4. DETAILED ISSUE RESPONSES

This chapter provides responses to issues raised in submissions which require additional explanation and/or further information. The issue register in Chapter 3 of Part B, provides a cross-reference to the relevant section of this chapter where the response can be found. The issues and responses are provided in subsections of sections that adopt the chapter headings used in the Arrow LNG Plant Environmental Impact Statement (EIS). The section headings reflect only those chapters of the EIS which were commented on in the submissions received. Subsection headings are a concatenation of the issue number and number of the submission in which the issue was raised.

4.1 EIS Chapter 2: Project Approvals

Issues 5 and 9 (LNG S001 and LNG S002)

The EIS is inadequate in addressing the bilateral agreement requirements of the Environment Protection and Biodiversity Conservation Act 1999 (Cwlth).

Response

The project is being assessed under the bilateral agreement between the Australian and Queensland governments in accordance with the assessment approach determined by the Australian Government Minister for the Environment, Heritage and the Arts. Under the bilateral agreement, the Australian Government has accredited the Queensland State Development and Public Works Organisation Act 1970 EIS process as meeting the impact assessment requirements under federal legislation. Consequently, the EIS is required to satisfy the impact assessment requirements of relevant Queensland and Australian Government legislation.

As part of this process, the Coordinator-General finalised the terms of reference for the project, taking into account comments received by the public, as well as recommendations put forward by the Commonwealth Government (see EIS Chapter 2, Project Approvals, Section 2.2.2). EIS Attachment 3, Terms of Reference Cross Reference Table, indicates where each item in the terms of reference is addressed in the EIS.

The EIS was submitted to the Queensland Coordinator-General in December 2011 and finalised in March 2012, as having met these requirements. It was placed on exhibition from 14 April 2012 to 28 May 2012.

Submissions were also received by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) as part of the EIS process. Responses are provided for issues raised in DSEWPC submissions within Part B, chapters 3 and 4 (Submission No. LNG S024). SREIS Attachment 2, Matters of National Environmental Significance (MNES) Update, provides an assessment of additional change in impact to MNES as a result of the changes in project design and/or further information being obtained.

Issue 329 (LNG S026)

Recommendations from the UNESCO World Heritage Committee meeting on the management of the GBRWHA (June 2012) should be applied and incorporated into the supplementary EIS. The EIS process should be suspended until receipt of these recommendations.

Response

The recommendations of the UNESCO World Heritage Committee (Draft Decision 36 COM 7B.8) require the Australian and Queensland governments, who have responsibility for management of the Great Barrier Reef World Heritage Area (GBRWHA), to undertake a strategic assessment and develop a long-term plan for the sustainable development of the property to ensure overall conservation of the outstanding values. They also require the governments to undertake independent review of the management arrangements for Port of Gladstone and Curtis Island to achieve '… highest internationally recognised standards for best practice commensurate with iconic World Heritage status.'

The recommendations require action by the Australian and Queensland governments, not Arrow Energy. The supplementary report to the Arrow LNG Plant EIS provides further information about potential impacts on outstanding values of the GBRWHA (SREIS Attachment 2, MNES Update). Arrow Energy's assessment concludes that the proposed development will not have a significant impact on World Heritage values.

4.2 EIS Chapter 13: Surface Water Hydrology and Water Quality

Issues 129 and 175 (LNG S018)

There is no specific consideration of the impacts on environmental values for waters as specified in the Environmental Protection (Water) Policy 2009. Provide information on environmental values for surface waters and assess impacts of the project on these values at each location within the project area. Include impacts on surface water users and on beneficial uses. If impacts are significant, mitigation should be proposed.

Response

EIS Chapter 13, Surface Water and Water Quality, Section 13.3 identifies the environmental values of surface water in the project area. The Environmental Protection (Water) Policy 2009 (EPP Water) environmental values were considered when identifying surface water values for the project area (Section 13.3.5). The sensitivity of these values was then determined dependent on the condition of the catchments, watercourses and wetlands in each location. The assessment of impacts on environmental values is outlined in Section 13.4. Overall, the surface water values identified in the project area were assessed to have low to moderate sensitivity. Surface water features on Curtis Island (which will be diverted) were described as being associated with overland flow with no environmental values as freshwater or estuarine aquatic habitat.

EIS Chapter 16, Marine Water Quality and Sediment, identifies the environmental values of marine and estuarine waters in the project area, including the Calliope River and explicitly considers the values contained in the EPP Water (Section 16.2.2).

EIS Chapter 26, Social, Section 26.5.8 outlines the impacts from project activities on water based recreation.

The EIS contains a range of commitments setting out a comprehensive range of mitigation measures to manage potential impacts on surface water values in the project area (see EIS Chapter 13, Section 13.8; and Chapter 16, Section 16.8).

Issues 131 and 341 (LNG S018)

Inadequate information is provided on baseline water quality in the permanent and ephemeral streams on the mainland and Curtis Island. The proponent should collect 2012 water quality data for all potentially impacted ephemeral and permanent waterways on the mainland and Curtis Island, including Calliope River freshwater and estuarine environs (particularly from wet season for ephemeral creeks on Curtis Island). Data should be collected to assist development of suitable TSS and turbidity limits for the construction stage.

Response

The baseline water quality assessment undertaken for the EIS (Chapter 13, Surface Water Hydrology and Water Quality, Section 13.2.1) is considered appropriate for the extent of interaction that the project will have with the environmental values of surface water.

Data from recent sampling activities was utilised in the baseline assessment, including data obtained from the Port Curtis Integrated Monitoring Program for Boat Creek and from the Australia Pacific LNG Project EIS for Targinie Creek. These creeks are the only freshwater watercourses where project activities may pose a threat to water quality. All water bodies on Curtis Island are ephemeral in nature. Water quality monitoring in these drainage channels is ineffective as water is only present following heavy rainfall events where overland flow is sufficient to infill areas with defined beds and banks. Any results of sampling during these periods would be highly variable and of limited value as a baseline.

Further water quality data has been collected from the Calliope River to inform additional studies completed for the EIS. This information was reviewed in conjunction with the results of other recent monitoring in the area to update the baseline water quality. The results of the additional sampling and data review are summarised in SREIS Chapter 13, Marine Water Quality, and are detailed in SREIS Appendix 5, Marine Water Quality Report.

Surface water monitoring will reflect the project approval requirements directed by government departments, and will utilise relevant indicators and appropriate criteria such as the Queensland Water Quality Guidelines.

Issue 132 (LNG S018)

Table 13.12 does not cover all parameters relevant to the area in the Queensland Water Quality Guidelines and should include potential contaminants in the storm water. The objectives in Section 13.7.2 do not give actual values to show how management will meet objectives. The EIS should contain quantified information and actual values.

Response

The water quality indicators detailed in EIS Chapter 13, Surface Water Hydrology and Water Quality (Section 13.7.2, Table 13.12) are considered appropriate for monitoring the water quality of the receiving waterways within the Port Curtis area.

The stormwater management system for the operation of the LNG plant has been designed to maintain the water quality in the receiving environments in accordance with Environment Protection (Water) Policy (EPP Water) objectives. A detailed stormwater quality assessment was completed for the project and is presented in the EIS in Appendix 6, Stormwater Quality Impact Assessment.

Chemicals and fuel on site will be stored in facilities designed to prevent spillage and any contamination of stormwater. The specific volumes of chemicals and fuels stored on site will be the subject of detailed engineering design. EIS Chapter 31, Waste Management, Section 31.4 discusses the quantities of solid and liquid waste that will be generated during construction and operation (Table 31.1). Full detail of potential contaminants, measures to prevent pollution, discharge points and monitoring regimes will be provided in a fully detailed statutory environmental management plan (EMP) that will be provided at the time of application for an environmental authority.

Issues 315, 316 and 317 (LNG S025)

Streams and creeks affected by the project, including Targinie Creek, will be re-evaluated by DAFF for waterways status under the Fisheries Act 1994 prior to work commencing to ensure the correct approvals are applied for.

Response

DERM (now DEHP) has advised that the unnamed creeks on Curtis Island are not watercourses as they do not exhibit the essential characteristics of a watercourse such as an extended (if non-permanent) period of flow and the flows do not benefit or support rural or commercial activity beyond the basic needs of a single property (DERM, Feb 2011).

The Department of Agriculture, Fisheries and Forestry (DAFF) draws its definition for a watercourse from the same legislation (Water Act, 2000) as DERM. DAFF also maintains specific guidance on fish habitat (Waterway Barrier Works Development Approvals - Fish Habitat Management Operational Policy FHMOP 008). With consideration of the criteria detailed in that guidance and the drainage system on Curtis Island, the following apply:

- The system does not have defined bed and banks and predominantly consists of steep gully lines, areas where the valley floor is ‘the channel’ and some places where the valley floor is incised. The drainage system has numerous alternative flood channels.
- The system features do not have an extended (if non-permanent) period of flow nor do the flows provide useful benefit or support to rural or commercial activity. The systems are ephemeral and only contain water following heavy rainfall events. Observations indicate that pools are not sustained for any significant duration after rain.
- The system does not have adequate flow. It is exclusively ephemeral. There are no significant storages in the catchment such as pools, lakes or headwater refuges for aquatic fauna to move into. The stream has no value as a movement corridor for aquatic species. It did not contain water at the time of the June 2010 aquatic ecology site inspection, when many ephemeral streams on the mainland contained last remnants of pools and occasionally minor flow. This observation suggests the stream flows only during and immediately after rainfall events, with the annual flow period likely to be measured in weeks.

Habitat within the ephemeral streams was generally of relatively poor quality. Substrates were often mud or silt, although some rocky substrate was observed. Structural woody habitat was generally sparse. The aquatic ecology study completed for the EIS (Appendix 11, Freshwater Ecology and Water Quality Impact Assessment) established that due to the very short flow period, the stream is unlikely to provide significant habitat for species moving up from marine environments during floods. The drainage channels rise within proximity of the coast and have no connectivity to permanent systems. The drainage systems are not considered to have any environmental values that are aligned with those defined in EPP Water. The status of the

drainage systems (not waterways, freshwater ecosystems, or fish habitat) on Curtis Island has been agreed via recent correspondence with DAFF. There is no opportunity to create fish habitat through redirection works as the drainage channel will be redirected to the upper reaches of a drainage channel over which Arrow Energy has no downstream control.

The only watercourse that may be affected on the mainland is the upper reaches of Targinie Creek. This part of the watercourse is also ephemeral in nature and only flows following rainfall events. As outlined in EIS Chapter 13, Surface Water Hydrology and Water Quality (Section 13.3) Targinie Creek was assessed as having a low sensitivity in terms of its environmental value. Service pipelines, security fences, and access tracks will cross the upper reaches of the creek with limited associated works. The impact of these crossings on the values of the creek was assessed in EIS Chapter 13 and Chapter 18, Freshwater Ecology (Sections 13.4 and 18.4). Several mitigation measures were proposed in the EIS (Chapter 13, Section 13.5, and Chapter 18 Section 18.5) to limit the impacts of any waterway crossing on the creek.

Issue 339 (LNG S026)

Regarding controlled discharge facility and observation pond, the EIS must:

1. *Identify water quality parameters and contaminants which will be monitored in the controlled discharge facility and observation pond prior to discharge, and trigger levels that will be used to identify release limits for each parameter and contaminant.*

2. *Identify contaminants that the treatment plant can remove or lower.*

For run-off water which is diverted to the treatment plant, identify how water quality parameters and contaminants will be measured after treatment, prior to discharge.

