APPENDIX 27

ARROW LNG PLANT

Health Impact Assessment

arrow energy
go further

Arrow CSG (Australia) Pty Ltd and Coffey Environments Australia Pty Ltd

Arrow LNG Plant

Health Impact Assessment

220819-00

Final | 14 October 2011

Arup
Arup Pty Ltd ABN 18 000 966 165

Arup
Level 4 108 Wickham Street
Fortitude Valley
QLD 4006
GPO Box 685 Brisbane QLD 4001
Australia
www.arup.com

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		Signature			
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		Name			
		Signature			
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Risk Assessment

Executive Summary

This Health Impact Assessment (HIA) describes potential impacts on the health of Gladstone's human population related to the construction and operation of the project. The primary focus of the HIA is the Gladstone Local Government Area, with data regarding this area sourced largely from stakeholder consultation, the Australian Bureau of Statistics, Queensland Health and the University of Adelaide's Public Health Information Unit. Additional information for the HIA has been sourced from other technical studies which have been completed for the project's EIS.

The HIA responds to the Environmental Impact Statement's Terms of Reference (TOR) which require that the current health status of the population and potential project related health impacts are studied and appropriate mitigation and management measures identified to protect and enhance the health of the community. It focuses on aspects of community health and does not address occupational health and safety. Occupational health and safety is addressed in the Hazard and Risk assessment undertaken by Planager (2011).

Mitigation and management measures outlined in the HIA and other technical studies for the EIS will also be captured in the project's Environmental Management Plan and Social Impact Management Plan.

While there is not yet an accepted standard for HIA in Australia, for the purposes of this assessment the general approach outlined in Queensland Health's Health Impact Assessment: A Guide For Service Providers (Queensland Health, 2003) has been followed.

Existing Health Status of the Study Area

While the current health status of the population within the study area is generally comparable to that of Queensland and Australia in terms of mortality and disease rates (such as heart disease, mental health, cancers), residents within the study area do display higher rates of risk factors, such as smoking, alcohol consumption and obesity, than the Queensland and Australian averages (Public Health Information Unit, 2010).

The existing health facilities in the region are generally considered adequate for the existing population (based on consultation with local health stakeholders), but are likely to be placed under pressure as the population increases.

Potential Community Health Impacts

No high risk health related impacts have been identified largely due to confinement of construction workers to camps where they will have limited interaction with the wider community. Potential health-related risks that were reviewed include environmental risks (i.e. noise, air quality), infectious diseases, food and water-borne diseases, vector-borne diseases, socio-economic factors, lifestyle, sexual health, social infrastructure and mental health.

Those risks identified can be adequately managed and mitigated via:

- Locating the project's fly-in-fly-out serviced construction camp on Curtis Island, thus limiting the interaction of workers with the broader community.

- Applying a strict code of conduct to workers (including fit for work testing) to reduce health risk factors such as alcoholism or illicit drug use.
- Implementing the mosquito management measures prescribed in the pest management plan (Ecosure, 2011)
- Conducting health awareness training with workers.
- Locating heath services on-site (Curtis Island) to minimise increasing pressure on existing health services

Overall, the HIA identifies that the potential health impacts associated with the project can be adequately managed by the Proponent.

Cumulative Impacts

There are no significant cumulative health impacts associated with the project.

1 Introduction

This Health Impact Assessment (HIA) describes the construction and operational impacts on the health of the human population of Gladstone resulting from the Arrow LNG Plant at Curtis Island.

This report responds to the Terms of Reference (TOR) issued under Part 4 of the *State Development and Public Works Organisation Act 1971* issued by the Coordinator-General in January 2010, which requires an assessment to be made of impacts on the health of the existing community that may be affected by the project, as well as a description of practical measures for protecting or enhancing identified values.

The HIA seeks to predict the impact on human health on the Gladstone community so that negative effects can be reduced or avoided and positive effects enhanced. It focuses on non-occupational community associated health issues, which does not address occupational exposures to workplace incidents. This is addressed in the Hazard and Risk Assessment undertaken as part of the environmental impact statement (EIS) by Planager (2011).

2 Project Objectives

The objectives of this HIA include:

- Responding to the TOR for the project.
- Determining the appropriate scope of the HIA and establishing study parameters such as timeframe, vulnerable communities and study area.
- Documenting the human health status and profile of the potentially affected communities within the study area.
- Identifying and evaluating all human health impacts arising from the project.
- Providing mitigation measures to reduce human health risk to acceptable levels.
- Identifying opportunities to enhance positive health impacts arising from the project.
- Describing the residual and cumulative human health risks associated with the project and providing mitigation measures (Note: some of these mitigation measures overlap with the mitigation measures identified in other discipline assessments i.e. noise, air quality etc)
- Identifying ongoing monitoring and reporting standards for the project.

3 Project Description

3.1 Proponent

Arrow CSG (Australia) Pty Ltd (Arrow Energy) proposes to develop a liquefied natural gas (LNG) facility on Curtis Island off the central Queensland coast near Gladstone. The project, known as the Arrow LNG Plant, is a component of the larger Arrow LNG Project.

The proponent is a subsidiary of Arrow Energy Holdings Pty Ltd which is wholly owned by a joint venture between subsidiaries of Royal Dutch Shell plc and PetroChina Company Limited.

3.2 Arrow LNG Plant

Arrow Energy proposes to construct the Arrow LNG Plant in the Curtis Island Industry Precinct at the south-western end of Curtis Island, approximately 6 km north of Gladstone and 85 km southeast of Rockhampton, off Queensland's central coast. In 2008, approximately 10% of the southern part of the island was added to the Gladstone State Development Area to be administered by the Queensland Department of Local Government and Planning. Of that area, approximately 1,500 ha (25%) has been designated as the Curtis Island Industry Precinct and is set aside for LNG development. The balance of the Gladstone State Development Area on Curtis Island has been allocated to the Curtis Island Environmental Management Precinct, a flora and fauna conservation area.

The Arrow LNG Plant will be supplied with coal seam gas from gas fields in the Surat and Bowen basins via high-pressure gas pipelines to Gladstone, from which a feed gas pipeline will provide gas to the LNG plant on Curtis Island. A tunnel is proposed for the feed gas pipeline crossing of Port Curtis.

The project is described below in terms of key infrastructure components: LNG plant, feed gas pipeline and dredging.

3.2.1 LNG Plant

Overview

The LNG plant will have a base-case capacity of 16 Mtpa, with a total plant capacity of up to 18 Mtpa. The plant will consist of four LNG trains, each with a nominal capacity of 4 Mtpa. The project will be undertaken in two phases of two trains (nominally 8 Mtpa), with a financial investment decision taken for each phase.

Operations infrastructure associated with the LNG plant includes the LNG trains (where liquefaction occurs; see 'Liquefaction Process' below), LNG storage tanks, cryogenic pipelines, seawater inlet for desalination and stormwater outlet pipelines, water and wastewater treatment, a 110 m high flare stack, power generators (see 'LNG Plant Power' below), administrative buildings and workshops.

Construction infrastructure associated with the LNG plant includes construction camps (see 'Workforce Accommodation' below), a concrete batching plant and laydown areas.

The plant will also require marine infrastructure for the transport of materials, personnel and product (LNG) during construction and operations (see 'Marine Infrastructure' below).

Construction Schedule

The plant will be constructed in two phases. Phase 1 will involve the construction of LNG trains 1 and 2, two LNG storage tanks (each with a capacity of between 120,000 m^3 and 180,000 m^3), Curtis Island construction camp and, if additional capacity is required, a mainland workforce accommodation camp. Associated marine infrastructure will also be required as part of Phase 1. Phase 2 will involve the construction of LNG trains 3 and 4 and potentially a third LNG storage tank. Construction of Phase 1 is scheduled to commence in 2014 with train 1 producing the first LNG cargo in 2017. Construction of Phase 2 is anticipated to commence approximately five years after the completion of Phase 1 but will be guided by market conditions and a financial investment decision at that time.

Construction Method

The LNG plant will generally be constructed using a modular construction method, with preassembled modules being transported to Curtis Island from an offshore fabrication facility. There will also be a substantial stick-built component of construction for associated infrastructure such as LNG storage tanks, buildings, underground cabling, piping and foundations. Where possible, aggregate for civil works will be sourced from suitable material excavated and crushed on site as part of the bulk earthworks. Aggregate will also be sourced from mainland quarries and transported from the mainland launch site to the plant site by roll-on, roll-off vessels. A concrete batching plant will be established on the plant site. Bulk cement requirements will be sourced outside of the batching plant and will be delivered to the site by roll on roll-off ferries or barges from the mainland launch site.

LNG Plant Power

Power for the LNG plant and associated site utilities may be supplied from the electricity grid (mains power), gas turbine generators, or a combination of both, leading to four configuration options that will be assessed:

- Base case (mechanical drive): The mechanical drive configuration uses gas turbines to drive the LNG train refrigerant compressors, which is the traditional powering option for LNG facilities. This configuration would use coal seam gas and end flash gas (produced in the liquefaction process) to fuel the gas turbines that drive the LNG refrigerant compressors and the gas turbine generators that supply electricity to power the site utilities. Construction power for this option would be provided by diesel generators.
- Option 1 (mechanical/electrical – construction and site utilities only): This configuration uses gas turbines to drive the refrigerant compressors in the LNG trains. During construction, mains power would provide power to the site via a cable (30-MW capacity) from the mainland. The proposed

capacity of the cable is equivalent to the output of one gas turbine generator. The mains power cable would be retained to power the site utilities during operations, resulting in one less gas turbine generator being required than the proposed base case.

- Option 2 (mechanical/electrical): This configuration uses gas turbines to drive the refrigerant compressors in the LNG trains and mains power to power site utilities. Under this option, construction power would be supplied by mains power or diesel generators.
- Option 3 (all electrical): Under this configuration mains power would be used to supply electricity for operation of the LNG train refrigerant compressors and the site utilities. A switchyard would be required. High-speed electric motors would be used to drive the LNG train refrigerant compressors. Construction power would be supplied by mains power or diesel generators.

Liquefaction Process

The coal seam gas enters the LNG plant where it is metered and split into two pipe headers which feed the two LNG trains. With the expansion to four trains the gas will be split into four LNG trains.

For each LNG train, the coal seam gas is first treated in the acid gas removal unit where the carbon dioxide and any other acid gases are removed. The gas is then routed to the dehydration unit where any water is removed and then passed through a mercury guard bed to remove mercury. The coal seam gas is then ready for further cooling and liquefaction.

A propane, precooled, mixed refrigerant process will be used by each LNG train to liquefy the predominantly methane coal seam gas. The liquefaction process begins with the propane cycle. The propane cycle involves three pressure stages of chilling to pre-cool the coal seam gas to - 33°C and to compress and condense the mixed refrigerant, which is a mixture of nitrogen, methane, ethylene and propane. The condensed mixed refrigerant and precooled coal seam gas are then separately routed to the main cryogenic heat exchanger, where the coal seam gas is further cooled and liquefied by the mixed refrigerant. Expansion of the mixed refrigerant gases within the heat exchanger removes heat from the coal seam gas. This process cools the coal seam gas from - 33°C to approximately - 157°C. At this temperature the coal seam gas is liquefied (LNG) and becomes 1/600th of its original volume. The expanded mixed refrigerant is continually cycled to the propane precooler and reused.

LNG is then routed from the end flash gas system to a nitrogen stripper column which is used to separate nitrogen from the methane, reducing the nitrogen content of the LNG to less than 1 mole percent (mol%). LNG separated in the nitrogen stripper column is pumped for storage on site in full containment storage tanks where it is maintained at a temperature of -163°C.

A small amount of off-gas is generated from the LNG during the process. This regasified coal seam gas is routed to an end flash gas compressor where it is prepared for use as fuel gas.

Finally, the LNG is transferred from the storage tanks onto LNG carriers via cryogenic pipelines and loading arms for transportation to export markets. The

LNG will be regasified back into sales specification gas on shore at its destination location.

Workforce Accommodation

The LNG plant (Phase 1), tunnel, feed gas pipeline, and dredging components of the project each have their own workforces with peaks occurring at different stages during construction. The following peak workforces are estimated for the project:

- LNG plant Phase 1 peak workforce of 3,500, comprising 3,000 construction workers: 350 engineering, procurement and construction (EPC) management workers and 150 Arrow Energy employees.
- Tunnel peak workforce of up to 100.
- Feed gas pipeline (from the mainland to Curtis Island) peak workforce of up to 75.
- A dredging peak workforce of between 20 and 40.

Two workforce construction camp locations are proposed: the main construction camp at Boatshed Point on Curtis Island, and a possible mainland overflow construction camp, referred to as a temporary workers accommodation facility (TWAF). Two potential locations are currently being considered for the mainland TWAF; in the vicinity of Gladstone city on the former Gladstone Power Station ash pond No.7 (TWAF7) or in the vicinity of Targinnie on a primarily cleared pastoral grazing lot (TWAF8). Both potential TWAF sites include sufficient space to accommodate camp infrastructure and construction laydown areas. The TWAF and its associated construction laydown areas will be decommissioned on completion of the Phase 1 works.

Of the 3,000 construction workers for the LNG plant, it is estimated that between 5% and 20% will be from the local community (and thus will not require accommodation) and that the remaining fly in, fly-out workers will be accommodated in construction camps. The 350 EPC management and 150 Arrow Energy employees are expected to relocate to Gladstone with the majority housed in company facilitated accommodation.

The tunnel workforce of 100 people and gas pipeline workforce of 75 people are anticipated to be accommodated in the mainland in company facilitated accommodation. The dredging workforce of 20 to 40 workers will be housed onboard the dredge vessel.

Up to 2,500 people will be housed at Boatshed Point construction camp. Its establishment will be preceded by a pioneer camp at the same locality which will evolve into the completed construction camp.

Marine Infrastructure

Marine facilities include the LNG jetty, materials offloading facility (MOF), personnel jetty and mainland launch site.

LNG Jetty

LNG will be transferred from the storage tanks on the site to the LNG jetty via above ground cryogenic pipelines. Loading arms on the LNG jetty will deliver the

product to an LNG carrier. The LNG jetty will be located in North China Bay, adjacent to the northwest corner of Hamilton Point.

MOF

Delivery of materials to the site on Curtis Island during the construction and operations phases will be facilitated by a MOF where roll-on, roll-off or lift-on, lift-off vessels will dock to unload preassembled modules, equipment, supplies and construction aggregate. The MOF will be connected to the LNG plant site via a heavy-haul road.

Boatshed Point (MOF 1) is the base-case MOF option and would be located at the southern tip of Boatshed Point. The haul road would be routed along the western coastline of Boatshed Point (abutting the construction camp to the east) and enters the LNG Plant site at the southern boundary. A quarantine area will be located south of the LNG plant and will be accessed via the northern end of the haul road.

Two alternative options are being assessed, should the Boatshed Point option be determined to be not technically feasible:

- South Hamilton Point (MOF 2): This MOF option would be located at the southern tip of Hamilton Point. The haul road from this site would traverse the saddle between the hills of Hamilton Point to the southwest boundary of the LNG plant site. The quarantine area for this option will be located southwest of the LNG plant near the LNG storage tanks.
- North Hamilton Point (MOF 3): This option involves shared use of the MOF being constructed for the Santos Gladstone LNG Project (GLNG Project) on the northwest side of Hamilton Point (south of Arrow Energy's proposed LNG jetty). The GLNG Project is also constructing a passenger terminal at this site, but it will not be available to Arrow Energy contractors and staff. The quarantine area for this option would be located to the north of the MOF. The impacts of construction and operation of this MOF option and its associated haul road were assessed as part of the GLNG Project and will not be assessed in this EIS.

Personnel Jetty

During the peak of construction, base case of up to 1,100 people may require transport to Curtis Island from the mainland on a daily basis. A personnel jetty will be constructed at the southern tip of Boatshed Point to enable the transfer of workers from the mainland launch site to Curtis Island by high-speed vehicle catamarans (Fastcats) and vehicle or passenger ferries (ROPAX). This facility will be adjacent to the MOF constructed at Boatshed Point. The haul road will be used to transport workers to and from the personnel jetty to the construction camp and LNG plant site. A secondary access for pedestrians will be provided between the personnel jetty and the construction camp.

Mainland Launch Site

Materials and workers will be transported to Curtis Island via the mainland launch site. The mainland launch site will contain both a passenger terminal and a roll on, roll-off facility. The passenger terminal will include a jetty and transit infrastructure, such as amenities, waiting areas and car parking. The barge or roll-on, roll-off facility will have a jetty, associated laydown areas, workshops and storage sheds.

The two location options for the mainland launch site are:

- Launch site 1: This site is located north of Gladstone city near the mouth of the Calliope River, adjacent to the existing RG Tanna coal export terminal.
- Launch site 4N: This site is located at the northern end of the proposed reclamation area for the Fishermans Landing Northern Expansion Project, which is part of the Port of Gladstone Western Basin Master Plan. The availability of this site will depend on how far progressed the Western Basin Dredging and Disposal Project is at the time of construction.

3.2.2 Feed Gas Pipeline

An approximately 8-km long feed gas pipeline will supply gas to the LNG plant from its connection to the Arrow Surat Pipeline (formerly the Surat Gladstone Pipeline) on the mainland adjacent to Rio Tinto's Yarwun alumina refinery. The feed gas pipeline will be constructed in three sections:

- A short length of feed gas pipeline will run from the proposed Arrow Surat Pipeline to the tunnel launch shaft, which will be located on a mudflat south of Fishermans Landing, just south of Boat Creek. This section of pipeline will be constructed using conventional open-cut trenching methods within a 40-m wide construction right of way.
- The next section of the feed gas pipeline will traverse Port Curtis harbour in a tunnel to be bored under the harbour from the mainland tunnel launch shaft to a receival shaft on Hamilton Point. The tunnel under Port Curtis will have an excavated diameter of up to approximately 6 m and will be constructed by a tunnel boring machine that will begin work at the mainland launch shaft. Tunnel spoil material will be processed through a de-sanding plant to remove the bentonite and water and will comprise mainly a finely graded fill material, which will be deposited in a spoil placement area established within bund walls constructed adjacent to the launch shaft. Based on the excavated diameter, approximately 223,000 m^3 of spoil will be treated as required for acid sulfate soil and disposed of at this location.
- From the tunnel receival shaft on Hamilton Point, the remaining section of the feed gas pipeline will run underground to the LNG plant, parallel to the above ground cryogenic pipelines. This section will be constructed using conventional open-cut trenching methods within a 30-m wide construction right of way. A permanent easement up to 30-m wide will be negotiated with the relevant land manager or owner.

Should one of the electrical plant power options be chosen, it is intended that a power connection will be provided by a third party to the tunnel launch shaft, whereby Arrow Energy would construct a power cable within the tunnel to the LNG plant.

Other infrastructure, such as communication cables, water and wastewater pipelines, may also be accommodated within the tunnel.

3.2.3 Dredging

Dredging required for LNG shipping access and swing basins has been assessed under the Gladstone Ports Corporation's Port of Gladstone Western Basin Dredging and Disposal Project. Additional dredging within the marine environment of Port Curtis may be required to accommodate the construction and operation of the marine facilities. Up to five sites may require dredging:

- Dredge site 1 (dredge footprint for launch site 1): The dredging of this site would facilitate the construction and operation of launch site 1. This dredge site is located in the Calliope River and extends from the intertidal area abutting launch site 1, past Mud Island to the main shipping channel. The worst-case dredge volume estimated at this site is approximately 900,000 m^3.
- Dredge site 2 (dredge footprint for launch site 4N): The dredging of this site would facilitate the construction and operation of launch site 4N. This dredge site would abut launch site 4N and extend east from the launch site to the shipping channel. The worst-case dredge volume identified at this site is approximately 2,500 m^3.
- Dredge site 3 (dredge footprint for Boatshed Point MOF 1): The dredging of this site would facilitate the construction and operation of the personnel jetty and MOF at Boatshed Point. This dredge site would encompass the area around the marine facilities, providing adequate depth for docking and navigation. The worst-case dredge volume identified at this site is approximately 50,000 m^3.
- Dredge site 4 (dredge footprint for Hamilton Point South MOF 2): The dredging of this site would facilitate the construction and operation of the MOF at Hamilton Point South. This dredge site would encompass the area around the marine facilities, providing adequate depth for docking and navigation. The worst-case dredge volume identified at this site is approximately 50,000 m^3.
- Dredge site 5 (dredge footprint for LNG jetty): The dredging of this site will facilitate the construction of the LNG jetty at Hamilton Point. This dredge site extends from the berth pocket to be dredged as part of the Western Basin Strategic Dredging and Disposal Project to the shoreline and is required to enable a work barge to assist with construction of the jetty. The worst-case dredge volume identified is approximately 120,000 m^3.

The spoil generated by dredging activities will be placed and treated for acid sulfate soils (as required) in the Port of Gladstone Western Basin Dredging and Disposal Project reclamation area.

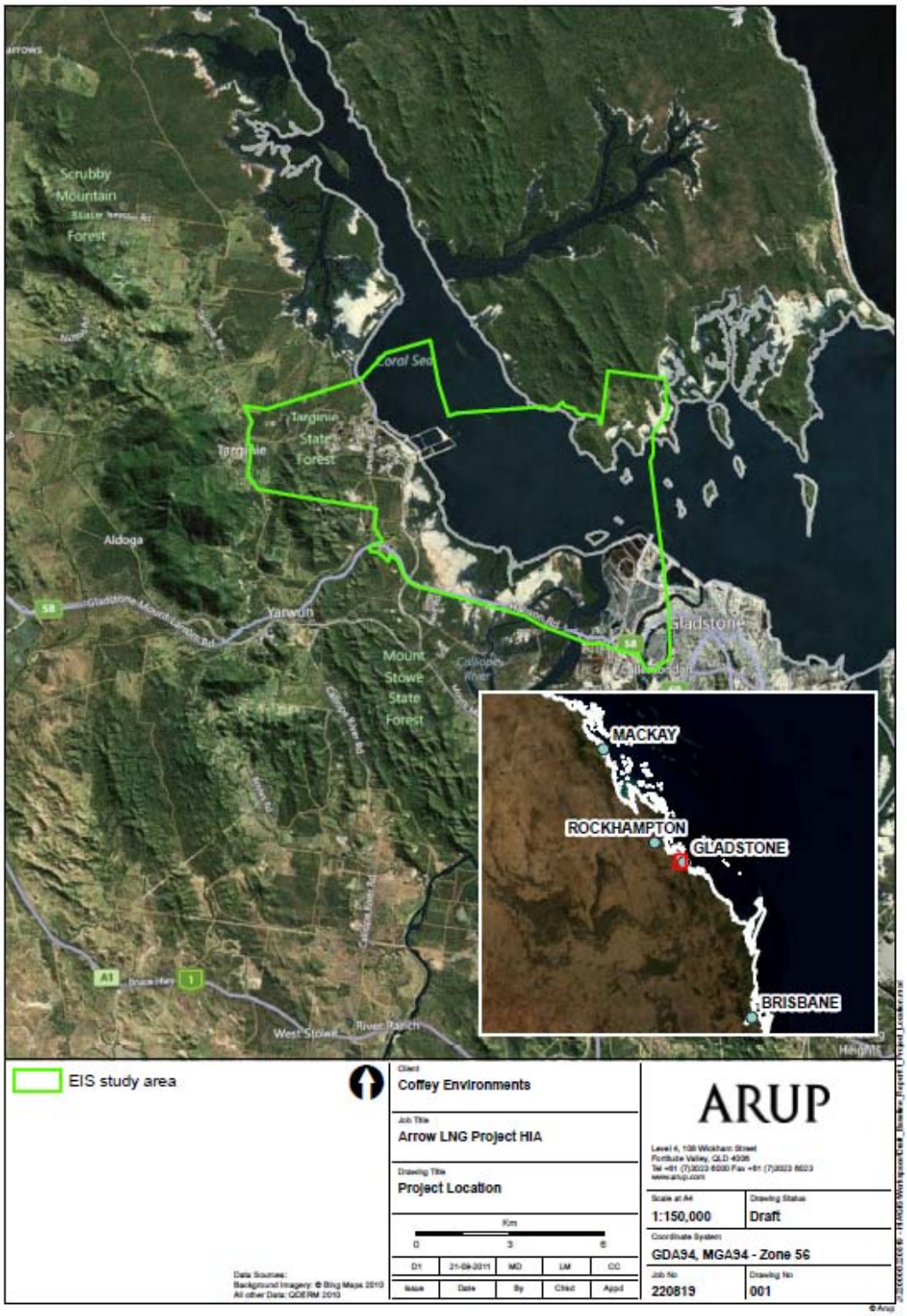

Figure 1 Project Location

4 Legislative Requirements

There are no specific Queensland or Australian legislative requirements for an HIA to be undertaken. Where it is identified that there are potential health risks associated with a project declared as significant under the *State Development and Public Works Act 1971*, the TOR will require this issue to be addressed in a statutory EIS, as is the case for the Arrow LNG Plant.

HIA for major projects is not widely practiced in Queensland to date, but is increasingly being utilised by Queensland Health where communities have raised concerns regarding the health impacts of development. Where HIAs have been undertaken (e.g. Narangba Industrial Estate) the World Health Organisation (WHO) procedure for HIA have been followed.

4.1 Terms of Reference

The TOR provided by the Department of Infrastructure and Planning for the project highlights that the following should be covered in the EIS under the heading of Health and Safety. Section 4.2, p81-82 of the TOR presents the following:

'Description of environmental values

This section should describe the existing community values for public health and safety that may be affected by the project. Populations likely to be affected by air emissions including odours should be identified and described. Particular attention should be paid to those sections of the population, such as children and the elderly that are especially sensitive to environmental health factors.

Potential impacts and mitigation measures

This section should define and describe the objectives and practical measures for protecting or enhancing health and safety community values, describe how nominated quantitative standards and indicators may be achieved for social impacts management, and how the achievement of the objectives will be monitored, audited and managed.

The EIS should assess the effects on the project workforce of occupational health and safety risks and the impacts on the community in terms of health, safety, and quality of life from project operations and emissions. Any impacts on the health and safety of the community, workforce, suppliers and other stakeholders should be detailed in terms of health, safety, quality of life for factors such as lighting, air emissions, odour, dust, noise and vibration, and water quality.

Maps should be provided showing the locations of sensitive receptors, such as, but not necessarily limited to, kindergartens, schools, hospitals, aged care facilities, residential areas, and centres of work (e.g. office buildings, factories and workshops). The EIS, illustrated by the maps, should discuss how planned discharges from the project could impact on public health in the short and long term, and should include an assessment of the cumulative impacts on public health values caused by the project, either in isolation or by combination with other known existing or planned sources of contamination.

The EIS should address the project's potential for providing disease vectors. Measures to control mosquito and biting midge breeding should be described. Any use of recycled water should be assessed for its potential to cause infection by the transmission of bacteria and/or viruses by contact, dispersion of aerosols, and ingestion (e.g. via use on food crops). Similarly, the use of recycled water should be assessed for its potential to cause harm to health via the food chain due to contaminants such as heavy metals and persistent or Janic chemicals. Practical monitoring regimes should also be recommended in this section'.

5 Methodology

Many literature resources advocate a wider social understanding of health. The broader understanding of health is captured in the World Health Organisation's definition: *'Health is a state of complete physical, mental and social well-being and not merely an absence of disease'* (WHO, 1946). Many factors combine together to affect the health of individuals and communities. The health of an individual is determined by their circumstances and environment. To a large extent, social determinants of health such as where a person lives, the state of their environment, genetics, income and education level, and relationships with friends and family all have considerable impacts on health. Whereas the more commonly considered factors such as access to and use of health care services often have less of an impact.

5.1 Sources of Information

Health-related data for the project has been sourced from publicly available information, supplemented with targeted consultation with local specialists where data was not otherwise available. A list of the specialist consulted is presented in Section 6 of this report.

