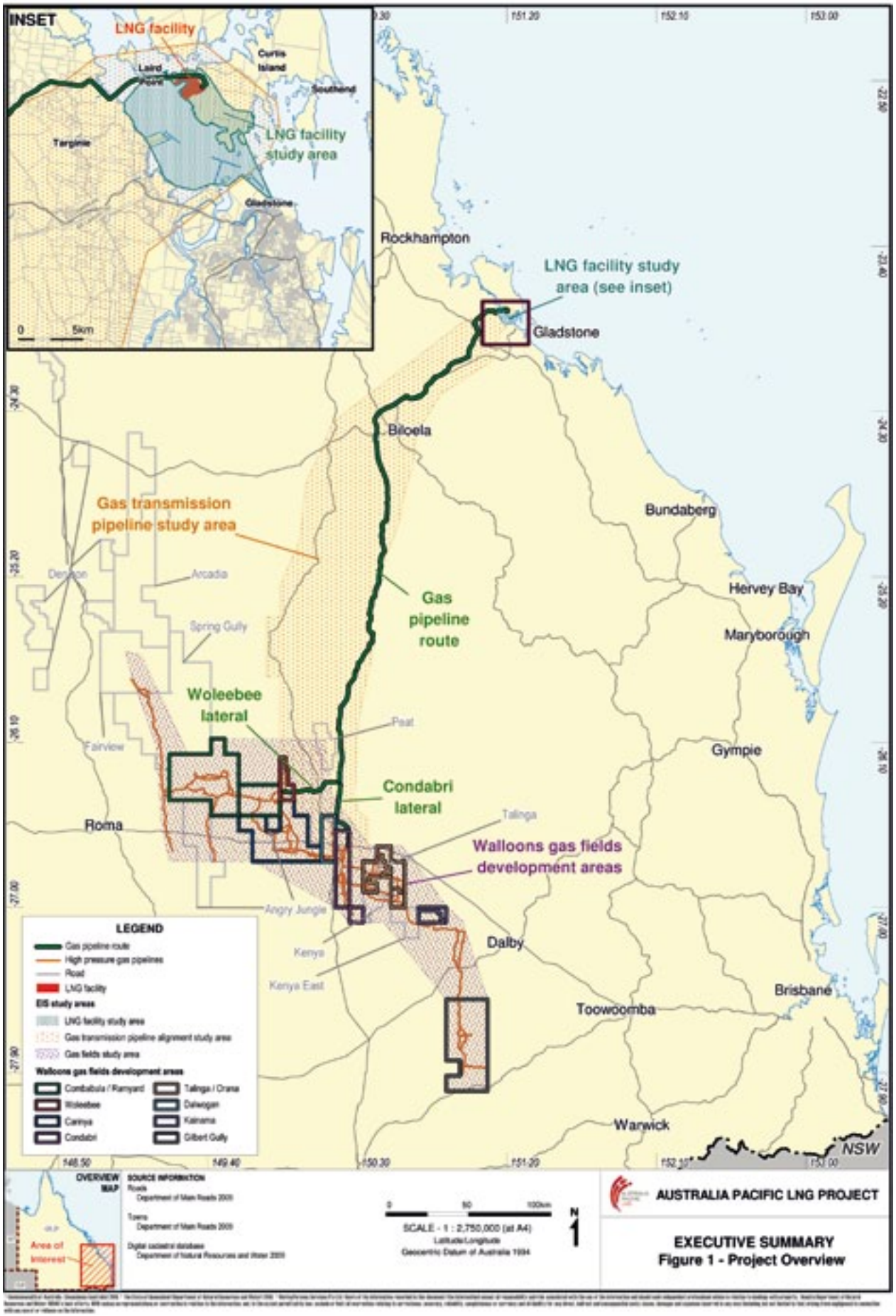


Figure 1 Project Overview

Australia Pacific LNG's Project is one of the first in Queensland to undertake a formal assessment of the cumulative impacts that this and other projects may have on the communities within the development area.

This assessment has been supported by extensive research in areas such as social impacts, biodiversity and associated water management. Australia Pacific LNG has gathered data which has not been previously available in these areas. It is hoped that the availability of this new data will contribute to wider scientific and community knowledge about the social, economic and environmental features of the regions the Project will impact.

1.1.1 Gas fields

Australia Pacific LNG has interests in major CSG fields in south central Queensland. These include the Spring Gully and Fairview fields in the Bowen Basin and the Talinga field in the Surat Basin, as well as significant interests in less developed areas across the Walloons gas fields in the Surat Basin (see Figure 1). These areas are world class in terms of their scale and productivity, comparable to CSG volumes in the San Juan Basin in the USA (the world's most productive CSG basin), and are well suited to provide the volumes of coal seam gas required over the life of the Australia Pacific LNG Project. Australia Pacific LNG has the largest portfolio of independently certified CSG reserves/resources in Australia[1].

The Walloons gas fields' development areas and gas infrastructure, including indicative gas processing facility locations and high pressure gas pipeline network connecting these facilities, are shown in Figure 2.

The water infrastructure for the management of associated water, comprising water treatment facilities, brine storage ponds and water pipeline network are shown in Figure 3. Associated water is the underground water taken during the drilling of a gas well or during gas production. Examples of gas processing and water treatment facility at Spring Gully are illustrated in Figure 4 and Figure 5.

Staged development of the Walloons gas fields, covering approximately 570,000ha, is proposed over a 30-year timeframe. An indicative development timetable for the gas fields' development areas is presented in Figure 6.

Planning for a 30-year coal seam gas project requires more flexibility than the traditional gas industry approach, given the potentially wide variations in quantities of gas and associated water produced in any one area. Coal seam gas projects evolve significantly over time due to the nature of coal seam gas fields. As such, the infrastructure requirements detailed in the EIS are expected to cover the maximum scenario. Depending on actual reservoir conditions, some infrastructure identified may ultimately not be required.

Further to the EIS process, the Project will evolve as gas reserves are proven and developed. Selection of sites to be developed will be guided by gas and associated water profiles, which are only available after pilot studies have been completed in each region. For this reason, the early stages of the Project are more defined, as better data is available for these areas. The Project will be refined on a continual basis using an adaptive planning approach. The availability of new technologies and other options to progressively reduce impact are components of this adaptive planning.

[1]Australia Pacific LNG's CSG reserves comprise 7,265 petajoules (PJ) of 2P reserves, 12,627PJ of 3P reserves and 13,073PJ of contingent resources (certified by NSAI, 30 June 2009). 2P is proved plus probable gas reserves, 3P is proved plus probable plus possible gas reserves.

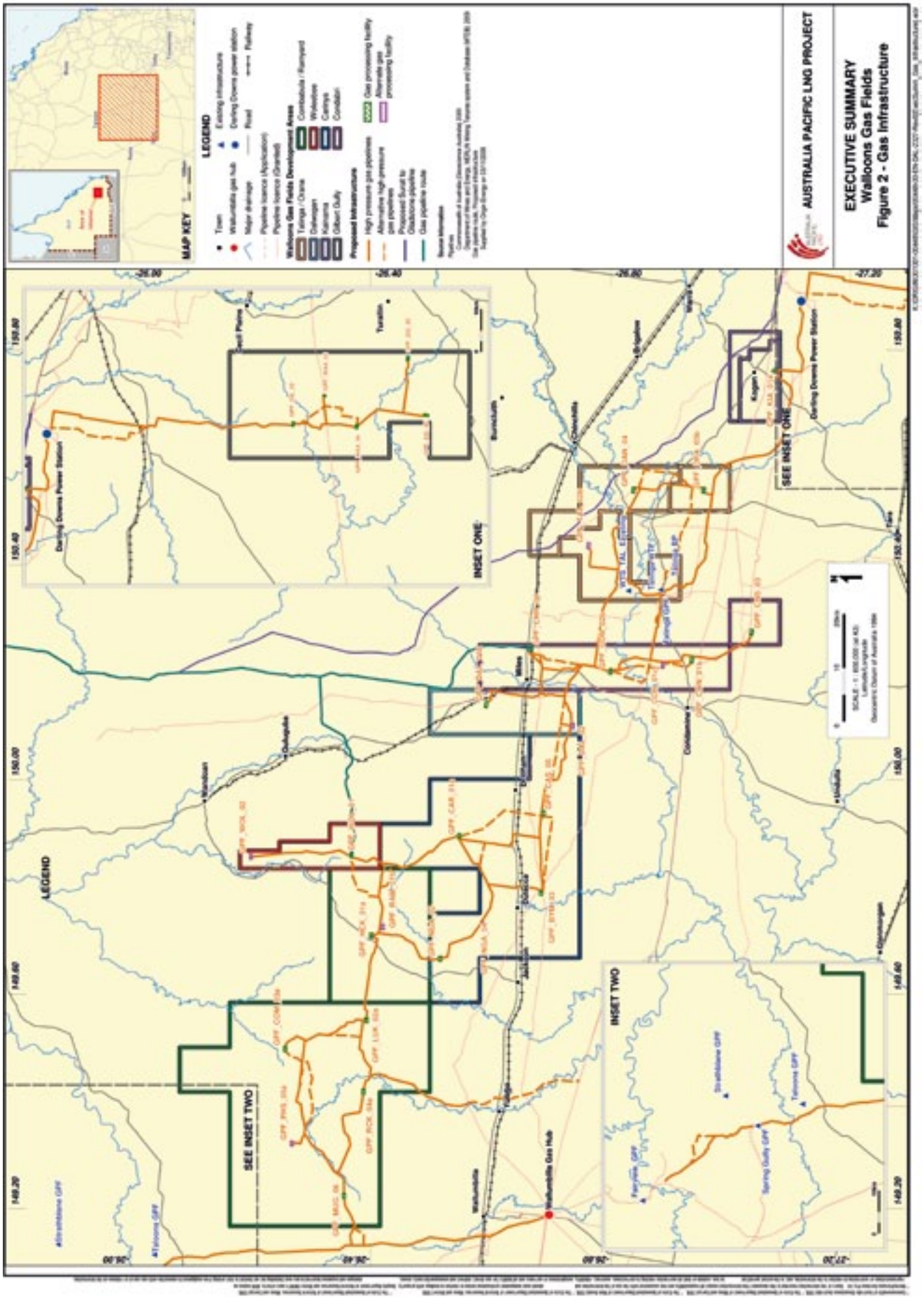


Figure 2 Walloons gas fields' - Gas infrastructure

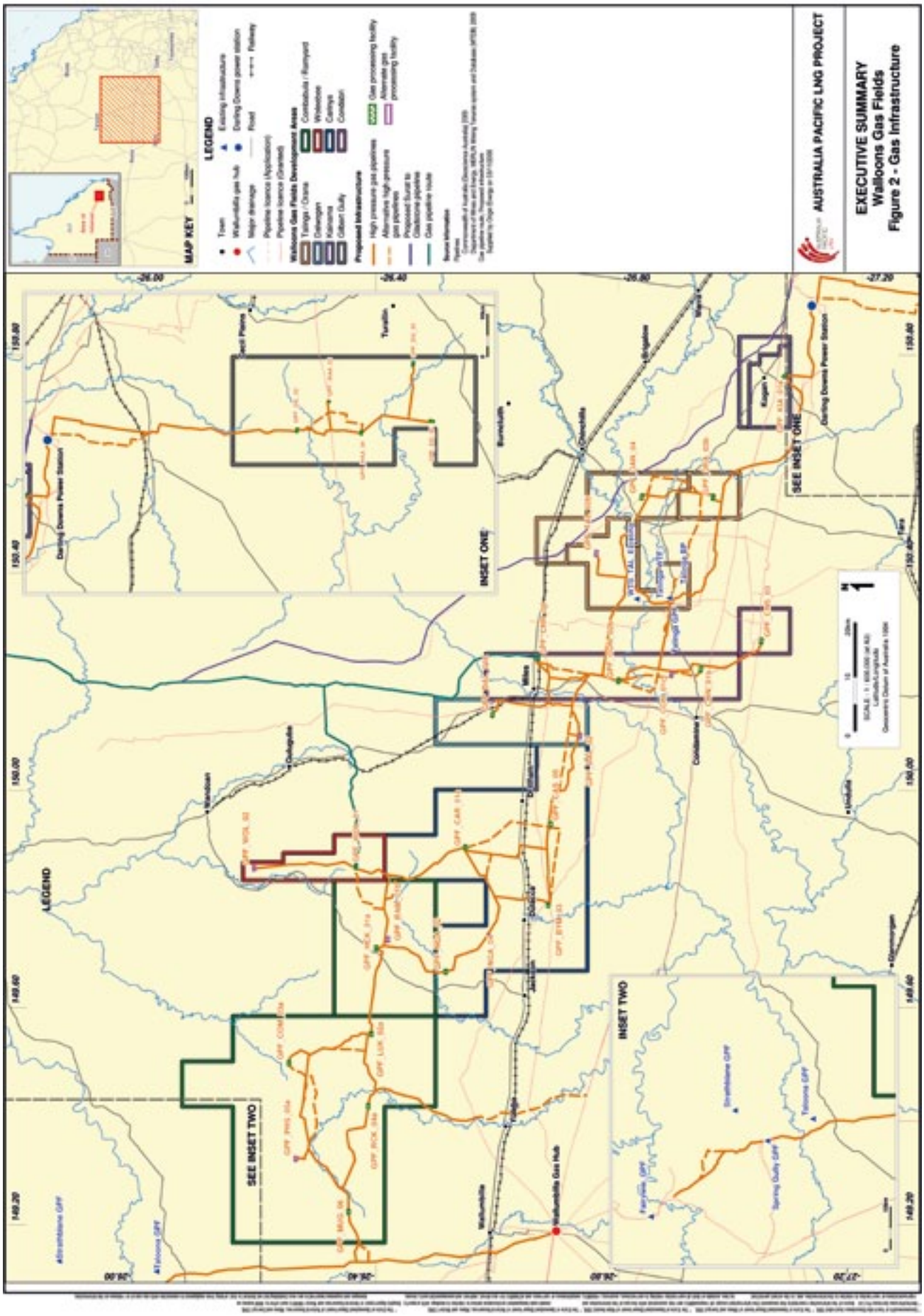


Figure 3 Walloons gas fields' - Water infrastructure

Figure 4 Australia Pacific LNG's operating gas processing facility at Spring Gully

Figure 5 Australia Pacific LNG's operating water treatment facility at Spring Gully

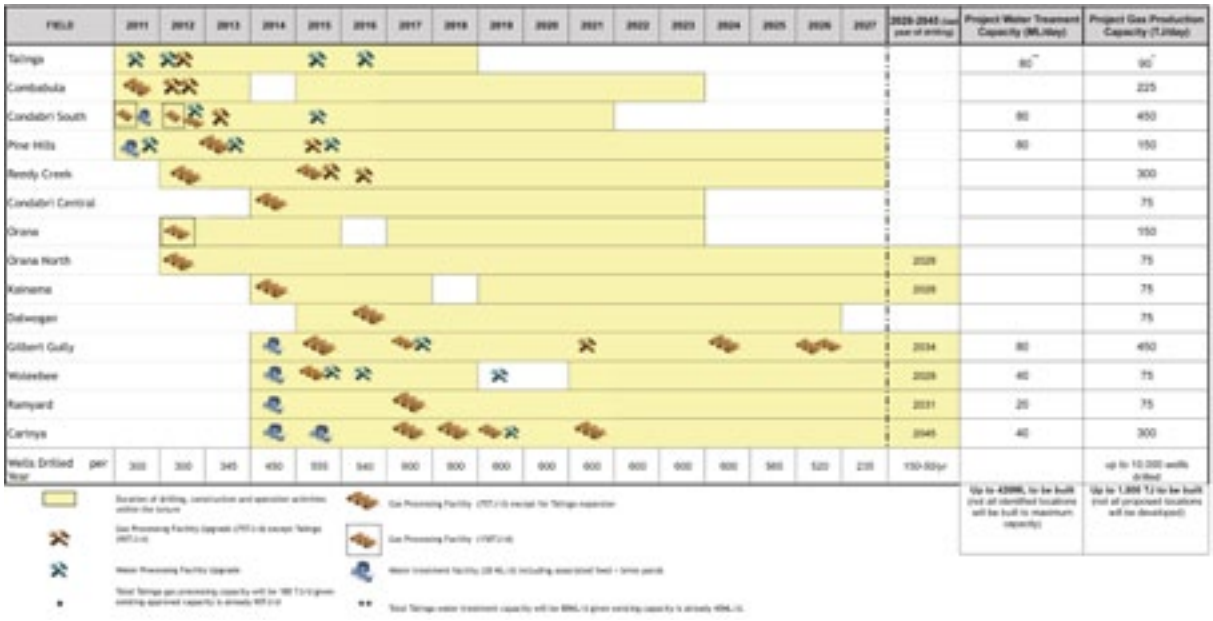


Figure 6 Gas fields' indicative maximum development case

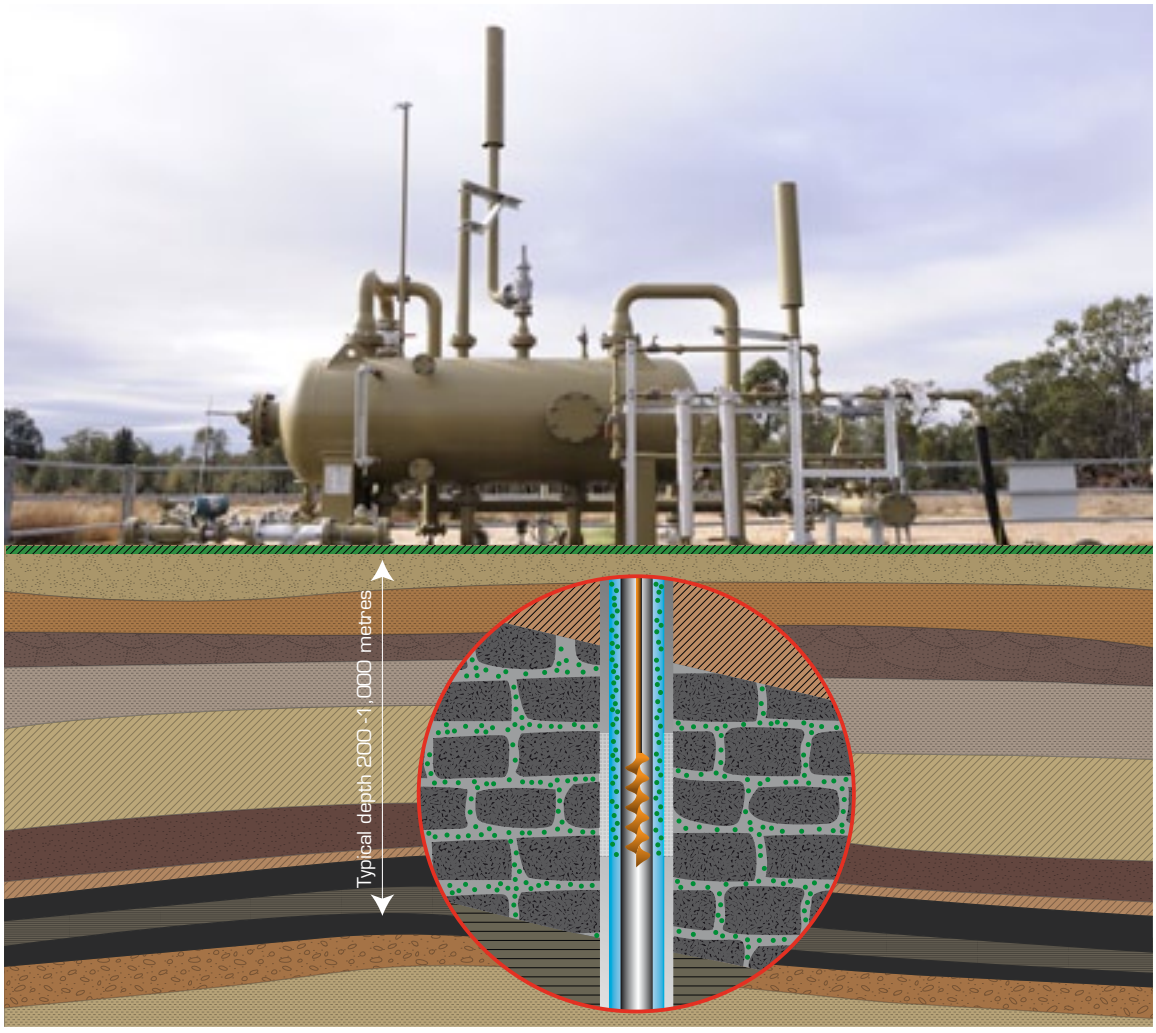


Figure 7 Gas well illustration

This EIS seeks approval for the full project based on the maximum development scenario. Drilling and completion activities will typically target 350 to 500 wells per year but may increase to 600 wells per year at the peak of development activities. A total of 10,000 wells are anticipated over the life of the Project.

Typically, well spacing will be based on a 750m grid, with each well producing both CSG and associated water as a two-phase mixture. The gas and water will be separated at the well site, and transported via an underground network of low pressure gathering lines linking wells to gas processing facilities and water treatment plants, respectively.

Gas will then be transferred through a network of high pressure gas pipelines to the main gas pipeline, for transmission from near Miles to the LNG facility to be located on Curtis Island in Gladstone. An indicative illustration of a gas well is provided in Figure 7, which shows a schematic section of a CSG well and associated surface facilities.

Australia Pacific LNG will endeavour to maximise the use of associated water in a beneficial and commercial way.

Infrastructure to support gas field development will also be required. This includes access roads, pipe and equipment stores, stockpile areas, accommodation facilities, power and communication systems.

1.1.2 Gas pipeline

A high pressure, 42 inch (1070mm) diameter, underground pipeline approximately 450 kilometres in length is required to transport dehydrated and compressed coal seam gas from the Walloons gas fields to the LNG facility on Curtis Island near Gladstone (as shown in Figure 1).