Response

An effluent treatment plant and controlled discharge facility were the proposed means of disposing of wastewater presented in the EIS. Since the EIS was finalised, the preferred option for wastewater treatment and disposal has changed. Gladstone Regional Council (GRC) has installed two sewer mains under Port Curtis to service the LNG plants on Curtis Island. Pipelines for category A and category B waste have been installed by horizontal directional drilling (HDD) from RG Tanna Coal Terminal to Hamilton Point. The sewer mains are expected to have a capacity of 864 m^3 per day, which will be sufficient to meet peak construction demands for both the LNG plant and construction camp. As a consequence, the front-end engineering design (FEED) considered disposal of effluent via the sewer mains in lieu of an effluent treatment facility. SREIS Chapter 4, Project Description: LNG Plant Figure 4.7 shows the updated conceptual water management system for effluent treatment and disposal using the GRC sewer mains.

While disposal of wastewater via the GRC sewer mains is preferred, Arrow Energy will retain the option to develop an effluent treatment plant in the event the sewer mains are unavailable (e.g., they reach capacity). Under this option, wastewater will be directed to the controlled discharge facility where it will be treated before discharge at the outfall on Boatshed Point. The quality of potentially contaminated runoff from facility process areas which will be routed to the controlled discharge facility will be monitored and either discharged with the uncontaminated stormwater runoff to the sea, or diverted to the effluent treatment plant. Arrow Energy committed in the EIS to testing and treating all discharges to Port Curtis to meet water quality criteria, as required, prior to discharge (EIS Chapter 16, Marine Water Quality and Sediment, Table 16.16). The details of these testing procedures will be included in a fully detailed statutory EMP that will be provided at the time of application for relevant environmental authorities.

4.3 EIS Chapter 14: Groundwater

Issue 134 (LNG S018)

Inadequate details of the groundwater monitoring program are provided in Section 14.7.2 of the EIS and Section 8.2.2 of Appendix 7. In order to provide a baseline, planning and implementation should be undertaken before production commences. It is also unsatisfactory that most existing monitoring bores monitor the shallow aquifer. A monitoring program should be developed that adequately monitors the mainland and island areas of development. Baseline data should be collected prior to plant construction.

Response

A network of temporary groundwater monitoring bores were installed on Curtis Island in 2012. These bores will collect baseline groundwater quality data up to the commencement of construction. While some bores will be retained during construction, others lie within the project construction footprint and will be affected by earthworks and will not remain in place for long term monitoring.

A network of permanent groundwater monitoring wells will be installed as part of the site construction works program. A detailed groundwater monitoring plan, which refers specifically to the permanent groundwater monitoring network, and that addresses a suite of analytes that are applicable for the potential contaminants stored on site, will be submitted to DEHP as part of a detailed EMP at the time of submission of an application for an environmental authority. A draft outline of this plan is included in SREIS Attachment 5, Other Management Plans.

Minimal impacts on groundwater are anticipated. The project will not extract groundwater resources or intersect deeper aquifers on Curtis Island or the mainland. With no anticipated mechanism for impact to deeper aquifers their inclusion in the monitoring regime is not warranted.

The tunnel under Gladstone Harbour will intersect groundwater aquifers as the tunnel shaft is excavated to depth. A dry installation technique will be used, which seals off connectivity with permeable strata, as the installation progresses. The amount of dewatering required is accordingly minimised and only the water initially encountered within the tunnel shafts is anticipated to require extraction.

Issue 177 (LNG S018)

The EIS does not evaluate the water quality impacts on groundwater for each environmental value that is considered relevant. There is also inconsistent reference to one of the classes of groundwater environmental values. Assess all environmental values in accordance with section 6 of the EPP Water including: aquaculture; aquatic ecosystems; cultural and spiritual values; farm supply and agricultural purposes; industrial use; irrigation and stock watering. Provide this assessment in three different parts: mainland site, project area under the channel, and the LNG site on Curtis Island. The department considers that the following environmental values do not need to be assessed: water used for producing aquatic foods for human consumption; primary recreation; secondary recreation; and visual appreciation.

Response

The environmental values, as defined in the Environmental Protection (Water) Policy 2009 (EPP Water) that are relevant to groundwater resources are described in EIS, Chapter 14, Groundwater, Section 14.2.2. A discussion of the groundwater conditions within the study area in relation to each value is presented in EIS Appendix 7, Groundwater Impact Assessment,

Section 5.1.1. Through this discussion those environmental values not supported by the actual groundwater conditions within the study area are identified. This discussion is represented in Tables 5.2a and 5.2b in Appendix 7, which show the presence of suitable conditions within each aquifer system for each of the environmental values as defined in the EPP Water. This refined list of values that are relevant to site conditions is presented in Section 14.3.6 and form the groundwater environmental values carried forward through the impact assessment.

The potential water quality impacts on groundwater for each environmental value that is considered relevant is discussed in Section 14.4 and subsequently summarised in Table 14.4, where potential groundwater quality impacts relative to site components are shown. The basis for describing potential impacts on groundwater quality is based on the understood location and distribution of the groundwater systems relevant to project activities with the potential to impact on groundwater quality. That is, shallow unconfined aquifers are expected in the vicinity of drainage systems and coastal areas, while the bedrock aquifers are more likely in areas away from drainage networks in more elevated areas.

In addition, the groundwater environmental values as defined by the EPP Water form part of the overall sensitivity ranking assigned to each groundwater system (by forming the conservation status component of the sensitivity ranking). Therefore, the impact assessment considers not only the groundwater values as defined by the EPP Water but those present by way of the groundwater systems' rarity, resilience to change, dynamicism and rehabilitation potential (Section 14.2.2).

4.4 EIS Chapter 16: Marine Water Quality and Sediment

Issues 102, 116 and 136 (LNG S017 and LNG S018)

Provide information on the characteristics of sediment at dredge sites including analysis of physical and chemical properties, and acid sulfate soils, as per the Terms of Reference. Data points should satisfy requirements of ANZECC/ARMCANZ (2000) guidelines. Detail the proposed treatment of ASS and the dredge disposal options, including management of dredged material during disposal operations and decant water quality monitoring requirements.

Response

Information on the characteristics of sediment at dredge sites including physical and chemical properties and acid sulfate soils (ASS) are provided in SREIS Chapter 12, Sediment Characterisation, Section 12.5. This information is based on the findings of the sediment sampling investigation undertaken to supplement the sediment quality information presented in the EIS, and address changes to the project description.

The ANZECC/ARMCANZ (2000) guidelines were used to determine project sediment quality assessment criteria which are provided in Table 12.1 within SREIS Chapter 12, Section 12.1.1. Results from the sampling campaign were assessed against these criteria.

Options for the disposal of dredge spoil are discussed in SREIS Chapter 6, Project Description: Dredging, Section 6.3. All of the proposed disposal sites are already approved sites and all disposal activities will be managed in accordance with those approvals.

An acid sulfate soil management plan will be developed in conjunction with the dredge management plan to provide clear procedures for managing and disposing of the expected volumes of ASS/potential acid sulfate soils (PASS) material at each site. All spoil disposal activities, to both onshore and offshore disposal sites will be undertaken in accordance with the

plan. The dredge management plan includes requirements for water quality monitoring and the review of activities in the event that project water quality criteria are exceeded.

Issue 135 (LNG S018)

There is insufficient water quality data for the purpose of determining locally derived physiochemical water quality objectives and baseline values in the EIS. EHP considers February 2011 data at sites 1 and 6 may have been flood affected and is therefore not representative of baseline. Adequate baseline data is imperative to inform the dredge management plan and receiving environment monitoring program, and the proponent should follow the ANZECC/ARMCANZ guidelines, which advocate 24 data points collected monthly over 2 years to adequately represent seasonality. Additional water quality data should be sourced from GPC or other companies, or be collected by the proponent to satisfy the recommendations in QWQGs and ANZECC/ARMCANZ (2000).

Response

A marine water quality study has been undertaken to address changes made to the project description, to review additional water quality data, and to supplement the water quality monitoring conducted for the EIS.

As part of this study, marine water quality sampling was conducted by Central Queensland University (CQU) in August and September 2012 at 30 sampling sites in Port Curtis and the Calliope River, and is presented in SREIS Chapter 13, Marine Water Quality, Section 13.3.2.

Additional water quality data is available for Port Curtis to that presented in the EIS, including water quality reports published by the Western Basin Dredging and Disposal (WBDD) Project, the Department of Environment and Heritage Protection, and proponents of other major projects planned for or under construction in Port Curtis.

This additional information informed the design of the water quality sampling program described in Section 13.3.2. Marine water quality criteria for physiochemical and nutrient analysis are discussed in SREIS Chapter 13, Section 13.3.3; and summarised in Table 13.2 within the same section.

The project water quality criteria were derived from those set out in the Queensland Water Quality Guidelines (QWQG, DERM, 2009) and the Australian and New Zealand guidelines for fresh and marine water quality (ANZECC/ARMCANZ, 2000).

Arrow Energy will draw on existing WBDD project monitoring program and the Port Curtis Integrated Monitoring Program (PCIMP) to inform a baseline for development of project water quality criteria. This data will be augmented as required to address project specific requirements.

4.5 EIS Chapter 17: Terrestrial Ecology

Issue 160 (LNG S018)

The EIS does not fully address nature conservation requirements. Recent and comprehensive freshwater aquatic and terrestrial surveys will be required. The EIS should describe how the project will address provisions of the Nature Conservation Act around clearing of plants, offsets, disturbance to breeding places and protected wildlife. The proponent should act in accordance with the management principles outlined in Section 73 of the Nature Conservation Act.

Response

A substantial desktop study and survey program was completed to inform the ecological assessments carried out for the EIS (Appendix 9, Terrestrial Ecology Impact Assessment and Appendix 11, Freshwater Ecology and Water Quality Impact Assessment).

Areas of further survey effort have since been identified and Arrow Energy commissioned additional ecological surveys to be undertaken in 2012. The aim of the surveys was to provide further assessment on the impacts of the Arrow LNG Plant on communities and species of conservation significance.

3D Environmental and Eco Smart Ecology were commissioned to undertake an analysis of the findings of the EIS, followed by additional desktop study and field work at project sites to supplement and validate the EIS findings. The reports of the field work and associated findings are presented in SREIS Appendix 11, Terrestrial Ecology. SREIS Chapter 18, Terrestrial Ecology puts these findings in the context of the impact assessment carried out for the EIS and identifies additional mitigation measures to limit potential impacts.

The application of the Nature Conservation Act 1992 in Queensland, in supporting biological diversity, ecologically sustainable development and nature conservation, was outlined in the Arrow LNG Plant EIS in Chapter 17, Terrestrial Ecology (Section 17.1.1). Subordinate to the act, are the Nature Conservation (Protected Areas) Regulation 1994 and the Nature Conservation (Wildlife) Regulation 2006.

Arrow Energy has taken into account the provisions of the Nature Conservation Act and Vegetation Management Act when developing mitigation measures for the Arrow LNG Plant. The requirements of these acts will also form the basis of plans to be developed prior to construction, including a vegetation management plan, species management plans and procedures for pre-clearance surveys. These plans will outline the approach to undertaking pre-clearance surveys, and clearing for construction, as well as procedures to be followed if breeding places or protected wildlife are discovered. A draft outline of these plans is contained in SREIS Attachment 5, Other Management Plans.

Issue 163 (LNG S018)

The EIS does not adequately address unavoidable impacts to State Significant Biodiversity Values by proposing offsets according to the Queensland Biodiversity Offset Policy. The policy requires that an offset strategy is delivered as part of the application documents or an approved Environmental Management Plan (refer to submission for detailed offset strategy requirements).

Response

Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (SREIS Attachment 6) which has been informed by the Queensland and Australian government's regulatory framework for environmental offsets.