Much of the health-related baseline data has been sourced from the Australian Bureau of Statistics, Queensland Health and the Public Health Information Unit located at the University of Adelaide. A literature review of medical research databases and journals was also undertaken. The Healthy and Clean Air for Gladstone Project and related reports have also been a primary source of baseline information. A media search was also undertaken to gain an understanding of key community health-related concerns.

5.2 Study Boundaries

The primary study area for this assessment, as shown in Figure 2, is the Gladstone Local Government Area (LGA) which consists of the Miriam Vale, Gladstone City, Calliope A and Calliope B Statistical Local Areas (SLAs). Data has been collected to the SLA level where available; however some baseline data is only recorded at the LGA level or regional level (Central Queensland). The potential direct impacts of the project are largely restricted to the primary study area.

As Gladstone sources healthcare services from other centres, a secondary study area has also been examined, which includes Rockhampton, Bundaberg and Brisbane. Detailed analysis of potential health impacts has not been carried out for the secondary study area as it is a considerable distance from the project area; however potential impacts on health service provision have been assessed.

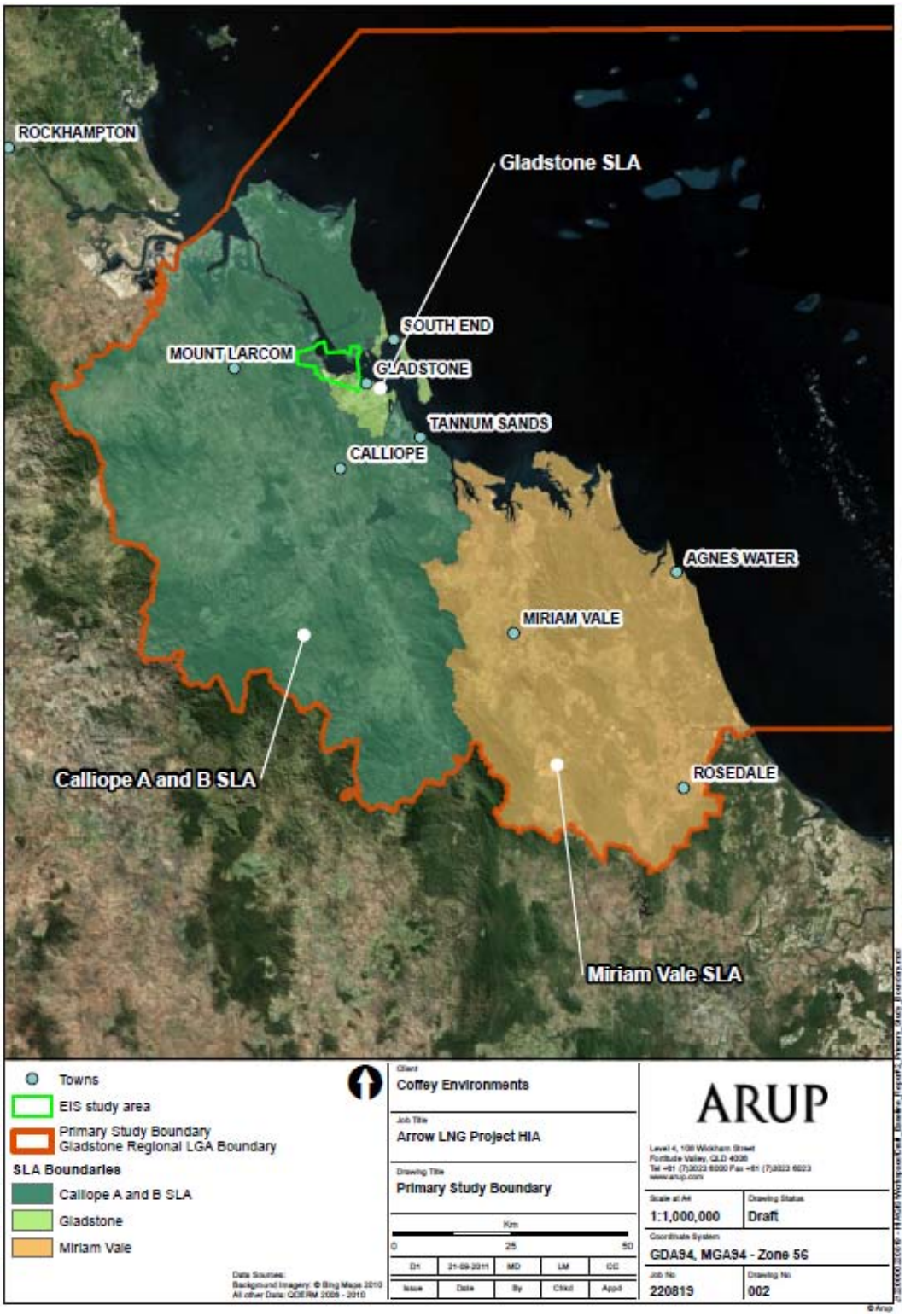

Figure 2 Primary Study Area Boundary

5.3 Study Team

This assessment has been conducted by a team of Health Impact Assessment and Environmental Impact Assessment professionals from Arup's environmental and sustainability practice. Curtin University School of Public Health has also provided technical advice and review.

5.4 Health Determinants

Health determinants are those factors considered to affect *'life expectancy, quality of life, and morbidity and mortality of communities'* (Queensland Health, 2003). The following potential health determinants have been adapted from *Health Impact Assessment: A Guide For Service Providers* (Queensland Health, 2003). These health determinants have been refined and supplemented by members of the project team to include those that are likely to be relevant to the project, in response to and drawn from research and stakeholder engagement conducted by Arup (refer to Section 7).

Table 1 Potential Health Determinants

Category	**Potential Health Determinants**
Environmental conditions	Air quality, water quality, soil conditions, noise levels, vibration levels, odour, visual amenity, land use, waste, hazards, use of natural resources, traffic and agriculture.
Socio-economic	Business activity, job creation, availability of employment, quality of employment, distribution of income, availability of training, technological development, social contact, community participation, peer pressure, crime, anti-social behaviour and discrimination.
Lifestyle and personal circumstances	Prescription drugs, alcohol, smoking, medication, leisure and substance abuse, exercise, diet, sexual and other health behaviours. Family relationships, employment status, working conditions, income, means of transport, housing tenure and housing conditions.
Social infrastructure	Housing, shops and retail services, banking and financial services, community facilities, advisory and advocacy services, information accessibility, public transport accessibility, education, training, healthcare, social services, child care, respite care, leisure facilities, voluntary and charity negotiations, art and culture.
Health infrastructure	Access to and funding for local and regional healthcare facilities and services.
Individual/Family/Biological	Age, sex, genetic factors, ethnicity, disability, personality and gender.

Individual/Family/Biological Age, sex, genetic factors, ethnicity, disability, personality and gender.

Location, proximity and equity of access to health services are also key considerations in relation to these health determinants; these are discussed further under sensitive community members in Section 5.5.4.1. Individual or biological

determinants of health have not been addressed specifically in this assessment, as these are pre-existing factors that are beyond the scope of the project to address or influence. Their influences on health outcomes have been considered however.

5.5 HIA Guidelines

A number of HIA Guidelines have been reviewed in order to inform the methodology for this assessment. Reviewed guidelines include:

- The Centre for Health Equity Training, Research and Evaluation NSW.
- International Finance Corporation Guidelines for Health Impact Assessments (IFC).
- The International Petroleum Industry Environmental Conservation Association (IPIECA).
- International Association for Impact Assessment (IAIA).
- Commonwealth Department of Health and Aged Care.
- Health Risk Assessment in Western Australia.
- World Health Organisation Health Impact Assessment Guidelines (WHO).

The chosen methodology for this project has relied on a number of these documents; given that the project is located in Queensland, the methodology developed by Queensland Health in particular has informed the methodology for health impact assessment, as illustrated in Figure 3.

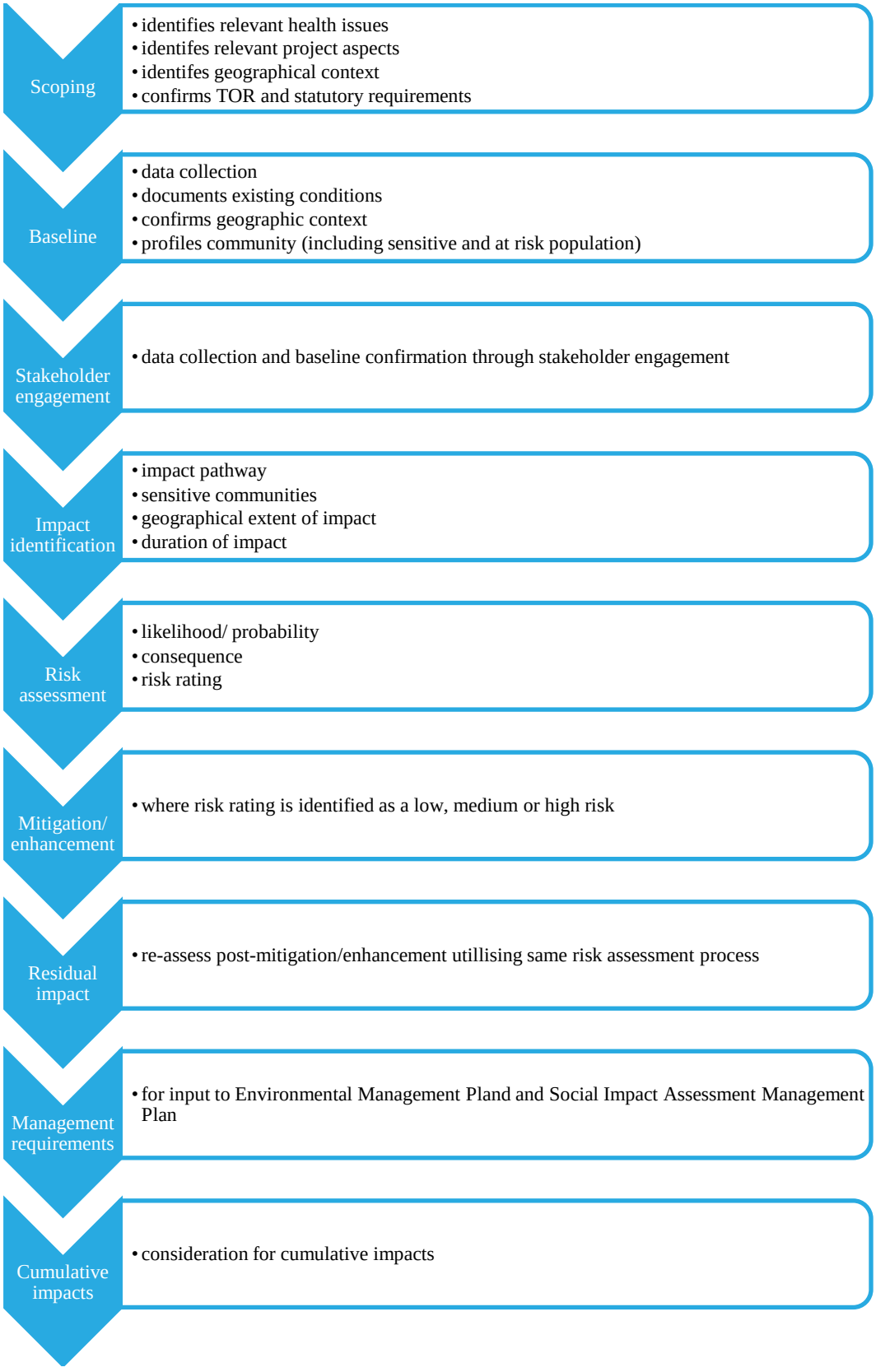

Figure 3 HIA methodology

5.5.1 Scoping

The scoping process identified the aspects of the project and community health issues relevant to this health impact assessment. The scoping exercise considered health impact assessments undertaken for comparative projects, as well as available reports, research and statistics about community health for the region. The scoping process also identified the geographical context for the health impact assessment, and identified relevant standards, guidelines, legislation, policy and thresholds relevant to the process. The TOR for the project provided overarching guidance for the scoping process. The scoped aspects included factors such as lighting, air emissions, noise and water quality.

5.5.2 Baseline

The baseline assessment documents existing conditions against which the health impact assessment is undertaken. The baseline considers socio-economic factors, and environmental factors, as well as other health determinants relevant to the project. Research about existing community health indicators for the region and the State, and relevant information drawn from other assessments (other EIS supporting studies). and contributors, is documented in the baseline. This information is then used to develop a community profile, identifying the at-risk or vulnerable populations/communities/individuals, and to select the health determinants to be assessed in the health impact assessment.

The baseline confirms the geographical context of the assessment, and describes the project elements considered in the health impact assessment.

5.5.3 Stakeholder Engagement

Stakeholder engagement confirms assessments and assumptions around issues, risks and impact ratings.

The stakeholder engagement process for the HIA aimed to:

- Gather data from primary sources/stakeholders, including local health service providers, using a structured survey.
- Confirm and clarify baseline information and potential health impacts associated with the project and other related issues.

The Western Australian Government's *Public Health Consultation: A Guide for Developers* recommends that the steps outlined in Table 2 be undertaken for public health consultation.

Table 2 HIA Consultation Steps

Recommended Steps for Public Health Consultation (Public Health Consultation Guidelines)			**HIA Approach**
Step	Process	Key Actions	
Step 1	Identifying	Preliminary identification of the key public health issues related to the proposal	Undertaken as part of the scoping phase (refer to Section 5.5.1.

Recommended Steps for Public Health Consultation (Public Health Consultation Guidelines)			HIA Approach
Step 2	Profiling	Identification of specific community segments who may be particularly affected by public health issues from the proposal	Undertaken as part of the scoping phase (refer to Section 5.5.1). Previous consultation exercises undertaken for Queensland Curtis LNG Project and GLNG Project in the Gladstone region were also reviewed.
Step 3	Contacting	Seeking out these community segments and finding ways of making it easy for them to become involved	Key health stakeholders were identified in the scoping phase and have been included in the HIA consultation process. Specific questions relating to health issues were included in the community process, and results have been included in the health impact assessment. The wider community will be consulted as part of the overall community consultation process for the EIS.
Step 4	Discussing	Input from stakeholders about the extent, relevance and prioritisation of public health issues in relation to the proposal	Key health stakeholders were consulted on the extent and prioritisation of public health issues (refer to Section6)
Step 5	Planning	Stakeholders and proponent jointly determine desired outcomes in relation to relevant public health issues	Key stakeholders will be consulted about health outcomes through the wider EIS consultation process.
Step 6	Incorporating	The proposal is developed including commitments to achieving the agreed public health outcomes	A number of proponent commitments to assist with achieving desired health outcomes are described in this document.
Step 7	Consolidating	Ongoing consultation and communication with stakeholders on the relevant public health aspects during the proposal development process	Ongoing consultation will be undertaken as part of the project.

Identification of appropriate stakeholders was undertaken via two methods:

- Desktop research (internet based).
- Utilising stakeholder lists provided by JTA Australia who are providing engagement services for the project's EIS.

By adopting a targeted approach, engagement is focused on health providers, and peak groups representing community health issues in the project region.

5.5.4 Impact Identification

The assessment of health impacts requires the identification of potential health impact hazards and impact pathways. The pathways are channels by which an individual or community's health may be affected. For the purpose of this health impact assessment, the following is considered in the identification of impact pathways:

- The aspect of the project or development which may potentially influence a health determinant.
- Vulnerable or at risk populations/ communities/ individuals, relevant to the health determinant.
- Geographical extent of potential influence.
- Duration of impact and the subsequent effect on the health determinant.

The figure below illustrates the process used in this assessment.

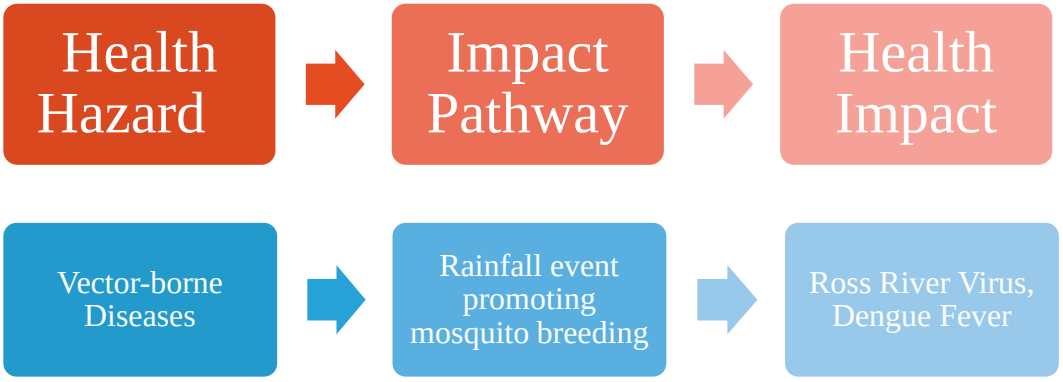

Figure 4 Health Impact Pathways. Adapted from *Health Risk Assessment (Scoping) Guidelines*, Department of Western Australia (Spickett, 2010)

5.5.4.1 Sensitive Communities

SKM (2011) undertook a social impact assessment (SIA) for the Arrow LNG Plant as part of the EIS. The assessment considered the demographics of residential communities and considered communities that may be vulnerable to the impacts of the project. Aspects of this report therefore guided the summary of sensitive communities for the health impact assessment.

Some community members can be more vulnerable to potential health impact pathways than others based on their location, health status, socio-economic status, race or age. An assessment of these sensitive communities has been undertaken, so that any specific impacts can be appropriately managed in a way that responds to that group's particular needs. Potential sensitive communities within the Primary Study Area have been identified as:

- The residential communities of South End and the Port Curtis Islands which are in closest proximity to the proposed LNG facility.
- The Miriam Vale SLA where there are a higher number of unemployed people or people with a lower socio-economic status.
- Children and elderly community members.
- Women, who due to gender disparity issues, may be subject to higher rates of domestic violence and lower incomes.
- Persons with a disability.
- Indigenous community members who may have a poorer health status than the general population.
- Foreign workers who may have a poorer health status than the general population. (This assumes that the country they are from has a lower socio-economic status)

Vulnerability is a function of exposure, sensitivity and adaptive capacity. Adaptive capacity can be described as the ability of a group or individual to adjust to or cope with a potential impact in certain circumstances (Spickett, J et al, 2010), however this does not imply that all health issues can be adapted to.

5.5.5 Health Risk Assessment

The health risk assessment process identifies significant impacts and those impacts where intervention, mitigation or enhancement may deliver improved outcomes.

A risk assessment framework has been adopted for this project, based on the *Western Australia Health Risk Assessment (Scoping) Guidelines* (Spickett, J et al, 2010). Consideration of the likelihood and consequence of the impact occurring delivers a risk rating for each identified impact pathway.

Consequence x Likelihood = Risk Level

Table 3 provides a guide to the possible impact on community health or health services of the study area, which forms the basis of the risk assessment. The impact assessment criteria presented below represent adverse impacts only. The project may also result in positive impacts that enhance community health and services.

Table 3 Health Consequences

Consequence	Examples
Catastrophic	• More than one fatality OR • More than five permanent disabilities OR • Non permanent injuries requiring hospitalisation for 5-10 percent of the Gladstone population OR • Acute health effect requiring hospital for > 5-10 percent

Consequence	Examples
	of Gladstone population OR • Chronic long-term health effect requiring medical treatment for 10-15 percent of the Gladstone population • More than $10,000,000 health cost per hazard OR demand exceeds capacity of the health services by more than 40 percent at any point in time
Major	• 1 fatality OR • 2-5 permanent disabilities OR • Non permanent injuries requiring hospitalisation for 2-5 percent of the Gladstone population • Acute health effect requiring hospitalisation for more than 1-2 percent of the Gladstone population • Chronic long-term health effect requiring medical treatment for 5-10 percent of the Gladstone population • $5,000,000 to $10,000,000 health cost per hazard OR demand exceeds capacity of the health services by between 30-40 percent at any point in time
Moderate	• No fatality AND • 1 permanent disability OR • Chronic long-term health effect requiring short-term medical treatment for 1-5 percent of the Gladstone population OR • Non permanent injuries requiring hospitalisation for 1-2 percent of the Gladstone population • Acute health effect requiring hospitalisation for 1-2 percent of the Gladstone population • $1,000,000 to $5,000,000 health cost per hazard OR demand exceeds capacity of the health services by between 20-30 percent at any point in time
Minor	• No fatality AND • No permanent disability AND • Non permanent injuries requiring hospitalisation for 1-5 persons AND • No permanent injuries requiring hospitalisation • Chronic health effect requiring medical treatment for about 0-1 percent of population at risk • $100,000 to $1,000,000 health cost per hazard OR demand exceeds capacity of the health services by between 1-20 percent at any point in time
Negligible/slight	• No fatality AND

Consequence	Examples
	• No permanent disability • No non permanent injuries requiring hospitalisation • No acute health effect requiring hospitalisation • No chronic health effect requiring medical treatment • Less than $100,000 health cost per hazard OR demand exceeds capacity of the health services by between 0-1 percent at any point in time

The likelihood of these consequences occurring is assessed using the following range of probabilities, as shown in Table 4.

Table 4 Likelihood Matrix

Likelihood	Frequency of Incident or Outbreak with Non-Chronic Health Effect	% Chance of Chronic Health Effect During Life of Project
Almost Certain	More than once a year	Over 90%
Likely	Once in 1-3 years	61-90%
Possible	Once in 3-5 years	31-60%
Unlikely	Once in 5 -10 years	6-30%
Rare	Once in more than 10 years	Up to 5%

The combination of the consequence and likelihood forms the risk level, as shown in Table 5.

Table 5 Risk Level Matrix

Likelihood	Consequence				
	Negligible	Minor	Moderate	Major	Catastrophic
Almost Certain	Medium	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	High	Extreme
Possible	Low	Medium	Medium	High	High
Unlikely	Very Low/Negligible	Low	Medium	Medium	Medium
Rare	Very Low/Negligible	Very Low/Negligible	Low	Low	Medium

Management criteria for each determined level of risk are described in Table 6 below.

Table 6 Risk Management Criteria

Risk Rating	Management Criteria
Extreme	Potentially unacceptable; modification of proposal required
High	Major management required
Medium	Management required
Low	Some management required, addressed with routine controls
Very Low/Negligible	No management required

5.5.6 Mitigation Measures and Residual Impact

Where a potential project specific risk has been identified as low (adverse) or above (i.e. medium, high or extreme), mitigation or enhancement has been considered and presented within the assessment.

Based on the outcome of the risk assessment, and considering the proposed mitigation or enhancement, the residual impact has been assessed. Residual Risk is defined as the risk remaining once controls have been put in place to reduce the likelihood or severity of a potential risk.

Where a potential risk has been classified as Very Low/Negligible, or Positive no mitigation measures are considered necessary and the residual risk has not been assessed.

Where the risk has been identified as cumulative issue, recommendations have been provided as part of the discussion around cumulative impacts. This is discussed further below.

Full details of the proposed mitigation and management for individual topics has not been presented in this assessment and reference should be made to the individual technical reports prepared in support of the EIS. For example, noise mitigation measures are provided in the Noise and Vibration Impact Assessment (Sonus, 2011). Only those that relate directly to health issues are described in this report.

5.5.7 Cumulative assessment – baseline

The baseline for assessment of cumulative impacts includes all existing developments constructed and operating in Gladstone region, and those projects that have taken a financial investment decision by January 2011. In addition to existing industry, the projects set out in Table 7 have been taken in to account for all parts of the EIS including the health impact assessment. The cumulative impact methodology was developed by Coffey Environments.

Table 7 Baseline Projects

Name of project	Proponent(s)	Status	Description
Queensland Curtis LNG Project	QGC Pty Limited (BG Group business)	EIS and supplementary EIS complete Project approved with conditions from the Coordinator General (CG). Project approved with conditions by Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) Financial Investment Decision taken 31 October 2010	Development of coal seam gas (CSG) resources in the Surat Basin. Construction of gas pipeline from the gas fields to Gladstone. Development of a liquefied natural gas (LNG) facility (12 million tonnes per annum (Mpta)) and export terminal on Curtis Island.
GLNG Project	Santos Limited (and partners Petronas, Total and KOGAS)	EIS and supplementary EIS complete Project approved with conditions by the CG. Project approved with conditions by DSEWPC. Financial Investment Decision taken 13 January 2011.	Development of CSG resources in the Surat Basin. Construction of gas pipeline from the gas fields to Gladstone. Development of a 10 Mtpa LNG facility and export terminal on Curtis Island.
Yarwun Alumina Refinery Expansion Project	Rio Tinto	EIS approved in 2007 Under construction	Development of CSG resources in the Surat Basin. Construction of gas pipeline from the gas fields to Gladstone. Development of a 10 Mtpa LNG facility and export terminal on Curtis Island.

As part of the wider EIS process, Coffey Environments has considered the cumulative impact of the project in conjunction with other existing or future projects (Coffey Environments, 2011). The projects have been chosen based on the following criteria:

- The project is currently located within the Gladstone region
- The project is being assessed by one or more of the following:

- The State Development and Public Works Organisation Act 1971 (Qld) and has been declared by the Coordinator General as a 'project of state significance' for which the status of the EIS is either complete or, as a minimum, has an Initial Advice Statement published on the Department of Local Government and Planning (DLGP) website.
- The Environmental Protection Act 1994 (Qld) and has completed an EIS or has an Initial Advice Statement (or similar) listed on the Department of Environment and Resource Management (DERM) website
- The project is envisaged in statutory planning documentation.

The projects considered in the cumulative assessment are described in Table 8 below.

Table 8 Projects included in the cumulative impact assessment

Name of project	Proponent(s)	Status	Description
Australia Pacific LNG Project	Australia Pacific LNG Ltd (ConocoPhillips and Origin Energy)	EIS complete Project approved with conditions from the Coordinator General (CG)	Development of coal seam gas (CSG) resources in the Walloon gas fields in the Surat Basin. Construction of gas pipeline from gas fields to Gladstone. Development of an 18 Mpta LNG facility and export terminal on Curtis Island.
Western Basin Strategic Dredging and Disposal Project	Gladstone Ports Corporation Limited	EIS and Supplementary EIS complete. Project approved with conditions by the CG. Project approved with conditions by DSEWPC.	Dredging associated with the deepening and widening of existing channel, swing basins and berth pockets in the Port of Gladstone. Dredging material will be placed into reclamation areas near Fisherman's Landing to create a land reserve.
Fishermans Landing Northern Expansion Project	Gladstone Ports Corporation Limited	EIS and Supplementary EIS complete. Project approved with conditions from the CG.	Expansion of Fishermans Landing by reclamation. Reclamation will provide for the containment of dredge material from future maintenance and capital dredge programs.
Arrow Surat Pipeline Project (formerly Surat to Gladstone Pipeline Project)	Arrow Energy Ltd	EIS complete. EIS assessment report received.	Construction of a high-pressure gas pipeline to transport CSG from Dalby to Gladstone
Central Queensland Pipeline Project	Enertrade (AGL Energy and Arrow Energy)	EIS and Supplementary EIS complete. Project approved with conditions	Construction of a high pressure gas transmission pipeline from Moranbah to Gladstone.