It comprises two lateral pipelines, 44km and 38km in length, connecting the Condabri and Woleebee developments, respectively, with the main pipeline. Beginning east of Wandoan at the junction of the two lateral pipelines, the main pipeline extends 362km to the north, veering east during the latter stages, with a marine crossing at The Narrows to arrive at the LNG facility.

The preferred route was identified based on engineering considerations and with the aim of minimising environmental, land use and cultural heritage impacts. Existing easements are used

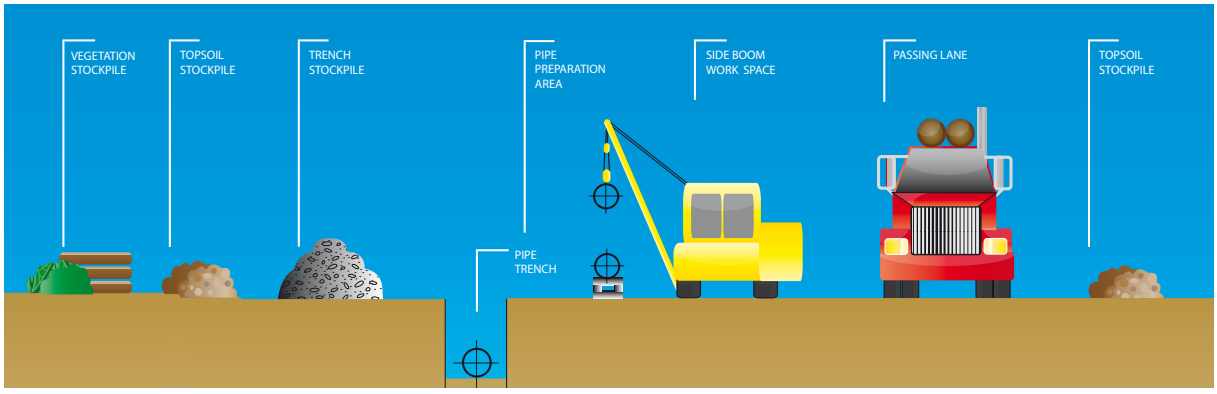


Figure 8 Pipeline corridor construction layout

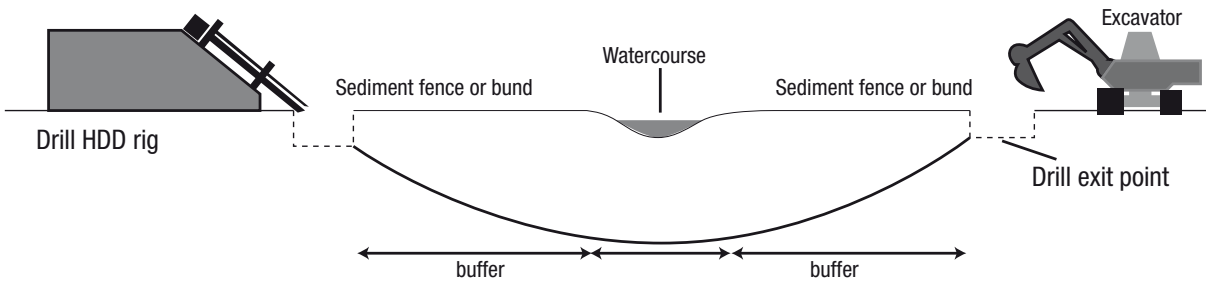


Figure 9 Cross-section of horizontal directional drilling

and the route deviated to avoid impacts wherever possible. It is expected the pipeline may be co-located with other CSG pipelines for more than half its length. This includes the section gazetted by the Queensland Government within the Callide Infrastructure Corridor State Development Area and the Gladstone State Development Area.

Figure 8 illustrates a typical working layout of a pipeline corridor during construction.

Two options have been assessed for construction across the marine section of The Narrows, within the Port of Gladstone between Kangaroo Island and Port Curtis Island. On a stand alone basis, Australia Pacific LNG's preferred construction method is to use horizontal directional drilling, a technique that offers the least risk to the marine environment. Figure 9 provides an indicative cross-section of the horizontal directional drilling method. If this method proves not to be feasible, the alternative would be to use conventional dredging techniques.

Australia Pacific LNG would consider joining with other LNG project proponents in a 'bundled' crossing – a single construction phase using conventional pipeline trenching techniques. This approach would minimise the cumulative impacts that would otherwise result from multiple crossings of The Narrows.

Construction of the pipeline would take approximately 18 months and is proposed to begin by mid 2012.

1.1.3 LNG facility

The LNG facility will be located on Curtis Island adjacent to Laird Point, within the Curtis Island Industry Precinct of the Gladstone State Development Area (see Figure 10). It will comprise gas processing facilities to remove impurities and to refrigerate the CSG, condensing it to liquid at low pressure, as well as product storage tanks and standard infrastructure services (including power, water, telecommunications and sewage disposal).

Associated facilities proposed for the site include:

- An inlet feed gas metering facility
- An offloading facility for the transfer of building materials, heavy equipment and people
- Loading berths to transfer product to tankers for shipping to market
- Temporary workforce accommodation facilities.

An indicative artist's impression of a gas processing facility is illustrated in Figure 11. The LNG facility will use ConocoPhillips' proprietary Optimized Cascade® technology which is proven, reliable and well suited to coal seam gas application. A simplified process schematic of this process is given in Figure 12. This technology was used for the Darwin LNG facility in 2006 and is also being proposed by most other LNG proposals in Queensland. Development is proposed to occur in stages, initially comprising two LNG trains[2] (increasing to four), with each train requiring approximately 250 petajoules of gas per annum to produce approximately 4.5 million tonnes per annum of LNG. The overall facility would have a total capacity of approximately 18 million tonnes per annum of LNG. Assuming the Project is approved, initial production of LNG is expected in late 2014 from the first production train, with production from the second train expected by mid 2015.

The timing of construction of subsequent trains will depend on the LNG market and gas field development.

Gladstone Ports Corporation will provide the dredging required for shipping access to the LNG facility as part of the Western Basin Dredging and Disposal Project. This will enable access for multiple port uses, including the LNG facilities and loading facilities for future export-oriented industries.

[2]A train is a term used to describe a processing plant that converts CSG to LNG.

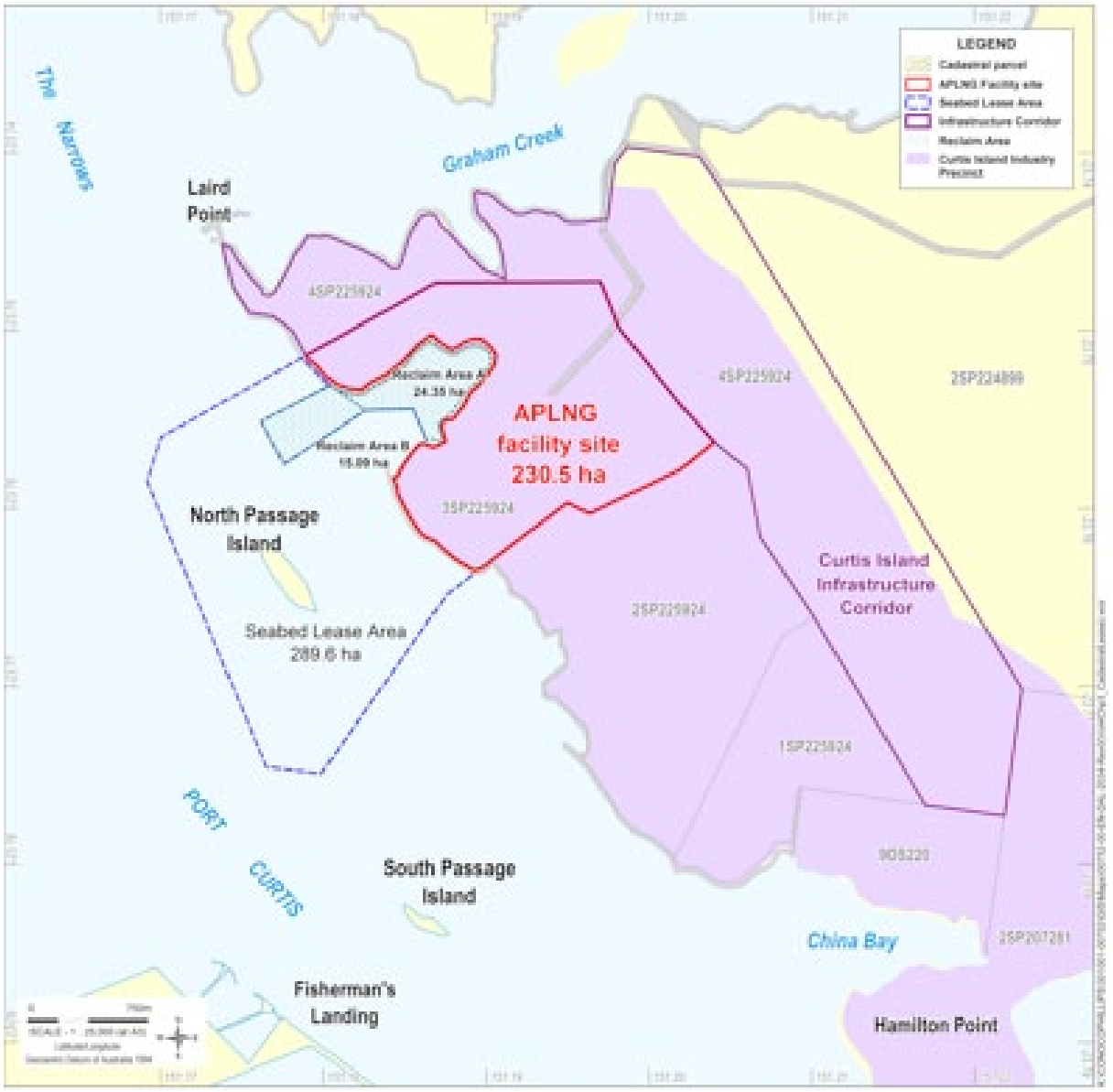


Figure 10 LNG facility location and property boundaries

1.2 Rationale

1.2.1 Demand for gas

The global increase in energy demand, particularly for liquefied natural gas, raises the potential to develop an LNG export industry from Queensland with CSG as the feedstock. Nations are looking for secure energy supplies, produced in a stable political and economic environment. This growth trend is forecast to continue, with liquefied natural gas seen as safe, flexible, reliable, economic and environmentally desirable. This is particularly the case in the context of climate change, and the growing acceptance of gas as a transition fuel to a less carbon-dependent economy. In 2007, global LNG demand was 165 million tonnes per annum. By 2015, global demand for liquefied natural gas is predicted to reach between 245 and 340 million tonnes per annum[3].

The Australian Bureau of Agricultural and Resource Economics has estimated the ultimate potential CSG resource in eastern Australia could be 250 trillion cubic feet (approximately 250,000 petajoules). This is more than sufficient

[3] McLennan Magasanik Associates 2009, Queensland LNG Industry Viability and Economic Impact Study, final report to the Queensland Department of Infrastructure and Planning, May 2009.

Figure 11 Artist's impression of LNG facility (indicative only)

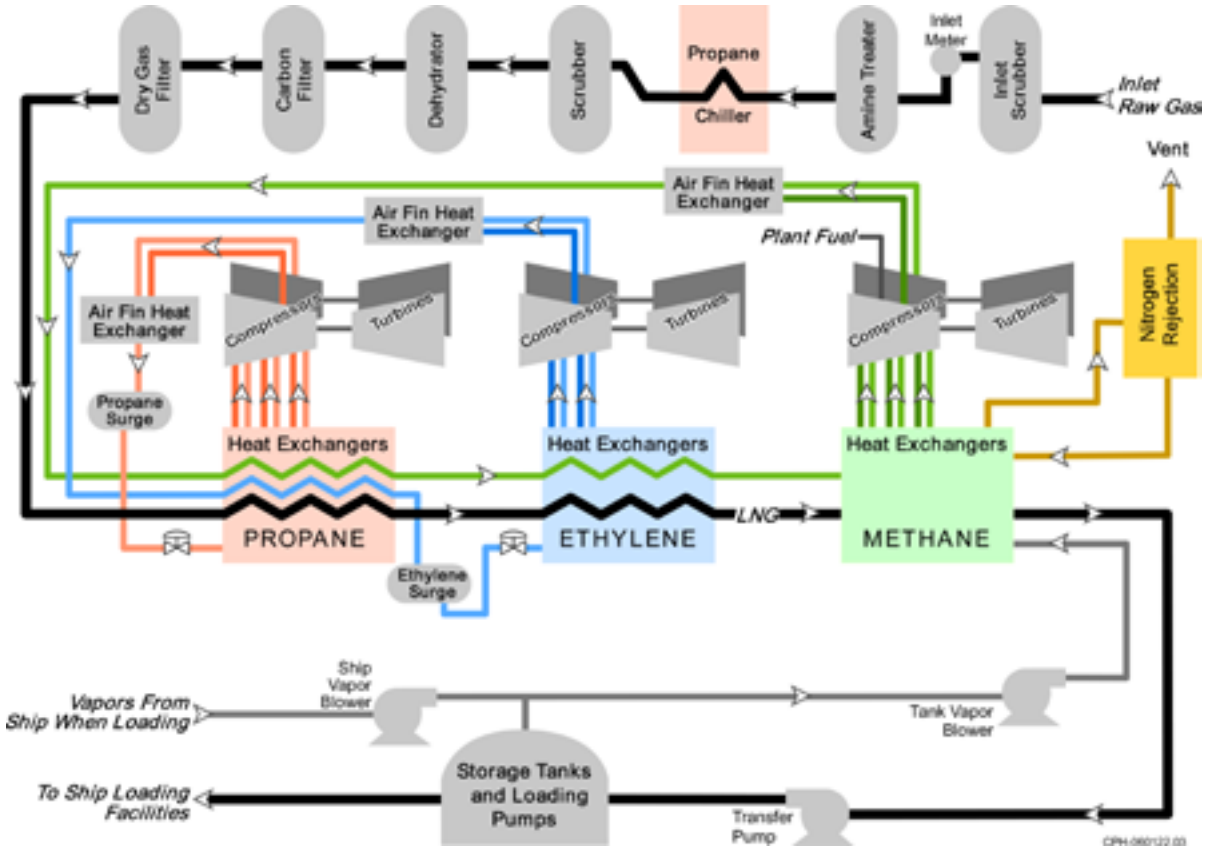


Figure 12 Simplified process schematic of the Optimised Cascade® Process

to meet domestic demand and to supply an economically viable export industry. The Australian Government's Energy White Paper seeks to deliver energy security to Australia, while at the same time realising Australia's potential to become a global energy producer in the 21st Century. Australia Pacific LNG, with its leading independent reserves position, is well-placed to respond to such policy platforms and the growing demand for gas.

Taking advantage of this global trend has become possible as the scale and nature of CSG reserves in Queensland have become apparent through ongoing drilling programs. These have revealed new and extensive reserves that can support an economically viable LNG export industry as well as forecast domestic demand. These discoveries and the success of existing CSG development by Australian companies have not gone unnoticed, with large international energy companies, in addition to ConocoPhillips, making significant investments. This includes Petronas, BG Group and Shell.

Domestically, the demand for and acceptance of CSG as a significant and viable long-term resource has also shifted dramatically in recent years.

Demand for gas within Australia has grown in response to the development of gas-fired power stations and the use of gas as an industrial energy source. Demand has been further driven in Queensland by the government's mandatory targets for gas-fired electricity generation under the Queensland Gas Scheme[4].

1.2.2 Social and economic benefits

The construction and operation of the Project will diversify Queensland's economy by creating a new export industry. It will make a substantial contribution to the local, regional and national economy, with benefits flowing to local and regional communities. The Project is expected to boost the Queensland economy by $A2 billion annually.

During the construction phase, the Project will increase national employment, directly and indirectly, by approximately 9,900 jobs, nearly 80% of these within Queensland. This higher employment will be increased in Queensland during the operations phase, with an average of 9,000 jobs directly and indirectly created by the Project.

The injection of money, people and activity will drive growth in rural and regional economies, providing opportunities to increase local skills capacity and act as a catalyst for improving local infrastructure services. The benefits of this project will continue for at least 30 years due to the significant level of ongoing investment required to progressively develop the gas resource.

[4] Under the Queensland Gas Scheme, the government's mandatory target for gas-fired generation increased from 13% to 15% in 2010, with the option to further increase the target to 18% by 2020.

Image: Sunrise in regional Queensland, on the way to Spring Gully

2 - The proponents

The Project is proposed by Australia Pacific LNG Pty Limited (Australia Pacific LNG), a 50:50 joint venture that brings together two companies with extensive experience in coal seam gas production: Origin, Australia's leading integrated energy provider, and US-based ConocoPhillips with a proven record in delivering LNG projects around the world.

Australia Pacific LNG, previously known as Origin Energy CSG Limited, was formed in November 2008 after Origin selected ConocoPhillips to invest in the joint development. This brought together Origin's extensive Queensland CSG reserves with ConocoPhillips' leading LNG technology and CSG production experience in North America.

Australia Pacific LNG already supplies gas to power stations in Queensland, major industrial customers, homes and businesses. Australia Pacific LNG is seeking to develop a world-scale project and create a new export industry for Queensland.

2.1 Origin

Origin is the largest integrated energy company operating across Australia and New Zealand. Listed in the ASX top 20, the company has more than 4,000 employees. Origin is a leading producer of gas in eastern Australia, the largest owner and developer of gas-fired electricity generation in Australia and a leading wholesaler and retailer of energy. The company services more than 3.5 million electricity, natural gas and LPG customers across Australia, New Zealand and the Pacific.

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

Origin has been a leading developer of coal seam gas in Australia. The company acquired its first CSG interest over 13 years ago, making Origin arguably the most experienced CSG producer in Australia. On behalf of Australia Pacific LNG, Origin operates the Spring Gully and Peat CSG fields in the Bowen Basin, and the Talinga CSG field in the Surat Basin. Origin also undertakes exploration on behalf of Australia Pacific LNG in the the Bowen Basin, the Surat Basin (covering the Walloon Coal Measures) and the Gallilee Basin. Origin also owns and operates some CSG exploration acreage in the Surat Basin in its own right.

The company has a significant position in Queensland having already invested around A$5 billion in power generation, gas exploration and production and energy retailing. Origin currently retails natural gas, electricity and LPG to more than one million customers in Queensland alone.

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

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

In Australia Origin operates six power stations and has interests in a portfolio of co-generation plants which supply electricity and steam under long-term contracts. Origin is continuing to develop additional power plants that will see its total capacity increase to 2,800 megawatts (MW) by late 2010.

2.2 ConocoPhillips

ConocoPhillips is an international, integrated energy company. As of Sept. 30, 2009, ConocoPhillips is:

- The third-largest integrated energy company in the United States, based on market capitalisation, oil and natural gas reserves, and production. Current net production is 2.2 million barrels of oil equivalent per day from an assets base valued at US$152 billion.
- The fourth-largest refiner in the world
- The seventh-largest worldwide reserves holder of nongovernment-controlled companies with 10 billion barrels of oil equivalent of reserves.

ConocoPhillips is known worldwide for its technological expertise in:

- Exploration and production
- Reservoir management and exploitation
- 3-D seismic technology
- High-grade petroleum coke
- E-Gas™ coal gasification process
- The Optimized Cascade® process to produce liquefied natural gas.

More than 30,000 ConocoPhillips employees work worldwide to consistently deliver top performance and value and to maintain the company's global market position.

With operations in more than 30 countries, ConocoPhillips is committed to contributing to social, economic and environmental improvements in all the communities in which it operates. ConocoPhillips is determined to meet the highest legal and ethical standards, and to practice sound environmental stewardship and good corporate citizenship.

It strives to improve the wellbeing of the communities in which it operates, by making contributions that help support vital community services. During 2008, philanthropic investments totalled US$70 million for education and youth services, health and social services, civic and arts initiatives, environmental and industrial safety programs, and emergency relief.

ConocoPhillips believes in sustainable development. It is working to produce hydrocarbon products in ever-cleaner forms, while ensuring the long-term viability of energy production. A key component to achieve this is the investment in active research and development programs associated with traditional oil and gas, biofuels, non-fossil fuel alternatives and renewable energy.

ConocoPhillips Australasia, a subsidiary of ConocoPhillips, is an oil and gas exploration and production company, with assets and exploration activities in the Timor Sea, Northern Territory, Western Australia and Timor-Leste. Its major producing assets are the Bayu-Undan gas condensate field in the Timor Sea, the Darwin LNG facility (see Figure 13) in the Northern Territory, and the 500km sub-sea pipeline linking the two facilities. The Darwin LNG facility is one of nine LNG facilities developed worldwide using ConocoPhillips' Optimized Cascade® process technology, and is the most recent LNG

Figure 13 ConocoPhillips operated Darwin LNG facility

facility developed in Australia, using the same technology as is proposed for the Australia Pacific LNG Project. The Darwin LNG facility was successfully delivered on time and on budget.

ConocoPhillips' LNG technology and project management experience began more than 40 years ago when it established its first Optimized Cascade® LNG facility in Kenai, Alaska, with sales of LNG to Japan. This facility remains an industry model for safety, efficiency and reliability.

ConocoPhillips is the world's leading developer and operator of LNG projects using lean (low energy content) gas similar to coal seam gas. Today, ConocoPhillips successfully operates facilities in Kenai, Alaska and Darwin, Australia, and has licensed its proprietary LNG liquefaction process to operators on three continents.

ConocoPhillips has more than 25 years experience developing and producing coal seam gas and is one of the largest CSG producers in North America, with assets in several CSG basins, including a dominant position in the prolific San Juan Basin.

