Gorgon Gas Development and Jansz Feed Gas Pipeline

Marine Facilities Construction Environmental Management Plan

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Terminology, Definitions and Abbreviations

Terms, definitions and abbreviations used in this document are listed below. These align with the terms, definitions and abbreviations defined in Schedule 2 of the Western Australian Gorgon Gas Development Ministerial Implementation Statement No. 800 (Statement No. 800) and the Commonwealth Gorgon Gas Development Ministerial Approvals (EPBC Reference: 2003/1294 and 2008/4178).

3D	Three dimensions, or three-dimensional
ABU	Australasia Business Unit
Anthropogenic	Related to the influence of human beings or their ancestors on natural objects.
ANZECC	Australian and New Zealand Environment and Conservation Council
AQIS	Australian Quarantine and Inspection Service
ARI	Assessment on Referral Information (for the proposed Jansz Feed Gas Pipeline dated September 2007) as amended or supplemented from time to time.
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AS	Australian Standard
AS/NZS	Australian Standard/New Zealand Standard
ASBU	Australasia Strategic Business Unit
ASS	Acid Sulfate Soils
ASSD	Accumulated Sediment Surface Density
At risk	Being at risk of Material Environmental Harm or Serious Environmental Harm and/or, for the purposes of the EPBC Act relevant listed threatened species, threatened ecological communities and listed migratory species, at risk of Material Environmental Harm or Serious Environmental Harm.
Avifauna	Birds of a particular region
Ballast water	Any water and associated sediment used to trim and stabilise a vessel.
Bathymetric	Relating to measurements of the depths of oceans or lakes.
Benthic	Living upon or in the sea floor.
Benthic Habitats	Areas on the sea floor or seabed that support living organisms. Examples include, but are not limited to, limestone pavement, reefs, bare sand and deepwater soft sediments.
Berm	A narrow ledge or shelf typically at the top or bottom of a slope.
BHD	Backhoe dredge

Bioclast	Skeletal fragments of marine or land organisms that are found in sedimentary rocks laid down in a marine environment.
Biosecurity	The protection of plants and animals against harm from disease or from human exploitation.
Biota	All the plant and animal life of a particular region.
Bombora	A shallow isolated piece of reef located a distance offshore.
BP	Before (the) Present
BPP	Benthic Primary Producer; photosynthesising organisms (mangroves, seagrasses, algae) or organisms that harbour photosynthetic symbionts (corals, giant clams).
BPPH	Benthic Primary Producer Habitat; benthic habitats that support primary producers.
BRUV	Baited Remote Underwater Video system
BTEX	Benzene, toluene, ethylbenzene and xylene aromatic hydrocarbon compounds present in petroleum; may be primary pollutants of soils and groundwater associated with petroleum products.
Bund	An area of containment, such as a dam, wall, or other artificial embankment.
BWI	Barrow Island
Caisson	A large watertight chamber used for construction under water.
Calcrete	A hardened deposit of calcium carbonate.
CALM	Former Western Australian Department of Conservation and Land Management (now DEC)
CALM Act	Western Australian *Conservation and Land Management Act 1984*
CAMBA	China–Australia Migratory Bird Agreement
Carbon Dioxide (CO_2) Injection System	The mechanical components required to be constructed to enable the injection of reservoir carbon dioxide, including but not limited to compressors, pipelines and wells.
CD	Chart Datum; the level of water that charted depths displayed on nautical charts are measured from. The chart datum is generally a tidal datum; that is, a datum derived from some phase of the tide. Common chart datums are Lowest Astronomical Tide and mean lower low water.
CDEEP	Construction Dredging Environmental Expert Panel
Cetacean	Various aquatic (mainly marine) mammals of the order Cetacea, (including whales, dolphins and porpoises) characterised by a nearly hairless body, front limbs modified into broad flippers and a flat notched tail.

CMBSEIR	Coastal and Marine Baseline State and Environmental Impact Report
CO_2	Carbon Dioxide
Construction	Construction includes any Proposal-related (or action-related) construction and commissioning activities within the Terrestrial and Marine Disturbance Footprints, excluding investigatory works such as, but not limited to, geotechnical, geophysical, biological and cultural heritage surveys, baseline monitoring surveys and technology trials.
CSD	Cutter Suction Dredge
Cth	Commonwealth of Australia
Cyclogenesis	The process that leads to the formation of tropical storms, cyclones and hurricanes.
dB	Decibel; a unit to measure sound
dB re 1µPa	Decibels relative to one micro pascal; the unit used to measure the intensity of an underwater sound
DEC	Western Australian Department of Environment and Conservation
Demersal	Living on the sea floor or just above it.
DEWHA	Former Commonwealth Department of the Environment, Water, Heritage and the Arts (now SEWPaC)
Diurnal	Daily
DoF	Western Australian Department of Fisheries
Dolphin (structure)	A fixed man-made marine structure that extends above the water level and is not connected to shore. Typical uses include extending a berth (a berthing dolphin) or providing a point to moor to (a mooring dolphin). Dolphins are also used to display regulatory information like speed limits, navigation information, lighted aids to navigation, etc.
DomGas	Domestic Gas
DoT	Western Australian Department of Transport
DSDA	Dredge and Spoil Disposal Area
DSDMMP	Dredge and Spoil Disposal Management and Monitoring Plan
DWT	Dead Weight Tonnage; maximum weight of a vessel including the vessel, cargo and ballast.
E&Q	Environment and Quarantine
Ecological Community	Refers to all the interacting organisms living together in a specific habitat.
Ecological Element	Element listed in Condition 14.2 of Statement No. 800 and Condition 11.2

	of EPBC Act Reference: 2003/1294 and 2008/4178.
EIS/ERMP	Environmental Impact Statement/Environmental Review and Management Programme (for the Proposed Gorgon Gas Development dated September 2005) as amended or supplemented from time to time.
EMP	Environmental Management Plan
Endemic	Unique to an area; found nowhere else.
EP Act	Western Australian *Environmental Protection Act 1986*
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPBC Reference: 2003/1294	Commonwealth Ministerial Approval (for the Gorgon Gas Development) as amended or replaced from time to time.
EPBC Reference: 2005/2184	Commonwealth Ministerial Approval (for the Jansz Feed Gas Pipeline) as amended or replaced from time to time.
EPBC Reference: 2008/4178	Commonwealth Ministerial Approval (for the Revised Gorgon Gas Development) as amended or replaced from time to time.
EPCM	Engineering, Procurement and Construction Management
ERA	Environmental Risk Assessment
Exceedance	Any monitored reading that goes over a standard.
Fines	Fine particles
GEMS	Global Environmental Modelling Systems
Geomorphology	The study of landforms, their classification, origin, development, and history.
Geostrophic Current	A geostrophic current results from the balance between gravitational forces and the Coriolis effect. The gravitational effect is controlled by the tilt of the sea surface and water density is controlled by horizontal changes in temperature and salinity.
Geotextile	Permeable fabric used as a soil reinforcement agent and as a filter medium; typically made from polypropylene or polyester.
Gorgon Gas Development	The Gorgon Gas Development as approved under Statement No. 800 and EPBC Reference: 2003/1294 and 2008/4178 as amended or replaced from time to time.
GPS	Global Positioning System
Greenhouse Gases (GHG)	Components of the atmosphere that contribute to the greenhouse effect. These include the six commonly reported GHGs under the Kyoto Protocol – methane (CH_4), carbon dioxide (CO_2), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur

	hexafluoride (SF_6).
Ground Truth	To verify the correctness of remote sensing information by use of ancillary information such as field studies.
ha	Hectare
HCFCs	Hydrochlorofluorocarbons
HES	Health, Environment and Safety
Hydrocarbons	A large class of organic compounds composed of hydrogen and carbon. Crude oil, natural gas, and natural gas condensate are all mixtures of various hydrocarbons.
IMS	Impact Mitigation Strategy
Introduced Species	A non-indigenous species in the Barrow Island terrestrial or marine environment.
IOPP	International Oil Pollution Prevention
ISO	International Organization for Standardization
ISQG	Interim Sediment Quality Guideline
Jack-up Barge	Jack-up barges can be jacked up above the sea using legs that can be lowered, much like jacks. They are designed to move from place to place, and then anchor themselves by deploying the legs to the ocean floor using a rack and pinion gear system on each leg.
JAMBA	Japan–Australia Migratory Bird Agreement
Jansz Feed Gas Pipeline	The Jansz Feed Gas Pipeline as approved in Statement No. 769 and EPBC Reference: 2005/2184 as amended or replaced from time to time.
Key Receptor Species	Relevant to observation by MFOs associated with marine blasting and impact piling, Key Receptor Species include whales, dolphins, dugong and marine turtles
KJVG	Kellogg Joint Venture Gorgon
km	Kilometre
L	Litre
LADS	Laser Airborne Depth Sounding (used for bathymetry mapping)
LAT	Lowest Astronomical Tide
LCT	Landing Craft Tank
Light Spill	Excessive brightening of the environment from both direct light and light glow.
LNG	Liquefied Natural Gas

LOW	Southern Lowendal Shelf (monitoring site)
LTMTMP	Long-term Marine Turtle Management Plan
m	Metre
m/s	Metres per second
m^3	Cubic metre
Macroalgae	Algae which can be seen easily, without using a microscope; includes large seaweeds.
Macroinvertebrates	Animals without backbones that are large enough to see with the naked eye. Examples include most aquatic insects, snails, clams, crayfish, sea cucumbers.
Management Triggers	Are quantitative, or where this is demonstrated to be not practicable, qualitative matters above or below whichever relevant additional management measures must be considered.
Marine Disturbance Footprint	The area of the seabed to be disturbed by construction or operations activities associated with the Marine Facilities listed in Condition 14.3 of Statement No. 800 and Condition 11.3 in EPBC Reference: 2003/1294 and 2008/4178 (excepting that area of the seabed to be disturbed by the generation of turbidity and sedimentation from dredging and dredge spoil disposal) as set out in the Coastal and Marine Baseline State Report required under Condition 14.2 of Statement No. 800, and Condition 11.2 of EPBC Reference: 2003/1294 and 2008/4178
Marine Facilities	In relation to Condition 17.2 Statement No. 800 and EPBC Reference: 2003/1294 and 2008/4178, the Marine Facilities relevant to this condition are: • Materials Offloading Facility (MOF); • LNG Jetty; and • Marine component of the Barge (WAPET) Landing upgrade.
Marine Turtles	Refers to Flatback, Green and Hawksbill Turtles nesting on Barrow Island.
MARPOL 73/78	The International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978.
Material Environmental Harm	Environmental Harm that is neither trivial nor negligible.
MDF	Marine Disturbance Footprint
Megafauna	Large vertebrate animals
Metocean	Meteorological and oceanographic conditions.
MFCEMP	Marine Facilities Construction Environmental Management Plan

MFO	Marine Fauna Observer
mg/L	Milligrams per litre
Migratory Species	Species listed as migratory under section 209 of the EPBC Act (Cth).
mm	Millimetre
MOF	Materials Offloading Facility
MOPP	Marine Oil Pollution Plan
MPa	Megapascal
MSDS	Material Safety Data Sheet. A widely used system for cataloguing information on substances, such as chemicals, chemical compounds, and chemical mixtures. MSDS information may include instructions for the safe use and potential hazards associated with a particular material or product.
MTEP	Marine Turtle Expert Panel (established under Condition 15 of Statement No. 800).
MTPA	Million Tonnes Per Annum
N/A	Not Applicable
Neap Tide	A less than average tide occurring at the first and third quarters of the moon.
NES	National Environmental Significance
NIS	Non-indigenous Species
nm	Nautical Mile
Non-indigenous Species (NIS)	Any species of plant, animal or micro-organism not native to Barrow Island.
NO_x	Nitrogen Oxides (NO and NO_2)
NRC	National Research Council (United States)
ODS	Ozone Depleting Substances
OE	Operational Excellence
OEMS	Operational Excellence Management System
Operations	In relation to Statement No. 800 and EPBC Reference: 2003/1294 and 2008/4178, for the respective LNG trains, this is the period from the date on which the Gorgon Joint Venturers issue a notice of acceptance of work under the Engineering, Procurement and Construction Management (EPCM) contract, or equivalent contract entered into in respect of that LNG train of the Gas Treatment Plant; until the date on which the Gorgon Joint Venturers commence decommissioning of that LNG train.

PASS	Potential Acid Sulfate-forming Soils
PCB	Polychlorinated Biphenyls
PER	Public Environmental Review for the Gorgon Gas Development Revised and Expanded Proposal dated September 2008, as amended or supplemented from time to time.
Performance Standards	Are matters which are developed for assessing performance, not compliance, and are quantitative targets or where that is demonstrated to be not practicable, qualitative targets, against which progress towards achievement of the objectives of conditions can be measured.
PGPA	Policy, Government and Public Affairs
pH	Measure of acidity or basicity of a solution
PIO	Pilbara Offshore (Marine Bioregion)
Porites	An important genus of long-lived, reef building corals.
ppm	Parts per million
Practicable	Practicable means reasonably practicable having regard to, among other things, local conditions and circumstances (including costs) and to the current state of technical knowledge. For the purposes of the conditions of EPBC Reference: 2003/1294 and 2008/4178 which include the term "practicable", when considering whether the draft plan meets the requirements of these conditions, the Commonwealth Minister will determine what is 'practicable' having regard to local conditions and circumstances including but not limited to personnel safety, weather or geographical conditions, costs, environmental benefit and the current state of scientific and technical knowledge.
PSD	Particle Size Distribution
PSI	Preliminary Site Investigation
QMP	Quarantine Management Plan
QMS	Quarantine Management System
Quadrat	A rectangle or square measuring area used to sample living things in a given site; can vary in size.
Revetment	Sloping structure placed on banks or cliffs in such a way as to absorb the energy of incoming water.
Risk Assessment	The development of quantitative estimates of risk based upon engineering evaluation and mathematical techniques that combine estimates of accident consequences and frequencies.
RMS	Root Mean Square
RO	Reverse Osmosis

ROKAMBA	Republic of Korea–Australia Migratory Bird Agreement
RORO	Roll-On Roll-Off (in relation to a vessel)
SCP	Spill Contingency Plan
Sea Pens	Sea pens are colonial marine cnidarians belonging to the order Pennatulacea. There are 14 families within the order; they are thought to have a cosmopolitan distribution in tropical and temperate waters worldwide. Sea pens are grouped with the octocorals ('soft corals'), together with sea whips and sea feathers.
Seagrass	Unrelated to seaweed, seagrasses are the flowering plants of the ocean, having roots, stems, leaves and inconspicuous flowers with fruits and seeds much like the flowering plants of the land.
SEL	Sound Exposure Level
Serious Environmental Harm	Environmental harm that is: a) irreversible, of a high impact or on a wide scale; or b) significant or in an area of high conservation value or special significance and is neither trivial nor negligible.
Sessile	Attached by the base and not free to move above (i.e. non mobile) without a stalk or stem.
SEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (formerly DEWHA)
Significant Impact	An impact on a Matter of National Environmental Significance, relevant to EPBC Reference: 2003/1294 and 2008/4178 that is important, notable or of consequence having regard to its context or intensity.
SO_2	Sulfur Dioxide
SOPEP	Shipboard Oil Pollution Emergency Plan
sp. (plural: spp.)	Species
Spoil Disposal Ground	The area where dredge and excavation material is to be disposed of at sea.
Spring Tide	The highest tides in a lunar month, occurring near new and full moons.
SSC	Suspended Sediment Concentration
Statement No. 748	Western Australian Ministerial Implementation Statement No. 748 (for the Gorgon Gas Development) as amended from time to time [superseded by Statement No. 800].
Statement No. 769	Western Australian Ministerial Implementation Statement No. 769 (for the Jansz Feed Gas Pipeline) as amended from time to time.
Statement No. 800	Western Australian Ministerial Implementation Statement No. 800 (for the Gorgon Gas Development) as amended from time to time.

STEL	Short-term Exposure Limit
Stressor	An environmental condition or influence that stresses (i.e. causes stress for) an organism.
Subgrade	The top surface of completed earthwork on which sub-base, base, surfacing, pavement, or a course of other material is to be placed.
Substrate	The surface that a plant or animal lives upon. The substrate can include biotic or abiotic materials. For example, encrusting algae that live on a rock can be substrate for another animal that lives above the algae on the rock.
Supernatant	Of a liquid; floating on the surface above a sediment or precipitate.
Surficial	Of or pertaining to the surface.
t	Tonne
TAPL	Texaco Australia Pty Ltd
Taxon (plural: taxa)	A taxon (plural taxa), or taxonomic unit, is a name designating an organism or a group of organisms.
TBT	Tributyltin
TC	Tropical Cyclone
Threatened Ecological Communities	Ecological communities listed as critically endangered, endangered or vulnerable under section 181 of the EPBC Act (Cth).
Threatened Species	Species listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable or conservation dependent under section 178 of the EPBC Act (Cth).
Transect	The path along which a researcher moves, counts and records observations.
TSHD	Trailer Suction Hopper Dredge
Turbidity	The cloudiness or haziness of a fluid caused by individual particles (suspended solids) that are generally invisible to the naked eye, similar to smoke in air. The measurement of turbidity is a key test of water quality.
TWA	Time Weighted Average
Vessel	Craft of any type operating in the marine environment including hydrofoil boats, air-cushion vehicles, submersibles, floating craft and fixed or floating platforms. Also includes seaplanes when present on and in the water.
WA	Western Australia
WAPET	West Australian Petroleum Pty Ltd
WAPET Landing	Proper name referring to the site of the barge landing existing on the east

	coast of Barrow Island prior to the date of Statement No. 800.
Waters Surrounding Barrow Island	Refers to the waters of the Barrow Island Marine Park and Barrow Island Marine Management Area (approximately 4169 ha and 114 693 ha respectively) as well as the port of Barrow Island representing the Pilbara Offshore Marine Bioregion which is dominated by tropical species that are biologically connected to more northern areas by the Leeuwin Current and the Indonesian Throughflow, resulting in a diverse marine biota is typical of the Indo–West Pacific flora and fauna.
Weir box	A device to measure and/or control surface water flows.
Zone of High Impact	An area where long-term impacts to corals are predicted to result directly from disturbance during horizontal directional drilling, dredging or construction of infrastructure on the seabed and burial during dredge spoil disposal, or indirectly from smothering due to elevated sedimentation and/or from deterioration in water quality. As set out in Schedule 1 of Statement No. 800 and Schedule 5 of EPBC Reference: 2003/1294 and 2008/4178.
Zone of Influence	This area is predicted to be indirectly influenced by dredging and spoil disposal activities (e.g. marginal increases in turbidity and sedimentation), but at levels that will have no measurable impact on corals. As set out in Schedule 1 of Statement No. 800 and Schedule 5 of EPBC Reference: 2003/1294 and 2008/4178.
Zone of Moderate Impact	An area where short-term moderate impacts (e.g. some partial mortality of corals) is predicted to result indirectly from horizontal directional drilling, dredging, dredge spoil disposal, due to deterioration in water quality and/or an increase in sedimentation rates. Moderate impacts are likely to include some partial mortalities among fast growing, more sensitive coral species (e.g. *Acropora* sp.) but less, if any, mortality of longer living, generally more resilient species (e.g. *Porites* sp., *Turbinaria* sp.). As set out in Schedule 1 of Statement No. 800 and Schedule 5 of EPBC Reference: 2003/1294 and 2008/4178.
µg	Microgram
µg/L	Micrograms per litre

Executive Summary

This Marine Facilities Construction Environment Management Plan (MFCEMP, this Plan) has been prepared to satisfy Condition 17 Statement No. 800 and Condition 13 of EPBC Reference: 2003/1294 and 2008/4178. The objectives of this MFCEMP, as prescribed in Condition 17.4 of Statement No. 800 and Condition 13.4 of EPBC Reference: 2003/1294 and 2008/4178, are:

i To reduce the impacts from the construction of the marine facilities listed in Condition 17.2 (13.2) (excepting from the generation of turbidity and sedimentation from dredging and spoil disposal) as far as practicable; and

ii. To ensure that construction of the marine facilities listed in Condition 17.2 (13.2) does not cause Material or Serious Environmental Harm outside the Marine Disturbance Footprint associated with those facilities (except from the generation of turbidity and sedimentation from dredging and spoil disposal).

This Plan primarily focuses on the management of activities associated with construction of the Marine Facilities as defined in Statement No. 800 and EPBC Reference: 2003/1294 and 2008/4178, which are the Materials Offloading Facility (MOF), the Liquefied Natural Gas (LNG) Jetty, and the marine component of the Barge (WAPET) Landing upgrade.

The scope of this Plan also includes:

- installation of a reverse osmosis (RO) brine intake structure, intake and outfall pipelines and outfall diffusers; these are referred to as the 'RO Structures'
- installation of vessel moorings.

This Plan does not address environmental management associated with operation of the Marine Facilities or potential environmental impacts emanating from dredging and spoil disposal activities, which are addressed in a separate Dredging and Spoil Disposal Management and Monitoring Plan (DSDMMP) (Chevron Australia 2009a).

The existing marine environment of Barrow Island has been well documented through the implementation of environmental baseline surveys undertaken as part of the Environmental Impact Statement/Environmental Review and Management Program (EIS/ERMP) studies (Chevron Australia 2005, 2006) and more recently through preparation of a Coastal and Marine Baseline State and Environmental Impact Report (CMBSEIR) as required by Condition 14 Statement No. 800 and Condition 11 of EPBC Reference: 2003/1294 and 2008/4178 (Chevron Australia 2009b).

In developing this Plan, Chevron Australia conducted a series of Environmental Risk Assessment (ERA) workshops to prioritise the most significant potential risks and impacts to the receiving environment that require the development of specific and targeted safeguard and mitigation measures. Through the risk assessment process, it was identified that there are no 'high risks' associated with construction activities.

The following activities were identified as having 'medium' risk. A series of management and monitoring measures have been developed to minimise potential impacts associated with these activities. These key risks and their associated management measures are also listed below.

- *Artificial light spill from construction vessels impacting marine fauna:* Potential impacts will be mitigated through the implementation of an artificial lighting management procedure by the Construction Contractor. Lighting management measures are presented in the Long-term Marine Turtle Management Plan (LTMTMP) (Chevron Australia 2012).
- *Noise and vibration from construction activities (impact piling and marine blasting) impacting marine fauna:* Potential impacts will be mitigated by the implementation of marine blasting and impact piling management measures. An exclusion zone for Key Receptor Species (whales, dolphins, dugongs and marine turtles) will be established for both marine blasting and impact piling and will remain in place for the duration of these activities. Marine Fauna

Observers (MFOs) will be present on board the piling vessel and a support vessel will be deployed for the blast program (if blasting is required).

- *Turbidity generation associated with reclamation activities impacting marine water and sediment quality:* A filter layer (geotextile/graded material) will be used in the construction of the MOF to minimise potential turbidity impacts from reclamation activities. The bunds will be primarily filled at or near high tides, allowing time for fines to settle. A weir box will be temporarily placed on the face of the MOF revetment and will discharge decant water via a return pipeline to the seabed to minimise turbidity effects.
- *Physical presence of construction vessels resulting in boat strike and impact to marine fauna:* Specified vessels will be required to maintain a MFO on watch during marine operations and vessel movements. Vessel speed limits will be managed.
- *Hydrocarbon spills resulting from vessel refuelling and impact to water and sediment quality:* Potential impacts from spills during refuelling will be minimised through development and implementation of detailed refuelling procedures by the Construction Contractor.
- *Discharge of ballast water resulting in introduction of marine species (biosecurity risk):* The Construction Contractor will be required to produce a Quarantine Management Plan and comply with Chevron Australia's Quarantine Management System.
- *Emissions from diesel generators and construction vessels causing localised reduction in air quality:* All vessels shall be compliant with MARPOL 73/78.

This Plan outlines how Chevron Australia will manage and monitor potential environmental impacts from construction of the Marine Facilities, thereby providing Chevron Australia and external parties with assurances that management strategies will be effectively implemented. Chevron Australia will clearly communicate the requirements of this Plan to the Engineering, Procurement and Construction Management (EPCM) Contractor and Construction Contractor as part of Chevron's duty of care and environmental stewardship responsibility to minimise environmental impacts from construction activities.

1.0 Introduction

1.1 Proponent

Chevron Australia Pty Ltd (Chevron Australia) is the proponent and the person taking the action for the Gorgon Gas Development on behalf of the following companies (collectively known as the Gorgon Joint Venturers):

- Chevron Australia Pty Ltd
- Chevron (TAPL) Pty Ltd
- Shell Development (Australia) Proprietary Limited
- Mobil Australia Resources Company Pty Limited
- Osaka Gas Gorgon Pty Ltd
- Tokyo Gas Gorgon Pty Ltd
- Chubu Electric Power Australia Pty Ltd

pursuant to Statement No. 800 and EPBC Reference: 2003/1294 and 2008/4178.

Chevron Australia is also the proponent and the person taking the action for the Jansz Feed Gas Pipeline on behalf of the Gorgon Joint Venturers, pursuant to Statement No. 769 and EPBC Reference: 2005/2184.

1.2 Project

Chevron Australia proposes to develop the gas reserves of the Greater Gorgon Area (Figure 1-1).

Subsea gathering systems and subsea pipelines will be installed to deliver feed gas from the Gorgon and Jansz–Io gas fields to the west coast of Barrow Island. The feed gas pipeline system will be buried as it traverses from the west coast to the east coast of the Island where the system will tie in to the Gas Treatment Plant located at Town Point. The Gas Treatment Plant will comprise three Liquefied Natural Gas (LNG) trains capable of producing a nominal capacity of five Million Tonnes Per Annum (MTPA) per train. The Gas Treatment Plant will also produce condensate and domestic gas. Carbon dioxide (CO_2), which occurs naturally in the feed gas, will be separated during the production process. As part of the Gorgon Gas Development, Chevron Australia will inject the separated CO_2 into deep formations below Barrow Island. The LNG and condensate will be loaded from a dedicated jetty offshore from Town Point and then transported by dedicated carriers to international markets. Gas for domestic use will be exported by a pipeline from Town Point to the domestic gas collection and distribution network on the mainland (Figure 1-2).

1.3 Location

The Gorgon gas field is located approximately 130 km and the Jansz–Io field approximately 200 km off the north-west coast of Western Australia. Barrow Island is located off the Pilbara coast 85 km north-north-east of the town of Onslow and 140 km west of Karratha. The Island is approximately 25 km long and 10 km wide and covers 23 567 ha. It is the largest of a group of islands, including the Montebello and Lowendal Islands.

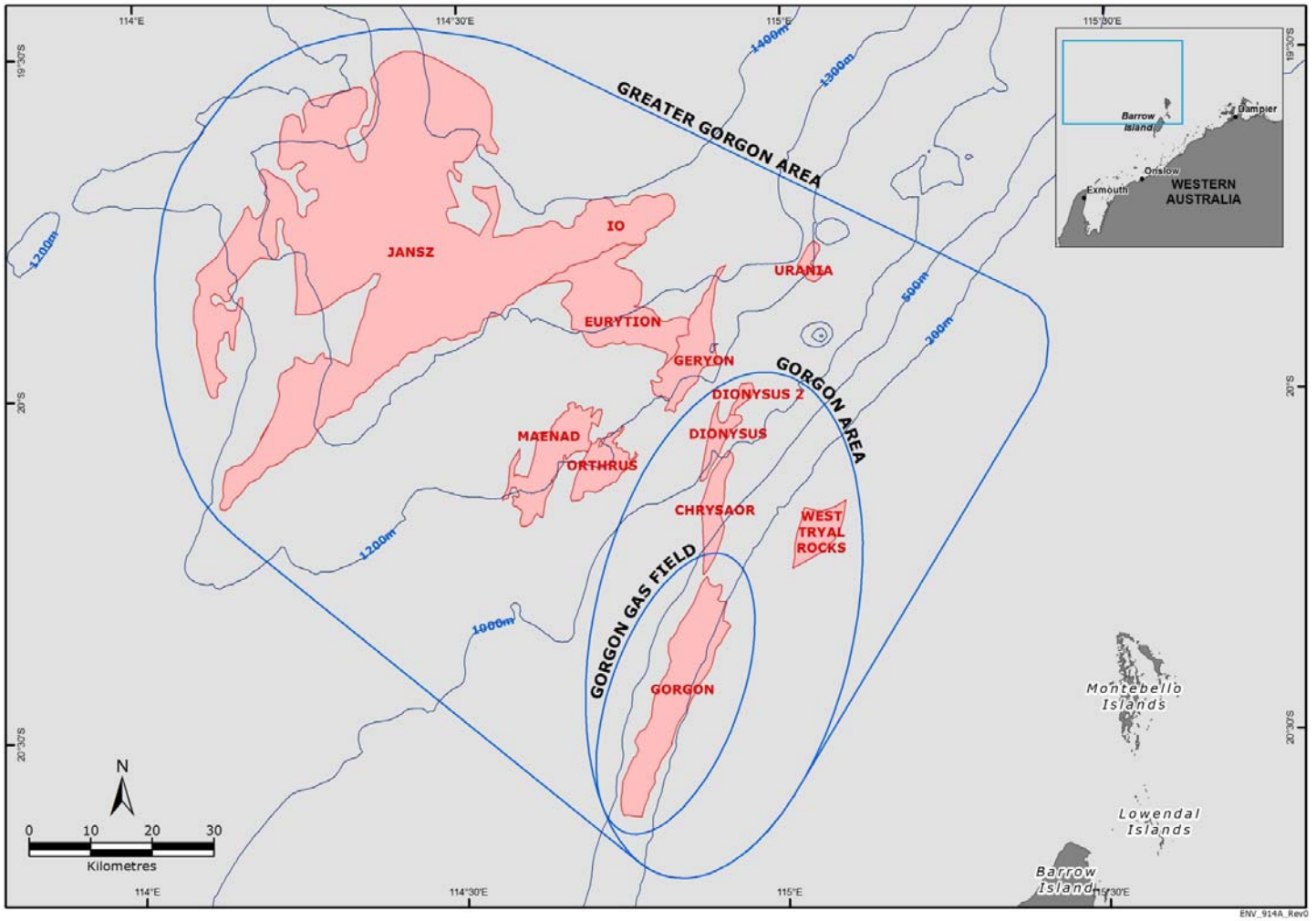


Figure 1-1 Location of the Greater Gorgon Area

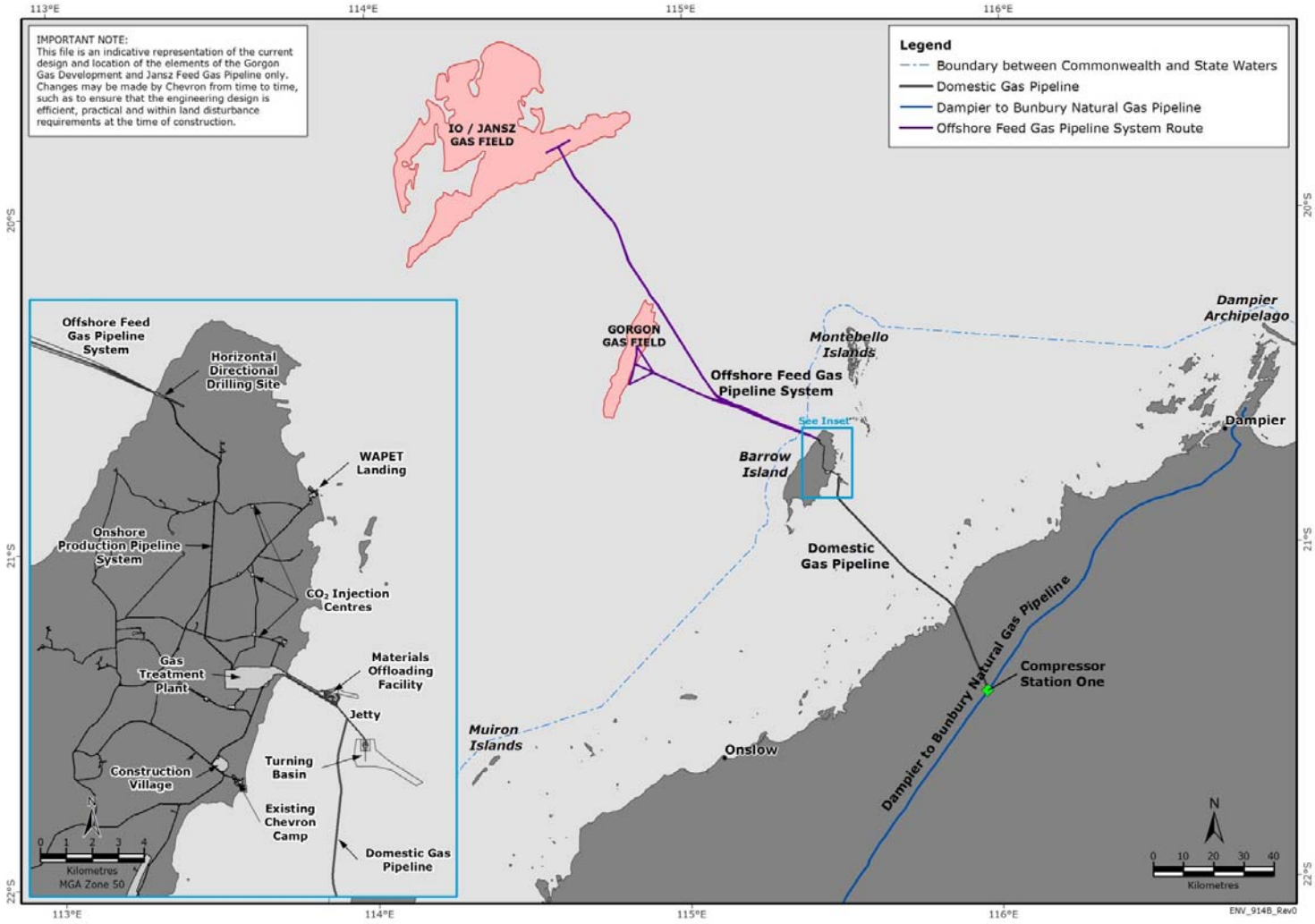


Figure 1-2 Location of the Gorgon Gas Development and Jansz Feed Gas Pipeline

1.4 Environmental Approvals

The initial Gorgon Gas Development was assessed through an Environmental Impact Statement/Environmental Review and Management Programme (EIS/ERMP) assessment process (Chevron Australia 2005, 2006).