Name of project	Proponent(s)	Status	Description
		from the CG. Project approved with conditions from DSEWPC.	
Wiggins Island Coal Terminal Project	Central Queensland Ports Authority and Queensland Rail	EIS and Supplementary EIS complete. Project approved with conditions from the CG.	Development of a coal terminal (25 Mtpa initially and an upgrade capability to a nominal 70 Mpta in later stages) and associated infrastructure in the Port of Gladstone. Dredging and reclamation.
Gladstone Nickel Project	Gladstone Pacific Nickel Limited	EIS and Supplementary EIS complete. Project approved with conditions from the CG.	Development of a Greenfield high pressure acid leach (HPAL) refinery in the Gladstone State Development Area. Development of slurry and water pipeline between Marlborough and the plant site. Development of a tailings storage facility in the GSDA and ore importing facilities at the Port of Gladstone.
Gladstone Steel Plant Project	Boulder Steel Limited	Initial Advice Statement complete. EIS in progress.	Development of an integrated steel making plant (2.1 Mtpa initially and increasing to 5 Mpta in later stages) at a site in the GSDA Aldoga Precinct.
Moura Link-Aldoga Rail Project	Queensland Rail Ltd	EIS complete No supplementary required. Project approved with conditions from the CG.	Development of a new rail line via the Moura Short Line to the existing North Coast Line. Development of a rolling stock maintenance yard at Aldoga in the GSDA. Quadruplication of the North Coast Line from the new yard to east of Yarwun.
Gladstone-Fitzroy Pipeline Project	Gladstone Area Water Board	EIS and Supplementary EIS complete Project approved with conditions from the CG. Pending approval with conditions from DSEWPC	Development of an underground pipeline to connect existing infrastructure from Laurel Bank to Yarwun Development of an intake and pump station, water treatment plant, booster pump station and a reservoir.
Hummock Hill Island Community Project	Eaton Place Pty Ltd	EIS and Supplementary EIS complete Project approved	Development of a residential and tourism community, including education facilities and a golf course, to accommodate the population of approximately 4000

Name of project	Proponent(s)	Status	Description
		with conditions by CG and DSEWPC.	on Hummock Hill Island.
Boyne Island Aluminium Smelter Extension of Reduction Lines Project	Rio Tinto Aluminium	EIS and Supplementary EIS complete Project approved with conditions from the CG. Works deferred until global market for aluminium improves.	Expansion of the existing smelter to increase the annual capacity to 733000 tonnes of aluminium product.
Gladstone LNG Project	Gladstone LNG Pty Ltd	EIS and Supplementary EIS complete Project approved with conditions by DERM.	Development of a 1.6 Mpta (initial) LNG facility and export terminal at Fisherman's Landing. Environmental Authority issued 7 May 2010.

6 Consultation

To assist in validating the HIA's baseline information and provide input for the impact assessment, a number of health service providers in the Central Queensland area were invited to provide input into the HIA via phone interviews conducted during August and September 2010.

The interviews aimed to:

- Gather data from primary sources for use in the HIA.
- Confirm and better understand baseline information and potential health impacts associated with the project and other related issues.
- 'Recruit' stakeholders interested in providing comment on the HIA via the EIS process.

Representatives from the following organisations were interviewed during the preparation of the HIA:

- Gladstone Regional Council – Environmental Health
- Central Queensland Health Service District – Rockhampton Hospital (Queensland Health)
- Retrieval Services Queensland (Queensland Health)
- Gladstone Community Health Service (Queensland Health)
- Queensland Ambulance Service

- Queensland Fire and Rescue Service
- Capricorn Helicopter Rescue Service
- Central Queensland Rescue
- AGL Action Rescue Chopper
- Australian Medical Association of Queensland
- Discovery Coast Community Health Service

A number of other organisations were also contacted and invited to provide input into the assessment, but were unable to participate. These include:

- The Capricornia Division of General Practice
- Mater Misericordiae Hospital
- Bidgerdii Aboriginal and Torres Strait Islander Corporation
- Community Health Services Central Queensland region
- Nhulunda Wooribah Indigenous Health Organisation
- Women's Health Centre and sexual assault service

The key issues highlighted by the interview process are:

- The pressure on housing and subsequent increase in the cost of accommodation is expected to have a negative impact on health outcomes for lower socio-economic groups in the population.
- Health service provision in the Gladstone area is perceived as being beyond its capacity due to funding and personnel issues. The addition of more residents (temporary or permanent) will further increase the demand for services.
- Coordination of health services is required in the region to ensure the services provided are meeting the needs of residents and workers. Public and private health services need to be coordinated with input from industry.
- A number of specific health areas are expected to require additional services to cope with the forecast demand, i.e. counselling services – especially drug and alcohol and family and child services, and pregnancy and early childhood services.
- Gladstone Hospital is not currently equipped to deal with the projected influx of temporary and permanent workers/residents.
- There needs to be a plan in place to sustainably manage the influx of workers and the demand they will place on health service provision during construction, operation and decommissioning of industry.
- Emergency services and retrieval services need to have plans and maps of construction camps, helicopters' landing pads and access routes to assist with emergency responses.

These issues have been considered and incorporated where appropriate into the risk assessment process and nominated mitigation measures.

6.1 Management Plan Requirements

An Environmental Management Plan and Social Impact Management Plan are being prepared for the project.

Any mitigation or enhancement responses from this report or other reports relevant to health will be dealt with in these Management Plans.

In some health determinants, Key Performance Indicators (KPIs) that can be monitored and measured relevant to the implementation of this project have been suggested. These should also be dealt with through these Plans.

7 Baseline Information

A Social Impact Assessment has been completed by SKM (2011), which profiles the Gladstone community including gender, age, level of education and employment type. The HIA has drawn on the baseline data contained in the SIA but does not re-present it in detail in this report to avoid duplication of information.

7.1 Community Health Overview

7.1.1 Community Health Perception

Industrial activity in Gladstone has grown over the last 40 years, with the city now containing a port facility, coal-fired power station, mineral and gas processing and chemical manufacturing industries. The 28,000 ha Gladstone State Development Area (GSDA) was established in 1993 and includes an alumina refinery, chemical manufacturing complex, waste management and recycling facility and an air separation facility. There are also a number of new industrial activities proposed for the region, including several LNG projects. A 1,500 ha site has been set aside on Curtis Island specifically for future LNG projects (Coffey Environments, 2011).

The increased level of industrial activity in the region has raised community concerns about air pollution and potential health impacts (Queensland Health 2008). Health concerns expressed included cancers (specifically leukaemia), lung disease, asthma and respiratory conditions, birth outcomes and their perceived causes including particulates, coal dust, and volatile or aromatic compounds. As a result, the Clean and Healthy Air for Gladstone (CHAG) project was launched by the Department of Environment and Resource Management and Queensland Health in 2007 to gain a more detailed understanding of any health risks posed to the community from industrial activity air emissions (Queensland Health, 2008).

As part of the CHAG project, a Community Health Survey of the Gladstone Local Government Areas was conducted in 2008, with a survey population representing a total of 5.9 percent of this area (Queensland Health, 2009). The survey was conducted by Computer Assisted Telephone interviewing which randomly dialled telephone numbers. A total of 3005 surveys were completed, which have a spread of age, country of birth, gender, employment and location. Respondents ranged from 18 years to 99 years, with a mean of 46 years. The published survey provides a detailed breakdown of the survey methodology and breakdown of respondents. The survey interviewed respondents about a range of health issues, concentrating on those that could potentially be related to exposure to key air pollutants. These included perception of general health, self-reported prevalence of asthma, heart and circulatory disease, cancer, diabetes, smoking, employment and percentage of shift workers. The study did not consider the cause of any reported health issues.

Of the Gladstone Health Survey respondents, 75 percent expressed a level of concern about potential impacts of industry on health, with between 25 percent and 33 percent expressing high or extreme concern. Of those who expressed concern, 68.7 percent were concerned about the health effects of air pollution and dust.

The survey reports that Gladstone residents had a slightly poorer perception of their health status (those reporting their health as excellent, very good, good, fair or poor) compared with other Queensland and Australian respondents (excluding Gladstone), when results where compared to the National Health Survey (collated regularly by the Australian Bureau of Statistics). The study concluded that there is a statistically significant difference (p=0.49) in the self-reported prevalence of asthma in adults. No comparison of reported prevalence of asthma was made between children (2-17 years) in Gladstone and those in other areas of Queensland or Australia. The self-reported incidence of other health impacts was similar or lower in Gladstone than Queensland or Australia. The self-reported prevalence of smoking in Gladstone (21.8 percent of those aged 18 years and over) is significantly higher than Queensland (17.9 percent). The percentage of those who had started smoking under 12 years of age in Gladstone (2.9%) was similar to that in Queensland (2.3%,) and Australia (2.7%,). Gladstone has a higher percentage of shift workers (24.3 percent of those aged 20 and over), compared to Queensland (16.9 percent).

This self-reported data provides a useful assessment of the perceived level of health of the Gladstone community which are considered representative of the health impact primary study area.

7.1.2 Mortality, Morbidity and Infant Mortality Rates

Morbidity, mortality and infant mortality rates are a common method to characterise the health of a community. Mortality is defined as the incidence of death, whereas morbidity is the incidence of ill health.

7.1.2.1 Mortality

In the years 2004 to 2008 (earlier data is not considered representative of the current population; no data is published by the ABS beyond 2008) there was an average of 182 deaths per year in Gladstone due to any cause which equated to a mortality rate of 6.0 (deaths per 1000 of the population) (ABS, 2009). As shown in Figure 5, rates of death in Gladstone due to all causes were statistically similar to the mortality rate in Brisbane (6.2), Queensland (6.2) and Australia (6.1).

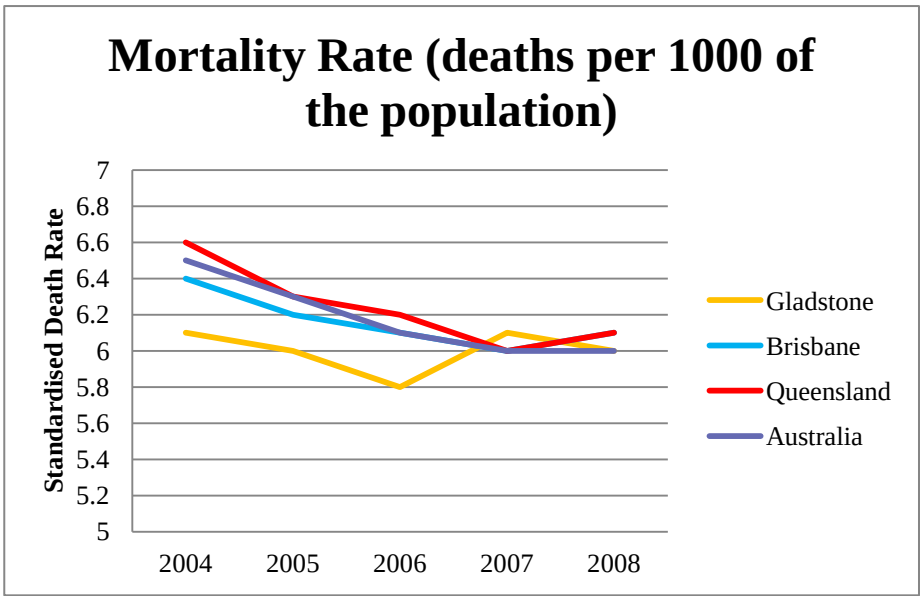

Figure 5 Gladstone Mortality Rates, 2004-2008 (Public Health Information Development Unit, 2010)

The Queensland Health Phase 1 interim report from the Clean and Healthy Air for Queensland Project (Queensland Health, 2008) examined all available health data for Gladstone and made the following findings relating to mortality:

- Overall rates of deaths in Gladstone from all causes were similar to rates of deaths in Queensland and Australia.
- For heart disease and diabetes, rates of deaths in Gladstone were similar to rates in Queensland and Australia.
- For deaths due to respiratory diseases, the Gladstone rates were similar to the Queensland rate (except in 2005 when the Gladstone rate was higher). The report does not offer an explanation for this higher rate.
- Between 1999/2000 and 2006/2007, cancers of the lung and major airways, prostate, liver, stomach and ovary, and acute myeloid leukaemia all occurred in Gladstone at rates that were similar to the Queensland rates (national rates were not discussed).

7.1.2.2 Morbidity

Morbidity rates for Gladstone are not publically available, however the Australian Health Survey of 2007-2008 (Public Health Information Development Unit, 2010), provides information on chronic illnesses which may influence morbidity rates; refer to Figure 6, below.

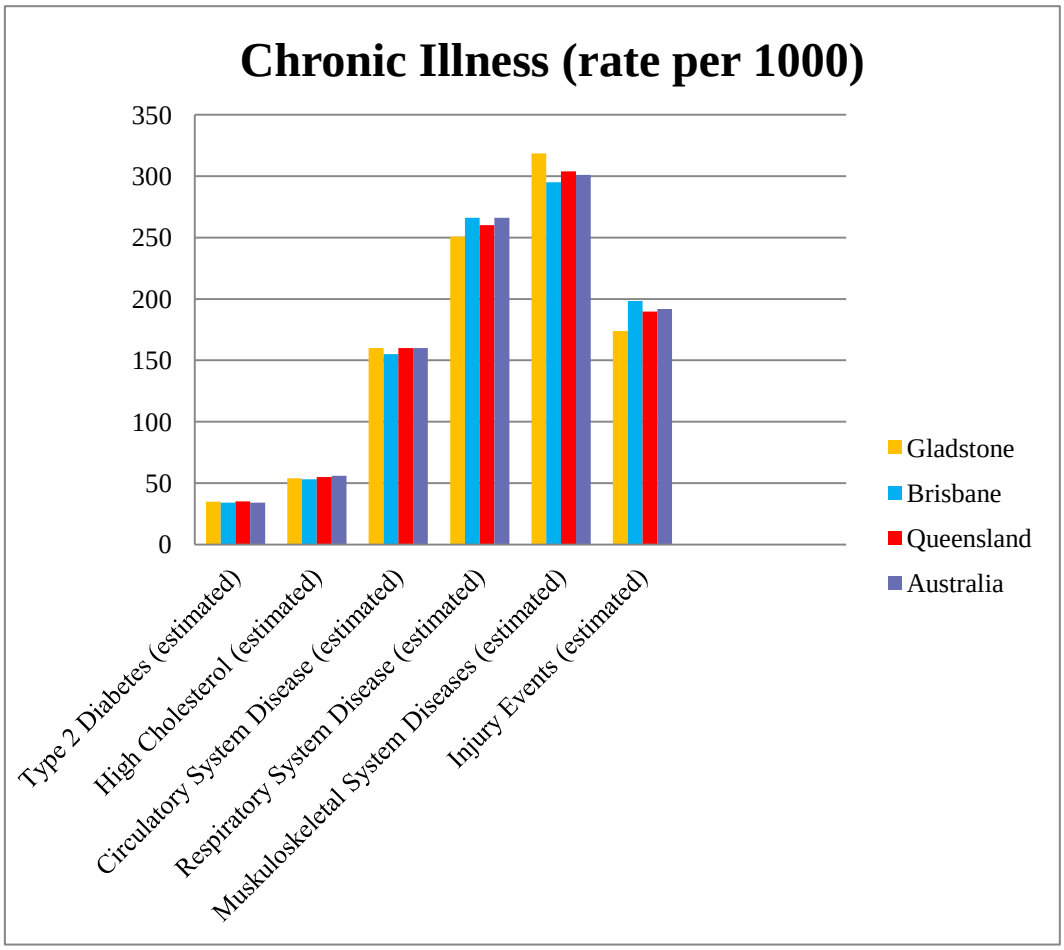

Figure 6 Chronic Illnesses 2004-2005 (Public Health Information Development Unit, 2010)

The results of the survey show that for the years 2007-2008, the rate of chronic illness in Gladstone was similar to that of Queensland and Australia. Gladstone did display a slightly higher level musculoskeletal disease (including arthritis and osteoporosis) and circulatory diseases than Australia but not a statistically significant (p=0.05) difference (rates were similar to Queensland). Gladstone had a slightly lower level of respiratory disease and a lower rate of injury events in comparison to Queensland and Australia.

When the data at an SLA level is reviewed however, Miriam Vale does have a statistically higher rate of most illnesses. Refer to Appendix A for detailed statistics.

The Queensland Health Phase 1 interim report (part of the Clean and Healthy Air for Gladstone Project); reports on health data on a number of conditions potentially related to air quality) made the following findings relating to morbidity. (Queensland Health, 2008)

- Between 1999/2000 and 2006/2007, hospitalisations for the following conditions were in some years, but not consistently, greater in Gladstone than the Queensland rate:
- Heart attack and abnormal heart rhythms.
- Chronic airways disease and respiratory tract infections.

- Diabetes.
- Hospitalisations for the following conditions were similar to the Queensland rates:
- Angina and heart failure.
- Asthma.

The Queensland Health Phase 1 interim report reviewed data at an LGA level, therefore did not draw any conclusions about spatial distribution of disease within the Gladstone LGA.

7.1.2.3 Fertility and Infant Mortality

An average of 695 children were born per year in Gladstone between 2004 and 2008, with an average fertility rate (no. of children born to a woman over her lifetime) of 2.1. This is slightly higher than the Queensland (1.9) and Australian (1.8) fertility rates. (Australian Bureau of Statistics, 2010).

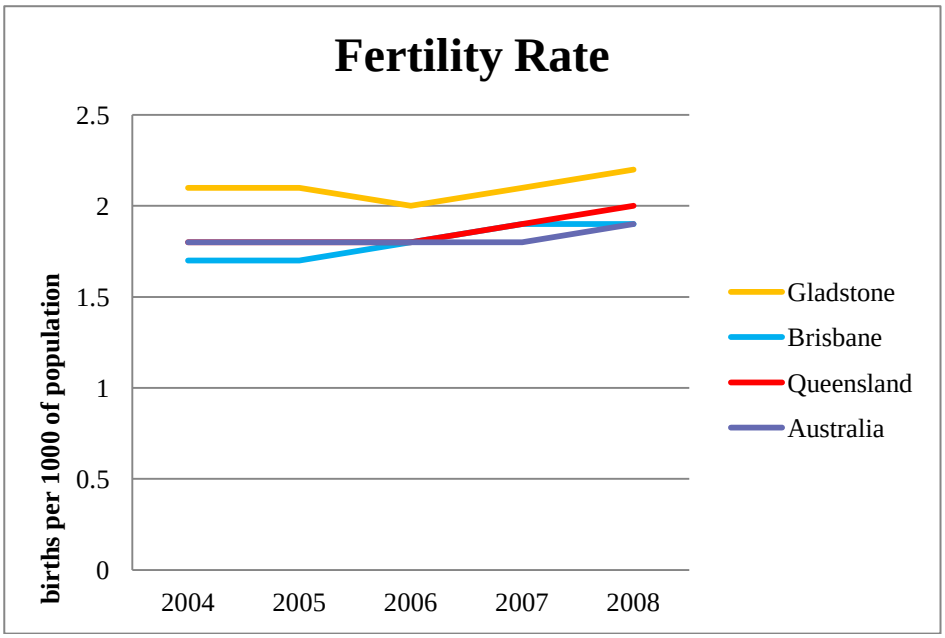

Figure 7 Fertility Rates, 2004-2008

Source: Australian Bureau of Statistics

Between 1999 and 2006, foetal deaths (stillbirths) and deaths due to congenital malformations and chromosomal abnormalities were rare in Gladstone and occurred at rates that were similar to or slightly lower than the Queensland rates (Queensland Health, 2008).

7.1.3 Mental Health

Queensland Health estimates that 16.6 percent of Queenslanders are affected by mental health disorders in any one year, or 22 percent if alcohol and drug-related problems are included. Anxiety-related and depressive orders are the most prevalent. Mental health issues cut across all age, gender and social strata.

The rate of mental health, behaviour problems and mood (affective) disorders for both male and females in Gladstone was statistically similar to the Queensland average, as illustrated in Figure 8 (Public Health Development Unit, 2010).

Mood (affective) disorders include depressive illnesses, bipolar disease and substance/illicit drug abuse issues. When the data is analysed via SLA boundaries however, it becomes apparent that mental health issues are unevenly distributed across Gladstone.

Miriam Vale has significantly higher reported mental health issues for both males and females than all other SLAs. Gladstone City consistently has the lowest level. For example, Miriam Vale has a rate of mood affective disorders in males which accounts for over double that of Gladstone city (61.7 per 1000 in comparison to 30.3 per 1000). This could be potentially linked to a number of socio-economic factors, i.e. Miriam Vale has a higher rate of residents with low-socio-economic status, unemployment and overall health risk factors (e.g. physical inactivity, smoking). It also has reduced access to health and other services in comparison to other SLAs (SKM, 2011).

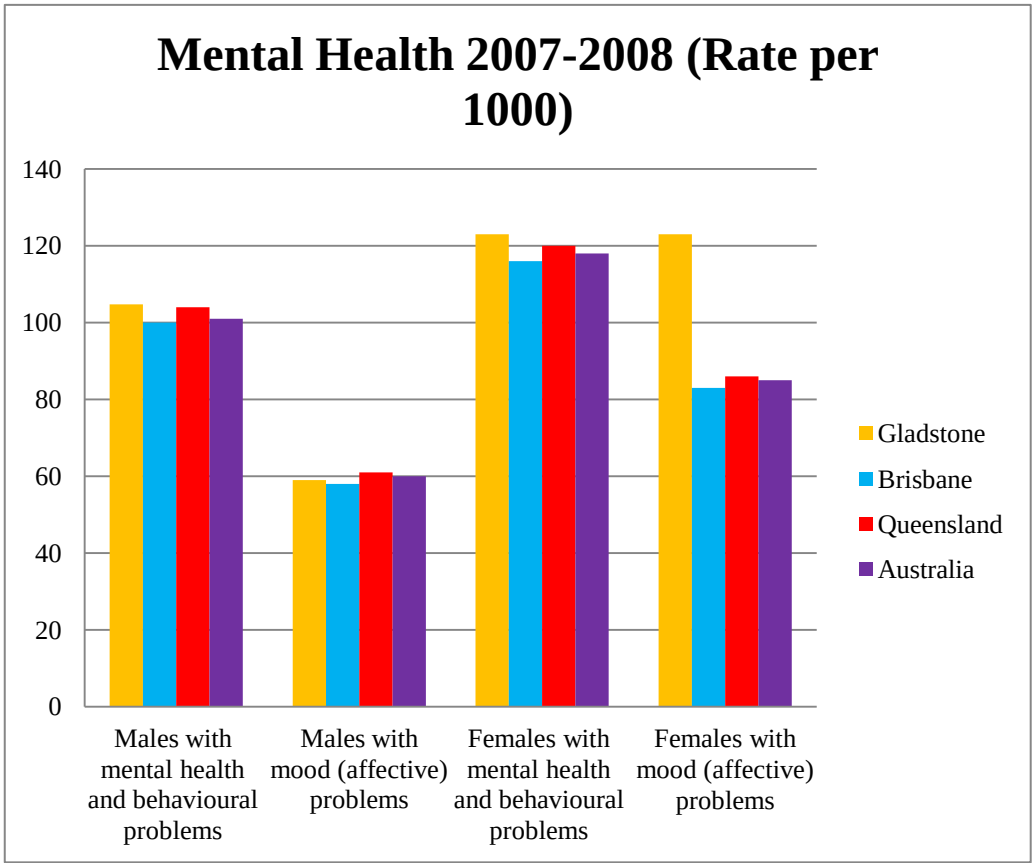

Figure 8 Mental Health (Social Health Atlas of Australia, 2010)

7.2 Environmental Determinants of Health

7.2.1 Air Quality

The TOR for the project (Co-ordinator General, 2010) requires the EIS to assess the potential air quality impacts. An air quality assessment has been conducted for the EIS to address this requirement (Katestone Environmental, 2011). This section

of the HIA focuses on the air quality baseline from a potential health perspective including consideration for the wider Gladstone area.

A study of air quality and health in Australia was undertaken by Hedley G. Peach (Environment Australia, 1997), which reviewed a number of investigations previously undertaken. It concluded there was a positive association in Australia between:

- Mortality from respiratory and other diseases and several air pollutants.
- Attendances of children with asthma at a hospital emergency department and the airborne particulate index.
- Respiratory disease admissions to hospitals and distance and place of residence from an industrial source of unspecified pollutants.

Similarly, overseas studies (Hedley G. Peach, 1997) have shown an association between:

- Air quality and all-cause mortality at high levels of sulphur dioxide.
- Sulphur dioxide concentrations and lung cancer mortality (in men).
- Total particulates and specific circulatory and respiratory diseases.
- Air quality and neonatal and post-neonatal mortality.

The final report summarising the results of the Clean and Healthy Air for Gladstone project (refer to Section 6.1) was released in 2010 (Queensland Health, August 2010). The report outlined the results of air pollutant monitoring in the Gladstone area over a 12 month period. Pollutants addressed were those known to potentially have an impact on human health and include particulate matter (PM_{10}, $PM_{2.5}$, and PM_1), coal dust, gaseous pollutants (nitrogen dioxide, sulphur dioxide, ozone and carbon monoxide), a range of metals, volatile organic compounds, carbonyl compounds, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, polychlorinated dioxins and furans, fluorides, cyanide and ionising radiation. The recorded pollutant levels in the ambient air were compared to published national or international-based standards or guidelines.

The results did not identify any key pollutants that were present at levels that consistently exceeded the relevant health-based standard or would be considered to pose unacceptable risks to health. Most of the key pollutants were present in low levels that were well below the health-based standards. The air quality of Gladstone is considered comparable to that of the urban Brisbane region (Queensland Health).

Particulate matter is known to exacerbate chronic cardiovascular and respiratory disease (Queensland Health, August 2010) and was a focus of the study. It concluded that the reported levels were consistent with relevant standards, with short term excursions above the standards associated with dust storms and fires. The instances when standards were exceeded are likely to have exacerbated symptoms in sensitive people. The report suggests that occupational exposure and cigarette smoking may also be responsible for the reported high rates of asthma.

The report also examined the effect of mixing pollutants; the cumulative impacts are still considered to be below health-based thresholds. It concludes that *'the ambient air quality in the Gladstone area meets current health-based standards*

or guidelines' and 'there are no stand-out health risks identifiable in the ambient air' (Page 21, Queensland Health, August 2010)

The release of the final report from the Clean and Healthy Air for Gladstone project has been well publicised in Gladstone and it is suggested that air quality will remain an ongoing concern for the Gladstone community.

7.2.2 Noise Quality

The TOR for project (Co-ordinator General, 2010) requires the EIS to consider the potential impacts of noise and vibration. A noise and vibration impact assessment (Sonus, 2011) has been conducted to satisfy this requirement. This section of the HIA focuses on noise from a potential health perspective.

The WHO considers that excessive noise can seriously harm human health and interfere with people's daily activities at school, at work, at home and during leisure time (WHO, 1999). Excessive noise can disturb sleep, increase stress, cause cardiovascular and psychophysiological effects, reduce immune response, cause fatigue, reduce concentration and provoke aggression and changes in social behaviour.

Low-level noise experienced as annoying or as interfering with activities or concentration, can cause stress and similar health effects as high-level noise.

To avoid sleep disturbance, the WHO suggests that the equivalent noise level (L_{Aeq}) should be limited to 30 dB(A) inside a bedroom at night. Based on the windows being partially open, the WHO suggests that to achieve the internal level described above, the equivalent noise level outside a bedroom window should be limited to 45 dB(A).

7.2.3 Visual Amenity

The TOR for the project (Co-ordinator General, 2010) requires the EIS to consider the potential visual impacts of the project including those associated with lighting. A landscape and visual assessment has been undertaken for the project to satisfy this requirement (AECOM, 2011). This section of the HIA focuses on visual amenity from a health perspective.

People can derive considerable psychological benefit from passive involvement with nature, relying on the visual amenity. The human-nature relationship can be seen to have a significant impact upon individuals and the community. It has been found that association with nature can be beneficial to psychological health (Ulrich 1979, 1981 cited in Weng, Chang, 2008).

The visual assessment highlights that the site of the LNG plant has historically been a green field site, vegetated with Eucalypt forest. However, it should be acknowledged that the view of Curtis Island is currently changing with the coastline of Queensland Curtis LNG and GLNG projects. The existing landscape will change to a lit industrial landscape as the LNG facilities planned for the Curtis Island development area are constructed.

The Arrow LNG Plant will include a steel emergency flare at 110m high, up to three concrete LNG storage tanks each at 45 m height and many steel vent stacks ranging from approximately 25m to 45m high. A large area of the site would be

occupied by residential construction camp buildings. The other projects will have similar infrastructure. In addition, LNG tankers would frequently be visible in the landscape however this is not inconsistent with current shipping traffic in Gladstone Harbour. This will be in the order of 1.5 movements per day (return average), based on the cumulative impact of 4 proponents on Curtis Island.

