Australia Pacific LNG Project

Volume 4: LNG Facility

Chapter 9: Aquatic Ecology

Contents

9. Aquatic ecology 1
9.1 Introduction 1
9.1.1 Purpose 1
9.1.2 Scope of work 1
9.1.3 Legislative framework 2
9.2 Methodology 2
9.2.1 Desktop review 2
9.2.2 Site investigations 3
9.3 Environmental values 3
9.4 Existing environment 5
9.4.1 Background information 5
9.4.2 Identified aquatic ecosystems 6
9.4.3 Aquatic assessment 9
9.5 Potential impacts 10
9.5.1 Construction phase 10
9.5.2 Operational phase 10
9.6 Mitigation and management 10
9.6.1 Construction phase 11
9.6.2 Operational phase 11
9.7 Conclusions 12
9.7.1 Assessment outcomes 12
9.8 Commitments 14
References 15

Figures

Figure 9.1 Waterway locations 4
Figure 9.2 Laird Point farm dam, June 2009 6
Figure 9.3 Laird Point farm dam, October 2009 7
Figure 9.4 Melaleuca wetland, July 2009 8
Figure 9.5 Melaleuca wetland, October 2009 8
Figure 9.6 Melaleuca soak, October 2009 9

Tables

Table 9.1 EPP Water environmental values 5

Table 9.2 Summary of environmental values, sustainability principles, potential impacts and mitigation measures 13

9. Aquatic ecology

9.1 Introduction

9.1.1 Purpose

This chapter assesses the localised freshwater aquatic ecological values of the liquefied natural gas (LNG) facility proposed for Curtis Island near Laird Point. The study involved desktop and field survey work to identify environmental values, identification of potential impacts, assessment and development of mitigation measures.

The purpose of this aquatic ecology assessment is to describe the potential effect of the LNG facility on the environment.

Australia Pacific LNG's sustainability principles will be applied to the planning, design, construction and operation of the Project to encourage management and mitigation of any adverse impacts to aquatic environments. Of Australia Pacific LNG's 12 sustainability principles, key principles relevant to aquatic ecology for the LNG facility include:

- Minimising adverse environmental impacts and enhancing environmental benefits associated with Australia Pacific LNG's activities, products or services; conserving, protecting, and enhancing where the opportunity exists, the biodiversity values and water resources in its operational areas
- Identifying, assessing, managing, monitoring and reviewing risks to Australia Pacific LNG's workforce, its property, the environment and the communities affected by its activities.

These principles will be applied to the planning, design, construction, operation and decommissioning of the LNG facility to ensure that works do not significantly impact the overall aquatic ecology of the site and surrounding environment.

9.1.2 Scope of work

The objectives of the aquatic ecology impact assessment were to:

- Identify key localised aquatic ecology values of the LNG facility site through desktop and field surveys.
- Identify potential impacts on these ecological features and values that may result from activities associated with the construction, operation and decommissioning of the LNG facility.
- Identify appropriate mitigation measures aimed to avoid and minimise potential impacts on these ecological features and values.
- Address Section 3.4.3 of the terms of reference for the Project focussing on freshwater flora and fauna.

Volume 4 Chapter 8 addresses terrestrial ecology, Volume 4 Chapter 10 addresses marine ecology and Volume 4 Chapter 11 addresses surface water, groundwater and water quality.

9.1.3 Legislative framework

Key legislative and planning policies that relate to freshwater ecology for the LNG facility site include the following. Legislation relating to marine waters, marine parks or terrestrial ecology is detailed within the above identified chapters of Volume 4.

Environmental Protection Act

The purpose of the *Environment Protection Act 1994* (EP Act) is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

These aims are achieved through the implementation of an integrated management program administered by the Department of Environment and Resource Management (DERM). The program incorporates policies and guidelines that have been refined for the last 15 years. This approach ensures that proposed future developments are ecologically sustainable.

Environmental Protection Regulation

The Environmental Protection Regulation 2008 supports the EIS process and identifies environmentally relevant activities prescribed under the EP Act. It outlines the matters that the administering authority must consider when making environmental management decisions and details the prescribed water contaminants.

Environmental Protection (Water) Policy

The Environmental Protection (Water) Policy 2009 (EPP Water) aims to assist in achieving the objectives of the EP Act in relation to Queensland waters through establishing environmental values (EVs) and water quality objectives (WQOs). No specific EVs or WQOs have been established for Curtis Island to date.

Water Act

The *Water Act 2000* provides for the sustainable planning and management of water and other resources by establishing a system for the planning, allocation and use of water.