2.3 Alternatives

2.3.1 No project

If the Project does not proceed, Queensland and Australia will forego significant social, economic and environmental benefits. These benefits include multi-billion dollar investment in rural and regional areas, creation of thousands of local jobs, new infrastructure and significant royalty and tax revenue. The Project will also contribute to reducing global greenhouse gas intensity, by producing LNG which can substitute for higher greenhouse gas intensive fuels.

If there is 'no project', these benefits will be greatly diminished or lost altogether. Australia Pacific LNG would continue to develop its CSG resources but on a much smaller and more localised scale. If the Project does not proceed, Australia Pacific LNG would consider alternative uses for its gas, including additional domestic power generation and supplying industries, small business and households. Australia Pacific LNG would assess these alternatives and determine the extent and timing of its CSG development.

Prospective LNG customers would also need to find alternative energy sources if the Project does not proceed. This could come from other LNG export projects, such as those in Qatar or Papua New Guinea. Where liquefied natural gas is not currently used, such as in north Asia, coal is likely to be the most common alternative.

2.3.2 Locations and technologies

A rigorous process was carried out to evaluate alternative routes for the main gas transmission pipeline, using a multi-criteria analysis. The preferred option was selected because it offers the best outcomes against land use, social, environmental, cultural heritage, ease and safety of construction, co-location opportunities and commercial considerations.

Similarly, the LNG facility site was selected after almost six months' study of alternative sites on Queensland's eastern seaboard. The preferred site was ultimately selected based on proximity to the gas fields, deep water harbour, proximity to Gladstone's heavy industry and availability of a suitable site within the Curtis Island Industry Precinct of the Gladstone State Development Area.

The proposed technologies for CSG extraction, processing and compression, and liquefaction are based on careful consideration of available technologies and the considerable experience of both ConocoPhillips and Origin. Opportunities to enhance the safety, environmental and commercial performance through alternative technologies or engineering design are being actively pursued through the project planning phase and will continue for the life of the Project.

Image: Bottle Tree on Nixon property, Drillham, QLD

3 - EIS process

3.1 Legal framework

In April 2009, the Queensland Coordinator-General declared the Australia Pacific LNG Project 'a significant project' requiring an EIS under the State Development and Public Works Organisation Act 1971 (SDPWO Act).

Under Commonwealth legislation, the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is also triggered by the Project, applying to actions that are likely to have a significant impact on matters of national environmental significance. Australia Pacific LNG submitted three EPBC Act referrals covering the three elements of the Project – the gas fields, gas pipeline and LNG facility. The Commonwealth Environment Minister determined that the Project constituted a 'controlled action' under the EPBC Act due to its potential impact on matters of national environmental significance, specifically Ramsar wetlands, listed threatened species and communities, listed migratory species, World Heritage properties and National Heritage places relate to one or more of the project elements. Consequently, the Project requires formal assessment and approval under the EPBC Act.

A bilateral agreement between the Australian and Queensland governments which accredits the assessment process under the SDPWO Act enables a single assessment process to be undertaken to satisfy the regulatory requirements of both pieces of legislation.

The EIS process in Queensland is managed by the Department of Infrastructure and Planning on behalf of the Coordinator-General, who is responsible for evaluating the EIS and other information to determine whether the Project can proceed and state any conditions that will apply to the development approval. At the completion of the EIS process under the SDPWO Act, the EIS will be assessed by the Commonwealth Environment Minister as it applies to matters of national environmental significance, to determine whether controlled actions will be approved under the EPBC Act. The Minister may also attach conditions to the approvals, if granted, for the three elements of the project.

An EIS provides the general public and relevant stakeholders with information on the need for the Project and its potential social and environmental effects. An EIS provides a process for demonstrating how a project has been planned and can be managed to protect and enhance environmental and social values. It is only by following thorough impact assessment and consultation, required under the EIS process, that Australia Pacific LNG will be able to make specific applications for project approvals. This process is shown diagrammatically in Figure 15. An overview of the legislation that applies to this Project, the principal approvals likely to be required and the government agencies that administer these is given in Chapter 2 of Volume 1.

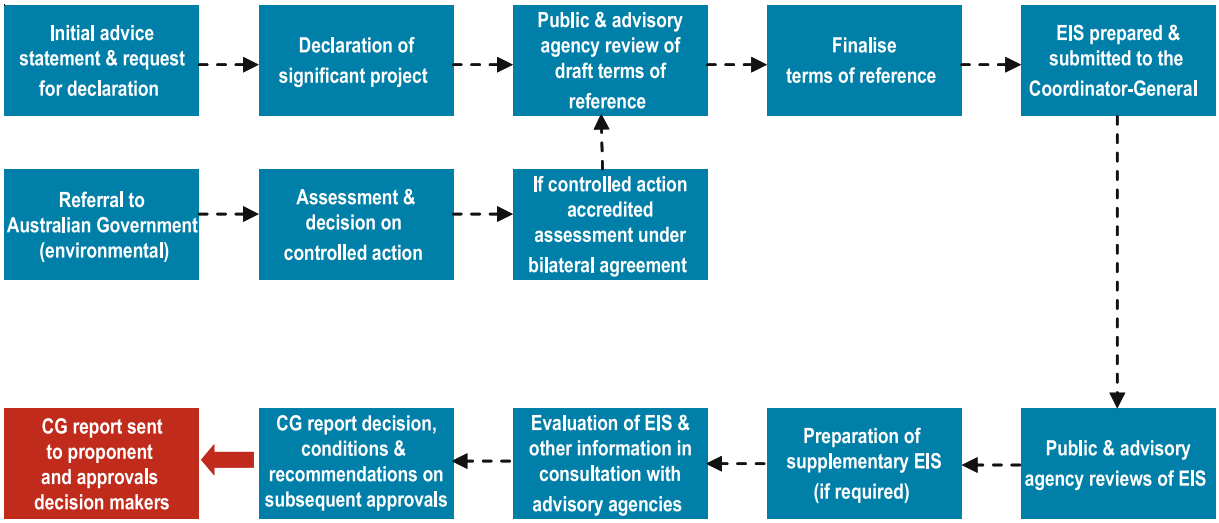


Figure 14 EIS process for a declared significant project, for which an EIS is required

3.2 Stakeholder engagement

Stakeholders have two opportunities to provide input to the EIS process. The first followed the release of the draft Terms of Reference in 2009 that set the framework and scope for the EIS. The second will follow the release of the EIS in early 2010. In addition to these formal processes, Australia Pacific LNG has an ongoing commitment to stakeholder engagement.

From April to November 2009, project personnel travelled to the gas fields in south central Queensland, communities extending along the proposed gas pipeline route, and areas associated with the proposed LNG facility to meet with stakeholders. This consultation built on relationships already established through previous projects, particularly in the gas fields where Origin and its predecessor companies have operated for more than 20 years. Australia Pacific LNG's engagement framework provided opportunities for active, open and transparent dialogue between project personnel and stakeholders with an emphasis on face-to-face consultation. This enabled immediate feedback and an invaluable sounding board for possible mitigation strategies.

In this way, stakeholder input became an integral part of the EIS process and, if the Project is approved, provision for ongoing consultation will continue to inform development throughout the project life.

Key stakeholders involved in the EIS process included individuals and members from:

- Local communities
- Landholders
- Elected representatives for local, Queensland and Australian governments
- Government officers
- Peak industry representatives
- Indigenous Australians
- Environmental groups
- Agricultural interests
- Business groups.

3.3 Sustainability commitment

The Project's joint venture partners, working under the auspices of the Australia Pacific LNG Project, aspire to be at the forefront of sustainable practices – to identify potential impacts on people and on the environment, and to find ways to minimise risks and contribute lasting benefits to society. This commitment is reflected in the project purpose:

We will create value for our stakeholders by delivering environmentally, socially and economically responsible energy from Australia Pacific LNG's substantial coal seam gas resources in Queensland. We will achieve this through teamwork, innovation, integrity and the application of safe and sustainable practices.

A set of 12 sustainability principles has been developed to guide the Project. Australia Pacific LNG will contribute to sustainable development by:

- Adhering to an overriding duty to safety, ensuring operations are carried out in a safe manner and empowering employees and contractors to place safety considerations above all other priorities
- Fostering the health and wellbeing of its workforce
- Creating and maintaining a rewarding workplace for employees and contractors by encouraging personal development, recognising good performance, valuing teamwork and fostering equality of opportunity and inclusivity
- Minimising adverse environmental impacts and enhancing environmental benefits associated with its activities, products or services; conserving, protecting, and enhancing where the opportunity exists, the biodiversity values and water resources in its operational areas
- Reducing greenhouse gas intensity through the development of an energy source less carbon intensive than the world average for the majority of fuel providers for power generation; and implementing a greenhouse gas mitigation strategy for its operations that continuously seeks opportunities to further reduce greenhouse gas emissions
- Using resources efficiently, reducing the intensity of materials used and implementing programs for the reduction and reuse of waste

- Respecting the rights, interests and diverse cultures of the communities in which it operates
- Engaging regularly, openly and transparently with people and communities affected by its activities, considering their views in its 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 its business
- Identifying, assessing, managing, monitoring and reviewing risks to its workforce, its property, the environment and the communities affected by its activities
- Ensuring that all employees and contractors work consistently with its sustainability principles, commitments, values and systems.

Through the EIS process and project development, these principles have been, and will be, applied to ensure thorough assessment, adequate identification of potential impacts and development of mitigations to reduce impacts where possible.

3.4 Risk management approach

As well as a strong focus on sustainability, the Australia Pacific LNG Project EIS has adopted a risk-managed approach to identify, focus on and seek the mitigation and management of key risks and likely potential impacts. Systematic risk-based assessments have also been undertaken as part of the EIS process, in accordance with Australian standards and industry guidelines.

In general, the systematic approach involved qualitative assessment of all identified risks, based on a combination of the likelihood of that risk occurring and the consequences of that event occurring.

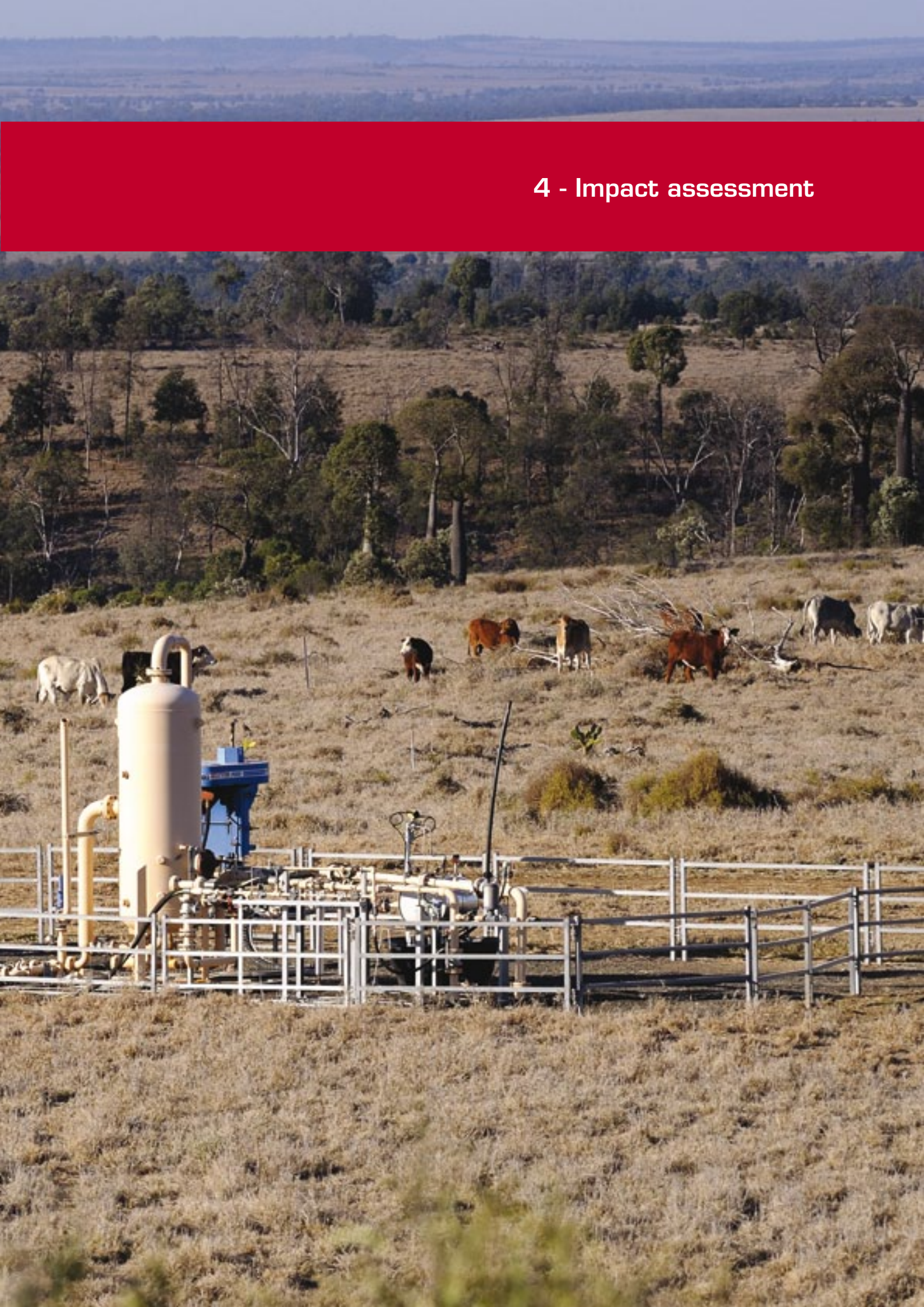
Based on initial assessment, a review was made of management measures that can be applied to mitigate and/or reduce the potential risk. This enabled an overall risk ranking for each element of the Project. This approach was modified for some elements of the Project to more accurately reflect risks associated with a particular activity or location. Some quantitative risk assessments were also undertaken where required.

To make risks as low as reasonably practicable, Australia Pacific LNG drew on the opinions of independent technical experts as well as an analysis of applicable standards, industry practice and available mitigation measures.

Risk assessment is not an exact science and judgements must be made. Ongoing monitoring and review will enable risk rankings to be regularly refined and mitigation measures and activities amended through revision of the Project's relevant environmental management plans.

Image: Rehabilitated operating gas well site co-existing with a grazing property at Spring Gully

4 - Impact assessment



Detailed EIS studies were undertaken to specifically address the three main elements of the Australia Pacific LNG Project – gas fields, gas pipeline and LNG facility – and the findings are contained in volumes 2, 3 and 4 of the EIS respectively.

The following summarises these findings for the Project as a whole, focusing on the principal environmental impacts predicted and the associated management and mitigation measures proposed. To avoid repetition, separate discussion is only provided for individual project elements where the findings have particular relevance or significance.

The impact assessment process followed a rigorous and systematic methodology, involving:

- Establishing baseline data and information
- Identifying potential impacts based on proposed activities
- Devising suitable mitigation measures to ameliorate these impacts
- Estimating the significance of environmental issues and proposed offsets, where required.

4.1 Social and economic

4.1.1 Community values and lifestyle

The workforce requirements for the construction and operation of the Australia Pacific LNG Project will result in population increases within the project area. When combined with increases predicted for other projects proposed or being developed in areas associated with the gas fields and LNG facility, the population increase becomes significant and has the potential to impact community values and resident lifestyle patterns.

The overall cumulative population increase of LNG and other projects planned and proposed for the Gladstone region is estimated at 7,000 people. This is based on multiplying estimates of the additional workforce[5] by average household numbers.

In the gas fields' area, there will be a large increase in the regional population associated with the growth of this industry. A cumulative peak of 6,300 construction workers could be required for all CSG projects by 2012, with an average of 3,600 during the 2009 to 2016 period. In general, these construction workers are expected to live in temporary accommodation facilities.

Another important component in addressing potential impacts on community values and lifestyle is the integration of workforce and dependents in a way that upholds existing community values. This is best achieved by fostering a culture of good behaviour, high levels of participation in community activities (including volunteering), and ensuring adequate resettlement and orientation services are available to those relocating.

In relation to the Project's gas fields, stakeholders highlighted the 'small-town feel', 'family values', 'rural heritage' and 'relaxed country lifestyle' as important values and lifestyle patterns. The Project has the potential to impact on the lifestyles enjoyed by rural and town residents through a general impact on their activities, exposure to noise and dust associated with construction and an increase in activity, people and traffic. In a cumulative context, these potential impacts would be compounded by significant population increases, non-resident workers, growth of the CSG industry and a general increase in economic activity. A range of mitigation measures will be employed to address these impacts.

For the pipeline element of the Project, potential impacts to community values and lifestyle in towns along the pipeline route are not expected to be significant given the short-term construction period and the accommodation of the workforce in temporary accommodation facilities.

In relation to the Project's proposed LNG facilities, an influx of a construction workforce, dependents and general growth attributed to the Project has the potential to place pressure on community values and residents' lifestyle patterns. This is compounded by the cumulative impacts of other major projects proposed or under construction within Gladstone.

Impacts are mainly related to the construction phase where the influx in population is short to medium-term and the demographics are more likely to

[5] Based on cumulative assessments, an additional 1,600 workers could be required in the Gladstone and Calliope by 2013, ramping up to 2,600 by 2016 and beyond.

consist of a young, male-dominated workforce with high levels of disposable income. Such changes are also likely to exacerbate existing pressures on social services and facilities.

These impacts would be mitigated by accommodating a large proportion of the workforce in temporary accommodation facilities on Curtis Island. The impacts are generally lower during the operational phase, as a smaller workforce is required and workers become more integrated into existing communities.

To mitigate impacts of the Project on community values and lifestyle, Australia Pacific LNG acknowledges the importance of these values and will strive to conduct its operations in a way that respects, upholds and, where possible, enhances existing community values and lifestyles. Specific strategies identified include:

- Expanding the community investment strategy
- Communicating relevant workforce numbers to, and working with, government agencies to ensure adequate services are provided
- Supporting health promotion and well-being programs for employees and contractors
- Encouraging employees to become active members of the community
- Reinforcing the culture of good behaviour
- Providing adequate relocation and orientation services for employees.

Regular monitoring and consultation will be necessary to ensure any detrimental change to community values and lifestyles is recognised quickly and acted upon. Stakeholder comments, complaints and criticism will be addressed promptly and appropriately through the Project's community complaints procedure.

4.1.2 Housing and accommodation

Australia Pacific LNG will develop a housing and accommodation strategy that details how it will minimise impacts on the local housing and rental market. It will focus on four key areas:

- Temporary accommodation
- Permanent accommodation
- Short-term accommodation
- Affordable housing.

The nature and size of the workforce required for the LNG facility in Gladstone, particularly when combined with cumulative impacts on housing and accommodation, could see a significant increase in housing demand, resulting in higher rental and property prices and reduced housing affordability. Furthermore, the cumulative impact of projects on the short-term commercial accommodation market in Gladstone could see zero percent vacancy rates and inflated prices, which could significantly impact local and regional businesses and the tourism industry.

During the construction phase in Gladstone, the non-local workforce will be housed in a temporary accommodation facility on Curtis Island. The non-local workforce may account for up to 80% of the total construction workforce when the cumulative effects of other projects being constructed at the same time are considered. Alternative locations for the temporary accommodation facility that have been considered include locating the facility at a mainland location in, or close to, Gladstone. Locating the temporary accommodation facility on Curtis Island is based on consideration of impacts to project cost and schedule and potential social impacts.

The operational phase of the LNG facility will require an expected workforce of 100 to operate one LNG train. Approximately 75 people will be required for each additional LNG train. While it is expected that a proportion of the operational workforce will be sourced from the Project's construction workforce and existing local residential labour, there may be some workers and their families relocating to Gladstone to work on the Project.

Workers required for pipeline and gas field construction will be primarily housed in temporary accommodation facilities and are therefore unlikely to affect housing demand or prices. However, some indirect impacts on housing demand may occur as a result increased regional growth.

[5] Construction of the gas fields is scheduled to begin in 2010 and be completed by 2027, with the peak period between 2012 and 2017.

During operations up to 800 people will be required for the gas fields and pipeline. Initially, most of the workforce is expected to be accommodated in temporary accommodation facilities at the logistics service hubs. Over time, the proportion of the operations workforce living in the region will grow as housing becomes available and local training and skills development programs mature.

Short-term accommodation for visiting project employees and contractors will be provided, where possible, to alleviate pressure on short-term commercial accommodation.

4.1.3 Employment

Australia Pacific LNG will create thousands of jobs during construction, and will also generate sustainable long term employment throughout the life of the Project.

For the gas fields, Australia Pacific LNG will require more than 1,600 workers on average per year during the peak construction period[6]. For the LNG facility, a peak workforce of approximately 2,100 workers will be required during the construction phases, with at least 20% expected to reside locally.

While Australia Pacific LNG is strongly committed to employing locals as much as possible, current labour conditions and cumulative demands will make this difficult. In its April 2009 listing of major projects, the Australian Bureau of Agricultural and Resource Economics[7] states that 74 projects with a total projected expenditure of A$80 billion were at an advanced stage of development across Australia.

Requirements for additional labour in an already stretched labour market will contribute to the current skills shortage (especially with respect to electrical and instrumentation technicians and electrical engineers) and pose challenges for recruitment and retention.

The availability of labour in the gas fields is restricted with the region experiencing low levels of unemployment (1.5% overall) and a high rate of participation. The Project will provide an opportunity to increase workforce participation. However, recognising the constraints of the local labour market, a key focus of the Australia Pacific LNG workforce strategy will be to target sectors of the community that are not currently participating in the labour force, such as under-represented groups.

Labour markets within the Gladstone region are also tight. Therefore, a large portion of the local workforce would consist of workers moving to Gladstone to work on the Project and as such would generate additional demands for housing, facilities and services. These issues will be further exacerbated by the cumulative impacts of other projects proposed and planned for Gladstone.