The strategy sets out Arrow Energy's principles for offset management planning (developed to align with the offset principles from the regulatory framework and to guide offset planning). The principles include the following:

- Offsets will meet the requirements of current government policy.
- Offsets will only be used once the hierarchy to minimise impact (avoid, minimise, mitigate) has been followed.

- Offsets will contribute to managing and protecting biodiversity.
- Offsets will be implemented strategically and economically.

The strategy will be supported by management plans which are specific to the project, and provide more detail at the planning level (SREIS Attachment 6, Section 3.3).

Arrow Energy's likely offset requirements for the Arrow LNG Plant are included in the Draft Environmental Offset Strategic Management Plan (SREIS Attachment 6). The proposal sets out how the offsets are likely to be achieved and will be used to inform the development of project specific offset management plans.

4.6 EIS Chapter 19: Marine and Estuarine Ecology

Issues 37, 221 (LNG S010 and LNG S020)

There is no indication that Arrow will test for underwater noise that may harm fish during pile driving activities. The noise of test drilling undertaken in the harbour to date is thought to have an impact on the abundance of fish in the area.

Response

The underwater noise environment has been affected by construction works associated with the development of the other LNG plants and other projects in Port Curtis.

Background noise data collected and publically reported for recent studies has been used to establish background levels for the Arrow LNG Plant. A supplementary marine ecology technical study was also undertaken to inform the SREIS (Appendix 8, Technical Study of Marine Ecology) and is summarised in SREIS Chapter 15, Marine Ecology. Impacts to marine and estuarine fauna from underwater noise are assessed in SREIS Chapter 15, Section 15.6.2, this follows the same approach as described in EIS Chapter 19, Marine and Estuarine Ecology, Section 19.2. Additional mitigation measures to those proposed in the EIS were identified to further manage potential impacts. These measures include evaluating, and deploying bubble curtains during pile driving activities where they are effective in aiding the rapid attenuation of underwater noise and deterring marine megafauna from approaching, or remaining, at pile driving sites.

Overall, measures such as soft starts and bubble curtains will mitigate the impact of underwater noise to as low as reasonably practicable, regardless of the background level (SREIS Chapter 15, Section 15.6.2). As such, testing of underwater noise is not required for the project.

Issue 65 (LNG S014)

Fully assess the direct and cumulative impacts of dredging the mouth of the Calliope River (including acid sulfate soils, spoil placement and maintenance and impacts to flora and fauna).

Response

The full assessment of the direct and cumulative impacts of dredging of the mouth of the Calliope River was undertaken as part of the EIS and SREIS program.

The modelling of dredge plumes and sediment deposition carried out to inform the EIS base case included other relevant projects currently underway or planned in Port Curtis. The impact of the Arrow LNG Plant dredging was then assessed against this baseline. The results of this modelling are included in EIS Chapter 15, Coastal Processes, and discussed in terms of impacts on water

quality in EIS Chapter 16, Marine Water Quality and Sediment, and on marine flora and fauna in EIS Chapter 19, Marine and Estuarine Ecology.

The dredge volumes and extent have changed since the EIS was finalised. Revised dredge volumes are provided in SREIS Chapter 6, Project Description: Dredging, Section 6.1. Details are also provided on dredge spoil disposal locations and spoil management within Section 6.3.

As a result of these revised dredge volumes, potential impacts discussed in the EIS were reassessed within the SREIS. Potential impacts to marine and estuarine ecology have been reassessed and discussed as part of SREIS Chapter 15, Marine Ecology, and Chapter 17, Estuarine Ecology (Calliope River). The supporting technical studies are provided as SREIS Appendix 8 Technical Study of Marine Ecology, and Appendix 10, Technical Study of Estuarine Ecology (Calliope River).

The findings of sediment sampling undertaken as part of the geotechnical program for the project are discussed in SREIS Chapter 12 Sediment Characterisation. This chapter includes information on the presence of acid sulphate soils (ASS) and potential acid sulphate soils (PASS) in marine and estuarine sediments in the Calliope River, at Boatshed Point and the LNG jetty. Likely spoil disposal locations are shown within Table 6.1 and Figure 6.2 in SREIS Chapter 6, Project Description: Logistics, Section 6.1.

An ASS management plan will be developed in conjunction with the dredge management plan to provide clear procedures for managing and disposing of the expected volumes of ASS material at each site.

Issue 137 (LNG S018)

No risk assessment has been performed into the likely rate of impingement and entrainment of marine biota at the reverse osmosis seawater intake structure, and what devices or strategies will be adopted to mitigate these impacts. A risk assessment should be provided and also include potential issues regarding chemical shock dosing and impingement.

Response

The EIS discussed the use of a desalination plant to treat seawater drawn from Port Curtis. The EIS also referred to the supply of mains water to Curtis Island via a pipeline installed by the Gladstone Area Water Board (GAWB) as an option undergoing feasibility.

The GAWB water supply pipeline option has since progressed beyond feasibility and is now Arrow Energy's preferred water supply option. In the event that mains water becomes unavailable or restricted (e.g., in a time of drought), Arrow Energy will retain the option to develop a desalination plant to ensure the plant is self-sufficient. Consequently, a desalination plant remains a water supply option for the proposed LNG plant (SREIS Chapter 4, Project Description: LNG Plant, Section 4.9).

If required, the desalination plant will include an inlet structure incorporating measures to reduce impingement and entrainment of marine biota. The design will be based on industry best practices and conditions at the intake. Chlorination of the intake system will prevent and control marine growth. The chlorine does not disperse beyond the intake pipe into the marine environment, as seawater is drawn inside the structure. Entrainment rates will be recorded and further measures taken if deemed necessary. Further details will be included with the statutory EM Plan that will accompany an environmental authority application should this option be pursued.

Issue 211 (LNG S020 and LNG S031)

Arrow's claim that the seagrass beds located 800 m to the east of Boatshed Point will not be indirectly impacted is an underestimate. Sediment is likely to fall on the corals and seagrass beds. Furthermore, the beds are deep, filtered from light, and have been affected by past flooding. The project may further slow down their revival period. Seagrass beds in this area trap sediments and use nutrients, filtering waters entering and leaving the harbour into the GBRMP. The harbour waters are already under a major health crisis arising from cumulative impacts of projects, and this is likely to continue into the early stages of this development. Seagrass sampling within 5 km of the area and coral sampling near to the sites should occur before the project commences.

Response

Dredge plumes and sediment deposition were modelled as part of technical studies completed for the EIS (Appendix 8, Coastal Processes, Marine Water Quality, Hydrodynamics and Legislation Assessment). The results of the modelling are discussed in EIS Chapter 15, Coastal Processes, and EIS Chapter 16 Marine Water Quality and Sediment. Figure 15.3 in EIS Chapter 15 and figures 16.2 to 16.6 within EIS Chapter 16 show the extent of dredge plumes and average sediment deposition rates at each dredge site. The impacts on marine ecology values were assessed in EIS Chapter 19, Marine and Estuarine Ecology. Figure 16 and 17 within the EIS technical study, Appendix 12, Marine and Estuarine Ecology Impact Assessment show the extent of sediment deposition in relation to marine habitats in Port Curtis including seagrass. The modelling shows that seagrass beds east of Boatshed Point will not experience total suspended sediment levels above ambient levels during dredging.

Revised modelling and assessment of sedimentation following design changes to dredging and plant layout was undertaken for the SREIS. These results are discussed in SREIS Chapter 15, Marine Ecology, Section 15.6.1. The modelling found that any impacts on the seagrass beds will be short-term and localised. Increased dredge volumes will not extend the maximum dredge plume, only the length of time for which the plume is present.

Seagrasses possess adaptations and mechanisms to tolerate smothering and to survive burial. A number of studies have shown seagrasses to be highly resilient to sediment deposition. Seagrasses tend to increase sedimentation rates and reduce re-suspension rates (by trapping and stabilising sediments around the seagrass plants). This in turn reduces turbidity and promotes further growth by reducing light attenuation in the water column.

A seagrass monitoring program will be developed and included in the dredge management plan.

Issue 313 (LNG S025)

All dredging not covered under the Western Basin project must take into account the size of sediment plumes and their effect on marine plants. The disposal of dredge spoil in spoil grounds must also be considered.

Response

The assessments undertaken as part of the SREIS have fully addressed sediment plume dispersion impacts on marine plants, and have determined that direct and indirect impacts are minor.

Dredge plumes and sediment deposition were modelled as part of technical studies completed for the EIS (Appendix 8, Coastal Processes, Marine Water Quality, Hydrodynamics and Legislation Assessment). The results of the modelling are discussed in EIS Chapter 15, Coastal Processes

and Chapter 16, Marine Water Quality and Sediment. Figure 15.3, in EIS Chapter 15, and figures 16.2 to 16.6 in EIS Chapter 16 show the extent of dredge plumes and average sediment deposition rates at each dredge site. The impacts on marine ecology values were assessed in EIS Chapter 19, Marine and Estuarine Ecology. Figure 16 and 17 in EIS Appendix 12, Marine and Estuarine Ecology Technical Report show the extent of sediment deposition in relation to marine habitats in Port Curtis including seagrass.

The modelling and associated assessments have been reviewed in studies completed for the EIS in light of changes to dredge volumes and the extent of dredging of some sites. SREIS Chapter 6, Project Description: Dredging describes these changes and identifies the preferred dredge disposal sites for spoil from each dredge site. Impacts from dredge plumes on marine plants, including seagrass, are discussed in SREIS Charter 15, Marine Ecology (sections 15.5 and 15.6).

All proposed disposal areas are previously approved dredge spoil disposal sites. Spoil disposal activities will be carried out in accordance with the conditions of such approvals. The dredge management plan will provide detailed information on how dredging and disposal activities will be carried out and appropriate permits will be obtained prior to activities commencing.

Issues 323, 324, 325, 326 and 327 (LNG S025)

Marine pest management plans and associated monitoring measures to prevent the introduction of exotic marine pests should be developed in accordance with applicable guidelines (e.g., National Biofouling Management Guidance for Non-Trading Vessels, ANZECC Code of Practice and Draft Antifouling and in-water cleaning guidelines) in consultation with relevant government departments. Plans should include measurable outcomes.

Response

Noted.

As discussed in EIS Appendix 12, Marine and Estuarine Ecology Impact Assessment (Chapter 7, Section 7.4) in order to reduce the risk of introduced and pest species entering the waters of Port Curtis, Arrow Energy LNG carriers and other vessels coming from overseas ports will comply with Commonwealth and local government ballast water management systems and implement Australian Quarantine and Inspection Service hull hygiene measures. Management of shipping waste such as wastewater discharges from shipping ballast will be regulated by the International Convention of Pollution from Ships (MARPOL) as established by the International Maritime Organisation.

The regulation of shipping waste is undertaken by Gladstone Ports Corporation under a certified agreement with the Australian Quarantine Inspection Service.

A marine activity management plan will be developed for the project and will include provisions for the management of marine pest species. The plan will be developed in accordance with applicable guidelines and protocols such as the National Biofouling Management Guidance for Non-Trading Vessels, and ANZECC Code of Practice and Draft Antifouling and in-water cleaning guideline; and in consultation with relevant government departments and other stakeholders.

4.7 EIS Chapter 23: Landscape and Visual

Issue 392 (LNG S030)

Plates 23.10 and 23.12 demonstrate the visual impact of the Arrow LNG Plant exceeds that of the other LNG projects, due to orientation towards Gladstone city. Greater emphasis should be placed on addressing visual amenity. The Coordinator-General should condition the proponent to:

(a) Provide further options to reduce visual impact (in light of UNESCO concerns).
(b) Identify and commit to specific measures to reduce lighting impacts on turtles.