The initial Gorgon Gas Development was approved by the Western Australian State Minister for the Environment on 6 September 2007 by way of Ministerial Implementation Statement No. 748 (Statement No. 748) and the Commonwealth Minister for the Environment and Water Resources on 3 October 2007 (EPBC Reference: 2003/1294).

In May 2008, under section 45C of the Western Australian *Environmental Protection Act 1986* (EP Act), the Environmental Protection Authority (EPA) approved some minor changes to the Gorgon Gas Development that it considered 'not to result in a significant, detrimental, environmental effect in addition to, or different from, the effect of the original proposal' (EPA 2008). The approved changes are:

- excavation of a berthing pocket at the Barge (WAPET) Landing facility
- installation of additional communications facilities (microwave communications towers)
- relocation of the seawater intake
- modification to the seismic monitoring program.

In September 2008, Chevron Australia sought both State and Commonwealth approval through a Public Environment Review (PER) assessment process (Chevron Australia 2008) for the Revised and Expanded Gorgon Gas Development to make some changes to 'Key Proposal Characteristics' of the initial Gorgon Gas Development, as outlined below:

- addition of a five MTPA LNG train, increasing the number of LNG trains from two to three
- expansion of the CO_2 Injection System, increasing the number of injection wells and surface drill locations
- extension of the causeway and the Materials Offloading Facility (MOF) into deeper water.

The Revised and Expanded Gorgon Gas Development was approved by the Western Australian State Minister for the Environment on 10 August 2009 by way of Ministerial Implementation Statement No. 800 (Statement No. 800). Statement No. 800 also superseded Statement No. 748 as the approval for the initial Gorgon Gas Development. Statement No. 800 therefore provides approval for both the initial Gorgon Gas Development and the Revised and Expanded Gorgon Gas Development, which together are known as the Gorgon Gas Development.

On 26 August 2009, the Commonwealth Minister for the Environment, Heritage and the Arts issued approval for the Revised and Expanded Gorgon Gas Development (EPBC Reference: 2008/4178), and varied the conditions for the initial Gorgon Gas Development (EPBC Reference: 2003/1294).

Since the Revised and Expanded Gorgon Gas Development was approved, further minor changes have also been made and/or approved to the Gorgon Gas Development and are now also part of the Development. Further changes may also be made/approved in the future. This Plan relates to any such changes, and where necessary will be specifically revised to address the impacts of those changes.

The Jansz Feed Gas Pipeline was assessed via Environmental Impact Statement/Assessment on Referral Information (ARI) and EPBC Referral assessment processes (Mobil Australia 2005, 2006).

The Jansz Feed Gas Pipeline was approved by the Western Australian State Minister for the Environment on 28 May 2008 by way of Ministerial Implementation Statement No. 769 (Statement No. 769) and the Commonwealth Minister for the Environment and Water Resources on 22 March 2006 (EPBC Reference: 2005/2184).

This Plan covers the Gorgon Gas Development as approved under Statement No. 800 and as approved by EPBC Reference: 2003/1294 and EPBC Reference: 2008/4178.

In respect of the Carbon Dioxide Seismic Baseline Survey Works Program, which comprises the only works approved under Statement No. 748 before it was superseded, and under EPBC Reference: 2003/1294 before the Minister approved a variation to it on 26 August 2009, note that under Condition 1A.1 of Ministerial Statement No. 800 and Condition 1.4 of EPBC Reference: 2003/1294 and 2008/4178 this Program is authorised to continue for six months subject to the existing approved plans, reports, programs and systems for the Program, and the works under the Program are not the subject of this Plan.

1.5 Scope

This Marine Facilities Construction Environment Management Plan (MFCEMP; 'this Plan') is required to satisfy Condition 17 of Statement No. 800, and Condition 13 of EPBC Reference: 2003/1294 and 2008/4178. This Plan forms part of an integrated set of Environmental Management Plans (EMPs) developed for all components of the Gorgon Gas Development (refer to Figure 1-3). This Plan primarily focuses on the management of activities associated with construction of the east coast Marine Facilities as defined in Statement No. 800 and EPBC Reference: 2003/1294 and 2008/4178, which are the Materials Offloading Facility (MOF), the LNG Jetty, and the marine component of the Barge (WAPET) Landing upgrade (WAPET Landing).

For the construction of the MOF and LNG Jetty, this Plan addresses marine construction activities up to the mean high water mark at Town Point. For WAPET Landing, the scope of this Plan includes those elements included within Section 2.0. Beyond this, the impacts associated with terrestrial-based construction activities will be managed and monitored as detailed in the Environmental Protection Plan as specified in Condition 7 Statement No. 800 and Condition 6 of EPBC Reference: 2003/1294 and 2008/4178.

In addition, this Plan covers the following activities for completeness:

- installation of a reverse osmosis (RO) brine intake structure, intake and outfall pipelines and outfall diffusers; these are referred to as the 'RO Structures'
- installation of vessel moorings and anchors.

A base case construction methodology is discussed for the Marine Facilities in the following sections. This methodology represents the most likely design scenario and therefore represents the basis for environmental assessment and associated management and monitoring described within this Plan. As detailed engineering design advances, potential for deviation away from the base case scenario may occur; however, any deviation is not expected to significantly alter the outputs of the environmental risk assessment (Section 4.0) or the proposed environmental management and monitoring measures described in Section 6.0. Any significant refinement to engineering design will be assessed and where necessary, this Plan will be updated.

This Plan does not address environmental management associated with operation of the Marine Facilities or potential environmental impacts emanating from dredging and spoil disposal activities, which are addressed in a separate Dredging and Spoil Disposal Management and Monitoring Plan (DSDMMP) (Condition 20 of Statement No. 800, and Condition 14 of EPBC Reference: 2003/1294 and 2008/4178) (Chevron Australia 2009a). However, reference is made in this Plan to interfaces between dredge and spoil disposal activities and wider Marine Facilities construction activities for ease of interpretation and where there is overlap between construction activities assessed within each Plan (e.g. the use of dredge spoil as reclaimed material in the construction of the MOF).

1.6 Purpose of this Plan

1.6.1 Legislative Requirements

1.6.1.1 State Ministerial Conditions

This Plan is required under Condition 17.1 of Statement No. 800, which is quoted below:

> *Prior to the commencement of construction of the marine facilities listed in Condition 17.2, the Proponent shall prepare and submit to the Minister a Marine Facilities Construction Environmental Management Plan (the Plan) that meets the objectives set out in Condition 17.4 and requirements set out in Conditions 17.5 and 17.6, as determined by the Minister unless otherwise allowed in Condition 17.1A.*

1.6.1.2 Commonwealth Ministerial Conditions

This Plan also satisfies the requirements of Condition 13.1 of EPBC Reference: 2003/1294 and 2008/4178, which is quoted below:

> *Prior to the commencement of construction of the marine facilities listed in Condition 13.2, the person taking the action must prepare and submit to the Minister, for approval, a Marine Facilities Construction Environmental Management Plan that meets the objectives set out in Condition 13.4 and requirements set out in Conditions 13.5 and 13.6, as determined by the Minister unless otherwise allowed in Condition 13.1A.*

1.6.2 Objectives

The objectives of this Plan, as stated in Condition 17.4 of Statement No. 800 and Condition 13.4 of EPBC Reference: 2003/1294 and 2008/4178. are:

i To reduce the impacts from the construction of the marine facilities listed in Condition 17.2 [or Condition 13.2] (excepting from the generation of turbidity and sedimentation from dredging and spoil disposal) as far as practicable; and

ii. To ensure that construction of the marine facilities listed in Condition 17.2 [or Condition 13.2] does not cause Material or Serious Environmental Harm outside the Marine Disturbance Footprint associated with those facilities (except from the generation of turbidity and sedimentation from dredging and spoil disposal).

1.6.3 Requirements

The requirements of this Plan, as stated in Condition 17 of Statement No. 800 and Condition 13 of EPBC Reference: 2003/1294 and 2008/4178, are listed in Table 1-1.

Table 1-1 Requirements of this Plan

Ministerial Document	Condition No.	Requirement	Section Reference in this Plan
Statement No. 800	17	Marine Facilities Construction Environmental Management Plan	Entire document
Statement No. 800	17.1	Prior to the commencement of construction of the Marine Facilities listed in Condition 17.2, the Proponent shall prepare and submit to the Minister a Marine Facilities Construction Environmental Management Plan (the Plan) that meets the objectives set out in Condition 17.4 and requirements set out in Conditions 17.5 and 17.6, as determined by the Minister, unless otherwise allowed in Condition 17.1A.	Entire document

Ministerial Document	Condition No.	Requirement	Section Reference in this Plan
Statement No. 800	17.3	The Proponent shall consult with the DEC, DoF, DoT and DEWHA (now SEWPaC) in the preparation of the Plan.	Section 1.6.5
Statement No. 800	17.4	The objectives of the Plan are: i. To reduce the impacts from the construction of the Marine Facilities listed in Condition 17.2 (excepting from the generation of turbidity and sedimentation from dredging and spoil disposal) as far as practicable; and	Sections 4.3, 4.4, 6.0
		ii. To ensure that construction of the Marine Facilities listed in Condition 17.2 does not cause Material or Serious Environmental Harm outside the Marine Disturbance Footprint associated with those facilities (except from the generation of turbidity and sedimentation from dredging and spoil disposal).	Sections 4.3, 4.4, 6.0
Statement No. 800	17.5	The Plan shall include the following: i. Management measures to reduce the impacts from the construction of the Marine Facilities as far as practicable;	Section 6.0
		ii. Management measures to ensure that construction of the Marine Facilities does not cause Material or Serious Environmental Harm outside the Marine Disturbance Footprint;	Section 6.0
		iii. The measures required by Conditions 17.5.i. and 17.5.ii. shall address but not be limited to: a. Generation and dispersion of turbidity caused by construction activities other than dredging;	Section 6.4
		b. Monitoring and managing the quality of any decant water released from the MOF bunded area;	Section 6.4
		c. Preventing harm to or fatalities of marine turtles or cetaceans;	Section 6.2
		d. Noise and percussion and other potential impacts associated with drilling and/or piling;	Section 6.5
		e. Generation and dispersion of drilling fluids and drill cuttings;	Section 6.4
		f. Direct disturbance of habitat; and	Section 6.3
		g. The avoidance of blasting as far as practicable and management measures to be applied if blasting is required.	Section 6.5
		iv. Performance Standards against which achievement of the objectives of this condition can be determined.	Sections 6.0, 8.0
Statement No. 800	17.6	Turbidity and sediment deposition and coral loss caused by the construction of the Marine Facilities shall be subject to the requirements of Conditions 18 and 21	Sections 6.3 and 6.4*

Ministerial Document	Condition No.	Requirement	Section Reference in this Plan
EPBC Refs: 2003/1294 and 2008/4178	13.1	Prior to the commencement of construction of the Marine Facilities listed in Condition 13.2, the person taking the action must prepare and submit to the Minister, for approval, a Marine Facilities Construction Environmental Management Plan (the Plan) that meets the objectives set out in Condition 13.4 and requirements set out in Conditions 13.5 and 13.6, as determined by the Minister, unless otherwise allowed in Condition 13.1A.	Entire document
EPBC Refs: 2003/1294 and 2008/4178	13.1A	In the event that any portions of the Plan related to specific elements or sub-elements (Marine Facilities listed in Condition 13.2) of the action are not submitted as required by Condition 13.1, the person taking the action must submit the portion of the Plan relevant to that element or sub-element to the Minster prior to the commencement of construction of that element or sub-element. All portions of the Plan must meet the objectives identified in Condition 13.4 and the requirements of Condition 13.5 as determined by the Minister	Entire document
EPBC Refs: 2003/1294 and 2008/4178	13.3	The person taking the action must consult with the DEC, DoF, DoT and DEWHA (now SEWPaC) in the preparation of the Plan.	Section 1.2
EPBC Refs: 2003/1294 and 2008/4178	13.4	The objectives of the Plan are: i. To reduce the impacts from the construction of the Marine Facilities listed in Condition 13.2 (excepting from the generation of turbidity and sedimentation from dredging and spoil disposal) as far as practicable; and ii. To ensure that construction of the Marine Facilities listed in Condition 13.2 does not cause Material or Serious Environmental Harm outside the Marine Disturbance Footprint associated with those facilities (except from the generation of turbidity and sedimentation from dredging and spoil disposal).	 Section 6.0 Section 6.0
EPBC Refs: 2003/1294 and 2008/4178	13.5	The Plan must include the following: i. Management measures to reduce the impacts from the construction of the Marine Facilities listed in Condition 13.2 as far as practicable; ii. Management measures to ensure that construction of the Marine Facilities listed in Condition 13.2 does not cause Material or Serious Environmental Harm outside the Marine Disturbance Footprint; iii. The measures required by Conditions 13.5.i. and 13.5.ii. must address but not be limited to: a. Generation and dispersion of turbidity caused by construction activities other than dredging; b. Monitoring and managing the quality of any decant water released from the MOF bunded area; c. Preventing harm to or fatalities of marine turtles or cetaceans;	 Section 6.0 Section 6.0 Section 6.4 Section 6.4 Section 6.2

Ministerial Document	Condition No.	Requirement	Section Reference in this Plan
		d. Noise and percussion and other potential impacts associated with drilling and/or piling; e. Generation and dispersion of drilling fluids and drill cuttings; f. Direct disturbance of habitat; and g. The avoidance of blasting as far as practicable and management measures to be applied if blasting is required. iv. Performance Standards against which achievement of the objectives of this condition can be determined.	Section 6.5 Section 6.4 Section 6.3 Section 6.5 Sections 6.0, 8.0
EPBC Refs: 2003/1294 and 2008/4178	13.6	The person taking the action must implement the Plan	Section 7.0
EPBC Refs: 2003/1294 and 2008/4178	3.2.1	A description of the EPBC listed species and their habitat likely to be impacted by the components of the action which are the subject of that plan.	Appendix 4
EPBC Refs: 2003/1294 and 2008/4178	3.2.2	An assessment of the risk to these species from the components of the action the subject of that plan, relevant to that plan	Appendix 4
EPBC Refs: 2003/1294 and 2008/4178	3.2.3	Details of the management measures proposed in relation to these species if it is a requirement of the condition requiring that plan.	Section 6.0
EPBC Refs: 2003/1294 and 2008/4178	3.2.4	Details of monitoring proposed for that species if it is a requirement of the condition requiring that plan.	Section 6.2 and 6.5
EPBC Refs: 2003/1294 and 2008/4178	3.2.5	Performance standards in relation to that species if it is a requirement of the condition requiring that plan	Section 5.0
EPBC Refs: 2003/1294 and 2008/4178	3.2.7	Protocols for reporting impacts on the species to the Department.	Section 8.2

** Monitoring of water quality and sedimentation and potential impacts to coral health from the reclamation activities will be encompassed within the water quality and coral health monitoring programs as described within the DSDMMP (Chevron Australia 2009a).*

Any matter specified in this Plan is relevant to the Gorgon Gas Development only if that matter relates to the specific activities or facilities associated with that particular development.

The sections in this Plan that are noted in the above table to meet the conditions of EPBC Reference: 2003/1294 and 2008/4178 shall be read and interpreted as only requiring implementation under EPBC Reference: 2003/1294 and 2008/4178 for managing the impacts of the Gorgon Gas Development on, or protecting the EPBC Act matter listed in Appendix 4. The implementation of matters required only to meet the requirements of Ministerial Statement No. 800 are not the subject of the EPBC Reference: 2003/1294 and 2008/4178.

1.6.4 Hierarchy of Documentation

This Plan will be implemented for the Gorgon Gas Development via the Chevron Australasia Business Unit (ABU) Operational Excellence Management System (OEMS). The OEMS is the standardised approach that applies across the ABU in order to continuously improve the management of safety, health, environment, reliability and efficiency to achieve world-class performance. Implementation of the OEMS enables the Chevron ABU to integrate its Operational Excellence (OE) objectives, processes, procedures, values, and behaviours into the daily operations of Chevron Australia personnel and contractors working under Chevron Australia's supervision. The OEMS is designed to be consistent with and, in some respects, go beyond ISO 14001-2004 (Environmental Management Systems – Requirements with Guidance for Use) (Standards Australia/Standards New Zealand 2004).

Figure 1-3 provides an overview of the overall hierarchy of environmental management documentation within which this Plan exists. Further details on environmental documentation for the Gorgon Gas Development and Jansz Feed Gas Pipeline are provided in Section 7.1 of this Plan.

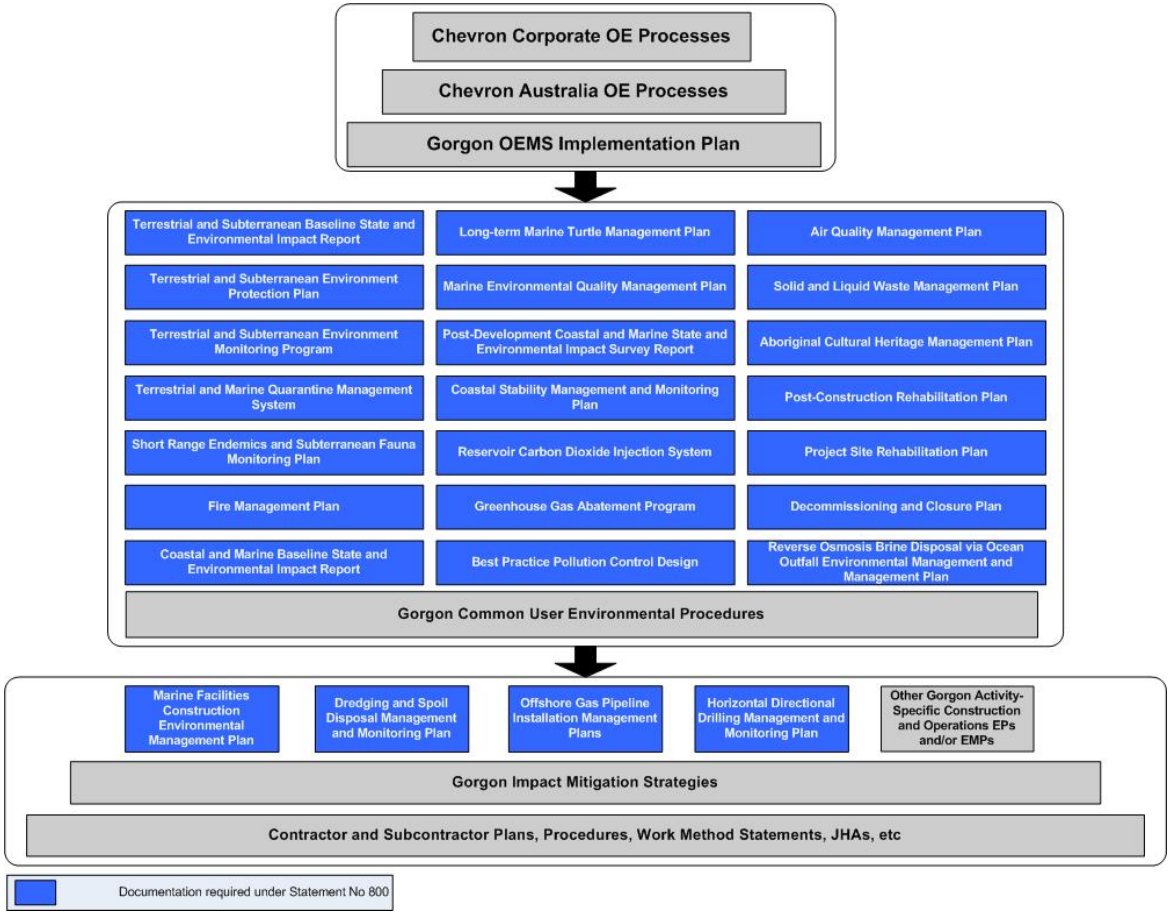


Figure 1-3 Hierarchy of Gorgon Gas Development Environmental Documentation

Note: The above figure refers to all Plans required for Ministerial Statement No 800. The Plans are only relevant to EPBC Reference: 2003/1294 and 2008/4178, if required for those Conditions of those approvals.

1.6.5 Stakeholder Consultation

Consultation with stakeholders has been undertaken by Chevron Australia on a regular basis throughout the development of environmental impact assessment management documentation for the Gorgon Gas Development and Jansz Feed Gas Pipeline. This has included engagement with the community, government departments, industry operators and contractors to Chevron Australia via planning workshops, risk assessments, meetings, teleconferences, and the PER and EIS/ERMP formal approval processes

Under Condition 17.3 of Statement No. 800 and Condition 13.3 of EPBC Reference: 2003/1294 and 2008/4178, this document has been prepared with input from:

- Department of Environment and Conservation (DEC)
- Department of Fisheries (DoF)
- Department of Transport (DoT)
- Department of the Environment, Water, Heritage and the Arts (DEWHA; now Department of Sustainability, Environment, Water, Population and Communities [SEWPaC]).

In addition, Chevron Australia has also sought input and consultation with the following:

- Construction Dredging Environmental Expert Panel (CDEEP)
- Marine Turtle Expert Panel (MTEP).

The process for development, review and approval of this Plan is shown in Figure 1-4.

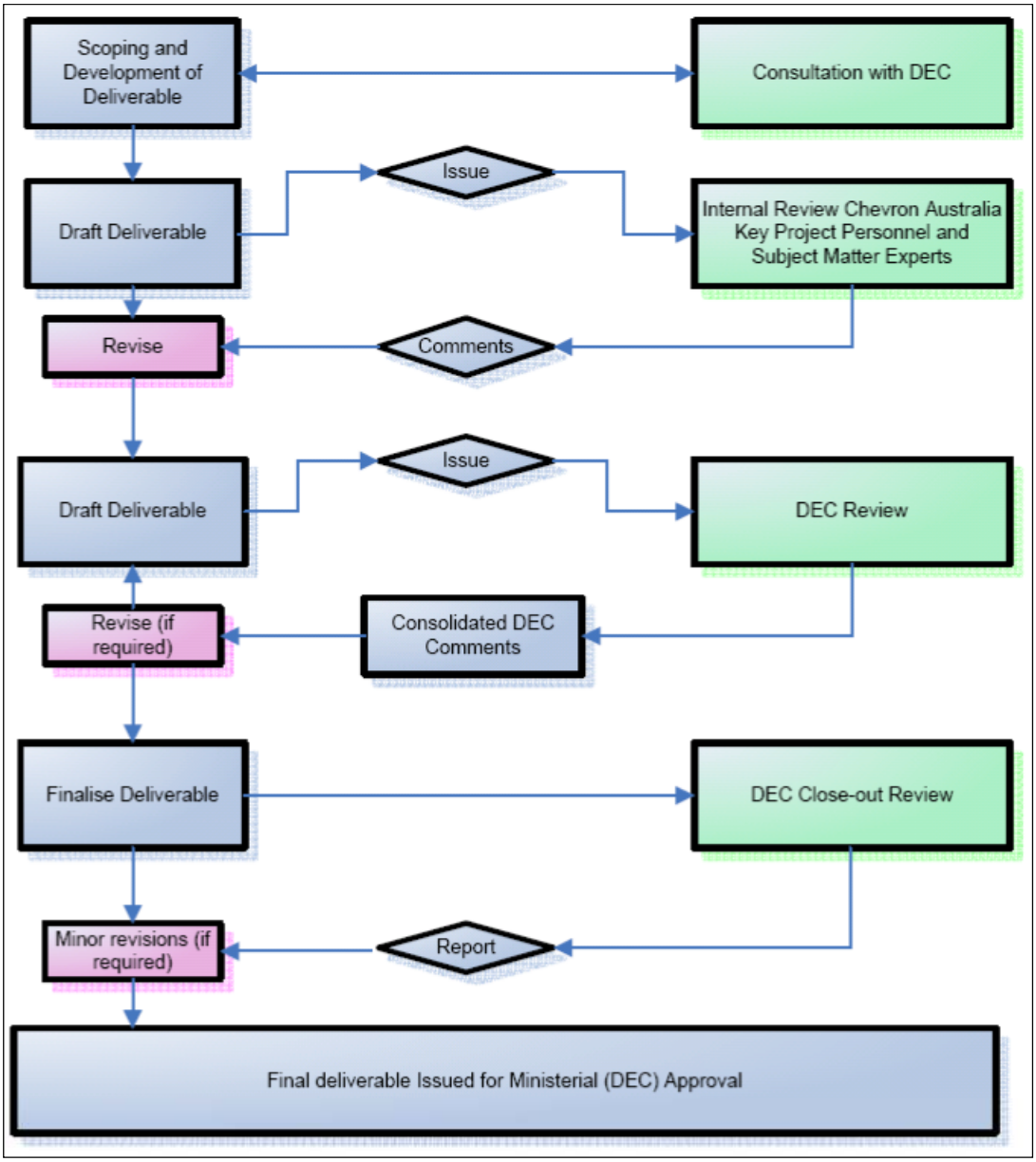


Figure 1-4 Deliverable Development, Review and Approval Flowchart

1.6.6 Public Availability

This Plan will be made public as and when determined by the relevant Minister, under Condition 35 of Statement No. 800 and Condition 22 of EPBC Reference: 2003/1294 and 2008/4178.

2.0 Relevant Footprint, Facilities and Activities

2.1 Marine Disturbance Footprint

The Marine Disturbance Footprint (MDF) is defined in detail in the CMBSEIR (Marine Baseline Report) (Chevron Australia 2009b). For the east coast of Barrow Island, the MDF includes the facilities to be constructed (MOF, LNG Jetty, WAPET Landing, and RO Structures) and the extent of surrounding seabed in which the planned construction activities (stressors) could be expected to disturb the seabed. These stressors include vessel propeller wash, vessel anchoring and mooring facilities, rock and fill material placement, seabed grooming for safe positioning of vessels, removal of high spots (to enable the safe transit of construction vessels), grounding of barges for logistics purposes, and pile and navigation aid installation. While the MDF does not include areas that will be disturbed by the generation of turbidity and sedimentation from dredging and dredge spoil disposal, it does include areas of the seabed that would be directly affected (removed) by these activities. The boundary of the MDF is presented in Figure 2-1 and Figure 2-2. For the MOF, LNG Jetty and WAPET Landing, the MDF corresponds to a 300 m buffer out from the toe of these facilities. Figure 2-2 also includes the MDF extending out (300 m buffer) from the turning basin and LNG shipping channel. The footprint for the navigation aids and the dredge spoil disposal ground are also represented.

Additionally, the MDF includes indicative areas where operational and cyclone moorings will be installed (refer to the hatched areas on Figure 2-1 and Figure 2-2). The number and specific location of each mooring will be subject to further investigation and planning as follows:

- Site surveys will be required to identify those areas with suitable sediment cover for holding capacity for the moorings.
- The number and type of vessels to be mobilised to site will be defined as each of the marine Construction Contractors is engaged.

Note that it is not proposed to disturb the entire footprint area identified for the installation of moorings in Figure 2-1 and Figure 2-2. Due to their concentrated nature, each mooring will create localised disturbance at the points of contact with the seabed and when anchors or clump weights are used instead of moorings, some additional disturbance will be created by anchor chain sweep of the seabed. It is however anticipated that approximately 50-60% of the indicative footprint will be directly disturbed. See Section 6.3 for the management of mooring installations.

Approval for the installation of moorings will be sought from either the WA Department of Transport (DoT), for moorings within Port limits or the WA Department of Environment and Conservation (DEC) for moorings within the Marine Management Area or Marine Park.

