1 INTRODUCTION

Volumes 3 to *6* of this Environmental Impact Statement (EIS) describe the environmental values of the area affected by construction, operation, decommissioning and rehabilitation of each component of the Queensland Curtis LNG (QCLNG) Project.

Volume 3 identifies the potential adverse and beneficial impacts of the Gas Field Component on environmental values. It addresses how adverse impacts may be mitigated and benefits maximised. Cumulative impacts of the Gas Field Component of the Project, together with the impacts of other projects identified in *Volume 1, Appendix 1.6*, are also addressed in this volume.

The risk assessment for determining impacts on environmental values is defined in *Volume 1, Chapter 3*. A risk matrix summary for impacts before and after the implementation of mitigation measures is detailed in *Chapter 19* of this volume.

1.1 BACKGROUND

Assessing environmental values is a key aspect of preparing an EIS. The process for determining environmental values is guided by Section 9 of the *Environment Protection Act 1994* (Qld) (*EP Act*), which defines an environmental value as:

a) a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety

b) another quality of the environment identified and declared to be an environmental value under an environmental protection policy or regulation.

Environmental factors assessed to determine environmental values and impacts were:

- climate and climate change
- topography and geomorphology
- geology and soils
- land use and infrastructure
- land contamination
- terrestrial ecology
- aquatic (freshwater) ecology
- surface water resources
- groundwater resources
- Associated Water
- air

- noise and vibration
- transport
- visual amenity
- waste management
- hazard and risk assessment.

1.2 *OVERVIEW OF GAS FIELD COMPONENT*

The Gas Field Component involves the following construction activities that may be affected by, or impact upon, the environment:

- creating hardstand areas approximately 100 m x 100 m in size as drilling pads at well sites with partial restoration of each drilling site to approximately 80 m x 60 m after the well becomes operational
- drilling 6,000 wells across the study area to extract coal seam gas (CSG), spaced approximately 750 m apart to optimise production
- building an estimated 27 Field Compression Stations (FCS) comprising compression facilities, a vent for pressure management, power generation facilities and a water management system including a small onsite evaporation pond
- building an estimated nine central processing plants (CPP) comprising compression facilities, gas dehydration and regeneration units, a flare, power generation, metering facilities, offices, control room and car park
- laying approximately 2,500 km of underground gas-gathering pipelines made of high density polyethylene (HDPE) pipe, fibreglass or steel pipe between the production wells, FCSs and CPPs involving the excavation of a trench to a maximum depth of 1.5 m
- erecting accommodation camps, administration and warehouse facilities
- constructing water management facilities, including desalination plants, storage ponds and water distribution infrastructure
- laying approximately 500 km of underground water gathering pipelines made of HDPE pipe connecting wellheads, ponds, water treatment facilities and potential beneficial use options
- infrastructure required for potential beneficial use options such as irrigation and reinjection.
- building an estimated 2,000 km of lightly formed and gravel access tracks (typically 4 m wide x 150 mm thick) to connect wellheads with other facilities
- use or excavation of borrow pits for accessing local construction materials.

Well life is typically 15 to 20 years and may be longer. Each well field will be

depleted and rehabilitated typically 20 to 25 years after initial construction.

Further details about the Gas Field construction and operation are described in *Volume 2, Chapter 7* and *Volume 2, Chapter 11* respectively.

1.3 STUDIES AND MODELLING

The Gas Field Component involves many small, discrete disturbances spread over a large area (approximately 468,000 ha) and occurring progressively over at least 20 years.

Wells are located as the Gas Field is developed and as additional wells are required. Studies and modelling undertaken for this EIS have been based on best-available predictions, drawing on QGC's operational and design experience in CSG field development.

Studies were based on desktop assessments and field surveys. Where appropriate, detailed modelling was conducted to understand impacts on identified environmental values. For identified environmental values, protection objectives and associated measurable indicators have been established. Alternative strategies for managing and mitigating impacts have been identified where applicable.