To enhance employment opportunities and mitigate negative impacts, Australia Pacific LNG proposes a range of strategies including:

- Developing a workforce strategy that details the approach to employment and training
- Maximising local employment opportunities by assessing existing community skills and identifying gaps to offer targeted skills training to a diverse range of people and sectors of the community
- Pursuing a range of opportunities to attract workers into the local workforce
- Developing a local content strategy which includes a business capacity building program.

For indigenous communities, the cumulative impacts of population increases associated with projects proposed or underway around Gladstone, are likely to be particularly significant given the lower than average levels of disposable income found in this sector of the community. If living costs increase significantly, households whose income levels do not increase at the same rate will have reduced disposable income and lower levels of affordability.

Australia Pacific LNG proposes to implement an indigenous engagement strategy with major elements aimed at investment in education and training, employment, and business development and support. This should mitigate potential increases in living costs and, more broadly, contribute to indigenous economic and social development.

[7] Refer http://www.abare.gov.au/publications_html/ energy/ energy_09/ME09_Apr.pdf

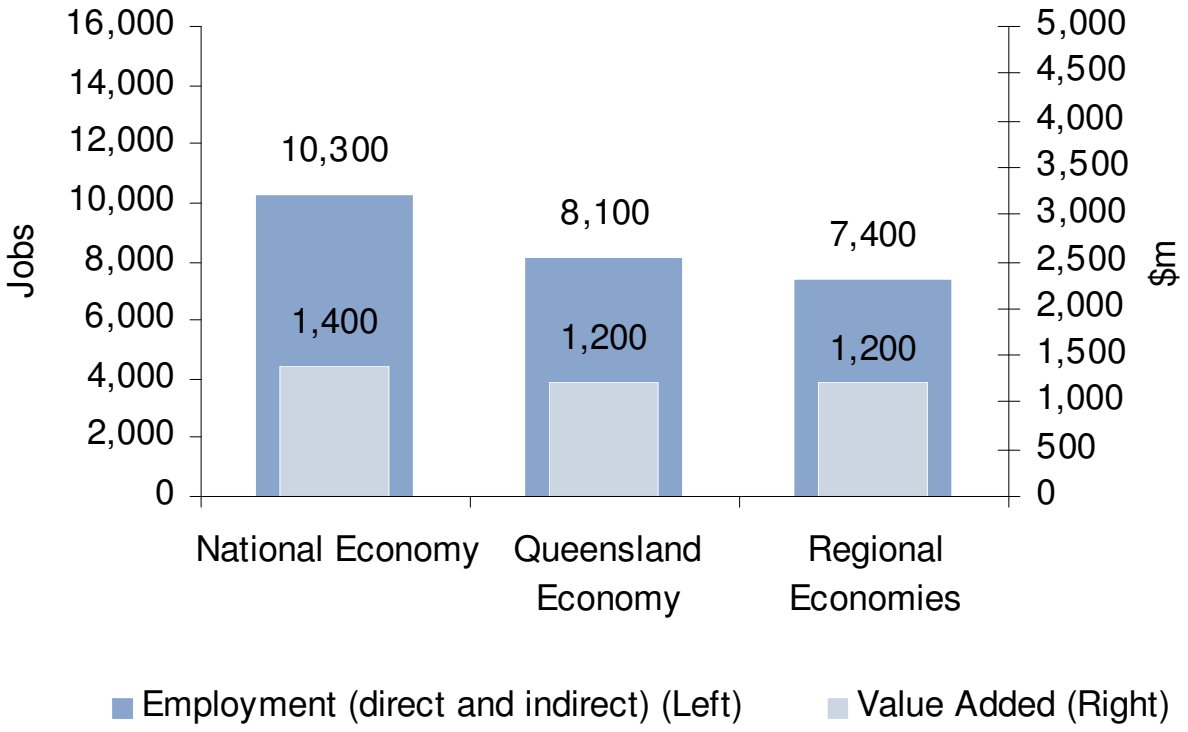


Figure 15 Average economic impacts of the construction phase of the Australia Pacific LNG Project (source: KPMG 2009)

4.1.4 Economic stimulus

The Australia Pacific LNG Project is expected to have significant positive impacts on the local, regional, state and national economies. At a regional level, the Project will contribute to gross regional product and employment growth during both construction and operational phases. For example the Project's annual contribution to the economy of the Darling Downs– South West region could be up to A$900 million during operation. Similarly, the economy of the Mackay-Fitzroy-Central West region (where the LNG facility is located) could see an increase of up to A$770 million a year during the construction phase.

On a state level, the Project could stimulate an increase in Queensland's gross state product of approximately A$2 billion per annum (0.9% higher than without the Project).

The Project also represents a major investment in Australia's growing LNG export industry. It is estimated to increase the nation's gross domestic product by around A$1.3 billion per annum when fully operational. The Project will also generate significant revenue for government through royalties and taxes.

Figure 15 shows the average economic impacts of the construction phase of the Australia Pacific LNG Project.

Australia Pacific LNG is committed, to the extent that it is reasonably practicable, to source goods and services locally and elsewhere in the Australian economy for the construction of the Project. For the purposes of the economic modelling, it has been assumed that of the A$35 billion investment, approximately 65% will be sourced from goods and services from Australia.

Strategies have been identified to maximise economic benefits and minimise adverse impacts from the Project.

4.1.5 Visual amenity

Generally, visual impacts associated with the gas fields' development are due to the visual contrast between the more industrial nature of proposed infrastructure and the surrounding rural landscape. Relatively small scale components, such as the microwave tower and gas wells, will generally have lower visual impact than larger components such as gas processing facilities.

Where possible, infrastructure will be designed to blend in with the existing landscape to reduce contrast and visual effect.

Views from residences and highways are considered more significant when it comes to evaluating and reducing visual impacts.

areas both on and off the development site. The design of the LNG facility incorporates shielded ground flares and low impact lighting. Whilst the structures of the LNG facility will impact visual amenity, it is considered the development of Curtis Island in this fashion is consistent with local and state planning regimes for the expansion of

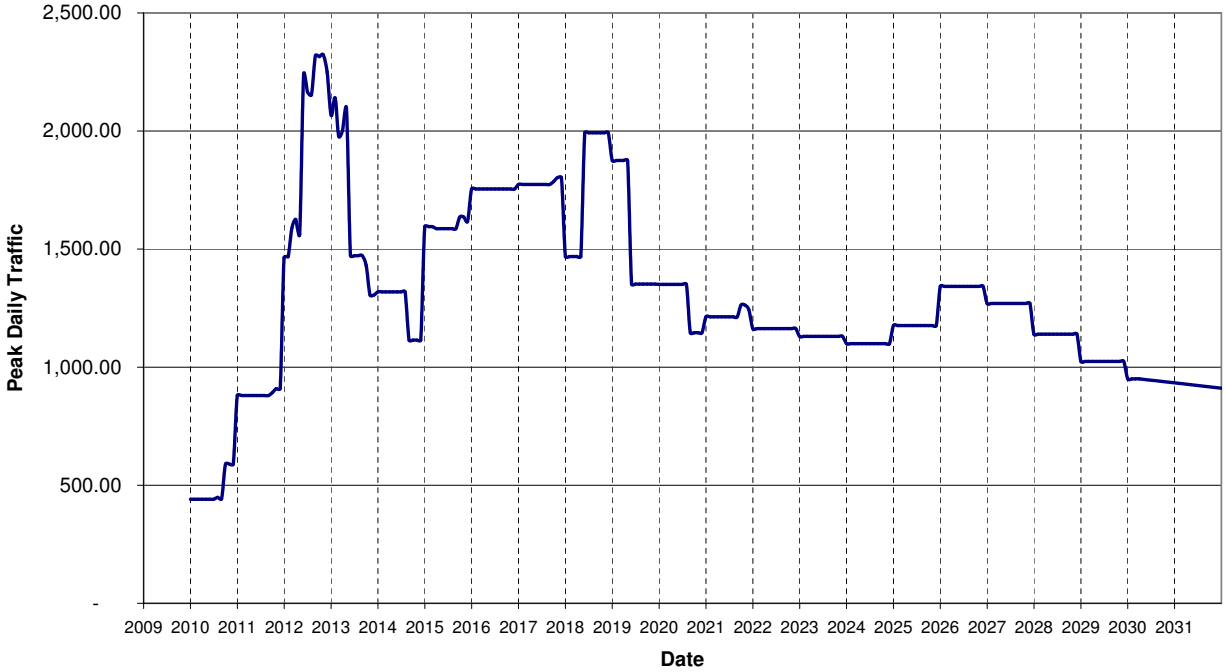


Figure 16 Peak daily traffic - Australia Pacific LNG Project

Larger facilities will be situated out of view of residences where possible. Where this is not possible, mitigation measures will be implemented to reduce the visual impact, including screening with vegetation and/or visual integration landscape treatments at the facility and/or at the point of viewing.

For the pipeline, some visual impact is inevitable particularly during construction. However, following restoration work when the pipeline is in operation, these impacts will be minor or negligible. The exception to this is in forested areas (constituting about 1% of the pipeline corridor) where a 40m wide right-of-way will be cleared for construction and a 6m wide easement maintained in a cleared state during pipeline operations.

The LNG facility will have an impact on the visual amenity of Curtis Island, as considered from certain view-sheds. The site provides high levels of visual screening and integration can be achieved through management of vegetation

the Port of Gladstone in Port Curtis. Therefore, with appropriate mitigation, the LNG facility will have a minor or negligible visual impact.

4.2 Traffic and transport

4.2.1 Road

Construction and operation of the Project will require significant road transport of materials, equipment and personnel. Traffic generation has been estimated for both construction and operation phases of each of the three project elements (gas fields, pipeline and LNG facility) throughout the analysis period 2010 to 2032, based on estimated project requirements and assumptions on delivery frequencies, origins and destinations.

The analysis shows there are two peaks in the daily traffic (Figure 16). The first occurs in 2013, coinciding with the construction of the gas

pipeline and the construction of LNG trains one and two. The second occurs in 2019, coinciding with the operation of trains one and two and the construction of trains three and four.

Key findings of the road network analysis of increased traffic associated with the Australia Pacific LNG Project are:

- Some road link capacities will be exceeded by background traffic alone, but the Project would not result in bringing forward any road alterations
- The capacity of a number of intersections on the Dawson Highway, Gladstone-Mt Larcom Road, and Hanson Road in the Gladstone district will be exceeded
- Road pavement rehabilitation would need to be brought forward for sections of the Warrego and Leichhardt highways, Millmerran-Cecil Plains, Tara-Kogan, Kogan-Condamine, Jackson-Wandoan and Surat Development roads in the gas fields' area
- Several bridges within the general gas fields' area were identified with load limits or other restrictions, such as vulnerability to flooding.

In a more general sense, traffic increases will increase the potential for accidents, disruptions, noise, dust and aesthetics for local landholders and other road users.

Australia Pacific LNG will work with Australian, Queensland and local governments and industry to identify infrastructure alterations which may be required to meet the increased demands on the regional and local transport network. Such works may include access road construction, flood mitigation measures and intersection and road alterations.

To reduce the risk of accidents to employees and other transport network users from project operations, Australia Pacific LNG will develop and implement detailed traffic management plans and transport and logistics management plans for constructing and operating the Project. These plans will incorporate safety measures to be implemented across all relevant modes of transport.

4.2.2 Rail

Construction of the main gas transmission pipeline requires large quantities of pipe to be delivered to the right-of-way. The pipe segments would be imported via the Port of Gladstone and possibly the Port of Brisbane, and could subsequently be transported by rail to possible lay down areas at Biloela, Moura and Miles.

If the rail option is pursued, the pipe segments would have to be transported from the lay down points by road to their final destinations. This would require construction of rail sidings and support facilities. A preliminary assessment of these locations indicates that this is feasible, but additional infrastructure would be required.

4.2.3 Shipping

The Project will result in significant additional shipping movements within the Port of Gladstone, and shipping channels to the open sea and to mainland facilities such as Auckland Point.

There are approximately 2,000 ship movements per year through the designated shipping channels. These ships comprise bulk carriers, multi-purpose vessels, tankers, break bulk vessels and liquefied petroleum gas (LPG) carriers. The major cargos imported into the port include bauxite, caustic soda, LPG, petroleum coke, liquid ammonia, bunker oil, magnetite, gypsum and copper slag. Additionally, major cargoes exported from the port include coal, alumina, magnesia, cement, limestone, scrap metal and ammonium nitrate.

At maximum production of 18Mtpa of LNG (four LNG trains), one LNG vessel will arrive in Gladstone every one to two days and will have a 24-hour turn around time.

Simulations of shipping operations within the Port of Gladstone identified that the shipping for the Project can be accommodated within existing channels. Mitigation measures have been developed in collaboration with Gladstone Ports Corporation and Maritime Safety Queensland and in consultation with relevant government agencies. These address potential safety and environmental impacts, including quarantine

procedures.

Inside the Port of Gladstone, the Project will require the following ferry or barge journeys:

- Approximately 140 one-way ferry journeys per month during the peak construction period (Fishermans Landing to Curtis Island)
- Approximately 70 barge journeys (direct to the materials offloading facility) per month at the peak construction period
- Additional ferry journeys from Fishermans Landing to Curtis Island, for transport of consumables and equipment and for waste removal from site.

These numbers represent a significant increase in vessel movements. However, the overall impact on non-project shipping and boating activities is anticipated to be less than these numbers suggest, as the proposed ferries are highly manoeuvrable, operate around existing bulk carriers and will be predominately in the Western Basin.

The port's strategic plan envisages an increase in total planned port capacity to 300 million tonnes per year within the next 50 years, which is nearly four times the 2008 throughput. The increased traffic linked to an LNG industry is expected to be less than 10% of this proposed increase.

4.2.4 Air

The transportation of people, principally construction staff during shift rotations, will require additional movements of passengers and aircraft through the regional and local airports. A large number of the additional flights required will be dedicated charter flights.

With the upgrades underway, the Gladstone regional airport will handle the higher number of additional passengers. This is estimated at 100 each day, on average, during construction periods, possibly higher during construction of the main gas transmission pipeline. Cumulative impacts also need to be considered as they are likely to be at least double the demands assessed for the Australia Pacific LNG Project.

There will be cumulative impacts to the Roma airport as a result of increased economic activity. Australia Pacific LNG supports the Maranoa Regional Council's application for Australian Government funding to upgrade the Roma airport.

There would also be a need to upgrade the Miles aerodrome, which does not currently operate regular commercial services. Australia Pacific LNG will work with the Western Downs Regional Council and relevant government agencies and service providers to determine the most appropriate options for the use of Miles aerodrome.

4.3 Water resources

4.3.1 Groundwater

A key part of EIS studies has involved assessing the impact of CSG activities on groundwater resources within the Project's gas fields and surrounding areas. Impacts to groundwater associated with construction of the main transmission pipeline and LNG facility have also been assessed and the risk of any significant harm to groundwater resources at these locations found to be negligible.

The key potential risks, prior to mitigation, to groundwater from gas fields' development were identified as:

- Drawdown of groundwater levels across the region
- Reduction or cessation of flows from existing landholder bores
- Gas migration to bores adjacent to the coal seams being developed.

These risks and associated mitigation measures are described in more detail in the following sections.

Groundwater assessment methodology

A groundwater flow model has been developed to simulate groundwater production from the coal seams according to two scenarios: the Australia Pacific LNG Project operating independently of other developments (project case) and in

conjunction with other proposed projects (cumulative case). The model is highly complex, reflecting the highly complex hydrogeology of the system and the challenges of the assessment task. Many elements were considered to make the modelling and its results as robust as possible. The model will continue to be refined with additional information as it becomes available, in consultation with regulatory agencies who have already provided valuable input data for the model.

The model is designed to enable reasonably accurate predictions of the effects of withdrawing water from the coal formation. While the model outcomes and interpretation of potential impacts are designed to be conservative, it is important to note that significant mitigation measures will be put into place to carefully manage the potential impacts associated with the water extraction.

Regional drawdown

The hydrogeological environment in the study area comprises a multilayered confined aquifer system that dips at a shallow angle to the southwest. Most groundwater in the study area is extracted by current users from aquifers overlying the Walloon Coal Measures from which the CSG and associated water will be drawn.

Figure 17 shows a conceptual geological section of the Surat Basin including the Walloon Coal Measures and proposed production and monitoring wells.

Production of groundwater from the coal seams creates a potential for water movement into the coal seams from overlying and underlying aquifers.

Typical drawdown levels projected by initial modelling are less than 5m in most aquifers across most of the region. The drawdown effect is projected to be the highest in the Springbok Sandstone, which is situated closest to the CSG interval. The Hutton Sandstone, which is situated beneath the Walloon Coal Measures and separated from it by low permeability shale, is expected to experience comparatively less drawdown. Smaller amounts of drawdown are expected to occur in the deeper Precipice Sandstone, and shallower Gubberamunda Sandstone/BMO Grouping and near-surface Cainozoic Units.

Potential effects and impacts associated with the projected groundwater level drawdown include:

- A low potential for groundwater quality changes
- Significant potential for reduced groundwater production rates in some water bores
- A low risk of the reduced baseflow to surface water systems and/or increases in stream losses
- A low risk of reduced spring flows and reduced water availability to groundwater dependent ecosystems
- Some risk of gas migration away from the gas fields and through wellbore pathways that may require monitoring and mitigation
- A low risk of proposed Australia Pacific LNG production wells providing an artificial connection between aquifers due to well completion practices that isolate the production zone.

Extensive planning and mitigation measures will be put into place to reduce or preclude the above impacts. Additionally, drawdown effects to overlying aquifers, where the upper coal seams could be in direct connection with the Springbok Sandstone, will be further reduced where practicable by sealing the upper coal layers from the perforated section of the coal seam gas well.

Existing water bores

In some localised areas there is a risk that groundwater drawdown or depressurisation associated with coal seam gas production will reduce groundwater production rates in existing bores, including stock and domestic bores. Those bores extracting water from the Walloon Coal Measures, and the Springbok sandstone, have the greatest potential to be affected. The bores accessing groundwater from the Hutton Sandstone, within Australia Pacific LNG's development areas, also have a higher potential of drawdown effects.

Australia Pacific LNG is committed to monitoring and mitigating these impacts according to the 'make good' requirement of the Queensland Petroleum and Gas (Production and Safety) Act 2004.

Due to the cumulative nature of groundwater impacts, an agreed CSG industry-wide response needs to be developed in consultation with

government. This will include an approach to regional-scale groundwater monitoring and cumulative effects groundwater modelling, along with an agreed process to assess and apportion the 'make good' responsibility.

Gas migration

Gas migration, seepage and venting are natural phenomena where coal beds are close to the surface. Human activities, such as poor well construction or inappropriately abandoned bores, can facilitate this process by providing conduits to convey gas to overlying aquifers and the surface. The dewatering of the coal seams during gas production may also increase the potential for gas migration.

Australia Pacific LNG's coal seam gas production wells will be constructed in accordance with industry standards. The design is based on maintaining separation between different water-bearing formations, and therefore reducing the risk of gas migration. In addition, the integrity of the wellhead and casing will be tested as part of normal operations to reduce the risks associated with gas migration.

Groundwater monitoring network

A rigorous and systematic groundwater monitoring program is proposed to detect groundwater impacts and provide information for ongoing adaptive management. Selected locations for groundwater monitoring will be predominantly based on the projections of the groundwater model. Water level, water quality and the local operating environment have been proposed for monitoring. Evidence of gas migration will also be monitored.

Monitoring data will be reviewed on an ongoing basis with results reported annually. A baseline monitoring program has been implemented which focuses on the Talinga development area.

Australia Pacific LNG will involve community groups in implementing its ongoing groundwater monitoring program, and will consult with stakeholders on strategies to 'make good' any impacts as required under relevant legislation.

Australia Pacific LNG is working with government to develop a publicly-accessible database containing easily interpreted groundwater level and quality monitoring data.

4.3.2 Associated water

In the Walloons Coal Measures, pressure from the surrounding body of water keeps the gas adsorbed on the surface of the coal. Therefore, to extract coal seam gas, the water pressure needs to be reduced by allowing the water, known as 'associated water', to be released to the surface.

The amount of associated water produced during coal seam gas extraction is difficult to predict and varies both with the location and stage of the production cycle. Figure 18 provides a summary of the maximum anticipated associated water profile for the gas fields by development area. This indicates a peak production of around 170ML/day. Likewise, the quality of the associated water is highly variable, but it frequently contains salt and other naturally occurring constituents.

Inappropriate management of associated water can potentially result in environmental harm. Responsible management of this resource is a key commitment for the Project, and Australia Pacific LNG will employ significant measures to treat and manage this water in a way that minimises potential environmental impact and maximises opportunities for beneficial and commercial use.

Key risks of associated water management include:

- Potential loss of water and/or wastewater from storage ponds with potential to contaminate water and soil environments and affect aquatic ecosystems
- Temporary discharge of high quality treated water to surface water courses with potential to cause localised erosion at discharge points and alter geomorphology
- Potential injection of associated water or brines and associated impacts, which require further investigation and site-specific assessment.