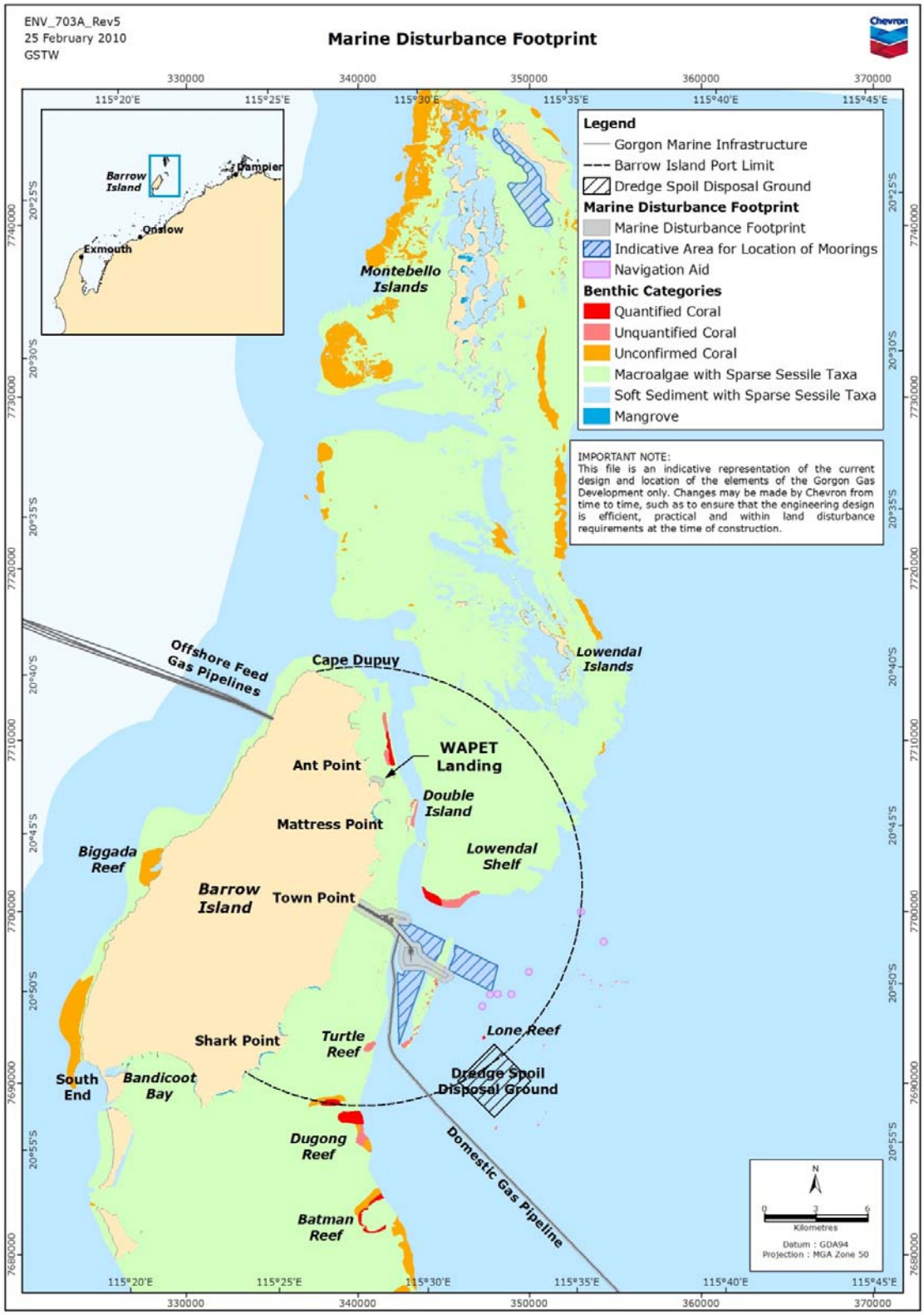


Figure 2-1 Marine Disturbance Footprint Overview

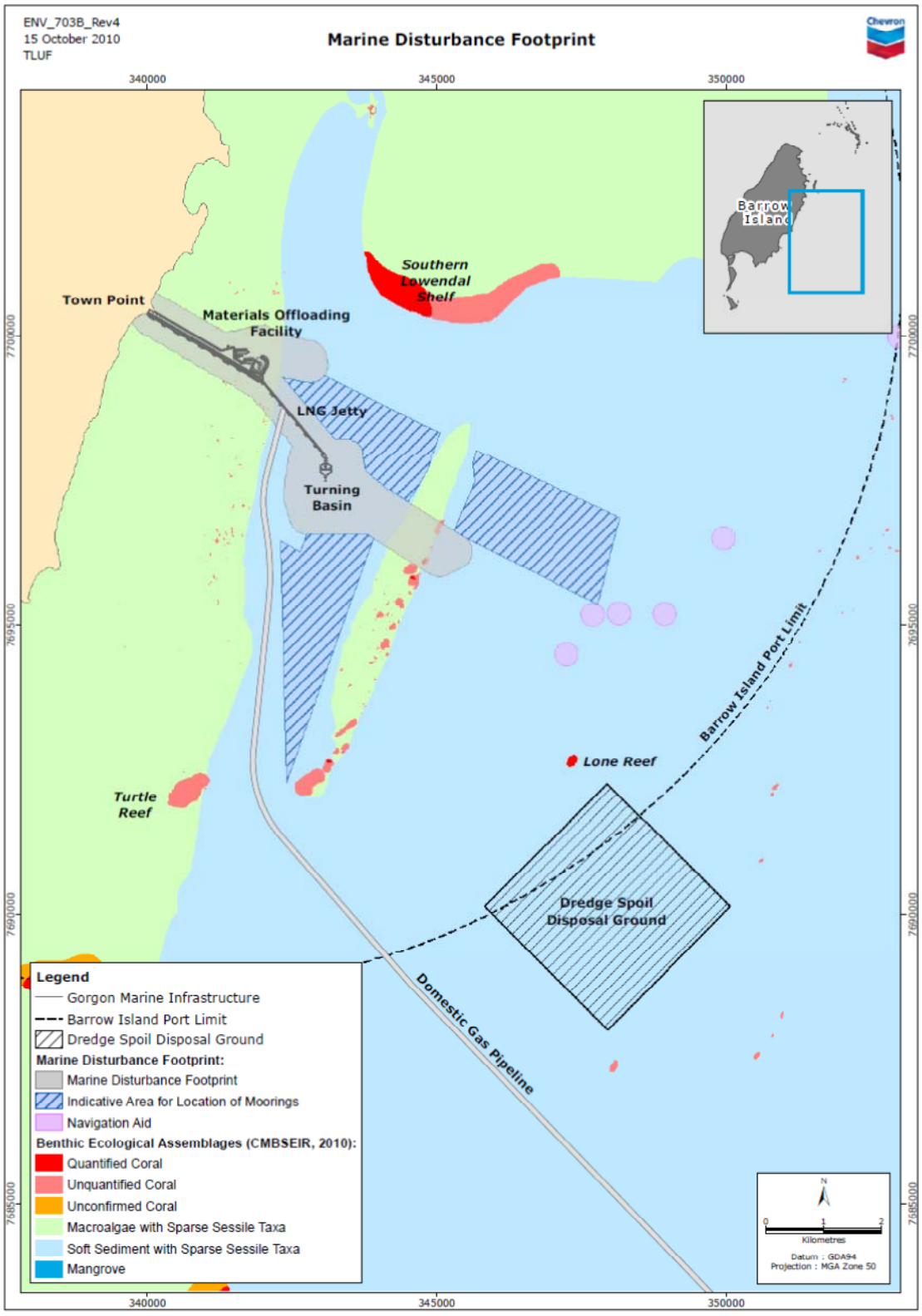


Figure 2-2 Marine Disturbance Footprint East Coast of Barrow Island

2.2 Description of Works

2.2.1 Overview

This Section provides a detailed description of the construction of the Marine Facilities (Condition 17.2, Statement No. 800), which are:

- Materials Offloading Facility
- LNG Jetty
- marine component of the Barge (WAPET) Landing upgrade

The installation of the RO Structures and vessel moorings is also included.

The key characteristics for marine construction activities associated with this Plan are summarised in Table 2-2, with the remainder of this section summarising each of the construction activities, supported by a detailed description in Table 2-3.

Table 2-1 provides an overview of the marine construction schedule. A number of the construction activities will be undertaken on a 24-hour basis. As outlined in Section 1.5, any significant changes to the base case development will be assessed and this Plan will be updated accordingly.

Table 2-1 Marine Construction Schedule

Activity	Timing
Marine drilling	24 hours
Marine blasting	Day shift
Marine impact piling	24 hours
Construction of the MOF Causeway (within 500 m from Town Point)	Day shift (occasional night shift may be required to shore up protection to partially constructed works in the event of approaching cyclones or other potentially destructive marine conditions)
Construction of MOF and Causeway (greater than 500 m from Town Point)	24 hours
LNG Jetty Construction	24 hours
WAPET Landing Upgrade construction (marine component)	Day shift

Table 2-2 Key Characteristics for Marine Construction Activities

Component	Key Characteristics
RO Structures*	• Installation of the intake structure on the northern or southern side of the MOF. This is likely to consist of a concrete caisson with submersible pumps in a wet well installation (Note: pending completion of detailed design) • Installation of the intake and outfall pipelines and diffuser
Pioneer MOF Platform (Figure 2-6)	• Reclamation of suitable dredge material from MOF access channel, turning basin and LNG channel • Construction of a triangular-shaped platform, using dredged fill material contained within a perimeter berm faced with rock armour • Construction of berthing ramps and berthing dolphins to accommodate large barges and Roll-on Roll-off (RORO) vessels • Installation of navigation aids
Pioneer MOF causeway (Figure 2-6)	• Construction of a causeway using fill material sourced from onshore Barrow Island, connecting Town Point to the Pioneer MOF Platform
Full MOF (Figure 2-5)	• Raising of upper causeway section • Extension of the Pioneer MOF Platform to include a breakwater, tug pen and heavy lift facility
LNG Jetty (Figure 2-6)	• Installation of the main jetty approach structure • Installation of jetty superstructure containing roadway, pipeway, loops, firewater intake structure, firewater pumps, DomGas risers and platforms • Installation of jetty head structures comprising one Operations Platform with substation, field instrumentation building and remote operations workshop, one emergency shutdown platform, two LNG and Condensate Loading Platforms, four berthing and six mooring dolphins at each platform, designed to accommodate LNG carriers up to 215 000 m^3 and condensate carriers up to 120 000 DWT • Installation of spar buoys and piled navigation aids
WAPET Landing (Figure 2-4)	• Two new Landing Craft Tank (LCT) landing ramps next to the existing concrete LCT ramp • Installation of a transition ramp (i.e. sunken barge) between the new LCT landing ramps • Improvements at the existing land-backed wharf • Reconstructed groyne barge berth • Small craft landing • Navigation aids
Installation of Moorings*	• Installation of moorings as required for the marine construction activities

*Note: * Additional works not defined as a Marine Facility (as per Statement No. 800, Condition 17.2 and EPBC Reference: 2003/1294 and 2008/4178 Condition 13.2).*

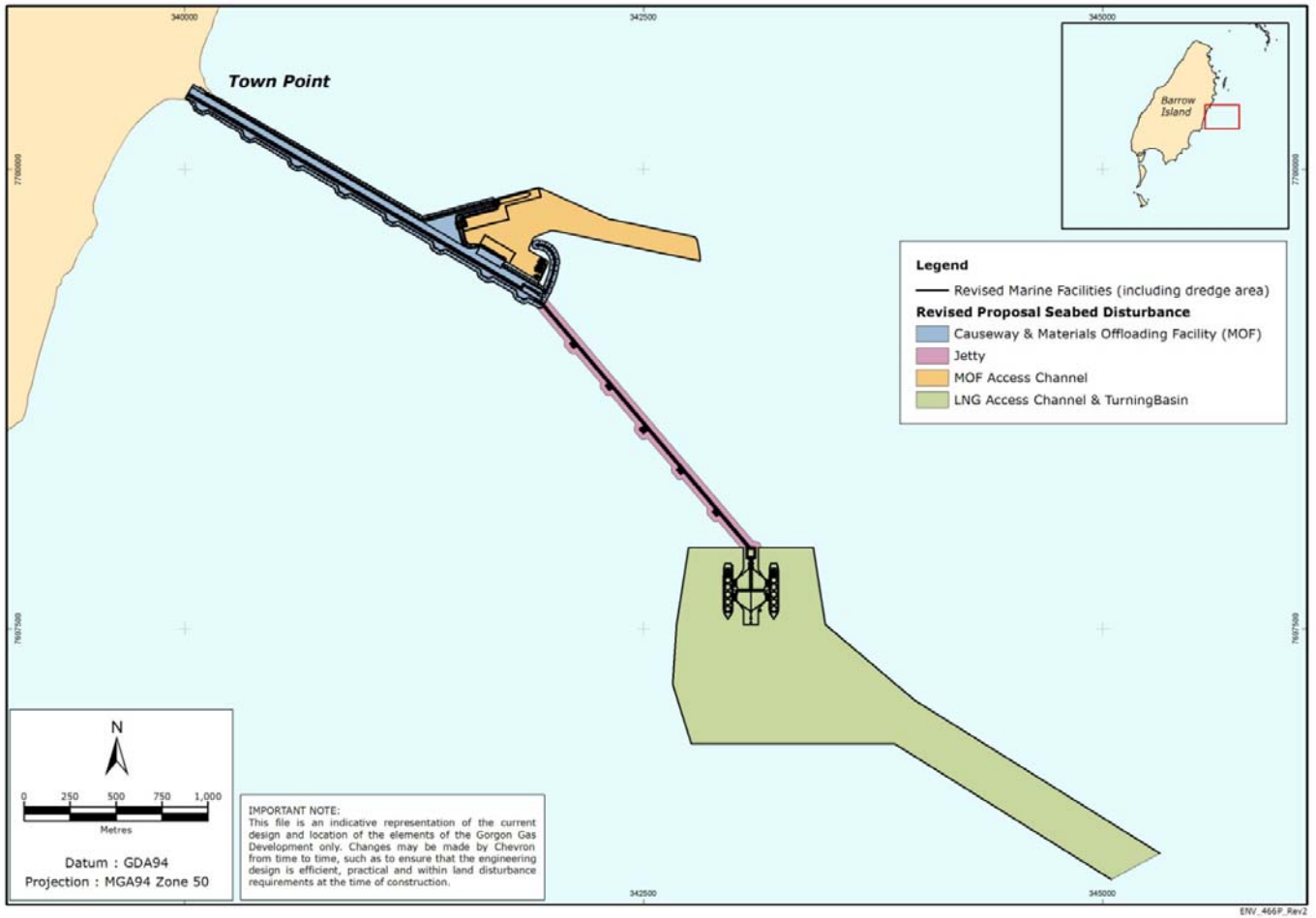


Figure 2-3 MOF and LNG Jetty Layout Adjacent to Town Point, Barrow Island

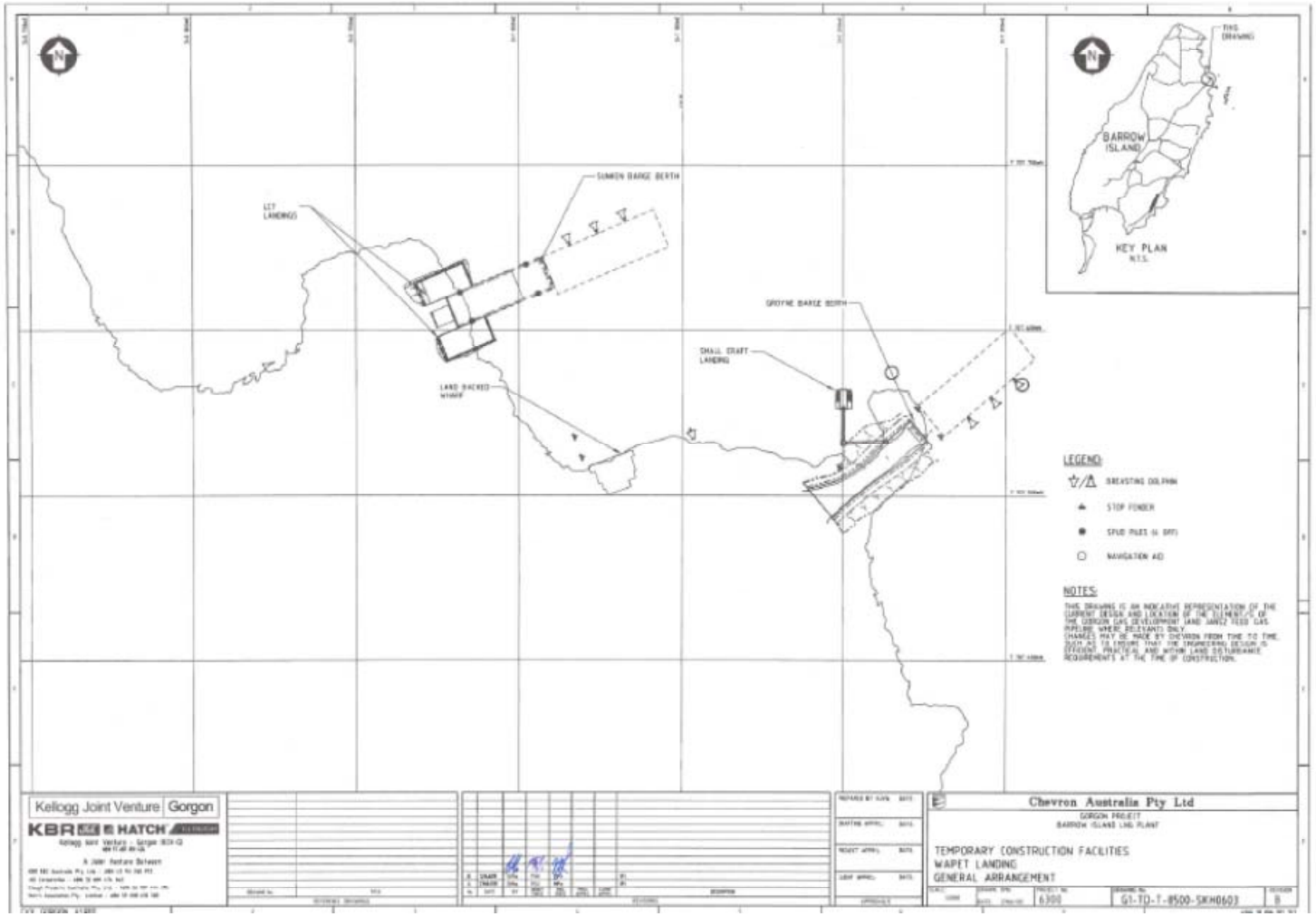


Figure 2-4 WAPET Landing Upgrade (Marine Component)

2.2.2 WAPET Landing Upgrade

The WAPET Landing will handle all vessel and freight movement for import and export to Barrow Island, prior to the completion of the MOF. It will also continue to be used as an alternative materials offloading facility during peak periods. Table 2-3 details the infrastructure upgrades to the:

- landing Craft Tank (LCT) Landing and Barge Berth
- land-backed wharf
- groyne barge berth.

2.2.3 RO Brine Structures

The construction methodology for the RO Structures is presented in detail in Table 2-3. The intake and outfall pipelines and outfall diffusers will be installed on the seabed.

The intake structure will be located within the armour of the Pioneer MOF. It will consist of a concrete caisson and shall contain submersible pumps in a wet well installation. An intake pipeline will extend from the caisson to a seawater intake located to the north or south side of the MOF.

The outfall diffusers will be located subsea so as to achieve the necessary dilution rates and prohibit the recycling of brine via the intake pipeline.

The exact location of the pipelines is pending completion of detailed design. Currently two options are under assessment:

- alignment predominantly within the MOF structure, with a deviation outside the MOF footprint in the vicinity of the Pioneer MOF
- installation adjacent to the MOF, on the southern side. The pipelines will be set back from the toe of the MOF to minimise impacts from construction of the MOF.

Both options require similar installation methods (see Table 2-3) and are contained within the MDF. This Plan has been developed to manage both options.

2.2.4 Materials Offloading Facility

2.2.4.1 Pioneer MOF

A Pioneer MOF will initially be required to allow offloading of equipment and materials for construction of the onshore LNG plant and associated facilities on Barrow Island, via large barges and Roll-on Roll-off (RORO) vessels. Construction activities will include:

- a Pioneer MOF perimeter berm, which will be constructed using a combination of suitably sized dredged material and rock transported from the mainland
- dredged material (approx 200 000 m^3) will be placed within the perimeter berm to form the Pioneer MOF Platform. Primary and secondary armour rock sourced from the mainland will be installed on the external face of the Pioneer MOF Platform
- construction of a Pioneer MOF causeway starting from Town Point and progressing outwards to the Pioneer MOF Platform.

The berm construction will include dredged rock material and will be pervious in parts. A filter layer (geotextile or graded material) will line the interior or exterior face of the bunds prior to the infill operation. Geotextile, when used, will be placed with the assistance of an excavator. After installation, the geotextile will be partly covered with suitable material.

The infill will be placed by pumping via a pipeline from the Trailer Suction Hopper Dredge (TSHD) positioned in the MOF turning basin. The placement of the fill will be primarily at or near high tides, limiting the hydraulic gradient between the inside and outside of the bund. This

will limit the speed of the infill operation allowing sufficient time for the fines within the MOF area to settle before subsequent loads.

Given the characteristics of the materials present within the dredging areas and their subsequent behaviour after having passed through a dredge pump, priority will be given to placing the coarser sand fraction within the MOF area. This will result in lower turbidity levels from decant water discharge, more usable engineering fill grade material, and generally a reclamation area that is easier to manage.

The berm wall will include a steel weir box placed on the temporary face adjacent to the dredge area. The steel box will provide an adjustable weir on the upstream side and pipe outflow on the downstream side to discharge at or near the seabed.

A diagrammatical sequence of the construction of the Pioneer MOF Platform is provided in Appendix 1 (note that the filter layer may be installed on the interior or exterior wall of the berm). As the construction of the Pioneer MOF Platform (including reclamation) is incorporated within the scope of the dredge program, more detailed information on this activity is included within the DSDMMP (Section 3.0; Chevron Australia 2009a).

The causeway will connect Town Point to the Pioneer MOF Platform using material excavated from Barrow Island combined with concrete armour units (Table 2-3). Bund embankments will be progressively constructed and filled, with appropriate rock and concrete armour units progressively installed to minimise erosion from cyclone damage during the construction phase. A roadway will be constructed on the surface of the causeway.

2.2.5 Full MOF

Once the Pioneer MOF has been constructed, work will commence immediately on extending the MOF platform seaward and raising part of the existing MOF causeway (Figure 2-5), including:

- extending the MOF platform seaward, forming a breakwater that will protect tug pen moorings, the heavy lift facility and other berths. This work will be completed using material excavated from Barrow Island and up to approximately 400 000m^3 of dredge material. Suitable dredge material may be also used in place of core fill material from Barrow Island. This is dependent on the quality and quantity of the core fill material. Up to 800 000 m^3 of dredged material may be required for this purpose
- constructing a Heavy Lift Facility and tug pens
- raising the existing MOF causeway by adding an upper causeway section (upper causeway height varies between +12 m to +16.5 m CD) to accommodate an all-weather access road to the LNG Jetty, a pipe rack containing LNG, condensate and other pipelines for export, and operations of the jetty offloading facilities. This work will be completed using material excavated from the Terrestrial Disturbance Footprint on Barrow Island
- installing armour comprising rock and precast concrete units.

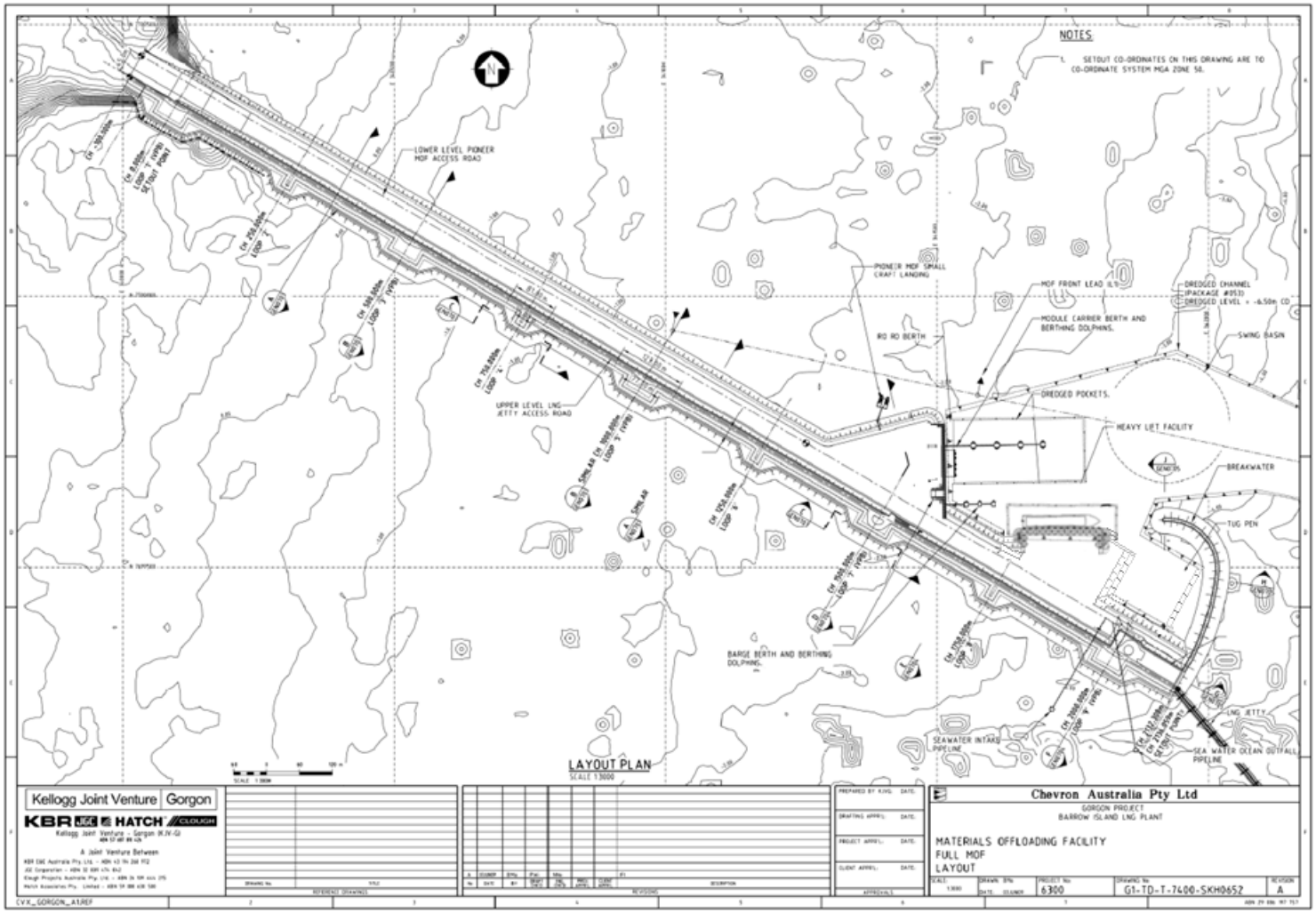


Figure 2-5 Layout of Full MOF

2.2.6 LNG Jetty

The selected design of the LNG Jetty is based on an open structure with gravity base concrete caissons founded on the seabed (Figure 2-6). The caissons typically have four piles each that are embedded in the caisson. The piles support the jetty superstructure. This section presents the construction details of this concept , which includes:

- seabed preparation, levelling and placement of the foundation gravel layer for the caissons
- offsite prefabrication of jetty elements
- transport to site, floating into position and immersion to the rock foundation of gravity base concrete jetty supports
- lifting by heavy lift crane barge onto the jetty supports of the offsite prefabricated superstructures, including roadways, pipe racks, buildings and pre-assembled units for fire water pumps, emergency shutdown and product loading.

The scope of work for the LNG Jetty also includes the navigation aids, channel markers and lead lights, and structures to protect the jetty from vessel impact. The channel markers are spar buoy type structures, while the lead lights and jetty protection structures are piled using both driving and drilling techniques.

2.2.7 Vessel Support Requirements

A range of construction vessels will be required for the marine construction activities as outlined in Table 2-3. Ancillary vessels will also be required, including:

- supply vessels
- refuelling vessels
- crew change vessels
- survey vessels
- tugs
- landing craft
- marine construction support vessels. Marine construction personnel will be accommodated on board the vessels.