Where details, data or specific information was not available, models were based on worst-case scenarios using standardised industry data to assess impacts. Where standardised data was used or assumptions made, a conservative approach was taken. This ensures that impacts are not underestimated.

Volume 3 provides a summary of the outcomes of impact assessment studies for each identified environmental factor and the associated environmental values. The full reports of studies and modelling conducted are provided in *Appendix 3.1* to *Appendix 3.10*.

1.4 SUMMARY OF FINDINGS

1.4.1 Climate and Climate Change

The Project environmental objective for climate and climate change is to ensure that Project infrastructure design and proposed management strategies incorporate consideration for climatic extremes and future climate change.

In the life of the Project, average annual temperatures may increase by 1.5^{o}C and average annual rainfall may vary between a decrease of 13.5 per cent and an increase of 9.2 per cent. The Gas Field and associated infrastructure will be designed to accommodate existing climate variations and predicted minor changes in temperature and rainfall.

Chapter 2 of this volume discusses, in detail, the impacts of existing climate and future climate change and the associated mitigation strategies. A summary of the impacts outlined in *Chapter 2* is provided in *Table 3.1.1* below.

Table 3.1.1 Summary of Impacts for Climate and Climate Change

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Short term
Impact extent	Local
Impact likelihood	Likely

Overall assessment of impact significance: negligible.

1.4.2 Topography and Geomorphology

The Project environmental objective for topography and geomorphology is to maintain a stable landform that does not result in uncontrolled erosion.

The Gas Field is located in the Surat Basin on the western slopes of the Great Dividing Range. The terrain of the Gas Field is predominantly flat with gentle slopes and undulating plains and rises, with only 1 per cent of the field considered to have a significant topographical constraint.

The overall topography and geomorphology impact assessment is discussed in *Chapter 3* of this volume. A summary of the impacts outlined in *Chapter 3* is provided in *Table 3.1.2* below:

Table 3.1.2 Summary of Impacts for Topography and Geomorphology

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Short term
Impact extent	Local
Impact likelihood	Unlikely

Overall assessment of impact significance: negligible.

1.4.3 Geology and Soils

The Project environmental objective for geology and soils is to protect soils from contamination and erosion arising from Project Activities.

The geology and soil characteristics of the Gas Field have been identified. The potential for soil erosion, combined with variable topsoil thickness and low fertility, mean that the management of topsoils and rehabilitation practices will require significant control measures. In addition, some areas of saline subsoil occur, the exposure of which can impact on the success of rehabilitation measures. Specific mitigation measures have been proposed with the primary objective of:

- preserving topsoil quantity and quality
- limiting the area of disturbance in affected areas
- controlling overland water flows around disturbed areas
- maintaining the low erosion condition of the area
- maintaining the cropping productivity of the area
- maintaining the salinity levels in soil surface layers
- keeping subsoil salinity below the surface of disturbed areas.

It has also been identified that approximately 39 per cent of the Gas Field is considered Good Quality Agricultural Land (GQAL) and 12 per cent of the Gas Field is used for cropping. Mitigation measures have been proposed to reduce the potential impacts on GQAL and current cropping land within the Gas Field.

The results of the geological and soil investigations and identified impacts with applicable mitigation strategies are discussed in *Chapter 4* of this volume. A summary of the impacts outlined in *Chapter 4* is provided in *Table 3.1.3* below.

Table 3.1.3 Summary of Impacts for Soils and Geology

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Short term
Impact extent	Local
Impact likelihood	High

Overall assessment of impact significance: minor.

1.4.4 Land Use and Infrastructure

The Project environmental objectives for land use and infrastructure are to:

- minimise impacts on existing townships and infrastructure
- minimise impacts on agricultural or rural activities and potential long term uses of land.

The Gas Field occurs in an area that is principally rural, with agriculture the

primary land use. However, there are also state forests, protected areas subject to native title claims, mining and petroleum tenures, road reserves and infrastructure corridors. Infrastructure is geared towards servicing small rural towns.