The Act requires that unless carried out under a petroleum authority, a permit be obtained for any works that will result in destroying vegetation or excavating or placing fill in a watercourse, lake or spring.

9.2 Methodology

9.2.1 Desktop review

Existing documentation for the Port Curtis and Curtis Island area was reviewed in order to extract relevant information regarding the aquatic habitat of the LNG facility site and surrounding region.

Background information was sourced from the following documentation:

- Curtis Coast Regional Coastal Management Plan, 2003, prepared by the Environmental Protection Agency
- Curtis Coast Stormwater Runoff, 2002, prepared for the Gladstone Harbour Protection and Enhancement Strategy by Brisbane City Council

- Design of an Integrated Monitoring Program. Gladstone Harbour Protection and Enhancement Strategy 2001, prepared by Central Queensland University
- Port Curtis Ecosystem Health Report Card 2007, prepared by Storey et al. (2007) for the Port Curtis Integrated Monitoring Program
- Department of Environment and Resource Management (DERM) website (www.derm.qld.gov.au)

9.2.2 Site investigations

A reconnaissance survey of the LNG facility site was carried out on 16 June 2009 for the assessment of drainage lines and their associated potential aquatic habitats. The survey was conducted during the dry season. Based on the desktop review, water was not expected to be found within the LNG facility site. The Bureau of Meteorology recorded no rainfall for Gladstone or South End (on Curtis Island) for at least three weeks prior to the reconnaissance survey. However, as a precaution, water sampling equipment was taken to the island so that if any freshwater waterbodies were found they could be sampled. A second field survey as part of the drainage line assessment was undertaken on 7 October 2009 to carry out water sampling and to conduct additional drainage line and habitat identification and mapping.

Where water was present, a TPS 90FL water quality meter was used to record temperature, dissolved oxygen, conductivity and pH. Samples were collected in laboratory prepared plastic or glass bottles, containing appropriate preservatives, where required. Sample bottles that did not contain preservatives were rinsed with site water immediately prior to the sample being collected. Nitrile gloves were worn to negate sample contamination as well as protection against potential spills of the preservative material. A chain of custody form accompanied any samples that were sent to the laboratory, with a copy kept for internal record purposes. Parameters analysed in the laboratory were nutrients (total nitrogen, total kjeldahl nitrogen, nitrate, nitrite, ammonia and total phosphorus), cations and anions (carbonate, chloride, calcium, magnesium, sodium and potassium), metals (arsenic, cadmium, copper, lead, mercury, nickel and zinc), and hydrocarbons (benzene, toluene, ethylbenzene and xylene).

Drainage lines were traversed and mapped using a global positioning system (GPS) unit. The GPS information was then exported to a site drawing locating the drainage lines over the LNG facility site. The location of all drainage lines and wetlands found are shown in Figure 9.1 .

9.3 Environmental values

Environmental values are the qualities of drainage lines that need to be protected from the effects of pollution, waste discharges and deposits to ensure healthy aquatic ecosystems and drainage lines that are safe and suitable for community use. These include the maintenance and protection of healthy aquatic ecosystems, health and safety, commercial and cultural heritage values.

The EPP Water was established to achieve the objectives of the EP Act in relation to Queensland waters and provides the framework for establishing EVs and WQOs for Queensland waters. No environmental values have been established for the freshwater areas around Port Curtis. Table 9.1 provides the environmental values applicable to Port Curtis marine waters only, as an indication of receiving waterway values.

Furthermore, no additional environmental values have been established for the Port Curtis area within the Queensland Water Quality Guidelines (2009). The Port Curtis Integrated Monitoring Program

monitors water quality, metals in sediments and oysters, oil spills and seagrass health. The program has been sampling sites around Port Curtis since 2005 and Australia Pacific LNG is a member.

Figure 9.1 Waterway locations

Table 9.1 EPP Water environmental values

EPP Water EVs	Port Curtis EVs
Aquatic ecosystems	Local – aquatic ecosystems within Port Curtis Regional and state – Great Barrier Reef Marine Park
Aquaculture use	Commercial fishing.
Primary recreation	Swimming, water sports and recreational fishing
Secondary recreation	Wading, boating
Drinking water	NA
Industrial purposes	LNG facility site water usage, cooling water for other industries, export of resources from Central Queensland
Cultural and spiritual values	Cultural significance of Port Curtis and Graham Creek, Indigenous Traditional Owners

9.4 Existing environment

9.4.1 Background information

There is little background information available regarding the aquatic ecology and ecological features of the area or information on the species that may inhabit the area. This is likely due to the ephemeral nature of the drainage lines and the difficulty in obtaining suitable information. There would be limited opportunity to obtain water quality and aquatic ecology samples, except during, or potentially immediately after, rainfall events.