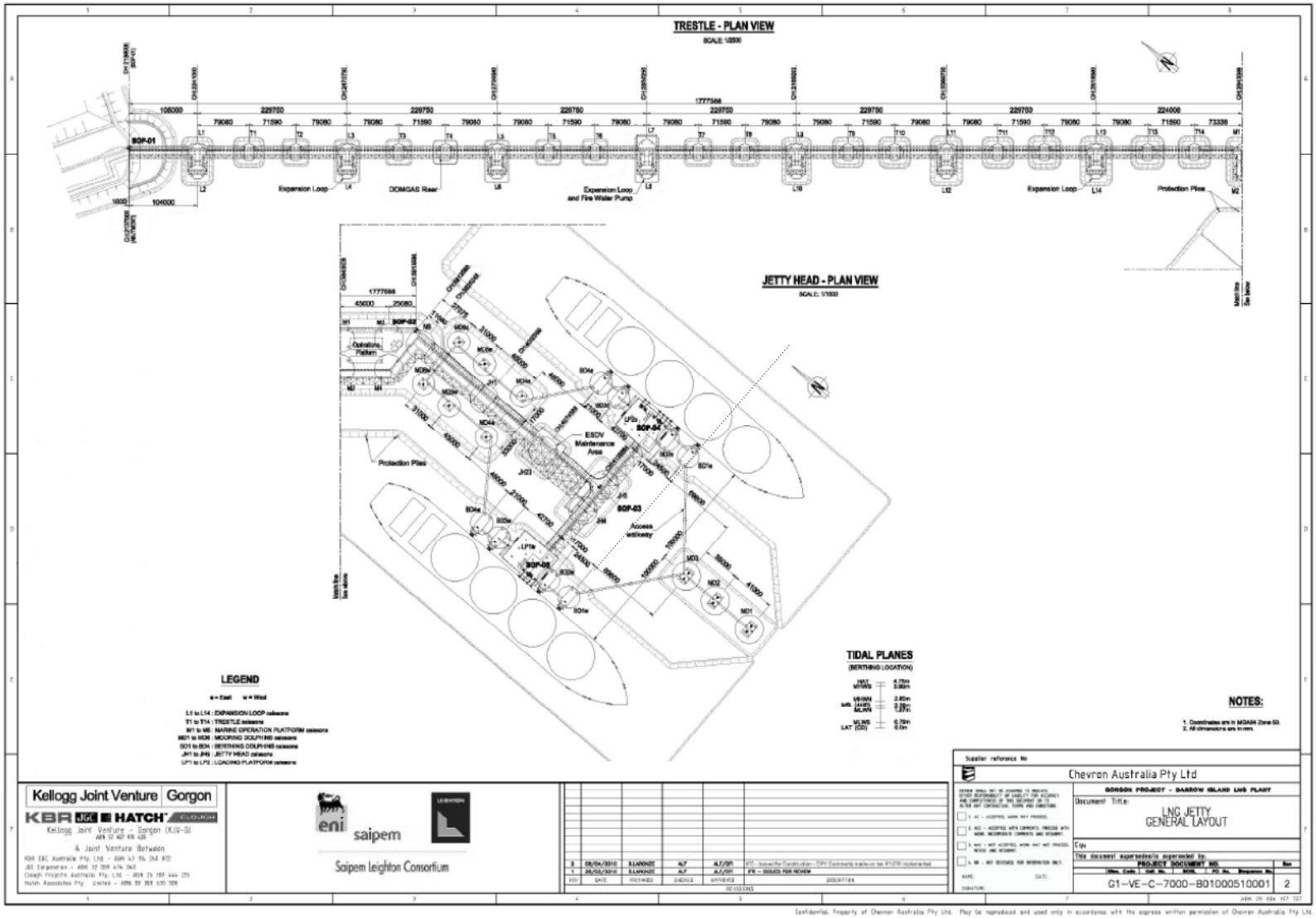


Figure 2-6 Layout of LNG Jetty Structure

Table 2-3 Detailed Description of Marine Construction Activities

Work Activity	Description	Construction Machinery Requirements	Indicative Timing
WAPET Landing (*Activity 1 – Barge Landing*)	Prior to completion of the operational MOF, all vessel and freight movement (approximately 355 000 freight tonnes) for import and export from Barrow Island will use WAPET Landing, which is the only available landing point. Following construction of the MOF, WAPET Landing will continue to be used as an alternative material offloading facility for Gorgon during peak periods. The existing material offloading facilities at WAPET Landing will be upgraded as follows: <u>Landing Craft Tank (LCT) Landing and Barge Berth</u> • Increase landing craft capacity (to manage two 250 / 300 deadweight tonnage [DWT] vessels at any one time) by installing additional ramps on either side of the existing concrete ramp. The new ramps will be formed by placing Flexmats (flexible concrete mattress) on prepared subgrade (approx 1000 m^3 of <75 mm) so as to achieve required ramp levels and grade. Preparation works for the Flexmats include the removal of existing fender piles, excavation of high points, removal of rock (approximately 600 m^3) to make level, a small excavation to the cliff face (approximately 10 m^3) on the south side of the ramp, as well as saw cutting the edge of the existing concrete ramp and removal of rubble material. Trenches will be cut around the perimeter of the Flexmat and material excavated to fix the mat edges. The subgrade will be placed using dump trucks and Flexmats placed over compacted material using an onshore crane. Mats will be fixed to the existing surface using long pin anchors (approx 750 mm). • A transition ramp (sunken barge) will be installed to act as a bridging structure to provide access and berthing of a barge up to 6000 DWT. Approximately 45 m of seabed measured from the toe line of the existing LCT ramp will be disturbed to allow for placement of the transition ramp. The ramp will be floated into position, ballasted and stabilised. Prior to the positioning of the transition ramp compacted subgrade (hard, durable, angular rock fragments, free from deleterious matter such as clay lump) will be placed on the seabed by a dump truck to achieve required levels and grade. This material will consist of approximately 1500 m^3 of 300 mm grade material. The transition ramp will then be placed on the top of the compacted subgrade. Piles will most likely be required to stabilise the sunken barge in addition to ballast. A steel ramp will be placed on the shore side of the barge to act as an approach ramp. A minimum of three breasting dolphins with fenders will be installed to assist berthing of the barges. Piles for breasting dolphins will be drilled and grouted and installed using a work barge with crane and drilling assembly. <u>Land-backed Wharf</u> • Two stop fenders and one breasting dolphin with fender will be installed at the wharf to enable berthing of a barge up to 6000 DWT. Piles for stop fenders and the breasting dolphin will be drilled and grouted and installed using a work barge with crane and drilling assembly. • Excavation of the Land-backed Wharf berthing pocket will involve removal of rock and sediment within the berthing pocket to allow a graded surface for improved barge access and landings. The work will be undertaken by a land excavator at low tide, with material being stockpiled on land for later re-use or disposal. The activity will take approximately one to two weeks to complete. <u>Groyne Barge Berth</u> • Rebuilding of the existing groyne and construction of a new barge berth/s is required to provide vehicle (truck) access to allow roll-on / roll-off (RORO) cargo transfers from barges (up to 10 000 DWT) and diesel offloading from LCTs and fuel barges. As a minimum (for one berth), two stop fenders and three breasting dolphins with fenders will be required to assist barge berthing. Piles for stop fenders and breasting dolphins will be drilled and grouted and installed using a work barge with crane and drilling assembly. To increase the logistics capabilities on the Island, a sunken barge may also be required to be landed off Bob's Beach to transfer logistic supplies (i.e. freight, cargo, diesel etc.). In addition to the barge, there may be a requirement to install moorings (clump weights) and/or fender dolphins. Cargo barges will be used to deliver equipment to the barge. • Slumped material from the existing groyne (approximately 600 m^3) will be recovered for re-use in the new groyne profile. This material will be separated for use into armour and groyne ramp core fill. The material will be placed and compacted using shore-based excavators and dump trucks. • For the groyne earth ramp, precast concrete retaining wall units and a precast concrete approach slab will be installed using a shore-based crane. Primary and secondary rock armour (approximately 5000 m^3) will be placed around the groyne earth ramp using dump trucks and excavators. Prior to the installation of secondary armour, a geotextile liner will be installed. Approximately 3000 m^3 of fill will be placed on the groyne by dump trucks. • A Small Craft Landing will be installed to serve small vessels. The existing landing will be removed and a new Small Craft Landing will be constructed, sheltered by the groyne and accessed by a gangway. The new landing will be located in deeper water, which will improve tidal availability. The Small Craft Landing consists of a pontoon structure connected to the land by a steel gangway supported by piles. Piles for the pontoon and gangway will be drilled and grouted and installed using a work barge with crane and drilling assembly. Pontoon and steel gangway will then be installed using the crane on the work barge. • Two marine navigation aids will be installed to assist barge berthing. One navigation aid will be fitted to the most eastern Groyne Berth breasting dolphin. The other will be installed on a pile just north of the Groyne Berth. This pile will be installed using a work barge with crane and drilling assembly. Normal moorings and cyclone moorings may be installed to suit construction and operations requirements.	• Work barge with crane and drilling assembly • Tugs and support vessels • Excavator with rock breaking capability • Onshore cranes • Front end loaders • Dump trucks • Heavy rollers	6 months

Work Activity	Description	Construction Machinery Requirements	Indicative Timing
RO Brine Outfall Installation (*Activity 2 – Town Point*)	<u>Seabed Preparation and Pipeline Installation (applicable to both installation options, within the MOF structure and adjacent to the MOF):</u> • Level seabed along route by removing high spots and filling using selected fill. • Install sleepers on gravel bedding to line and level at design spacing and fix to seabed. • Lay pipelines on sleepers aligned in saddles. • Fix pipelines and power cables to sleepers. • In the dredge area around the Pioneer MOF Platform, the pipeline may be installed in a trench to protect it from damage from dredge anchors. In this area the installation method will be: ▪ Excavate trench using barge-mounted backhoe. ▪ Install pipelines in trench. ▪ Fill trench using selected dredge fill. In addition to the above work, if the pipeline is located under the MOF it will be necessary to provide it with mechanical protection prior to MOF fill construction. There are two options for this mechanical protection: **Option 1**: Protect using precast reinforced concrete culverts: ▪ Culverts are precast on mainland. ▪ Culverts are loaded onto task-specific supply/storage barges and towed to site. ▪ Crane Barge lifts precast culvert sections from barge and installs over existing pipelines. Culverts are landed into position without anchoring until all culverts on the supply barge are installed. ▪ Divers to trace back over landed precast units and install seabed anchors. **Option 2**: Protect using mass concrete covering ▪ Prepare rock-fill bunds to a height approximately equal to the top of pipes either side of pipeline and cover with geotextile. ▪ Pump concrete covering over pipe to design thickness from either shore-based concrete pump or barge-mounted concrete pump. The mechanical protection described above will not be required in areas where the pipeline is laid in trench or if the pipeline is located outside the MOF footprint. <u>Intake Structure</u> • Precast and fabricate structure on mainland in a location with access to a deep water wharf for loading on heavy lift ship and transport to offshore Barrow Island. • Offload structure to a purpose built barge offshore of Barrow Island close to its installation location. • With tug boat assistance, float the structure into position and sink into position, on pre-prepared bed, using a combination of outgoing tide and ballast. • Drill and install rock anchors to fix structure in place. • Install equipment within caisson structure.	• Large crane barge • Work Boat • Dumb barge with excavator for seabed preparation gravel bedding • Gravel barge • General material barge • Dive Boat and crew • Heavy lift ship • Concrete batching plant and concrete pump	12 months
Pioneer MOF Platform (*Activity 3 – Town Point*)	• Initially, an access channel and rehandle pit will be dredged within the overall MOF dredging footprint. The access channel will allow access to the Pioneer MOF Platform construction area for construction vessels and equipment. The rehandle pit will be used as a temporary stockpile area for suitably sized dredged material that can be used in construction of the Pioneer MOF. • Once the access channel is complete, a Pioneer MOF berm will be constructed using a combination of suitably sized dredged material and rock from the mainland. Unsuitable dredge material will be placed into the offshore spoil disposal ground. • Dredged material will be used as infill to form the Pioneer MOF Platform (approx 200 000 m^3). Once a stable working platform has been created, land-based earthmoving equipment can be used in the construction of the Pioneer MOF Platform. Dredged material will be pumped into the bunded area on an intermittent basis. The supernatant water will be discharged through a dedicated discharge point at the seaward end of the Pioneer MOF Platform. • Primary and secondary rock armour sourced from the mainland will be placed on the outer side of the Pioneer MOF Platform to provide protection and to prevent erosion from storm or cyclone damage. This will also reduce turbidity generation and potential loss of reclaimed material into the water adjacent to the MOF location. • Precast concrete units will be installed to form the berth facilities. • Navigation aid support structures will be installed.	• Backhoe Dredge (BHD) • Trailer Suction Hopper Dredge (TSHD) • Drill and blast spread (potentially) • Flat-top ramp barges • Heavy lift ships • Land-based excavators • Crane barge • Rock supply barges	8 months

Work Activity	Description	Construction Machinery Requirements	Indicative Timing
Pioneer MOF Causeway Construction (*Activity 4 – Town Point)*	• A causeway will be constructed connecting Town Point to the Pioneer MOF Platform using material excavated from the LNG plant site. The Pioneer causeway will be constructed to +6.5 m CD. • Construction of the Pioneer MOF causeway will be completely land-based and will start from Town Point and progress outwards to the Pioneer MOF Platform. • Outer bund embankments will be constructed from hard, durable rock material, sourced from Barrow Island. This material will either be screened to remove fines, or if not screened a filter layer (geotextile) will be placed on the outside of the embankment to minimise fines spreading to the environment. • Core fill material will be placed in between the bund embankments as they are constructed. It is planned that core fill will not extend beyond the end of the bund embankments. • On the outer side of the northern bund, both secondary and primary armour sourced from Barrow Island will be placed to provide protection and to prevent erosion from storm or cyclone damage. • On the outer side of the southern bund, a deforming berm breakwater will be placed, constructed from secondary armour sourced from Barrow Island.	• Land-based excavators (trim bunds and place rock armour) • 40 t Articulated Dump Trucks (transport Barrow Island excavated material to the MOF work front) • D8 Dozers (support placement of Barrow Island excavated material)	10 months
Full MOF (*Activity 5 – Town Point*)	• After the Pioneer MOF causeway has been completed, work will immediately continue beyond the Pioneer MOF to construct the remaining MOF structures. This involves raising the southern side of the causeway to accommodate the process piping as well as extending the MOF seaward of the Pioneer MOF Platform to create a heavy lift facility and breakwater. • The southern section of the causeway will be raised to accommodate the LNG and condensate process piping. This will be constructed from Barrow Island rock material. Precast concrete armour will be placed on the secondary armour. • The MOF (including the breakwater) will be extended out from the Pioneer Platform to create a heavy lift facility and breakwater to protect the tug pens. Crushed rock will be recovered from dredging and placed on the seabed using the split hopper barges. The dredge material will be shaped into bunds and the bunds filled with additional dredge material from the TSHD. • Rock and precast concrete armour will be placed on the outer sides of these bunds to provide erosion and storm protection. • A heavy lift facility will be installed, which involves placing precast concrete units and constructing a concrete deck. • A floating pontoon system will be installed to accommodate four tugs and two service vessels. This will involve piling activities using a Jack-up barge.	• Land-based excavators (trim bunds and place rock armour) • 40 t Articulated Dump Trucks (transport Barrow Island excavated material to the MOF work front) • D8 Dozers (support placement of Barrow Island excavated material) • 150 t Crawler Crane (placement of precast concrete armour) • BHD • TSHD • Flat-top ramp barges • Heavy lift ships	13 months
LNG Jetty Installation (*Activity 6 – Town Point*)	Extending out from the abutment at the end of the MOF causeway, a jetty 2 km in length will be constructed to support the LNG, condensate, vapour return, firewater and utilities pipelines from the onshore LNG plant to the loading platforms. The loading platforms will be located at approximately Lowest Astronomical Tide (LAT)-10 m water depth and will require a channel and turning basin dredged to LAT-13.5 m and to LAT-15 m at the berth pockets. Roadway access for operational, maintenance and emergency access is provided up to the loading platforms. The selected design concept for the LNG Jetty is based on gravity base supports. This is an open structure design whereby the jetty caissons are founded on the prepared seabed layer. Gravity base caisson supports consist of a concrete caisson and steel pile support structure embedded into the caissons. The caisson supports are installed directly on a prepared gravel foundation on the seabed. Prior to placement of the gravel the loose sediments are removed from the caisson location to obtain a solid and stable foundation. The caisson foundations are protected from erosion by sea water currents or wave action by scour protection around the base placed after installation of the caisson. The steel trusses for the roadways and pipe racks are installed on top of the gravity base pile supports. The length of each structure varies between 70 and 90 m. The roadway truss contains a 4 m wide roadway, footpath and cable racks for electrical and instrument cables. The pipe rack truss contains the LNG, utility, condensate and domestic gas piping; The gravity base supports and steel trusses are prefabricated offsite and transported by sea to Barrow Island for erection and installation. The jetty is built up from the following prefabricated elements: • The 1.6 km straight approach trestle between the abutment and operations platform, accommodating the roadway, pipe racks and pipe expansion loops, which is built up from 28 caisson supports, 22 roadway trusses and 29 pipe trusses. It also accommodates the Seawater Fire Water intake platform and the domestic gas riser pipe connection where it branches off the jetty towards the mainland approximately halfway along the trestle. • The operations platform, which is supported on five gravity base caissons and accommodates the substation, field equipment room and remote operations workshop. The platform accommodates the electrical substation, field equipment room and a remote operations workshop. The piperacks and roadway is routed around the outside of the platform. • The jetty head, which consists of four gravity base caissons and trusses for pipe racks and roadways. It also accommodates emergency shutdown valves for LNG loading operations. The southern part of the jetty head has the shape of a T-section where both the roadway and pipe rack split to the east and west berth respectively. • Both loading platforms rest on two steel jackets embedded into a single caisson support. The concrete deck on top of the jackets supports the LNG and utility piping as well as the loading arm and gangway tower to allow safe access to and from the vessels. • The berthing facilities comprise of 17 dolphins of similar design to the jetty caissons. The dolphin superstructure is a concrete plate. There are four breasting dolphins per berth equipped with fenders and quick release mooring hooks, and three single mooring dolphins equipped with quick release mooring hooks only ,and three dual mooring dolphins shared by both berths also equipped with quick release mooring hooks. The dolphins can be accessed from the loading platform and are interconnected through the catwalks.	• Jack-up barges • Crane barges • Work and tug boats • Work barges • Transport barges • Rock supply barges	24 months

Work Activity	Description	Construction Machinery Requirements	Indicative Timing
	Construction works at location requires specialist marine vessels including heavy lift crane barges up to 1600 tonnes capacity, transport barges travelling between the offsite fabrication yards and Barrow Island, work barges for placement of scour protection around the caissons, seabed levelling and foundation preparation of the caissons prior to installation, and support vessels for various activities including towing, personal transfers and anchor handling. The sequence of marine works for installation of the jetty elements is as follows: • Localised seabed preparation is required to remove loose sediments and to level any local high spots for placement of the caissons. The excavated material will be relocated to either the Spoil Disposal Ground or re-used in construction of the MOF. The seabed preparation activities will either be undertaken by one or more work barges with the required suction and pumping equipment, or, alternatively, by vessels already on site as part of the marine construction program (e.g. TSHD, BHD). It is anticipated that up to approximately 400 000m^3 of material may be required to be removed to permit placement of all caissons. • Place the gravel foundation, which is nominally 500 mm thick. The rock is placed into chutes from a rock transportation barge down to the actual placement level. • Tug boats will subsequently float the caissons into position above the target installation position. • Immerse the caisson by ballasting it with water. • Fill the caisson with gravel solid ballast to prevent sliding or overturning of the gravity based structures. The filling is done with a conveyor belt suitable for marine environments and chutes penetrating into the caisson itself. • Remove temporary equipment for the positioning and immersion of the caisson and placement of rock around the gravity based caissons to prevent scouring. The scour protection is placed with a backhoe placed onto a barge. • Install the jetty superstructures, roadway trusses, pipe trusses, buildings and other pre-assembled units for the fire water pumps and product loading units. These are lifted into place with the heavy lift crane barge. Construction work at location also includes the construction the operations platform and loading platforms including prefabricated concrete elements and an *in situ* deck layer. The platforms will accommodate the pre-assembled buildings and the LNG and Condensate loading units respectively.		

3.0 Existing Environment

3.1 Overview

Barrow Island is located approximately 1200 km north of Perth and 130 km west of Dampier and the Burrup Peninsula within the Pilbara Offshore (PIO) Marine Bioregion (Interim Marine and Coastal Regionalisation for Australia 1998). Barrow Island is the largest of a group of islands that include the Montebello and Lowendal Islands to the north-east (Figure 2-1).

The existing environment of Barrow Island and scope of the Gorgon Gas Development is described in the EIS/ERMP (Chevron Australia 2006) and PER (Chevron Australia 2008). Additional existing environment information is described in the following documents, as required under Statement No. 800 and EPBC Reference: 2003/1294 and 2008/4178:

- Coastal and Marine Baseline State and Environmental Impact Report (the Marine Baseline Report) (Chevron Australia 2009b)
- Long-term Marine Turtle Management Plan (Chevron Australia 2012)
- Coastal Stability Management and Monitoring Plan (Chevron Australia 2009d)

This section summarises the above-mentioned documents to provide background and context to the proposed marine construction activities, and covers the:

- existing physical environment (including water and sediment quality)
- existing biological environment (including habitats and species)
- sediment plume modelling details.

3.2 Existing Physical Environment

3.2.1 Coastal Geomorphology and Processes

Barrow Island lies near the edge of the continental shelf, with water depths increasing rapidly on the west coast of the Island. To the east of Barrow Island, water depths do not generally exceed 20 m. Bathymetry for the east coast of Barrow Island is shown in Figure 3-1 and Figure 3-2.

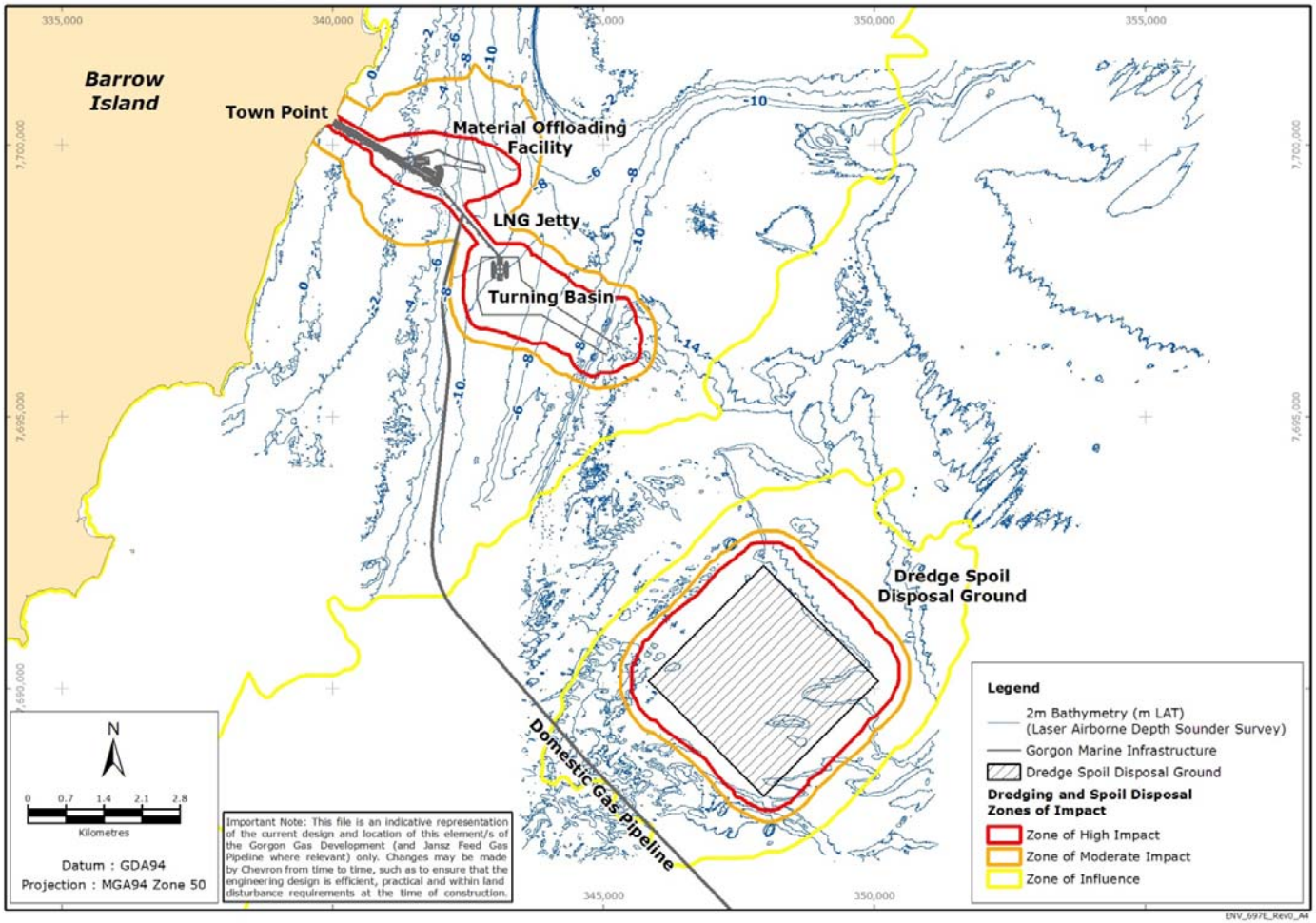


Figure 3-1 Bathymetry off the East Coast of Barrow Island

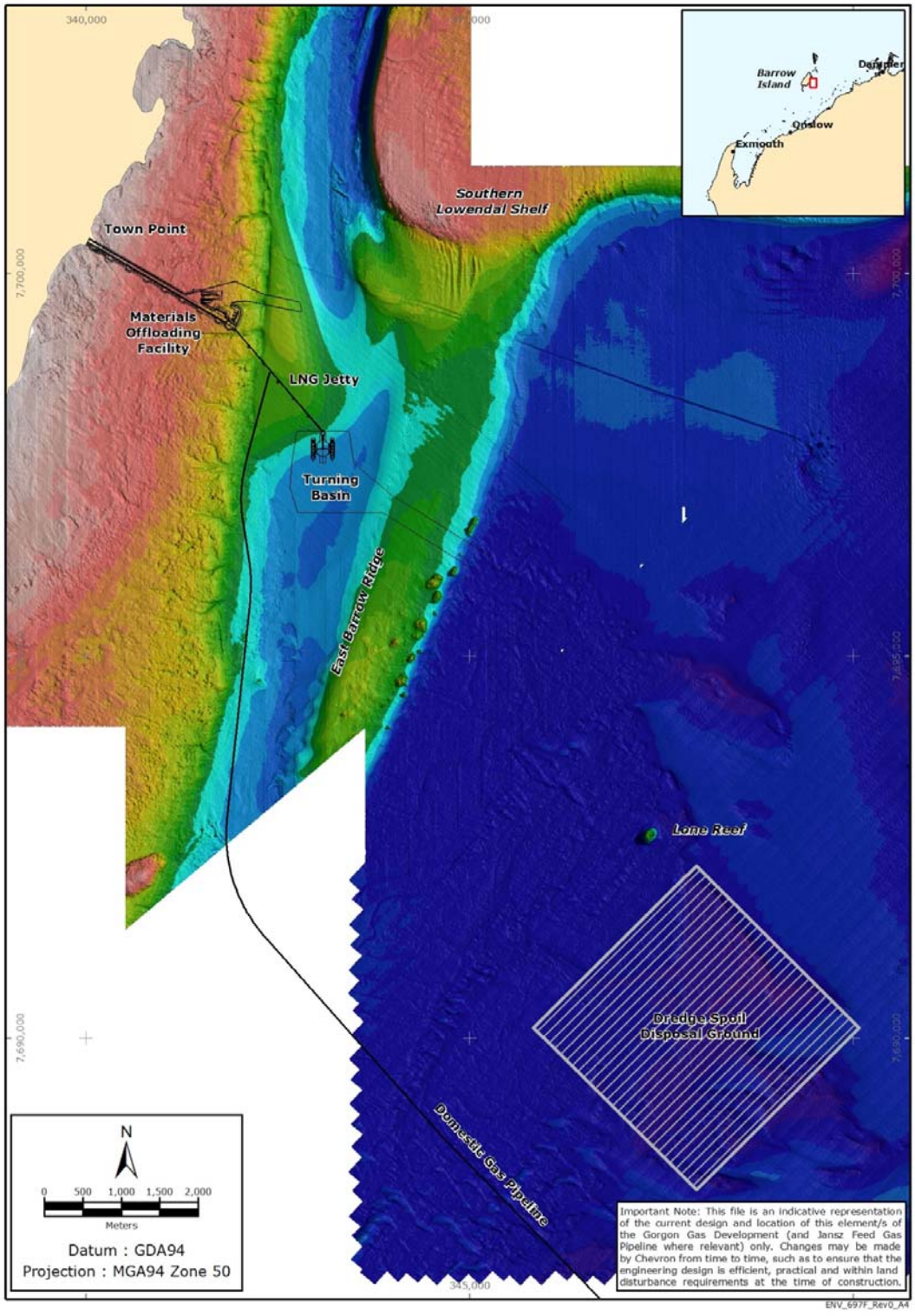


Figure 3-2 Gorgon Gas Development and MOF and Jetty Facilities Overlain on Laser Airborne Depth Sounder (LADS)

3.2.2 Metocean Conditions

3.2.2.1 Regional Meteorology

The climate of the North West Shelf region is effectively dominated by two main seasons: dry and wet, separated by short transitional seasons of approximately one month. During the dry season (generally May to October), a belt of high pressure known as the subtropical ridge forms over the continent and results in a semi-persistent easterly flow across the Pilbara. This flow may weaken and strengthen as individual high pressure centres evolve to the south in response to cold frontal activity. The easterly flow is characterised by low moisture content and stable weather conditions.

The wet season (generally December to March) is the product of a warming of the continent following the winter solstice that results in a gradual southward migration of the subtropical ridge. This has a twofold effect: the general strength of the easterlies weaken and a persistent heat trough (area of low pressure) forms along the Pilbara coast. Over the Greater Gorgon Area (Figure 1-1), the general flow then tends to be more south-westerly. Closer to the coast, diurnal variations in terrestrial temperatures cause local sea-breeze impacts to become important. This general trend toward more westerly flow results in monsoonal flow across the tropical north.

Episodic bursts in monsoonal activity results in increased tropical convection (thunderstorms). Convective clusters can form into discrete low pressure systems and, if conditions are conducive, these can eventually intensify to tropical cyclones. Generally, cyclogenesis occurs well to the north where sea temperatures are warmer. Storms may then intensify as they track southwards. The direction of movement of the storms is generally controlled by upper atmospheric steering; some storms track to the west under the influence of strong upper easterlies, but others can curve towards the Pilbara coast. This situation can be conducive to rapid intensification and acceleration of the cyclones toward the Pilbara coast.

3.2.2.2 Regional Oceanography

The North West Shelf coastal oceanography has several main features, which are described in this section.

Currents in the Upper Water Body Caused by Regional Wind Stress

The North West Shelf can experience strong winds, which generate flows in the surface waters that diminish with depth. The persistent winds from the south and south-west for up to eight months of the year result in residual flows along the coast towards the north-east. These residual currents generally cease during winter when the easterly winds exert their influence.

Relatively Strong Astronomical Tides

Astronomical tides can generate sea level variations in excess of 7 m on the North West Shelf, particularly in the northern regions. These tidal variations can generate relatively strong currents.

Eddies and Geostrophic Currents

The shelf edge of the southern regions of the North West Shelf can be influenced by geostrophic flows such as the Leeuwin Current, which usually flows southwards along the continental shelf break during the winter months. The Leeuwin Current is thermodynamically generated and can have a complex structure, including the shedding of small eddies near the continental shelf edge. This eddy shedding may cause local northward current flows to be experienced, rather than just an overall southward flow. An illustration of geostrophic flows modelled by the Global Environmental Modelling Systems (GEMS) Three Dimensional (3D) Ocean Model (GCOM 3D) is shown in Figure 3-3.

Ocean Waves

The North West Shelf is exposed to a wave climate that includes deep ocean waves with effectively unlimited fetch due to the lack of land masses in the Indian Ocean. The dominant

component of this is the southern ocean swell driven by the persistent southerly and south-westerly winds during much of the year. However, the swell spectrum can be bipolar, with swell wave energy also arriving from the north-west driven by the tropical meteorology between Australia and Asia. Local, shorter period wind waves can also be generated on the North West Shelf due to the dominant coastal wind regime, which is most often southerly during the spring, summer and autumn months and easterly during the winter months.

Tropical Cyclone Storm Surges

The North West Shelf experiences relatively frequent impacts from tropical cyclones. Storm surges generated from these cyclones on the coast can be in excess of six metres every one hundred years on average.

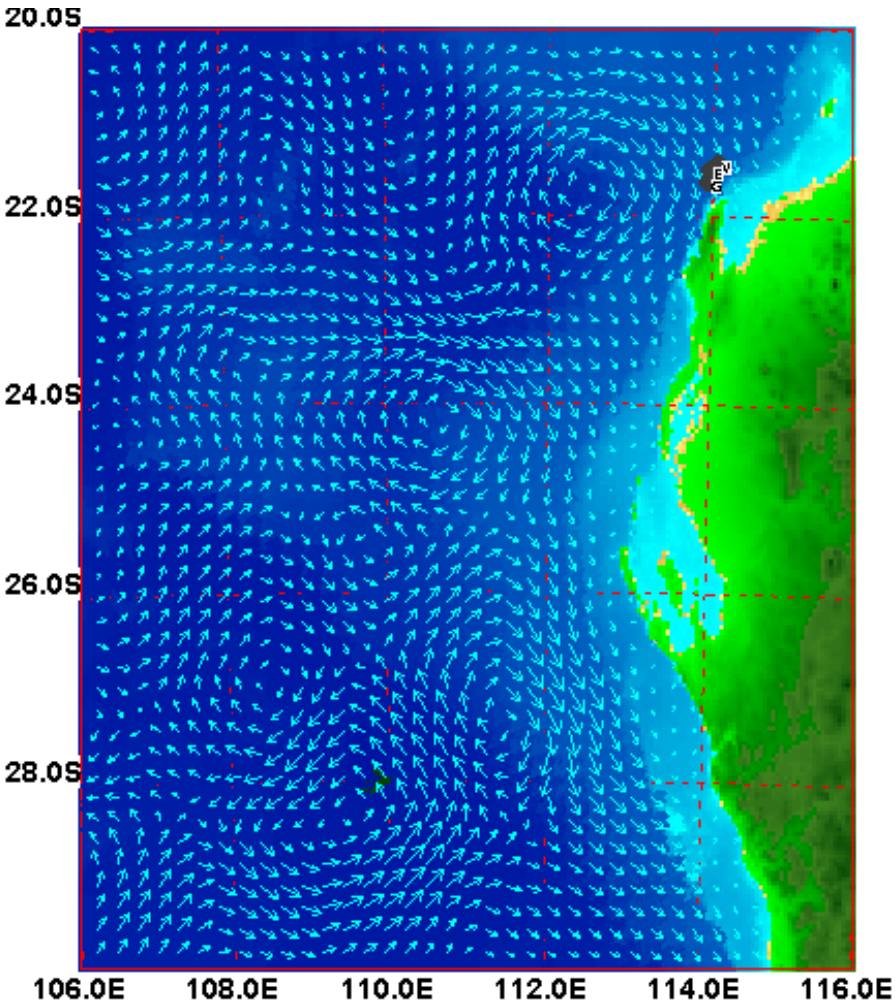


Figure 3-3 Geostrophic Circulations off the Southern North West Shelf and the Western Australia Continental Shelf Modelled with a 3D Ocean Model

Tsunamis

Tsunamis are experienced infrequently on the North West Shelf and tend to originate from disturbances off Indonesia and propagate southwards. The largest sea level disturbances on the North West Shelf from tsunamis are believed to have occurred at North West Cape with relatively smaller changes in sea levels generated on the coast north of that region. Nevertheless, recent simulations commissioned by the Roebourne Shire (GEMS 2009) have shown the possibility of tsunamis generating sea levels in excess of one metre in Nickol Bay.