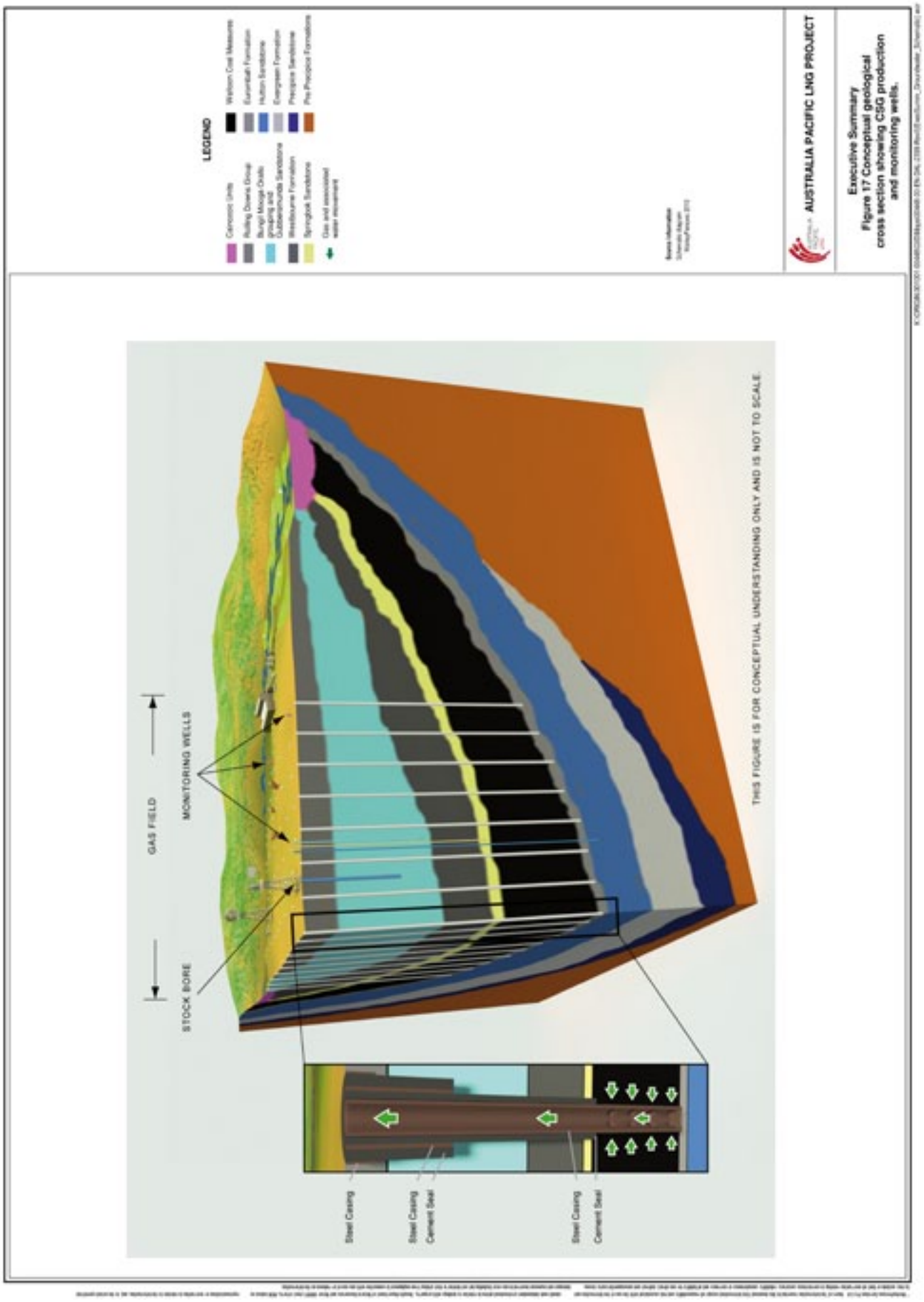


Figure 17 Conceptual geological cross section showing CSG production and monitoring wells.

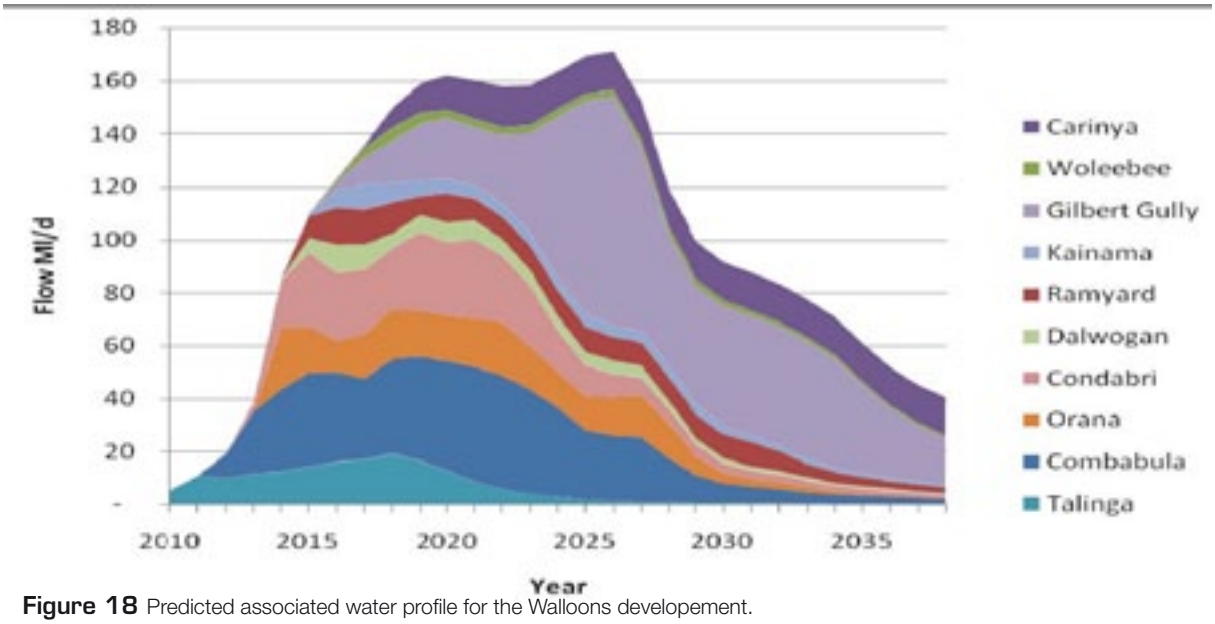


Figure 18 Predicted associated water profile for the Walloons developement.

Associated water management plan

Sustainable resource management and development is a key sustainability principle of the Australia Pacific LNG Project. The appropriate management of associated water is critical to the gas fields' development program. Australia Pacific LNG is committed to a water management strategy that will encourage commercial and beneficial uses of associated water to deliver sustainable outcomes.

An adaptive associated water management plan has been developed to assist with the long-term management of the associated water produced during the CSG extraction process. The plan has been developed in accordance with government policies and uses an adaptive approach that aims to optimise beneficial reuse.

The initial solution for associated water involves:

- A low pressure water collection system delivering water to a series of central locations
- Short-term storage ponds to facilitate initial water treatment and operational flexibility
- Water treatment facilities to treat the water to a standard suitable for use
- Australia Pacific LNG owned and operated agricultural use, complemented with negotiated water supply to existing agricultural ventures
- Discharge of high quality treated water to major watercourses in accordance with environmental flow objectives and to mimic pre-development flows wherever practicable
- Storage of brine (from the water treatment facilities) within ponds and encapsulation of the ponds when their use has expired.

Based on mitigation measures implemented as part of this initial case, the residual risk to the environment was considered low.

Further adaptive measures are still in development, and will be designed to maximise beneficial use and minimise environmental impacts. Five options are currently being targeted as listed below, with other innovative technologies being considered:

- Water supply to industrial use
- Urban water supply
- Agricultural use
- Aquifer injection
- Salt recovery.

4.3.3 Surface water

There are a number of catchments and associated river systems associated with the Project area including the:

- Condamine River, a major tributary of the Darling River

- Border Rivers catchment, located on the Queensland–New South Wales border, covering about 50,000km2
- Dawson River catchment, a sub-catchment of the Fitzroy Basin, with a total area of about 50,800km^2.

Discharge

The initial solution for managing associated water includes releases to watercourses within the Project area. Such releases would only occur once the water was treated and only under strictly controlled conditions.

Existing flow regimes of watercourses under consideration for release of treated water were characterised and potentially suitable beneficial discharge regimes based on pre-development flows were developed.

Any water discharged will need to meet statutory environmental flow objectives[8]. Preliminary integrated quantity–quality modelling (IQQM) indicated that discharges of up to 65ML/d at one of the proposed Condamine River discharge locations would comply with current environmental flow objectives.

Existing regional watercourses are typically ephemeral in nature with no-flows between 5% and 70% of the time. It is concluded that all proposed discharge locations have the capacity to accept the addition of treated water discharges. Based on pre-development flow modelling, discharge during periods of low or no-flow will be avoided.

Flooding

An analysis of catchment response and flooding behaviour over the gas fields has showed varying degrees of inundation during flooding across the gas fields. Most proposed infrastructure was predicted to be flood free during all of the modelled rainfall events (10, 20, 100, 500-year average recurrent interval [ARI] design rainfall events). Where potential inundation is a concern, proposed infrastructure will be located above the predicted 100-year ARI flood extent.

It is envisaged that some gas wells will be located within the flood extents of major waterways investigated as part of the study. Wells will be designed to deal with possible inundation at these locations.

Given the nature of creek crossings by minor roads within the gas fields, as well as the number of major roads predicted to be inundated during the 10-year ARI event, it is envisaged that the majority of infrastructure sites will be inaccessible at some point during a major rainfall event (≥10 year ARI event) if no augmentation of creek crossings occurs.

Three short ephemeral creeks drain the LNG facility site on Curtis Island. Runoff from the upper catchment areas beyond the site will be diverted via a channel. The drainage system will be designed to accommodate a 100-year ARI flood event. Similarly, a stormwater treatment system comprising vegetated swales, sediment basin and hydro-test pond is proposed to reduce suspended sediments, nutrients and fuels/ chemicals from stormwater runoff.

Watercourse crossings

Watercourse crossings associated with development of the proposed pipeline were also assessed, focusing on flooding and erosion, water quality, scour and sediment transport.

The construction of pipeline creek crossings will be undertaken during dry periods where practicable. Techniques will be used to minimise damage to creek banks and riparian vegetation. The backfill placed over the pipeline will be compacted to minimise the potential for scour along the trench line and subsequent erosion to creek banks.

EIS studies found that most proposed creek crossing sites are prone to scouring of the creek beds during flood, as expected, and will require site-specific investigation to determine the appropriate depth of cover or scour protection measures to be adopted at each crossing.

[8] Environmental flow objectives were established under the Condamine-Balonne Resource Operations Plan.

Water storages

An assessment of the hazards associated with the various water storages within the gas fields study area was undertaken, and included the proposed water treatment facility, brine ponds and water transfer station storages. No significant water storages are planned for the pipeline or LNG facility.

Hazard classification of the ponds has been carried out in accordance with relevant government guidelines based on both the physical and chemical composition of the stored water, as well as identification of impacts associated with a potential dam breach (based on a failure impact assessment).

The proposed water treatment facility, brine ponds and water transfer station storages are within the high hazard category as defined by government regulations. This is primarily due to their large volumes (e.g. brine ponds hold up to 8,300 mega litres) and potential to cause economic and/or human harm if these storages were breached or failed. Due to this high hazard classification, Australia Pacific LNG will comply with the 'Environmental authority streamlined conditions for high hazard dams containing high hazard waste', and the 'Code of compliance for high hazard dams containing high hazard waste' and any other regulatory requirements for these storages.

4.4 Terrestrial and aquatic ecology

Impacts on ecological values can be considered in terms of direct and indirect effects, both short-term and long-term. Direct impacts on terrestrial ecology refer to the loss of vegetation and habitat, usually through land clearing. Indirect impacts are secondary effects such as weed invasion and increased sedimentation. Impacts vary in their potential to occur, in both intensity (scale) and duration.

[9] Listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Nature Conservation Act 1992* (NC Act).

[10] Biodiversity status under the NC Act.

4.4.1 Terrestrial ecology

This section focuses on the impacts the gas fields and gas pipeline will have on terrestrial ecology within the project area. The LNG facility's impacts are addressed in the marine and coastal ecology section.

Vegetation clearing

The most intensive and long-term impacts on conservation significant vegetation communities and flora species will come from the proposed clearing of approximately 6,000ha of remnant vegetation within the 570,000ha gas fields area. While no regional ecosystem will lose more than 0.5% of its area, clearing may fragment habitats of species that only occur sparsely throughout the area.

Without mitigation, there is potential for 'moderate' to 'significant' impacts on three endangered ecological communities and nine endangered regional ecosystems . Clearing in these communities will be limited to isolated occurrences and areas adjacent to current disturbance, while any work carried out within a 200m buffer zone will be subject to a management plan. Proposed mitigation measures can reduce the potential residual impact to 'negligible'.

The proposed 40m wide main gas transmission pipeline right-of-way covers a total area of approximately 1,750 hectares. Approximately 1,300ha (74%) falls within cleared areas or non-remnant vegetation. The scale of the pipeline makes impacts such as edge effects and fragmentation unavoidable in places. These impacts are expected to be most severe in large remnant areas with minimal existing disturbance, such as the sandstone areas in the central sections of the pipeline route. Historically, the vegetation in other sections has already undergone significant disturbance, mostly through broad-scale clearing. The impacts on the local flora in these areas are expected to be minimal.

The pipeline has been positioned to largely avoid endangered regional ecosystems and threatened ecological communities within the 450ha (26%)

[11] Listed under the *Vegetation Management Act 1999*

[12] Listed under the EPBC Act.

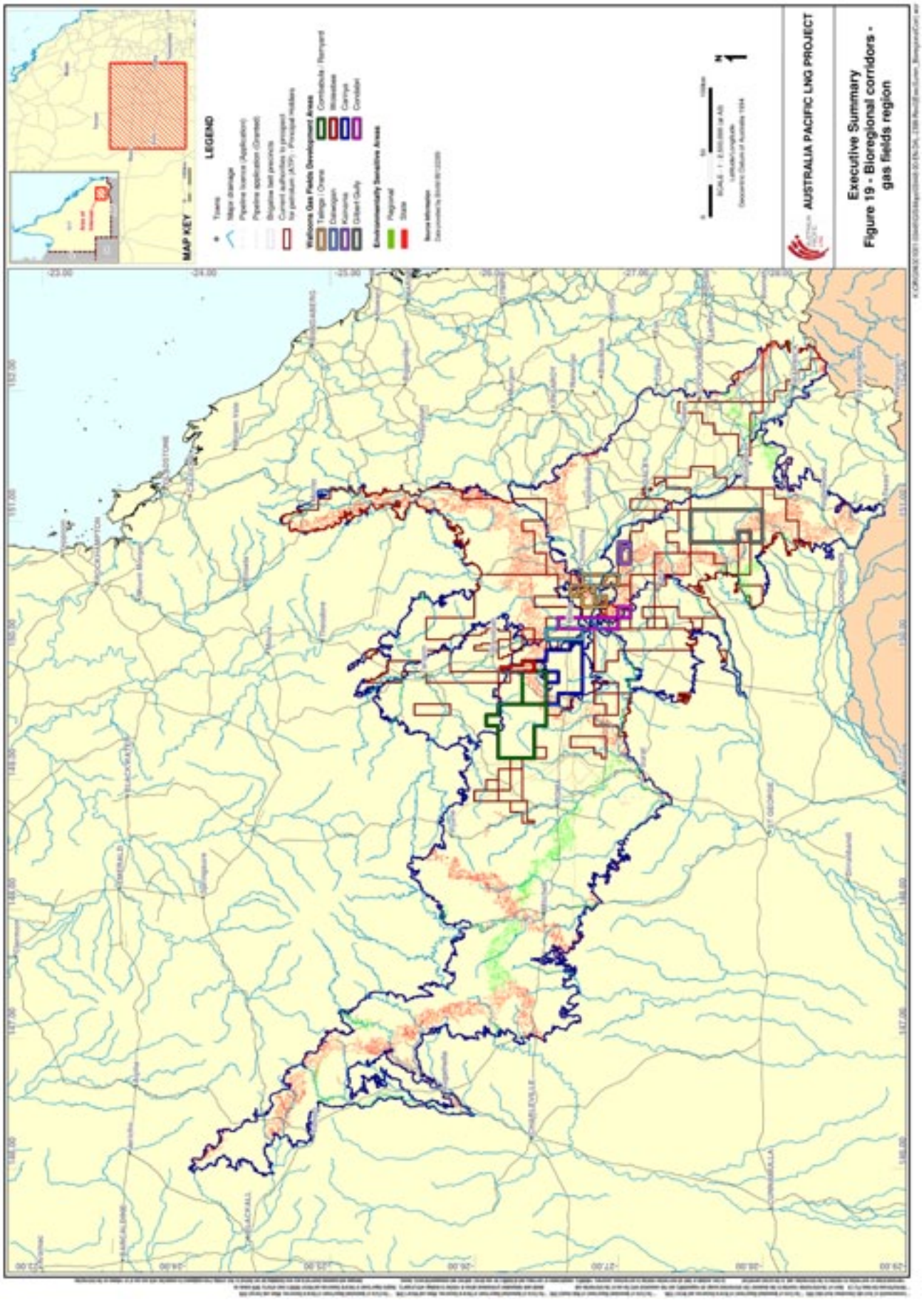


Figure 19 Bioregional corridors – gas fields region

of remnant vegetation. Of this area, the proposed pipeline right-of-way will transect a combined total of 2.8ha of endangered regional ecosystems. There is potential for moderate to significant impacts in these areas.

It is important to note that the pipeline is buried and regrowth will be encouraged, except for a 6m width over the pipeline for maintenance access and integrity inspection., Impacts associated with clearing for pipeline construction and maintenance after decommissioning are considered to be largely reversible within all regional ecosystems.

During construction, operations and decommissioning of the Project, the major threats to conservation significant communities are associated with the increased possibility of accidental fire, as well as decreased habitat quality through edge effects. Throughout the life of the Project potential impacts will be reduced to minor or negligible by strictly implementing habitat management plans which incorporate weed and ecological fire management, along with individual threatened species management plans.

Habitat fragmentation

State and regional bioregional corridors traverse the gas fields and are particularly important in several individual gas field tenements (see Figure 19). The importance of these corridors for flora and fauna is afforded particular significance within the region due to extreme fragmentation and continued disturbance of remnant vegetation, primarily as a result of grazing practices. Many of the corridors are themselves highly fragmented. Creating further barriers to fauna movement within these corridors, such as from clearing for infrastructure and constructing roads, tracks and pipelines, has the potential for significant and long-term negative impacts on regional biodiversity.

Mitigation measures will include minimising clearing and concentrating rehabilitation and restoration of remnant vegetation for offsets within the bioregional corridors. Implementing these measures will mean the potential impacts are predicted to be minor in the short term. Significant, long term, positive impacts on regional biodiversity over the life of the Project can result from reconnecting currently fragmented habitat in the bioregional corridors that occur within the Project's boundaries.

The overall condition and integrity of vegetation communities along the proposed gas pipeline may be impacted during construction, operation and decommissioning activities. However, most flat fertile land in the Brigalow Belt South bioregion has already undergone historic disturbance. The effects of vegetation fragmentation and disturbance will be most severe in large remnant areas with minimal existing disturbance such as the sandstone areas in the central sections of the pipeline corridor.

Potential impacts to vegetation on site may include fragmentation of vegetation communities and an increase in edge effects associated with clearing activities. Changes to hydrological regimes, greater susceptibility to erosion and increased air pollution and dust emissions during construction activities are also a possibility if not managed effectively.

While the pipeline alignment avoids as many large and connected areas of remnant habitat as possible, it was not feasible to avoid all such areas over the entire length of the pipeline. Construction will require some clearing of vegetation and therefore loss of fauna habitat. This is not likely to have a significant long-term impact on common fauna, as similar habitats will remain adjacent to the proposed alignment.

High value fauna species

Australia Pacific LNG has identified that 18ha of potential habitat for the critically endangered Brigalow Woodland Snail, out of approximately 800 hectares of potentially suitable habitat across the gas fields, may be disturbed by the Project. In recognition of this, Australia Pacific LNG is committed to undertaking detailed surveys prior to any ground disturbing works within identified potential habitat areas, avoiding habitat where the snail is found to occur, and contributing to the long-term persistence of this species within the landscape.

There is also potential for moderate to significant impacts on 16 species considered threatened,

[13] Listed under the EPBC Act and/or NC Act.

rare or near threatened. These species are highly restricted in distribution, occur very sparsely throughout their distribution, and/or are difficult to detect without targeted surveys.

Mitigation measures include pre-development surveys, avoidance and buffers. Threatened[13] species management plans will also be prepared and implemented.

During construction, operations and decommissioning phases of the Project, threats to conservation significant fauna species are associated with the increased potential for accidental fire, decreased habitat quality through edge effects, increased access for feral predators and competitors, increased weed invasion (particularly exotic grasses), changes to hydrological conditions, the creation of artificial water bodies, and the more localised effects of increased noise and night-time lighting.

It is possible to reduce potential impacts for many species to 'minor' or 'negligible', by preparing and strictly implementing feral species management plans and threatened species management plans, along with the habitat management plans discussed below.

Habitat management

Habitat management plans will be central to mitigating and managing impacts for the Project's elements. These plans will be prepared to address threatened species, clearing, weeds, feral animals, rehabilitation and revegetation, and ecological fire.

Habitat management plans will be incorporated into the overall environmental management plans for the Project.

Offsets: regional biodiversity

Biodiversity offsets are proposed for all conservation significant regional ecosystems subject to clearing. Offsets have also been proposed for conservation significant species where mitigation measures cannot reduce impacts to 'minor' or 'negligible' levels.

Offsets provide compensation for those impacts which cannot be adequately reduced through avoidance and/or mitigation. Where direct offsets are unable to adequately mitigate potential impacts, such as the impact of cane toads on reptiles of conservation significance, indirect offsets have been proposed. For example, research will be carried out to determine the most effective design to discourage toad breeding in artificial water bodies required for the gas fields.

Approximately one-third of the cleared vegetation is proposed to be rehabilitated to pre-clearing condition following construction of each infrastructure element. It is assumed that all other offsetting will be undertaken within bioregional corridors.

It is also assumed that delivery of the offset package will be staged as the development of the Project progresses. Offsets information provided in the EIS is intended as a guide only. The final offset package must be negotiated with, and agreed by, the regulatory authorities.