People will therefore experience a change in the perception of Curtis Island during the daytime and night time. For the latter, light pollution will be in the form of sky glow, light trespass and glare from the lighting of the plant, including the emergency flare. The Landscape and Visual Assessment (AECOM, 2011) acknowledges that the exact impact or acceptability of night lighting is difficult to define as it is dependent on individual perceptions and sensitivities as well as the presence of existing light at the viewing source.

The change also needs to be put in the context of the potential health impacts during construction or operation and during daytime or night time and in the perspective of the high level of existing industrial development in the Gladstone area generally.

As outlined in the Landscape and Visual Impact Assessment (AECOM, 2011), the main receptors that will be potentially sensitive to any changes in the visual environment during daytime or night time include:

- Tourists, workers and residents being ferried from Gladstone to Heron Island, Lady Musgrave Island, uninhabited coral cays and South End
- Recreational users of Gladstone Marina, Spinnaker Park, Auckland Hill/ Point, Radar Hill and Round Hill
- Users of Gladstone CBD
- Residents living in properties on the north side of Round Hill
- Residents and recreational users of Port Curtis
- Residents at South End and Farmers Point on Facing Island
- Motorists and travellers on major and minor roads in the area
- Recreational users of Port Curtis and residents in proximity to construction activities on the mainland.

This means that the project could be viewed by a large number of people living or working in Gladstone or travelling along roads and waterways within and around the study area. However, given that the LNG plant is located over 1 km from any sensitive communities/receptors and is over 5 km from Gladstone and South End, from most sensitive viewers (e.g. residents and road users), the visual impacts are limited to the changes to the attractiveness and character of the view in the day or night effects due to plant lighting.

Furthermore, the most sensitive viewpoints are from scenic lookouts and parks that may be expected to have viewers whose interest is focused on landscape appreciation, which will be partly altered with the development on Curtis Island which is currently undeveloped. However, it should be acknowledged that the view of Curtis Island is currently changing with the coastline of Queensland Curtis LNG and GLNG projects. It is also important to recognise that the

Gladstone Harbour Port is industrial in nature and forms a major part of the viewshed from many of these viewpoints.

The Landscape and Visual Assessment (AECOM, 2011) outlines that the most significantly affected views are those obtained from the waters of southern Port Curtis, due to its close proximity to the LNG plant. Views from around Tide, Witt and South passage islands are predicted to change from a predominantly natural view, to an industrial landscape during both construction and operation phases. It is acknowledged that residents would be more sensitive to light nuisance and mitigation measures may be required if nuisance is experienced, even for temporary work.

7.2.4 Food and Waterborne Diseases

Food and water can be a source of a number of major health hazards, including:

- Microorganisms such as salmonella, campylobacter, E. Coli, listeria, and cholera.
- Viruses such as Hepatitis A, and parasites.
- Naturally occurring toxins.
- Persistent organic pollutants such as dioxins, polychlorinated biphenyl compounds (PCBs) and metals such as lead and mercury.

Although there is no available data on the rate of food or waterborne diseases, Gladstone residents are assumed to have access to a reliable drinking water supply, adequate sewage treatment, good waste management and clean food. This assumption is based on fact that Gladstone is an established town serviced by Gladstone Area Water Board (GAWB) and the facilities will be controlled by strict standards, legislation and monitoring such as those specified in the Australia/New Zealand Food Standards Code and the *Queensland Food Act 2006*. Therefore it is likely that disease rates would be similar to Queensland and Australian rates where there are high standards in food and water related regulation.

Drinking water and water used for food preparation during construction and operation for the project will either be sourced from the GAWB potable water supply via a pipe from the mainland or desalination and treatment on site.

There is a potential risk that the activities at the Arrow LNG Project could impact on the groundwater of Curtis Island and this may pose a risk to drinking water quality if it is sourced from groundwater. However, Gladstone City Council have confirmed that the closest residential population (South End) do not use groundwater for drinking purposes because all drinking water is sourced from rainwater tanks or is delivered by truck (via the barge). This is therefore not discussed further in this report.

No potential risk to Gladstone town water supply or to rainwater has been identified. Again, this is therefore not discussed further within the report.

7.2.5 Food Contamination

From a land based perspective, there is currently no agricultural land within proximity of the project area that could potentially be contaminated by the Arrow LNG Plant. It should however be acknowledged that there is potential that a temporary workers accommodation facility (TWAF) will be located on an area that is currently recognised as Good Quality Agricultural Land (GQAL). It is suggested that this is a potential land use issue and not a potential health risk. It is therefore not discussed further in this report.

From a water based perspective, the waters around Curtis Island are used for seafood fishing.

The most common forms of seafood contamination are Ciguatera and various shellfish poisonings (Queensland Health, 2010), as described below:

- Ciguatera poisoning – derived from small amounts of algae and dinoflagellates that are eaten by fish (commonly larger reef fish over 6kgs) and can build up to dangerous levels that are poisonous to humans. The risk is greatest in summer months, or any time there is a large amount of algae in marine waters.
- Shellfish poisoning – caused by toxins made by dinoflagellates which can build up in shellfish. Similar to Ciguatera, poisoning is most likely to occur in the summer months, or when there is a build up of algae.

Both forms of poisoning exhibit a variety of symptoms, including vomiting, diarrhoea, headaches, low blood pressure, numbness/tingling, hives and itching. The long term health concerns from seafood poisoning are minimal, however symptoms can in some cases last for months. Deaths from toxic seafood poisoning has occasionally been recorded.

In Queensland, there was an average of 29 cases annually of Ciguatera poisoning over the 2002-2006 period (Sweeney and Beard, 2009), with cases concentrated around central Queensland (Bundaberg and the Fraser Coast). There was one death attributed to Ciguatera poisoning.

Ciguatera and shellfish poisoning is most often associated with subtropical and tropical waters and coral reef habitats. It is particularly prevalent in areas with disturbed ecosystems that have experienced pollution from industry, agriculture, sewage discharge or dredging. The latter may occur as part of the Arrow LNG project and neither commercial nor recreational fishing is restricted in the coastal waters immediately adjacent to the proposed Arrow LNG Plant.

It is believed that there are approximately 6 commercial fishing operations in the area (GHD, 2009).

In September 2011, Fisheries Queensland received reports from commercial fishers regarding a condition affecting fish being caught in Gladstone Harbour. Some fish have been found with cloudy eyes and others have lesions.

Biosecurity Queensland test results have confirmed red-spot disease and a parasite in some barramundi caught in an area centred on Gladstone Harbour. Red-spot disease is endemic and is seen in Queensland waters occasionally. The parasite is a parasitic flat worm, which is also endemic to Australia and is reported occasionally in Queensland in saltwater areas.

Fifteen people working within the harbour also reported impacts, however Queensland Health has not identified any clear link between the diseases in fish and infections in humans.

Water quality studies are being undertaken by DERM to determine the cause of the disease.

7.2.6 Surface Water

The TOR for the project (Co-ordinator General, 2010) requires the EIS to consider the potential impacts on surface water. A detailed assessment of the coastal processes, hydrodynamics and marine water quality (BMT WBM, 2011) has been undertaken to satisfy this requirement. This section of the HIA focuses on baseline surface water determinants from a health perspective. The waters around Curtis Island, particularly at South End, are used for recreational swimming and boating. This provides significant health and well-being for the community in the form of relaxation and exercise.

Port Curtis currently serves numerous large and expanding industries. These include alumina and aluminium processing facilities, a coal-fired power station, a cement works, several chemical refineries and an extensive network of shipping wharves, storage and bulk handling facilities.

The marine water quality assessment (BMT WBM, 2011) highlights the two most potentially influential activities to water quality as dredging and the potential brine outfall which would be required if a desalination plant was constructed. It concludes that the dredging activities are likely to increase turbidity at the dredge sites and the brine outfall is not likely to have a significant impact on water quality.

7.2.7 Use of Recycled Water

Australia in general and Queensland in particular has experienced drought conditions in recent years and is likely to face water shortages in the future with a changing climate. It is therefore desirable to recycle water used for the LNG plant to minimise demand on existing water supply infrastructure and to encourage conservation practices.

It is understood that there are no plans to reuse grey water or industrial water on site. This has therefore not been assessed further.

7.2.8 Infectious Diseases

7.2.8.1 Tuberculosis

Tuberculosis (TB) is a bacterial infection that mostly affects the lungs. Although the risk of developing TB is very low in Queensland (only three cases of TB are diagnosed per 100,000 people each year) (Queensland Health), Queensland Health have recently had reported cases of TB in foreign workers located in Gladstone (Pers. Comm Queensland Health – August, 2010). Overseas infection rates (particularly in Africa) are much higher (300 per 100,000), and there is some concern about foreign workers spreading the disease. TB can be cured by appropriately prescribed medications but can become a very serious disease if not

diagnosed and treated. TB also requires significant medical attention and resources (Queensland Health, 2010)

7.2.9 Vector-borne Diseases

In Gladstone, the most common mosquito-borne diseases are:

- Ross River Fever – occurs widely in Australia, with most cases occurring between February and May in central Queensland. It is spread by both fresh and salt water mosquitoes (including *Culex annulirostris, Aedes vigilax* and *Aedes notorscriptus*) which breed in still or slow-moving water. The symptoms include body ache and tiredness for up to 12 months (Queensland Health, 2010). The average annual rate of notifications in the Gladstone health service district for the period 2002 to 2006 was in the range of 100 to 199 per 100,000 (Sweeney and Beard, 2009) which is one of the highest Queensland rates (Queensland average between 2002 and 2006 was 24-66 per 100,000). A recent report by Queensland Health (Queensland Health 2010) reported that Ross River notifications for 2010 year to date (up to Quarter 2) were higher than the 5 year mean in Gladstone (59 cases) compared to the 2005-2009 mean of 18.6 cases). The 2011 flood events may have contributed to an increase in disease notifications for 2011.
- Dengue Fever – occurs mostly in North Queensland, with an epidemic declared in Cairns in 2009. The symptoms include headache, muscle, joint pains and gastrointestinal affects such as diarrhoea. Haemorrhagic syndromes caused by Dengue Fever, which can result in death, occur rarely, and manifest in individuals who are infected by different serotypes (strains). Dengue Fever mosquitoes (*Aedes egypti*) breed in freshwater environments and are mostly found in the built-up environments; in standing water such as pots, gutters, and old tyres (Queensland Health, 2010). The recorded cases in Queensland between 2002 and 2006 were between 1.2 and 19.1 per 100,000 (Sweeney and Beard, 2009) and were all recorded in Cairns, the Torres Strait and Townsville. Recent inspections by the Gladstone Regional Council did locate potential breeding sites and some evidence of the species breeding. There have been no locally acquired cases of Dengue Fever recorded in Gladstone in recent years, however, it has been suggested that it has the potential to spread from North Queensland further South with climate change (Office of Climate Change, 2010).
- Barmah Forest Virus – is the second most common vector-borne disease in Australia and has a wide distribution. Its symptoms include fever, arthritis and joint pain, but it is non-fatal. (Queensland Health, 2010). The average number of reported cases in Gladstone between 2002 and 2006 was 50 to 70 per 100,000 (Queensland Health, 2010).

There are very rare cases of Murray Valley encephalitis, Japanese encephalitis and malaria, associated with people returning to Gladstone from overseas where these diseases are more prevalent.

Insect bites can also cause considerable nuisance to some people who experience itchiness, slight swelling and redness.

Gladstone Regional Council, in association with Queensland Health, has an active vector control program, for both fresh and saltwater mosquito species (pers comm. GRC, 2010). The region has significant areas of potential breeding sites, associated with the presence of large wetland and mangrove environments. After large tides or heavy rain mostly between October and May, mosquito breeding occurs and impacts on residents, particularly around Gladstone City (pers comm., GRC, 2010). The Council carries out fogging programs at identified breeding sites on public land; treatment on private land is the responsibility of the property owner (pers comm., GRC 2010). The Council does not currently carry out extensive treatment on Curtis Island as it is mostly within private ownership and there are difficulties in accessing breeding sites. The Gladstone Regional Council Environmental Health Department have stated that mosquitoes are likely to be an issue for workers or visitors to Curtis Island unless they undergo treatment (pers comm., GRC 2010).

Due to the recent Northern Dengue outbreak there has also been a substantial public campaign to raise awareness amongst the community about Dengue Fever prevention measures.

The construction and operation of the Arrow LNG Plant will increase the amount of people in the area who potentially could be bitten by an infected mosquito.

7.3 Socio-economic Determinants of Health

A SIA has been conducted by SKM (2011) as part of the EIS to assess the potential impacts of the project on the community. This section of the HIA is focussed on the relevant socio-economic health determinants. Reference should be made to the SIA for detailed information on income, population, housing, employment, education and crime.

Socio-economic determinants of health can be defined as the economic and social conditions under which people live, which can determine their opportunity to be healthy, their risk of illness and their life expectancy (WHO, 1999). The economic status of a person can dictate their access to education, satisfactory employment, housing, participation in society, access to services and feeling in control of their life (WHO, 1999).

7.3.1 Social Disadvantage

The Australian Bureau of Statistics reported Gladstone as having a Socio-Economic Index for Areas (SEIFA) score for the Index of Relative Socio-economic Disadvantage of 1003 in 2006 (ABS, 2010). This compares favourably to Queensland's LGA average of 883 for the same time, suggesting Gladstone is significantly less socio-economically disadvantaged than Queensland as a whole.

At an SLA level, Miriam Vale had a lower SEIFA rating than other SLAs (936), with Calliope A having the least amount of socio-economic disadvantage (1037). Miriam Vale has a population with lower income levels and higher unemployment in comparison to the other SLAs, suggesting potential and actual community disadvantage.

7.3.2 Population distribution, Housing and Employment

7.3.2.1 Population distribution

In 2009 the Gladstone LGA recorded an estimated population of 59,644 people with a population growth of 3.2% between 2004 and 2009 (compared to Queensland's 2.7%) (SKM, 2011). This made it one of the most rapidly growing LGA's in the state. The population of the area is projected to grow to 98,010 persons by 2031 equating to an annual average growth rate of 2.4% (compared to Queensland's 1.8%).

The Gladstone Region Social Infrastructure Plan (Buckley, 2009) notes that the people currently moving into the area are generally either young, single workers or workers with young families, which is similar to the anticipated workforce for the project.

Compared to Queensland as a whole, the area also has a high proportion of children between 0 and 14 years but a low proportion of people aged 15 to 24 years. The former group are often more vulnerable to diseases or other potential health issues.

7.3.2.2 Employment

In 2010, the unemployment rate for the Gladstone LGA was 5.4 percent, similar to the Queensland rate of 5.6 percent (SKM, 2011). However, it was significantly higher in Miriam Vale (7.4 percent) and marginally higher in Calliope B (6.4 percent) (SKM, 2011).

The peak construction workforce for the Arrow LNG Plant (Phase 1) is predicted to reach 3,500 by 2016. During this peak, the workforce will increase the population of the area by between 4.2% and 5% dependent on the local employment that can be secured.

7.3.3 Levels of Violent Crime

The social impact assessment (SKM, 2011) notes that *a factor which heavily influences an individual's ability to enjoy their surroundings relates to feelings of safety and security. Not only does an unsafe social environment present direct risks to heath, but the apprehension and fear felt by individuals can lead to anxiety, depression and the general erosion of individual well-being. Community perceptions of safety are sometimes nebulous and difficult to measure and often highly influenced by media and other external influences.*

The study goes on to note *that levels of crime in the study area are consistent with other areas in Queensland and whilst the murder rate in the study area was three per capita compared to one for Queensland, other categories of crime against an individual were generally consistent with or lower than those for Queensland as a whole.*

In terms of 'other offences', the assessment (SKM, 2011) notes that the *Gladstone police district (which includes the study area) recorded higher rates of 'other offences' compared to Queensland as a whole, particularly in the areas of drug and traffic related offences.*

7.4 Lifestyle Determinants of Health

Smoking, drinking, drug-taking, poor diet and lack of physical activity are life-style related health determinants linked to a number of major health problems, such as cancer, cardio-vascular disease and obesity (WHO, 2010).

According to the WHO estimates, up to 80 percent of cases of coronary heart disease, 90 percent of type 2 diabetes cases, and one-third of cancers can be avoided by increasing physical activity, instigating a healthier diet and stopping smoking (WHO, 2010).

Figure 9 highlights the rate of lifestyle risk factors experienced in Gladstone. More than half of Gladstone's residents (rate of 636) display one or more lifestyle factors that may cause health issues. This is a higher rate than the Queensland (583) and Australian (559) rates (Social Health Atlas Australia, 2010).

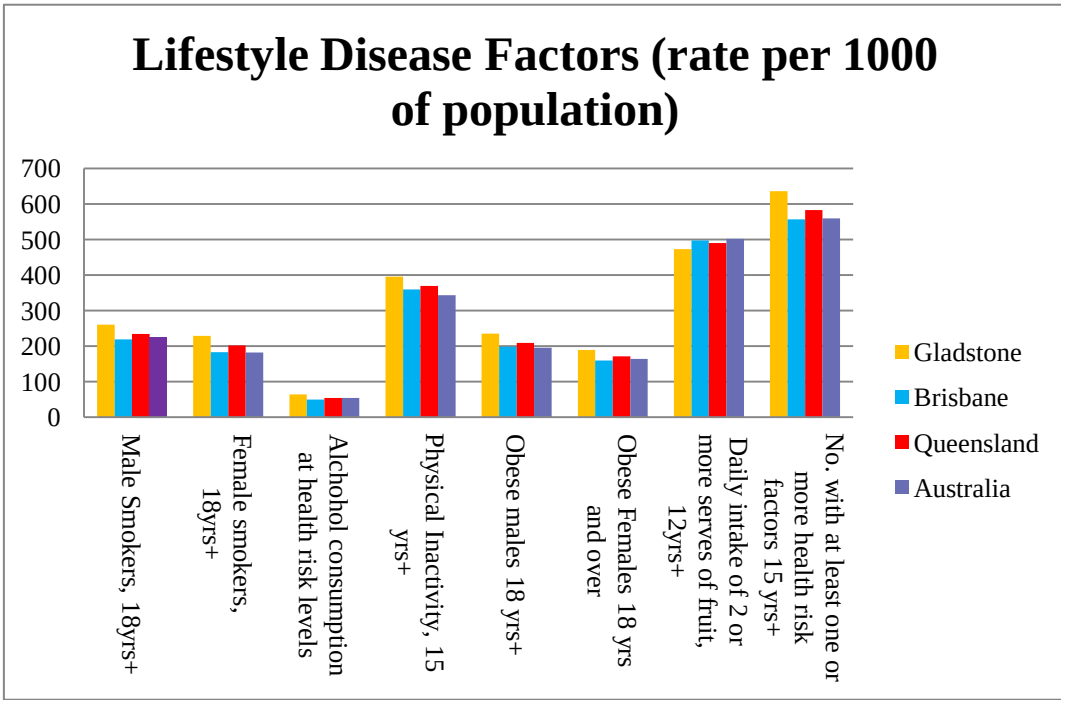

Figure 9 Lifestyle Health Determinants (Social Health Atlas Australia, 2010)

Gladstone Regional Council (GRC) has recently launched the 'Healthy Active Gladstone Region' program, which is aimed at encouraging the residents of Gladstone to be more active and healthy. There is a range of programs available aimed at residents, organisations and businesses. It has also partnered with the Mater Foundation, which has launched the Mater Healthy Start program in Gladstone to raise funds for and an awareness of health issues. The Healthy Active Gladstone Region program has recently won the 'Queensland's Healthiest Community' Award. The $600,000 prize money will help fund the program and it will also be used for community infrastructure such as fitness stations, water bubblers and shade structures.

7.4.1 Drug Use

7.4.1.1 Smoking

The rate of smoking in Gladstone between 2007 and 2008 (18 years and over) was 260 per 1000 of the male population and 229 for the female population (as seen in Figure 9). This was higher than the Queensland rate (234 for males and 202 for females) and the national (224 for males and 182 for females) rate. The reasons for the higher rate of smoking are not clear.

The Gladstone Community Health Survey (Queensland Health 2009) undertaken in 2009 found that 22.3 percent of respondents were current smokers (97 percent smoked at least once per day). Of those who did not currently smoke, 89 percent said they had smoked regularly in the past.

For those who were 18 years or older, the smoking rate in Gladstone (21.8 percent of respondents) is higher than the 2007 National Drug Strategy rate for Queensland (17 percent). The difference (4 percent) is statistically different ($p<0.01$).

The final report of the Clean and Healthy Air for Gladstone project (Queensland Health, 2010) concluded that the high rate of self-reported asthma in adults and wheezing in children could be partially explained by the higher level of smoking in the Gladstone community. It is suggested that the latter is a result of passive smoking.

7.4.1.2 Alcohol Abuse

Alcohol consumption can have both a direct health impact on the drinker (mortality, certain cancers, liver cirrhosis, psychosis, poisoning, gastritis, stroke, foetal alcohol syndrome) as well as an indirect social impact (traffic accidents, unintentional work/home accidents, road accidents, violence, crime, higher risk of unwanted pregnancy and STIs) (WHO, 2010). The direct effects of alcohol are often worsened by other risk factors, such as smoking and dietary factors, or are the underlying cause of other health issues such as mental illness.

An Australian Bureau of Statistics report (ABS, 2007) identified that alcohol is the second largest cause of drug-related deaths in Australia (after tobacco) and is the leading cause of deaths on Australian roads.

The National Health Survey (ABS, 2006) identified that the proportion of people drinking at a risky/high level nationally has increased from 8.2 percent in 1995 to 10.8 percent in 2001 and 13.4 percent in 2004-2005. Whilst there is still a higher level of males who drink at this risky/high level than females, the number of females drinking at risky levels has increased at a greater rate than males.

Queensland statistics (Chief Health Officer, 2008) show that alcohol misuse in 2005-2006 led to approximately 706 deaths annually in Queensland, of which 68 percent were male. Death rates were 80 percent higher in most socio-economically disadvantaged areas in comparison to least disadvantaged areas. Younger Queenslanders have the riskiest drinking profile with 17.6 percent drinking at levels that put them at risk of harm. There was an average of 25,621 hospitalisations annually in Queensland between 2005-2007 from alcohol misuse,

at an annual cost of over $128 million. Alcohol-related deaths in regional and remote areas were higher than in major cities.

The rate of estimated harmful alcohol consumption in Gladstone between 2007 and 2008 was 64 per 1000 of the population (see Figure 9). The rate was significantly higher than the Queensland (54) and national (54) rates.

During consultation for this project, a Queensland Health representative (Central Queensland Health Services District, 2010) observed that the incidence of alcohol and drug problems and associated intentional and unintentional violence is higher amongst industry and mining workers. These problems and acts were attributed to the workforce being predominantly male, highly paid, and single. The male workers are associated with high-risk behaviours linked to alcohol and other drugs, resulting in violence-related trauma, motor vehicle accidents, and STIs. However, no evidence or statistics were provided to prove this statement.

The level of harmful alcohol intake is higher in Gladstone than the Queensland and National rates. Crime rates (Queensland Police Service 2009) appear to support the theory that alcohol is an issue, with the number of drink driving offences recorded in Gladstone (930 per 100,000) higher than the Queensland rate in 2008/2009 (746 per 100,000). The number of Offences Against Person (including assault) and number of drug offences is also higher in Gladstone for the years 2008/2009.

There is no data to suggest that these rates are directly attributable to industry or mine workers in Gladstone. A number of past Australian studies (Midford et al, 1997; Drugs and Crime Prevention Committee, 1994, Holland, 2005, Olympic Dam Expansion EIS, 2009, Carrington, 2009 and Petkova et al., 2009) have hypothesised that temporary construction workforces associated with industry or mining projects are likely to have a high rate of alcohol and drug problems related to a number of risk factors including isolation, boredom, removal from family and lack of commitment to existing communities. This does not take into account management measures put into place by companies to reduce risk factors. Further research is required to substantiate observations made by Queensland Health.

7.4.1.3 Illicit Substance Abuse

It has been found that the likelihood of illicit drug use can be linked to a number of risk factors (Crime and Misconduct Commission, 2007). In particular, social groups of young people, males and people who have never married are identified as being the most likely to use illicit drugs. Other risk factors include sexual abuse, family violence, low education level, parental drug abuse, unemployment, poverty, crime and school-related factors such as drug-use normalisation. Conversely, there are factors that seem to decrease the likelihood of people using drugs which include being married, of stable temperament, enjoying strong family bonds, and association with peers with conventional attitudes (Crime and Misconduct Commission, 2007).

Whilst tobacco and alcohol are the drugs found to be responsible for the most harm associated with drugs in Queensland, accounting for over 90 percent of all drug-related deaths and illnesses (Queensland Health, 2006). There is a strong community perception that drug-related problems are associated with illicit drug use. However, illicit drug use does have a significant involvement in crime,

mental health disorders and the transmission of HIV/AIDS and other blood-borne viruses (Queensland Health, 2006).

The *Australian Institute of Health and Welfare* (2008) reports that the illicit drug most widely used in Queenslander is cannabis, with 12 percent of residents aged 14 years and older having used marijuana/cannabis in the preceding 12 months, and its use is most prevalent in 14-24 year olds. This is followed by ecstasy (3.7 percent) and pain killers / analgesics for non medical purposes (2.8 percent). Other illicit drug use includes meth/amphetamines, tranquilisers/sleeping pills for non medical purposes and cocaine.

Illicit drug use was responsible for 90 deaths and 4,100 hospital admissions in Queensland in 2006.

A report published by the Crime and Misconduct Commission (2007) found that the Fitzroy Region (incorporating Gladstone and Rockhampton Local Governments) had a lower rate of illicit drug use (28.7 percent) in comparison to Brisbane (31.9 percent) and most other Queensland regions. Cannabis was the illicit drug most in use (28.3 percent) followed by amphetamines (4.2 percent), hallucinogens (4.2 percent), ecstasy (2.2 percent) and heroin (1.3 percent).

It is often the case that people who misuse alcohol, cannabis or other drugs also have affective, anxiety or psychotic disorders. It is generally accepted that between 50 to 70 percent of mental health clients also have drug use issues (Queensland Health, 2006).

7.4.2 Obesity

Being overweight or obese is associated with increased risk of mortality and morbidity from a number of conditions including coronary heart disease, hypertension, non-insulin-dependent diabetes mellitus (type 2 diabetes) and degenerative joint disease. Obesity is linked to lifestyle factors such as increased consumption of foods with high levels of sugar and saturated fats, as well as a reduction in physical activity (Queensland Health, 2010).

Nationally, based on self reported data (ABS, 2007), the proportion of Australians who were classified as overweight/obese has been increasing from 50 percent in 2001 to 54 percent in 2004-05 and 56 percent in 2007-08.

The rate of obesity recorded in Gladstone between 2007 and 2008 as part of the National Health Survey was 235 per 1000 of the male population and 189 for the female population (as seen in Figure 9). This was higher than the Queensland (209 for males and 171 for females) and national (196 for males and 164 for females) rates. Levels of physical inactivity were also higher with a rate of 395.5 compared to Queensland (369) and Australia (343) (Social Health Atlas, 2010).

7.4.3 Nutrition and Food Supply

Nutrition has a strong connection to the overall health of an individual. Eating the recommended volume of fruit and vegetables can reduce the risk of stroke, heart disease and certain cancers. Whist poor nutrition can cause a variety of health issues such as obesity, heart disease, vitamin deficiency stroke and other vascular diseases (Queensland Health, 2010).

The rate of people over 12 years of age who consume the recommended daily intake of fruit in Gladstone between 2007 and 2008 was 473 per 1000 of the population (Figure 9). This was lower than the recorded Queensland (490) and national (502) rates (Social Health Atlas, 2010).

Nationally, surveys for 2007-2008 of persons aged 15 years and over noted that 56 percent of females and 46 percent of males met the recommended daily intake of fruit and 10 percent of females and 7 percent of males met the recommended daily intake of vegetables (Social Health Atlas, 2010).

The nutritional habits of individuals and families are influenced by a variety of factors including cultural background, affordability and availability of healthy food, and knowledge of nutrition.