Shelf Waves

Shelf waves propagating southwards have been observed on the North West Shelf during cyclones, which track parallel to the continental shelf. Tropical Cyclone Alby in 1978 generated a shelf wave with amplitudes of up to one metre, which propagated southwards as far as Bunbury.

Thermal Structure

North West Shelf waters can exhibit significant vertical variation in temperature and density when examined on a large spatial scale. The existence of such stratification can affect the behaviour of plumes, particularly buoyant discharges from near the ocean floor (e.g. pipeline ruptures or hydrotest fluid discharges). The thermal structure varies with meteorological and oceanic conditions and should be investigated with temperature/density vertical profiling instruments. However, at the site-specific scale, little stratification in temperature was recorded during the Marine Baseline Program (Chevron Australia 2009b).

Internal Tides

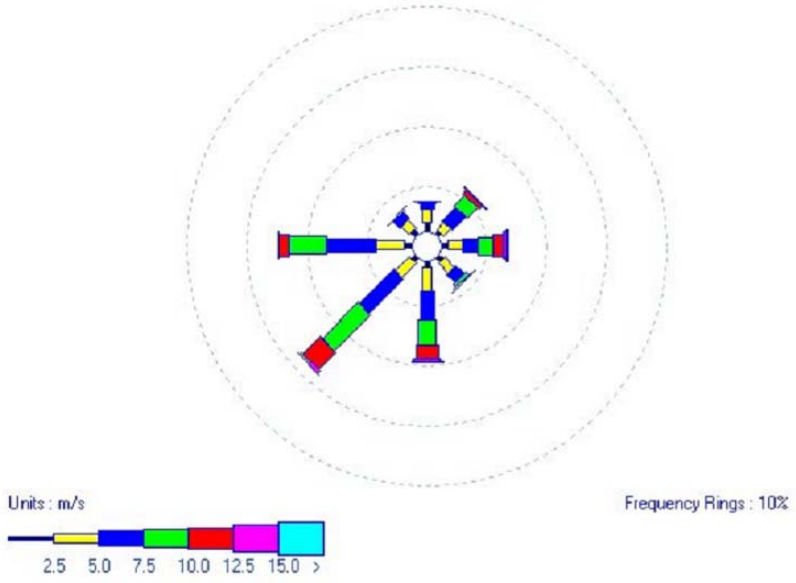
The existence of stratification and strong tides on the Australian North West Shelf can also result in the propagation of internal tides such as those measured at the Woodside North Rankin A platform. Vigorous vertical stirring and mixing near the shelf break occurs, which can generate semidiurnal internal tides (Holloway 2001). These tides steepen as they shoal onto the slope and can develop into an energetic shoreward propagating internal tide of large amplitude; multiple generation sites can occur, coinciding with steep bottom slopes. The internal tide is largely confined to a region in water depths between 70 and 1000 m, where strong generation and dissipation of the internal tide energy is observed and therefore warrants only minor consideration for the east coast of Barrow Island.

3.2.2.3 Meteorology in the Vicinity of Barrow Island

The average annual wind rose from seven years of data at Barrow Island is shown in Figure 3-4. Figure 3-5 shows the wind roses derived from these data for three monthly periods.

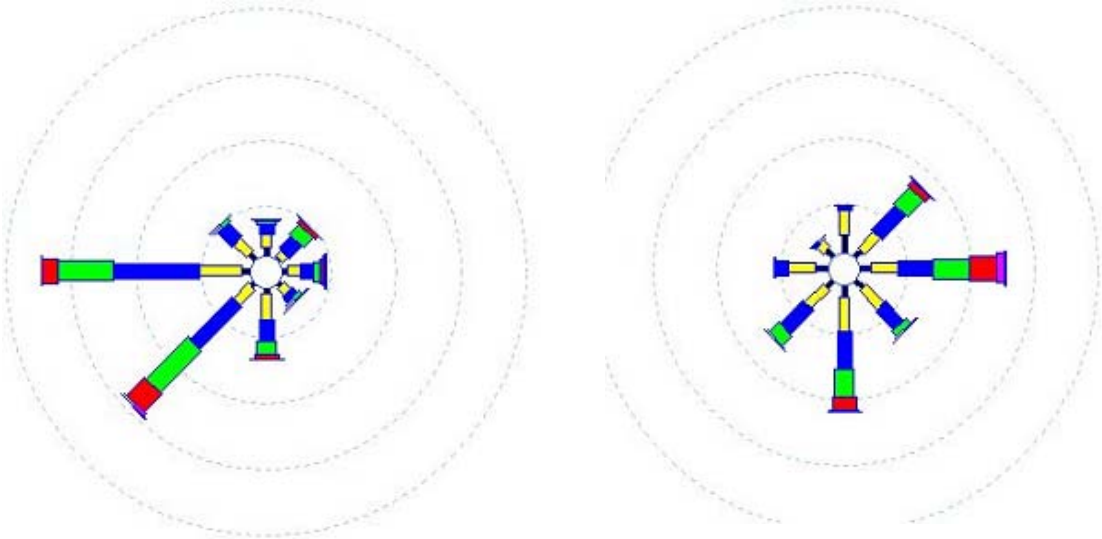
The mean ambient wind speed around Barrow Island during the summer period, October through March, is 6.6 m/s and the maximum summer wind speed is 16.2 m/s. The dominant wind directions during summer are from the south-west and west.

April to September winds approach from the east, south and south-west and have a mean speed of 5.8 m/s and maximum speed of 19.4 m/s. Easterly gales occur between May and August with speeds in the range of 12.5 to 20 m/s (Kellogg Joint Venture Gorgon [KJVG] 2008).



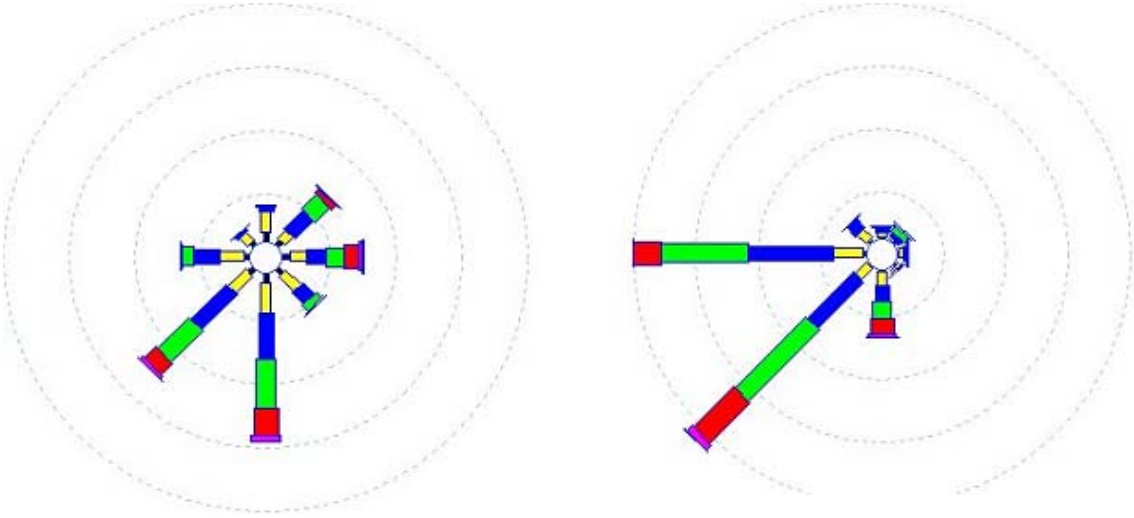
Source: GEMS (2007)

Figure 3-4 The Annual Wind Rose for Barrow Island Derived from Data for the Years 1999 to 2005



January to March

April to June



July to August September to December

Source: GEMS (2007)

Figure 3-5 Quarterly Wind Roses for Barrow Island Derived from the Years 1999 to 2005

Barrow Island is in a region of high tropical cyclone frequency. Between 1960 and 2003, an average of four cyclones passed within 400 nm of Barrow Island each year (MetOcean 2006). Tropical cyclones usually form in the Timor and Arafura seas between November and April. They initially travel in a generally south-westerly direction but as they travel further south, the tracks become more variable. An example of cyclones that passed near Barrow Island in the 2007/2008 cyclone season is shown in Figure 3-6.

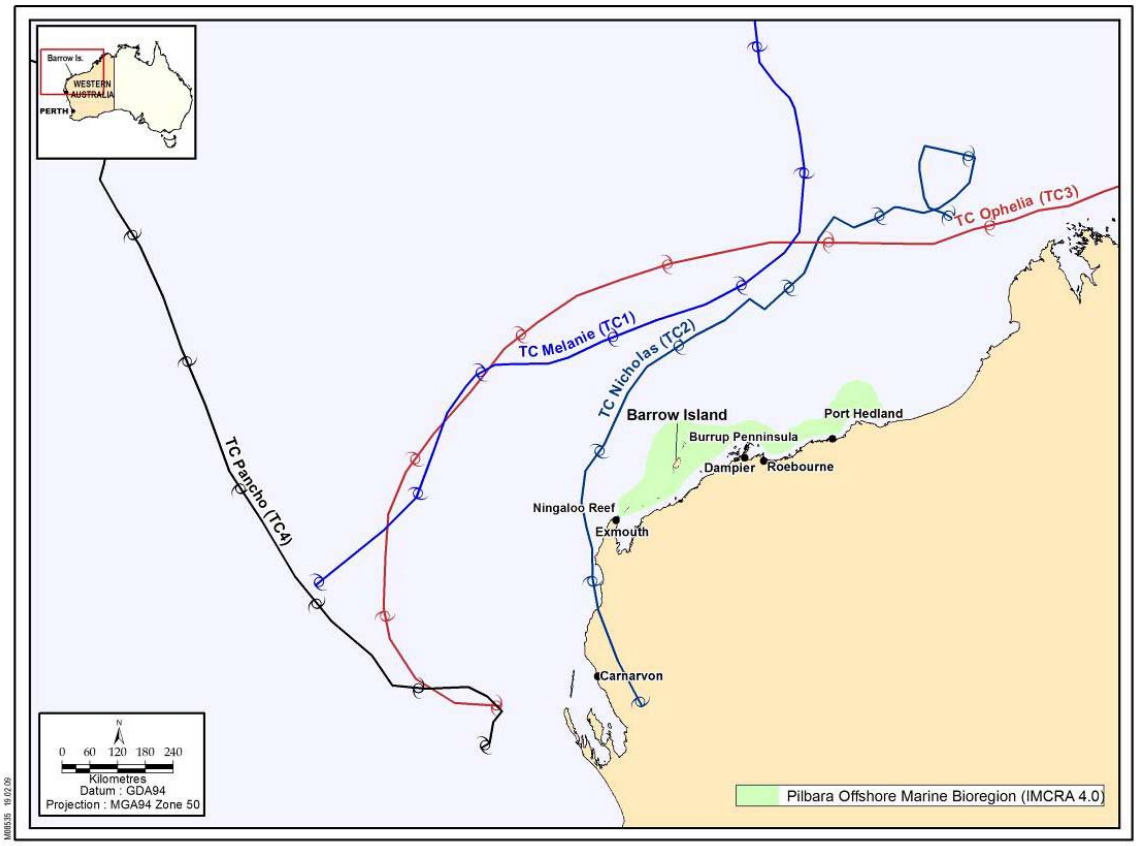


Figure 3-6 Track of Tropical Cyclones Melanie, Nicholas, Ophelia and Pancho that Passed near Barrow Island During the 2007/8 Cyclone Season

3.2.2.4 Oceanographic Influences around Barrow Island

Of the major regional influences, astronomical tides and regional surface wind stress are the dominant contributors to currents in the region of Barrow Island, which in turn is likely to influence turbidity plumes.

Astronomical Tides

Astronomical tides in the Barrow Island region are semidiurnal, comprising two high tides and two low tides per day. There is a significant change in tidal amplitudes around Barrow Island where, for example, the main lunar tidal constituent, M2, undergoes a 100% change in amplitude from one side of the Island to the other. This variation is due to the varied propagation of the tidal wave around Barrow Island where the eastern side bathymetry is very shallow and the western side bathymetry slopes away to the shelf edge. As a result of the shallow bathymetry, the flood tide cannot fully propagate to the coast across the Barrow Shoals, or through the channels between Barrow Island and the Montebello Islands. A large water flux is forced northward along the western side of Barrow Island and then flows to the coast around the northern end of the Montebello Islands. This produces a southward flowing flood tide on the east coast of the Montebello and Barrow Islands. There is a region near the south-eastern end of Barrow Island where this flow meets the flow coming across the Barrow Shoals and they join up to flow towards the coast.

The ebb tide behaves approximately in the reverse manner to the flood tide with the majority of the water flux flowing up the eastern side of the Lowendal Shelf and around the northern end of the Montebello Islands. This tidal flow is the major flushing mechanism for waters from the eastern side of Barrow Island into the open sea. The tidal range varies significantly around

Barrow Island. The maximum spring tidal ranges on the east coast of the Island are just over 4 m (Figure 3-7), whilst on the west coast, the tidal range is less than 2.5 m. The significant tidal ranges and shallow bathymetry result in large areas of exposed seabed on the east coast of Barrow Island at low tide (West Australian Petroleum 1989).

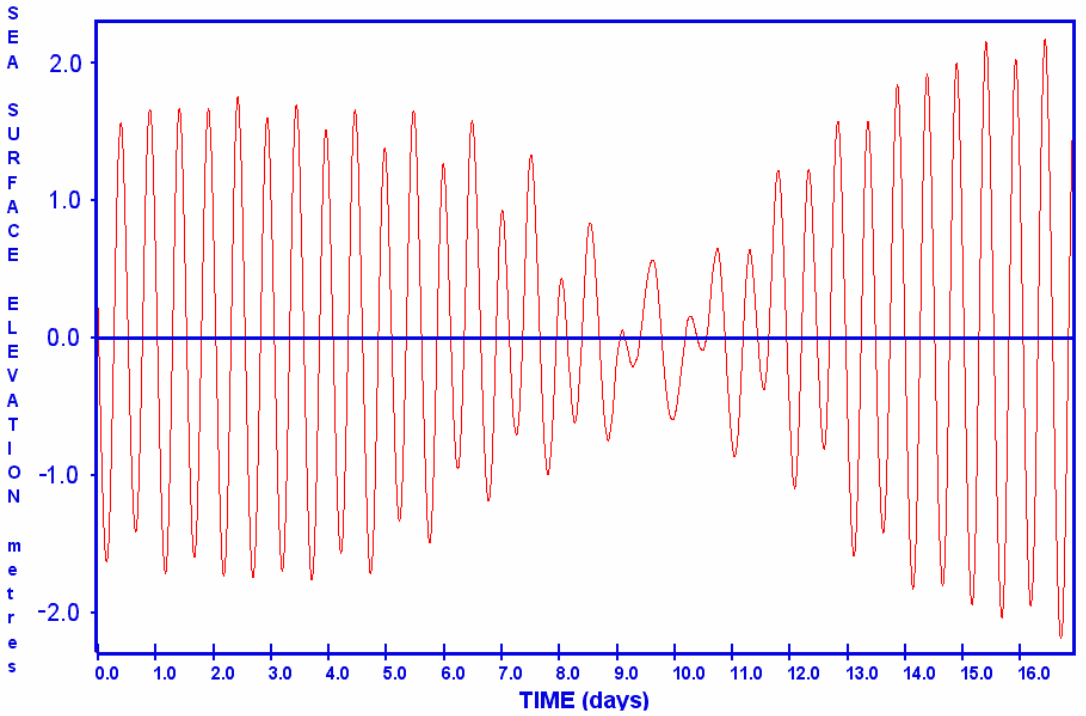


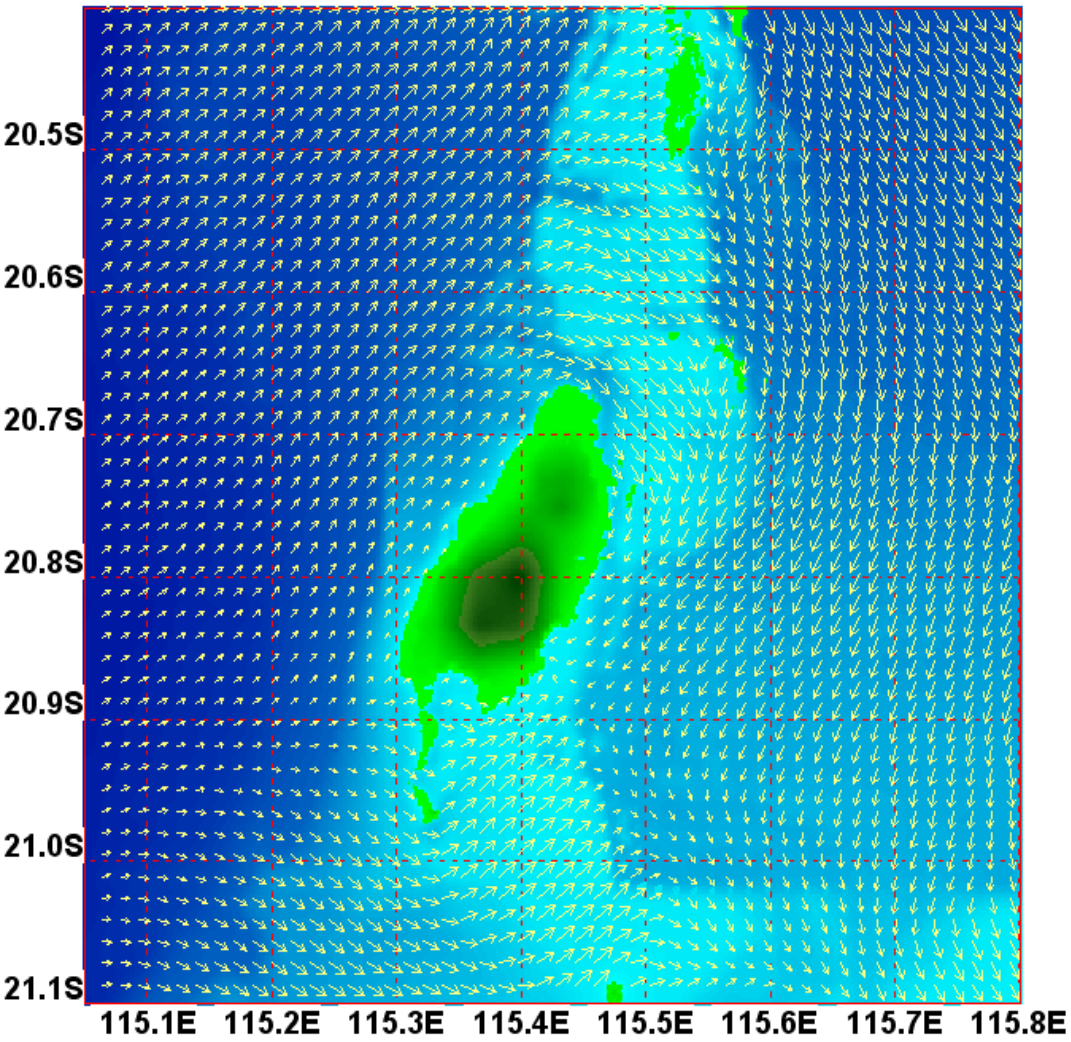
Figure 3-7 Example of Sea Levels Generated by the 15-day Spring–neap Tidal Cycle on the Mainland (east) side of Barrow Island in September 2005

Tidal and Wind-driven Currents

The instantaneous current patterns on the eastern side of Barrow Island are strongly dominated by the barotropic tide and its spring–neap cycle. However, longer term transports over the inner- and mid-shelf are mainly controlled by wind-driven flow, which follows the seasonal switch from summer monsoon winds to south-easterly trade winds in winter. The currents on the eastern side of Barrow Island can be quite strong due to the tidal mechanisms discussed earlier.

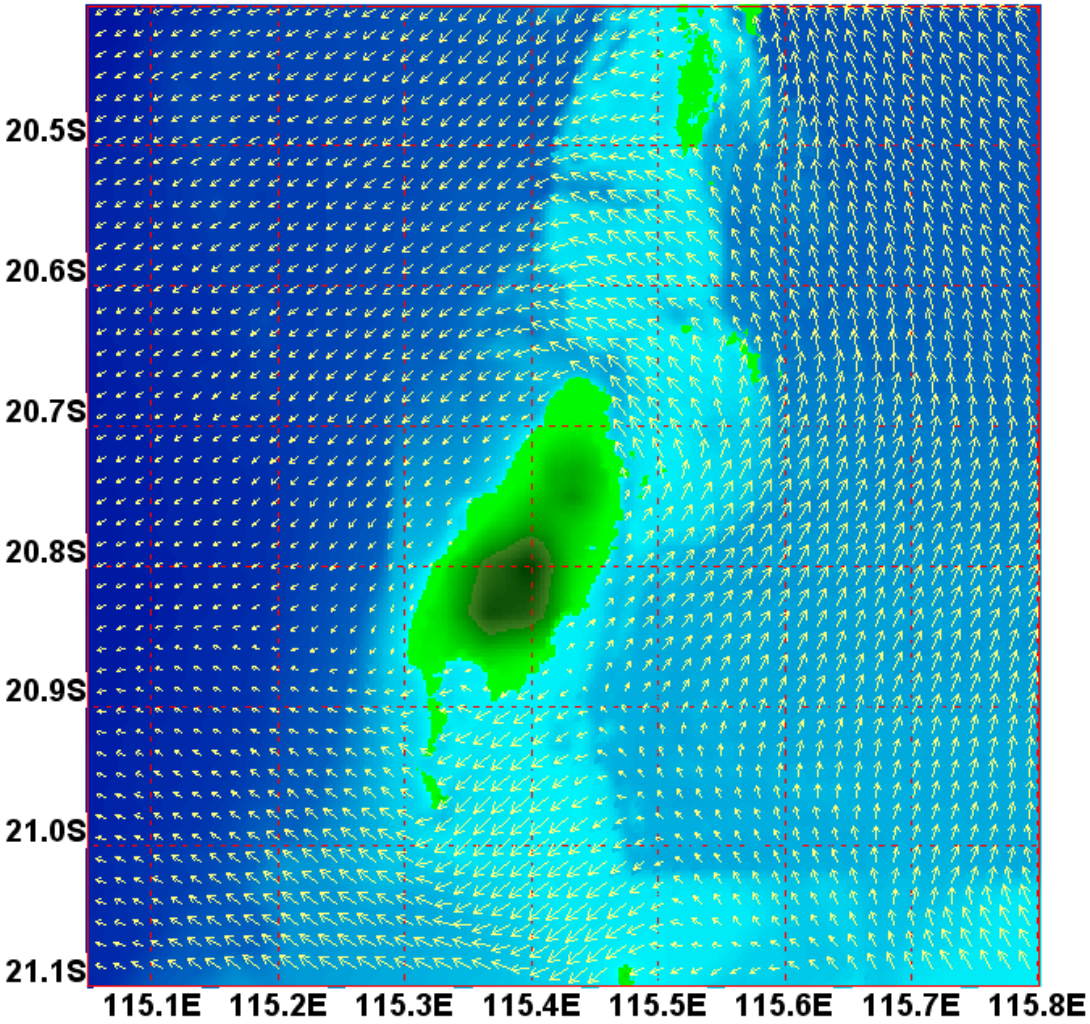
On the western side of Barrow Island, the balance of the driving forces for ocean currents can be more complex. The tidal currents are weaker, particularly in the deeper waters, but satellite imagery indicates that phenomena associated with large-scale ocean circulations in the Indian Ocean, such as eddies and other geostrophic flows, can impinge on the region.

Sample flood and ebb currents around Barrow Island from the verified modelling undertaken by GEMS are shown in Figure 3-8 and Figure 3-9. Current measurements at the LNG tanker mooring confirm the tidal nature of these currents, reflecting a distinct flood flow towards the south-west and an ebb flow towards the north-east (Figure 3-8 and Figure 3-9) (ChevronTexaco Australia 2003). The maximum current speed measured at the LNG tanker mooring has been recorded at 0.62 m/s (Figure 3-10).



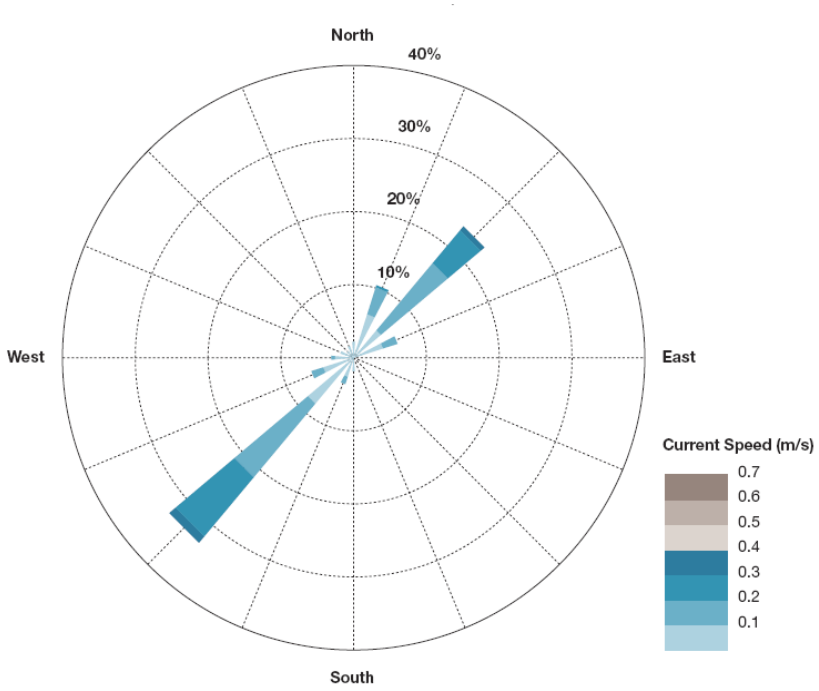
Source: GEMS (2007)

Figure 3-8 Example of the Flood Tide near Barrow Island



Source: GEMS (2007)

Figure 3-9 Example of the Ebb Tide near Barrow Island



Source: Chevron Texaco Australia (2003)

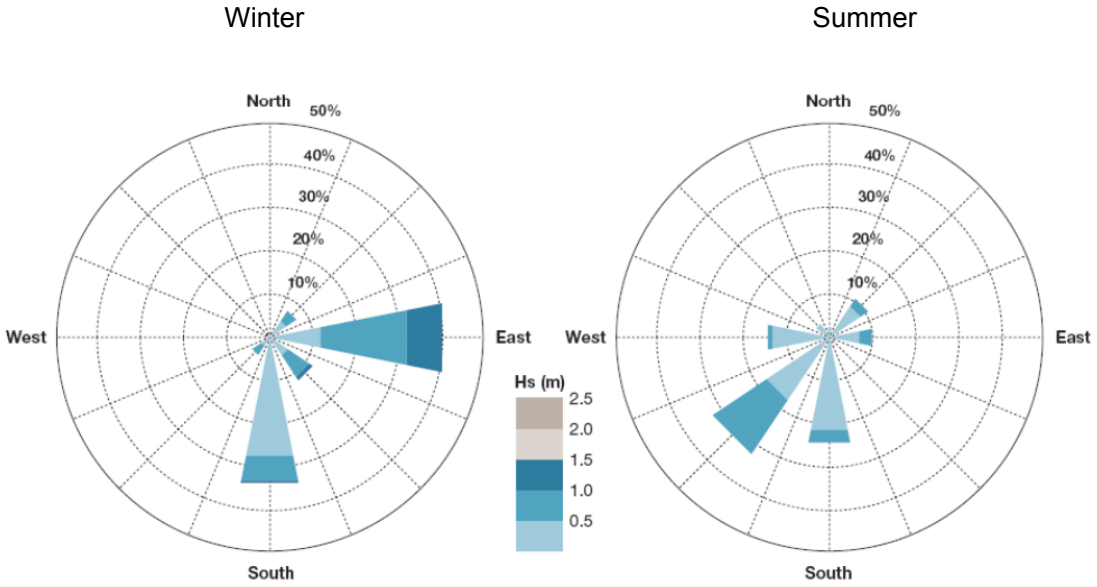
Figure 3-10 Example Surface Currents (Summer) Measured at the Tanker Mooring, 9 km East of Barrow Island

Waves

The south-western to north-western sides of Barrow Island are exposed to the open ocean and a relatively vigorous wave climate, bringing long period southern ocean swells and shorter period local wind waves, particularly during times of sustained southerly winds. At times, the southern ocean swell can refract around the northern and southern ends of the Island, but the shallow bathymetry prevents significant wave propagation (ChevronTexaco Australia 2003).

As the eastern side of Barrow Island is protected from ocean swells, the greatest wave activity on the eastern shoreline occurs during periods of strong easterly winds, mostly during winter (ChevronTexaco Australia 2003). This result is illustrated in Figure 3-11, which shows a wave rose for the winter and summer months derived from data measured at the current condensate (oil) Tanker Loading Facility, 9 km east of Barrow Island.

The mean significant wave height at the MOF is 0.47 m; with a mean maximum wave height of 2.11 m. Town Point is largely sheltered from the westerly swell by Barrow Island and the shallow reef system to the south. Maximum wave heights, therefore, are mostly a result of tropical cyclones. However, the maximum wave heights at the MOF are limited by the shallow bathymetry (KJVG 2008).



Source: Chevron Texaco Australia (2003)

Figure 3-11 Combined Wave Field Data for Winter and Summer Months at the Tanker Loading Facility, 9 km East of Barrow Island

Other Drivers of Ocean Circulation around Barrow Island

Due to Barrow Island's location on the continental shelf, separated from both the continental shelf edge and the coast by a significant distance, the Island is not likely to be affected to any great extent by large-scale ocean circulations such as the Leeuwin Current and associated eddies. This conclusion is particularly relevant to the eastern side of the Island, which is isolated from the continental shelf edge. Internal tides have been measured at the Woodside North Rankin A platform and could be a factor on the west side of Barrow Island but would not be expected to occur between Barrow Island and the coast.

Tropical Cyclone Storm Surge and Waves

During Tropical Cyclone Olivia (April 1996), Barrow Island experienced a storm surge of just under four metres, together with hurricane force winds, strong currents and large breaking waves. This event emphasised the need to establish the return period of storm surge flood levels and waves for the planning of coastal and shore facilities at Barrow Island.

Tsunamis

Tsunamis have been shown to amplify as they move southward along the continental shelf towards North West Cape where events with amplitudes of greater than three metres have occurred. Again, the location of Barrow Island, isolated from the mainland coastline, reduces the possibility of large tsunamis occurring at the Island. The eastern side of the Island is particularly unlikely to experience significant tsunamis due to its protection from the open ocean.

3.2.3 Water Quality

The results from the baseline water quality (light and turbidity) and sediment deposition monitoring program indicate that in the waters around Barrow Island, turbidity and concentrations of suspended sediments were generally low (<5 mg/L) and indicative of clear water environments. There were very low levels of sediment deposition over the duration of the baseline program (below the limits of instrument detection) and any deposition that did occur was temporary and rapidly resuspended by waves and tidal flow.