Response

Plates 23.10 and 23.12 in EIS Chapter 23, Landscape and Visual, show an artistic impression of just the Arrow LNG Plant from the potential viewpoints of Auckland Point and Round Hill Lookout respectively. While the locations of the GLNG and QCLNG project sites are shown, they are not represented in the visualisations as detailed information on these projects was not available. However, the cumulative impacts of these other projects were taken into account in the assessment of landscape and visual impacts as presented in EIS Chapter 23.

A range of measures have been developed and commitments made to reduce the visual impact of the Arrow Energy LNG plant on Curtis Island. In particular, the headland of Boatshed Point will be protected from excavation and clearing to preserve areas of vegetation and topography that help screen lower parts of the LNG plant and the construction camp. Vegetation in a 20 m wide wildlife corridor along the eastern boundary of the LNG plant site will also be retained to screen the site from the east. The design of the plant also minimises cutting into the high ground of the Curtis Island hogsback ridge system that will assist in maintaining a vegetated backdrop and visually absorbing the built form of the development. Several measures were also developed to address the visual impact of project lighting, including minimising night time working, shielding/directing lighting on to work areas and the use of passive lighting (e.g., reflectors). These measures are discussed in detail in EIS Chapter 23, Section 23.5 and listed in Table 23.14.

Specific measures to reduce lighting impacts on turtles are identified and discussed in EIS Chapter 19, Marine and Estuarine Ecology, Section 19.6.2. A separate study was also completed for the SREIS to further assess the impacts of project lighting on marine turtles (SREIS Appendix 9, Marine Ecology (Turtles) Technical Study). Further measures to reduce lighting impacts on turtles were identified through that study and are presented in SREIS Chapter 16, Turtles and Lighting, sections 16.5 and 16.6.

4.8 EIS Chapter 26: Social

Issue 22 (LNG S004 and LNG S031)

Identify management strategies to address the consequences of limited accommodation availability and affordability, the impact for local residents including emergency service personnel at a reasonable cost (i.e., increases in Gladstone population may lead to need for QAS/QFRS to recruit and pay sufficient numbers of paramedics/ fire fighters. These services may face additional costs in supporting staff through the provision of government housing, subsidies and other support measures). Identify project housing commitments.

Response

Actions for addressing impacts on housing affordability and availability are included in the housing and accommodation plan in the Social Impact Management Plan (SIMP) Update (SREIS Attachment 4, Section 3.1). In particular, the plan includes actions to:

- Identify viable housing options for the non local construction workforce who may reside outside of the construction camps, including minimising the need to source housing in the private rental market unless vacancy rates increase to 3% or higher.
- Identify the preferred approach to provide up to 90 houses during construction and up to 130 houses for the operational workforce (i.e., rental guarantees, investment in the housing market, encouraging staff to live in company provided accommodation) subject to current market conditions at the time.
- Work with the Queensland Government to identify opportunities to bring additional affordable housing to market for existing residents.

Arrow Energy has already committed to provide $6.5 million towards the development of affordable housing in Gladstone and $1 million for Emergency Rental Assistance (ERA) to Gladstone Regional Council (GRC) for distribution to where it is most needed. Arrow Energy has already commenced discussions with GRC to develop the criteria and distribution processes for access to the ERA funding.

The commitments relating to housing and accommodation are detailed in SREIS Attachment 4, Social Impact Management Plan (SIMP) Update, Section 3.1

Issue 23 (LNG S004)

Identify the impact of the project on surrounding community health and services infrastructure, should the project result in a significant increase in population.

Response

The social impact assessment (SIA) technical report (EIS Appendix 20, Section 5.7) includes an assessment of impacts from an increased demand on social infrastructure and services associated with the project.

In particular, the SIA assesses potential impacts on education services and other social infrastructure, including medical and emergency services, cultural facilities and community support services, due to an increase in population from the project during construction and operation.

A range of medical and other services will be provided within the construction camp on Curtis Island, minimising the need for workers to access existing services and facilities in Gladstone. Arrow Energy has also committed to communicating project activities, milestones, workforce numbers and other relevant information to appropriate state departments and agencies as well as local government to help plan for demand on services (EIS Attachment 7 SIMP, and SREIS Attachment 4, SIMP Update, Section 3.6).

Issue 39 (LNG S011)

The EIS identifies 130 additional families requiring services in the Gladstone community during construction and operation. Arrow has classed this as a minor impact, however DCCSDS consider the housing and rental in Gladstone highly stressed at the moment.

Response

The SIA (EIS Appendix 20, Section 5.12) notes that the project is expected to result in an increase in demand for housing stock of 130 houses during operation. Project impacts on housing costs were assessed as high, with demand for housing from the project likely to be sufficient to sustain the housing and rental increases that have already occurred due to other projects.

A range of mitigation measures were proposed in the EIS to manage this impact, including the development of an early works workforce accommodation strategy, a construction workforce accommodation strategy, and an operations workforce accommodation strategy (SREIS Attachment 4, SIMP Update, sections 2.10 and 3.1).

In addition, Arrow Energy will consult with the GRC, Regional Community Consultative Committee (RCCC) and other proponents to identify social, community or recreational infrastructure impacted by the project and potential mitigation required.

Issue 42 (LNG S011 and LNG S031)

Further detail/commitment is requested in relation to the Social Investment Plan (i.e., net social investment as a percentage in relation to the likely impacts to the community).

Response

Arrow Energy's social investment program covers a range of initiatives including the Brighter Futures Program community funding, sponsorships and partnerships.

Arrow Energy is committed to supporting and expanding its involvement in social investment initiatives and will focus on the key action areas identified within the SIMP Update (SREIS Attachment 4).

Details on the Brighter Futures community funding and partnerships will be released on Arrow Energy's website. This will include information about the Brighter Futures program for Gladstone including information on criteria for funding, fund expended, processes for applying for funding and how often funding will be available. The website will also include information on projects that receive funding or in kind support to offset or mitigate direct project impacts.

Further, Arrow Energy has committed to investing up to $3.5 million for projects to offset or mitigate the impacts of the project (comparative with the other LNG proponents). Arrow Energy will work with the Office of the Coordinator-General and GRC to identify the most suitable mechanism to coordinate efforts across all proponents and identify projects that may provide an equivalent offset or mitigation of impacts.

Issues 273 and 274 (LNG S020)

Arrow Energy has indicated that 30-40% of the workforce are planned to be sourced locally, and the remainder will be under a fly-in fly-out model/regime. Clarify how healthcare will be provided for this workforce including details of where services will be provided (mainland and/or Curtis Island), and requirements for onsite health personnel.

Response

During operation, Arrow Energy has indicated that approximately 30% of the Arrow Energy workforce and 40% of contractors are expected to be local to the study area.

Arrow Energy will liaise with emergency services and Queensland Health in the planning of health services and facilities and medical emergency response plans.

For operations, medical emergency response procedures and treatment facilities will be provided to comply with the minimum standards documented in Queensland legislation and Arrow Energy Standards. As an additional guide, the Shell Exploration and Production Medical Emergency Response Guidelines (2005) have been consulted. There will be an on-site medical facility that will be designed to meet appropriate standards, including Australian, International and Arrow Energy as required. The facilities and resources available will be detailed in the health management plan and include:

- Project Health Management
- Health Impact Assessment
- Medical Emergency Response
- Health Risk Assessment
- Human Factors Engineering.

Issues 361 and 405 (LNG S029 and LNG S030)

GRC sees difficulties in implementing a strategy around a rental vacancy rate of 3%. A measure of rental property prices would be a more responsible measure.

GRC considers the commitment to some 90 to 130 houses for up to 600 long term mainland based operational staff as significantly below the demand generated for the project.

Response

The Department of Communities has suggested that an ideal rental market vacancy rate is approximately 3%. This rate is used more generally across the housing industry as an indicator with values below 3% indicating a constrained rental market.

The rationale for the number of houses to be provided during the project operations phase is outlined in EIS Chapter 26, Social, Section 26.4.2.

It is expected that 450 workers will be required during operation of trains 1 and 2, of which 295 workers will come from outside of the Gladstone area. This includes 175 people employed directly by Arrow Energy and 120 contractors.

Arrow Energy estimate that 70% of its workers (about 123 people) will relocate to the Gladstone area with their families for the Project. The 130 houses identified in the SIA would be sufficient to cater for these families. The remaining Arrow Energy workers and contractors will comprise single status workers, who will be accommodated within company facilitated accommodation. This creates demand for approximately 175 beds. An additional 50 beds would be required for regular maintenance workers.

Accommodation provision for the train 3 and 4 workforce will be determined at a later date, recognising these are planned to begin operation 8 years after trains 1 and 2 enter production.

Issue 363 (LNG S029)

The statement under SIMP 3.1 Housing and Accommodation Action Plan (Long Term Housing): "Identify preferred approach for facilitation of 380 beds in company facilitated accommodation for construction management single status workers and 225 for operation workers through project accommodation strategy" is unclear.

This is included under long term housing but seems to refer to camp accommodation. Please clarify.

Response

The housing and accommodation action plan has been amended in the SIMP Update to clarify Arrow Energy's approach to housing workers (SREIS Attachment 4, Section 3.1).

While EPC and Arrow Energy staff will be housed on the mainland, the majority of staff (380 people) will be accommodated in company facilitated accommodation. This requirement may be met directly by the project, either through the development of purpose built accommodation or through agreements with third party providers. Examples of company facilitated accommodation include:

- Medium to high density development.
- Third party construction camps currently operating in the Gladstone Region.
- Pioneer workers camp on the mainland.
- Rental properties, where market conditions allow.

A series of accommodation strategies will be developed to refine these options. These include:

- Early works workforce accommodation strategy to be developed four months prior to construction commencing.
- Construction workforce accommodation strategy to be developed within 12 months of awarding the EPC contract.
- Operations workforce accommodation strategy 24 months prior to the completion of construction.

Issue 400 (LNG S030)

There is no dollar commitment to the Brighter Futures Program. The proponent should target a minimum amount for disbursement in the Gladstone Regional Council area over a stated period of years.

Response

Arrow Energy acknowledges that it has a shared responsibility with government and society more broadly to help facilitate the development of strong and sustainable communities. It is committed to managing the residual social impacts of its activities that cannot be avoided or sufficiently minimised and to contributing to the social and economic wealth of the communities in which it operates through its social investment program.

The Brighter Futures Program is one Arrow Energy initiative designed to support social investment in key action areas identified in the SIMP (SREIS Attachment 4, SIMP Update). The level of funding provided through this program will be commensurate to Arrow Energy's role as a privately owned company.

Arrow has committed to each of the following social investment activities:

- Brighter Futures Program, providing funding for community, sponsorships and partnership opportunities
- $3.5 million to offset or mitigate impacts of the project (comparable to other LNG proponents)
- $1 million for emergency rental assistance to Gladstone Regional Council (GRC) for distribution

- $6.5 million to Gladstone Affordable Housing to develop affordable housing options

These amounts are comparative with the other LNG proponents.

4.9 EIS Chapter 27: Economics

Issue 16 (LNG S003)

The EIS offers insufficient detail on the costs and negative externalities of decommissioning. Discussion should include the environmental costs of LNG technology becoming obsolete, or the risk that Arrow LNG gets priced out of Asian markets due to North American shale gas, or for some other reason.