A 2006 survey of the cost of a healthy food basket in Queensland (Queensland Government, 2006) showed that the average cost in inner regional areas (including Gladstone) was similar to that of major cities ($459.49 for a family of six for two weeks, compared to $457.46). In terms of the availability of healthy foods, inner regional areas had a similar range of fruit and vegetables to that found in major cities. It was noted that the cost of healthy food has increased more than the cost of less nutritious alternatives.

This indicates that healthy food is not more expensive or less available in Gladstone and is therefore not contributing to the low rates of healthy intake of fruit and vegetables.

7.4.4 Road Safety

A traffic assessment has been prepared as part of the EIS. This section of the HIA focuses on the traffic baseline information from a potential health perspective. The Queensland Department of Transport and Main Roads have identified road toll comparisons for the 2008/2009 period. The central region, in which Gladstone is located, had 55 road incidents causing death in 2009. The 2009 figures were a 66.7 percent increase on 2008 where 33 fatalities were reported.

The Royal Automobile Club of Queensland (RACQ) has collected data (unpublished) regarding the number of accidents that are attributed to excessive drug or alcohol use, as provided below.

Table 9 Gladstone region accidents attributed to alcohol/drug use

Year	2004/2005	2005/2006	2006/2007	2007/2008	2008/2009
Alcohol/drug related crashes	9	22	18	27	31

Within the Gladstone region there exists a number of campaigns and mechanisms that aim to increase road safety. Some of the programs are state-wide but incorporate Gladstone: they include driver reviver stations, child restraints, a cycle safety program, anti-drink walking, safe school travel, rider survivor, B-Triple road network access and the $70 million Calliope Range Realignment (Queensland Transport, 2010).

7.4.5 Sexual and Other Health Behaviours

7.4.5.1 HIV

Up to 31st December 2008, there had been a total of 2,863 cases of HIV infection recorded in Queensland (Queensland Health, 2009). Approximately 40 percent of these cases have been diagnosed with AIDS, with 709 AIDS deaths recorded during the reporting period. AIDS diagnoses and AIDS-related deaths have declined sharply since the mid 1990s. The Australian Bureau of Statistics (2008) cites that this could be due to the introduction of combination antiretroviral therapy for the treatment of HIV infection in 1996. In contrast, HIV notifications in Queensland have risen by 74 percent between 2001 and 2008.

Homosexually active men are accountable for the majority of new notifications in Queensland (approximately 75 percent). For women, rates are highest for those who originate from a high prevalence country or have a sexual partner from a high prevalence country.

Central Queensland, of which Gladstone is a part, recorded 32 cases of HIV and 8 cases of AIDS in 2008. This is low in comparison to the southern metropolitan region which recorded 374 cases of HIV and 80 of AIDS in the same period (Queensland Health, 2009).

7.4.5.2 Hepatitis C

Between 2004 and 2008 Queensland Health received 13,359 HCV notifications (the virus that in the majority of cases develops into chronic Hepatitis C) (Queensland Health, 2009). It can result in liver disease such as cirrhosis, liver failure and liver cancer. Rates in Queensland were 69.9 per 100,000, which is higher than the national rate of 60.4 per 100,000 (Sweeney and Beard, 2009). Rates in Gladstone were recorded as being significantly lower than other regions in Queensland (less than 50 per 100,000 between 2002 and 2006). HVC transmission is predominant among people with a recent history of injecting drug use (more than 75 percent), and is more prevalent in males (62 percent in 2006). Other risk factors include receiving tattoos and transplant/transfusion (Queensland Health, 2010).

7.4.5.3 Other STIs

Sexually transmitted infections (STIs) can lead to an increased risk of infertility, cervical cancer and other chronic health issues (Queensland Health, 2010).

Infection rates of Chlamydia have increased since 1999 (90 percent for females and 112 percent for males). Chlamydia is the most commonly notified STI in Queensland with 15,009 notifications in 2008. Gonorrhoea notifications have also increased with 1,197 cases during 2004. Both Gonorrhoea and Chlamydia are disproportionally represented in indigenous populations, young people (aged 15-20) and women (Queensland Health, 2010).

In Queensland, 2008, there were 204 notifications of Syphilis, which is an 86 percent increase since 2004 (Queensland Health, 2010). For the Aboriginal and Torres Strait Islander population, Syphilis decreased by 49 percent. For the non-Aboriginal or Torres Strait Islander population, the syphilis notification rate

increased threefold, with males comprising 93 percent of these cases. Notifications in this category are mostly associated with homosexual sex.

7.5 Social Infrastructure Determinants of Health

The availability of social infrastructure such as cultural and recreational facilities can influence a person's health through the provision of relaxation or physical activity opportunities or the encouragement of social interaction. Communities that have strong social infrastructure and community networks generally experience a higher level of wellbeing (Queensland Government, 2005).

Swimming, boating and fishing are very popular recreational pastimes in Gladstone. There are also a large number of sporting clubs and services available. The Gladstone Wellbeing Study (Hornery Institute, 2010) noted that there is a level of importance placed on Curtis Island by the community as a natural environment in which to undertake recreational pursuits.

7.5.1 Recreation facilities

The Gladstone Wellbeing Study (Hornery Institute, 2010) was conducted in 2010. It consulted with the Gladstone community and identified the perception that the region was overly-dependent on cars and lacked infrastructure for walking and cycling. While pride in the range of recreation infrastructure and sporting facilities was expressed, it was felt these were 'second rate'. There was also a concern about the decreasing affordability of sport and recreation, thereby reducing access to the broader population.

The Arrow LNG Plant's SIA (SKM, 2011) also determined that there is a shortage of recreational land and facilities in the Gladstone region.

7.5.1.1 Access to Cultural Capital

The region also holds a number of cultural events such as multicultural festivals, markets, rodeos, and yacht races and it enjoys a high level of volunteerism. The city also provides cultural infrastructure, with the Gladstone Entertainment Centre, and the Gladstone Regional Art Gallery and Museum located in Gladstone City. The region boasts significant tertiary facilities; the Central Queensland University and Central Queensland both have branches. There are six small libraries servicing smaller centres and one regional library (Gladstone Regional Council, Sept 2010).

A 2008 community survey undertaken as part of the Gladstone Regional Visioning Project (Futureeye, 2008) identified that residents most value the sense of community in Gladstone and the lifestyle associated with the city's natural environment. The survey noted that there appears to be some level of conflict experienced by residents regarding the need to balance the industrial development of Gladstone with maintaining the natural environment and relaxed lifestyle that attracts people to the region. Further industrial development is supported due to its accompanying economic value, provided it can deliver effective community benefits.

The Fitzroy area (comprising Gladstone and Rockhampton Councils) has a strong level of volunteerism with a 23 percent annual volunteer rate for 2006. This is

compared to 19 percent for Brisbane and 20 percent for Queensland (Department of Communities, 2008).

7.5.1.2 Access to Social Infrastructure

A social infrastructure needs assessment for Gladstone (Buckley Van et al, 2009) identified the following needs regarding social infrastructure in the Gladstone LGA:

- There is a need for youth friendly areas such as youth centres, improved Police Citizens Youth Club (PCYC) and skate parks.
- There is an under-resourcing of youth services such as programs to prevent disengagement and antisocial behaviour, more affordable and accessible entertainment, specialist counselling, resources for homeless youths, and drug and alcohol programs.
- There is a need to build the capacity of local organisations (rather than outsourcing from Rockhampton) that foster social interactions such as dog parks and community gardens.
- Upgrading of library facilities will be needed as the population grows.
- Several small performing arts spaces could be desired in the long-term.
- An improvement in facilities and information/services for multicultural community members is needed.
- Additional playgrounds, sporting facilities and active recreational parks will be required to cater for the growth in population.
- There is a demand for an increased network of walking and cycling facilities.
- There is a lack of childcare and after hours care.

The study also found that services to welcome new residents to the community, such as partners and family of those employed in workers camps that may otherwise experience social isolation, could be improved.

Access to public transport is also an issue in smaller, regional communities where low-income households are more likely to be located (e.g. Miriam Vale) as housing is cheaper and more readily available. The report found that this lack of public transport has increased demand for outreach health and social services.

From a positive perspective, the assessment highlighted that there is an adequate supply of community meeting places and religious facilities for the current and future population.

Gladstone Regional Council has recently prepared a Social Infrastructure Management Plan to address some of the issues raised in the Needs Assessment. The Social Infrastructure Voluntary Industry Contributions Framework for Gladstone (Gladstone City Council, 2010) provides a list of social infrastructure needed within the region such as sporting, cultural, and aged persons and indigenous social facilities or services. Its purpose is to allow major companies to contribute to the provision of social infrastructure.

7.6 Institutional Determinants of Health

Community access to quality and affordable health infrastructure and services is a key determinant of health. This section describes the current operation and future direction of primary healthcare services in Gladstone and secondary referral areas (Rockhampton and Brisbane).

7.6.1 Hospitals and Community Health Services

The Gladstone Hospital contains 69 beds, including four high dependency units and 65 general medical and surgical beds. The Gladstone Hospital is staffed by a physician, surgeon, paediatrician, obstetrician, gynaecologist, eight senior medical staff and nine junior medical staff. It is able to perform simple surgery. There is also a private hospital in Gladstone (Gladstone Mater Private hospital, 2010).

Rockhampton Hospital (located approximately 110 km north, or an hour and a half away by car and 10 minutes by helicopter) is the main referral hospital. In particular, it provides specialist medicine, surgery, obstetrics/gynaecology, paediatrics, rehabilitative and psychiatric care. For disadvantaged patients, travel to and from Rockhampton Hospital can be difficult as public transport options between Rockhampton and Gladstone are limited. Other options include the Prince Charles Hospital, the Royal Brisbane and Women's Hospital, or the Royal Children's Hospital which are all located in Brisbane (approximately 530 km south). Queensland Health has plans to expand the Gladstone Hospital, particularly its obstetric services.

There are community health centres in Gladstone City, Miriam Vale and Agnes Water. The community health service is the public allied health service for Gladstone. The centres' services include physiotherapy, occupational therapy, and dietetics. During consultation for this project, the Community Health Centres have commented that some of their services have long waiting lists (up to 12 months). The waiting lists are due to lack of funding and a lack of private sector services that is placing pressure on public services, particularly speech therapy, dietetics and occupational therapy. It is thought that an influx of industry workers would increase the need for physiotherapy and occupational therapy associated with work-related injuries.

The Gladstone Regional Social Infrastructure Strategic Plan Needs Assessment (Buckley Van et al, 2009) predicts that a large increase in beds at Gladstone Hospital will be required by 2031 as the population increases. It also advocates an additional community health centre at Boyne Island/Tannum sands by 2021 and a small centre at Calliope, Turkey Beach. This analysis was confirmed by Queensland Health during consultation (Central Queensland Health Services District, 2010) which has noted that current public health infrastructure cannot support dramatic increases in demand and utilisation. Redevelopment of the Gladstone Emergency Department is a priority for the Central Queensland Health Service District, as a response to the anticipated increase in industry workers. It was also noted that the Gladstone Hospital has no Intensive Care Unit (ICU), thereby increasing pressure on local retrieval services that would be required to divert significant trauma patients to Rockhampton or Brisbane.

A detailed description of existing services provided is detailed in Table 10.

Table 10 Hospital Services in the Gladstone Region (Queensland Health, 2010)

Facility	Description
Gladstone Hospital	Emergency, outpatients, general medicine and day surgery, basic orthopaedics, obstetrics and gynaecology, medical imaging, pharmacy, pathology and central sterilising.
Gladstone Mater Private Hospital	General surgery, general medicine, obstetrics and gynaecology, oncology and palliative care, after hours medical service, radiology, pathology and visiting specialist clinics.
Rockhampton Hospital	Red Cross Blood Transfusion Service, Emergency Medicine, Anaesthetics, Radiology & Ultrasound, Specialist Outpatient Department review, Central Sterilising Services & Supply, Rehabilitation, Renal, Coronary Care, Intensive Care, Palliative Care & Chemotherapy, Day Surgery Unit, Operating Rooms, General Surgery, General Orthopaedics, Visiting Urology, Visiting Neurosurgical, ENT, General Medicine, Visiting Facio/Maxillary, Obstetrics & Gynaecology, Visiting Haematology, Visiting Rheumatology, Visiting Oncology, Paediatrics, including Neonatal (Special care nursery), Visiting Paediatric Cardiology, General Respiratory Medicine.

The Gladstone Regional Social Infrastructure Strategic Plan Needs Assessment (Buckley Vann et al, 2009) suggests that there is a significant need for more acute oncology and renal dialysis services because travel to Rockhampton is particularly onerous for people with these conditions.

The number of specialists per capita in Gladstone is approximately half the national average; however there are a number of visiting specialists and higher level services are provided in Rockhampton. Nonetheless, additional specialists are required to service future growth in the population and because Queensland Health reports difficulties in attracting and maintaining appropriately trained staff.

The number of General Practitioners (GPs) appears adequate, according to the Needs Assessment (2009) However, it identifies that after-hours, weekend and bulk billing services are not sufficient, thereby placing pressure on the Gladstone Hospital emergency department. There are a total of 17 GP clinics registered in Gladstone at present. Access to after-hours services has been raised as an issue in community surveys. Access to after-hours services may be a significant issue for the project, as employees living in the community are likely to work irregular hours due to shift work. The Capricornia Division of General Practice is a not-for-profit group that works with GPs and other health service providers to improve the quality and accessibility of health care. It supports approximately 143 GPs in the Rockhampton and Gladstone region through training and programs for mental health, community nutrition, chronic disease management, immunisation and remote community health. (Capricornia Division of General Practice, 2010).

Gladstone Public Hospital works under the jurisdiction of Queensland Health. As with all hospitals managed under Queensland Health, the Australian Medical Association (AMA) has undertaken general assessments of services. The general assessment for Gladstone Public Hospital is reported by the Australian Medical Association Queensland (2010), with the following findings. The elective surgery waiting periods is a key performance indicator for most specialist hospitals. The Gladstone hospital elective surgery general waiting period has had a 31 per cent decrease since 2007; long waits have also decreased by 82 per cent. The median

waiting time from arrival at the Emergency Department to admission is one of the shortest of the 27 hospitals included in the general assessment.

7.6.2 Other Health Services

7.6.2.1 Disability Services

The Department of Community (Disabilities Services) is the primary government organisation that provides disability services in Gladstone. There are currently only two providers of overnight respite care for people with disabilities (Australian Medical Association, 2010). Consultation undertaken for the *Gladstone Infrastructure Needs Assessment* (2009) suggested that the provision of respite care is not meeting current demand and additional respite is required. It recommends that a new specialised 24 hour purpose-built respite facility be provided, or that the two existing centres be expanded. There are three providers of day-based care, and it is suggested that additional places are needed.

Housing for people with a disability is also a key need, with only one identified provider of residential care which caters for six clients and one emergency unit. Some limited accommodation is available in aged care facilities (Buckley Vann et. al, 2009).

7.6.2.2 Mental Health Services

There are currently two groups that provide mental health services in Gladstone. The first is the Gladstone Community Mental Health Centre which provides assessment and treatment services for all ages as well as education programs. The other is the Community Solutions Support and Mentor Program, which functions to provide treatment and to progress patients back into the community. Consultation has identified that greater provision of mental health services would be beneficial.

The Capricornia Division of General Practice provides a number of free qualified mental and allied health professionals who can assist with psychological programs for patients (Capricornia Division of General Practice, 2010).

Emergency after-hours mental health care is provided by the Gladstone Hospital.

7.6.2.3 Alcohol, Tobacco & other Drugs Service

An Alcohol, Tobacco and Other Drugs Services (ATODS) is provided by Gladstone Hospital. The service offers access to anti-smoking information (e.g. the QUIT Helpline) and drug and alcohol counselling. Acute cases are referred to the Gladstone Hospital by GPs. Non-urgent cases are handled by GPs, who may refer a patient to local counselling or psychiatric services.

7.6.2.4 Healthy Lifestyle Programs

The Gladstone Community Health Services provides ‘Lighten Up’ and healthy weight programs in conjunction with chronic disease management programs around diabetes and renal, pulmonary and cardiac diseases. They also provide

information to the community on healthy lifestyles, physical activity and good nutrition (Gladstone Community Health Services, 2010).

7.6.2.5 Child, Adolescent and Family Support Services

Currently, there are two child and family health services based in central Gladstone. There is also one in Agnes Water and one in Miriam Vale. Their services include infant care, screening for child abnormalities (e.g. hearing, vision), parenting classes, immunisation, healthy decisions, youth workers and drug counselling.

The Community Health Services has noted that the need for pregnancy and services for early childhood is increasing as workers with families are being attracted to the area because of industrial projects. The need is reflected in the most recent statistics (SKM, 2011), which reveals that Gladstone has a significantly higher proportion of people between 0 and 14 years than the Queensland average.

7.6.2.6 Women's Shelter and Physical Abuse Services

There are several health services that centre on women and issues of physical abuse in the Gladstone area. These can be categorised into women's specialist services and women's abuse services. The former includes the Women's Health Specialist, offering obstetrics, gynaecological and general health support. Further services available in Gladstone include paediatricians and maternal and child health care. Women's abuse services offer women's and children's shelters as well as sexual/physical abuse support and women's health education. They are offered by OZCare Women's Refuge and Gladstone Women's Health Centre.

7.6.3 Indigenous Services

Nhulundu Worribah Indigenous Health Organisation (Nhulundu Worribah) services the Murri communities in Gladstone, Boyne Island, Tannum Sands and Calliope.

Regular health clinics are coordinated every week. Influenza and pneumonia immunisation clinics run twice a year as well as regular high school visits to check blood pressure, blood sugar, hearing, weight and height. Specific women's and men's health checks are run throughout the regions. There is also a visiting child health clinic and, in the recent past, there has been a visiting psychologist (Nhulundu Worribah Indigenous Health Organisation, 2010). As well as coordinating its regular projects, there are some programs that are run on demand. A healthy weight program was recently trialled as a result of consultation with the community.

Nhulundu Worribah has recently been grated $500,000 from the Federal Government to deliver a program to reduce the incidence of smoking among indigenous people and to support Healthy Lifestyle workers to improve nutrition and physical activity. (Nhulundu Worribah Indigenous Health Organisation, 2010).

7.6.4 Emergency Response Capacity

7.6.4.1 Queensland Ambulance Service

The majority of emergency trips are handled by the Queensland Ambulance Service, which has stations located in the townships of Agnes Water, Calliope, Gladstone, Miriam Vale and Mount Larcom. The service works closely with rescue helicopters based at Rockhampton and Mackay and with the Royal Flying Doctor Service fixed wing aircraft, also based at Rockhampton.

In the period 1 July 2009 to 30 June 2010 the central region's response times (50th percentile) were 7.5 minutes for Code 1 (emergency) calls. In that same period 58,340 incidences occurred that required ambulance assistance; this is approximately 7.8 per cent of the total number of incidences in Queensland (Queensland Ambulance Service, 2010).

7.6.4.2 State Emergency Services

The State Emergency Service (SES) assists people and communities in times of natural disasters and emergency situations. There are eight units in the Gladstone LGA, with the regional headquarters based in Rockhampton. The Gladstone *Infrastructure Needs Assessment* (Buckley Vann et al, 2009) has concluded that the Gladstone, Mount Larcom and Agnes Water SES facilities are adequate at present. Modifications are desired at Calliope, Tannum Sands, Miriam Vale and Rosedale/Baffle Creek to cater for future community needs.

7.6.4.3 Police and Fire Services

There are two police stations located in Gladstone and one in Calliope. There is one permanent fire station in Gladstone (located in Gladstone city SLA), with a further station proposed at Agnes Water. Auxiliary stations are also located in Calliope and Miriam Vale. The region's communication centre is located in Rockhampton.

7.6.4.4 Retrieval Services

Retrieval Services Queensland (RSQ) is operated by Queensland Health, which coordinates aeromedical retrieval services for Queensland. The RSQ organises helicopter or road pick up of injured or ill patients. Its two main coordination centres, Brisbane and Townsville, direct the following activities:

- On-site accident, pre-hospital and inter-facility air retrieval responses to a higher level of care facility
- Identification of the most appropriate health facility destination and clinical escort requirements in accordance with the patients needs.
- Regional road based resource disputation.
- Multiple casualty incidents.
- Contracted retrieval services and their clinical performance.

- Liaison with Queensland Ambulance Service, Royal Flying Doctor Service and contracted retrieval services to optimise patient care and safety.
- Development and implementation of State-wide retrieval policies and standard operating procedures.

Helicopters are sourced from Rockhampton (Capricorn Helicopter Rescue). It is estimated that the mobilisation time is 40 minutes to reach Curtis Island. The majority of patients are taken to Gladstone Hospital, which has a helicopter pad. Acute patients that require services not available at Gladstone are taken to either Rockhampton Hospital or Royal Brisbane Hospital (RSQ, 2010).

Central Queensland Health Service District (CQHSD) (2010) noted that major traumas (potentially increased by increased industrial activity) would be sent to Rockhampton or Brisbane. This action has the potential to place increased pressure on retrieval services. Additionally, Gladstone relies on specialist care in Rockhampton. An increased population would place more demand on retrieval services.

8 Potential Health Impacts

As described in Section 5.5.5, an assessment of potential impacts of the project on the health of Gladstone was undertaken, using a risk assessment approach. Appendix B contains the full risk assessment that was undertaken with input from a range of health professionals, EIS specialists and Arrow Energy representatives. It considered vulnerable groups, contributing project factors, the capacity of health services to manage the issue (it considered both funding and current resources) and the likely health risk. The health risk can be ranked as Extreme, High, Medium, Low or Very Low/Negligible.

The following section is a summary of the health issues and potential impacts on health without any mitigation. It is based on the health baseline data, consultation process and issues identified during the risk assessment process. It includes both construction and operational risks. This section focuses on the issues related to the project, and does not address general community health issues already experienced in Gladstone.

8.1 Environmental Determinants of Health

8.1.1 Air Quality

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Very Low/Negligible

Construction activities will generate air emissions from engine exhausts, generators, dust from earthworks, vehicle movements and concrete batching. The majority of these emissions will be confined to Curtis Island which is isolated from sensitive receptors. Whilst mainland works will occur, construction activities will be short term and transient. Furthermore, the construction activities on the mainland are located away from sensitive receptors.

The health risk associated with construction phase air emissions is rated as **Low**.

During commissioning of each train or if there are upset conditions during operation, the disposal of gases will be carried out through process flares.

The Air Quality Impact Assessment (Katestone Environmental, 2011) concluded that all air quality objectives will be met for routine and non-routine operations of the LNG plant at sensitive receptors for pollutants that can impact on human health (nitrogen dioxide, carbon monoxide, particulate matter, odour, ozone, sulphur dioxide and hydrocarbons).

The health risk associated with air emissions from the project during commissioning and once it is operational is therefore rated as **Very Low/Negligible**. This is therefore not assessed further with this report.

Overall, the project therefore will not pose a health risk for Gladstone residents due to a deterioration in air quality.

8.1.2 Noise Quality

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Low

Construction will occur at a number of locations, including the LNG Plant, construction camps and launch facilities on the mainland. The noise quality assessment (Sonus, 2011) observes that the predicted noise levels (without any noise attenuation or mitigation) will exceed the WHO night-time criterion of 45 dB (A) at the closest sensitive receptor to the site during construction of the LNG plant, construction camps and marine facilities.

The predicted noise level from the construction of the gas pipeline will achieve the night-time criterion at all sensitive receptors. Noise from construction activity at the laydown areas, launch sites and dredging activities will also achieve the criterion at all assessment locations except at Boatshed Point.

Noise associated with operation of the construction camps include vehicle movements and air conditioning. It has been assessed that noise emitted from the camps will meet the criterion at all assessment locations.

Based on this assessment, sensitive receptors on Tide and Witt Islands may experience noise disturbance during construction without mitigation measures being applied, but other sensitive receptors on the mainland should not experience nuisance noise that disturbs sleep, potentially causing health impacts. The potential health risks associated with noise disturbance from construction of the LNG Plant and auxiliary facilities are therefore rated as **Low**.

The noise quality assessment (Sonus, 2011) predicts that the noise level from the operation and of the LNG Plant and flaring will be exceeded at Boatshed Point only without the application of noise treatment measures. It is not predicted there will be an exceedance of the WHO Guidelines at other mainland receptors. The only sensitive receptors within the vicinity of Boatshed Point that may experience sleep disturbance should no noise mitigation measures be put in place are residents of Tide and Witt Islands.

The potential health risks associated with noise disturbance from the operation of the LNG plant are therefore rated as **Low**.

8.1.3 Visual Amenity

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Low

The LNG plant has potential to impact landscape and visual values of the area due to activities during construction (including vegetation removal) as well as during operation. The existing landscape will change dramatically to a lit industrial landscape as the LNG facilities are constructed. People will therefore experience a change in the perception of Curtis Island during the daytime and night time.

It should also be acknowledged that the view of Curtis Island will gradually change over the coming years as the Queensland Curtis LNG and GLNG projects are constructed.

However, given the distance to the predominant sensitive receptors, no prolonged health impacts are expected. The potential health risk during construction and operation is therefore rated as **Low**.

8.2 Food and Water-borne Disease and Contamination

8.2.1 Drinking water contamination

Unmitigated Construction Risk Rating: Very Low/Negligible

Unmitigated Operational Risk Rating: Very Low/Negligible

Assuming that drinking water and water used for food preparation during construction and operation is sourced from potable water supply, there would be a very low/negligible health risk.

If onsite desalination and treatment is progressed as an option for the water supply, the facilities shall have to comply with the WHO Guidelines for Drinking Water Quality (Queensland Health, 2010) and the Australian Drinking Water Guidelines (Queensland Health, 2010). Both guidelines provide comprehensive health-based criteria for providing safe-drinking water covering aspects such as microbial, bacterial, chemical and radiological impacts. Therefore, once again there would be a **Very low/Negligible** health risk. Drinking water is therefore not discussed further within this report.

8.2.2 Seafood Poisoning

Unmitigated Construction Risk Rating: Very Low/Negligible

Unmitigated Operational Risk Rating: Very Low/Negligible

There is potential for coastal water contamination, with the most significant risk likely to occur during the construction phase of the project. These potential impacts are from:

- Dredging
- Clearing of marine and estuarine vegetation
- Boating and shipping activities and accidents
- Introduced species and pest species
- Desalination including the brine outfall (if required)
- Stormwater runoff.

These impacts have the potential to cause deterioration in the health of commercial or recreational fishery stocks (fish or shellfish) which may then influence human health through the risk of seafood poisoning. The cause of recent reported health issues with diseased fish in Port Curtis are not known, but are under investigation.

Furthermore, introduced and pest species have the potential to cause an impact to water quality which could in theory impact on seafood, however, given past trends and current protocols the invasion of exotic species in Port Curtis, the Great Barrier Reef Marine Park and the Great Barrier Reef World Heritage Area has been assessed as insignificant (Coffey Environments, 2011).

The potential health risk associated with seafood poisoning during construction has been assessed as **Very Low/Negligible**. This may be revised following the results of investigation into the recent outbreak of Red Spot Disease. During operation, the potential health risk has also been rated as **Very Low/Negligible**. This is therefore not discussed further in this report.

8.2.3 Surface Water Contamination

Unmitigated Construction Risk Rating: Very Low/Negligible

Unmitigated Operational Risk Rating: Very Low/Negligible

As discussed above, there are potential impacts to surface water from the construction and operational activities including dredging, vegetation clearance shipping and desalination (if required).

There is therefore potential that recreational users could be exposed to water pollutants through physical contact or ingestion, which could have either direct health impacts or restrict recreational use of the surrounding area.

However, the LNG plant is around 5 km from the nearest swimming beach at South End, it is therefore not expected to physically restrict use for this purpose.

Furthermore, the water quality assessment (WBM BMT, 2011) notes that any construction or operational works must comply with the relevant standards. This means that all water discharged from the Arrow LNG Plant will comply with the WHO Guidelines for Safe Recreational and Water Environment (WHO, 2003) and the Australian Guidelines for Managing Risks in Recreational Water (Australian Government, 2004). Both guidelines provide criteria for a range of coastal water pollutants including pathogens, faecal contamination, cyanobacteria, algae, chemical hazards, oil and litter.