This will include protection and enhancement of regrowth vegetation, replanting and re-establishing pre-clearing regional ecosystems within corridor areas that are already cleared, and rehabilitating infrastructure locations following decommissioning as part of the offset package.

For those few cases where a community or species is listed only by the Commonwealth, a similar offset strategy is proposed.

4.4.2 Aquatic ecology

This section focuses on the impacts the gas fields and gas pipeline will have on aquatic ecology within the project area. The LNG facility's impacts on aquatic ecology are addressed in the marine and coastal ecology section.

Aquatic sites throughout the Project area were found to be in a degraded condition, with moderate to poor water quality, including elevated nutrients, turbidity, suspended sediment and metals. They were also found to have high geomorphic disturbance and poor aquatic and riparian habitat.

No rare, endangered or otherwise noteworthy fish, macro-invertebrates or aquatic macrophytes were recorded from the sites sampled. However, seven significant species of fish are known to occur within the region, where there is suitable habitat.

[14] Listed under the EPBC Act

These include the Murray cod[14], silver perch, purple spotted gudgeon, olive perchlet, spotted barramundi, leathery grunter and Darling River hardyhead.

Two species of aquatic macrophytes also occur in artesian mound springs across the region. These are the Salt pipewort and Artesian milfoil.

Potential impacts and mitigation measures

Several construction and operational activities could impact water quality, aquatic ecology or fluvial geomorphology. However, with effective mitigation, the risks are considered to be low.

Construction activities will be localised and of relatively short duration. There is a medium risk that road and pipeline crossing construction activities could increase sediment delivery to watercourses without effective mitigation measures. Throughout the construction phase, sediment control measures will be strictly implemented to ensure impacts are minimised.

During the operational phase of the gas fields, key risks are associated with proposed releases of treated water from the water treatment facilities. Australia Pacific LNG will avoid discharge during periods of low or no flow as this would alter flow regimes downstream of the discharge location with consequent impacts on aquatic communities and possible bed scour and bank erosion. The impacts are likely to be greater on smaller tributaries than on the main Condamine River, as these experience larger seasonal increases in flows.

There may be an alteration to low flow regimes, but further modelling indicated impacts could be minimised by better mimicking pre-development flow regimes. If this was done, the residual risk would be low.

The potential for chemical contamination from brine pond overflow in the gas fields was identified as a risk. Detailed stormwater and waste management plans as part of the environmental management plan, effective design controls for flooding and adequate vegetated buffers will be implemented to ensure that contaminated water does not enter local watercourses.

Risks were also identified in relation to inadequate drainage control and altered low flow hydrology from road crossings. Australia Pacific LNG will mitigate potential impacts by implementing good practice design and drainage control.

Further pre-construction, construction and operational environmental monitoring programs will be developed and implemented for road and pipeline crossings and treated water releases. This will be done to continuously improve Australia Pacific LNG's environmental management and procedures.

4.5 Coastal and marine ecology

Potential coastal and marine impacts have been assessed for the Australia Pacific LNG Project, specifically for the pipeline crossing of The Narrows and the proposed LNG facility within Port Curtis of Gladstone harbour.

The principle project activities likely to impact on the coastal and marine environment are:

- The pipeline crossing of The Narrows
- Reclamation of habitat for the LNG facility and the materials offloading facility
- Localised dredging for the construction of the materials offloading facility
- Brine discharge from the desalination plant.

The enhancement of existing channels in Port Curtis to support LNG shipping and other future export oriented industries, including an approach channel for the LNG facility, is being assessed separately as part of the Western Basin Dredging and Disposal project EIS prepared by Gladstone Ports Corporation.

Key features of the marine environment in Port Curtis are:

- Saltpan/saltmarsh, seagrass and mangrove habitats
- Nesting and feeding habitats for marine turtles
- Habitat for inshore dolphin species
- Some areas of natural rocky reef habitat, although the sea bed is dominated by un-vegetated sedimentary environments

- Sediment dwellers (macrobenthic infauna)
- Utilisation for commercial and recreational fishing
- Generally high water quality, but influenced by tidal state and input from river systems.

4.5.1 Pipeline crossing

The proposed pipeline crossing traverses saltpan/saltmarsh habitat that drains into Targinie Creek before entering The Narrows in the vicinity of Friend Point. The foreshore in this area is mangrove fringed with extensive intertidal flats. The sub-tidal area of the proposed pipeline route is un-vegetated.

The pipeline corridor proposed by the Queensland Government traverses the Great Barrier Reef World Heritage Area and the Rodds Bay Dugong Protection Area, which apply over the whole of Port Curtis, and in part a habitat protection zone of the Great Barrier Reef Coast Marine Park. Australia Pacific LNG's preferred option is to avoid the state marine park.

Crossing The Narrows has two distinct sections – an inter-tidal and sub-tidal land section; and an open marine section. Each section will be crossed by different methods.

It is proposed to cross the wetland section by excavating a trench and installing the pipe using either of two methods. The trench will be dug between the rows of sheet piling by excavators working from a temporary access way built on the mudflats. Soil will be stockpiled on one side of the sheet piling, while the other side will be used as working side. If the trench can be kept relatively free of water, the pipe will be installed by lower-in as for onshore pipeline construction.

Alternatively, the trench may be flooded, in which case flotation devices will be attached to the pipeline, and the welded pipe string pulled into place by cable. The flotation devices will be removed, allowing the pipe to settle to the bottom of the trench and the spoil placed back over the pipeline.

Australia Pacific LNG considered several alternative methods for crossing the marine section of The Narrows, including by horizontal directional drilling or conventional dredging techniques. The preferred method is horizontal directional drilling because the potential impacts are confined to the shoreline construction areas where workspace is required to set up the drilling rig and pipe-string. The pipe is then pulled into place through a hole drilled under the sea bed, then tied into the rest of the pipeline or capped awaiting the tie-in.

Australia Pacific LNG would also consider joining up to three other proponents in a 'bundled' crossing in a single phase of construction, using conventional pipeline dredging techniques to form a common trench. In this case, the cumulative impact would be lower than from up to four separate crossings.

Dredging has potential environmental impacts associated with the disturbance of the sub-tidal seabed at the dredge location, creation of a turbid plume, and generation of underwater noise. Using a 'bundled' approach would minimise the cumulative impacts that would otherwise result from multiple dredged crossings of The Narrows.

4.5.2 Dredging and reclamation works

Construction of the Australia Pacific LNG materials offloading facility will involve the reclamation of intertidal and sub-tidal areas (approximately 8.3ha) and related dredging.

This dredging is relatively minor compared to the larger scale dredging project for the Western Basin to be undertaken by the Gladstone Ports Corporation. Impacts and mitigation for the Western Basin Dredging and Disposal project have been addressed in the EIS prepared by Gladstone Ports Corporation.

4.5.3 Brine discharge for the LNG facility

Fresh water demand for the LNG facility during operations is primarily driven by the continuous demand for demineralised water required by the acid gas removal unit. Potable water during construction and operation phases is also required. This water will be supplied through the collection of stormwater, the reuse onsite of treated effluents and the operation of a seawater desalination unit with seawater sourced in Port Curtis directly offshore of the LNG facility.

Desalination plants produce a hyper-saline brine (highly concentrated salty water) waste-stream, containing seawater constituents at around double their normal concentrations. Additionally, the waste stream also contains small amounts of additives used for treatment and cleaning during the desalination process. Typical additives include sodium hypochlorite, sodium bisulphite, sulphuric acid, citric acid and anti-scalant.

Cumulative water quality impacts associated with the cumulative brine disposal from Australia Pacific LNG and the other LNG proponents on Curtis Island have been assessed.

The predicted cumulative mean salinity increase at the entrance to Graham Creek and along the Curtis Island shoreline from Laird Point to China Bay is approximately 0.06 parts per thousand. The predicted maximum increase in salinity due to the cumulative discharges of desalination brine is 36.09 parts per thousand. Both mean and maximum increases in salinity are well within the natural ambient salinity variations and would not be detrimental to the marine environment.

4.5.4 Marine fauna

Project activities have the potential to affect turtles, dolphins and dugongs. Key elements of such activities and their potential impact on the species of marine fauna are discussed in this section.

Boat strikes

Marine turtles and dugong are vulnerable to boat strikes when they are at the surface. Boat strike is considered the most significant known cause of human-induced dugong mortality and there is evidence that this has had an impact on dugong populations in Queensland.

Slow moving vessels, such as tugs, barges, and LNG ships are considered to pose an inherently low risk of boat strike to dugong and marine turtles in Port Curtis. However, the high speed passenger ferries to service the LNG facilities pose a risk to these marine fauna.

Australia Pacific LNG will work with Gladstone Ports Corporation and other port users to develop an industry wide approach to minimise boat strikes to marine mammals and turtles.

Lighting

Although the nearest turtle nesting beach is in the vicinity of the east coast of the south end of Curtis Island, it is plausible that lighting from the operational LNG facility will affect the sea-finding behaviour of hatchlings and the selection of nesting areas by adult flatback turtles.

Complicating any assessment is the highly modified light regime already present in the Gladstone area, which will be further modified by future planned developments.

A combination of measures can mitigate light impacts on marine turtle nesting while allowing for safe and efficient construction and operation of coastal infrastructure.

Measures include:

- Physically shielding the lights and directing the lights onto work areas
- Lowering the height of lights
- Reducing the amount of reflective surfaces through the use of matt paints on surfaces where practical
- Using motion detecting sensors and light timers.

Australia Pacific LNG is committed to use a sensitive lighting approach to reduce light spill impact on marine fauna.

Underwater noise

Activities associated with construction in the marine environment and operations, in particular vessel movements, have the potential to displace dugong and cetaceans from critical habitat and interrupt critical behaviours through the creation of underwater noise.

Cetaceans have been found to avoid some human sound sources for ranges of several kilometres, potentially abandoning valuable habitat. Underwater noise sources from the Project that may affect cetaceans and dugong include pile driving, dredging and vessel traffic.

Percussive piling for the construction of the materials offloading facility jetty is most likely to be of a frequency and volume that will disturb dolphins. Overall, disturbance to dolphins will occur during the construction phase, but they will use the area again once construction activities cease. Australia Pacific LNG will implement measures to reduce underwater noise generated by pile driving.

Noise generated by dredging and vessel activities can also change the behaviour of dugong and result in alienation from important habitat. The potential energy cost of such disturbance to dugongs include a reduction in energy intake, the energy expended while moving, and the possible cost of moving to a different patch of seagrass beds. Disturbed dugongs may be forced to spend time searching for alternative feed patches and may be forced to feed on less desirable patches with lower nutritional value.

If animals can move to suitable nearby habitat, this disturbance can be largely mitigated. In the case of Port Curtis, existing high value dugong (seagrass) habitat occurs in areas unaffected by the current development.

4.6 Soils and land

The most significant risks to the land and soils occur within the various gas field and gas transmission pipeline project areas and are related to construction activities. However, there is potential to cause contamination of land from uncontrolled release of contaminants during operations. The key risks are discussed below.

4.6.1 Soil characteristics

Soils within the Project area are predominantly shallow texture contrast soils with significant areas of deep, dark cracking and non-cracking clays.

The shallow texture contrast soils are predominantly used for grazing on improved and native pastures while those 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 a highly sodic and dispersive subsoil, which is prone to erosion. Reactive soils were identified within the pipeline study area. Moisture variations can cause reactive soils to expand and contract leading to heaving and subsidence, which can damages buildings, roads and pipelines if not allowed for in their design.

4.6.2 Erosion

Soil erosion associated with development of gas field infrastructure, the gas transmission pipeline and LNG facility is a key project risk. It can result in scarring of the landscape, gullying of local drainage lines and adverse water quality impacts in downstream areas. This risk can be substantially reduced by effective mitigation and management measures, based on a good understanding of the soil characteristics in areas likely to be disturbed by construction activities.

Those areas within the Project most at risk are associated with shallow, gravelly soils and texture contrast soils with sodic and dispersive subsoils, particularly on steep slopes.

Australia Pacific LNG recognises the significant risk of soil erosion and will implement appropriate measures to avoid or minimise erosion impacts. These will include:

- Carefully designed water diversions
- Erosion and sediment control
- Topsoil segregation and handling procedures
- Rehabilitation and revegetation plans.

Particular attention will be given to areas with a combination of shallow dispersive texture contrast soils and steeper grades, especially those above 8% slope. Areas of erosion risk have been defined during the EIS studies. These will require intensive control measures and ongoing maintenance and monitoring to ensure the objectives of minimising environmental harm are being met.

4.6.3 Acid sulfate soils

Soils comprising hydrosols occur over land within the pipeline crossing and locally within the LNG facility site, associated with mudflats, saltpans and flats. These soils are prone to generate acid sulfate following disturbance and exposure to the air which can cause mobilisation of heavy metals in runoff.

Further detailed investigations are planned to assess the full extent of the acid sulfate soils hazard, and an acid sulfate soils management plan will be developed as part of the Project's overall environmental management plan in accordance with the Queensland 'Acid sulfate soil technical manual – soil management guidelines'.

4.6.4 Good quality agricultural land

Australia Pacific LNG intends to avoid or reduce loss of access to good quality agricultural land (GQAL) by locating surface infrastructure off such land where practicable. Some loss of GQAL is unavoidable.

The assessment of potential impact on GQAL associated with gas fields has considered gas wells, gas and water gathering pipelines, high pressure gas and water networks, gas processing and water treatment facilities, water and brine storage ponds, tracks/roads, accommodation facilities, telecommunication towers and pipeline lay down areas. Of the 335,000ha of GQAL identified in the gas fields area (comprising gas tenements and connecting pipeline areas), 23,726ha (7.1%) will be disturbed during construction, and only 4,319ha (1.3%) of this is estimated to be removed from agricultural production for the life of the Project.

The impact on GQAL associated with pipelines in the gas fields and the main transmission gas pipeline will be mainly temporary, confined to the construction phase.

The pipelines will be constructed such that agricultural activities can be resumed following burial of the pipes and reinstatement of the land. Of the 874ha of identified GQAL in the main transmission line construction corridor which will be disturbed during construction, only 31ha (3.5%) of this is estimated to be removed from agricultural production for the life of the Project.

No GQAL occurs at the LNG facility site.

Proposed rehabilitation measures in GQAL areas, moving from construction to operation phases, and following decommissioning of operational areas, will include reinstatement of the original landform and soil profile to minimise productivity losses and maintain cropping efficiency. During the decommissioning phase of the Project there are likely to be some structures associated with the gas fields that will be retained for use by landholders or the community after their use for the Project ceases (such as access roads and some water storage facilities).

In general, Australia Pacific LNG will work with affected landholders to limit disruption to their use of the land. Property-specific plans will be prepared with landholders to manage the impact of project activities around their businesses and residences, including opportunities for landholders to beneficially use treated water to increase rural production from their landholdings.

4.7 Cultural heritage

Australia Pacific LNG recognises that indigenous and non-indigenous (shared) cultural heritage could be lost or damaged as a result of development of the Project.

4.7.1 Indigenous

Indigenous people play a primary role in the custodianship of their heritage, and Australia Pacific LNG has taken appropriate steps to correctly identify the Aboriginal parties and Aboriginal cultural heritage or establish processes to identify and manage the Aboriginal cultural heritage in the future across all three project elements.

For the land component of the LNG facility area, the identified Aboriginal party is the Port Curtis Coral Coast registered native title claimants. Identified Aboriginal parties in the gas fields' area are the Iman, Mandandanji, Barunggam, Western Wakka Wakka, and Bigambul. Along the gas pipeline route are the Port Curtis Coral

Coast, Wulli Wulli, Gangulu, Iman, Western Wakka Wakka, and Barunggam. In relation to the marine areas from the mainland to Curtis Island, following the issue of a public notice, the Port Curtis Coral Coast registered claimants have identified themselves as the relevant Aboriginal party. There have been other responses to the public notice and these responses are currently being assessed by Australia Pacific LNG.

The likelihood of the Project impacting indigenous cultural heritage in the gas fields and along the gas pipeline is greater than for the LNG facility on Curtis Island. However, no elements will have any impacts to registered cultural heritage sites.

Listed indigenous cultural heritage locations were identified early in the site selection process which guided the selection of locations for key gas fields infrastructure, such as pipelines, gas processing and water treatment facilities, water and brine storage ponds and roads.

Of the 247 identified sites, only seven are within 100m of any currently planned infrastructure. Identified sites across the Project will be avoided where practical and appropriate measures taken to ensure they are not accessed or accidentally damaged during construction. Where impacts cannot be avoided, mitigation and management measures will be agreed with the relevant Aboriginal parties, pursuant to the approved cultural heritage management plans.

There are 11 listed indigenous cultural heritage sites within 1km of the main gas transmission pipeline route, with the nearest being approximately 230m from the preferred pipeline route.

It is likely that additional cultural heritage areas and objects, particularly isolated stone artefacts and artefact scatters, scarred trees, shell middens and hearths, will be identified during detailed field investigations and construction. The cultural heritage management plans will contain processes for assessing and managing this Aboriginal cultural heritage.

Although there are some indigenous sites such as shell middens on parts of Curtis Island and the mainland opposite Laird Point, there are no registered cultural heritage sites in the LNG facility area itself. Construction of the facility may cause some impacts, as widespread cultural heritage traces occur along the coastline and around the estuarine mud flats, as well as in the northern part of Curtis Island. Cultural heritage management plans are being developed to meet the unique needs of each Aboriginal party.

4.7.2 Non-indigenous

The existing environmental values and shared (non-indigenous) heritage sites present across the Project area have been shaped by the complex history of exploration and settlement.

Shared heritage sites in or near the gas fields include Jimbour Station Homestead (32km outside of the area), and the Digger Statue in Chinchilla and the Nostalgic Queens Theatre in Wallumbilla, which are both within the gas fields' area. None of these sites will be affected by gas field construction. However, detailed field inspections will be carried out throughout the gas fields to ensure that known and previously unrecorded shared heritage sites are protected from construction impacts.

There are 43 known shared heritage sites and locations within the 10km wide pipeline study corridor.

The gas pipeline will also cross the Great Barrier Reef World Heritage Area, but no known heritage sites of national or state significance will be impacted. Curtis Island is the largest island in the Great Barrier Reef World Heritage Area's land portion. At present it is largely uninhabited, except for a small settlement on the far side of the Island from the LNG facility site. The Island's history has been strongly influenced by the history of the surrounding area, especially Gladstone.

Significant shared cultural heritage sites include lighthouses, shipwrecks and ruins, which are all at a distance from the LNG facility and will not be affected by the development.

Australia Pacific LNG is committed to ensuring that shared heritage sites are protected during construction. A heritage management plan will be prepared to identify risks to recorded sites if field inspection reveals the potential for construction impacts. This plan will be prepared in consultation with local community.

4.8 Greenhouse gases and climate change

4.8.1 Greenhouse gas emissions

Liquefied natural gas is a key fuel that will assist international efforts in the transition to a low-carbon economy. Supplying international markets with liquefied natural gas will contribute to this transition and long term global energy security.

The Project will result in increases in the Queensland, Australian and global greenhouse gas (GHG) emissions inventories. However, the Project will contribute to reducing global greenhouse gas intensity by producing LNG which can substitute for higher greenhouse gas intensive fuels. On a lifecycle GHG basis, LNG use in a combined-cycle gas turbine is substantially lower in GHG emissions than coal combustion in a sub-critical power plant, which produces 112% more GHG emissions. Even more advanced coal-fired generation such as super-critical and ultra super-critical power plants still produces 57% and 50% more GHG emissions, respectively, than LNG combusted in a combined-cycle gas turbine.

At full development, annual GHG emissions from the Australia Pacific LNG Project would equate to approximately 1.5% of Australia's GHG emissions (2007 as base) and 5% of Queensland's GHG emissions. However, if the Project's LNG output replaces higher greenhouse gas intensive fuels such as coal in power generation, this may avoid 35Mt CO_2-equivalent per year[15]. This is approximately 6% of Australia's GHG emissions, based on 2007 emissions[16].

The overall GHG emissions intensity of the Australia Pacific LNG Project (from coal seam gas reservoir to ship) is estimated to be approximately 0.64 tonnes of carbon dioxide equivalent (CO2-e) per tonne of liquefied natural gas. Of this, the LNG facility accounts for approximately 0.31 tonnes CO_2-e per tonne of liquefied natural gas, while the gas field and gas pipeline account for approximately 0.33 tonnes CO_2-e per tonne of liquefied natural gas.

The major sources of GHG emissions associated with the gas fields are combusting CSG for compression and power generation (77%), and flaring during operations and scheduled maintenance (13%). Around 2% of the Project's GHG emissions come from vegetation clearing and decommissioning.

A key mitigation measure is to reduce flaring during CSG production operations. This will be achieved through automated well control, improving maintenance procedures, and re-routing CSG when a gas processing facility is off-line for maintenance.

The major sources of the LNG facility's GHG emissions are combusting CSG for compression and power generation (83%), venting (15%) and flaring (2%) during operations and scheduled maintenance.

The key mitigation measures that have been included in the design of the LNG facility are:

- Efficient turbines
- Waste heat utilisation
- Vapour recovery to reduce flaring.

These mitigation measures could save around 46 million tonnes CO2-e over a 30-year period.

Other mitigation measures will be assessed in the future. Examples of these include more efficient plant design, using heat exchangers, air cooling to turbine inlets instead of water cooling, implementing process control, shutdown and metering systems and reducing fugitive GHG emissions.

These GHG mitigation opportunities have been incorporated into the design phase of the Project and further mitigation may be possible as the design matures. This is all part of Australia Pacific LNG's policy to continually develop and deploy innovative technologies to mitigate GHG emissions, and to encourage energy efficiency at all stages of the LNG life cycle.