Response

The LNG plant has a design life of 25 years. A decommissioning and final rehabilitation plan will be prepared and approved by the relevant authority at least 12 months prior to the planned closure of the LNG plant. The plan will adopt standards and good industry practices applicable at that time (EIS Chapter 6, Project Description: LNG Plant, Section 6.15). A detailed costing will be undertaken at this time to reflect the required standards and available technology. Environmental and social impacts associated with decommissioning were assessed in the EIS across a range of values and found to be manageable with appropriate mitigation measures in place.

Worldwide LNG sales are predicted to rise and a global increase in the gas trade of about 80% by 2035 is expected, more than half of which is LNG (IEA, 2010). The International Energy Agency has also identified that natural gas is likely to play a key role in meeting the world's energy needs for the next two and a half decades, as governments focus on maintaining economic growth and utilising less carbon intensive energy options (EIS Chapter 3, Project Rationale, Section 3.1).

Issue 58 (LNG S013 and LNG S031)

The EIS notes that Gladstone's property market is 'tight', rental vacancy rates are low, rental prices have risen sharply, and property prices have risen sharply. Higher accommodation costs are born not just by resource sector employees with rising wages, but other residents. There appears to be no requirement for FIFO workers to reside in workers camps. This will add pressure to the accommodation market.

Response

The majority of construction workers will be engaged on 'single status' and therefore required to reside in construction camps as a condition of employment. The updated SIMP (Attachment 4 of the SREIS, Section 3.1) states that FIFO workers will reside in the construction camp on Curtis Island or the mainland TWAF if the construction camp reaches capacity.

The potential impact of the Arrow LNG Plant and cumulative LNG projects on Gladstone's property market has been acknowledged. Arrow Energy has made a number of commitments to address accommodation for staff and contractors moving to the area, as well as measures to address potential pressure on housing affordability for other employment sectors (EIS Attachment 7, SIMP, and SREIS Attachment 4, SIMP Update, Section 3.1).

An early works accommodation strategy will be developed four months prior to construction commencing and a construction workforce accommodation strategy will be developed within 12 months of awarding the engineering, procurement and construction (EPC) contract which will

refine these options. An operations accommodation strategy will also be developed 24 months prior to commissioning of the plant.

Issue 411 (LNG S030)

Council is concerned the economics presented in the EIS and resultant commitments does not adequately address concerns of local businesses. The proponent should:

(a) Give specific consideration to the development of procurement policies to enhance the prospects of smaller, local businesses.

(b) Work in partnership with the Industry Capability Network (Queensland) to meet obligations under the Australian Industry Participation Plan which align with the Queensland Local Industry Policy in the areas of building local supply capability and full fair and reasonable opportunity to local suppliers.

Response

Arrow Energy has made a number of commitments to maximise opportunities for and minimising adverse impacts on local businesses. These commitments are set out in the Local Content Action Plan contained in the SIMP (EIS Attachment 7, Section 3.5). The plan aims to manage impacts on local businesses and to help businesses to provide goods and services to the project. Arrow Energy has a Local Procurement Policy will provide information to local businesses to assist them in maximising opportunities to service the project.

In addition, Arrow Energy has developed a draft Australian Industry Participation Plan (AIPP), which will be submitted to the Federal Government in December 2012. The plan provides detailed information on the strategies and approaches that will be taken to:

- Encourage contractors to source local goods and services where possible.
- Encourage businesses to consider Indigenous procurement to maximise Indigenous employment opportunities.
- Engage key business bodies regarding appropriate opportunities for local businesses to supply goods and services to the project.

Arrow Energy is currently engaging with the Coordinator-General in respect to the AIPP and its applicability to local industry participation plan requirements.

4.10 EIS Chapter 28: Traffic and Transport

Issues 53, 252, 260 and 261 (LNG S012 and LNG S021)

Describe the consultation undertaken with the LNG Maritime Movement Scheduling Committee, Maritime Safety Queensland, the Regional Harbour Master and the commercial shipping sector with regards to compliance with Port of Gladstone requirements for safe project shipping and marine construction vessel movement and scheduling, including dredges and pilotage requirements.

Response

Extensive studies and simulations for the safe navigation of LNG carriers within the Port of Gladstone have been carried out in consultation with Maritime Safety Queensland, the Regional Harbour Master, GPC and other LNG proponents.

Arrow Energy is actively engaged in a number of proponent forums established to address LNG shipping and marine construction traffic matters in the Port of Gladstone, as shown in SREIS Chapter 2, Consultation Update, Section 2.2.1. These forums include:

- LNG Protocols Group, which was formed in late 2008 and has worked to formalise the LNG rules for shipping in Gladstone, which included tug and pilotage requirements and navigational aids. This forum has comprised of LNG proponents, Gladstone Ports Corporation, Maritime Safety Queensland and contractors.
- LNG Simulations Group, which has commissioned simulations for the safe navigation and mooring of LNG tankers. This forum has comprised LNG proponents, Gladstone Ports Corporation, Maritime Safety Queensland, and contractors.
- Gladstone Harbour Construction Vessels Scheduling and Safety Committee, which is focused on harbour traffic management during the construction phase.

Arrow Energy maintains ongoing communication with the Regional Harbour Master on all areas of marine activity associated with the project, including proposed berth layouts and channel marking. The Regional Harbour Master was also consulted prior to deploying current meter buoys in the channel between Boatshed Point and Tide Island.

Shipping activities for the project will be managed in accordance with the appropriate legislation and guidelines discussed in EIS Chapter 28, Traffic and Transport, Section 28.1.5.

Arrow Energy is maintaining regular and ongoing communication with agencies on shipping requirements for the project and potential impacts to stakeholders.

Issues 93 and 100 (LNG S017)

Provide further information and consult GPC regarding potential impacts to port roads, intersections and rail infrastructure (e.g., rail access to RG Tanna Coal Terminal). Acknowledge and assess the adverse impact of locating Launch Site 1 adjacent to the RGTCT and across from WICET.

Response

Arrow Energy consulted GPC and other relevant stakeholders throughout the EIS process and will continue to do so as the project moves forward.

Car parking at the mainland launch site has been reduced, as forecast congestion at roundabouts on Port Curtis Way (particularly at its intersection with Blain Drive and Red Rover Road) makes it prudent to develop a vehicle parking/staging area from which workers would be bussed to and from the mainland launch facility. Reducing potential congestion along Port Curtis Way will reduce the likelihood of project traffic impacting travel to RG Tanna Coal Terminal and Wiggins Island Coal Export Terminal (WICET).

Two potential sites for staging areas have been identified and are under consideration, at Red Rover Road and TWAF 7 (SREIS Chapter 4, Project Description: LNG Plant (Section 4.8)).

Access options to launch site 1 from the Port Curtis Way – Red Rover Road intersection and Alf O'Rourke Drive were discounted as they involved railway crossings. Three options utilising the existing access road to the Calliope River Sewerage Treatment Plant are still under consideration. These are described in SREIS Chapter 3, Assessment of Alternatives Update. The options are shown on Figure 3.3 in that chapter. The traffic and transport assessment for the project has been

updated for the SREIS as is included in Appendix 13. The findings of the study are described in SREIS Chapter 20, Traffic and Transport.

Issues 94, 95 and 240 (LNG S017 and LNG S021)

Supply details of heavy vehicle transport of goods and materials to project sites, including traffic management and heavy vehicle parking. Assessment under GARID requires analysis of pavement impacts and road safety risks from project traffic. Early estimates are required to develop broad mitigation strategies which will be developed as more detailed estimates are available.

Response

Further information on logistics for the project is contained in SREIS Chapter 7, Project Description: Logistics.

The updated traffic and transport assessment for the SREIS follows the Guidelines for Assessment of Road Impacts of Development (GARID) assessment process, which was also utilised to produce the traffic and transport assessment for the EIS.

Updated information on the transport of plant, personnel and materials to and from the LNG plant site including during the early works phase was used to update traffic scenarios considered in this assessment. Information on heavy vehicles is discussed in SREIS Appendix 13, Traffic and Transport, Section 5.5.2, and in SREIS Chapter 20, Traffic and Transport, Section 20.5.2.

The pavement impact assessment is described in SREIS Appendix 13, Section 6.5 and Chapter 20, Traffic and Transport, Section 20.5.2. Pavement impacts to Council-Controlled roads were not identified at this time, and will be assessed after pioneer launch site location(s) have been confirmed. The pavement impact assessment for Council Controlled Roads will be conducted in accordance with the GRC ‘Pavement Impact Assessment Guidelines’ (GRC, 2010).

Safety considerations are described in SREIS Appendix 13, Section 6.7.

Issue 97 (LNG S017)

Lack of assessment of impacts of maritime traffic associated with the project. The EIS should acknowledge the extra construction traffic Arrow will add to existing commercial traffic levels and assess mitigation strategies for identified impacts.

Response

The Arrow LNG Plant will introduce additional marine construction traffic within Gladstone Harbour. Estimated vessel movements during construction and operations are described in SREIS Chapter 7, Project Description: Logistics (Section 7.1.1 and Section 7.2.1 respectively).

Managing the potential impacts of marine construction traffic is the focus of the Gladstone Harbour Construction Vessels Scheduling and Safety Committee, which comprises LNG proponents and their contractors, GPC and Maritime Safety Queensland. Participation in this forum provides the most effective means of managing potential project and cumulative LNG project impacts (congestion, safe passage of LNG and other vessels) on Gladstone Harbour, in consultation with maritime authorities. Arrow Energy will require its principal construction contractors to work with this committee.

Marine construction traffic associated with the Arrow LNG Plant must also have regard to Maritime Queensland's Standard for Marine Construction Activities in Gladstone Harbour (MSQ, 2011).

Issue 247 (LNG S021)

Further information should be presented on the purpose of the logistics plan. Follow the draft guidelines on preparing a logistics plan.

Response

The objectives of the logistics plan are to:

- Identify logistics HSE requirements for inclusion in the project specification.
- Identify estimated quantities of materials and personnel and number of movements (both land and marine) to support early logistics planning during FEED and to support EIS traffic studies.
- Identify existing infrastructure in Gladstone.
- Identify functional requirements for infrastructure (MOF, MLS and other) and equipment.
- Identify risk and opportunities with a focus on logistics local to the Gladstone region.

The EPC contractor will undertake further materials quantity estimates and assessments of transport alternatives to refine logistics prior to commencing early works. Final estimates will be contained in various construction management plans including:

- Project logistics plan.
- Traffic management plan.
- Marine activity management plan.

The logistics plan will be developed in a timely manner in consultation with relevant agencies, incorporating applicable guidelines.

Issue 248 (LNG S021)

In order of preparation the following transport related documents or plans are required:

1) Road Impact Assessment (following the GARID)

2) Road use management plan (documents latest traffic estimates and summarises final RIA once FID is made).

3) Logistics Plan documenting strategies to maximise transport logistics.

4) Traffic Management Plan demonstrating how road works will be safely undertaken in accordance with DTMR guideline.

Response

The assessment of significance was applied to the traffic and transport assessment in the EIS in addition to following the standard methodology in accordance with the GARID. Further assessment in the SREIS phase follows the GARID. Updated information available on the transport of plant, personnel and materials to and from the LNG plant site including during the early works phase was used to update scenarios considered in the SREIS assessment.

The EPC contractor will undertake further materials quantity estimates and assessments of transport alternatives to refine the logistics estimates presented in the SREIS prior to commencing early works. Final estimates will be contained in various construction management plans including:

- Project logistics plan.
- Traffic management plan.
- Marine activity management plan.

SREIS Chapter 20, Traffic and Transport (Section 20.5.2) identifies the requirements for infrastructure agreements, including finalising a road impact assessment, road use management plan, logistics plan and traffic management plan.

Issue 304 (LNG S025)

Existing LNG projects have already increased vehicle movements in Gladstone. Commit to the delivery of proposed upgrades to identified intersections in advance of project construction.