QGC will endeavour to minimise impacts on existing land use by appropriately locating infrastructure and using techniques that minimise disturbance. The Project will not hinder the functionality of local infrastructure as the majority of water will be sourced from Associated Water production, and power is undergoing optimisation investigation between gas-powered or electric engines for field compression and gas processing.

Local services and labour will be used which will beneficially stimulate regional economies where possible. Contractors to QGC are required to comply with BG Group's policy on corporate behaviour. Economic and social impacts are discussed in greater detail in *Volume 8*.

The overall impact assessment and any mitigation strategies for impacts on land use and infrastructure are detailed in *Chapter 5* of this volume. A summary of the impacts outlined in *Chapter 5* is provided in *Table 3.1.4* below.

Table 3.1.4 Summary of Impacts for Land Use and Infrastructure

Impact assessment criteria	Assessment outcome
Impact assessment	Negative impact on existing land use Positive impact on economic stimuli
Impact type	Direct and indirect
Impact duration	Short term and long term
Impact extent	Local
Impact likelihood	High

Overall assessment of impact significance: minor.

1.4.5 Land Contamination

The Project environmental objective for land contamination is to protect land from contamination arising from Project activities and ensure that any existing contaminated land is not disturbed, or if disturbed is appropriately managed and/or rehabilitated.

With appropriate mitigation measures, the Project is not expected to contaminate land during the construction and operation of the Gas Field. However, land may have been contaminated from previous activities and may be exposed during infrastructure construction. In this case, a risk-based approach to land contamination has been adopted that considers the most likely contaminants to be encountered and their likely locations. To date no contaminated sites have been identified. Based on this, management plans will be developed to address any contaminated areas with regard to health,

safety and the environment.

The prevention and minimisation of contaminated land and the risk assessment approach that will be used are discussed in *Chapter 6* of this volume. A summary of the impacts outlined in *Chapter 6* is provided in *Table 3.1.5* below.

Table 3.1.5 Summary of Impacts for Land Contamination

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Short term
Impact extent	Local
Impact likelihood	Unlikely

Overall assessment of impact significance: negligible.

1.4.6 Terrestrial Ecology

The Project environmental objective for terrestrial ecology is to undertake Project activities such that impacts on abundance and distribution of terrestrial flora, fauna and ecological communities are minimised.

Approximately 37 per cent of the Gas Field contains remnant ecosystem vegetation and includes small areas of *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (*EPBC Act)* listed and *Vegetation Management Act 1999* (Qld) (*VM Act*) endangered and of concern communities. These are often small fragments and in a degraded condition but a small number of healthy patches remain.

Several state forests containing more intact natural values occur in the Gas Field. The most outstanding one, in terms of biological values and ecological condition, is Gurulmundi State Forest in the north, which represents approximately 3 per cent of the tenements.

Environmentally sensitive areas occurring in the tenements include:

- state forests
- threatened species and ecological communities (*EPBC Act* [Cth])
- endangered regional ecosystems (RE) *VM Act* (Qld)
- of concern RE *VM Act* (Qld)
- woodlands fringing drainage lines (RE 11.3.25)
- wetlands (RE 11.3.27)
- endangered, vulnerable or rare (EVR) and regionally significant species

habitats

- large intact tracts of vegetation.

In the absence of appropriate mitigation measures there is potential for the Project to affect these areas and their values. However, clearing for the proposed infrastructure represents less than 3 per cent of the existing vegetation. Activities will generally be excluded from the most sensitive areas with the highest conservation values. All impacts will be minimised and offset initiatives put in place in the few instances that Gas Field activities (particularly linear infrastructure) are unable to avoid these areas of highest ecological value.

This means, with the implementation of appropriate mitigation and rehabilitation measures, there would be low potential for the Project to have a significant impact on the ecological values of the Gas Field or adjoining areas.