Existing documentation was reviewed and provided some general information on the region. The Curtis Coast Regional Coastal Management Plan identifies water quality management as a primary focus for the region. Polluted runoff has the potential to impact on the sensitive environment on the coast, including fish habitat areas, the dugong protection area and the Great Barrier Reef Marine Park World Heritage Area. Increased impervious areas can impact on quantity and velocity of water which can also impact on aquatic ecosystems (Environmental Protection Agency and Queensland Parks and Wildlife Service 2003).

The Gladstone Harbour Protection and Enhancement Strategy (Central Queensland University 2001) identified that biannual macrobenthic monitoring was undertaken north of the LNG facility site. Mangrove monitoring was undertaken west of the Hamilton Point site. No monitoring was undertaken within the creeks on the LNG facility site and all monitoring was in estuarine or marine areas.

The Port Curtis Ecosystem Health Report Card (Storey et al. 2007) investigated a number of monitoring locations within The Narrows and Grahams Creek, north and west of the site. All of these monitoring locations investigated marine or estuarine locations. No freshwater samples were taken.

Numerous aquatic and water quality investigations have occurred on Curtis Island to determine suitable locations for new LNG facility infrastructure. Although a number of assessments have occurred, no water quality or aquatic ecology sampling has been undertaken for freshwater on the southern section of the island.

Although recognising the area as an area for protection, DERM has no water quality monitoring results or aquatic ecology information available for the LNG facility site or other freshwater areas on the south of the island. The abovementioned reports do identify the need for adequate water quality management and sediment and erosion control to ensure that contaminated water does not enter sensitive receiving environments.

9.4.2 Identified aquatic ecosystems

During the course of the site investigations, two wetlands, an artificial farm dam and several drainage lines were identified. The location of all drainage lines and wetlands found are shown in Figure 9.1 . The two wetlands and farm dam are within the development footprint of the LNG facility.

Wetlands and farm dam

One water body was found within the LNG facility site area during the first aquatic ecology site survey. This was a small, established farm dam (Figure 9.2). A groundwater bore is located near the farm dam, which previously pumped water to the surface to fill the dam during dry periods (to provide water for stock). The groundwater bore and farm dam are no longer used. The dam contained very little vegetation at the time of the reconnaissance survey, consisting of generally filamentous and suspended algae. Soils in the vicinity were dusty, consisting of sandy silty clays and gravel, with some areas showing bedrock and cobble-sized material.

Figure 9.2 Laird Point farm dam, June 2009

Water from the farm dam was sampled during the first aquatic ecology site survey, however it could not be taken as reflective of surface waters due to the nature of the source. Having been pumped from the groundwater bore, the water had become stagnant prior to sampling. Volume 4 Chapter 11 provides details of the water sampling results from the farm dam, however in summary there were naturally elevated with chloride, sodium and copper readings from the groundwater, as well as organic nitrogen from the presence of an algae bloom. Generally all other parameters were low.

The second aquatic ecology site survey was carried out on 7 October 2009. The farm dam was found to be dry due to the extremely dry conditions of the previous months and the inactivity of pumping groundwater to the dam. Figure 9.3 shows the state of the farm dam in October 2009.

A natural *Melaleuca* wetland was identified on site during the soils investigation survey from 13 to 19 July 2009 (Figure 9.4). This wetland was in relatively good condition with some evidence of disturbance including grazing and litter. The wetland had weed infestations of common prickly pear and suspended algae throughout the shallow water column. There was no evidence of flow into or out of the wetland. Water in this wetland was not sampled, due to the limited sampling apparatus available for the nature of the site investigation at that time.

During the second aquatic ecology site survey in October 2009, the wetland was found to be dry due to the extremely dry conditions of the previous months. Due to the condition of the wetland, no water quality sampling could be undertaken. Figure 9.5 highlights the conditions of the wetland during October 2009.

One other small wetland was identified during the October aquatic ecology site survey. This was a *Melaleuca* soak area on the southern side of the mudflats. The *Melaleucas* were present in a slight depression that, although dry at the time of the assessment, would collect water from surface runoff during wet periods. Limited standing surface water would be present within the shallow depression, with the *Melaleucas* surviving through groundwater. Figure 9.6 shows the Melaleuca soak.