Response

Arrow Energy is a participant in the Road Transport Infrastructure Cumulative Impacts Study - Proposed LNG Industry Impacts, facilitated by the Department of Infrastructure and Planning (now Department of State Development, Infrastructure and Planning), which includes representatives of DTMR, GLNG, QCLNG and APLNG. This forum was established to address the cumulative impact assessment on state road infrastructure and the apportionment of impacts by the respective projects. Arrow Energy will continue to work with forum members to further understand the apportionment of the cumulative road impacts from Arrow Energy's road use, once the detailed logistics strategy and associated traffic management plans have been developed.

The traffic assessment undertaken for the SREIS (Appendix 13) has identified likely timing for intersection upgrades under background conditions, but also with the addition of Arrow LNG Plant and cumulative LNG project traffic. The results of this assessment will be provided to GRC and DTMR to inform future upgrades planning. The upgrade of intersections will be the subject of commercial discussions.

4.11 EIS Chapter 29: Hazard and Risk

Issue 21 (LNG S004)

Provide further detail to QAS on: whether construction camps will be alcohol free; fatigue management policy in relation to roster shifts and pre- and post-shift; Major Emergency Incident Plan; any road diversions or other closures to the Ambulance Communication Centre; methods and equipment to be used in the transfer of injured persons from the island; possible landing sites for rescue helicopter services / fixed wing aircraft services if required (including landing zone, flight paths, lighting and wind sock).

Response

Project policies and codes of conduct relating to public and worker’s health and safety and based on Arrow Energy’s existing Code of Conduct and drug and alcohol policy will be developed prior to construction commencing. The range of measures are identified in the SIMP (EIS Attachment 7), Section 3.6, Community Health and Safety and include implementation of policies and programs to maintain the wellbeing of personnel, including:

- Provision of welfare and recreation facilities.
- Provision of a counselling service (including drug and alcohol services).
- Implementation of a range of Arrow Energy policies including the OHS Policy, Drug, Alcohol and Contraband Policy, Duty to Stop Work Policy and Fit for Duty Policy.
- Enforcement of smoking regulations on site.
- Restrictions on working hours to reduce worker fatigue.
- Provision of nutritionally balanced food to all personnel living within construction camps in line with guidance issued by Queensland Health.

At all times Arrow Energy's Drug, Alcohol and Contraband and Fit for Duty Policies will apply to the workforce whilst on Arrow Energy sites and whilst engaged in Arrow Energy work.

Arrow Energy has committed to ongoing consultation with relevant agencies, including QAS, in developing the various management plans required for the project. The detailed medical emergency response plan will outline key areas of responsibility for personnel on site and the medical emergency facilities and resources available. A range of medical emergency facilities and resources will be made available in accordance with the minimum standards set out in the Shell Exploration and Production Medical Emergency Response Guidelines (2005).

A detailed medical emergency response study will be undertaken to assess transport times between the LNG plant and the mainland and determine whether required response times can be met. Arrow Energy will also contribute to a common Curtis Island local emergency response strategy being developed by the various stakeholders involved in the Curtis Island LNG projects.

The location of particular infrastructure at the LNG plant on Curtis Island including marine (vessel) and land (helicopter) emergency landing sites and associated facilities will be finalised through the detailed design phase.

Issue 99 (LNG S017)

Include the risks associated with bulk fuel transfers in the hazard and risk assessment.

Response

EIS Chapter 29 Hazard and Risk notes that the prevention of marine incidents and loss of containment during shipping is managed through a number of maritime safety related Acts such as the Maritime Transport and Offshore Facilities Securities Act 2003 and the Navigation Act 1912.

Potential hazards associated with the loss of containment of bulk fuels (oil, lubricants, and diesel) on site will be managed in accordance with Australian Standard AS 1940-2004 The Storage and Handling of Flammable and Combustible Liquids. This includes filling of tanks from ships, prevention of loss of containment, and operational and personnel safety precautions.

Preliminary hazard and risk assessments completed for the project (EIS Appendix 24) found that compliance with the appropriate standards and codes for the storage of dangerous goods such as flammable liquids and corrosive liquids would ensure that the risks associated with the use of this material would be very low. Further detailed hazard and risk assessments will be completed for the project through the detailed design.

4.12 EIS Chapter 32: Cumulative Impacts

Issue 51 (LNG S012)

No assessments have been made in relation to the cumulative impacts of dredging and loss of marine habitats in the Western Basin Dredging and Disposal Project and the Arrow dredge projects (refer sections 8.1, 32.3.5). Little responsibility is taken by Arrow, except to state the project is adding to existing infrastructure in the region.

Response

EIS Chapter 32, Cumulative Impacts, Section 32.3.5 discusses project dredging activities that could occur concurrently with other dredging activities in Port Curtis. Arrow LNG Plant dredging activities are limited to Stage 2 of the Western Basin Dredging and Disposal (WBDD) Project dredging at Laird Point. The dredge management plan for the Arrow LNG Plant will consider the locations and timing of all dredging activities in Port Curtis (project and non-project) and include requirements for water quality monitoring and actions to be taken to minimise the impacts of dredging on sensitive areas should water quality monitoring data show performance criteria are exceeded.

Potential cumulative impacts to the marine environment are also discussed in EIS Chapter 32, Cumulative Impacts, including information on direct and indirect impacts to marine fauna and potential loss of marine and estuarine habitat. This assessment took into account the impacts of the WBDD Project as an existing project i.e. in the baseline or base case for the assessment. The computer modelling of dredge plumes and sediment deposition took into account the WBDD project under its 'base case'. The potential impact of the loss of marine habitats in Port Curtis as a result of this project was considered as part of the baseline for the marine ecology assessment i.e. as an element of the existing environment.

Issue 68 (LNG S014)

Proponent has failed to adequately address cumulative impacts of shipping on environmental values. The proponents should be required to describe these impacts and provide data including the number of shipping movements.

Response

Cumulative impacts to the marine environment are discussed in EIS Chapter 32, Cumulative Impacts, Section 32.3.5 and in SREIS Chapter 15, Marine Ecology, Section 15.6.3, including cumulative impacts of shipping activities. Increases in vessel frequency and varying navigation routes used by each project could interfere with the feeding and movement of marine fauna species within Port Curtis. Direct and indirect cumulative impacts on marine fauna and potential loss of marine and estuarine habitat are discussed in this section of the EIS.

The estimated type, number and frequency of marine vessels during peak construction and operations are provided in EIS Chapter 28, Traffic and Transport, Section 28.4.5. Updated estimates of vessel movements during construction and operations are described in SREIS Chapter 7, Project Description: Logistics (Section 7.1.1 and Section 7.2.1 respectively) and have been used to review potential impact on marine fauna as part of technical studies completed for the SREIS (SREIS Appendix 8, Technical Study of Marine Ecology (Port Curtis)).

Issue 70 (LNG S016)

Clarify Arrow's involvement with the cooperative model currently operating in Gladstone that includes participation by other LNG proponents, Gladstone Regional Council and Gladstone Affordable Housing Company.

Response

EIS Chapter 4, Consultation and Communication (Section 4.2.4) outlines Arrow Energy's participation in consultation with other LNG proponents to explore opportunities to create efficiencies in project planning and design. Consultative forums involving proponents, government and industry are shown in Table 4.1 within this chapter.

As discussed throughout the consultation report within the EIS (Appendix 30), Arrow Energy has been participating in ongoing discussions with other proponents and state government agencies in looking at issues relating to housing.

The cumulative impacts action plan within the SIMP Update (SREIS Attachment 4, Section 3.8) outlines Arrow Energy's commitment to take a position on the Gladstone Affordable Housing reference group on the commitment of funding at final investment decision (FID) and to continue to engage with the Office of the Coordinator General, other LNG proponents and state agencies to manage housing and accommodation across the industry.

Arrow Energy has committed to provide $6.5 million towards the development of affordable housing in Gladstone and $1 million for Emergency Rental Assistance (ERA) to GRC. Arrow Energy is currently working with GRC to develop the criteria and distribution process to access ERA funding (EIS Attachment 7 SIMP, and SREIS Attachment 4 SIMP Update, Section 3.2).

Issue 152 (LNG S018)

The EIS does not adequately address the cumulative impacts of brine water discharge into Port Curtis taking into account other LNG plants on Curtis Island and major harbour dredging programs. Consider and address this matter.

Response

EIS Chapter 15, Coastal Processes, Section 15.3 discusses the receiving environment into which brine from the reverse osmosis desalination plant will be discharged. Large tidal storage areas and the amplification effect on water levels results in good tidal flushing and large current speeds. In addition, further hydrodynamic modelling discussed in SREIS Chapter 14, Coastal Processes, Section 14.6 confirms that the area in the vicinity of Boatshed Point is considered a well-mixed hydrodynamic environment. Due to the nature of the receiving environment, and the volume of the brine discharge relative to the total tidal exchange within the receiving waters, discharged brine water will rapidly mix with ambient seawater and salinity will return to naturally occurring conditions in the localised area. Large separation distances between the brine outfalls of other LNG plants and the volumes of these discharges relative to the volume of the receiving waters mean there are unlikely to be cumulative water quality impacts from brine water discharges into Port Curtis.

The highest volume of brine discharge is predicted to occur during operation of the LNG trains, by which point the majority of dredging works will be complete. The dredge management plan for the Arrow LNG Plant will consider the locations and timing of all dredging activities in Port Curtis (project and non-project) and additional activities that may affect the water quality of Port Curtis.

As discussed in SREIS Chapter 3, Assessment of Alternatives Update, the EIS referred to the supply of mains water to Curtis Island via a pipeline installed by GAWB as an option undergoing feasibility. This option has since progressed beyond feasibility and is now Arrow Energy's preferred water supply option. However, in the event that mains water becomes unavailable or restricted (e.g., in a time of drought), Arrow Energy will retain the option to develop a desalination plant to ensure the plant is self-sufficient.

Should the desalination option be pursued, no sensitive areas (such as seagrass) are located close to the discharge location and any discharge will comply with applicable water quality criteria.

Issue 429 (LNG S030)

Cumulative impacts of the Arrow LNG Plant with the Arrow Bowen and Arrow Surat pipeline projects should be identified and mitigated by the proponent. The Coordinator-General should condition the proponent to consolidate the impacts of these projects with respect to traffic, housing and other social impact related issues. Cumulative impact analysis and mitigation strategies should be prepared accordingly.

Response

The Arrow LNG Plant, Arrow Surat Pipeline and Arrow Bowen Pipeline are being assessed under different legislation and assessment processes which were initiated at different times. The Arrow Surat Pipeline has been assessed and approved under the Environmental Protection Act 1994, and a pipeline licence issued. The Arrow LNG Plant is being assessed under the State Development and Public Works Organisation Act 1971. That assessment process commenced prior to the Arrow Bowen Pipeline assessment process under the Environmental Protection Act 1994 being initiated. Specific impacts associated with each of these projects are assessed, and mitigation measures proposed, within each of the individual project's EIS.

Cumulative impacts of the proposed developments have been or will be assessed. The cumulative impact assessment undertaken for the Arrow LNG Plant EIS includes the Arrow Surat Pipeline (see EIS Chapter 9, Impact Assessment Method, and EIS Chapter 32, Cumulative Impacts). Terms of reference for the Arrow Bowen Pipeline EIS require an assessment of cumulative impacts which will include the Arrow LNG Plant and Arrow Surat Pipeline. This approach is consistent with accepted practice, where proposed developments are required to assess the cumulative impacts of projects for which environmental impact assessments have commenced or have been completed, and there is sufficient information to inform a cumulative impact assessment.