The multiple, discrete locations of Gas Field development allows for areas with environmentally valuable terrestrial ecology to be avoided. Mitigation measures described in *Chapter 7* of this volume are available to be incorporated into the detailed design of the Gas Field. A summary of the impacts outlined in *Chapter 7* is provided in *Table 3.1.6* below.

Table 3.1.6 Summary of Impacts for Terrestrial Ecology

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Long term
Impact extent	Regional
Impact likelihood	High

Overall assessment of impact significance: minor.

1.4.7 Aquatic (freshwater) Ecology

The Project environmental objective for aquatic ecology is to undertake Project activities such that impacts on abundance and distribution of aquatic flora, fauna and ecological communities are minimised.

There are two major wetlands outside, but in the vicinity of, the Gas Field. These are Lake Broadwater Conservation Park and Resources Reserve, just outside the south-eastern corner of the Gas Field, and The Gums Lagoon 26 km south-west of Tara, to the south-west of the Gas Field (refer *Figure 3.8.1*). A small portion of the Gas Field is within the catchment for Lake Broadwater. No parts of the Gas Field act as a catchment for The Gums Lagoon.

The Gas Field area also contains a number of small areas mapped by the Queensland Herbarium mapping as wetlands. These are all small ephemeral

wetlands, in most cases closely associated with, and in close proximity to, significant watercourses.

The Gas Field contains little aquatic flora, consisting primarily of a small number of common aquatic plants on the margins of waterways, farm dams, watercourse depressions, ephemeral wetlands and flood-out areas. Although there are no records of EVR aquatic flora species within the Gas Field, there is potential habitat for the three EVR aquatic flora species *Aponogeton queenslandicus*, *Eleocharis blakeana* and *Fimbristylis vagans*.

A number of fish species are recorded from the catchment in the Gas Field, including one species, the Murray Cod, which is listed as vulnerable under the *EPBC Act* (Cth). In addition, the Southern Purple-spotted Gudgeon is listed as a regionally significant species.

Gas Field activities will generally be excluded from all wetlands and watercourses. Impacts will be minimised and offset initiatives put in place in the small number of instances that Gas Field activities are unable to avoid these aquatic areas. With the adoption of appropriate mitigation measures, and based on the minimal disturbance of aquatic areas, there is low potential for the Project to have a significant impact on aquatic flora or fauna species.

Detailed findings regarding Gas Field impacts on aquatic ecology, along with the mitigation strategies, are discussed in *Chapter 8* of this volume. A summary of the impacts outlined in *Chapter 8* is provided in Table 3.1.7 below.

Table 3.1.7 Summary of Impacts for Aquatic Ecology

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Short term
Impact extent	Local
Impact likelihood	Unlikely

Overall assessment of impact significance: negligible.

1.4.8 Surface Water Resources

The Project environmental objective for surface water resources is to protect as much as practicable surface waters from contamination, diversion of natural flows, and sedimentation so as to preserve the ecological health, public amenity and safety of surface waters.

The surface water characteristics of the Gas Field include the Condamine River. Two main factors can pose risks to the surface water environment from the development of the Gas Field:

- the volume and the quality of the Associated Water that has to be handled
- the development of infrastructure which can affect surface water flow and water quality.

The main potential impacts to surface water include:

- increased run-off into watercourses as a result of the creation of impervious surfaces (e.g. access roads, ponds, compressor stations)
- potential for increased nutrient loads from erosion and sedimentation as a result of vegetation clearance
- damage to in-stream biodiversity due to impacts on riparian vegetation
- contamination from fuels and drilling fluids
- salinity impacts due to loss of control of Associated Water.

Mitigation measures have been proposed to ensure that the potential impacts to surface water resources can be eliminated or minimised.

Detailed surface water impacts and mitigation strategies are presented in *Chapter 9* of this volume. A summary of the impacts outlined in Chapter 9 is provided in *Table 3.1.8* below.