[15] LNG-combined cycle gas turbine comparison with coal fired ultra super-critical utilising GHG emission intensities

[16] Based on annual emissions in Australia of 597 Mt CO_2-e in 2007

4.8.2 Climate change adaptation

Australia Pacific LNG has considered both the mitigation and adaptation aspects of energy and climate change. A core goal is to operate efficiently and reduce project-related GHG emissions through specific energy efficiency measures and other initiatives. Seeking opportunities to further reduce GHG emissions will continue throughout the Project life.

Specific measures for reducing GHG emissions are discussed above. Along with mitigation strategies, climate change adaptation risks were considered. These were investigated through a risk assessment process, using accepted climate change scenarios such as sea level rise, coastal erosion, extreme weather events, flooding, more variable rainfall and elevated temperatures.

A risk register has been developed and operational treatment options are being investigated. Climate change adaptation risks will also be included in the Project's front-end engineering design process, to ensure adaptation risks and scenarios are considered when designing facilities, and that any impacts become embedded in project planning.

The greatest risks from the effects of predicted climate change to the Project are associated with the LNG facility. The key factors are sea level rise inundating facilities, coastal erosion from increased frequency and severity of storms and tidal surge, damage to shore facilities from cyclones and flooding, disruption and damage to shipping from cyclonic winds.

The greatest risks to the gas fields' element of the Project from the effects of climate change are damage from increased and more severe droughts and associated intense bushfires, increased frequency and severity of storms resulting in flooding and storm damage to facilities and infrastructure, and higher temperatures with associated risks of heat stress for personnel.

The risk assessment determined that there are currently adequate design controls and strategies in place or planned to adequately mitigate climate change risk. Climate change risk will continue to be assessed during further stages of project implementation.

4.9 Air and noise

4.9.1 Air quality

Air emissions will occur during the construction, operational and decommissioning phases of the Project. Australia Pacific LNG will seek to control emissions from project activities to ensure ambient air quality is not degraded, and there is no potential for environmental harm or adverse health effects.

However, some air quality impacts are inevitable during construction. This includes dust emissions, which can occur whenever soil, fill, rock and vegetation are handled, traversed, crushed, conveyed or open to erosion by the wind.

Air quality impact assessments were carried out for the three project elements, being gas fields, pipeline and LNG facility. These assessed the sources, quantity and nature of air emissions associated with the Project, the ambient air quality of the area that might be affected by project activities from both normal and abnormal (upset) operating conditions, and cumulative impacts.

Gas fields

The quality of air over the gas fields is typical of agricultural areas, given that the region is predominantly rural in nature. The primary source of air emissions attributed to the Project within the gas fields' area will be gas-fired engines and gas-fired boilers. Gas-fired engines drive the gas compressors at the gas processing facilities and water pumps at the gas wellheads and water transfer stations, and generate power for the gas processing and water treatment facilities.

The key air pollutants likely to be emitted within the gas fields were identified as oxides of nitrogen (as nitrogen dioxide), sulphur dioxide, carbon monoxide, hydrocarbons, and particulate matter with an aerodynamic diameter less than ten microns (PM10).

Potential impacts to air quality were also considered for abnormal or upset operating conditions, when gas may be combusted

under controlled conditions in flares at the gas processing facilities. During these conditions, the predicted ground-level concentrations of all air pollutants are predicted to be below limits set in the air quality objectives during the operation of the gas flares. This includes the use of all flares simultaneously, while all other infrastructure is operating under normal conditions.

Australia Pacific LNG will manage air emissions and dust generation associated with all gas field activities through the design and operation of fixed plant and mobile equipment, control of fugitive gas emissions, limiting gas venting and flaring and compliance with environmental management plans.

Gas pipeline

The pipeline corridor is mostly located away from major population centres in inner central Queensland. At certain times, air quality can be influenced by local activities such as agriculture, mining and industry (particularly at the northern end of the pipeline, near Gladstone), as well as dust storms and bushfires.

The principle source of dust emissions during pipeline construction activities include:

- Clearing, grading and subsequent restoration of the right-of-way
- Trenching, including rock-breaking
- Production of rock-free material, known as bedding or padding, to protect the pipe
- Traffic on unsealed roads and construction areas.

Australia Pacific LNG will manage dust emissions by reducing the area and duration of land disturbance, suppressing dust nuisance with water and rehabilitating disturbed areas as soon as possible. Cleared vegetation will generally be mulched for re-spreading and none will be burnt.

Emissions generated during the operational phase are expected to be limited and infrequent, associated with periodic maintenance and possible emergency release of CSG.

LNG facility

The regional air quality in Gladstone is impacted by existing industry. Ground-level concentrations of all air pollutants associated with the LNG facility are well below the air quality objectives at all sensitive receptors. Nitrogen dioxide was found to be the most important air pollutant. However, predicted ground-level concentrations from the Project are likely to be below the air quality objectives during normal operations, accounting for other sources of nitrogen dioxide and other LNG facilities proposed for the region.

Australia Pacific LNG will incorporate air emission reduction and treatment technology in design and implement management procedures to meet the air quality objectives in the Queensland Environmental Protection (Air) Policy 2008.

4.9.2 Noise and vibration

Australia Pacific LNG's sustainability principles will be applied to planning, designing, constructing and operating all project elements, to ensure noise and vibration emissions do not significantly impact the qualities of the acoustic environment or cause environmental harm.

Gas fields

The construction and operation of gas production wells, gas processing facilities and associated infrastructure will result in emissions of noise and vibration to the surrounding environment. Critical noise issues are associated with constructing the gas production wells, and operating gas processing facilities and the associated network of gas wells.

Noise emissions and ground vibration from all construction and operational activities will be minimised. This will include the design and location of key infrastructure, which will be positioned away from sensitive receptors where practicable. Acceptable mitigation and management outcomes will be negotiated with potentially affected people, and noise attenuation measures will be implemented where required.

Where practicable, Australia Pacific LNG will use lower noise design and operation of drilling rigs, coal seam gas wells, gas processing, water

treatment facilities, and other infrastructure. Construction activities will be managed to minimise noise and vibration emissions, and to comply with environmental management plans. These are developed to meet the acoustic quality objectives set down in the Queensland Environmental Protection (Noise) Policy 2008.

Significant vibration impacts are not anticipated for the construction or operational phases of the gas fields.

Gas pipeline

Development of the gas pipeline will result in emissions of noise and vibration to the surrounding environment, including the marine environment in the vicinity of the pipeline crossing at Port Curtis.

Australia Pacific LNG will manage noise emissions and ground vibration through the appropriate design and location of the pipeline, compliance with environmental management plans, and limiting gas venting during maintenance activities. A noise and vibration management plan will address noise quality.

Blasting may be used as part of pipeline construction techniques. Ground vibration and blast overpressure will be carefully managed, with a minimum separation distance between the pipeline and sensitive dwellings or commercial premises. Mitigation measures will minimise noise and vibration impacts from construction activities.

LNG facility

Noise and vibration modelling was undertaken to predict noise levels for the LNG facility's construction, operational and decommissioning phases. It was identified that during construction, noise levels would not be significant at existing residential receptors during the day or night due to the large separation distance between the site and residential receptors. However, it was noted that there may be potential impacts associated with piling noise for constructing LNG storage tanks and jetty structures.

For normal operating conditions noise levels met all planning criteria at all existing residential receptors during the day and night. However, it was noted that for non-normal operating conditions there may be potential noise impacts due to flaring.

In order to manage potential impacts of noise and vibration during construction, Australia Pacific LNG will develop and implement construction noise and vibration management plans that address potential impacts including:

- Scheduling of high noise activities during normal working hours, where practicable
- Techniques for noise reduction for high noise activities such as piling.

Australia Pacific LNG will further assess design measures to reduce noise impacts including measures to address low frequency noise.

Australia Pacific LNG will manage potential impacts of airborne noise, vibration and blasting during construction by limiting noise or vibration emitting construction activities to between 6.30am and 6.30pm, as far as practicable. A noise and vibration management plan will also be developed, and this will be implemented on a case by case basis for potentially affected residents. If blasting is required, it will comply with the Environmental Protection Act 1994.

A traffic management plan will be prepared for personnel during construction. This will identify suitable routes and times of travel to minimise noise disturbances to residents and local traffic conditions.

4.10 Matters of national environmental significance

On 3 August 2009, the three elements of the Project were each formally determined to be controlled actions requiring assessment and approval by the Commonwealth Minister for the Environment, Heritage and the Arts. The relevant controlling provisions under the EPBC Act were determined as being:

- World Heritage (sections 12 and 15A)
- National Heritage Places (sections 15B and 15C)
- Wetlands (Ramsar) (sections 16 and 17B)

- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A).

The world heritage and national heritage places controlling provisions are applicable to the gas pipeline and the LNG facility, but not the gas fields. The wetlands controlling provision does not apply to the LNG facility.

These matters have been addressed using the EPBC Act Policy Statement 1.1: Significant Impact Guidelines (DEH 2006). Comprehensive management and mitigation measures for potential impacts to these matters have been developed.

4.10.1 Listed threatened species and communities – gas fields and gas pipeline

The gas fields and gas pipeline project elements are almost entirely within the Brigalow belt bioregion and the Condamine, Balonne and Dawson water catchments. Most of the land within this bioregion and these catchments is used for agriculture, and has been subjected to extensive clearing and severe habitat modification, including in relation to riparian and in-stream vegetation.

Many of the ecosystem and habitat remnants on which native species now depend are marginal habitats such as steep, rocky slopes or are in poor condition and highly degraded, making them highly sensitive to further disturbance through activities such as clearing, increased sediment delivery to waterways or the introduction of invasive species into important remnant areas. However, the development of the gas fields and gas pipeline will only result in a negligible reduction in the extent of EPBC listed threatened ecological communities and/or habitat of EPBC listed threatened species. No important habitat for the listed species will be substantially modified, destroyed or isolated by construction and operation activities associated with the gas fields and gas pipeline.

Ongoing rigorous worksite and route selection, along with appropriate management of development will ensure important locations for ecosystems and species' habitats will be avoided. Where clearing of relevant vegetation and habitat is necessary, offset measures will be implemented to ensure the overall extent of the relevant ecosystem or habitat is maintained or enhanced. Effective measures to constrain further degradation to remnant vegetation and waterways are available and will be implemented for the Project.

Pre-disturbance surveys will be carried out by qualified flora and fauna specialists to ensure that any impacts are negligible and restricted to individual plants or animals as far as practicable.

Where practicable, individual threatened plants will be avoided, buffered and monitored for long-term health. If disturbance is unavoidable, the design and implementation of an offsetting strategy, and/or a translocation plan according to Australian Network for Plant Conservation (2004) will occur in consultation with the Department of the Environment, Water, Heritage and the Arts.

Where necessary, habitat for threatened species will be enhanced through measures such as the establishment of an appropriate fire regime and other activities such as weed and pest control. Post disturbance monitoring programs will be implemented to ensure that impact mitigation measures are working as expected.

On the basis of the proposed mitigation and offset measures, there are no predicted significant impacts on any species or community listed under the EPBC Act.

4.10.2 Listed threatened species and communities – LNG facility

Based on available mapping and confirmed through field assessment there is no vegetation on or adjacent to the LNG facility that is a threatened ecological community as defined under the EPBC Act. Therefore development of the proposed LNG facility will not impact upon threatened communities.

No threatened flora species listed under the EPBC Act were identified on site during field surveys and there are no historical records of threatened flora species occurring on or adjacent to the site. However, based on habitat preference,

the LNG facility site area may support suitable habitat for two threatened flora species.

No threatened fauna species listed under the EPBC Act were identified on site during the field survey. However based on habitat preference and known distribution, the LNG facility site area may support suitable habitat for eight threatened fauna species, and the LNG facility marine facilities area may support habitat suitable for use by five threatened fauna species (marine turtles). Habitat associated with the site is not considered to be critical to the threatened flora and fauna species that may use the site area from time to time.

Potential impacts of the development of the LNG facility on terrestrial flora are likely to be primarily associated with the physical clearing of vegetation for infrastructure development. It is considered unlikely that development of the LNG facility would have a significant impact on either of the two threatened flora species for which suitable habitat was identified on Curtis Island.

Potential impacts of the LNG facility on threatened terrestrial fauna species are likely to be primarily associated with habitat loss, degradation, fragmentation and loss of connectivity due to the physical clearing of vegetation for infrastructure development. Potential impacts to threatened marine fauna species are principally related to dredging and reclamation (for the purpose of the LNG facility), boat strikes, lighting and underwater noise.

Given the implementation of mitigation measures it is considered unlikely that the development of the LNG facility will have a significant impact on the threatened fauna species which may use the general area.

4.10.3 Wetlands – gas fields and gas pipeline

The Narran Lakes Nature Reserve is located in central northern NSW in the Condamine Balonne catchment, and is the closest Ramsar listed wetland to the Project area.

Given that the Narran Lakes Ramsar site is located approximately 500km downstream from the gas field and pipeline areas, the risk of adverse impacts is assessed to be minimal.

Operational discharges are unlikely to impact the Narran Lakes wetland. Any discharge water will be suitably treated before release and, in any event, upon reaching Beardmore Dam upstream of the wetland, the released water would be thoroughly mixed with natural flows. Any reduction in flow reaching the wetlands that may be associated with groundwater drawdown in the gas fields is considered highly unlikely.

Preliminary hydrological modelling indicates that there is potential to provide additional flows, consistent with natural flow patterns, which could be beneficial to the wetland. Further modelling using the standard hydrological model (i.e. the DERM model used for the Condamine-Balonne Water Resource Plan) will be undertaken to confirm the likely downstream extent of discharges as the associated water strategy is further developed and implemented.

4.10.4 Listed migratory species - gas fields and gas pipeline

It is assessed that 41 migratory bird species listed under the EPBC Act are predicted to occur within or close to the gas pipeline right of way. An additional three migratory bird species are predicted to possibly occur within or close to the gas fields.

There is no evidence to suggest that the gas fields area supports important habitat for any migratory species. Given their migratory habits, the ephemeral nature of food and habitat resources, and the extent of habitat across their range, it is likely that the existing resources within the area would be utilised infrequently and on a transitory basis. The suitable habitat for the remaining species within the gas fields' area is not considered important habitat. It is considered that no important habitat for these species will be modified, destroyed or isolated by the Project.

The above conclusions are similarly applicable in relation to most species predicted to occur along the pipeline route. However, there will be disturbance to approximately 15ha of habitat for 15 or more migratory shorebird species, from construction of the pipeline in the vicinity of The Narrows near Gladstone. Given the mobility of shorebirds, it is considered unlikely that the

construction and operation of this pipeline will result in direct mortality of migratory shorebirds in the study area. Shorebirds are likely to move away from disturbance during the construction period.

The Project will not reduce the area of occupancy of nine migratory marine species (excluding birds) that may occupy the offshore area traversed by the pipeline. Similarly, no existing important population will be fragmented into two or more populations for any of these species. While underwater noise associated with construction activities may disrupt some of these species, it will be a temporary impact only that will not persist.

4.10.5 Listed migratory species – LNG facility

Seven migratory bird species listed under the EPBC Act were identified during the field survey of the LNG facility study area. Based on habitat preference, the LNG facility site may support suitable habitat for a further 34 migratory bird species which may be expected to occur, at least occasionally, in the vicinity of the site. The marine facilities area may support habitat for five marine turtle species and four other listed migratory marine species (i.e. dugong, dolphins and crocodile). Habitat associated with the site is not considered to be critical to the migratory bird species or migratory marine species that may use the site area.

Potential impacts of the LNG facility on migratory bird species are principally associated with habitat loss, degradation and fragmentation. Given the implementation of intended mitigation measures, such as the development of a biosecurity management plan to deal with weeds and feral/exotic animals, it is considered unlikely that the LNG facility will have a significant impact on the migratory bird species which may visit the general area.

Potential impacts to migratory marine fauna species are as described for threatened marine species above. Given the implementation of mitigation measures described for these it is considered unlikely that the development of LNG facility will have a significant impact on the migratory fauna species which may visit the general area.

4.10.6 World heritage and national heritage places – gas fields and gas pipeline

No items with indigenous cultural heritage values are recorded on the world or national heritage lists for the gas fields or gas transmission pipeline study areas.

Other than the Great Barrier Reef World Heritage Area (see below), there are no heritage sites of national or state heritage significance along the pipeline route that would be affected.

On the basis of proposed mitigation measures, no significant impacts on heritage values are expected or predicted in relation to the gas field developments and the gas transmission pipeline.

4.10.7 World heritage and national heritage places – LNG facility

The LNG facility and associated facilities are located within the Great Barrier Reef World Heritage Area. The criteria against which the Great Barrier Reef World Heritage Area was listed as a world heritage property are described below:

- Outstanding example representing a major stage of the earth's evolutionary history
- Outstanding example representing significant ongoing geological processes, biological evolution and man's interaction with his natural environment
- Contain unique, rare and superlative natural phenomena, formations and features and areas of exceptional natural beauty
- Provide habitats where populations of rare and endangered species of plants and animals still survive.

It is considered that development of the LNG facility will not damage, modify, alter or obscure important geological formations in a World Heritage property or National Heritage place. The development of the LNG facility will impact on and alter the landforms and landscape features near Laird Point on Curtis Island through excavation and infilling. However, the extent of this impact is considered to be localised and consistent with local and state planning regimes for the expansion of the Port of Gladstone in Port

Curtis. The area is part of the Port of Gladstone, designated for future development in the Gladstone Ports Corporation (GPC) Land Use Plan. The area to be developed is designated as an industrial precinct, particularly for the development of the Queensland LNG Industry.

It is considered that development of the LNG facility will have a minor impact on landscape processes in the coastal environment, through the dredging and reclamation works associated with this and other projects. This impact is largely associated with works to be undertaken by GPC and assessed through the Western Basin Dredging and Disposal project EIS. The development of the LNG facility will divert two to three drainage lines on Curtis Island, and reclaim an area of tidal wetland. In the context of the Great Barrier Reef World Heritage Area, this impact is considered to be minor and will be mitigated through actions described in above sections.

The operation and construction of the LNG facility will not substantially increase concentrations of pollutants in stormwater runoff or other discharges. Results of modelling of discharges from the LNG facility's desalinisation plant indicate that salinity impact will be within the natural ambient salinity variations and are not likely to be detrimental to the marine environment.

The cumulative impact of dredging associated with the Western Basin Dredging and Disposal project, and the relatively minor local dredging for the LNG facility, is predicted to have a temporary and localised impact on the concentrations of suspended sediments in areas adjacent to the dredging activities.

Development of the LNG facility will remove vegetation and associated habitat. However, this impact is likely to be minor in the context of total extent of these habitats in the region and is localised. Ecological processes associated with Port Curtis may be impacted by the Project in the short term, during dredging and reclamation works, but these works are not expected to have a long term impact. Project operations pose some risk of impact to marine species through boat strike, lighting and underwater noise impacts. Proposed management measures are considered to provide sufficient mitigation to this risk.

Construction of the LNG facility will remove vegetation and habitat from part of the Great Barrier Reef World Heritage Area. However, it is not considered that this will reduce the diversity or significantly modify the composition of plant and animal species in that world heritage area.

It is not considered the construction and operation of the LNG facility will fragment, isolate or substantially damage habitat important for the conservation of biological diversity in the Great Barrier Reef World Heritage Area. It is considered that the construction and operation of the LNG facility will not cause a long term reduction in rare, endemic or unique plant or animal populations or species in the Great Barrier Reef World Heritage Area. Australia Pacific LNG is actively supporting the management of environmental values of the adjacent environmental management precinct of Curtis Island, managed by the Queensland Department of Infrastructure and Planning. This will further mitigate potential impacts of fragmentation.

The LNG facility will have an impact on the visual amenity of Curtis Island, as considered from certain view-sheds. This impact has been mitigated to some extent through plant design and use of natural landscape features. Whilst an impact on visual amenity will be made by the structures of the LNG facility, it is considered the development of Curtis Island in this fashion is consistent with local and state planning regimes for the expansion of the Port of Gladstone in Port Curtis.

It is considered that construction and operations of the LNG facility will not cause any values of the Great Barrier Reef World Heritage Area to be lost, degraded or damaged. The construction and operations of the LNG facility is likely to cause minor modification to some of the attributes of the Great Barrier Reef World Heritage Area, and particularly of the Port Curtis area, which assists to make up the values of the Great Barrier Reef World Heritage Area.

The area to be developed is excluded from the Great Barrier Reef Marine Park. The development is consistent with state and local planning regimes. Avoidance of potential impacts on the Great Barrier Reef World Heritage Area has been considered when developing proposed mitigation measures.

4.10.8 Consequential impacts of LNG facility relating to the development of shipping access by GPC

As an indirect impact of the undertaking of this and other projects proposed to be developed in Port Curtis, GPC proposes to undertake the Western Basin Dredging and Disposal Project. This Project is a controlled action for which GPC is the proponent and it is being assessed through a separate EIS under the SDPWO Act and EPBC Act. Impacts associated with the Western Basin Dredging and Disposal project relevant to a consideration of consequential impacts for the Australia Pacific LNG Project (LNG facility) are summarised in this EIS (refer Volume 4 Chapter 23) and detailed in the EIS for the Western Basin Dredging and Disposal Project.

4.11 Hazard and risk

4.11.1 Gas fields and gas pipeline

Studies have been undertaken to identify hazards to the public, to the environment, and to the new infrastructure associated with development of the gas fields and the main gas transmission pipeline to Gladstone. This has included identifying potential risks to the overall project, identifying and quantifying potential hazards for persons and infrastructure in the vicinity of the Project development, and completing a preliminary safety management study of potential threats to the high pressure pipelines in accordance with the applicable Australian Standard for pipelines.

Risks have been assessed in accordance with the internal corporate risk assessment model, and mitigation measures have been defined as required to reduce the risks where practical. Risk events associated with bushfires, wildlife and disease, natural events such as flood and earthquake and abnormal operating conditions resulting in loss of containment of either coal seam gas or hazardous substances have all been taken into consideration.