If a desalination plant is constructed for the project, the assessment (BMT WBM 2011) recommends that a suitable diffuser design and configuration should be adopted at the brine outfall and industry standard techniques should be adopted for the dredging.

Overall, the risk to health as a result of surface water contamination is predicted to be **Very Low/Negligible** during construction and operation. Surface water contamination has therefore not been considered further in this report.

8.3 Infectious Disease

8.3.1 Tuberculosis

Unmitigated Construction Risk Rating: Very Low/Negligible

Unmitigated Operational Risk Rating: Very Low/Negligible

The current level of Tuberculosis in Queensland is very low; however recent cases have been recorded in Gladstone amongst foreign workers who have arrived from countries with high infection rates.

It is likely that there will be foreign workers on the Arrow LNG Plant during both the construction and operational phases, so there is a risk of infection being passed onto the Gladstone community. However, the treatment provided for Tuberculosis is of a high standard in Queensland and the condition is fully treatable.

Given the current low infection rate, the use of local and Australian workers and the high standard of treatment available to those infected, the risk of the project during either phase leading to an increase in the rate of Tuberculosis in Gladstone is **Very Low/Negligible**.

8.4 Vector-borne Diseases

Both Gladstone Regional Council and recent site investigation visitors have reported that mosquito numbers on Curtis Island are high. Whilst this will place workers at a high risk of being bitten by mosquitoes, it does not necessarily mean that the project will cause an increased risk of mosquito-borne viruses for the general population. The community members who are most vulnerable to an increase in breeding mosquitoes and diseases are considered to be residents of South End due to their proximity to the site.

8.4.1 Dengue Fever

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Low

The disease of most concern is Dengue Fever which, in some instances, can be fatal. Other mosquito viruses, although debilitating, are unlikely to result in death. Although there have been no recently reported cases of Dengue Fever in Gladstone, it is predicted that its incidence will increase due to a warming climate (Office of Climate Change, 2009, p55).

For the project to contribute to an increased risk of Dengue Fever, additional mosquito-breeding areas would need to be created either during construction or operation where fresh water may pool (e.g. uncovered containers, water tanks, depression areas associated with erosion and sediment control measures, tyres etc). Mosquitoes carrying Dengue Fever (specifically, *Aedes Aegypti*) would then need to breed in these locations and travel beyond the project site to areas where people are residing or working. Investigations of the distance breeding *Aedes Aegypti* mosquitoes travel shows that they move on average no more than 200m from their point of origin (Deon Canyon, 2008; Muir and Kay, 1998), suggesting that the likelihood of disease-carrying mosquitoes bred onsite infecting residential areas beyond the site is very low.

Without any mitigation, the risk of this occurring is unlikely in the near future given there have been no recently recorded cases of Dengue Fever occurrence in Gladstone. The risk will increase over time however, as Dengue Fever extends southwards from North Queensland (Office of Climate Change, 2009). Dengue Fever outbreaks will need to be closely monitored and the risk level regularly reviewed. Based on the current level of Dengue activity (zero), despite the severity of health issues associated with the disease, the risk rating for Dengue Fever is ranked as Low for both the construction and operational phases. This should be reviewed should the extent of Dengue Fever change.

8.4.2 Ross River Fever and Barmah Forest Virus

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Low

Gladstone does have a higher than average incidence rate of both Ross River Fever and Barmah Forest Virus (24-66 per 100 000 and 50-69.9 per 100,000 respectively). Whilst both diseases can be debilitating in the short term, they rarely result in chronic ongoing health conditions. Both Ross River Fever and Barmah Forest Virus can be caused by mosquitoes that breed in both tidal and fresh waters. Similar to Dengue Fever, the project would need to create additional breeding areas (fresh or tidal) for the risk of both diseases to increase. The project is not anticipated to create any additional tidal areas, therefore any potential risk would be predominantly associated with the creation of freshwater breeding environments. The type of mosquitoes associated with Ross River and Barmah Forest Virus are more likely than Dengue Fever mosquitoes to travel beyond the site and infect nearby residential sites (South End, Harbour Islands or other workers camps).

Based on the current incidence of Ross River Fever and Barmah Forest Virus in Gladstone, the construction workforce would be expected to contribute an additional two or three cases of either disease a year to overall cases in Gladstone (less than 1 per cent of the overall population). During operations, this risk would be even lower. However, those housed in a construction camp on Curtis Island will be placed in a heavily mosquito-infested environment (without mitigation measures) and could experience a higher incidence of disease than the general population.

As the health risks associated with Ross River Fever and Barmah Forest Virus are less harmful than those associated with Dengue Fever, the potential risk for both construction and operation has been ranked as **Low**.

8.5 Socio-economic Determinants of Health

8.5.1 Infant, Child and Pregnancy Health

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Very Low/Negligible

As discussed in section 7.3.2.1, Gladstone's LGA population has a high proportion of children aged between 0 and 14 years and a high fertility rate. It is also noted that infant mortality rates in Gladstone are statistically similar to other regions in Queensland and Australia.

Given this large young population and the fact that infants and children are often more vulnerable to diseases or other potential health issues, there is potentially a greater health risk to this group as a result of the construction and operation of the LNG plant. This is not likely to be a direct health impact from the project itself, rather, a result of a potential increased demand for infant, child and pregnancy care services.

The majority of workers for this project will be living in construction camps, then flying home on their time off. It is possible however that some construction workers will move their family to Gladstone as a result of this project. The social impact assessment (SKM, 2011) notes that *Arrow Energy has identified local employment targets of between 5% and 20% for both construction and operation* which includes permanent relocations to the local community. Based on this, it is likely that there will be some additional requirements for these specific infant, child and pregnancy care health services.

The demand on these services is already high based on the demographic profile and is increasing as a result of the number of workers with young families moving to Gladstone seeking employment opportunities in the expanding industry sector. Overall, the risk to the health to infants, children and pregnant women is rated as Low during construction and **Very Low/Negligible** during operation.

8.5.2 Income, Employment and Level of Education

Unmitigated Construction Risk Rating: Benefit

Unmitigated Operational Risk Rating: Benefit

As discussed in section 7.3.2.2, the peak construction workforce for the Arrow LNG Plant (Phase 1) is predicted to reach 3,500 by 2016. Based on the local employment target of between 5% and 20% (SKM, 2011), it is suggested that this will contribute to a reduced level of unemployment and higher level of income for Gladstone residents. This can be correlated with an improved level of wellbeing and health.

The project will also offer apprenticeships and on-the-job training opportunities for local residents.

Although difficult to quantify the health benefit, it would be reasonable to assume that the project would have a positive impact on income, employment and level of education, thereby having a positive influence on health and wellbeing. This has been rated as **Very Low (benefit)**.

8.5.3 Level of Violent Crime

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Very Low/Negligible

The level of crime (including domestic violence) in Gladstone is considered to be similar to other Queensland communities. From a health perspective, violent and domestic crime can cause physical harm requiring medical attention or have an impact on mental wellbeing. The direct relationship with the project and levels of crime is difficult to determine with any certainty, as there are many factors involved.

As interaction with the community during the construction phase will be very limited (with the exception of those employed from within the existing local community) it is not considered likely that the project would have a significant impact on crime requiring medical treatment or associated services (particularly acute care at Gladstone or Rockhampton Hospitals), although such an impact cannot be ruled out. The risk during construction has been assessed as **Low**.

Once the project is operational, the small local workforce is unlikely to have a significant impact on levels of violent crime within Gladstone and has been assessed as **Very Low/Negligible**.

8.6 Lifestyle Determinants of Health

8.6.1 Lack of Physical Exercise

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Very Low/Negligible

Construction and ongoing maintenance work is physically demanding, and it would be expected this would correlate with workers having a higher level of fitness. This is not always the case, and there is some speculation within the construction industry that unfit workers are at higher risk of workplace injuries. Many workplace tasks are also increasingly automated, leading to a more sedentary work environment. Long working hours and reduced access to recreation and fitness facilities for those confined to workers' camps could reduce physical activity and increase the risk of obesity. There is also some evidence that those on shift work are less likely to eat a balanced and healthy diet, also contributing to the risk of obesity.

As with other lifestyle related issues outlined above, the major impact associated with an increased level of obesity (and associated disease profile) within the workforce population is the burden it would place on the Gladstone health system. Based on the current obesity levels in Gladstone, the construction workforce could theoretically contribute approximately an additional 705 cases of obesity to Gladstone (approximately 1 per cent of the existing population).

During the operational phase, the reduced workforce is anticipated to limit any significant impacts on levels of obesity or health and recreation infrastructure.

Overall, this will represent a **Low risk/Negligible** during construction, downgraded to a **Very Low/Negligible** risk when the LNG plant is operational without mitigation measures being applied.

8.6.2 Nutrition

Unmitigated Construction Risk Rating: Very Low/Negligible

Unmitigated Operational Risk Rating: Very Low/Negligible

Australians in general are not eating the recommended amount of fruit and vegetables, and Gladstone reflects this trend. Nutrition is influenced by a number of elements including cultural background, affordability, availability and knowledge of nutrition.

The Arrow LNG Plant will have little influence on cultural background or community knowledge of nutrition, however it is possible that the provision of food for workers in camps could temporarily increase local demand and consequently increase prices. At this point in time, the source of camp food is not known, however it is unlikely it would be purchased in sufficient volume from local sources to impact on availability.

It is therefore considered a **Very Low/Negligible** risk. With the reduced operational workforce, the operational risk is considered to be **Very Low/Negligible**.

8.6.3 Alcohol Abuse

Unmitigated Construction Risk Rating: Medium

Unmitigated Operational Risk Rating: Low

Gladstone has a higher rate of harmful alcohol consumption than the national average, although the reasons for this are unclear. Harmful levels of alcohol consumption are generally higher in the male population, which will comprise a significant portion of the Arrow LNG Plant construction workforce. Gladstone does have a slightly higher number of males than females, so this may partially explain the higher rate of drinking. Construction workers are also likely to be employed in shiftwork and housed in workers camp, which is also often associated with higher drinking rates. (Midford et al, 1997; Drugs and Crime Prevention Committee, 1994, Holland, 2005, Olympic Dam Expansion EIS, 2009, Carrington, 2009 and Petkova et al., 2009).

As well as the direct health impacts, alcohol is linked to other high risk behaviours such as illicit drugs, violence-related trauma, vehicle accidents and unprotected sex.

Health practitioners consulted during the EIS process have raised concerns that there is minimal support for alcohol related health issues in Gladstone. It is suggested that a further influx of construction workers that are at high risk of partaking in harmful alcohol consumption if no restrictions are in place could put further pressure on existing health services. In general, excessive alcohol intake by construction workers could impact the community if not adequately controlled. Workers will be largely restricted to construction camps however and will have minimal interaction with the community. The risk rating for additional alcohol

abuse resulting from the construction phase of the project has been rated as **Medium** without mitigation measures put in place due to risk factors associated with construction workers, the current level of treatment available and the harmful consequences of excessive alcohol intake. For the operational phase, the ability of the project to contribute to alcohol abuse and the subsequent consequences remain high. However, the likelihood of the project having a significant on the health of the general population or health services is reduced proportionate to the lower number of workers. Therefore the risk for the operational phase has been ranked as **Low**.

8.6.4 Illicit Substance Abuse

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Very Low/Negligible

Similar to alcohol abuse, construction workers on the project are exposed to or will exhibit a number of risk factors associated with illicit substance abuse including isolation from family, being male and having a higher level of disposable income. Gladstone already has a high rate of industry or construction workers however, and evidence collected by the Crime and Misconduct Commission indicated the Fitzroy region has a lower rate of illicit drug use than Brisbane. For this reason, the construction risk has been assessed as Low without mitigation measures being applied.

Once the operational phase commences, workers will be accommodated in the local community which would minimise their level of isolation, lessening the number risk factors associated with illicit substance abuse. The reduced number of workers is also expected to limit any significant impact on existing health services, reducing the level of risk to **Very Low/Negligible**.

8.6.5 Smoking

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Low

As with harmful drinking, Gladstone residents have a higher recorded incidence of smoking than the Queensland average. The health impacts of smoking are well documented, and there is a high likelihood that workers who smoke will need health treatment beyond that which can be provided within the camp. Based on the current rate of smoking in Gladstone, in theory the project could contribute an additional 850 smokers to the Gladstone community during the construction period. This estimate would vary significantly depending on controls in the workforce and the source of workers. It is also unknown how many smokers will require medical treatment within Gladstone itself. It is assumed that most would seek treatment whilst at home and not actively working, thereby greatly reducing the burden on the Gladstone health system.

The project itself is unlikely to significantly increase the rate of smoking within Gladstone however or to pose additional health risks to those already experienced. The risk of the project contributing to increased smoking rates or placing a burden on health facilities is rated as **Low** during construction and **Low** during operation.

8.7 Sexual and other High Risk Behaviours

8.7.1 STIs

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Very Low/Negligible

There is no publically available data to suggest that STI rates are higher in the Gladstone region than other locations. A need for additional health programs to address behaviours amongst mining and industrial works has been identified during consultation with local medical practioners however (refer to Section 6.0). Project-specific factors affecting the incidence of disease include the general management of the construction camp and the degree of access to local communities.

Construction workers will be largely confined to workers' camps, limiting the potential scope for cross-infection between the local population and workers during this phase of the project. When on leave it is assumed that workers will travel directly to the airport and fly-out from Gladstone to their homes; however, it is likely that a small percentage of workers will remain in Gladstone and its surrounds. Whilst on leave away from camp restrictions, it is possible they will partake in high risk activities, including drinking and unprotected sex.

Evidence from overseas projects in developing countries has shown that workers' camps can attract unregulated sex work and the surrounding community can experience increased STI rates (Fass et al., 1999, Zhao et al., 2005, Stablum, A, 2007). This is less likely to be the case in Queensland, where sex work (and disease control) is regulated, there is a higher standard of living and employment levels high. However, there is currently no licensed brothel in the Gladstone region that would offer safe sex. The isolation of the camp on Curtis Island (where most workers will be housed) will assist in restricting sexual encounters with the general community or with sex workers. The recruitment of foreign workers from developing countries that may have a higher rate of existing infection is also understood to be limited.

The potential construction phase impact was ranked as **Low** based on the likelihood of infection occurring, restriction of workers interaction with the community and that STIs are medically treatable.

During the operational phase, there will be approximately 150 Arrow Energy employees placing much less burden on existing health services. They will all be locally based, and living within the general community, which is expected to reduce the incidence of high-risk behaviours exhibited by construction workers living in camps. These factors are likely to reduce the risk ranking for STIs during the operational phase to **Very Low/Negligible**.

8.7.2 HIV/AIDS

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Very Low/Negligible

Existing rates of HIV/AIDs infections in Australia and central Queensland are low in comparison to many other countries, and AIDS related deaths and notifications are declining as treatment measures improve (although HIV infection rates are rising).

Especially during the construction phase, the project will introduce risk factors that may contribute to the incidence of HIV. In particular, the construction workforce is expected to be mostly male, who have a higher risk of being infected. As discussed in Section 8.7.1, interaction with the Gladstone community during the construction phase will be limited; therefore it is unlikely that HIV infection of a community member from construction workers may occur from sexual activity. The use of foreign workers from countries with a higher incidence of HIV infection will be minimal.

During operation, the reduced number of employees and the mostly local workforce are expected to limit the potential for an increase in the current incidence level of HIV/AIDS.

The potential construction impact was ranked **Low** on the basis that the current incidence of HIV/AIDS is low in central Queensland, although there is potential for serious health consequences if infection occurs. The operational risk is ranked as **Very Low/Negligible**.

8.7.3 Hepatitis C

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Very Low/Negligible

The available figures establish that Hepatitis C incidence in Gladstone is low and is mostly restricted to those with a recent history of drug use. The virus may be sexually transmitted, although this is rare, and usually only occurs when an STI is also present and makes blood contact more likely. Workers will be regularly drug-tested and subject to strict disciplinary procedures and it is considered unlikely that intravenous (IV) drug use will be high amongst workers.

The likelihood of the project leading to increased rates of Hepatitis C is unlikely, however the health impacts can be considerable and for this reason, the risk has been assessed as **Low** for the construction period and **Very Low/Negligible** for the operational phase (a reduced level risk has been apportioned based on lower worker numbers).

8.8 Social Infrastructure Determinants of Health

8.8.1 Access to Cultural Capital and Recreation

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Very Low/Negligible

The Arrow LNG Plant will be constructed on Curtis Island and adjacent to Port Curtis, which is used by locals for walking, camping, fishing and swimming. These activities are generally associated with health and wellbeing. The project will reduce the available land on Curtis Island for these types of activities,

however the proposed location of the LNG plant is not heavily utilised for this purpose, and much of the island will be retained as conservation reserve. Access to boating and fishing may also be reduced around the loading dock and wharf, however there are many other easily accessible places within proximity of Gladstone to undertake similar activities.

Although not a major contributor to ill-health when combined with other risk factors, access to cultural capital (e.g. theatre, libraries, music or areas where social interaction occurs) can promote an overall feeling of wellbeing. Confinement to a workers' camp can restrict access to these services for employees and contribute to a reduced feeling of wellbeing or mental health which may require medical treatment.

It is therefore considered that the risk of reducing health and wellbeing by restricting access to recreational areas or cultural capital is considered **Low** for the construction phase and **Very Low/Negligible** for operations.

8.9 Mental Health

Unmitigated Construction Risk Rating: Low

Unmitigated Operational Risk Rating: Very Low/Negligible

There are obviously many causes of mental illness, however the workplace is one of the key factors as it can impact on personal identity, self-esteem and social status. A person's mental health not only affects an individual, but also their work colleagues and family. Although there appears to be little research on the topic, it is assumed that accommodating employees in workers' camps would place additional strain on workers as they are isolated from their normal support systems, e.g. family/friends, and there may be limited opportunities for relaxation or socialising away from the work environment. This would not be the case during operations.

Gladstone currently experiences a rate of mental illness on par with Queensland and Australia, for both males and females. As it currently has many construction projects occurring, it does not appear that this lifestyle has impacted the overall mental health of residents. It is therefore unlikely that workers associated with the project would have a higher risk of mental illness than the rest of the Gladstone population. Nevertheless, mental illness may still exist with the project workers and may require localised treatment.

The project could indirectly impact mental illness through an impact on the socio-economic status of the Gladstone population. The project aims to source 5-20% per cent of the construction workforce from within the Gladstone region. This action would contribute to a temporary lower level of unemployment. The WHO (2000) states that those who are unemployed are at more than twice the risk of experiencing depression than those who are employed. Construction workers also have a reasonable level of income, which would be expected to partially contribute to mental wellbeing. This positive impact is reduced during the operational phase, and could have a significant negative impact for those who are employed during the construction phase and who then may experience unemployment.

Consultation has identified that mental health services in Gladstone would need additional resources if there was further population growth. Given the burden

mental health currently places on the health system, the likelihood of the project having a direct impact on Gladstone's current services during the construction phase is high, if measures are not taken to address workers mental health and well-being. Based on the current percentage of mental health issues within the Australian population (16.6 per cent excluding drug and alcohol-related issues) it could be estimated that as a worst case scenario up to 594 construction workers would experience mental health issues at any one time. This is the rate for the general population however the level of mental illness in the working population is expected to be lower. It is also unknown how many workers would seek medical treatment from Gladstone health services. Obviously, the impact during the operational phase would be lower.

In this situation where the project may have both a positive and negative influence on mental health and health services it is difficult to assign a risk rating. An overall **Low** rating has been assigned for the construction phase and a **Very Low/Negligible** rating during operations, based on the impacts to demand for health services.

9 Summary of Potential Impacts

A summary of potential impacts is provided in Table 11 below.

Table 11 Potential impacts of the Arrow LNG Plant on health outcomes and infrastructure

Health Impact Pathway	Potential Health Impact	Construction Risk Rating	Operational Risk Rating
Environmental Determinants of Health			
Poor air quality	Exacerbation of existing cardiovascular/respiratory disease (including asthma), eye and throat irritation	Low	Very Low /Negligible
Excessive noise	Sleep disturbance, stress, reduced mental wellbeing, fatigue, changes in behaviour	Low	Low
Poor visual amenity	Reduced mental wellbeing	Low	Low
Food and Water-borne Disease			
Contaminated Surface Water	Seafood poisoning	Very Low /Negligible	Very Low/ Negligible
Physical contact with contaminated surface water	Inhalation of toxic substances, skin irritants	Very Low /Negligible	Very Low/Negligible
Contaminated Drinking Water	Salmonella, campylobacter, E. Coli, listeria, cholera. Viruses such as Hepatitis A, and parasites.	Very Low /Negligible	Very Low /Negligible
Infectious Diseases			
Contact with infected workers	Tuberculosis	Very Low /Negligible	Very Low /Negligible
Mosquito-borne Disease			
Breeding mosquitoes	Dengue Fever	Low	Low

Health Impact Pathway	Potential Health Impact	Construction Risk Rating	Operational Risk Rating
Breeding mosquitoes	Ross River Fever/Barmah Forest Virus	Low	Low
Socio-economic Determinants of Health			
Increased number of families	Child and Adolescent Health	Low	Very Low /Negligible
Changes to Income, unemployment and level of education	Lower life expectancy, increased chronic illness.	Benefit	Benefit
Increased level of violent crime	Physical harm, reduced mental health	Low	Very Low /Negligible
Lifestyle Determinants of Health			
Nutrition	Higher food costs, obesity, general health	Very Low /Negligible	Very Low /Negligible
Alcohol Abuse	Mortality, cancer, liver cirrhosis, foetal alcohol syndrome, traffic incidents, increased violence, crime, higher risk of unwanted pregnancy and STI's.	Medium	Low
Illicit Substance Abuse	Mortality, overdose, reduced mental wellbeing, violent acts, traffic accidents, crime.	Low	Very Low
Smoking	Respiratory and circulatory diseases	Low	Very Low
Lack of physical exercise	Obesity, some cancers, circulatory disease.	Low	Very Low
Sexual and other High Risk Behaviours			
Unprotected sex	STI's	Low	Very Low
Unprotected sex, IV drug use	AIDS/HIV	Low	Very Low
IV drug Use	Hepatitis C	Low	Very Low

Health Impact Pathway	Potential Health Impact	Construction Risk Rating	Operational Risk Rating
Social Infrastructure Determinants of Health			
Access to Cultural Capital and recreation	Mental wellbeing	Low	Very Low /Negligible
Mental Health			
Workplace stress	Insomnia, greater incidence of smoking, drug, alcohol intake, gastrointestinal disorders, reduced socialisation	Low	Very Low

10 Mitigation Measures

There are many factors that influence and protect against deterioration in health, many of these outside of the ability of the project to directly influence. Where the risk assessment has identified a risk that may be attributable to the project, control measures to reduce or eliminate this risk that will be undertaken by the proponent have been identified. Where positive factors have been identified, potential enhancement measures will also be explored.

The *WA Public Health Consultation Guidelines* (2010) identify factors that influence health:

- **Healthy conditions and environments** – safe physical environment, supportive economic and social conditions, regular supply of nutritious food and water
- **Psychosocial factors** – participation in social engagement, strong social networks, feeling of trust, feeling of power and control over life decisions
- **Effective health services** – provision of preventative services, access to culturally appropriate health services, community participation in the planning and delivery of health
- **Healthy Lifestyles** – decreased use of tobacco and drugs, regular physical activity, balanced nutritional intake, positive mental health, safe sexual activity
- **Healthy public policy and organisational practice** – provision for meaningful, paid employment, provision of affordable housing, restricted access to tobacco and drugs.

The following mitigation measures address the construction and operational phases of the project, and are based on the factors that can influence health described above. An assessment of residual impacts has been made following the application of these measures. Where a potential risk (refer to **Section 8**) has been classified as Very Low/Negligible or Positive, no mitigation measures are considered necessary and the residual risk has not been assessed.

It is also important to monitor the performance of the mitigation measures put in place for the project. Where applicable, Key Performance Indicators have been identified that can be monitored as part of the project.

10.1 General Mitigation Measures

There are a number of overarching measures that are expected to assist in mitigating a number of risk factors, as described below. These general measures are particularly relevant to the community health, socio-economic, lifestyle, social infrastructure and institutional health determinants.

Some mitigation measures are also discussed in the residual impact section where relevant.

The following general mitigation measures have been identified:

- Workers will undertake a 'fitness for duty' health assessment prior to being employed. This will reduce the likelihood that individuals with serious medical conditions will be working on the project and being a burden to health services
- Medical facilities and support will be provided on-site during both the construction and operational phases. As well as first aid and general medical assistance, a counselling service will be provided.
- If the workers camp contains a number of foreign workers, culturally-specific health services will be provided.
- A helipad will be provided to facilitate timely medical evacuation if required.
- All construction and operation employees and contractors will receive health awareness training.
- All construction and operation employees and contractors will be required to adhere to a Code of Conduct. The Code of Conduct will outline employee responsibilities and appropriate levels of behaviour while at work, within the construction camp and when leaving the camp. This will include details of the relevant policies i.e. the Occupational Health and Safety Policy, the Drug, Alcohol and Contraband Policy, the Duty to Stop Work Policy and the Fit for Duty Policy.
- Disciplinary action will be taken if the Code of Conduct / Policies are not complied with.
- A community complaints procedure with be established to receive and respond to complaints against staff or impacts on the community.
- A Health Advisory Committee comprised of staff, Arrow Energy, Gladstone medical professionals, community members or other relevant stakeholders to regularly discuss potential health issues and management will be established.
- Access to workers camps will be restricted to residents only or those with approved permits.
- An Environmental Management Plan and Social Impact Management Plan are being prepared for the project for both the construction and operational phases that details management measures, on-going performance monitoring, corrective measures and reporting requirements.

10.2 Mitigation Measures (Air, Noise, Visual, Water)

Given the overlap of the HIA with other technical environmental and social studies in the EIS, relevant and specific mitigation measures have been identified in other technical studies. They have therefore not been repeated here. However, a list of the applicable topics and studies has been presented below.

10.2.1 Air quality

Mitigation measures required for air quality during construction are presented in the air quality assessment (Katestone Environmental, 2011). Although no specific mitigation is required during operation, applicable emission specifications and requirements are prescribed in the assessment.

10.2.2 Noise

Mitigation measures required for noise during construction and operation are presented in the noise quality assessment (Sonus, 2011).

10.2.3 Visual

Mitigation measures required for visual amenity during construction and operation are presented in the visual assessment (AECOM 2011)

10.2.4 Water

Mitigation measures required for water during construction and operation are presented in the water quality assessment (BMT WBM, 2011)

10.3 Specific Mitigation Measures

In addition to the mitigation described above, the following additional measures have been identified.

10.3.1 Mosquitoes

Mitigation measures required for mosquitoes during construction and operation are presented in the pest management plan (Ecosure, 2011). The following additional measures have been identified as part of the HIA.

The Queensland Health *Guidelines to minimise mosquito and biting midge problems in new development areas* provide guidance on the construction and operational controls that will be required for the project. Measures will be centred on removing and preventing the creation of areas of stagnant or standing water where mosquitoes may potentially breed.

Measures to minimise the creation of mosquito breeding areas during both construction and operational phases include:

- Filling or draining areas of stagnant water located within the LNG plant on Curtis Island.
- The design of filling and excavation works so that areas of standing water are not created.
- The design of buildings (both temporary and permanent) to ensure that roof water drains quickly from gutters.
- Monitoring regularly, particularly after rain events, in coordination with Gladstone Regional Council.

- Design of stormwater drainage to minimise mosquito breeding and avoid the creation of ponded areas. In particular, the requirements of AS/NZS 3500:3:2003 will be followed.
- Regular monitoring of potential breeding areas for signs of disease outbreaks or breeding.
- Spraying of mosquito breeding areas in consultation with Gladstone Regional Council. Avenues to undertake a spraying program and prepare a Mosquito Management Plan for the whole of Curtis Island will be explored with other future and existing land owners to promote a coordinated approach.