Table 3.1.8 Summary of Impacts for Surface Water Resources

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Short term
Impact extent	Local
Impact likelihood	Medium

Overall assessment of impact significance: minor.

1.4.9 Groundwater Resources

The Project's environmental objectives for groundwater resources are to:

- protect, as much as practicable, groundwater from contamination so as to preserve ecological health, public amenity and safety
- not extract groundwater resources to the detriment of other groundwater users and biodiversity dependent on groundwater supplies.

A model has been developed to quantitatively predict, to the greatest extent possible, the likely drawdown of groundwater resources from Gas Field activities. Based on the conceptual groundwater model it has been concluded that overall there is low to moderate risk to neighbouring users and low risk to the ecosystem likely to ensue from the proposed development and future operation of the Gas Field.

Based on current data, drawdown effects have been predicted that are expected to exceed the nominated Trigger Levels of various formations within the Gas Field. External to the Gas Field, the Springbok Sandstone formation, may experience drawdown in excess of Trigger Levels.

The risk of inter-aquifer flows arising from bore design or poor bore construction techniques are considered very low.

There would be a low potential for impact on water levels in the local unconfined aquifers and underlying Intermediate aquifers and water quality changes are not considered likely.

Owing to the generally low to insignificant impacts expected on the water table aquifers in the study area, any significant impact on the base flow to the local river systems, particularly the Condamine River, is unlikely.

Groundwater modelling, detailed impact descriptions and management strategies to ensure that other groundwater users are not disadvantaged, are provided in *Chapter 10* of this volume. A summary of the impacts outlined in *Chapter 10* is provided in *Table 3.1.9* below.

Table 3.1.9 Summary of Impacts for Groundwater

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Long term
Impact extent	Local
Impact likelihood	High

Overall assessment of impact significance: negligible to minor.

1.4.10 Associated Water

The Project environmental objectives for Associated Water are to:

- maximise the beneficial use of Associated Water
- treat and manage Associated Water so as not to contaminate other waters and lands, or compromise ecological health, public amenity or safety.

Approximately 160 megalitres per day of Associated Water may be produced in the first 15 years of operation, after which Associated Water production will decrease rapidly. It is proposed to treat, where necessary, Associated Water so it meets water quality objectives for various beneficial uses.

QGC is considering desalination and brine concentration techniques to treat Associated Water for beneficial use. Waste management strategies for brine produced from Associated Water treatment will seek to minimise the potential for contamination of soils and water.

Options for beneficial use of treated Associated Water include irrigation of trees and crops, supply of potable water to townships, reinjection, QGC's own use and surface water discharge. Options for beneficial use of untreated Associated Water include reinjection and supplying industries and mines. Current management of Associated Water is disposal via evaporation ponds. The preferred options are a combination of irrigation, supply to mines and industry and some minor additional uses. Pending further technical studies, reinjection may become a preferred option.

Short-term water management strategies will focus on proven management methods that can readily accommodate large volumes. Long term water management strategies will focus on optimising treatment methods and selecting the optimal beneficial use option based on environmental, social, economic, technical, commercial and regulatory criteria.

Associated Water management is discussed in *Chapter 11* of this volume. A summary of the impacts outlined in *Chapter 11* is provided in *Table 3.1.10* below.

Table 3.1.10 Summary of Impacts for Associated Water

Impact assessment criteria	Assessment outcome
Impact assessment	Negative,
Impact type	Direct
Impact duration	Long term
Impact extent	Local
Impact likelihood	High

Overall assessment of impact significance: moderate.

1.4.11 Air

The Project environmental objective for air quality is to preserve ambient air quality to the extent that ecological health, public amenity or safety is maintained.

The main sources of air emissions are the reciprocating and screw compressors. Emissions include oxides of nitrogen, carbon monoxide, ozone, particulates and hydrocarbons. A conservative approach has been adopted in modelling impacts on air quality, as the exact location of the compressors is not known. Where required, stack testing has been performed to verify model results and refine the model as necessary. Modelling and stack testing results indicate that there will be no exceedences of air quality objectives for oxides of nitrogen, carbon monoxide, particulates, ozone or hydrocarbons.