Figure 9.3 Laird Point farm dam, October 2009

Figure 9.4 Melaleuca wetland, July 2009

Figure 9.5 Melaleuca wetland, October 2009

Figure 9.6 Melaleuca soak, October 2009

Drainage lines

Within the LNG facility site are ephemeral drainage lines and overland flow paths that largely drain into Port Curtis. To the north of the site, the drainage line flows into Graham Creek in the Marine Park to the north. All drainage lines found within the LNG facility site area were dry at the time of targeted investigation (July and October 2009). Soils within the drainage lines were dusty, consisting of sandy silty clays and gravel, with some areas showing bedrock and cobble sized material.

Little or no vegetation was established within these drainage lines that would be considered as potential aquatic habitat during wet periods. Further information regarding the drainage lines conditions and the associated hydraulics and hydrology are detailed in Volume 4 Chapter 11.

9.4.3 Aquatic assessment

The farm dam is an artificial waterbody with water sources predominantly from a groundwater bore that was previously pumped into the dam as required. Without a permanent source of water and due to no presence of vegetation within the dam and evidence of cattle and horses disturbing the substrate, it is concluded the dam provides little habitat value to native aquatic species.

The *Melaleuca* wetland has low vegetation diversity and short inundation periods, equating to limited value for establishing long-term aquatic habitat. Similar to the farm dam, cattle and horses have damaged the substrate and vegetation due to unmitigated access. Although the wetland would provide a watering point for birds and other fauna (refer Volume 4 Chapter 8), other wetlands experiencing longer inundation periods around Curtis Island may provide more suitable habitats and values for aquatic species. These wetlands, where in-stream vegetation is established, allow aquatic communities the opportunity for higher interaction through breeding regimes and feeding cycles, providing a higher aquatic habitat value.

The height of standing water within the *Melaleuca* soak area is vulnerable to climatic conditions and it is likely that aquatic habitat value is low for most of the year.

Each drainage line encountered during the site surveys was ephemeral in nature and would quickly dry after rain events. Some areas contained deeper pools that would most likely retain water longer than the drainage lines, though only for a short period. It is concluded that these drainage lines have low aquatic habitat value due to the short tern nature of water retention.

9.5 Potential impacts

As described in Section 9.4.2, there were no permanent drainage lines identified on the LNG facility site. Ephemeral drainage lines, the farm dam and wetlands will be removed as a result of the LNG facility development. Volume 4 Chapter 11 provides measures for the diversion of stormwater around the LNG facility site. The aquatic habitat value of these ephemeral drainage lines and wetlands is low, and other wetlands throughout Curtis Island may provide higher habitat prospects than those within the development footprint. Notwithstanding this, the potential cumulative effect of each proposed LNG facility along the western coastline of Curtis Island, south of Laird Point, may impact on the overall quality of aquatic habitat available if extensive filling or redirection of watercourses occurs at each site. The extent of impacts from other facilities is currently unknown.

9.5.1 Construction phase

The main impact from construction activities is the loss of low value, aquatic habitat. Other impacts on aquatic habitat are associated with the removal of vegetation and earthworks. The erosion potential will be high if not mitigated. Stockpiles have the potential for soil loss into drainage lines, causing sedimentation and infilling of drainage lines and potential interruptions to flow, thereby increasing local flooding risks.

Other construction impacts to aquatic ecology include the potential release of contaminants that may be attached to the soils that enter drainage lines and flow into Port Curtis. Earthworks and piling may disturb acid sulfate soils which could impact the pH of the receiving environment.

Ponded water may provide a suitable habitat for mosquito breeding. If construction is undertaken during periods of high rainfall and water pools for long periods this may create suitable habitat for mosquito breeding.

9.5.2 Operational phase

Contaminated stormwater has the potential to runoff from fuel/chemical storage areas and plant equipment storage areas, if not managed appropriately. The presence of hydrocarbons in either the water runoff or air can affect habitat status. The ephemeral nature of the drainage lines that would be affected by the development of the LNG facility means that natural stresses would be accentuated. Nutrient and dissolved oxygen fluxes (Boulton and Brock 1999) may be impacted through increases in suspended sediment and introducing hydrocarbons or other pollutants.

Permanent sediment ponds have the potential to provide suitable mosquito breeding habitat.

9.6 Mitigation and management

Measures to mitigate the potential impacts of the LNG facility on the aquatic ecosystems have been identified. Measures have been developed with the aim of avoiding or minimising the intensity of the impacts.