In addition to preventing mosquito breeding, measures will be put in place to prevent the spread of disease to humans such as protective clothing and repellents, use of window and door screens and mosquito coils.

10.3.2 Physical exercise and nutrition

On-site exercise and recreation facilities will be provided for workers during the construction phase of the project. The exact facilities to be provided are yet to be determined, but may include a gym, sports fields, exercise classes, tennis/basketball courts. The importance of exercise and nutrition will also be addressed in health awareness programs provided to employees and contractors.

The project will also be implemented in line with Arrow Energy's Fit for Duty policy.

Food provided to staff on-site either during construction or operation will be nutritionally balanced.

10.3.3 Alcohol

In order to limit alcohol abuse within the construction camp, alcohol will not be permitted to be brought onto site. Luggage searches may be conducted if there is reasonable cause to suspect a person may be doing so. Some drinking will be allowed at a controlled venue within workers' camps, however hours of operation will be limited. It is hoped that allowing some drinking will avoid the incidence of binge-drinking once workers leave the site.

The proponent's Drug, Alcohol and Contraband policy will be made clear to all employees and contractors who will be required to adhere to the Code of Conduct.

Workers will be required to have a zero blood alcohol limit whilst they are on duty (including driving a vehicle), and disciplinary measures will be enforced for any breaches of the Code of Conduct. Random testing may also be undertaken.

Despite these measures, it is still possible that binge-drinking may occur when workers are on leave. Those vulnerable to the impacts of alcohol abuse include family members. Independent alcohol counselling will also be made accessible to staff and immediate family members, although privacy issues mean that staff are more likely to seek treatment away from work for fear of the employer becoming aware of an issue and undertaking disciplinary action.

10.3.4 Illicit substance abuse

Many of the measures outlined for the control of alcohol are also applicable to reduce the incidence of illicit substance abuse. No illicit drugs will be permitted to be brought onto site. Luggage searches may be conducted if there is reasonable cause to suspect a person may be doing so. The proponent's Drug, Alcohol and Contraband policy will be made clear to all employees and contractors who will be required to adhere to the Code of Conduct.

Disciplinary measures will be enforced for any breaches of the Code of Conduct. Random drug testing may also be undertaken.

Independent drug counselling will also be made available to staff.

10.3.5 Smoking

Smoking regulations will be enforced on site, as per legislative requirements and site safety requirements; however it is not proposed to restrict smoking beyond those measures. Awareness training on potential health impacts will be provided to workers and contractors.

10.3.6 STI's

The isolation of the construction camps will partly assist in limiting sexual interaction with the Gladstone community. Access to camps will be restricted to residents only. However, it is expected that workers staying in the mainland camp will have access to the wider community. Employee and contractor safe sex awareness programs will be run and free condoms provided.

10.3.7 Mental Health

The construction camp will be managed to minimise stress on workers and the general community as much as possible. Recreational and fitness facilities will be provided to staff and counselling will be available for those experiencing mental health issues. Quiet or rest times will be enforced so that sleep disturbance is minimised. The proponent will work with staff to identify acceptable working hours that limit stress on workers. Additionally, social occasions which encourage social interaction will be regularly organised.

During operation, the majority of workers will reside locally. Any mental health issues experienced by workers will also impact upon the Gladstone community and their families in particular. A mental wellbeing program will be put in place by the proponent during the operational phase to support workers. As it has been identified that current mental health programs may not have the capacity to deal with an increasing population, the proponent will provide funding through the Gladstone Foundation for community mental health initiatives that will support workers and their families.

10.3.8 Incidents

All workers will be inducted in line with the proponents policies to minimise the risk of any workplace incident occurring. This includes the following:

- Occupational Health and Safety Policy
- Drug, Alcohol and Contraband Policy
- Duty to Stop Work Policy
- Fit for Duty Policy

There is potential that a major workplace incident would require an evacuation so there is potential to increase demand on this service in the area.

In order to facilitate clear access for emergency services to retrieve injured workers, a helipad will be constructed at the LNG plant. An Evacuation Management Plan will also be prepared in consultation with relevant stakeholders that outlines staff training in evacuation procedures, emergency treatment procedures, etc.

11 Residual Risk

11.1 Environmental Determinants of Health

11.1.1 Air Quality

Residual Construction Risk Rating: Very Low/Negligible

Residual Operational Risk Rating: Very Low/Negligible

With the mitigation and management measures prescribed in the air quality assessment (Katestone Environmental, 2010), it is considered that the risk of health impacts from changes in air quality during construction or operation is **Very Low/Negligible**.

Key Performance Indicator: No. Of complaints received

11.1.2 Noise Quality

Residual Construction Risk Rating: Very Low/Negligible

Residual Operational Risk Rating: Very Low/Negligible

The noise and vibration assessment (Sonus, 2011) demonstrates that noise mitigation measures will be required to achieve the night-time construction criterion. With these measures, WHO Guidelines for noise and the acoustic quality objectives of the *Environmental Protection (Noise) Policy 2008* will be met. Where compliance with the evening noise limit is unable to be achieved, the noise generating activity will be ceased.

In regards to operational noise, with the recommended acoustic treatment in place, noise levels at the closest sensitive receptor (Tide Island) are predicted to achieve the relevant criteria under normal and worst-case meteorological conditions.

It is therefore considered that the risk of health impacts from nuisance noise during construction and operation is **Very Low/Negligible** once mitigation measures have been applied.

Key Performance Indicator: No. Of complaints received

11.1.3 Visual Amenity

Residual Construction Risk Rating: Low

Residual Operational Risk Rating: Low

In consideration of the residual visual impact from a health perspective, the sensitivity of the visual receptors remains the same. However, there is potential for the magnitude of change to decrease as a result of any proposed mitigation, particularly how vegetation, earthworks, built form and lighting are implemented.

The visual assessment (AECOM, 2011) highlights whilst the identified mitigation measures would diminish the impacts at a localised (site) level, they are unlikely to change the significance of the impacts identified. This is because the size of the project components and technical requirement to be adjacent to open water mean there is little opportunity for measures that seek to 'screen' or 'hide' the facility within landform, such as are frequently used for other industrial projects. The residual risk from a health perspective during construction and operation is therefore sustained at **Low**.

Key Performance Indicator: No. of Complaints Received

11.2 Infectious Disease

11.2.1 Mosquito-borne Diseases

Residual Construction Risk Rating (Ross River Fever, Dengue Fever and Barmah Forest Virus): Very Low/Negligible

With the mitigation measures outlined in section 10.2 in place, the residual risk for both the construction and operational phases has been reduced from Low to **Very Low/Negligible** for Ross River Fever, Barmah Forest Virus and Dengue Fever.

Key Performance Indicators: Cases of Dengue Fever, Ross River Virus or Barmah Forest Virus amongst construction or operational workforce.

11.3 Socio-economic Determinants of Health

11.3.1 Infant, Child and Pregnancy Health

Residual Construction Risk Rating: Low

Residual Operational Risk Rating: Very Low/Negligible

There are limited measures the project can directly put in place to prevent families with children moving to Gladstone. The workforce makeup will be communicated to the Queensland Government for use in Health Service Planning. In fact, there is potentially some socio-economic benefits of this demographic group moving to the area in comparison with young, single workers.

The residual risk is expected to remain the same at **Low** during construction and **Very Low/Negligible** during operation.

Key Performance Indicator: Indicators of child health

11.3.2 Level of Violent Crime

Residual Construction Risk Rating: Low

Residual Operational Risk Rating: Very Low/Negligible

Although workers will be also be subject to a Code of Conduct, provided with awareness training and have access to Counselling (including drug and alcohol services), violence associated with alcohol, drug use or mental health issues may still occur and the level of risk remains at **Low** for construction. The risk during operation is expected to be sustained as **Very Low/Negligible**.

Key Performance Indicators: No. of violent incidents at the workplace and annual incidence rates for Gladstone

11.4 Lifestyle Determinants of Health

11.4.1 Lack of Physical Exercise and Nutrition

Residual Construction Risk Rating: Very Low/Negligible

Residual Operational Risk Rating: Very Low/Negligible

As a result of the measures outlined above in section 10.3.2, the residual risk during construction is predicted to reduce from Low to **Very Low/Negligible**. Similarly, the residual impact during operation will remain at **Very Low/Negligible**.

Key Performance Indicator:

- Workers complying with Fit-to-Work standards.
- Health Awareness programs.
- Availability of fitness facilities and healthy food.

11.4.2 Alcohol Abuse

Residual Construction Risk Rating: Very Low/Negligible

Residual Operational Risk Rating: Very Low/Negligible

With the implementation of the measures outlined in section 10.3.3, it is expected that the risk will reduce from Medium to **Very Low/Negligible** during construction and from Low to **Very Low/Negligible** during operation.

Key Performance Indicators: Conformance with Code of Conduct.

11.4.3 Illicit Substance Abuse

Residual Construction Risk Rating: Very Low/Negligible

Residual Operational Risk Rating: Very Low/Negligible

With the implementation of the measures outlined in section 10.3.4, it is expected that the risk will reduce from Low to **Very Low/Negligible** during construction and will remain at **Very Low/Negligible** during operation.

Key Performance Indicators: Conformance with Code of Conduct

11.4.4 Smoking

Residual Construction Risk Rating: Very Low/Negligible

Residual Operational Risk Rating: Very Low/Negligible

With the implementation of the measures outlined in section 10.3.5, the residual risk during both construction and operation is reduced to **Very Low/Negligible**.

11.5 Sexual and Other High Risk Behaviours

11.5.1 STI's

Residual Construction Risk Rating: Very Low/Negligible

Residual Operational Risk Rating: Very Low/Negligible

With the implementation of the measures outlined in section 10.3.6, it is expected that the risk will reduce from Medium to **Low** during construction and from Low to **Very Low/Negligible** during operation.

Key Performance Indicator: Annual STI incidence rates for Gladstone (if available)

STIs are considered a treatable condition, and medical treatment will be available for staff at workers' camps to minimise any increased load on local healthcare facilities. They will also be provided with information on safe sex and condoms.

11.5.2 HIV/AIDS

Residual Construction Risk Rating: Very Low/Negligible

Residual Operational Risk Rating: Very Low/Negligible

Similar measures to those outlined for STI's will be provided.

With the implementation of these measures, it is expected that the risk will reduce from Medium to **Low** during construction and from Low to **Very Low/Negligible** during operation.

Key Performance Indicator: Annual HIV/AIDS prevalence rates for Gladstone (if available)

11.5.3 Hepatitis C

Residual Construction Risk Rating: Very Low/Negligible

Residual Operational Risk Rating: Very Low/Negligible

Similar measures to those outlined for STI's and HIV/AIDS will be provided.

With the implementation of these measures, it is expected that the risk will reduce from Medium to **Low** during construction and from Low to **Very Low/Negligible** during operation.

Key Performance Indicator: Annual Hepatitis C prevalence rates for Gladstone (if available)

11.6 Social Infrastructure

11.6.1 Access to Cultural capital and Recreation

Residual Construction Risk Rating: Low

Residual Operational Risk Rating: Very Low/Negligible

It is considered that the residual risk of reducing health and wellbeing by restricting access to recreational areas or cultural capital will be maintained at **Low** for the construction phase and **Very Low/Negligible** for operations.

11.7 Mental Health

Residual Construction Risk Rating: Very Low/Negligible

Residual Operational Risk Rating: Very Low/Negligible

With the implementation of the measures outlined in section 10.3.7, the residual risk of workers experiencing mental health issues that may impact on the community or requiring medical treatment in Gladstone during the construction phase is reduced from Medium/High to **Medium**. The risk during operation is maintained at **Low**.

Key Performance Indicator: No. Of sick days or workers applying for stress leave and incidence rate of mental health in Gladstone.

11.8 Summary of Residual Risks

A summary of residual impacts is provided below. The summary table in Appendix C presents the pre-mitigation risk and residual risk alongside each other for ease of comparison.

Table 12 Residual Impacts from the Arrow LNG Project

Health Impact Pathway	Potential Health Impact	Residual Construction Risk Rating	Residual Operational Risk Rating
Environmental Determinants of Health			
Poor air quality	Exacerbation of existing cardiovascular/respiratory disease (including asthma), eye and throat irritation	Very Low/Negligible	Very Low /Negligible
Excessive noise	Sleep disturbance, stress, reduced mental wellbeing, fatigue, changes in behaviour	Very Low /Negligible	Very Low /Negligible
Poor visual amenity	Reduced mental wellbeing	Low	Low
Mosquito-borne Disease			
Breeding mosquitoes	Dengue Fever, Ross River Fever, Barmah Forest Virus	Very Low/ Negligible	Very Low /Negligible
Socio-economic Determinants of Health			
Increased number of families	Child and Adolescent Health	Low	Very Low /Negligible
Increased level of violent crime	Physical harm, reduced mental health	Low	Very Low /Negligible
Lifestyle Determinants of Health			
Alcohol Abuse	Mortality, cancer, liver cirrhosis, foetal alcohol syndrome, traffic incidents, increased violence, crime, higher risk of unwanted pregnancy and STI's.	Very Low/Negligible	Very Low/Negligible
Illicit Substance Abuse	Mortality, overdose, reduced mental wellbeing, violent acts, traffic accidents, crime.	Very Low /Negligible	Very Low /Negligible
Smoking	Respiratory and circulatory diseases	Very Low /Negligible	Very Low /Negligible
Lack of physical exercise	Obesity, some cancers, circulatory disease.	Very Low /Negligible	Very Low /Negligible

Health Impact Pathway	Potential Health Impact	Residual Construction Risk Rating	Residual Operational Risk Rating
Sexual and other High Risk Behaviours			
Unprotected sex	STI's	Very Low/Negligible	Very Low/Negligible
Unprotected sex, IV drug use	AIDS/HIV	Very Low/Negligible	Very Low/Negligible
IV drug Use	Hepatitis C	Very Low/Negligible	Very Low/Negligible
Mental Health			
Workplace stress	Insomnia, greater incidence of smoking, drug, alcohol intake, gastrointestinal disorders, reduced socialisation	Very Low/Negligible	Very Low/Negligible
Social Infrastructure Determinants of Health			
Access to Cultural Capital	Mental wellbeing	Low	Very Low /Negligible

12 Cumulative Impacts

Morris and Therival (1995) define cumulative impacts as 'the sum of the project's impacts when added to those of other past, present or future projects'. Cumulative impacts may result from a number of activities with similar impacts interacting with the environment in a region. There is no defined process for Cumulative Impact Assessment (CIA) in Australia.

In order to understand cumulative impacts, it is necessary to appreciate the interrelationships between impacts. Interactive effects arise where effects from one environmental element bring about changes in another environmental element. A working knowledge of the residual impacts caused by an activity is also necessary for CIA. The previous sections in this document have described the likely impacts of the project. This section explores the interrelationships between the residual environmental impacts described in section 11 that remain significant after mitigation methods have been put in place.

The likely cumulative effects that could occur as a consequence of the project in conjunction with the development of other projects that are currently in the project area are also discussed.

Committed developments are normally considered in a cumulative impact assessment. There are a number of projects that are either under construction or

are confirmed that will be constructed within a similar timeframe to the Arrow LNG Plant. The relevant projects are discussed in section 5.5.7 of this report.

12.1 Construction Cumulative Impacts

This section details the cumulative risk for all potential health impacts during construction where a residual risk has been identified.

12.1.1 Dengue Fever

Each construction project will be required to have measures in place to manage and monitor the spread of mosquito-borne disease, similar to those proposed in this document. The current risk of contacting Dengue Fever is negligible, but is expected to increase over time. Dengue Fever outbreaks are spasmodic, and it is difficult to predict when or where they may occur, but they are most likely to occur in residential communities.

Should a Dengue Fever outbreak occur in Gladstone, the cumulative risk of projects creating an environment where Dengue-carrying mosquitoes would breed is greater than that of a singular project. Each of these projects would need to be located in close proximity to a residential population for transference of the virus to occur, however. It is not considered that a combination of construction projects would significantly raise the incidence rate of Dengue Fever should an outbreak occur.

12.1.2 Infant, Child and Pregnancy Health

Statistics show that Gladstone is experiencing an increase in the number of families with children, attributable to workers and their families moving to Gladstone for employment opportunities. This trend is projected to continue given the number of projects confirmed or proposed for the region. Wherever possible, each project is seeking to employ locally based workers, but there will be some temporary increase of workers in the area who may move their family to Gladstone for the duration of the project. Some of these families would be expected to remain in the area after project completion. Although difficult to estimate the exact numbers, projects are cumulatively expected to increase the demand for infant, child and pregnancy services, at least on a temporary basis.

12.1.3 Alcohol, Illicit Drug Abuse and Smoking

The Arrow LNG Plant will put in place a number of measures to minimise alcohol consumption, illicit drug abuse and smoking and it is expected that other projects will do so as well. It is therefore not considered that there is a cumulative impact on existing health services related to alcohol or illicit substance abuse or smoking.

12.1.4 STIs, AIDS/HIV and Hepatitis C

The addition of up to 13,020 mostly male workers to Gladstone would be likely to increase the risk of contracting sexually transmitted diseases from increased sexual activity. This is dependent on a number of factors such as the source of workers, housing of workers, location, and workplace controls put in place. In this

instance, community education and health programs are recommended as an effective way to minimise the impact on the Gladstone community.

12.1.5 Mental Health Issues

The combined projects will have a positive economic impact on Gladstone in terms of employment, income levels and business. This is also expected to have a positive influence on the mental wellbeing of Gladstone Residents whilst construction is ongoing.

This additional influx of workers will also place pressure on existing mental health facilities and programs however and it is likely that additional Government support will be required.

12.2 Operational Cumulative Impacts

There are not likely to be substantial cumulative impacts associated with the operational phase, as the workforce numbers will be substantially decreased, limiting the capacity to put pressure on health infrastructure or the incidence of disease. Workers also will be more likely to be sourced from within the existing community.

13 Conclusions

This Health Impact Assessment (HIA) describes potential impacts on the health of Gladstone's human population related to the construction and operation of the project. The primary focus of the HIA is the Gladstone Local Government Area, with data regarding this area sourced largely from stakeholder consultation undertaken as part of this project. The Australian Bureau of Statistics, Queensland Health and the University of Adelaide's Public Health Information Unit. Additional information for the HIA has been sourced from other technical studies which have been completed for the project's EIS.

The HIA responds to the Environmental Impact Statement's Terms of Reference which require that the current health status of the population and potential project related health related impacts are studied and appropriate mitigation and management measures identified to protect and enhance the health of the community. It focuses on aspects of community health and does not address occupational health and safety. Occupational health and safety is addressed in the Hazard and Risk assessment undertaken by Planager (2011).

Mitigation and management measures outlined in the HIA and other technical studies for the EIS will also be captured in the project's Environmental Management Plan and Social Impact Management Plan.

While there is not yet an accepted standard for HIA in Australia, for the purposes of this assessment the general approach outlined in Queensland Health's Health Impact Assessment: A Guide For Service Providers has been followed.

Existing Health Status of the Study Area

While the current health status of the population within the study area is generally comparable to that of Queensland and Australia in terms of mortality and diseases rates (such as heart disease, mental health, cancers), residents within the study area do display higher rates of risk factors, such as smoking, alcohol consumption and obesity, than the Queensland and Australian averages.

The existing health facilities in the region are generally considered adequate for the existing population (based on consultation with local health stakeholders), but are likely to be placed under pressure as the population increases.

Potential Community Health Impacts

The HIA assesses the potential impact on the current health status of the community and existing health services from the project. No high risk health related impacts have been identified largely due to confinement of construction workers to camps where they will have limited interaction with the wider community.

Those risks identified can be adequately managed and mitigated via:

- Locating a large proportion of the project's fly-in-fly-out serviced construction camp on Curtis Island and the mainland TWAF, thus limiting the interaction of workers with the broader community.
- Applying a strict code of conduct to workers (including fit for work testing) to reduce health risk factors such as alcohol abuse or illicit drug use.

- Implementing the mosquito management measures prescribed in the pest management plan (Ecosure, 2011).
- Conducting health awareness training with workers.
- Locating heath services on-site (Curtis Island) to minimise increasing pressure on existing health services

Overall, the HIA identifies that the potential health impacts associated with the project can be adequately managed by the Proponent.

There are no significant cumulative health impacts associated with the project.

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Glossary

Adaptive capacity

The ability of a group of individuals to adjust or cope with a potential impact in certain circumstances.

Ciguatera poisoning

A form of food poisoning, caused by eating warm ocean water finfish that carry ciguatera poison.

Grey water

Wastewater generated from domestic activities such as cleaning, laundry, dishwashing, and bathing.

Health determinants

Factors considered to affect ‘life expectancy, quality of life, and morbidity and mortality of communities.’ [Queensland Health]

Lay down area

An area that has been cleared for the temporary storage of equipment and supplies.

Mortality

Incidence of death.

Morbidity

Incidence of ill health.

Pigging

The practice of using pipeline inspection gauges or 'pigs' to perform various operations on a pipeline without stopping the flow of the product in the pipeline p2.

Vector

An insect or other organism that transmits a pathogenic fungus, virus, bacterium, etc.

Abbreviations

AMA	Australian Medical Association
ATODS	Alcohol, Tobacco and other Drugs Services
BPSD	Barrels per stream day
DERM	Queensland Government Department of Environment and Resource Management
CHAG	Clean and Healthy Air for Gladstone project
CG	Co-ordinator General
CSG	Coal Seam Gas
CQHSD	Central Queensland Health Service District
DLGP	Department of Local Government and Planning
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
EMP	Environmental Management Plan
EIS	Environmental Impact Statement
GP	General Medical Practitioner
GPC	Gladstone Port Corporation
GSDA	Gladstone State Development Area
HIA	Health Impact Assessment
HSEMP	Health, Safety and Environment Management Plan
IAIA	International Association for Impact Assessment
IFC	International Finance Corporation
IPIECA	International Petroleum Industry Environmental Conservation Association
KPI	Key Performance Indicator
LGA	Australian Bureau of Statistics Local Government Area
LNG	Liquefied Natural Gas
Mtpa	Million tonnes per annum
PCYC	Police Citizens Youth Club
PM	Particulate Matter
QERL	Queensland Energy Resources Ltd
QR	Queensland Rail
RSQ	Retrieval Services Queensland

SEIFA	Australian Bureau of Statistics Socia-economic Indexes for Areas
SES	State Emergency Service
SIA	Social Impact Assessment
SLA	Australian Bureau of Statistics Statistical Local Area
WHO	World Health Organisation

Appendix A

Health Statistics

A1.1 Total Fertility Rates

	Total Fertility Rate
Gladstone City	2.05
Calliope A	2.12
Calliope B	2.42
Rockhampton	1.96
Bundaberg	2.14
Miriam Vale	2.34
Brisbane	1.84
Queensland	1.91
Australia	1.83

A1.2 Historical Fertility Rates

	2004	2005	2006	2007	2008	5 yr avg
Gladstone	2.1	2.1	2.0	2.1	2.2	2.1
Brisbane	1.7	1.7	1.8	1.9	1.9	1.8
Queensland	1.8	1.8	1.8	1.9	2.0	1.9
Australia	1.8	1.8	1.8	1.8	1.9	1.8

A1.3 Infant Deaths 2003-2007

	Infant Deaths	Births	Average Annual IDR
Gladstone City	10	2,323	4.3
Calliope A	NA	NA	NA
Calliope B	0	176	0.0
Rockhampton	28	4,154	6.7
Bundaberg	13	2,991	4.3
Miriam Vale	NA	NA	NA
Brisbane	602	122,559	4.9
Queensland	1,340	263,415	5.1
Australia	6,146	1,313,082	4.7

A1.4 Chronic Health

	Type 2 diabetes (estimated) 2007-08				High cholesterol (estimated) 2007-08			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City	844.00	34.00	85	**	1392.00	54.00	95	*
Calliope A	426.00	33.00	83	**	718.00	54.00	96	
Calliope B	106.00	35.00	85		168.00	55.00	93	
Rockhampton	2238.00	37.00	95	*	3470.00	58.00	89	**
Bundaberg	2239.00	38.00	127	**	3320.00	59.00	90	**
Miriam Vale	260.00	37.00	136	**	378.00	53.00	108	
Brisbane	57000.00	34.00	93	**	92488.00	53.00	110	**
Queensland	140844.00	35.00	95	**	223956.00	55.00	100	
Australia	72276.00	34.00	100		1179909.00	56.00	100	

	Males with mental and behavioural problems (estimated) 2007-08				Males with mood (affective) problems (estimated) 2007-08			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City	1569.00	95.00	112	**	873.00	54.00	73	**
Calliope A	745.00	92.00	107		402.00	51.00	65	**
Calliope B	163.00	104.00	124	**	93	59	105	
Rockhampton	3337.00	108.00	134	**	1669.00	72.00	121	**
Bundaberg	2865.00	123.00	149	**	1912.00	63.00	140	**
Miriam Vale	408.00	128.00	148	**	251.00	75.00	148	**
Brisbane	93303.00	100.00	117	**	54181.00	58.00	99	*
Queensland	217206.00	104.00	122	**	126220.00	61.00	105	**
Australia	1055826.00	101.00	100		631987.00	60.00	100	

	Females with mental and behavioural problems (estimated) 2007-08				- Females with mood (affective) problems (estimated) 2007-08			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City	1836.00	119.00	105	*	1836.00	119.00	110	**
Calliope A	838.00	115.00	119	**	835.00	115.00	105	
Calliope B	154.00	117.00	110		154.00	117.00	112	
Rockhampton	3928.00	124.00	115	**	2684.00	86.00	121	**
Bundaberg	3384.00	135.00	129	**	2607.00	106.00	128	**
Miriam Vale	364.00	141.00	128	**	364.00	141.00	137	**
Brisbane	110434.00	116.00	104	**	79117.00	83.00	106	**
Queensland	250815.00	120.00	107	**	180946.00	86.00	111	**
Australia	1253930.00	118.00	100		899328.00	85.00	100	

	Circulatory system diseases (estimated) 2007-08				- Hypertensive disease (estimated) 2004-05			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City	4227.00	164.00	117	**	3,204	139.2	133	**
Calliope A	1931.00	148.00	115	**	1,263	111.7	107	*
Calliope B	482.00	166.00	89	*	290	101.9	97	
Rockhampton	10471.00	171.00	114	**	8,467	141.7	135	**
Bundaberg	9949.00	173.00	107	**	5,700	103.8	99	
Miriam Vale	1059.00	164.00	106		653	113.6	109	*
Brisbane	268806.00	155.00	103	**	165,656	102.8	98	**
Queensland	650105.00	160.00	104	**	408,363	108.3	103	**
Australia	3383308.00	160.00	100		2,100,677	104.6	100	

	Respiratory system diseases (estimated) 2007-08				- Asthma (estimated) 2004-05			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City	8282.00	260.00	101		3,254	107.6	107	**
Calliope A	4001.00	251.00	99		1,464	104.3	104	
Calliope B	712.00	246.00	105		325	114.5	114	*
Rockhampton	NA	NA			7,255	117.6	117	**
Bundaberg	NA	NA			5,570	119.2	119	**
Miriam Vale	1418.00	246.00	103		586	117.4	117	**
Brisbane	**501157.00**	**266.00**	106	**	186,779	105.1	105	**
Queensland	**1090728.00**	**260.00**	103	**	421,642	108.2	108	**
Australia	**5622832.00**	**266.00**	100		2,013,516	100.3	100	

	Musculoskeletal system diseases (estimated) 2007-08				- Arthritis (estimated) 2004-05			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City	8995.00	319.00	107	**	3,930	164.7	109	**
Calliope A	4493.00	319.00	105	**	1,903	162.5	108	**
Calliope B	939.00	319.00	110	**	474	163.9	109	
Rockhampton	NA	NA			10,519	177.5	118	**
Bundaberg	NA	NA			9,620	180.1	120	**
Miriam Vale	2019.00	317.00	110	**	1,057	181.5	121	**
Brisbane	530085.00	295.00	106	**	233,569	143.3	95	**
Queensland	1253905.00	304.00	106	**	592,165	156.3	104	**
Australia	6346445.00	301.00	100		3,020,085	150.5	100	