Potential impacts on air quality and associated mitigation measures are discussed in full in *Chapter 12* of this volume. A summary of the impacts outlined in *Chapter 12* is provided in *Table 3.1.11* below.

Table 3.1.11 Summary of Impacts for Air

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Short term
Impact extent	Local
Impact likelihood	Unlikely

Overall assessment of impact significance: negligible.

1.4.12 Noise and Vibration

The Project environmental objective for noise and vibration is to ensure that impacts arising from noise and vibration on ecological health, public amenity or safety are minimised.

The main sources of noise emissions from the Gas Field are reciprocating and screw compressors. A conservative approach has been adopted in modelling noise impacts, as the exact location of the compressors is not known. Modelling indicates that nocturnal noise limit objectives would be exceeded within approximately 4 to 5 km of an unmitigated compressor station.

Noise mitigation measures have been proposed to reduce the noise impacts of the compressors. The noise levels could be reduced by 10 to 40 dB(A). Reducing noise levels by 20 dB(A) would lower, by about 90 per cent, the number of sensitive receptors potentially affected by nocturnal noise in excess of the guidelines. Reducing noise by 30 dB(A) or more would lower the number of potentially affected sensitive receptors to almost zero. QGC intends to ensure that all compressors and other noise and vibration emitting equipment are attenuated effectively and located at an appropriate distance from potential receptors.

The noise and vibration model assessment and proposed mitigation measures are discussed in *Chapter 13* of this volume. A summary of the impacts outlined in *Chapter 13* is provided in *Table 3.1.12* below.

Table 3.1.12 Summary of Impacts for Noise

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Long term
Impact extent	Local
Impact likelihood	High

Overall assessment of impact significance: minor to negligible when appropriate site selection and mitigation measures are employed.

1.4.13 Transport

The Project environmental objective for transport is to ensure that use of roads, rail and other transport infrastructure does not impact on ecological health, public amenity or safety of those who use or are in proximity to transport infrastructure.

The assessment of impacts to transport infrastructure reflects a worst-case scenario based on all transport for the Gas Field being by road. A review of splitting the large diameter pipeline delivery between Gladstone and Brisbane highlighted the potential for cumulative increases in traffic volumes (e.g. through Toowoomba) as a result of the Pipeline and the Gas Field development works. This will be considered when developing the final transportation strategy. Key potential transport routes have been identified but could be subject to change when the transport logistics contract is finalised.

Based on increases in traffic volumes during construction, the impact assessment indicated that road pavements could be adversely affected in a number of locations and that contributions for impacts to road pavements might be required. A methodology for progressing agreement with the Department of Transport and Main Roads and other road authorities has been proposed. Some local government roads may need to be upgraded to permit the passage of construction vehicles.

No assessment of rail impacts has been undertaken at this stage. The use of rail for the transport of large units such as the compressors would be limited due to the presence of tunnels on the line. However, rail will be considered in the overall transport strategy.

Impacts associated with the operations phase will be less than for the construction phase due to smaller workforce numbers. However, there will be an ongoing need to transport materials and equipment for well development.

Mitigation strategies have been developed to ensure that the safety of road users is not reduced, but enhanced if possible. Transport impacts and

mitigation strategies are presented in *Chapter 14* of this volume. A summary of the impacts outlined in *Chapter 14* is provided in *Table 3.1.13* below.

Table 3.1.13 Summary of Impacts for Transport

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Long term
Impact extent	Local
Impact likelihood	High

Overall assessment of impact significance: Depending on the strategies to be implemented and the final transport corridors to be used, the initial assessment is moderate to major. However, once transport options are better defined during the detailed design phase and roads identified in consultation with relevant government departments and agencies, the impact from transport on roads is expected to be minor to moderate.

1.4.14 Visual Amenity

The Project environmental objective for visual amenity is to preserve the visual amenity of the landscape as far as practicable.