At most sites, wind-generated wave activity was significant in contributing to local re-suspension of sediments resulting in elevated turbidity and suspended sediment concentrations. The majority of the sites are exposed to wind-generated waves from easterly winds, and suspended sediment concentrations were therefore generally higher during winter when easterly winds are more common. Extreme weather events, such as tropical cyclones, also had a strong influence on water quality. Eight tropical cyclones (TCs) were recorded off the Western Australian coast near Barrow Island during the 2007/8 and 2008/9 cyclone seasons (Figure 3-12). The most notable effect of cyclones on water quality across the monitoring sites was during TC Nicholas (TC2 on Figure 3-12) and TC Dominic (TC7 on Figure 3-12). Short periods of elevated suspended sediment concentrations and reduced light levels and elevated light attenuation as a consequence of increased turbidity in the water column, coincided with the passage of tropical cyclones. Higher average particle flux rates were also recorded during periods of increased wave activity and elevated suspended sediment concentrations, as well as following the passage of a tropical cyclone. Conversely, relatively low flux rates were observed during extended periods of calm conditions.

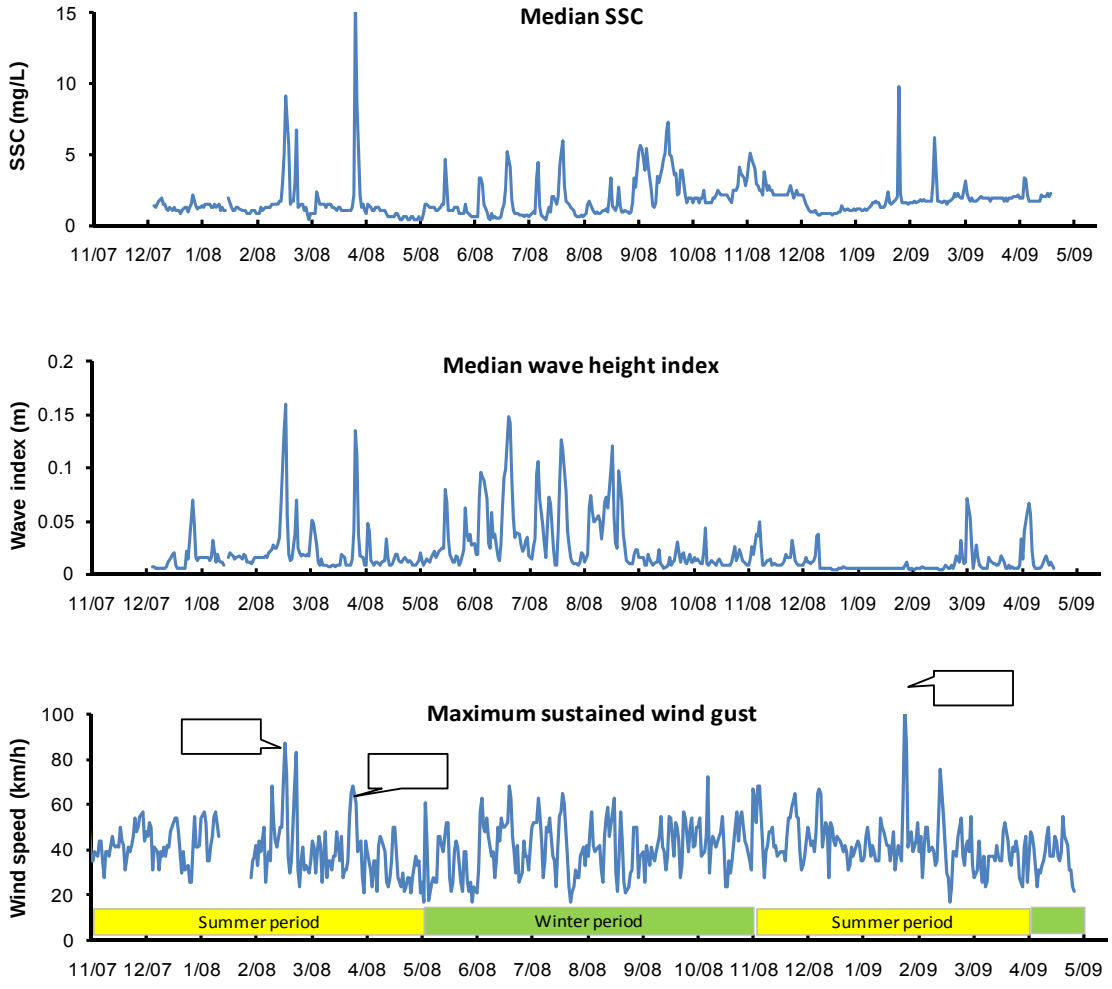


Figure 3-12 Example Time Series Plots of SSC, ASSD and RMS Water Height at the LNG2 Monitoring Site

Water column profiles consistently demonstrate that the water column was well mixed, indicative of an offshore environment with limited influence from surface water run-off and groundwater inflow.

Seabed light levels were primarily influenced by depth and there were seasonal patterns in the daily average light levels at most sites, with the summer values generally higher than in winter.

The Marine Baseline Program (Chevron Australia 2009b) indicates that there is considerable variability, with water quality and sediment deposition varying markedly between sites in close proximity to each other, and seasonal patterns, such as higher light levels in summer than in winter, more evident at some sites than others. Similarly, the influence of environmental parameters on water quality also varied over relatively small spatial scales.

Sedimentation and turbidity are major influences on the health and survival of scleractinian corals and other benthic primary producers (BPP) through alteration of both physical and biological processes. The extent and severity of impacts related to turbidity, light attenuation and sedimentation are highly variable and depend on a number of factors including the species and morphology of corals, sediment grain size, and water temperature (Rogers 1990). Additionally, the magnitude, duration and frequency of turbidity and sedimentation events, as well as the pre-event condition of the coral, also affects the extent and severity of impacts. Coral health data collected during the Marine Baseline Program showed no discernible impacts on coral health associated with water quality (turbidity and light attenuation) or sediment deposition.

3.2.3.1 Contaminants in the Water Column

Background contaminant concentrations in the seawater around Barrow Island were mostly below the respective Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ) 2000 water quality guidelines (RPS Bowman Bishaw Gorham 2007). Concentrations of all trace metals, other than cadmium, were below laboratory reporting limits. Although cadmium concentrations were above laboratory reporting limits, they were relatively consistent among samples from both the east and west of Barrow Island (1.2–1.6 µg/L), and are likely to reflect natural background conditions rather than anthropogenic contamination (RPS 2007). Hydrocarbons (total petroleum hydrocarbons, BTEX, oils and grease), phenol and tributyltin (TBT) concentrations were equal to or below the respective laboratory reporting limits at the majority (greater than 50%) of sampling sites.

Chlorophyll a concentrations in nearshore waters were relatively low, while concentrations of some nutrients (ammonia, orthophosphate, and nitrate/nitrite) occasionally exceeded the respective ANZECC/ARMCANZ (2000) guidelines for 99% species protection. On occasions when nutrient concentrations exceeded the guidelines, these generally occurred across a number of sampling locations within a large area rather than within a discrete site.

Slightly elevated levels of radionuclides have been detected near Barrow Island. No pesticides were detected in any of the seawater samples collected.

3.2.4 Sediment Quality

3.2.4.1 Sediment Characteristics

A geotechnical seafloor survey was undertaken by Worley Parsons Pty Ltd between 5 July and 2 August 2004 as detailed in the EIS/ERMP (Chevron Australia 2006). Based on these investigations, the following sediment layers were identified within the Gorgon Gas Development area:

- **Marine Sediments**: Superficial soils (predominantly carbonate sands). Considered to be mobile where they occur between Town Point and the -6 m LAT contour. Elsewhere, sediments are less likely to be mobile as they occur beneath a thin surface mantle of coastal limestone or have been shown to be cemented in some places. The marine sediments are of variable relative density (loose to medium dense).
- **Calcrete**: This is a minor unit in the nearshore environment. It is not extensive (it was only encountered in two boreholes over depth increments of less than 1 m). It is characterised by

very high strength crystalline limestone rock and is well-represented onshore within the Gas Treatment Plant site.

- **Coastal Limestone**: Rocks within this category are of quaternary age and have been formed by the recementation of gravels, sands and silts, and hence have a broad range of grain sizes from calcilutites, calcisiltites to calcarenites and calcirudites. The distinction between this unit and the underlying Upper Limestone is often not distinct and subject to some judgement. The Coastal Limestone may be classified as a medium strength rock or stronger as defined in Australian Standard (AS) 1726-1993 (Standards Australia 1993).
- **Upper Limestone Soils**: This is a soil unit comprising of a range of soils from sands to plastic clays. It exists within the Upper Limestone layer as cavity infill. It is not an extensive unit in the nearshore environment and exists at depth.
- **Upper Limestone**: This is a rock unit comprising of predominantly rocks with sand-sized grains or larger (i.e. calcarenites and limestone). At least 75% of the point load test results were greater than 0.83 MPa, indicating that the rock is generally of a medium strength in terms of AS 1726-1993.
- **Silica Sand**: This is a sand unit comprising of predominantly silica sands. It was only intersected in a few deep boreholes drilled in the MOF area, and its presence is not certain along the jetty alignment.
- **Lower Limestone***:* The Lower Limestone unit is known to be located below the Silica Sand unit based on the results of onshore drilling. However, none of the nearshore boreholes were drilled deep enough to intersect this unit. It is too deep to affect the nearshore development.

Within the vicinity of the MOF, diver-based surveys undertaken as part of studies for the Marine Baseline Program encountered thin veneers of surficial sediments overlying solid limestone pavement. The mobile sediments were largely comprised of fine to medium grained sands, with gravel fractions accounting for up to 20% of the volume (Chevron Australia 2009b).

On the eastern boundary of the natural channel (where the turning basin is to be located) some surficial sediment samples had elevated mud fractions, with muddy sand commonly observed. In these samples, clay and silt fractions accounted for more than 10% of the particles, suggesting a greater deposition of finer particles.

Sediments on the elevated ridge in the vicinity of the LNG channel were mainly comprised of gravel fractions of varying sediment depths overlying the limestone pavement ridge. Samples containing high levels of gravel fractions (>40%) were common, probably due to shell grit and from coral rubble generated by the bombora fields and scattered coral colonies that occur along this ridge.

3.2.4.2 Sediment Quality and Contaminants

Marine sediments in the vicinity of the Marine Facilities have been investigated as part of the studies for the Gorgon Gas Development EIS/ERMP and PER documents (Chevron Australia 2006, 2008). Sediments in the Barrow Island area are generally undisturbed, with the exception of some areas of localised impact from previous and existing activities (e.g. petroleum exploration and production).

Sediment quality data indicates that most of the contaminant concentrations at majority of sites were either below laboratory reporting limits or below ANZECC/ARMCANZ (2000) Interim Sediment Quality Guideline (ISQG) low trigger values. The contaminants that were detected and exceeded the relevant ANZECC/ARMCANZ (2000) ISQG trigger value were silver and Tributyl Tin (TBT).

3.3 Existing Biological Environment

Surveys of the ecological elements listed in Condition 14.2 of Statement No. 800 and Condition 11.2 of EPBC Reference: 2003/1294 and 2008/4178 were undertaken in 2007 and 2008 and 2009 as part of the Marine Baseline Program (Chevron Australia 2009b). Surveys to date have included: hard and soft corals, macroalgae, non-coral benthic macroinvertebrates, seagrass, mangroves and surficial sediment characteristics. Figure 3-13 shows the benthic ecological assemblages and Figure 3-14 shows the surficial sediment characteristics in the waters around Barrow Island. Note: In Figure 3-13, 'Quantified Coral' represents those polygons that have been confirmed as coral assemblages in a quantitative manner (i.e. quadrats or transects) and those confirmed as coral assemblages in a qualitative manner (i.e. visual estimation) as having cover >10%; 'Unquantified Coral' represents those polygons that are, or may be, potential coral features, which have been identified or refined using survey data (e.g. remote imagery, in situ surveys), but for which there are insufficient data for them to be classified as 'Quantified Coral'; 'Unconfirmed Coral' is unchanged from the Department of Conservation and Land management (CALM) (2004) map (Chevron Australia 2009b). 'Macroalgae with Sparse Sessile Taxa' includes assemblages dominated by macroalgae with seagrass and non-coral benthic macroinvertebrates at subdominant levels of cover, and 'Soft Sediment with Sparse Sessile Taxa' predominantly represents unvegetated bare sand with patches of seagrass and non-coral benthic macroinvertebrates at subdominant levels of cover, the boundaries of which could not be accurately mapped (Figure 3-13).

Very few EPBC listed species were encountered during these surveys, although the programs were not designed to examine the distribution of such species. Instead, programs focused on habitats that support common and EPBC listed species. The likely distribution of EPBC listed species in the vicinity of the Marine Facilities was assessed through desktop studies (Table 3-2).

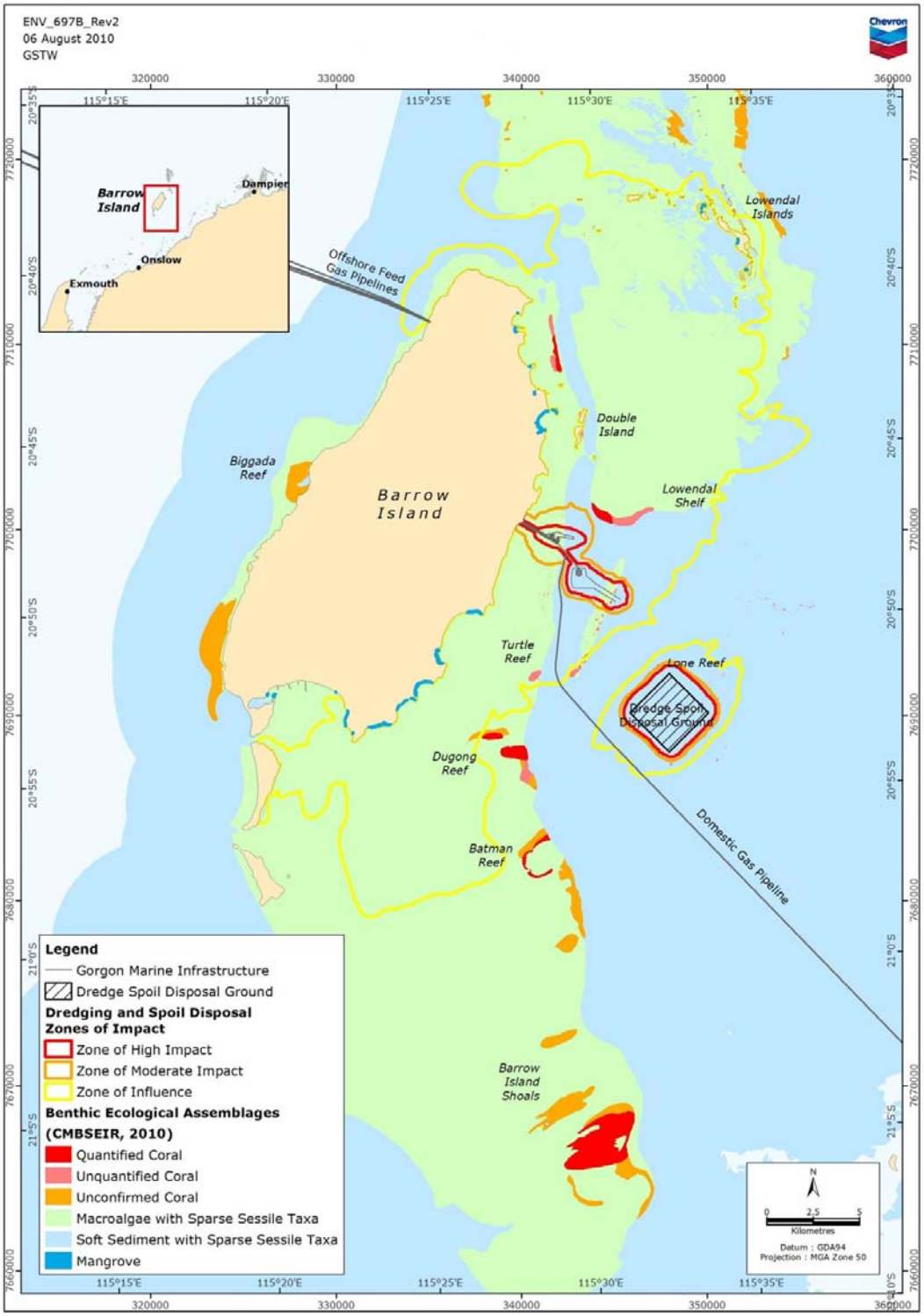


Figure 3-13 Benthic Ecological Assemblages

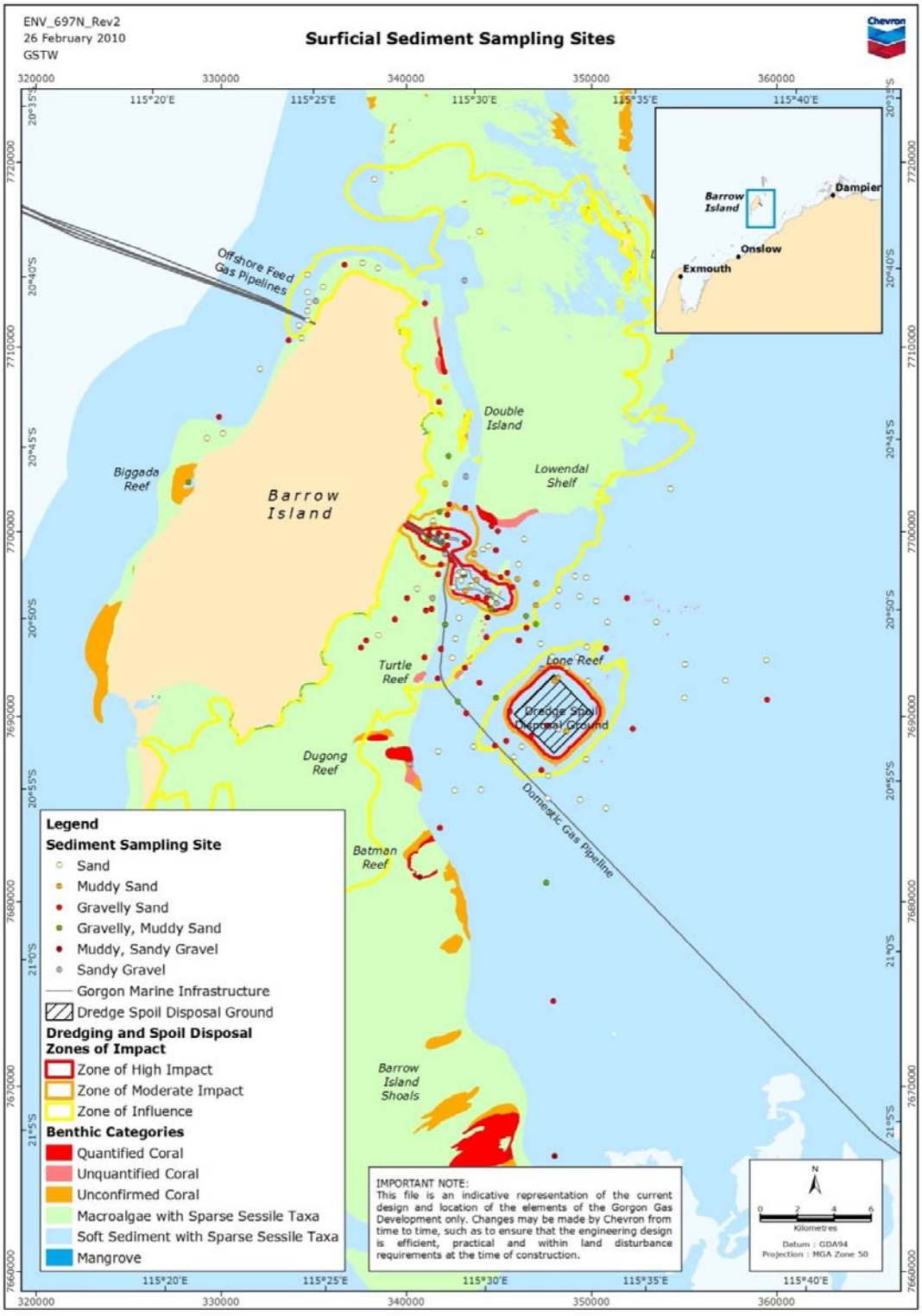


Figure 3-14 Surficial Sediment Characteristics

3.3.1 Marine Habitats

The shallow, rocky platforms that surround Barrow Island provide suitable habitat for a range of BPPs, including corals and macroalgae. In addition, silt layers overlying the rocky substrate provide suitable habitat for sparse patches of seagrass, in some areas.

3.3.1.1 Corals

Coral Habitat

Broad-scale habitat mapping and intensive ground truthing identified several major reef areas around Barrow Island (Figure 3-14) (Chevron Australia 2009b). Corals are abundant BPP around Barrow Island, occurring in a variety of growth forms. Coral reefs and coral bomboras are restricted to water depths where sufficient light penetrates the water column to support photosynthesis. Coral reefs, bomboras and coral pavements are found on both the east and west coasts of the Island (Chevron Australia 2009b). The most significant coral reefs around Barrow Island include Biggada Reef on the west coast, Dugong Reef and Batman Reef off the south-east coast of the Island and Southern Lowendal Shelf off the east coast.

The distribution of corals around Barrow Island was found to be patchy, with variable community composition and variable percentage cover. Coral bomboras are scattered across limestone pavement along the eastern side of the Island, along the eastern side of the Town Point subtidal pavement, and across the Southern Lowendal Shelf (Chevron Australia 2009b).

There was moderate variation among sites in percentage cover of live coral among sites as well as differences in the composition of coral communities across Barrow Island. In general, *Porites* spp. hard corals dominated assemblages that occurred closest to the main construction and dredging areas, while *Acropora* spp. dominated larger coral banks, such as within the Lowendal Shoals Site (LOW). A full description of the composition of coral assemblages at each of the monitoring sites is provided in the Marine Baseline Report (Chevron Australia 2009b).

Coral Bleaching

No instances of coral bleaching were observed at any of the sites surveyed between May and December 2008, nor in the mortality/growth studies. Similarly, no corals have been observed producing excess amounts of mucus.

3.3.1.2 Macroalgae and Mixed Sessile Benthic Communities

Macroalgae are the most common form of BPP on the subtidal pavement on the east coast of Barrow Island (Figure 3-14), often interspersed with sparse sessile benthic invertebrate assemblages and coral bombora (Chevron Australia 2009b). Subtidal areas of bare sand are common along the east coast of the Island, and where hard substrate is present, it is commonly colonised by macroalgae or mixed, sessile benthic invertebrate assemblages. In deeper areas where light becomes limited, sessile benthic macroinvertebrates such as gorgonians, sea whips and sponges are more common (Chevron Australia 2009b). The distribution of these sessile benthic macroinvertebrates appears linked to two factors: the availability of hard substrate for settlement, and the absence of macroalgal-dominated communities (Chevron Australia 2009b).

3.3.1.3 Seagrass

Seagrass beds, usually composed of *Halophila* spp., are patchily distributed on some sand habitats off the east coast of Barrow Island and in sandy habitats to the south of the Southern Lowendal Shelf. No obvious seagrass meadows were found to occur within the waters surrounding Barrow Island, or within the MDF (Chevron Australia 2009b).

3.3.1.4 Mangroves

A single species of mangrove, *Avicennia marina*, grows on Barrow Island. This species is associated with sheltered embayments on the south and east coasts of the Island where it grows in thin bands in soft sediments of the intertidal zone (Chevron Australia 2009b).

Mangrove assemblages are also sparsely distributed from Bandicoot Bay to Shark Point, with a small assemblage also found further north at Mattress Point. There are no mangroves within the MDF. The closest mangroves to any construction activities are in a small area at Donald River mouth, approximately 5 km north of Town Point (Chevron Australia 2009b).

3.3.1.5 Habitats within the MOF Footprint

The MOF causeway extends over a limestone pavement reef east of Town Point. This shallow pavement habitat slopes gently into the lower intertidal and subtidal zones approximately 200 m seaward from the boulder zone. There is a large shallow lagoon surrounding Town Point, with a narrow break in the platform open to the sea (RPS Bowman Bishaw Gorham 2005). The subtidal section of the limestone pavement within the footprint of the MOF supports macroalgae, seagrass, benthic invertebrates, hard and soft corals and a demersal fish assemblage associated with both macroalgae and coral habitats.

The nearshore footprint of the MOF causeway varies from almost bare exposed rock, to low turf, to abundant macroalgae in the rock pools and the lower intertidal zone. The upper intertidal pavement is covered in sediment veneers of varying thicknesses and is mostly bare of macroalgae, apart from low turfing red algae in areas free from sediment. Rock pools support macroalgae (*Sargassum* spp. and *Cystoseira* spp.) and seagrass in varying abundance, ranging from occasional plants to small meadows. Seagrasses include *Halophila* spp., *Halodule* sp. and *Thalassia* sp. (RPS Bowman Bishaw Gorham 2005).

The lower intertidal rock platform has less sediment cover and supports macroalgae and seagrass, as well as scleractinian corals (hard corals) and octocorals (soft corals). The coral assemblage is dominated by *Goniastrea* spp., with some specimens exceeding 80 cm in diameter (RPS Bowman Bishaw Gorham 2005).

The subtidal limestone pavement offshore from Town Point is overlain by a thin veneer of sediment and is generally covered by *Sargassum* spp., with other macroalgae such as *Padina* spp. and *Dictyopteris* spp. also common. Less common species included *Udotea* spp. and *Halimeda* spp. Sparse seagrass is also present, predominantly the genus *Halophila*, with *Syringodium* sp. less common. A mixed, sessile benthic invertebrate assemblage is present on this pavement. The assemblage is sparsely distributed and the most abundant benthic invertebrates present are hydroids and ascidians.

The hard corals near the MOF are predominantly bombora, located on the limestone pavement. These coral bombora tend to be composed of a mixed assemblage of *Poritidae, Acroporidae*, *Mussidae, Faviidae*, and *Pectinidae*. The bombora found inshore on this pavement tend to have a greater abundance of macroalgae, whereas the bombora on the offshore side of the pavement tend to have a greater abundance of live coral cover. The majority of bombora are relatively small (<2 m in diameter), but several larger bombora do occur near the MOF. The distribution of benthic habitats in relation to the Marine Facilities is presented in Figure 3-15.

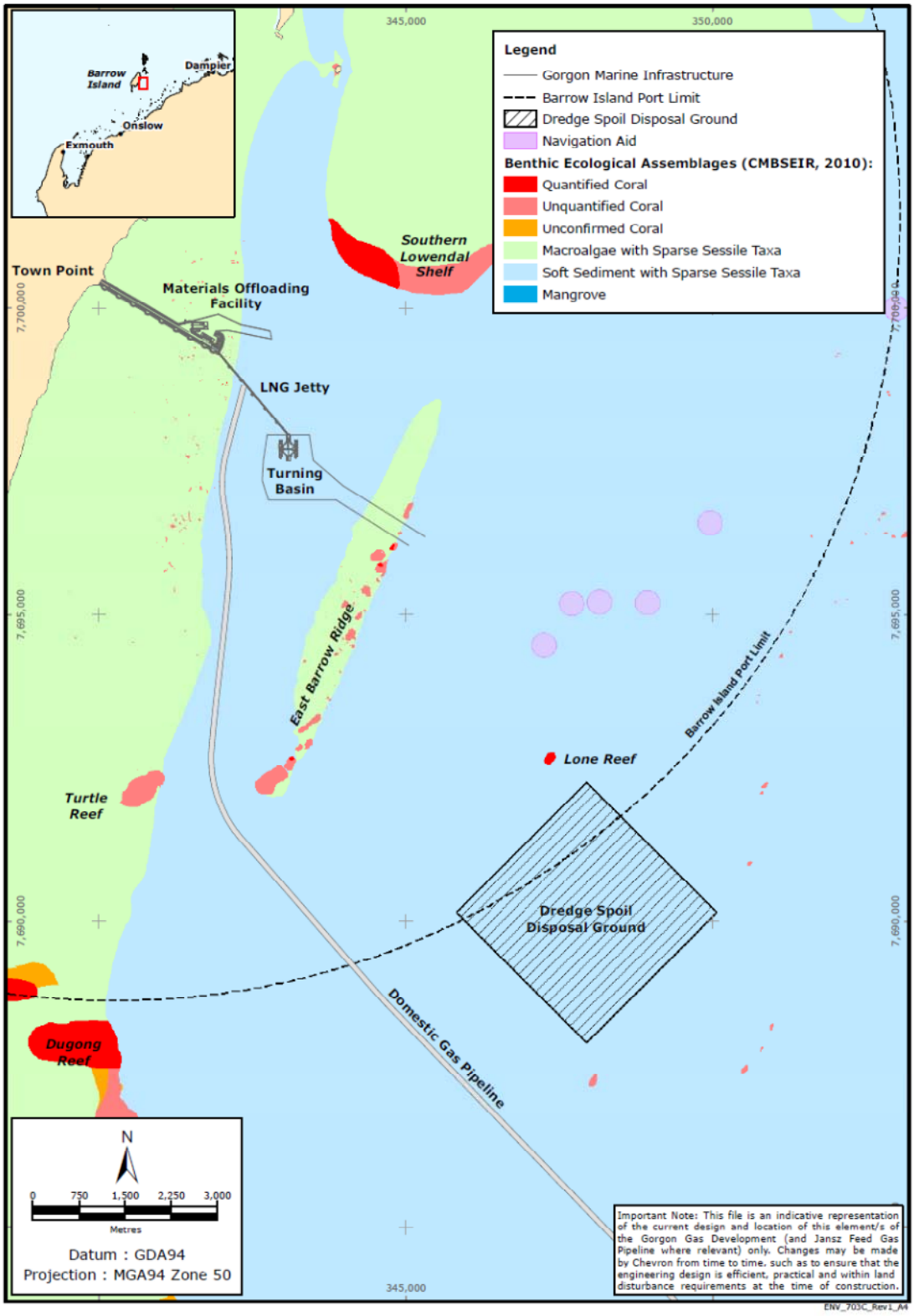


Figure 3-15 Marine Habitats in the Vicinity of the Marine Facilities

3.3.1.6 Habitats within the Footprint of the LNG Jetty and LNG Access Channel

The inshore section of the proposed LNG Jetty will cross the previously described subtidal limestone pavement. The most common biota on this pavement is macroalgae, interspersed with scattered small hard corals (*Acropora* spp. and *Turbinaria* spp.) and *Porites lobata* bombora*,* as well as a sparse cover of seagrass and benthic invertebrates are also present. The benthic invertebrate assemblage present comprises ascidians, hydroids, sea whips and sponges.

Further offshore, the LNG Jetty is located in an area of sand habitat with sparse benthic invertebrates, including sponges and sea whips growing on rock protrusions within the sandy substrate. There is little seagrass, macroalgae or coral on this sand habitat within the footprint of the LNG Jetty.

Further offshore, the LNG Access Channel will traverse East Barrow Ridge – a raised limestone pavement habitat. This limestone ridge supports scattered small hard corals and several large bombora. There are two large bombora which are dominated by *Porites lobata* and *Porites australiensis* within the proposed LNG Access Channel.

Macroalgae is common on East Barrow Ridge, but occurs only sparsely within the proposed LNG Access Channel. *Sargassum* (*S. decurrens, Sargassum* spp.) are the most common macroalgae in this area. *Udotea* spp., *Halimeda* spp. and calcareous red algae are also present. The area of East Barrow Ridge proposed for the LNG Access Channel contains relatively abundant benthic invertebrates. Sea whips are the most abundant benthic invertebrates in this area, with *Turbinaria* (coral), sponges and soft corals all common in low numbers.