	-- Rheumatoid arthritis (estimated) 2004-05				-- Osteoarthritis (estimated) 2004-05			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City	794	32.5	133	**	2,077	90.1	117	**
Calliope A	383	32.0	131	**	1,020	89.9	117	**
Calliope B	90	30.5	125	*	197	69.0	89	
Rockhampton	1,892	32.1	131	**	5,724	96.0	125	**
Bundaberg	1,185	22.6	92	**	6,247	114.0	148	**
Miriam Vale	133	22.4	91		410	70.9	92	
Brisbane	36,076	22.0	90	**	144,980	89.9	117	**
Queensland	99,699	26.2	107	**	335,363	88.9	115	**
Australia	490,997	24.5	100		1,547,606	77.1	100	

	- Osteoporosis (estimated) 2004-05				Injury events (estimated) 2004-05			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City	522	51.5	105		5,704	182.3	95	**
Calliope A	249	51.1	104		2,523	176.2	92	**
Calliope B	30	26.7	54	**	539	190.6	99	
Rockhampton	1,711	54.5	111	**	11,669	188.6	98	
Bundaberg	1,521	51.1	104		8,635	188.2	98	
Miriam Vale	77	35.9	73	**	713	145.8	76	**
Brisbane	40,840	51.0	104	**	356,579	198.2	103	**
Queensland	89,144	48.3	98	**	743,100	189.8	99	**
Australia	496,412	49.1	100		3,847,498	191.7	100	

A1.5 Lifestyle Disease

	Male current smokers (estimated), 18 years and over 2007/08				Female current smokers (estimated), 18 years and over 2007-08			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City		253.00	118	**		204.00	113	**
Calliope A		247.00	113	**		197.00	111	**
Calliope B		252.00	138	**		248.00	120	**
Rockhampton		239.00	118	**		207.00	118	**
Bundaberg		263.00	128	**		222.00	140	**
Miriam Vale		288.00	137	**		268.00	138	**
Brisbane		219.00	97	**		183.00	100	
Queensland		234.00	107	**		202.00	109	**
Australia		224.00	100			182.00	100	

	Alcohol consumption at levels considered to be a high risk to health (estimated), persons aged 18 years and over 2007-08				Physical inactivity (estimated), persons aged 15 years and over 2007-08			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City		56.00	139	**		367.00	110	**
Calliope A		57.00	137	**		362.00	100	
Calliope B		70.00	121	*		431.00	130	**
Rockhampton		51.00	108	**		410.00	116	**
Bundaberg		51.00	128	**		425.00	117	**
Miriam Vale		73.00	134	**		422.00	140	**
Brisbane		**50.00**	106	**		359.00	100	
Queensland		54.00	110	**		369.00	105	**
Australia		**54.00**	100			343.00	100	

	Overweight (not obese) males (estimated), 15 years and over 2007-08				Obese males (estimated), 15 years and over 2004-05			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City		368.00	101			239.00	116	**
Calliope A		375.00	99			196.00	110	**
Calliope B		367.00	105			238.00	131	**
Rockhampton		354.00	101			235.00	121	**
Bundaberg		350.00	97	*		297.00	121	**
Miriam Vale		337.00	97			267.00	120	**
Brisbane		**363.00**	98	**		198.00	97	**
Queensland		**362.00**	98	**		209.00	105	**
Australia		**360.00**	100			196.00	100	

	Overweight (not obese) females (estimated), 15 years and over 2007-08				Obese females (estimated), 15 years and over 2007-08			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City		233.00	101			199.00	112	**
Calliope A		239.00	100			167.00	111	**
Calliope B		238.00	107			199.00	135	**
Rockhampton		234.00	106	**		178.00	118	**
Bundaberg		235.00	108	**		198.00	135	**
Miriam Vale		232.00	110	*		194.00	141	**
Brisbane		229.00	98	**		**160.00**	98	**
Queensland		231.00	101	**		**171.00**	106	**
Australia		227.00	100			**164.00**	100	

	Normal weight range (estimated), persons aged 15 years and over 2004-05				Usual daily intake of two or more serves of fruit (estimated), persons aged 12 years and over 2004-05			
	Number	Rate per 1,000	SR	Sig.	Number	Rate per 1,000	SR	Sig.
Gladstone City	8,853	305.00	96	**		474.00	93	**
Calliope A	3,854	257.00	93	**		450.00	91	**
Calliope B	899	310.00	105			473.00	101	
Rockhampton	20,406	NA	103	**		490.00	102	**
Bundaberg	14,464	NA	98	*		482.00	96	**
Miriam Vale	1,535	264.00	101			450.00	99	
Brisbane	558,628	NA	97	**		497.00	98	**
Queensland	1,228,847	NA	99	**		490.00	97	**
Australia	6,490,858	NA	100			502.00	100	

	People with at least one of four of the following health risk factors - smoking, harmful use of alcohol, physical inactivity, obesity (estimated) - 18 years and over 2004-05			
	Number	Rate per 1,000	SR	Sig.
Gladstone City		607	112	**
Calliope A		566	109	**
Calliope B		688	121	**
Rockhampton		632	112	**
Bundaberg		655	113	**
Miriam Vale		683	121	**
Brisbane		557	96	**
Queensland		583	102	**
Australia		559	100	

Appendix B

Risk Assessment

Health Determinant	Pathway	Potential Health Impact	Current Health Services	Sensitive communities	Risk Rating	Justification	Mitigation Measures	Residual Risk Rating
Environmental Health Determinants								
Air Quality	Construction dust created by surface exposure is air borne beyond construction site. Dust enters rainwater tanks. Visual intrusion	Irritant for those with respiratory illness e.g. Asthma, allergies. Can also cause eye/nose/throat irritation	No specific health services. Treatment at GP/Hospital	Those with existing respiratory illnesses or allergies	**Low**	This is almost certain to occur without mitigation measures in place to minimise dust creation. Dust creation will be temporary in nature and will not cause ongoing chronic health impacts. There are no properties within close proximity to Curtis Island - impacts would be associated with mainland construction only.	Refer air quality assessment (Katestone, 2011)	**Very Low/ Negligible**
	Dust and air pollutants from construction vehicle movement	Irritant for those with respiratory illness e.g. Asthma, allergies	No specific health services. Treatment at GP/Hospital	Those with existing respiratory illnesses or allergies	**Low**	Not currently assessed in air quality chapter - need further information regarding no. of		**Very Low/ Negligible**

Health Determinant	Pathway	Potential Health Impact	Current Health Services	Sensitive communities	Risk Rating	Justification	Mitigation Measures	Residual Risk Rating
						traffic movements and haul routes		
Noise	Mainland pipeline construction	Sleep disturbance/stress	No specific health services. GP/Counselling	Those within close proximity of construction.	**Low**	Noise impacts would be temporary only, although night time construction is unlikely to meet noise standards for properties within 2km of works. Unlikely to cause ongoing chronic health impacts.	Refer noise assessment (Sonus, 2011)	**Very Low/ Negligible**
	Construction vehicle movement	Sleep disturbance/stress	No specific health services. GP/Counselling	Those within close proximity of construction.	**Low**	Need transport information to ascertain no. Of vehicle movement, haul routes, timing		**Very Low/ Negligible**
	LNG facility construction	Sleep disturbance/stress	No specific health services. GP/Counselling	Harbour islands/south end	**Low**	Noise modelling shows that 24 hr noise levels at the nearest receptor (Tide Island) will be within recommended guidelines.		**Very Low/ Negligible**

Health Determinant	Pathway	Potential Health Impact	Current Health Services	Sensitive communities	Risk Rating	Justification	Mitigation Measures	Residual Risk Rating
Visual Assessment	Mainland pipeline construction	Sleep disturbance/stress	No specific health services. GP/Counselling		**Low**	Impacts would be temporary only for a small number of rural properties. Risk of health issues occurring is low.	Refer visual assessment (AECOM, 2011)	**Low**
	LNG facility construction	Sleep disturbance/stress	No specific health services. GP/Counselling	Harbour islands/south end	**Low**	Visual assessment predicts that there is a visual impact for residences on Tide/Turtle/Whit Islands, but not South End	Refer visual assessment (AECOM, 2011)	**Low**
Food and Water-borne Disease								
Seafood Poisoning	Contaminated surface water	Shellfish poisoning, Ciguatera	GP or hospitalisation	Fisherman, regular seafood consumers	**Very Low/ Negligible**		Not Required	**Very Low/ Negligible**
Surface Water Contamination	Physical contact with contaminated surface water	Inhalation of toxic substances, skin irritants	GP or hospitalisation	Swimmers, fishermen in Curtis Island/Gladstone Harbour	**Very Low/ Negligible**		Not Required	**Very Low/ Negligible**

Health Determinant	Pathway	Potential Health Impact	Current Health Services	Sensitive communities	Risk Rating	Justification	Mitigation Measures	Residual Risk Rating
Use of Recycled Water	Physical contact or drinking of with untreated recycled water	Pathogenic microorganisms including bacteria, viruses, protozoa (e.g. giardia)	GP or hospitalisation	Residents nearby recycled water plant	**Very Low/ Negligible**	Recycled water use will be contained to the construction site only and will not be used for drinking purposes	Not Required	**Very Low/ Negligible**
Infectious Diseases								
Tuberculosis	contact with infected workers	Tuberculosis	Initial hospitalisation with ongoing care from GP	General community	**Very Low/ Negligible**	QLD infection rate is very low. Minimal use of foreign workers who could spread infection. Available treatment in QLD is very good	Not Required	**Very Low/ Negligible**
Mosquito-borne Disease								
Dengue Fever	Contact with Dengue Fever mosquito bred within construction site	Fevers, aching joints, tiredness, mortality	Hospitalisation and ongoing GP treatment	Residents within close proximity of breeding areas	**Very Low/ Negligible**	No Dengue outbreaks in Gladstone. Dengue mosquitoes only travel small distance from breeding site.	Refer pest management plan (Ecosure, 2011)	**Very Low/Negligible**

Health Determinant	Pathway	Potential Health Impact	Current Health Services	Sensitive communities	Risk Rating	Justification	Mitigation Measures	Residual Risk Rating
Ross River Fever and Barmah Forest Virus	Contact with breeding mosquitoes carrying virus within construction site	Fever, aching joints, tiredness	Ongoing GP Treatment	Gladstone Residents	**Low**	Incidence rate in Gladstone is relatively low compared to other diseases, and health consequences are not chronic.	Refer pest management plan (Ecosure, 2011)	**Very Low/ Negligible**
Socio-economic								
Increased no. of families	Workers moving family to Gladstone	Increased pressure on child healthcare services	Infant/childc are specialist services	Families	**Low**	Majority of workers will be in construction camp or fly in/fly out. Unlikely for large no. Of families to move.	Communication of workforce make-up to Government for use in Health Services Planning.	**Low**
Changes to economic circumstances	Disparity in incomes, pressure on public housing, increase in cost of living	Drug and alcohol abuse, mental health, increased level of violence, poor nutrition, reduced access to healthcare/services, risk taking behaviour, smoking	GP, counselling	Low socio-economic status, women, pensioners, families, single men	**positive**	Positive impact of increased employment, business etc. Confirm when look at pressure on public housing.	Not Required	**positive**

Health Determinant	Pathway	Potential Health Impact	Current Health Services	Sensitive communities	Risk Rating	Justification	Mitigation Measures	Residual Risk Rating
Increased level of violent crime	Drinking, ,drug intake	Physical harm, reduced mental health	Police	Gladstone Residents	**Low**	Very limited interaction of workers with community	Code of Conduct	**Low**
Lifestyle								
Nutrition	increased workers drive demand and cost of food, decreasing food affordability	Malnutrition	No specific health services	Low socio-economic status, disabled, families	**Very Low/ Negligible**	Food for the project will be sourced from beyond Gladstone and is not anticipated to influence local food supply.	No mitigation required	**Very Low/ Negligible**
Alcohol	Increased divide between rich and poor (dual economy), camp living away from family, home life and recreational activities, increased opportunity due to increased pay	Increased rate of workplace accidents, road incidents, violence, direct physical impacts, risk-taking behaviour, liver disease	Drug & alcohol counsellors, private groups, mental health unit at Gladstone Hospital	Women, general community, families, low socio-economic status	**Medium**	Alcohol consumption rates in Gladstone are significantly higher than Qld/Aus rates. Rates are also higher amongst shift workers. Likely to cause a burden on existing health services.	Limited drinking in camps Provision of other recreational activities within camp Staff Education Zero blood alcohol limit on shift, including driving	**Very Low/Negligible**

Health Determinant	Pathway	Potential Health Impact	Current Health Services	Sensitive communities	Risk Rating	Justification	Mitigation Measures	Residual Risk Rating
	, shift work, risk-taking behaviour, housing pressure							
Illicit Substance Abuse	Increased divide between rich and poor (dual economy), camp living away from family, home life and recreational activities, increased opportunity due to increased pay , shift work, risk-taking behaviour, housing pressure	Increased rate of workplace accidents, road incidents, violence, direct physical impacts, risk-taking behaviour, HIV/AIDS, STIs.	Drug & alcohol counsellors, private groups, mental health unit at Gladstone Hospital	Families, general community, women, low-socio economic status	**Low**	Illicit drug use in Gladstone is lower than most of Queensland and less likely to cause death or illness than alcohol/tobacco abuse. The impacts of use can be substantial however and can place a burden on existing health services.	Provision of other recreational activities within camp Staff Education Drug testing and zero tolerance policy	**Very Low/Negligible**

Health Determinant	Pathway	Potential Health Impact	Current Health Services	Sensitive communities	Risk Rating	Justification	Mitigation Measures	Residual Risk Rating
Smoking	Passive smoking when in community, increased disposable income	Respiratory disease, cardio-vascular disease, cancer.	GP, Hospitalisation, QUIT Program	Family	**Low**	Likelihood of project causing additional community health impacts related to smoking is low . It is noted that the existing level of smoking in Gladstone is high.	Staff Education	**Very Low/Negligible**
Lack of physical exercise & Obesity	Increased pressure on recreational/sporting facilities from increased workers	Mental health, obesity, cardio-vascular disease	Healthy Gladstone Program, community centre health programs	General community, sporting clubs, GRC	**Low**	Increased workers will mostly be confined to construction camps and unlikely to use existing recreation/sporting facilities. Lack of physical exercise may impact on long-term health of workers and existing health services.	Provision of health and fitness programs within camps. Provision of sporting/recreation facilities within camp e.g. Gym etc.	**Very Low/Negligible**
Sexual and other High Risk Behaviours								

Health Determinant	Pathway	Potential Health Impact	Current Health Services	Sensitive communities	Risk Rating	Justification	Mitigation Measures	Residual Risk Rating
STI's	Workers having unprotected sex with community member. (workforce is mostly male, confined to camps, and more likely to partake in risky behaviour e.g. drinking	Chlamydia, Gonorrhoea Etc.	Community Health Clinics, STI awareness programs	Women, families of workers, young people	**Low**	Although health consequences are minor, infection is likely to occur without preventative measures in place	Workplace awareness training, camp restrictions, free condoms	**Very Low/Negligible**
AIDS/HIV	Workers having unprotected sex with community member. (workforce is mostly male, confined to camps, and more likely to partake in risky behaviour e.g. drinking	HIV/AIDS	No specific health services	IV drug users, homosexual males	**Low**	Deaths do occur, although rate is decreasing with treatment. Requires ongoing medical treatment. Current incidence rate in Gladstone is low. Unlikely to import significant numbers of foreign workers	Workplace awareness training, camp restrictions, free condoms	**Very Low/Negligible**
Hepatitis	contact with infected	Hepatitis C	No specific health	IV drug users, males	**Low**		Strict disciplinary action for drug	**Very Low/Negligi**

Health Determinant	Pathway	Potential Health Impact	Current Health Services	Sensitive communities	Risk Rating	Justification	Mitigation Measures	Residual Risk Rating
	workers		services				users Staff education Drug testing to minimise use of IV drugs	**ble**
Social Infrastructure								
Access to recreational areas	Restriction of access to coastal areas for fishing/swimming), loss of natural areas on Curtis Island	spiritual/mental health, lower physical activity	NA	Curtis Island users, Gladstone harbour users, fishermen	**Low**	There may be some minor loss of access, but it would be a small component of overall recreation space; there are many other opportunities in the Gladstone region	No mitigation required	**Low**
Access to cultural capital	Growth in population puts pressure on the lifestyle valued by existing residents, greater demand for cultural activities/facilities e.g.	Spiritual/mental health, sense of community	NA	General community, communities with lower socio-economic status with poor transport access	**Low**	There will be minimal demand on cultural capital from workers accommodated in camps. This is not a major health risk in isolation.	Funding support for cultural capital in outlying areas with minimal facilities.	**Low**

Health Determinant	Pathway	Potential Health Impact	Current Health Services	Sensitive communities	Risk Rating	Justification	Mitigation Measures	Residual Risk Rating
	Religious, libraries, playgrounds, bike paths etc.							
Mental Health	Workers with mental health issues (work-related) or underlying requiring medical assistance. Change to socio-economic circumstances of Gladstone residents	Depression, anxiety/stress related illnesses, substance abuse	GP, Mental health workers, clinics	Workers families, general community	**Low**	Conditions in work camp could impact negatively on mental health. Assuming level of mental health is 20% at any one time adds an additional potential 600 workers requiring medical assistance. Conversely, project could improve wealth/employment in Gladstone which	Mental health worker employed Staff education Provision of recreation/socialisation opportunities within Camp.	**Very Low/Negligible**

Health Determinant	Pathway	Potential Health Impact	Current Health Services	Sensitive communities	Risk Rating	Justification	Mitigation Measures	Residual Risk Rating
						would be a positive influence.		

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
Environmental Health Determinants								
Air Quality	Dust and pollution from operational vehicle movement	Irritant for those with respiratory illness e.g. asthma	No specific health services. Treatment at GP/Hospital	Residents adjacent to mainland vehicle movement corridors	**Very Low/ Negligible**		Refer air quality assessment (Katestone, 2011)	**Very Low/ Negligible**
	Emissions from operations of the LNG Plant	Irritant for those with respiratory illness e.g. Asthma, allergies	No specific health services. Treatment at GP/Hospital	Those with existing respiratory illnesses or allergies who are within the air path of the project.	**Very Low/ Negligible**			**Very Low/ Negligible**
Noise	Operation of the LNG Plant	Sleep disturbance/ stress	No specific health services. Treatment at GP/Hospital	Residents of harbour islands/Southend	**Low**	Noise at the nearest sensitive receptor (Tide Island) will exceed recommended levels without acoustic treatment. No other receptors are predicted to	Refer noise assessment (Sonus, 2011)	**Very Low/ Negligible**

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
						be impacted.		
	Operational vehicle movement	Sleep disturbance/ stress	No specific health services. Treatment at GP/Hospital	Residents adjacent to mainland vehicle movement corridors	**Low**			**Very Low/ Negligible**
Visual Assessment	LNG facility operation (normal daytime Conditions)	stress	No specific health services. GP/Counselling	Harbour islands	**Low**	Visual assessment predicts there is a major visual impact for residences on Tide/Turtle/Whit Islands, but not South End. The extent of impact is very limited. With treatment however, the risk is reduced.	Refer visual assessment (AECOM, 2011)	**Low**
	LNG Facility operation (night time glare)	Sleep disturbance/ stress	No specific health services. GP/Counselling	Harbour islands	**Low**			**Low**

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
	LNG facility operation (flaring)	Sleep disturbance/ stress	No specific health services. GP/Counselling	Harbour islands/south end	**Low**			**Low**
Food and Water-borne Disease								
Drinking Water	Drinking Groundwater contamination from accidental oil/chemical spill at LNG facility	Salmonella, E. Coli, listeria, cholera. Viruses such as Hepatitis A and parasites	No specific health services. Treatment at GP/Hospital	South End	**Very Low/ Negligible**	Southend does not use groundwater for drinking purposes	Not required	**Very Low/ Negligible**
Surface Water Contamination	Physical contact with contaminated surface water	Inhalation of toxic substances, skin irritants	GP or hospitalisation	Swimmers, fishermen in Curtis Island/Gladstone Harbour	**Very Low/ Negligible**	Need further info from marine water quality chapter on potential contaminants.		**Very Low/ Negligible**

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
	caused by leak from LNG Plant or vessels							
Use of Recycled Water	Physical contact or drinking of with untreated recycled water	Pathogenic microorganisms including bacteria, viruses, protozoa (e.g. giardia)	GP or hospitalisation	Residents nearby recycled water plant	**Very Low/ Negligible**	Recycled water use will be contained to the project site only and will not be used for drinking purposes	Not Required	**Very Low/ Negligible**
Infectious Diseases								
Tuberculosis	Contact with infected workers	Tuberculosis	Initial hospitalisation with ongoing care from GP	General community	**Very Low/ Negligible**	QLD infection rate is very low. Operational workers will be sourced from local community. Available treatment in QLD is very good	No mitigation required	**Very Low/ Negligible**
Mosquito-borne Disease								

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
Dengue Fever	Contact with Dengue Fever mosquito bred within permanent or temporary pools of water.	Fevers, aching joints, tiredness, mortality	Hospitalisation and ongoing GP treatment	Residents within close proximity of breeding areas	**Low**	No Dengue outbreaks in Gladstone. Dengue mosquitoes only travel small distance from breeding site.	Refer pest management plan (Ecosure, 2011)	**Very Low/Negligible**
Ross River Fever and Barmah Forest Virus	Contact with breeding mosquitoes carrying virus within LNG site	Fever, aching joints, tiredness	Ongoing GP Treatment	Gladstone Residents	**Low**	Incidence rate in Gladstone is relatively low compared to other diseases, and health consequences are not chronic.	Refer pest management plan (Ecosure, 2011)	**Very Low/Negligible**
Socio-economic								
Increased no. of families	Workers moving family to Gladstone	Increased pressure on child healthcare services	Infant/childcare specialist services	Families	**Very Low/ Negligible**	Operational workers sourced locally, and their families would already be residing in Gladstone region.	No mitigation required	**Very Low/ Negligible**

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
Changes to economic circumstances	disparity in incomes, pressure on public housing, increase in cost of living	Drug and alcohol abuse, mental health, increased level of violence, poor nutrition, reduced access to healthcare/service, risk taking behaviour, smoking	GP, counselling	low socio-economic status, women, pensioners, families, single men	**Very Low (Positive)**	Positive impact of increased employment, business etc.	No mitigation required, as impact is positive.	**Very Low (Positive)**
Increased level of violent crime	Drinking, ,drug intake	Physical harm, reduced mental health	Police	Gladstone Residents	**Very Low/ Negligible**	Low number of workers	No mitigation required	**Very Low/ Negligible**
Lifestyle								
Nutrition	Increased workers drive demand and cost	Malnutrition	No specific health services	Low socio-economic status, disabled, families	**Very Low/ Negligible**	Workers will be locally based, and the workforce numbers reduced.	No mitigation required.	**Very Low/ Negligible**

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
	of food, decreasing food affordability							
Alcohol	Increased divide between rich and poor (dual economy), increased opportunity due to increased pay , shift work, risk-taking behaviour, housing pressure	Increased rate of workplace accidents, road incidents, violence, direct physical impacts, risk-taking behaviour, liver disease	Drug & alcohol counsellors, private groups, mental health unit at Gladstone Hospital	Women, general community, families, low socio-economic status	**Low**	Alcohol consumption rates in Gladstone are significantly higher than Qld/Aus rates. Rates are also higher amongst shift workers. Likely to cause a burden on existing health services, however number are reduced with the smaller workforce. Workers will also housed within the community, not within construction camps.	Staff Education Zero blood alcohol limit on shift, including driving Good working conditions	**Low**

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
Illicit Substance Abuse	Increased divide between rich and poor (dual economy), increased opportunity due to increased pay , shift work, risk-taking behaviour, housing pressure	increased rate of workplace accidents, road incidents, violence, direct physical impacts, risk-taking behaviour, HIV/AIDS, STIs.	Drug & alcohol counsellors, private groups, mental health unit at Gladstone Hospital	Families, general community, women, low-socio economic status	**Very Low/Negligible**	Illicit drug use in Gladstone is lower than most of Queensland and less likely to cause death or illness than alcohol/tobacco abuse. Workforce will be drawn from within existing population	Staff Education Contribution to community education campaigns Drug testing and zero tolerance policy	**Very Low/ Negligible**

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
Smoking	Passive smoking when in community, increased disposable income	Respiratory disease, cardio-vascular disease, cancer.	GP, Hospitalisation, QUIT Program	Family	**Very Low/Negligible**	Likelihood of project causing additional community health impacts related to smoking is low, workers will also be drawn from within existing community, limiting additional pressure on health system	Staff Education Gladstone Fund Contribution to community education programs	**Low**
Lack of physical exercise & Obesity	Increased pressure on recreational/sporting facilities from increased workers, reduced physical activity of	Mental health, obesity, cardio-vascular disease	Healthy Gladstone Program, community centre health programs	General community, sporting clubs, GRC	**Very Low/Negligible**	Lack of physical exercise may impact on long-term health of workers and existing health services.	Provision of health and fitness programs within work environment. Education programs	**Very Low/ Negligible**

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
	workers							
Sexual and other High Risk Behaviours								
STI's	Workers having unprotected sex with community member. Risky behaviour is less likely in permanent workforce that live locally and have family support.	Chlamydia, Gonorrhoea Etc.	Community Health Clinics, STI awareness programs	Women, families of workers, young people	**Very Low/Negligible**	Although health consequences are minor, infection is likely to occur without preventative measures in place, although risk taking behaviour is reduced in the permanent workforce	Workplace awareness training.	**Very Low/ Negligible**

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
AIDS/HIV	Workers having unprotected sex with community member. Workers are drawn from local community	HIV/AIDS	No specific health services	IV drug users, homosexual males	**Very Low/Negligible**	Deaths do occur, although rate is decreasing with treatment. Requires ongoing medical treatment. Current incidence rate in Gladstone is low. Workers will be drawn from the existing community and unlikely project will contribute to increased numbers.	Workplace awareness training, camp restrictions, free condoms	**Very Low/ Negligible**
Hepatitis	contact with infected workers	Hepatitis C	No specific health services	IV drug users, males	**Very Low/Negligible**	Death can occur and health impacts can be chronic. Over 75% of cases are associated with IV Drug Users.	Strict disciplinary action for drug users Staff education contribution to community education campaigns Drug testing to minimise use of IV drugs	**Very Low/ Negligible**

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
Social Infrastructure								
Access to recreational areas	restriction of access to coastal areas for fishing/swimming), loss of natural areas on Curtis Island	spiritual/mental health, lower physical activity		Curtis Island users, Gladstone harbour users, fishermen	**Very Low/ Negligible**	There may be some minor loss of access, but it would be a small component of overall recreation space; there are many other opportunities in the Gladstone region	No mitigation required	**Very Low/ Negligible**
Access to cultural capital	Growth in population puts pressure on the lifestyle valued by existing residents, greater demand for cultural activities	Spiritual/mental health, sense of community		General community, communities with lower socio-economic status with poor transport access	**Very Low/ Negligible**	Operational workforce drawn from existing community.	No mitigation necessary	**Very Low/ Negligible**

OPERATIONAL RISK ASSESSMENT								
Health Determinant	**Pathway**	**Potential Health Impact**	**Current Health Services**	**Vulnerable communities**	**Risk Rating**	**Justification**	**Mitigation Measures**	**Residual Risk Rating**
	/facilities e.g. Religious, libraries, playgrounds, bike paths etc.							
Mental Health	Workers with mental health issues (work-related) or underlying requiring medical assistance.	Depression, anxiety/stress related illnesses, substance abuse	GP, Mental health workers, clinics	Workers families, general community	**Very Low/Negligible**	Workers will be drawn from within existing community and are likely to experience levels of mental health in line with the current community.	Mental health worker employed Staff education Provision of recreation/socialisation opportunities within facilities	**Very Low/Negligible**