A visual amenity assessment has been carried out to determine the impact of Gas Field development. As Project infrastructure is generally of low height and widely scattered across a vegetated landscape, any impact on visual amenity is considered negligible. Mitigation measures have been proposed where required, and may include vegetation screening of well sites.

For further details of the visual amenity assessment and the proposed mitigation strategies, see *Chapter 15* of this volume. A summary of the impacts outlined in *Chapter 15* is provided in *Table 3.1.14*.

Table 3.1.14 Summary of Impacts for Visual Amenity

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Long term
Impact extent	Local
Impact likelihood	High

Overall assessment of impact significance: negligible.

1.4.15 Waste Management

The Project environmental objectives for waste management are to:

- minimise waste generation and maximise reuse and recycling of waste products
- transport, store, handle, and dispose of waste in a manner that does not cause contamination of soil, air or water.

Under BG Group policy, new developments such as the QCLNG Project shall optimise process design, constructability and operation to minimise resource use and waste generation across the Project life cycle.

Solid and liquid waste streams and volumes have been identified, including general domestic waste, commercial and industrial waste and some hazardous waste. Waste management strategies, taking into account the location of the Gas Field and the necessity to provide a range of waste services, have been proposed to mitigate impacts. A waste management plan has also been developed and forms part of the detailed Environmental Management Plan (EMP) for the Gas Field in *Volume 9*.

Details of waste streams, volumes and proposed mitigation measures are detailed in *Chapter 16* of this volume. A summary of the impacts outlined in *Chapter 16* is provided in *Table 3.1.15* below.

Table 3.1.15 Summary of Impacts for Waste Management

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Short term
Impact extent	Local
Impact likelihood	High

Overall assessment of impact significance: negligible.

1.4.16 Hazard and Risk Assessment

The Project environmental objective for hazard and risk assessment is to protect the ecological health, public amenity and safety of those on site or in proximity to the site from hazardous events.

The key risks identified for the construction and operation of the Gas Field include:

- unplanned gas release with the possibility of fire or explosion through introduction of an ignition source
- contact with live or high energy sources

- inappropriate or unauthorised infrastructure use or access
- infrastructure or equipment failure, other than gas processing equipment
- natural disasters
- pollutant release to air, soils or water
- accidental release of associated water
- traffic accidents involving multiple or single vehicles.

A quantitative risk assessment has been undertaken for the unplanned release of gas from Gas Field infrastructure. All other hazards have been identified and assessed using a qualitative risk assessment process. For each hazard assessed qualitatively, controls have been proposed to minimise the likelihood and consequence of the hazard. Hazards with the greatest residual risk were related to transport incidents. Further control measures have been proposed to minimise these risks.

All fatality risk criteria (as specified in the Hazardous Industries Planning Advisory Paper guidelines) from the unplanned release of gas are considered negligible. Moderate injury risk criteria are unlikely to be exceeded at distances greater than 16 m.

Establishment and maintenance of adequate safety zones for each infrastructure type will ensure the risk to human health is as low as reasonably practical. Comprehensive Emergency Management Plans will be developed to further mitigate potential hazards and manage any hazards should they occur.

Impacts and mitigation measures for potential hazards are discussed in detail in *Chapter 17* of this volume. A summary of the impacts outlined in *Chapter 17* is provided in *Table 3.1.16* below.

Table 3.1.16 Summary of Impacts for Hazards and Risks

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Short term
Impact extent	Local
Impact likelihood	Likely

The overall project assessment level of significance: negligible.

1.4.17 Conclusion

The following chapters describe potential impacts from the proposed Gas Field Component on identified environmental values and the methodology used to assess those impacts. Strategies to mitigate environmental and social impacts have been proposed for the management of the Gas Field.

No impacts in relation to the Gas Field Component were considered major or critical after mitigation measures have been implemented. No unacceptable risks were identified during the impact assessment for the Gas Field Component.