3.3.1.7 Habitats within the Footprint of the WAPET Landing

Diver-based ecological surveys undertaken in 2006 at WAPET Landing (BBG 2006) identified a range of habitats including sand overlying limestone with patchy distribution of sponges and small turfs of macroalgae including *Sargassum* and *Dictyopteris*. Other habitats include a thin veneer of sand and shell grit overlying a hard relatively flat limestone pavement supporting both *Sargassum* and *Dictyopteris* (BBG 2006). The red and brown macroalgae communities in the vicinity of WAPET Landing are typical of the habitat found in the inshore waters on the east coast of Barrow Island and are not considered to be of local or regional significance (BBG 2006).

The small, spare patches of seagrass (*Halodule* sp.) occasionally observed in sand were low density and not considered significant seagrass beds. In general, the highly mobile sand on the inshore pavement restricts the settlement and establishment of seagrasses (BBG 2006).

Table 3-1 presents a summary of flora and fauna species observed during the WAPET marine ecological survey (BBG 2006).

Table 3-1 Flora and Fauna recorded during the WAPET Landing Marine Survey

Flora/ Fauna Type	Genus
Macroalgae (Brown)	*Dictyopteris*
	Sargassum
	Padina
Macroalgae (Green)	*Caulerpa*
	Halimeda
	Codium
Macroalgae (Red)	*Champia*
	Eucheuma
	Asparaopsis

Flora/ Fauna Type	Genus
Seagrass	*Halodule*
Sponge	Branching cup

3.3.2 Marine Fauna

This section focuses on the marine mammals, marine reptiles, fish and marine avifauna, which may occur within the vicinity of the Marine Facilities. Particular attention is paid to species listed under the EPBC Act (Cth) and the *Wildlife Conservation Act 1950* (WA). EPBC listed species likely to occur within Barrow Island waters are shown in Table 3-2.

Although monitoring programs were not designed to examine the distribution of significant marine fauna, such as dolphins, dugongs, whales and sea snakes, monitoring programs focused on recording habitats that support these fauna and any opportunistic sightings of marine fauna of significance were concurrently recorded. There are no known species that are endemic to either Barrow Island waters or to the more specific location of the Marine Facilities.

Table 3-2 EPBC Act Listed Threatened Fauna Species and Listed Migratory Species that may occur in the vicinity of the Marine Facilities, Barrow Island

Species	Scientific Name	EPBC Act (Cth) Status
Marine Mammals		
Humpback Whale	*Megaptera novaeangliae*	Vulnerable, Migratory, Cetacean
Blue Whale	*Balaenoptera musculus*	Endangered, Migratory, Cetacean
Bryde's Whale	*Balaenoptera edeni*	Migratory, Cetacean
Killer Whale (Orca)	*Orcinus orca*	Migratory, Cetacean
Dusky Dolphin	*Lagenorhynchus obscurus*	Migratory, Cetacean
Irrawaddy Dolphin	*Orcaella heinsohni*	Migratory, Cetacean
Indo-Pacific Humpback Dolphin	*Sousa chinensis*	Migratory, Cetacean
Dugong	*Dugong dugon*	Migratory, Marine
Marine Reptiles		
Olive Ridley Turtle	*Lepidochelys olivacea*	Endangered, Migratory, Marine
Loggerhead Turtle	*Caretta caretta*	Endangered, Migratory, Marine
Leatherback Turtle	*Dermochelys coriacea*	Vulnerable, Migratory, Marine
Hawksbill Turtle	*Eretmochelys imbricata*	Vulnerable, Migratory, Marine
Flatback Turtle	*Natator depressus*	Vulnerable, Migratory, Marine
Green Turtle	*Chelonia mydas*	Vulnerable, Migratory, Marine
Fish		
Whale Shark	*Rhincodon typus*	Vulnerable, Migratory
Great White Shark	*Carcharodon carcharias*	Vulnerable, Migratory
Grey Nurse Shark	*Carcharias taurus*	Vulnerable

3.3.2.1 Marine Reptiles

Six species of marine turtle are known from the Montebello/Barrow Island region, all of which are protected under the International Bonn Convention, the EPBC Act (Cth)and the *Wildlife Conservation Act 1950* (WA):

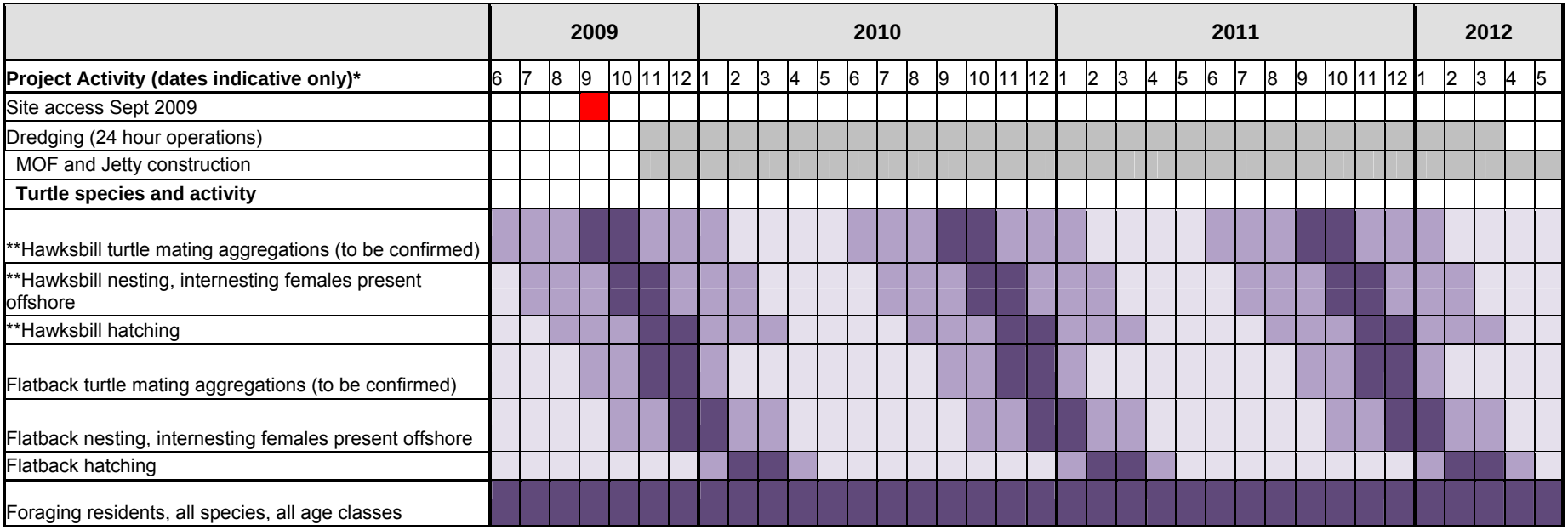
- Green Turtle (*Chelonia mydas*)
- Flatback Turtle (*Natator depressus*)
- Olive Ridley Turtle (*Lepidochelys olivacea*)
- Loggerhead Turtle (*Caretta caretta*)
- Hawksbill Turtle (*Eretmochelys imbricata*)
- Leatherback Turtle (*Dermochelys coriacea*).

Barrow Island is a regionally important nesting area for Green Turtles and Flatback Turtles. Hawksbill Turtles nest at low densities around the Island and Loggerhead Turtles have only been recorded from the Island occasionally (Chevron Australia 2009c).

The estimated size of the total Green Turtle reproductive population at Barrow Island is in the order of 20 000 females, with a similar level of nesting in the Montebello Group (Pendoley 2005), and as such is of regional significance (Prince 1994) and potentially of significance to the Western Australian stock. Green Turtles favour the west and north-east coast of Barrow Island where beaches are characterised by high energy, deep, steeply sloped, sandy beaches with an unobstructed foreshore approach (Pendoley 2005). Most Green Turtles nest on Barrow Island between December and February, with hatchling emergence occurring February to March (Chevron Australia 2009c).

Barrow Island supports an estimated 1700 nesting female Flatback Turtles annually. Flatback Turtle nesting is concentrated on the east coast of Barrow Island, on deep, sandy, low sloped beaches with wide shallow intertidal zones (Pendoley Environmental 2008). Highest nesting densities have been reported on the central east coast beaches, in particular Mushroom Beach, Bivalve Beach, Terminal Beach, Yacht Club Beach North and Yacht Club Beach South (Chevron Australia 2005). Limited nesting has been reported on the south-west, north and north-east coasts (Pendoley Environmental 2009). The nesting season for Flatback Turtles on Barrow Island occurs mainly between December and January, with the main hatchling emergence period occurring from February to March (Chevron Australia 2009c) (Table 3-3).

Table 3-3 Key Activities for Marine Turtles in Relation to Timing of Implementation of Gorgon Gas Development



Notes:

* *Dates are indicative only*

** *Hawksbill turtles have the most seasonally diffuse nesting cycle, individuals may nest at any time throughout year*

	Peak period. Presence of animals reliable and predictable each year
	Shoulder period. Lower level of abundance/activity/presence, year to year variability
	Out of season period. Very low level of abundance/activity/presence, year to year variability

Source: Chevron Australia 2009c

For further information on the ecology and biology of turtles refer to the LTMTMP (Chevron Australia 2012).

Sea snakes are common inhabitants of the waters around Barrow Island and the shallow Rowley Shelf (Chevron Australia 2005). Storr *et al.* (1986) estimate nine genera and 22 species of sea snakes and kraits occur in Western Australian waters, many of which may frequent Barrow Island. Little is known of the distribution of individual species around Barrow Island; however, most species have generalist habitat associations, are highly mobile and are likely to be found within the vicinity of the Marine Facilities at some time during the construction program. The most common sightings within the vicinity of the Marine Facilities to date have been of Olive Sea Snakes (*Aipysurus laevis*) (Chevron Australia 2009c).

3.3.2.2 Marine Mammals

The Pilbara region supports migratory, transient and resident marine mammals such as whales, dolphins and dugongs, all of which are EPBC listed. Marine mammals that are likely to be found in the vicinity of the Marine Facilities (and their conservation status) are listed in Table 3-2.

The regional distribution of many whale species is not well understood, and while many species may occur in the Pilbara region, most are likely to be transient or occasional visitors. Humpback Whales (*Megaptera novaeangliae*) pass through Barrow Island waters between June and October on their annual migration between feeding grounds in Antarctic waters and calving grounds in Pilbara/Kimberley waters. Humpback Whales are more common in waters west of Barrow Island but also visit waters in the vicinity of the Marine Facilities on the east coast of Barrow Island (Chevron Australia 2009c).

Dolphins have been sighted occasionally in the marine areas in the vicinity of the MDF. Bottlenose Dolphins (*Tursiops truncatus*) and Indo-Pacific Humpback Dolphins (*Sousa chinensis*) have resident populations within the shallow waters of the inner Rowley Shelf, including Barrow Island. Common dolphins (*Delphinus* spp.), Spinner Dolphins (*Stenella longirostris*) and Striped Dolphins (*Stenella coeruleoalba*) are also abundant around Barrow Island, but these species generally occur in deeper, oceanic waters (Chevron Australia 2009b).

Dugongs (*Dugong dugon*) occur throughout the shallow waters between the Pilbara offshore islands and the mainland. Dugongs are associated with shallow seagrass meadows on which they feed and have been observed in the shallow waters over the Barrow Shoals, along the east coast of Barrow Island, and over the Lowendal Shelf (Chevron Australia 2009). However, since significant seagrass meadows are absent from the vicinity of the Marine Facilities, it is unlikely that significant numbers of dugongs will occur as resident populations in or near the area, but rather, would be occasional visitors to subtidal seagrass patches in the vicinity of the Marine Facilities.

3.3.2.3 Fish Species

No fish species listed under the EPBC Act (Cth) or the *Wildlife Conservation Act 1950* (WA) were observed in the dredge and spoil disposal area (DSDA) during the baseline surveys of 2007 and 2008. However, a wide variety of reef fish are known to occur within the location of the Marine Facilities, and the area could potentially support listed species, such as Potato Cod (*Epinephelus tukula*). Listed fish species that are likely to inhabit waters near the Marine Facilities also include Syngnathids (pipefish and seahorses). Approximately 30 species of pipefish and seahorse occur on the North West Shelf and are expected to be present within shallow benthic habitats of Barrow Island, including in and near the location of the Marine Facilities. No areas of regional importance to fish were identified during seabed surveys of the location of the Marine Facilities.

Numerous shark species are present in the offshore waters of the North West Shelf, including listed species such as the Whale Shark (*Rhincodon typus*), Great White Shark (*Carcharodon carcharias*) and Grey Nurse Shark (*Carcharias taurus*). Whale Sharks occur along the northern Western Australian coast, including the Montebello/Barrow Island region and congregate each year between March and April off Ningaloo Reef, approximately 150 km south-west of Barrow

Island. Whale Sharks are expected to visit the deeper parts of the location of the Marine Facilities occasionally. Grey Nurse Sharks are expected off the west coast of Barrow Island; however, it is likely Great White Sharks would be encountered rarely, as they are more common in temperate waters. Neither species has been observed so far during BRUVs as part of the baseline studies program (Chevron Australia 2009b).

3.3.2.4 Marine Avifauna

Barrow Island supports numerous species of migratory and resident shorebirds. Many of these species are protected under International treaties—e.g. Japan–Australia Migratory Bird Agreement (JAMBA), China–Australia Migratory Bird Agreement (CAMBA), and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), and the Island is both a staging site and an important non-breeding site for migratory shorebirds. However, the areas of greatest shorebird abundance on Barrow Island are a substantial distance from the location of the Marine Facilities, on the south-eastern and southern coasts of the Island.

Migratory shorebird surveys around Barrow Island, including the Town Point area, were conducted in October 2005, and in February and March 2006 (RPS Bowman Bishaw Gorham 2006). Bivalve Beach and Terminal Beach, on either side of Town Point, the shoreward site of MOF development, were not found to support large aggregations of shorebirds (RPS Bowman Bishaw Gorham 2006)

3.4 Socioeconomic Environment

3.4.1 Land and Sea Tenure

In 1966, the State Government of Western Australia granted a Petroleum Lease (L1H) to WAPET. The lease is held currently by ChevronTexaco Australia, Santos Offshore and Mobil Australia Resources Company (the Barrow Island Joint Venture) and covers all but two small exploration areas (EP 61 and EP 62) held solely by ChevronTexaco Australia.

A large area off the east coast of Barrow Island is currently a designated port. The Barrow Island Port was created under the *Shipping and Pilotage Act 1967* (WA) and vested under the *Marine and Harbours Act 1981* (WA) in the body corporate Minister for Transport.

3.4.2 Marine and Terrestrial Protected Areas

Barrow Island is reserved under the *Conservation and Land Management (CALM) Act 1984* (WA) as a Class A nature reserve for the purposes of 'Conservation of Flora and Fauna'. The Class A Barrow Island Nature Reserve was declared in 1910 and the Class A marine conservation reserves were created in 2004. The Island is vested in the Conservation Commission of Western Australia and is managed on its behalf by the DEC, who drafted the Barrow Island Nature Reserve Management Plan. The nature reserve is also listed on the Commonwealth Register of the National Estate. The Marine Facilities and RO Structures will be located in the designated Barrow Island Port zone.

Barrow Island is zoned 'Conservation, Recreation and Nature Land' under the Shire of Ashburton Town Planning Scheme No. 7. The waters around Barrow Island are part of the Montebello–Barrow Island marine conservation reserves. The majority of the conservation area is zoned as a Marine Management Area. The conservation area also comprises the Barrow Island Marine Park and Bandicoot Bay Conservation Area, located in waters adjoining the west and south coasts of Barrow Island, respectively. The Barrow Island marine area is listed on both the State Register of Heritage Places and the Commonwealth Register of the National Estate. The marine conservation reserves are vested in the Marine Parks and Reserves Authority and managed by DEC.

3.4.3 Aboriginal Heritage and Native Title

Barrow Island occupies a potentially important position in the indigenous archaeology of north-western and continental Australia. It is located between the Cape Range Peninsula (mainland) and the Montebello Islands, both of which were initially occupied by indigenous people at 34 200 ± 1050 years Before Present (BP) and 27 220 ± 650 years BP respectively.

There are no lodged Native Title claims over Barrow Island or surrounding waters. However, Native Title rights over onshore and offshore seas have been recognised by Australian courts. In August 2002, the High Court in the Ward Case held that vesting of reserves under the *State Land Act 1933* (WA) (now the *State Land Administration Act 1997* (WA)) has extinguished Native Title. Accordingly, the vesting of Barrow Island as a Class A nature reserve will have extinguished Native Title to the Island.

3.4.4 Maritime Heritage

Records indicate there are no known shipwreck sites in the vicinity of the Marine Facilities. However, archival sources suggest a number of significant vessels have been lost in the Onslow/Barrow Island region, and pearling lugger shipwreck sites may occur in the vicinity of Barrow Island.

The MOF and shore areas adjacent to the Gas Treatment Plant site were examined by a marine heritage expert and no shipwreck sites were discovered. Marine underwater video survey work and a review of side-scan sonar results to date have not revealed any evidence of shipwrecks.

4.0 Risk Assessment

4.1 Overview

Chevron Australia has prepared the HES Risk Management: ASBU – Standardized OE Process (Chevron Australia 2007) to assess and manage health, environment and safety (HES) risks, which it internally requires its employees, contractors, etc. to comply with.

A number of environmental risk assessments have been completed for the Gorgon Gas Development. A strategic risk assessment was undertaken during the preparation of the Draft EIS/ERMP to determine the environmental acceptability of the Development, and identify key areas of risk requiring mitigation (Chevron Australia 2005).

This original assessment was reviewed as part of the development of the Gorgon Gas Development Revised and Expanded Proposal PER (Chevron Australia 2008), in light of the changes to the Gorgon Gas Development (described in Section 1.4). The outcomes of these assessments have been reviewed and considered during the preparation of this Plan.

A quantitative Environmental Risk Assessment (ERA) of the construction activities described in Section 2.0 of this Plan was undertaken. The assessment attempted to identify all potential environmental risks to environmental receptors within the project locality. In doing so, construction activities considered to represent a higher level of risk to environmental receptors were ranked and appropriate mitigation and safeguard measures identified to reduce environmental risks as far as practicable. The environmental elements and potential environmental impacts associated with the key risks are further discussed in Section 4.4. A copy of the outcomes from the ERA for construction of Marine Facilities is included in Appendix 2.

Additional detailed risk assessments have been undertaken for specific scopes of work, using Chevron's RiskMan2 Procedure (Chevron Corporation 2008) (Appendix 2.3).

A summary of the risk assessments that have been undertaken to date, and that have provided input into this Plan, is provided in Table 4-1.

Table 4-1 Risk Assessments Relevant to this Plan

Scope of Risk Assessment	Method(s)	Documentation	Year
Entire Scope of the Approved Development	AS/NZS 4360:2004	Draft EIS/ERMP (Chevron Australia 2005)	2005
Entire Scope of the Revised and Expanded Proposal	AS/NZS 4360:2004	Gorgon Gas Development PER (Chevron Australia 2008)	2008
Marine Facilities	RiskMan2	Outcomes from the Environmental Risk Assessment for the MFCEMP (Appendix 2)	2009
Dredging and Spoil Disposal	RiskMan2	Dredging and Spoil Disposal Management and Monitoring Plan (Chevron Australia 2009a)	2009
Marine Turtles	RiskMan2	Long-term Marine Turtle Management Plan (Chevron Australia 2012) (summarised in Appendix 2.4)	2009
Solid and Liquid Waste	RiskMan2	Solid and Liquid Waste Management Plan (Chevron Australia 2009E)	2009
Marine Quarantine	Workshop specific methodology	Terrestrial and Marine Quarantine Management System (Chevron Australia 2009e)	2009

4.2 Methodology

The following sections refer specifically to the outputs of three risk assessments: the MFCEMP-specific Environmental Risk Assessment (incorporating relevant factors from the DSDMMP risk assessment)*;* the Marine Turtle Risk Assessment; and the Solid and Liquid Waste Risk Assessment. All risk assessments were undertaken in accordance with the following standards:

- Australian Standard/New Zealand Standard (AS/NZS) 4360:2004 Risk management (Standards Australia/Standards New Zealand 2004a)
- AS/NZS Handbook 203:2006 Environmental Risk Management – Principles and Process (Standards Australia/Standards New Zealand 2006)
- AS/NZS 3931:1998 Risk Analysis of Technological Systems – Application Guide (Standards Australia/Standards New Zealand 1998).

The methodologies used for the risk assessments were similar, allowing the outcomes for each risk assessment to be compared. The process followed in the risk assessments included:

- **Hazard Identification**: Identifying potential hazards that are applicable to Gorgon Gas Development activities and determining the hazardous events to be evaluated.
- **Hazard Analysis**: Determining the possible causes that could lead to the hazardous events identified; the consequences of the hazardous events; and the safeguards and controls currently in place to mitigate the events and/or the consequences.
- **Risk Evaluation**: Evaluating the risks using the Chevron Integrated Risk Prioritization Matrix (Appendix 2.2). The risk ranking is determined by a combination of the expected frequency of the hazard occurring (likelihood) and the consequence of its occurrence. Note that when assessing the consequence no credit is given to the hazard controls; hazard controls are taken into account in determining the likelihood of the event.
- **Residual Risk Treatment**: Reviewing the proposed management controls for each of the risks identified and proposing additional controls or making recommendations, if required.

Risk assessments used the Chevron RiskMan2 methodology (Chevron Corporation 2008). Residual Risk Rankings were determined using a combination of the Chevron Integrated Risk Prioritization Matrix (Appendix 2.2) and Gorgon RiskMan2 Environmental Consequence Interpretative Guide (Appendix 2.3). These matrices use a 6-point scale for Consequence and Likelihood rankings to arrive at a Residual Risk Ranking on a 10-point scale, which were also convertible to high, medium and low risk categories.

Residual Risk Ranking Categories have been used in the development of this Plan to determine whether the risks are considered acceptable or whether further mitigation and safeguards are warranted. This Plan refers to risks that were ranked as either **medium** or **high** as requiring the development and implementation of management measures. Risks that were ranked as **low** can possibly be accepted without further mitigation and safeguards. However, where appropriate, mitigation measures have also been developed for **low** risks, in accordance with Chevron's ABU Operational Excellence (OE) policy, in particular 'Environmental Stewardship: Working to prevent pollution and waste; striving to continually improve environmental performance and limiting impacts from operations'.

The outcomes from the three relevant risk assessments were converted to low–medium–high Residual Risk Ranking Categories using standard ranking levels outlined in the RiskMan2 methodology (Chevron Corporation 2008) and listed in Table 4-2.

Table 4-2 Scale used to Convert Risk Assessment Numerical Rankings to High, Medium and Low Risk Categories

Overarching Residual Risk Category	RiskMan2 Residual Risk Ranking
High	1, 2, 3, 4
Medium	5, 6
Low	7, 8, 9, 10

The assessment of marine quarantine risks was outside the scope of this Plan. They are addressed within the Terrestrial and Marine Quarantine Management System (Chevron Australia 2009f), which was developed to meet the requirements of Condition 10 of Statement No. 800 and Condition 8 of EPBC Reference: 2003/1294 and 2008/4178.

4.3 Outcomes

The environmental risk assessment outcomes for the marine construction activities are detailed in Appendix 2 and summarised in Table 4-3. The majority of the residual risks identified in the environmental risk assessment were considered to be **low** and can be managed via application of routine safeguards and mitigation measures. For key risks identified in Table 4-3 (**medium** and **high** ranking), specific management measures and monitoring (where considered necessary) have been developed and are discussed in Section 6.0 of this Plan.

Note: Risk assessment outcomes are based solely on assessment of environmental risks. Risks to company reputation, regulatory compliance, or community relationships were considered but not risk assessed.

Section 4.4 discusses in detail the key environmental elements and impacts outlined in Table 4-3.

Condition 3.2.1 of EPBC Reference: 2003/1294 and 2008/4178 require a description of the EPBC listed species likely to be implemented by the components of the action that is the subject of this Plan. Those species are listed in Appendix 4.

Condition 3.2.1 of EPBC Reference: 2003/1294 and 2008/4178 also require descriptions of the habitat of those listed species. The habitat description is also detailed in Appendix 4.

Condition 3.2.2 of EPBC Reference: 2003/1294 and 2008/4178 require an assessment of the risk to the relevant EPBC listed species. The risks identified during the assessments noted in Table 4-3 and Appendix 2 are inclusive of the risks to the listed species in Appendix 4.

Table 4-3 Key Environmental Residual Risks Relevant to Marine Construction Activities

Environmental Element at Risk	Environ-mental Aspect	Activity	Potential Worst Case Environmental Impact	Residual Risk Level	Management Strategy	Relevant Management Measures
Marine Fauna (excluding Turtles)	Physical presence and water quality	Construction activities and vessels	• Changes in localised distribution of marine fauna due to vessel collision/strike • Change in local abundance/distribution of mobile fauna through construction of Marine Facilities, causing localised changes in fauna behaviour/movement. i.e. restricting preferential patterns of movement or access to certain waters • Direct effects on fish including irritation of fish gills and damage to fish eggs and larvae due to suspended sediments from reclamation activities	Medium	Marine Fauna Interactions and Water Quality	Section 6.2 and Section 6.4
Marine Fauna (excluding Turtles)	Artificial light spill	Artificial lighting requirements for vessels/ construction activities at night	• Change in local abundance/distribution of mobile marine fauna through either attraction or avoidance of the Marine Facilities construction area • Increased feeding opportunities for adaptable species leading to reduced numbers of prey species attracted to light • Increased chance of interaction/collision of marine fauna with equipment and vessels due to attraction to artificial lighting	Medium	Artificial Light Spill	Section 6.6
Marine Fauna (excluding Turtles)	Noise and vibration (general)	Construction activities and vessels	• Noticeable change (through visual observations) in abundance/ distribution of marine fauna and avoidance of construction area • Disruption of fish breeding activities due to stress, disruption of schooling behaviour or avoidance of an area where construction activities are being undertaken	Medium	Noise and Vibration (including drill blasting and piling)	Section 6.5
Marine Fauna (excluding Turtles)	Drilling, blasting and piling	Shock waves, generated underwater from drill and blast activities (if required)	• Mortality or physiological impacts to marine megafauna (permanent and/or temporary hearing loss), injury or mortality • Mortality or physiological effects to fish including damage to fish larvae and eggs	Medium	Noise and Vibration (including drill blasting and piling)	Section 6.5
Marine Water and Sediment Quality	Turbidity generation	Increased turbidity from vessel movements, drilling, seabed preparation and reclamation activities	• Reduction in visual amenity throughout the Barrow Island region during construction activities • Reduction in water quality causing impacts to marine biota e.g. avoidance of area by mobile fauna, reduced health or mortality • Loss of benthic primary producer habitat (BPPH) • Loss of sensitive coral patches	Medium	Water Quality	Section 6.4

Environmental Element at Risk	Environ-mental Aspect	Activity	Potential Worst Case Environmental Impact	Residual Risk Level	Management Strategy	Relevant Management Measures
Marine Water and Sediment Quality	Seabed disturbance	Deposition of fines from MOF construction (reclamation and rock dumping)	• Changes to sediment particle size distribution and seabed in the vicinity of the Marine Facilities	Medium	Water Quality	Section 6.4
Marine Fauna (Turtles) [(1)]	Artificial light spill	Light emissions from marine vessels and construction equipment and navigation aids	• Potential displacement and/or relocation of nesting female turtles from beaches adjacent to construction and dredging works, with potential for less reproductive viability at alternative beaches • Mate finding inhibited at night where lighting is present in mating areas • Hatchling disorientation	Medium	Artificial Light Spill	Section 6.6
Marine Fauna (Turtles) [(1)]	Physical presence	Boat strikes from vessels	• Death or injury to turtles • Animal stranding due to injuries sustained • Reduced reproductive success in the long term	Medium	Marine Fauna Interaction	Section 6.2
Marine Fauna (Turtles) [(1)]	Blasting	Marine blasting	• Mortality or physiological impacts to turtles (permanent and/or temporary hearing loss), injury or mortality	Medium	Noise and Vibration (including drill blasting and piling)	Section 6.5
Marine water and sediment quality	Hydrocarbon spills (<1000 L)	Vessel refuelling	• Localised pollution of water column or contamination of marine sediments	Medium	Hydrocarbon Spills and Management	Section 6.7
Marine water and sediment quality [(2)]	Biosecurity	Discharge of ballast water within unauthorised area	• Contamination of marine waters • Contamination of marine sediment	Medium	Biosecurity	Section 6.9
Marine Fauna and Flora [(2)]	Biosecurity	Discharge of ballast water within unauthorised area	• Introduction of marine pests • Change in abundance or distribution of competing native fauna and flora	Medium	Biosecurity	Section 6.9
Air Quality	Atmospheric Emissions	Emissions from diesel engines/ construction and dredging vessels	• Smoke particulates and greenhouse gases emitted, reducing local air quality	Medium	Atmospheric Emissions	Section 6.10

Notes:

[(1)] Refers to the outcomes of the Turtle Risk Assessment

[(2)] Refers to the outcomes of the Solid and Liquid Waste Management Risk Assessment

This table only includes risks ranked medium or high; for full risk assessment outcomes refer to Appendix 2.

4.4 Environmental Elements and Impacts

4.4.1 Physical Presence

The presence of construction vessels manoeuvring in waters off Barrow Island has the potential to result in marine fauna vessel strikes, sustained either by direct contact with the vessel hull or via propeller contact. There are a range of mobile marine fauna species that may frequent the waters off Barrow Island, including species that are of particular conservation significance.

Potential impacts from vessel strike can include serious harm and injury, or in the worst case, mortality. Non-fatal injuries from boat strikes may result in animal strandings or require time to recover from injuries, which may adversely affect feeding or breeding activities. The most susceptible species to vessel strikes are slow-moving species with restricted capacity to rapidly alter course or direction, such as dugongs, various whale species, and marine turtles. The ability of these species to avoid an approaching vessel decreases with increasing vessel speed.

Marine turtles are considered to be at greatest risk of vessel strike from Marine Facilities construction activities. Located either side of Town Point are Terminal and Bivalve Beaches, known to represent significant nesting beaches for Flatback Turtles. Similarly, Hawksbill Turtles are known to nest at Bob's Beach South, located to the south-east of WAPET Landing. Turtles are likely to be more susceptible to vessel strike during the peak, nesting and internesting period, December and January each year.

Refer to Management Strategy 1 (Section 6.2) for associated management and monitoring requirements.

4.4.2 Seabed and Benthic Habitat Disturbance

Construction of the Marine Facilities and the installation of the RO Structures will directly remove habitat within the MDF in the vicinity of the MOF, LNG Jetty, and WAPET Landing footprints. The potential impacts associated with habitat loss at the Marine Facilities and WAPET Landing locations were assessed in the EIS/ERMP and PER (Chevron Australia 2005, 2006, 2008). Broadly, construction activities will result in the direct physical removal of some coral, macroalgae and other sparse sessile taxa. The WAPET Landing area is highly disturbed as it has been an operating facility for WA Oil for approximately 30 years. The upgrade of WAPET Landing is likely to result in localised removal of red and brown macroalgae and sparse seagrasses within the MDF; potential impacts are likely to be localised and insignificant given the absence of local or regionally significant habitat (Bowman Bishaw Gorham 2006).

Seabed disturbance is likely to result from construction activities such as rock dumping, drilling, seabed preparation, anchoring, propeller wash, grounding of barges, seabed grooming and mooring installation. Disturbance may also result from indirect activities, including changes in particle size distribution resulting from deposition of fines.

Marine habitats in the vicinity of the Marine Facilities are identified in Sections 3.3.1.5 and 3.3.1.6, and Figure 3-15.

A description of the marine habitats for WAPET Landing is included in Section 3.3.1.7.