4.13 EIS Attachment 4: Matters of National Environmental Significance

Issues 162 and 287 (LNG S018 and LNG S024)

Provide a map and details of the areas of vegetation proposed to be cleared including for MNES vegetation. Vegetation clearance should be discussed in the context of wilderness, natural beauty or rare and unique environmental values. Provide details of the vegetation management plan, including its purpose and the proposed mitigation measures.

Response

SREIS Chapter 18, Terrestrial Ecology, Section 18.6 provides a revised assessment of terrestrial vegetation. Section 18.6.2 addresses EPBC listed threatened ecological communities and Section 18.6.4 addresses EPBC listed flora species. SREIS Chapter 18, Table 18.3 tabulates the revised areas of regulated vegetation to be cleared within the Arrow LNG Plant project area. This information is summarised in SREIS Attachment 2 (MNES Update), sections 3.1.2 and 3.2.2, and tables 3.1 and 3.2.

EPBC Act listed vegetation communities are shown on Figure 18.5 of Chapter 18, and updated field validated regional ecosystem mapping is shown on Figures 18.6 and 18.7.

Table 2.2 of Attachment 2 correlates specific project activities to potential impacts to the World Heritage and National Heritage values of the GBRWHA.

Revised and additional management measures (commitments) identified during the supplementary technical studies to address impact on terrestrial ecology are included in Section 18.10 (Table 18.7) of the SREIS.

The cumulative impacts of vegetation clearing are presented in EIS Chapter 32, Cumulative Impacts, Section 32.3.7, Table 32.2; and Attachment 4 (MNES), Table 6.4. This table has been updated in SREIS Chapter 18, Section 18.8 (Table 18.6).

Issue 282 (LNG S024)

Further detail required in MNES attachment around vegetation communities, habitat type and use with the Great Barrier Reef World Heritage Area (GBRWHA). Maps of important habitat for key species (seagrass for dugongs) and other values in relation to project infrastructure would be useful, including any within the area of 10m salinity discharge. Vegetation clearance should be discussed in the context of wilderness, natural beauty or rare or unique environment values.

Response

Project activities, including vegetation clearance, against Great Barrier Reef World Heritage and National Heritage values are assessed in SREIS Attachment 2, MNES Update, Section 2.1 (Table 2.1).

Important habitats for marine species are shown in EIS Chapter 19, Marine and Estuarine Ecology, Figure 19.1. Updated information on turtle nesting sites is provided in SREIS Chapter 16, Turtles and Lighting, and shown in Figure 16.1. Important shorebird habitats within Point Curtis are shown in SREIS Chapter 19, Shorebirds, Figure 19.2.

Areas potentially impacted by wastewater discharge are identified in SREIS Attachment 2, MNES Update, Chapter 2, Section 2.2.1. Arrow Energy's preferred option is to use the two sewer mains servicing Curtis Island from the mainland to dispose of effluent. The treatment plant on Curtis Island is being maintained as a project option. Should this option be pursued, no sensitive areas (such as seagrass) are located close to the discharge location and any discharge will comply with applicable water quality criteria. Impacts are predicted to be extremely localised and will not have a significant impact on the heritage values of the GBRWHA (SREIS Attachment 2, Section 2.2).

Issue 286 (LNG S024)

Provide a more detailed rationale in MNES attachment for the conclusion that there will be no residual significant impact on landscape and visual receptors from lighting during construction, given that the EIS states that lighting will have a significant impact on landscape and visual receptors.

Response

EIS Chapter 23, Landscape and Visual, Section 23.4.2 provides an assessment of 15 sensitive visual receptors/viewpoints. The assessment identified impacts, mainly due to lighting, of varying degrees of significance depending on the viewpoint. Commitments to avoid, mitigate and manage visual impacts are included in EIS Chapter 23, Section 23.8.

The cumulative impact assessment (EIS Chapter 32 and EIS Attachment 4 (MNES) Section 6.5.2) considered impacts on landscape and visual amenity and of lighting from the increased number of developments planned and under construction in the Gladstone region. Lighting from the Arrow LNG plant during construction will be set in the context of three other LNG plants either under construction or operational on Curtis Island. Against this industrialised background, the additional cumulative impacts of lighting from the Arrow LNG plant will be minimal.

Commitments to avoid, mitigate and manage visual impacts are included in EIS Chapter 23, Landscape and Visual, Section 23.8.

The SREIS provides additional assessment of potential lighting impacts to turtles in Chapter 16, Turtles and Lighting. The technical study informing the SREIS concludes that with appropriate management, the residual impact of LNG plant lighting can be reduced to an absolute minimum, reducing the sky glow and long term visibility of the LNG plant during the production phase, thereby reducing residual impacts to nesting turtles and hatchlings. Additional commitments have been included in the SREIS to manage light from the LNG plant site, during both construction and operations.

Issue 288 (LNG S024)

Further detail of MNES protected species is required around:

- *Status of each species (vulnerable, endangered, etc.) and scientific name of each species.*
- *Use of diagrams and illustrations to show proximity of species/habitat (potential/known/type) in relation to project infrastructure.*
- *Assessment of impacts on all listed threatened species or communities likely to occur or be impacted by the proposed action.*
- *Detail around methodologies used.*
- *Assessment of residual impacts.*
- *Details around proposed mitigation measures and management plans.*
- *Detail around pre-clearance surveys to demonstrate avoidance and mitigation measures will be effective. The timing of pre-clearance surveys is crucial (especially shorebirds).*
- *Proposed offsets (what will be offset and how will it be implemented/managed).*

For those species considered not likely to be impacted by the proposed action, a clear rationale of why no impact is likely is required to be presented.

Response

Further assessment of EPBC listed threatened species is provided in SREIS Attachment 2, MNES Update, Chapter 3 and draws on details provided by the technical studies completed for the SREIS for terrestrial ecology (Appendix 11), shorebirds (Appendix 12) and marine ecology (Appendix 8). These studies included detailed discussion on the desktop and field survey methodologies; and impact assessment methodology, including conclusions regarding the magnitude and significance of residual (post-mitigation) impacts; mitigation and management commitments; and offsets. The rationale for species considered not likely to be impacted by the proposed action is presented in SREIS Attachment 2, MNES Update, Appendix D based on detailed information provided in the technical studies. This took into account the species status and the impact this had on the significance threshold. The status of each species is detailed within the EIS Attachment 4, MNES and the supporting technical studies and is included in the SREIS. Scientific names were included for all species and are also included in the SREIS.

Conservation-listed species records are shown on Figure 4 in EIS Attachment 4, MNES, in relation to the project area. Figures 5 and 6 within Attachment 4 show regional ecosystems in relation to the project area. Many species (particularly migratory species) potentially present in the study area are generalist species. It is not possible to isolate a particular habitat type of importance to those species. No important populations were identified of any conservation-listed species in the EIS.

The SREIS Attachment 2, Table 3.2 identifies the changes in potential impact to threatened species, notably the water mouse (Xeromys myoides). This species was detected in the vicinity of Boatshed Point on Curtis Island. Figures 18.8 and 18.9 of SREIS Chapter 18, Shorebirds show records of endangered, vulnerable and near-threatened species in relation to the project area.

Appendix D of SREIS Attachment 2 tabulates the revised assessment of threatened species where no change to potential impact is predicted. The assessment of impacts was undertaken in accordance with the EPBC Act Policy Statement 1.1 ‘Significant Impact Guidelines: Matters of National Environmental Significance’ (DEWHA, 2009).

Additional terrestrial ecology field surveys are proposed for the 2012/13 wet season targeting species that are more readily detectable in the warmer wet season months.

The MNES attachments to the EIS and the SREIS include commitments to address potential impacts to EPBC listed species.

Arrow Energy will develop management plans to address ecological issues prior to construction. Outlines of the species management plan, pre-clearance survey procedure, wildlife corridor management plan and shorebirds management plan are provided in SREIS Attachment 5 (Other Management Plans).

Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (Attachment 6 of the SREIS), consistent with its Environmental Offset Strategy. This plan:

- Describes measures taken to avoid and minimise impacts.
- Identifies Arrow Energy’s likely offset requirements.
- Presents evidence that there are opportunities to achieve the required offsets.
- Sets out Arrow Energy’s preferred approach to the provision of environmental offsets.

The Draft Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.

Issue 289 (LNG S024)

Further detail of MNES migratory species is required around:

- *Use of diagrams and illustrations to show proximity of species/habitat (potential/known/type, e.g., white-bellied sea-eagle nest) in relation to project infrastructure;*
- *Assessment of impacts on all listed threatened species or communities likely to occur or be impacted by the proposed action;*
- *Detail around methodologies used;*
- *Assessment of residual impacts;*
- *Details around proposed mitigation measures and management plans;*
- *Detail around pre-clearance surveys to demonstrate avoidance and mitigation measures will be effective. The timing of pre-clearance surveys is crucial (especially shorebirds); and*
- *Proposed offsets (what will be offset and how will it be implemented/managed).*

Response

The white-bellied sea eagle nest is shown on Figure 4 of the EIS Attachment 4, MNES. This species forages widely in Port Curtis, and there are regular sightings around the port. The Hamilton Point South MOF is not taken forward to the SREIS as a project option and there will be no project infrastructure in the vicinity of this nest.

Migratory shorebird habitat is shown on Figure 3 of the EIS Attachment 4, MNES (both foraging areas and roost sites). An updated figure is provided in SREIS Chapter 19, Shorebirds, Figure 19.2.

Further assessment of migratory species is provided in SREIS Attachment 2, MNES Update, Chapter 4, and draws on details provided by the SREIS technical studies for terrestrial ecology (Appendix 11), shorebirds (Appendix 12) and marine ecology (Appendix 8). Detailed discussion is provided on the desktop and field survey methodologies; and impact assessment methodology, including conclusions on the magnitude and significance of residual (post-mitigation) impacts; mitigation and management commitments; and offsets.

The assessment of impacts was undertaken in accordance with the EPBC Act Policy Statement 1.1 ‘Significant Impact Guidelines: Matters of National Environmental Significance’ (DEWHA, 2009) and the draft Background Paper to EPBC Act Policy Statement 3.21 – Significant Impact Guidelines for 36 Migratory Shorebird Species (DEWHA, 2009).

The SREIS Attachment 2, Table 4.1 identifies changes in potential impacts to migratory species, notably the eastern curlew (due to potential indirect disturbance to the Clinton Ash Ponds site).

Appendix E of Attachment 2 of the SREIS tabulates the revised assessment of migratory species. No change to potential impacts is predicted.

Additional migratory shorebird and terrestrial ecology field surveys are proposed for the 2012/13 wet season, in part to validate the assessment of sites such as Clinton Ash Ponds.

SREIS Chapter 15, Marine Ecology, Section 15.4.2 details the results of scientific literature reviews undertaken for EPBC listed marine fauna, in particular the snubfin and Indo-Pacific humpback dolphins.

The SREIS concludes that there are no changes to the EIS assessment of potential impacts to migratory marine species - that there is a risk of moderately significant direct impact to the Australian snubfin dolphin, Indo-Pacific humpback dolphin and dugong due to potential vessel strike.

The MNES attachments to the EIS and the SREIS include commitments to address potential impacts to migratory species.

Arrow Energy will develop management plans to address ecological issues prior to construction. Outlines of the species management plan, pre-clearance survey procedure, wildlife corridor management plan and shorebirds management plan are provided in SREIS Attachment 5 (Other Management Plans).

Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (SREIS, Attachment 6), consistent with its Environmental Offset Strategy. This plan:

- Describes measures taken to avoid and minimise impacts.
- Identifies Arrow Energy's likely offset requirements.
- Presents evidence that there are opportunities to achieve the required offsets.
- Sets out Arrow Energy's preferred approach to the provision of environmental offsets.

The Draft Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.

Issue 292 (LNG S024)

Provide information on proposed offsets, including what the offsets compensate for and how the offsets comply with guidelines and policies. The offset strategy must specifically address MNES. The Australian Government preference is for the strategy to align with the offsets required for the three approved LNG plants on Curtis Island.

Response

Offsets are discussed in SREIS Attachment 2, MNES Update, Chapter 5, with reference to the Australian Government's EPBC Act Environmental Offsets Policy, October 2012.

SREIS Attachment 2, chapters 2, 3 and 4 provide the rational for consideration of offsets for the World Heritage and National Heritage values, and EPBC listed threatened ecological communities and species and migratory species for which the project is declared a controlled action.

Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (SREIS Attachment 6), consistent with its Environmental Offset Strategy. This plan:

- Describes measures taken to avoid and minimise impacts.
- Identifies Arrow Energy's likely offset requirements.
- Presents evidence that there are opportunities to achieve the required offsets.
- Sets out Arrow Energy's preferred approach to the provision of environmental offsets.

The Draft Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.

4.14 EIS Attachment 6: Environmental Management Plan

Issue 185 (LNG S018)

EMP – The draft EMP provided in the EIS references both the LNG facility and the feed gas pipeline. Provide two draft EMPs, one for the petroleum facility license and another for the petroleum pipeline license to accompany the environmental authority applications for each tenure.

Response

The Environmental Management Plan (EMP) provided in the EIS (Attachment 6) is a preliminary document that will be further developed designed to support the application for development approval of all of the project components. The plan summarises the mitigation, inspection and monitoring measures identified in the EIS developed to manage impacts and minimise environmental risk. It is not intended to be a statutory EMP of the type that will be produced in support of application(s) for environmental authorities for the project. While representing a thorough summary of Arrow's commitments to avoid, minimise, mitigate and manage environmental impacts it does not contain all of the detailed information required for formal issuance of an environmental authority.

For further clarity, the EMP updated for the purposes of the SREIS has been termed a Strategic EMP. The purpose of the Strategic EMP and subsequent plans that may be developed as the project progresses are presented in Section 1.3 of the Strategic EMP (SREIS Attachment 3, Strategic EMP).

When discussing statutory EMPs, please note that two EMPs will be required, one relating to the Petroleum Pipeline Licence (PPL) and one relating to the Petroleum Facility Licence (PFL). These will be submitted in support of application(s) for environmental authorities.

Issue 192 (LNG S018)

EMP - Impacts such as groundwater dewatering presenting a risk to personnel, and dewatering leading to reduced aquifer recharge are not addressed adequately by mitigation in the EMP. Provide further information on groundwater dewatering, management of contaminants, and groundwater monitoring bores (refer to submission for detailed information requirements).

Response

The EMP provided in the EIS (Attachment 6) is a preliminary document that will be further developed to support the application for development approval of all of the project components. The plan summarises the mitigation, inspection and monitoring measures identified in the EIS developed to manage impacts and minimise environmental risk. It is not intended to be a statutory EMP of the type that will be produced in support of application(s) for environmental authorities for the project. Whilst representing a thorough summary of Arrow's commitments to avoid, minimise, mitigate and manage environmental impacts it does not contain all of the detailed information required for formal issuance of an environmental authority.

Impacts on groundwater, including dewatering impacts on aquifer recharge and management of potential contaminants is described in detail in EIS Appendix 7, Groundwater Impact Assessment and summarised in EIS Chapter 14, Groundwater. Section 14.4 identifies specific issues and

potential impacts, including ground disturbance and dewatering, tunnelling and dewatering, saline intrusion, contamination through leaks and spills, and disturbance to acid sulfate soils. Management measures to mitigate the magnitude of impacts are also identified (Section 14.5) including measures to limit the extent and duration of dewatering and numerous commitments to manage hazardous substances.

EIS Chapter 14, Groundwater, Section 14.7.2 includes an outline of requirements for the groundwater monitoring program to be established prior to construction.

All project works will be progressed in accordance with Arrow Energy's Health, Safety and Environmental system.

Issue 194 (LNG S018)

EMP - The EMP provides insufficient detail of where storm water, hydrostatic test water, brine, dewatering of tunnel spoil, treated sewage effluent and process water will be disposed, and how disposal will be managed. Provide evidence-based assessment for each contaminant for each release point (refer to submission for detailed information requirements).

Response

The details of wastewater disposal and management strategies were included in the Waste Management Impact Assessment (EIS Appendix 29) and summarised in EIS Chapter 31, Waste Management. The updated Strategic EMP (SREIS Attachment 3, Section 4.22.2) includes an update on these strategies. Further details will be available after the completion of detailed engineering design that is yet to be completed by an EPC contractor. These will be provided in statutory EMPs that will accompany the environmental authority applications for the project.

It should be noted that Arrow Energy's preferred option for wastewater and effluent disposal has changed since the EIS was finalised. GRC has now installed two sewer mains under Port Curtis to service the LNG plants on Curtis Island. As a consequence, FEED considered disposal of effluent via the sewer mains in lieu of an effluent treatment facility (SREIS Chapter 4, Project Description: LNG Plant, Section 4.10).

While disposal of wastewater via the GRC sewer mains is preferred, Arrow Energy will retain the option to develop an effluent treatment plant in the event the sewer mains are unavailable.

Issue 197 (LNG S018)

EMP - Clarify whether brine will be generated by the reverse osmosis or desalination plant. Ensure consistent use of terminology in the EMP as both reverse osmosis plant and desalination plant are used. Detail the quantity of brine and how it will be stored, including capacity/design of any storage ponds.

Response

Arrow Energy's preferred option for water supply has changed since the EIS was finalised. The Gladstone Area Water Board supply pipeline option has progressed beyond feasibility and is now Arrow Energy's preferred water supply option (SREIS Chapter 4, Project Description: LNG Plant, Section 4.9). Construction of the pipeline has commenced and it will be operational when required for construction and operation of the LNG plant. In the event that mains water becomes unavailable or, Arrow Energy will retain the option to develop a desalination plant to ensure the plant is self-sufficient.

Should the desalination plant option be pursued, further detail on the quantity and management of brine will be included with the statutory EMP that will accompany the environmental authority application for the project. In the event that the desalination plant is pursued after issuance of an environmental authority, full details of the plant will be provided through a formal environmental authority amendment process.

Issue 202 (LNG S018)

EMP - The EMP does not provide background air quality monitoring data, or detail regarding the proximity of sensitive receptors or modelling of the expected air quality from the project. Revise the EMP with reference to the detailed information requirements set out in the submission.

Response

The studies completed for the EIS provided a detailed review and presentation of background air quality data and modelling of project impacts on air quality in Appendix 14 (Air Quality Impact Assessment) and Chapter 21, Air Quality. This baseline and modelling was updated in the studies completed for the SREIS (Appendix 1, Supplementary Air Quality Assessment) and Chapter 8, Air Quality.

The air quality impact assessment study area encompasses all sensitive receptor areas relating to human health and wellbeing and aesthetics that may be impacted by project activities. Additional sensitive areas that may be impacted by project relate to health and biodiversity of ecosystems and protecting agricultural use. The sensitive receptor areas within the air quality impact assessment area are shown within EIS Chapter 21, Air Quality, Figure 21.1. The sensitive receptor area has been revised in the SREIS and is shown in Figure 8.1 in SREIS Chapter 8, Air Quality.

The Strategic EMP has been updated and is included in SREIS Attachment 3. Further details, as required, on air quality will be included in the statutory EMPs that will accompany the environmental authority applications for the project.

Issue 203 (LNG S018)

EMP - The EMP does not provide a locality map showing monitoring sites. It is unclear if any of the assessment points refer to sensitive receptor locations. There is no outdoor noise criterion for day and evening in the plan for the construction phase of the project. No detail has been provided on the expected air overblast pressure and/or ground borne vibration. Revise the EMP with reference to the detailed information requirements set out in the submission.

Response

A locality map showing noise monitoring locations and sensitive receptor is included in the updated Strategic EMP presented as SREIS Attachment 3. Full details of monitoring locations and the updated predicted noise levels at those locations are presented and discussed in SREIS Chapter 11, Noise and Vibration and Appendix 4, Supplementary Noise and Vibration Impact Assessment.

During construction, all reasonable and practicable measures will be undertaken to minimise noise in the day time. During the night time, a project criteria of 40 dB(a) has been set. Works will be scheduled and managed to meet this criteria at night time.

The requirement for, and location of, blasting has not yet been determined. When the requirement for and location of blasting is determined, it is standard practice that the blast is designed to

ensure that all blasting activities meet the relevant overpressure level and ground-borne vibration peak particle velocity level when measured at or extrapolated to any sensitive receptor.

In the event that the design of any required blasting is not completed at the time of submission of a statutory EMP in support of environmental authority application, an indicative assessment of blasting on Curtis Island will be included. The assessment will be based on a 500 kg charge weight per delay at the closest point on Curtis Island to sensitive receptors. The predicted overpressure will be designed to meet a maximum level of 120 dB (linear peak) and the predicted ground-borne vibration will be designed to meet a peak particle velocity of 10 mm/s.

Issue 204 (LNG S018)

EMP - The EMP does not provide adequate detail on the expected quantity and type of waste to be generated on the petroleum facility license or petroleum pipeline license areas. Revise the EMP with reference to the detailed information requirements set out in the submission.

Response

A detailed assessment of the waste expected to be generated at the LNG plant was presented in EIS Appendix 29, Waste Impact Assessment and Chapter 31, Waste Management. The assessment was presented on the data available prior to completion of FEED and was based on experience of waste generated at similar LNG facilities operated by Shell. The types of waste generated, their volumes, streams, and storage and disposal methods are presented in Chapter 31, Table 31.1 of the EIS. An assessment of the waste facilities in Gladstone to handle the wastes is also presented in EIS Chapter 31.

The Strategic EMP has been updated to include detail on waste types, quantities and management strategies (SREIS Attachment 3, Section 4.22.2).

These details will be updated as a result of detailed engineering design. Full details of the waste likely to be generated (type, stream, volume) and the proposed storage and disposal methods will be incorporated in the statutory EMPs to be submitted in support environmental authority applications.

Issue 205 (LNG S018)

EMP - No information is provided in the EMP regarding the quality or quantity of wastewater to be disposed to land or reused on site, or the characteristics of the receiving site and proposed reuses. Revise the EMP with reference to the detailed information requirements set out in the submission.

Response

The details on wastewater are described in the EIS in Chapter 6, Project Description: LNG Plant, Section 6.2.3. Detailed quantities are provided in Figure 6.9 and further discussed in the Waste Management Impact Assessment (Appendix 29 of the EIS) and summarised in Chapter 31, Waste Management.

Arrow Energy's preferred option for wastewater and effluent disposal has changed since the EIS was finalised. GRC has now installed two sewer mains under Port Curtis to service the LNG plants on Curtis Island. As a consequence, FEED considered disposal of effluent and wastewater via the sewer mains in lieu of an effluent treatment facility (SREIS Chapter 4, Project Description: LNG Plant, Section 4.10).

While disposal of wastewater via the GRC sewer mains is preferred, Arrow Energy will retain the option to develop an effluent treatment plant in the event the sewer mains are unavailable.

The Strategic EMP (SREIS Attachment 3, Section 4.22.2) includes an update on disposal strategies. Further details will be provided in statutory EMPs that will accompany the environmental authority applications for the project.