Potential risks to the environment, persons and infrastructure in the vicinity of the development have been similarly assessed, and those considered potentially significant have been further analysed by applying quantitative risk assessment methods to determine theoretical outcomes. Scenarios representative of maximum credible impacts were analysed as a worst case approach, and the risk contours (measurement lengths) associated with potential outcomes were generated. Risks have been calculated to be within nominated acceptance criteria.

The routes for the high pressure pipelines in the gas fields and the main transmission pipeline to Gladstone have been selected where feasible to minimise impacts on sensitive areas of the environment and to avoid existing dwellings, infrastructure and cultural heritage sites. Potential threats to the high pressure pipelines (both mainline and gas fields) have been identified and assessed in accordance with the requirements of AS2885 – Pipelines: Gas and Liquid Petroleum. Appropriate control measures have been defined for implementation during design, construction, and operation of the pipelines.

Origin Energy (working as upstream operator for Australia Pacific LNG) has operated high pressure gas pipelines and gas processing facilities in the region for many years without serious incident or significant impact on the local environment. The lessons learned in those operations will be applied to development of the Australia Pacific LNG Project.

For both the gas fields and the main gas transmission pipeline, the risk ranking for a serious traffic accident associated with construction activities or involving a project vehicle remained high, even following application of feasible control measures. Construction traffic will represent a significant increase on the existing public traffic in the project area, and Australia Pacific LNG will work closely with relevant authorities to develop and implement all feasible means of traffic accident prevention. Increased traffic associated with other project activities in the area is also likely and Australia Pacific LNG will work with other project proponents to develop methods to collectively reduce risks, including driver training, logistics planning and scheduling, and road and intersection up-grades.

Appropriate safety and emergency response plans will be developed for implementation both during construction and the longer term operations of the Project.

Australia Pacific LNG acknowledges that other proponents propose similar project developments in the region in approximately the same time period, and has also considered the cumulative risks associated with multiple concurrent construction and operation activities.

Australia Pacific LNG will continue to liaise with other proponents and with government agencies as necessary to coordinate project activities so as minimise as far as practical such cumulative risks to the public and to the environment.

4.11.2 LNG facility

The LNG facility will store approximately 480,000m^3 (~250,000 tonnes) of LNG and hence is expected to be classified as a major hazard facility (MHF). As an MHF, Australia Pacific LNG will design, build and manage operations in accordance with the regulations for an MHF. It should be noted that the ConocoPhillips' LNG facility in Darwin has been operating under MHF requirements since 2006, without significant incident.

The LNG facility will be located in the Gladstone State Development Area and within an industrial area. The off-site risks meet all the minimum requirements of a MHF in an industrial area,. including a high level of compliance with the acceptability criteria set by Hazardous Industries and Chemical Branch of Workplace Health and Safety Queensland.

An analysis of shipping incidents in Gladstone Harbour has been undertaken. Shipping risks have largely been mitigated by the use of four tugs and a pilot while in port, and provide sufficient control in managing the transit through the port to minimise the likelihood of incidents. These protocols will apply to all LNG facilities.

Worldwide, LNG facilities have an excellent safety history. This includes the processing plants, marine terminals, and shipping. LNG has been produced and transported for over 50 years in increasing quantities. This safety record has been achieved by ongoing improvements in the design, construction, and operations of LNG facilities. Supporting this are the requirements of the Dangerous Goods Safety Management Act 2001, as well as a number of international and Australian standards.

To reduce potential impacts to aviation safety from operation of the LNG facility, equipment will be properly maintained to minimise plumes from flaring and the merged plume from gas turbine compressors. Aircraft in the region will be alerted if a ground flare event occurs, following appropriate procedures developed in consultation with the Civil Aviation Safety Authority and Gladstone Regional Council Airport Services.

A health, safety and environmental management plan will be developed and implemented to ensure the health and safety of the community, personnel and the environment associated with the LNG facility. In addition to this, safe design will be used for the LNG facility, using knowledge gained from the LNG industry over the last 50 years.

An emergency management plan will also be developed to provide a consistent and structured response for each type of emergency event including natural disasters. The plan will also take into account the assistance that can be offered to, or taken from, similar facilities in the area.

4.12 Cumulative impacts

The Australia Pacific LNG Project is the largest coal seam gas to liquefied natural gas project currently under consideration in Queensland.

A number of other major projects are also proposed in the same region of Queensland. These include, Gladstone LNG, Gladstone LNG – Fisherman's Landing, Queensland Curtis LNG, Gladstone Pacific Nickel, Western Basin Dredging and Disposal, Wiggins Island Coal Terminal, Central Queensland Gas Pipeline, Gladstone to Fitzroy Pipeline, Surat to Gladstone Pipeline, Surat Basin Railway, and the Wandoan Coal Mine.

Together, these projects will have a positive impact on the regional, state and national economies – leading to increased incomes, expenditure and employment. Substantial employment opportunities will be created, especially in the mining, transport and manufacturing industries.

With construction and operational workforces and other development coming to the Project area, a significant increase in population is inevitable, particularly during the construction phases of each project. This has the potential to impact community values and lifestyles.

There will be additional significant cumulative impacts when all other projects are taken into account. This is particularly the case when construction phases of the Project overlap with those of other projects.

Key cumulative social and economic impacts, both positive and negative, will affect landholders, the broader community, suppliers and service providers, and housing and accommodation in the region. Key impacts will be associated with social changes, road traffic, land use, land disturbance, ground water and surface water, noise, air quality, and visual amenity.

Australia Pacific LNG acknowledges the potential cumulative impacts and is working closely with the community, government agencies and local industry to achieve sustainable outcomes and create value for stakeholders. This has also been critical for developing the EIS, both to help stakeholders understand the Project and the EIS development process, and to gather feedback to enhance the Project's development.

Image: Rehabilitated Darling Downs pipeline corridor

5 - Key outcomes

5.1 Conclusions

The Australia Pacific LNG Project brings together two companies with extensive experience in coal seam gas production. Origin is Australia's leading integrated energy provider, while US-based ConocoPhillips has a proven record in delivering LNG projects around the world and is the largest coal seam gas (CSG) producer in North America.

The Project will bring significant benefits to the region, Queensland and Australia. This includes a multi-billion dollar investment in rural and regional areas, the creation of thousands of local jobs, new infrastructure and significant royalty and tax revenue. It will also diversify Queensland's economy by contributing to the creation of a new export industry.

Australia Pacific LNG's sustainability principles will be applied to planning, designing, constructing and operating all project elements. The company will strive to conduct its operations in a way that respects, upholds and, where possible, enhances existing community values and lifestyles. Australia Pacific LNG will work closely with key stakeholders to minimise the Project's impact and support the development of sustainable regional communities.

The impact of increased road, rail, shipping and air traffic associated with the Project will be mitigated and managed in close consultation with regulatory agencies, and by developing and implementing detailed transport and logistics management plans.

The impact of coal seam gas activities on groundwater resources within the Project's gas fields and surrounding areas has also been carefully assessed. Mitigation measures including adherence to the government's 'make good' provisions will be put in place to address impacts to groundwater resources.

The proposed approach to managing associated water includes releases to water-courses within the gas fields' area, during the initial stages of gas field development. Such releases will only occur once the water is treated and only under strictly controlled conditions.

Australia Pacific LNG is committed to protecting and enhancing the natural environment. Sensitive areas have been avoided where possible and offsets will be developed to address those impacts which cannot be adequately reduced through avoidance or mitigation to ensure no net loss. Habitat management plans will be incorporated into the overall construction and operational management plans for each element of the Project.

Potential marine impacts have also been assessed, specifically for the pipeline crossing of The Narrows and the proposed LNG facility within the Gladstone Harbour Port, and these impacts will be mitigated. The full impact of dredging associated with the LNG facility is addressed in the Gladstone Ports Corporation Western Basin Dredging and Disposal Project EIS.

An overall project intent is to minimise the loss of good quality agricultural land. Proposed rehabilitation measures include reinstating the original landform and soil profile to minimise productivity losses and maintain cropping efficiency.

Facilities design and equipment will be chosen to meet or improve on air emission limits. Site-specific environmental management plans, which include measures to minimise dust emissions, will be developed.

To ensure noise and vibration impacts are minimised, construction and operating activities will be managed to reduce disturbance. Australia Pacific LNG will also consult with potentially affected neighbours on acceptable noise and vibration mitigation measures.

Australia Pacific LNG respects the rights, interests and cultures of the communities in which it operates. To minimise impacts to cultural heritage, Australia Pacific LNG will engage regularly, openly and transparently with people affected by its activities, considering their views in the decision making process.

The Project will contribute to reducing global greenhouse gas intensity by producing LNG which can substitute for higher greenhouse gas intensive fuels. GHG mitigation measures have been incorporated into the design phase of the Project and further mitigation may be possible as the design matures.

Climate change adaptation risks have also been considered and a risk register has been developed, which will be included in the Project's front-end engineering design process.

Australia Pacific LNG will build on its existing stakeholder relationships and those developed during the EIS process. Community consultation will be a strong focus throughout the life of the Project.

With substantial coal seam gas reserves, and a proven track record of responsible development of major energy projects, Australia Pacific LNG will deliver an environmentally, socially and economically sustainable project.

5.2 Commitments

Australia Pacific LNG's key commitments for the Project are summarised below. A full list of project commitments is provided in Volume 1, Chapter 5.

5.2.1 Social

Employment and business

Australia Pacific LNG will:

- Continue to use existing methods or develop new methods to attract people to the workforce who are local to the region, as well as those from under-represented groups
- Implement a local content strategy, to participate in or establish programs to assist qualified local and regional businesses with tendering opportunities for providing goods and services for the Project
- Aim to build collaborative partnerships with government and community organisations, to enhance the capacity for employers to provide jobs and for local people to develop skills and obtain employment (e.g. through the Community Skills Scholarship program)
- Work with government, the community and industry to plan for potential cumulative impacts and to share information about potential impacts and mitigation measures
- Ensure contracts with suppliers and contractors are aligned with Australia Pacific LNG's sustainability principles and objectives
- Work closely with EnergySkills Queensland's CSG/LNG Skills Taskforce to help meet the growing skills demand by:
  - Enhancing vocational training
  - Creating community awareness about the industry and opportunities
  - Facilitating career advice and work readiness programs for new entrants and mature entrants from related industries.

Stakeholder engagement and consultation

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
- Continue to participate with government in local and regional planning processes and provide timely information about the Project to inform discussion and decision making
- Continue to work to mitigate project impacts on local landowners throughout the project life by:
  - Engage with each landowner within the project area prior to any project activity on their land
  - Where possible, working towards mutually beneficial outcomes
  - Assign a dedicated liaison officer to each landowner in the project area
  - Locate and schedule project activities to reduce impacts on landowner activities.

Education and training

Australia Pacific LNG will:

- Implement CSG/LNG gateway programs with high schools in the region, in partnership with providers such as the Queensland Minerals and Energy Academy, to promote career opportunities and facilitate employment in the CSG/LNG industry
- Expand competency based training and skills development programs for production and

process plant operators, including further development of the dedicated training facilities at the Peat gas processing facility near Wandoan

- Provide specialised LNG operator training programs, including potential opportunities for onsite training on an existing LNG facility
- Continue to collaborate on programs with government, training and educational groups that build the local skills base, to meet the specific needs of the industry and other impacted sectors. This includes ongoing development of apprenticeship, traineeship, scholarship and higher education programs.

Community health and safety

Australia Pacific LNG will:

- Expand its community safety awareness program in conjunction with industry partners, government and community groups, to develop responses to project-related community safety issues in the region
- Communicate and strictly enforce its code of conduct for all staff and contractors, to uphold a high standard of behaviour
- Collaborate with government, industry and other providers to mitigate the impact on health services in local communities, including providing the appropriate level of medical facilities for operating plants and accommodation facilities.

Local services and facilities commitments

Australia Pacific LNG will:

- Collaborate on research programs with government, industry and community partners to understand social impacts and opportunities the development creates in the communities in which it operates
- Implement community investment programs to support sustainable community development.

Housing and accommodation commitments

Australia Pacific LNG will:

- Provide temporary accommodation facilities for non-local construction staff and contractors, and consult with stakeholders during the site selection process for these facilities
- Mitigate pressure on housing affordability during gas fields and pipeline operations, including transitioning non-local operations workforce from temporary accommodation facilities into the community when housing stock becomes available
- Expect the operations workforce for the LNG facility to live within the local community in the general housing pool
- Work through committees established under the Queensland Government's Sustainable Resource Communities Policy to identify housing market issues, forecasts and possible responses
- Mitigate potential impacts on housing affordability and availability, through community programs that involve working with government and agencies that provide housing to people in distress.

5.2.2 Greenhouse gas

Australia Pacific LNG will:

- Contribute to reducing global greenhouse gas intensity by producing LNG which can substitute for higher greenhouse gas intensive fuels
- Account for climate change risks (flooding, temperature change, sea level rise) in the design process
- Develop a process for ongoing minimisation of energy consumption and GHG emissions
- Investigate using solar and electric drive at well heads and gas processing facilities
- Install waste heat recovery units to meet the process heat requirements of the LNG facility
- Use high efficiency (e.g. aero derivative) drivers for LNG facility refrigerant compressors
- Minimise operational flaring and venting by:
  - Developing a leak detection and repair program
  - Developing a strategy to minimise plant shutdowns
  - Installing automated well control to allow field well turn down capability

  - Recovering vapours generated during liquefied natural gas ship loading
  - Using air instead of gas to run process instrumentation in gas processing facilities
- Implement a biodiversity offset program.

5.2.3 Water resources

Groundwater

A regional scale groundwater study has commenced as part of the EIS. Australia Pacific LNG will:

- Continue to assess impacts from associated water extractions over the life of the Project
- Collaborate with the Queensland Government in support of their Blueprint for Queensland's LNG Industry (2009), and other CSG operators in the region, to develop an agreed approach to regional groundwater monitoring and cumulative effects groundwater modelling
- Work with government to develop a publically accessible database which will contain easily interpreted groundwater level and quality monitoring data
- Actively investigate alternative water management technologies including aquifer injection.

Surface water

Australia Pacific LNG will discharge treated water 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).

Water sufficiency/own use water

Australia Pacific LNG will:

- Implement water efficiency measures for the Project's construction and production activities
- Be as self-sufficient as practical for all construction and operational water requirements.

Brine management

Australia Pacific LNG will:

- Minimise the number and size of ponds and line all associated water and brine ponds
- Actively investigate improved water management technologies to address beneficial use of brine.

Provision of water

Australia Pacific LNG will:

- Continue to work with the Western Downs Regional Council to study options to make water available to Miles and the towns near the gas field development
- Participate in studies into long-term sustainable water supply options and support programs for water conservation within the region.

Australia Pacific LNG will optimise commercial and beneficial water use through an adaptive approach including:

- Entering into contracts with commercial customers to supply water, when it is known to be a reliable long term water source
- Investigating opportunities for water to be managed in conjunction with other producers, including water aggregation.

Australia Pacific LNG will offer impacted landholders near the water network the opportunity to access water on commercial terms or as a compensation offset, subject to availability and relevant approvals.

Australia Pacific LNG will require all major contractors to submit water conservation plans.

5.2.4 Land and biodiversity

Marine

Australia Pacific LNG will:

- Work collaboratively with other Western Basin projects to offset loss of sensitive marine habitat
- Work with government, the Gladstone Ports Corporation, other port users and stakeholders to address loss of fishing access
- Utilise community monitoring of fisheries and fisheries habitat, where appropriate, pre- and post-construction
- Work with the Gladstone Ports Corporation and

other port users to develop an industry wide approach to minimise boat strikes to marine mammals and turtles

- Use a sensitive lighting approach to reduce light spill impact on marine fauna.

Biodiversity

Australia Pacific LNG commits to utilising the sensitivity mapping and landscape management guidelines to plan the location of infrastructure, taking into account the landscape biodiversity values with the aim of minimising habitat fragmentation.

Australia Pacific LNG will limit clearing in areas of high biodiversity value, 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 the approved habitat management guidelines, infrastructure will be positioned along existing disturbed areas, and active rehabilitation will be implemented.

Australia Pacific LNG will also establish a vegetation offset program that includes:

- Developing offsets for each hectare of conservation significant vegetation removed for the Project
- Considering ecological values at a regional 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.

Australia Pacific LNG will engage with government and the community to develop sustainable regional land use strategies that combine the interests of gas production, agriculture and biodiversity values.

Weed prevention

The introduction and/or spread of weeds have the potential to degrade habitat over time. The management of weed populations, the minimisation of the spread of weeds throughout the study area and the eradication and control of new infestations will be detailed within the weed management guidelines.

Australia Pacific LNG will:

- Work with regional councils in weed control
- Construct weed wash down facilities near Miles to support gas field construction and operations and at a location in the Banana Shire to support pipeline construction and operations.

5.2.5 Traffic and transport

Australia Pacific LNG will:

- Work with the Australian, Queensland and local governments and industry regarding potential upgrades required to meet the increased demands on regional infrastructure
- Develop and implement detailed traffic management plans and transport and logistics management plans, for construction and operation, to reduce the impact of traffic and transport on communities.

5.2.6 Indigenous engagement

Australia Pacific LNG recognises that successful indigenous engagement is underpinned by building long-term relationships. Australia Pacific LNG's indigenous engagement strategy will target:

- Improved opportunities for indigenous owned companies
- Increased employment, retention, and career development of local indigenous people
- Positive contribution to indigenous economic and social development
- Excellence in cultural heritage management.

5.2.7 Agricultural land

Australia Pacific LNG will:

- Minimise the loss of good quality agricultural land
- Undertake ongoing assessments and update good quality agricultural land mapping so potential impacts can be mitigated.

5.2.8 Waste management

Australia Pacific LNG will implement waste management guidelines which apply the principles of the waste management hierarchy – avoid, reduce, re-use, recycle, dispose.

5.2.9 Visual amenity

Australia Pacific LNG will consider impacts to visual amenity when designing and locating facilities, including providing low impact lighting design and shielded ground flares at the LNG facility.

5.2.10 Health and safety

Australia Pacific LNG will:

- Conduct its operations with an aspiration of achieving zero harm and incident free performance
- Together with its contractors, provide the resources, systems and capability to enable comparable top quartile performance to be achieved for health and safety matters.

Image: Sunset at Spring Gully, located 90kms North of Roma

6 - Submissions

6 Submissions

Submissions on the EIS are invited and may be made to the Coordinator-General during the public comment period. The Coordinator-General will consider properly made submissions when preparing the evaluation report of the EIS.

Submissions must:

- Be made in writing to the Coordinator-General (either electronically or in hard copy)
- Be received within the comment period
- Be signed by each person making the submission
- State the name and address of each person making the submission
- State the grounds of the submission, and the facts and circumstances relied on in support of the submission.

Address your submissions to:

The Coordinator-General
c/o EIS Project Manager –
Australia Pacific LNG Project
Significant Projects Coordination

Department of Infrastructure and Planning

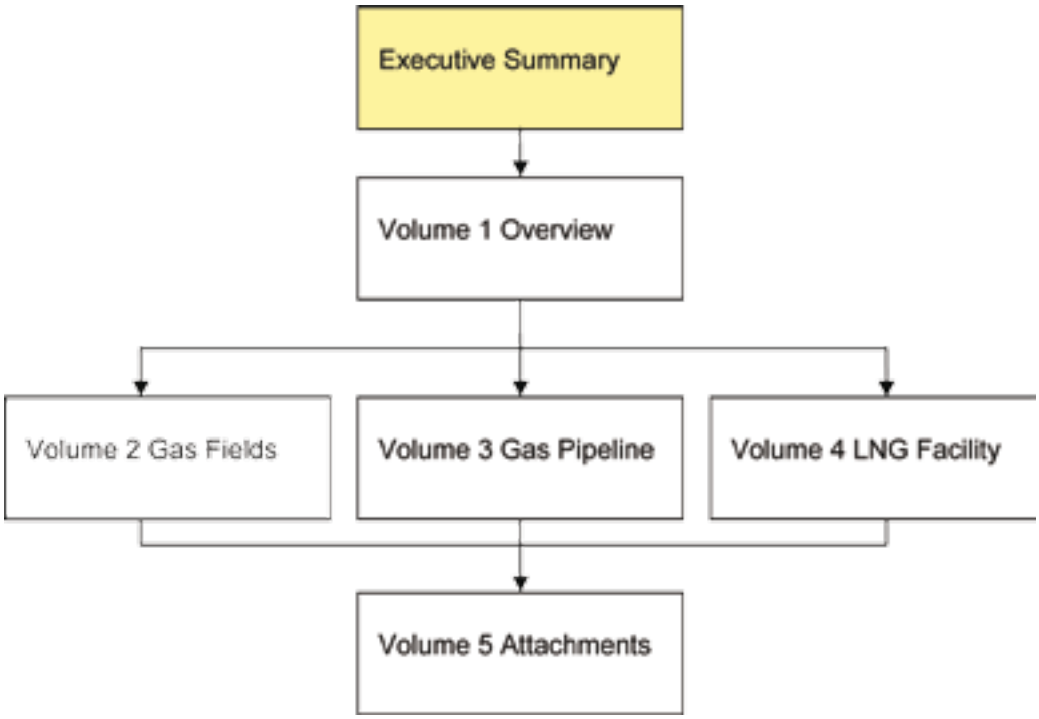
By post: PO Box 15009
City East Qld 4002
Australia

By fax: + 61 7 3225 8282
By email: APLNG@dip.qld.gov.au

Further information on the EIS may be obtained by telephoning the Department of Infrastructure and Planning on:

Telephone: +61 7 3224 8351

Australia Pacific LNG welcomes your comments, and invites you to obtain more information about each aspect of the Project in the following volumes of the EIS.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