9.6.1 Construction phase

Mitigation measures for the construction phase are as follows:

- Stormwater management techniques as described in Volume 4 Chapter 11 will be implemented. These include:
  - Diversion of uncontaminated stormwater around the site
  - Construction of sediment ponds to capture stormwater prior to release and the construction of check dams or other stormwater management devices to reduce flows and therefore erosion potential
  - Capture of sediment-laden water within sediment ponds will be important to mitigate against potential impacts to water quality
- When scheduling construction over the melaleuca wetlands consideration will be given to managing impact on transient aquatic fauna during high risk periods
- Fauna found around the wetlands during construction will be managed as detailed in Volume 4 Chapter 8
- Soil stockpiles will have either erosion control devices or diversion drains constructed. Long term stockpiles will be vegetated or mulched
- Open water storage areas will be designed to be deeper than 0.6m to prevent waterborne insects breeding. Management of waterborne insects will be included in the biosecurity management plan.

9.6.2 Operational phase

Mitigation measures for the operational phase are as follows:

- Stormwater management techniques as described in Volume 4 Chapter 11 will be implemented. These include:
  - Diversion of uncontaminated stormwater around the site
  - Capture of sediment-laden water within sediment ponds
- Fuel/chemical storage areas will be bunded and spill kits will be readily available
- Open water storage areas will be designed to be deeper than 0.6m to prevent waterborne insects breeding. Management of waterborne insects will be included in the mosquito management plan.

9.7 Conclusions

9.7.1 Assessment outcomes

This study was undertaken to identify potential impacts of the construction and operation of the LNG facility on aquatic ecology and develop mitigation measures in accordance with the Australia Pacific LNG sustainability principles.

A summary of the environmental values, sustainability principles, potential impacts and mitigation measures in relation to aquatic ecology associated with the LNG facility is presented in Table 9.2.

Additionally, Table 9.2 includes the residual risk levels for aquatic ecology. The residual risk is categorised as either negligible, low, medium, high, or very high. A full description of the risk assessment methodology is given in Volume 1 Chapter 4.

Table 9.2 Summary of environmental values, sustainability principles, potential impacts and mitigation measures

Environmental values	Sustainability principles	Potential impacts	Possible causes	Mitigation and management measures	Residual risk level
Habitat integrity Aquatic flora and fauna health	Minimising adverse environmental impacts and enhancing environmental benefits associated with Australia Pacific LNG's activities, products or services; conserving, protecting, and enhancing where the opportunity exists, the biodiversity values and water resources in its operational areas Identifying, assessing, managing, monitoring and reviewing risks to Australia Pacific LNG's workforce, its property, the environment and the communities affected by its activities	Injury or displacement of aquatic fauna, or loss of aquatic flora species	Construction activities	Ensuring fauna spotted during clearing, construction and operation are managed as part of the terrestrial fauna management activities	Low
Habitat integrity		Loss of aquatic habitat values, erosion and sedimentation of receiving waterways	Inappropriate construction methods for redirected drainage lines, inadequate management techniques	Soil stockpiles will have either erosion control devices or diversion drains constructed. Long term stockpiles will be vegetated or mulched. Implement a stormwater management plan during construction and operation.	Low
		Creation of suitable habitat for mosquito breeding	Ponded water	Open water storage areas will be designed to be deeper than 0.6m to prevent waterborne insects breeding. Management of waterborne insects will be included in the biosecurity management plan.	Low
		Loss of aquatic habitat from contamination.	Contaminated run-off from process areas and loss of containment of contaminants.	Fuel/chemical storage areas will be bunded and spill kits will be readily available.	Low

9.8 Commitments

Australia Pacific LNG will implement an effective management plan to mitigate potential impacts to freshwater aquatic flora and fauna.

References

Boulton, AJ and Brock, MA 1999, *Australian Freshwater Ecology: Processes and Management*, Cooperative Research Centre for Freshwater Ecology, Gleneagles Publishing, Australia.

Central Queensland University 2001, *Gladstone Harbour Protection and Enhancement Strategy research module – Volume 2 – Design of an integrated monitoring program*, Centre for Environmental Management - Central Queensland University, Gladstone.

Environmental Protection Agency and Queensland Parks and Wildlife Service 2003, *Curtis Coast Regional Coastal Management Plan*, Environmental Protection Agency and Queensland Parks and Wildlife Service, Queensland.

Storey, AW, Anderson, LE, Lynas, J and Melville F 2007, *Port Curtis Ecosystem Health Report Card. Port Curtis Integrated Monitoring Program (PCIMP),* Centre for Environmental Management, Central Queensland University.