The macroalgae-dominated limestone reef habitat that occurs within the MDF is considered appropriate for the colonisation of a number of listed Syngnathid fish species including the Rock Pipefish (*Phoxocampus belcheri*), and is suitable for foraging by Flatback, Hawksbill and Green Turtles prior to nesting on beaches located adjacent to Town Point. Removal of small amounts of this habitat type in the MDF is considered insignificant, due to its abundance along the entire east coast of Barrow Island. Similarly, removal of brown and red macroalgae and spare seagrasses in the vicinity of WAPET Landing is considered insignificant due to the absence of any locally or regionally significant habitat (Bowman Bishaw Gorham 2006).

Other habitats that occur in the MDF include bare sand patches suitable for colonisation of filter feeders such as sea pens and sea sponges, and small patches of seagrass. Both sea pens and sponges are a food source of Flatback Turtle populations, while seagrass patches provide a food source for Green Turtles and dugongs. The removal of sea pen and sponge habitat is

considered unlikely to impact on turtle populations due to its high abundance within the region. Similarly, the removal of seagrass in the MDF is unlikely to impact on listed species due to the low abundances found within the MDF.

Seabed disturbance outside the MDF could potentially result from unauthorised anchoring and anchor drag, vessel groundings, accidental placement of material in incorrect locations, and accidental loss of solid objects from vessels overboard.

The potential significance of impacts caused by anchoring outside the MDF will be dependent on the type of benthic habitat, the anchor pattern, and the frequency of occurrence. Anchoring on significant coral assemblages may break or overturn corals and scour small areas of seagrass habitat. The consequence of these impacts is higher due to the slow recovery of these habitat types.

The potential for alteration in seabed characteristics (including particle size distribution from deposition of fines beyond the MDF) is considered possible, although potential effects are likely to be limited and superseded by the turbidity effects from the wider dredging program activities that will be undertaken in parallel to construction of the Marine Facilities.

Refer to Management Strategy 2 (Section 6.3) for associated management and monitoring requirements.

4.4.3 Water Quality

Elevated turbidity is likely to result from these construction activities:

- discharge of MOF decant water
- seabed preparation
- propeller wash from construction vessels operating in shallow waters
- placement of rock along the MOF causeway
- upgrade of marine component of WAPET Landing
- potential loss of fine sediments from the MOF bunded area
- release of sediments into the water column from drilling of piles.

Turbidity from construction activities is likely to be localised and short term and contained within the Zones of Impact for the dredge program (refer to DSDMMP [Chevron Australia 2009a]). The turbidity associated with the reclamation site will be inseparable from the turbidity generated from the MOF dredging as they are at the same location and will occur concurrently. Therefore, the monitoring and management program associated with the dredge activity will also be applicable to the reclamation site. The program will also encompass seabed preparation activities for the LNG Jetty.

The movement of sediments entrained within the water column will be influenced by various parameters including particle size and depth of release, as well as prevailing bathymetric and hydrodynamic conditions. Turbidity from the WAPET Landing upgrade is likewise anticipated to result in localised and short-term turbidity effects due to the small-scale nature of the activities.

Potential environmental impacts resulting from elevated turbidity are likely to include:

- deterioration in water quality leading to marine fauna disturbance and effects on predator/prey interaction, e.g. reduced effectiveness of visual hunting techniques
- increased light attenuation in the water column resulting in limited light reaching benthic primary producers (BPP), including coral and seagrass communities resulting in stress and if prolonged, leading to mortality
- smothering of BPP by redeposition and accumulation of fine sediments

- reduction in visual amenity
- alteration of seabed characteristics including particle size distribution.

Sediment deposition and turbidity are potential causes of stress and mortality in corals and other BPP. This effect has been extensively reviewed in the EIS/ERMP (Chevron Australia 2006) and elsewhere (Cortés and Risk 1985; Hodgson 1990; Pastorok and Bilyard 1985; Rogers 1983). However, the extent and severity of impacts is highly variable and depends on a range of factors including the coral species affected, duration of exposure, sediment concentration, grain size, water depth, and water temperature (International Council for the Exploration of the Sea 1992).

Turbidity effects from Marine Facilities construction activities are expected to be localised and short term. Furthermore, no Material or Serious Environmental Harm outside the MDF is likely to result from turbidity effects associated with Marine Facilities construction.

Refer to Management Strategy 3 (Section 6.4) for associated management and monitoring requirements.

4.4.4 Noise and Vibration

4.4.4.1 Overview

The key sources of noise associated with marine construction activities that have the potential to impact on marine fauna include drilling activities, impact piling, marine blasting (if required) and vessel engines.

Determining effects of noise on different marine species requires consideration of distance from the source, frequency, vibration, intensity and persistence of underwater noise, as well as the hearing, vocalisations and other biological characteristics of the organism. Regardless of the source, the effects diminish with distance, the range dependent on sound attenuation, and the organism's sensitivity (Richardson *et al.* 1995). Secondary effects may also occur if, for example, the sound drives away prey or attracts predators.

For underwater noise impacts on marine fauna, two effects are of interest, namely physical injury and avoidance. These two effects result in the determination of two areas or zones of interest for underwater noise assessments (SVT 2009). These areas or zones are:

- Area of Possible Physical Injury: In this area, there is a possibility that the animal may suffer physical injury and/or permanent hearing damage.
- Area of Possible Avoidance: In this area, there is a possibility that the animal may experience masking and/or behavioural change and/or avoid the area.

Table 4-4 provides the assessment criteria for the impact of noise on marine turtles, based on an in-depth study of the literature (SVT 2009).

Table 4-4 Estimated Received Levels at which there is a Possibility of Physical Injury or Behavioural Effect for Marine Turtles

	Possible Physical Injury	Possible Avoidance
Peak Pressure	222 dB re 1µPa	175 dB re 1µPa
Sound Exposure Level (SEL)	198 dB re 1µPa	No Data Available

The criteria that will be used for the assessment of cetaceans and dugongs are given in Table 4-5. They are based on the criteria recommended by Southall *et al.* (2007) and the EPBC Act Policy Statement 2.1 (SVT 2009).

Table 4-5 Estimated Received Levels at which there is a Possibility of Physical Injury or Behavioural Effect for Cetaceans and Dugongs

	Possible Physical Injury	Possible Avoidance
Peak Pressure	230 dB re 1µPa	224 dB re 1µPa
Sound Exposure Level (SEL)	198 dB re 1µPa^2.s	160 dB re 1µPa^2.s

Analytical formulae were used to estimate the areas of possible physical injury specifically for marine blasting (Section 4.4.4.2) and impact piling (Section 4.4.4.3), taking into account (SVT 2009):

- transmission loss
- model cut-off frequency
- absorption
- geometric spreading
- seabed characteristics
- seabed absorption
- peak pressure.

4.4.4.2 Marine Blasting

Underwater blasting generates unique acoustic characteristics, which include a high-amplitude shock wave and low frequency noise (URS 2008). The noise and associated shock wave are capable of inducing physiological damage to marine animals and, in certain instances, may result in mortality if the animals are too close to the noise source (Burton 2008).

It is important to note that the blasting program (if required) will be relatively minor, with 50 000 m^3 nominally proposed. Potential impacts to Key Receptor Species from blasting activities are likely to be minimal, resulting in temporary avoidance behaviour. Some species may develop new movement or migratory patterns to avoid these activities, although the activities are unlikely to have an impact on population viability.

Table 4-6 and Table 4-7 show the calculated received levels (RL) for marine blasting (SVT 2009). Table 4-6 shows the expected sound exposure level, while Table 4-7 uses the calculated peak pressure level. The area of possible physical injury (cells in red) for Key Receptor Species was determined based on the information in Table 4-4 and Table 4-5. The zone of avoidance is in green for marine turtles and yellow for cetaceans and dugongs. From the calculations, the area of possible physical injury may be expected to be up to 500 m from the blast. Based on this information, an exclusion zone for Key Receptor Species has been proposed for marine blasting activities (Section 6.5). This has been set conservatively to manage any potential physical injury to Key Receptor Species.

Table 4-6 Calculated SEL Received Levels at Ranges from Marine Blasting Source

SEL	Distance from source	In-water sound speed	In-bottom sound speed	Absorption in water	BL	Cylindrical spreading loss	Received Level
[dB re 1 µ Pa^2.s]	[m]	[m/s]	[m/s]	[dB]	[dB]	[dB re 1m]	[dB re 1 µ Pa^2.s]
212	20	1500	1708	0.00	0.00	13.0	202.68
212	100	1500	1708	0.00	11.40	20.0	184.29
212	500	1500	1708	0.00	16.17	27.0	172.53

Table 4-7 Calculated Received Levels at Ranges from Marine Blasting Source

SPL Peak	Distance from source	In-water sound speed	In-bottom sound speed	Absorption in water	BL	Cylindrical spreading loss	Received Level (Peak)
[dB re 1 µ Pa]	[m]	[m/s]	[m/s]	[dB]	[dB]	[dB re 1m]	[dB re 1 µ Pa]
258	20	1500	1708	0.00	0.00	13.0	244.99
258	100	1500	1708	0.00	11.40	20.0	226.60
258	500	1500	1708	0.00	16.17	27.0	214.84

4.4.4.3 Impact Piling

The action of driving the pile into the seabed will excite bendy waves (comprising a compression wave and a transverse wave) in the pile that will propagate along the length of the pile and then into the seabed. The transverse wave component of the wave will create compression waves that will propagate into the marine environment, while the compression component of the bendy wave will propagate into the seabed. There will also be some transmission of the airborne acoustic wave into the marine environment.

It can be expected that most of the energy from driving the pile will transfer into the seabed (SVT 2009). Once in the seabed, the energy will then propagate outwards as compression and shear waves. Some of the energy may be transferred into Rayleigh waves, which are seismic waves that form on the water/seabed interface, but it is expected that this will be a small portion of the total energy.

The noise that is generated by impact driving the piles is short in duration lasting approximately 90 ms and can therefore be described as an impulsive noise; therefore, the frequency spectrum generated is broadband and hence does not have any tonal characteristics (SVT 2009).

Potential impacts from piling activities will be limited, given that it is anticipated that only short periods of impact driving per pile will be required to create a seal with the seabed prior to drilling. Therefore, this activity will be intermittent.

Table 4-8 shows the calculated received levels (RL) from a pile driving source (SVT 2009). The area of possible physical injury (cells in red) for cetaceans, dugongs and marine turtles was determined based on the information in Table 4-4 and Table 4-5. The zone of avoidance is highlighted in green for marine turtles and yellow for cetaceans and dugongs. Note that a conservative approach has been taken to assume the average water depth is 10 m for the span

of the jetty. There is potential for the zone of potential injury to be between 20 and 100 m away from any pile. Based on this information, an exclusion zone for Key Receptor Species has been proposed for impact piling activities (Section 6.5). This has been set conservatively to manage any potential physical injury to Key Receptor Species.

Table 4-8 Calculated Received Levels at Ranges from Piling Source

SEL	Water depth	Distance from source	In-water sound speed	In-bottom sound speed	Model cut off frequency	SEL (with model cut off)	Absorption in water	BL	Cylindrical spreading loss	Received Level	Received Level (Peak)
[dB re 1 µ Pa^2.s]	[m]	[m]	[m/s]	[m/s]	[Hz]	[dB re 1 µ Pa^2.s]	[dB]	[dB]	[dB re 1m]	[dB re 1 µ Pa^2.s]	[dB re 1 µ Pa]
220	10	20	1500	1708	78.4	215.7	0.00	0.00	13.0	202.68	208.68
220	10	100	1500	1708	78.4	215.7	0.00	11.40	20.0	184.29	190.29
220	10	500	1500	1708	78.4	215.7	0.00	16.17	27.0	172.53	178.53

Refer to Management Strategy 4 (Section 6.5) for associated management and monitoring requirements.

4.4.4.4 Drilling

Drilling is the primary method for the installation of piles. This method has been chosen due to the hardness of substrates identified at the site. However, impact piling will be initially used to create a seal with the seabed (see Section 4.4.4.3). Drilling can propagate noise at frequencies and levels that are harmful to marine animals (URS 2008). Sound characteristics produced by drilling (for pile installation and potentially for drill and blast) will vary depending on substrate type, depth, and environmental factors such as meteorological and other hydrodynamic conditions.

The noise level experienced during drilling depends on the distance and the closest point of approach. In most cases, there is still no direct evidence of an effect, let alone an effect that presents a significant risk to marine mammals (European Science Foundation 2008).

4.4.4.5 Rock Dumping

Rock dumping is not expected to generate significant noise, except for that generated by the vessels. Sound transmission in shallow water is highly variable due to seabed/surface interactions. Noise from rock dumping is likely to be broadband low frequency, although at relatively modest source levels.

4.4.5 Artificial Light Spill

The impact and associated management measures for artificial lighting are discussed in the LTMTMP (Chevron Australia 2009c). However, some information is provided here for context.

Lighting sources during construction of the Marine Facilities will include lighting required for night shift works, lighting on board vessels and jack-up barges, safety lights, navigational lights and lighting on board the marine construction support vessels. Potential environmental impacts associated with artificial light spill include:

- change in local abundance/distribution of mobile marine fauna through either attraction or avoidance of the light sources within the construction area
- displacement of turtle nesting activity to adjacent beaches or reduced reproductive output. Similarly, alternative nesting beaches may provide less suitable nesting habitat and result in reduction of nesting success

- hatchling disorientation through attraction to light spill from vessels/marine construction activities at night
- alteration in hatchling sex ratios and reduced reproductive output due to lower energy reserves. This may subsequently result in a reduction in survival rates for those hatchlings that reach the ocean due to low energy reserves
- increased incidents of marine fauna collisions/interactions with vessels and equipment (e.g. Bottlenose Dolphins known to congregate in lit areas at night to assist in hunting; increased incidents of seabird collisions/interaction with vessels and equipment due to light attraction). Greater concentration of adaptable species leading to increased mortality of food source (e.g. Silver Gulls known to respond to increased feeding opportunities on turtle hatchlings around light sources).

Artificial lighting may also have the potential to disorient certain marine bird species such as localised populations of the Wedge-tailed Shearwater (*Puffinus pacificus*). Light that penetrates marine surface waters may also attract fish and other marine species including predators that may affect population distributions by providing some individual species with a competitive advantage.

4.4.6 Hydrocarbon Spills

Potential hydrocarbon spills have been assessed based on two spill sizes: <1000 L and >1000 L. The risk assessment determined that each scenario is likely to differ in likelihood and consequence and that a relatively small (<1000 L) hydrocarbon spill during construction was most likely. The key potential sources of these spills include:

- refuelling earthworks machinery along the MOF causeway
- refuelling construction equipment and vessels
- leaks from on board vessels
- droplets of grease from vessels
- used lubricating oils and waste oil
- hydraulic fluid, particularly from burst seals.

These hazards would typically involve the spill of diesel fuels in relatively small quantities.

The severity of potential environmental impacts resulting from a hydrocarbon spill will depend on a number of factors including location of the spill, depth of release, type of hydrocarbon spilled (i.e. diesel versus petroleum), prevailing sea and weather conditions, proximity of the spill to sensitive marine habitats, and effectiveness of spill response measures.

Marine biota sensitive to hydrocarbon spills as a result of marine construction activities include marine mammals, marine turtles, seabirds and fish as well as benthic marine habitats and biota.

4.4.6.1 Fish

Fish are susceptible to the effects of hydrocarbon spills, either directly or indirectly. Direct effects include direct contact with the hydrocarbon, which can potentially contaminate fish gills. Similarly, the water column may contain toxic and volatile hydrocarbon components that may be absorbed by fish eggs, larvae and juvenile fish. Fish may also eat contaminated food and low concentrations of hydrocarbons can affect reproduction and feeding in fish and shellfish.

4.4.6.2 Seabirds

Foraging seabirds are particularly susceptible to hydrocarbon spills as they dive into the water column in search of prey. Birds that come into contact with surface spills risk their feathers being coated in hydrocarbons, resulting in loss of ability to remain waterproof and buoyant on the water surface. Oil may also affect the reproductive success of the birds as oil from feathers

of a bird that is laying on eggs may pass through the pores in the eggshells and either kill the embryos or lead to malformations (GPA Online [n.d.]).

4.4.6.3 Sea Snakes

Potential impacts to sea snakes can include toxicity effects resulting from feeding on contaminated fish or from surfacing frequently to breathe and bask in the sun, making them susceptible to coating of their respiratory apparatus from potential surface slicks.

4.4.6.4 Marine Turtles

Hydrocarbon spills in shallow waters in the construction area have the potential to impact all turtle life cycle stages. Marine turtles' diving behaviour puts them at risk as they rapidly inhale a large volume of air before diving and continually resurface over time. In the event of a hydrocarbon spill (and depending on the nature and extent of the spill), adult turtles may experience both extended physical exposure to the oil and prolonged exposure to petroleum vapours, the most acutely harmful phase of a spill (National Oceanic and Atmospheric Administration [NOAA] 2003). Potential physical effects can include irritation caused by hydrocarbon contact with eyes, nasal and other body cavities, and potentially ingestion or inhalation of toxic vapours, depending on the hydrocarbon type spilled. However, compared to hatchlings, juveniles and adults spend less time at the sea surface, which potentially reduces their chances of exposure from a smaller oil slick (NOAA 2003).

Other potential direct effects to marine turtles resulting from hydrocarbon spills can include impacts to nesting activities and hatchling success (NOAA 2003).

4.4.6.5 Marine Mammals

Potential impacts to whales and dolphins are most likely to occur when they surface to breathe. For dolphins, this may lead to damage of the airway and lungs, mucus membrane damage, or even death. Dolphins' eyesight may also be affected by oil (GPA Online [n.d.]).

There is little documented evidence of whales being affected by oil spills, due to their migratory behaviour (GPA Online [n.d.]). Similarly, there are also indications that whales can inhale droplets of oil, vapours and fumes if they surface in slicks when they need to breathe (GPA Online [n.d.]).

4.4.6.6 Benthic Primary Producers

Spilled hydrocarbons can adversely affect marine benthic primary producers if there is direct contact at low tide, through the dispersal of oil droplets into shallow subtidal areas or by dissolution of toxic hydrocarbons into the water column (National Research Council [NRC] 1993). Coral, seagrass and mangrove communities located in these areas are particularly sensitive to liquid hydrocarbons, as are supratidal seabird nesting areas (International Petroleum Industry Environmental Conservation Association 1993; Duke *et al*. 1999; United States Environmental Protection Agency 1999). In general, deeper subtidal communities tend to be buffered from the effects of a spill by the overlying water.

Although strong winds and rough sea conditions can disperse hydrocarbons through the water column, light oils (such as diesel) usually float and typically evaporate quickly, particularly when ambient sea and air temperatures are warm. Marine diesel is a light hydrocarbon and will be used for the majority of construction vessels. Depending on wind conditions, up to 60 to 80% of the initial volume is predicted to evaporate following contact with the sea surface (Woodside Energy 2006). Therefore, the potential effects of spilled hydrocarbons are likely to be limited to near-surface organisms, as well as intertidal and shoreline species or communities.

Through the implementation of appropriate mitigation measures and controls, potential impacts are likely to be limited.

Refer to Management Strategy 6 (Section 6.7) for associated management and monitoring requirements.

4.4.7 Solid and Liquid Waste Management

4.4.7.1 Liquid Waste

Liquid waste sources that will be discharged into the marine environment will include:

- vessel effluent
- deck drainage, which may comprise primarily rainwater and washdown water
- engine cooling water
- brine resulting from the production of water on board vessels.

Routine discharge of liquid waste from vessels has the potential to result in localised changes to the water column, including elevation in water temperature and nutrients. Potential impacts include attraction of marine fauna to discharge locations. Management of liquid wastes is addressed in the Solid and Liquid Waste Management Plan (Chevron Australia 2009e).

4.4.7.2 Solid Waste

Solid wastes that may be generated during construction include plastics, materials packaging, scrap metal, containers, wood, and food waste. Management of solid waste is addressed in the Solid and Liquid Waste Management Plan (Chevron Australia 2009e).

4.5 Biosecurity

Invasive marine species are marine biota that are translocated into waters outside their natural geographical distribution range and that subsequently settle, survive and have detrimental impacts. Not all introduced marine species are considered invasive. Introduced species are considered invasive if they are able to tolerate a range of local environmental conditions, form a common component of the habitats and communities into which they spread, and/or colonise a relatively wide geographical area.

An increase in the number of vessel movements around Barrow Island associated with marine construction activities presents a threat of exposure of introduced marine species. The introduction of non-indigenous species (NIS) could lead to irreversible impacts to the composition and function of the ecosystem through competition, predation or habitat modification.

Key vectors for invasive marine species on equipment or vessels include:

- ballast water
- fouling on the vessel hull or external niches
- fouling on internal niches.

A Terrestrial and Marine Quarantine Management System (QMS) (Chevron Australia 2009f) has been developed in accordance with Statement No. 800, Condition 10 and EPBC Reference: 2003/1294 and 2008/4178, Condition 8. The system has been prepared with reference to Schedule 4 of Statement No. 800 and EPBC Reference: 2003/1294 and 2008/4178, which provides specific details of the structural and functional pathway requirements of the QMS.

Refer to Management Strategy 8 (Section 6.9) for associated management and monitoring requirements.

4.6 Atmospheric Emissions

Atmospheric emissions including SO_2, NO_x, ozone depleting substances (ODS), BTEX and hydrocarbons from vessel exhausts and land-based machinery have the potential to result in

localised air quality impacts. Potential impacts include the generation of dark smoke and contribution to greenhouse gas emissions.

Refer to Management Strategy 9 (Section 6.10) for associated management and monitoring requirements.

5.0 Objectives, Performance Standards and Relevant Documentation

5.1 Overview

This section summarises the environmental objectives, performance standards and relevant documentation that have been developed as part of a systematic approach to the management of environmental risks. Specific objectives, performance standards and documentation will be used to assess the overall environmental performance for the Gorgon Gas Development against the stated environmental objectives.

Table 5-1 contains the objectives, performance standards and documentation that relate to this Plan. These will provide input into the Environmental Performance Reports required under Condition 5 of Statement No. 800 and Condition 4 of EPBC Reference: 2003/1294 and 2008/4178.

5.2 Objectives

Chevron Australia is committed to conducting activities associated with the Gorgon Gas Development and Jansz Feed Gas Pipeline in an environmentally responsible manner, and aims to implement best practice environmental management as part of a program of continual improvement. To meet this commitment, objectives have been defined that relate to the management of the identified environmental risks for the Gorgon Gas Development. These objectives are those in Condition 17.4 of Statement No. 800 and Condition 13.4 of EPBC Reference: 2003/1294 and 2008/4178, and where necessary, additional, more specific objectives have been developed.

Table 5-1 details the objectives specific to this Plan.

5.3 Performance Standards

Performance standards are the measures Chevron Australia will use to assess whether or not it is meeting its objectives. For each objective and element of each objective, Chevron Australia has described a matter ('description') that will be measured, and a quantitative target or, where there is no practicable quantitative target, a qualitative target, which is to be measured against when assessing whether the objective has been met. These targets have been developed specifically for assessing performance, not compliance, and so failure to meet the target does not represent a breach of this Plan. Rather, it indicates that an objective may not have been met and there may be a need for management action or review of this Plan.

Table 5-1 includes performance standards required in respect of the matters of National Environmental Significance (NES) listed in Appendix 4 of this Plan, as required by Condition 3.2.5 of EPBC Reference: 2003/1294 and 2008/4178.

The performance standards specific to this Plan are detailed in Table 5-1.

5.4 Relevant Documentation

Chevron Australia has defined the relevant documentation that contains information about whether the performance standards have been met.

Relevant documentation specific to this Plan is detailed in Table 5-1.

Table 5-1 Objectives, Performance Standards and Relevant Documentation

Goal: To reduce potential environmental impacts from the construction of the Marine Facilities on the east coast of Barrow Island			
Objectives	**Performance Standards**		**Evidence/Relevant Documentation**
	Descriptor	**Target**	
Overarching Objectives (Ministerial Condition 17.4) To reduce the impacts from the construction of the Marine Facilities listed in Condition 17.2 (excepting from the generation of turbidity and sedimentation from dredging and spoil disposal) as far as practicable To ensure that construction of the Marine Facilities listed in Condition 17.2 does not cause Material or Serious Environmental Harm outside the Marine Disturbance Footprint associated with those facilities (except from the generation of turbidity and sedimentation from dredging and spoil disposal.)	Implementation of Management Measures defined in this Plan	100% implementation of management measures during marine construction	• Employee/contractor induction, awareness and training to foster a culture of environmental awareness and understanding of conservation values of the waters surrounding Barrow Island • Chevron and EPCM Contractor to routinely audit the implementation of the management measures • Annual Compliance Report
	Material or Serious Environmental Harm outside the MDF associated with those facilities (except from the generation of turbidity and sedimentation from dredging and spoil disposal)	No Material or Serious Environmental Harm outside the MDF associated with those facilities (except from the generation of turbidity and sedimentation from dredging and spoil disposal)	• Audit results
	Review the efficacy of the MFCEMP	Substantive review after six months following commencement of Marine Facilities construction activities and then every six months (or more frequently if required) over the duration of Marine Facilities construction	• Management related changes incorporated into MFCEMP

6.0 Environmental Management and Monitoring Strategies

6.1 Overview

The environmental management of the construction of the Marine Facilities described in Condition 17.2, Statement No. 800 and the RO Structures will be focused on minimising key potential environmental impacts via the implementation of aspect-based management measures. Management strategies have been developed to outline key management measures, monitoring and reporting requirements, which Chevron Australia will expect as minimum standards of contractor environmental performance, to be included as components of their management systems where relevant. Specific Management Strategies that will be implemented and adhered to during construction include:

- Management Strategy 1: Marine Fauna Interaction
- Management Strategy 2: Direct Habitat Disturbance
- Management Strategy 3: Water Quality
- Management Strategy 4: Noise and Vibration (including drill and blasting)
- Management Strategy 5: Artificial Light Spill
- Management Strategy 6: Hydrocarbon Spills and Management
- Management Strategy 7: Solid and Liquid Waste Management
- Management Strategy 8: Biosecurity (Marine Pest Species)
- Management Strategy 9: Atmospheric Emissions.

For each of the Management Strategies, the following information is provided:

- management measures, including responsibility and timing
- monitoring requirements

The measures outlined in the sections below include the measures required in respect of the matters of NES listed in Appendix 4, as required by EPBC Reference: 2003/1294 and 2008/4178.

Section 6.2 and 6.5 includes monitoring procedures required in respect of the matters of NES listed in Appendix 4 of this Plan, as required by Condition 3.2.4 of EPBC Reference: 2003/1294 and 2008/4178.

6.2 Management Strategy 1: Marine Fauna Interaction

Management Measures	Responsibility	Timing
Prior to the commencement of construction, selected crew from the construction vessels will be trained as Marine Fauna Observers (MFOs) on marine turtle and marine mammal behaviour and the actions to be taken in the event of marine fauna sightings, injury or mortality.	Construction Contractor	Prior to mobilisation
During daylight hours, operators of specified vessels will be required to maintain a MFO on watch during marine operations and vessel movements. If marine fauna are spotted, moving vessels will adjust their speed and direction to avoid impacting the animal, where practicable.	Construction Contractor	Ongoing during construction
In the event that injured marine fauna are sighted, the requirements of the Fauna Handling Common User Procedure will be complied with, where practicable.	Chevron Australia	Ongoing during construction
A log detailing marine mammal and marine turtle sightings will be maintained on all vessels. If marine mammals or turtles at risk from construction activities are sighted, relevant vessels operating in the area will be notified and the location of marine mammals or turtles will be monitored and recorded, where practicable.	Construction Contractor	Ongoing during construction
The risk of impact to marine turtles increases with an increase in vessel speed, shallow water, and reduced under keel clearance. Vessel speed >10 knots can impact on marine turtles; therefore, vessel speed will be restricted in the Barrow Island Port Area. Within this area, vessel speeds will be under the control of the Harbour Master who will ensure that all vessels operate in a safe manner with due respect paid to ongoing operations, navigational constraints, and environmental considerations. The Harbour Master will be advised of environmental matters from onsite environmental staff, including Marine Fauna Observers, as applicable. Vessel speed will also be managed based on environmental conditions (turtle abundance observed in area by MFO), weather conditions, vessel manoeuvrability, and location of navigational hazards.	Construction Contractor	Ongoing during construction
The marine construction workforce and all vessels will be limited to designated areas only, except for emergencies. Recreational fishing, diving, spear fishing, fossicking (i.e. collecting shells and any other biological or natural material e.g. animal bones), surfing or recreational boating will be prohibited during construction.	Construction Contractor	Ongoing during construction
Monitoring Requirements	• The Long-term Marine Turtle Management Plan (LTMTMP) has been developed that includes various monitoring programs to record potential impacts to turtle numbers, nesting and hatchling success associated with the larger development (Chevron Australia 2012) • An MFO will maintain watch for Key Receptor Species during daylight during construction activities on specified vessels	
Reporting Requirements	See Section 8.2 for relevant reporting requirements	

6.3 Management Strategy 2: Direct Habitat Disturbance

Management Measures	Responsibility	Timing
Construction Contractor will be provided with: • boundaries of the MDF in a suitable format (i.e. GPS coordinates) • locations of coral assemblages • the latest revision of all relevant engineering drawings. This information will be available to all vessel skippers and relevant crew.	Construction Contractor	Prior to mobilisation
Construction Contractor will develop internal anchor management procedures, approved by the EPCM contractor and/or Chevron Australia. This procedure will include details of, or about, the: • required anchor spreads • management of chain/wire drag and anchor movements • procedures for deployment and retrieval of anchors. The objective of the procedure will be to manage impacts to coral assemblages and to keep impacts within the MDF through effective anchor management. Figure 6-1 shows the development process for this procedure.	Construction Contractor	Prior to mobilisation
Construction Contractor will avoid any disturbance outside the MDF boundaries.	Construction Contractor	Ongoing during construction
Construction Contractor will implement the approved anchor management procedures.	Construction Contractor	Ongoing during construction
Approval must be sought from the EPCM Contractor prior to setting anchors outside the approved anchor management procedure.	Construction Contractor	Ongoing during construction
Where anchoring is required around coral assemblages, measures such as the use of pre-set anchors and buoyant lines will be implemented, where practicable.	Construction Contractor	Ongoing during construction
Chevron and/or the EPCM contractor shall routinely audit compliance with the anchor management procedure.	Chevron Australia and/or EPCM contractor	Ongoing during construction
Establish mooring locations to avoid unnecessary vessel anchoring so as to minimise impacts to coral assemblages.	Construction Contractor	Prior to mobilisation
Locations of moorings will be selected to avoid impacts to coral assemblages, where practicable.	Construction Contractor	Prior to mobilisation
The location of moorings will be approved in consultation with the EPCM Contractor and Chevron Australia.	Construction Contractor	Prior to mobilisation
Conduct pre-construction planning to minimise the requirements for anchor sets in nearshore waters.	Construction Contractor	Prior to mobilisation
Construction Contractor will manage construction activities to minimise impacts to coral assemblages, where practicable.	Construction Contractor	Ongoing during construction
Marine construction activities will be guided by survey controls and construction design requirements, where practicable.	Construction Contractor	Ongoing during construction
All equipment on board vessels shall be stowed securely to prevent solid objects from falling overboard.	Construction Contractor	Ongoing during construction
Dropped objects shall be reported to the EPCM Contractor as soon as practicable. Retrieval of submerged objects will be assessed in consultation with the EPCM Contractor and/or Chevron Australia.	Construction Contractor	Ongoing during construction

Management Measures		Responsibility	Timing
Monitoring Requirements	Audits for compliance with the anchor management procedure will be routinely undertaken by the EPCM Contractor and/or Chevron Australia.		
Reporting Requirements	See Section 8.2 for relevant reporting requirements.		

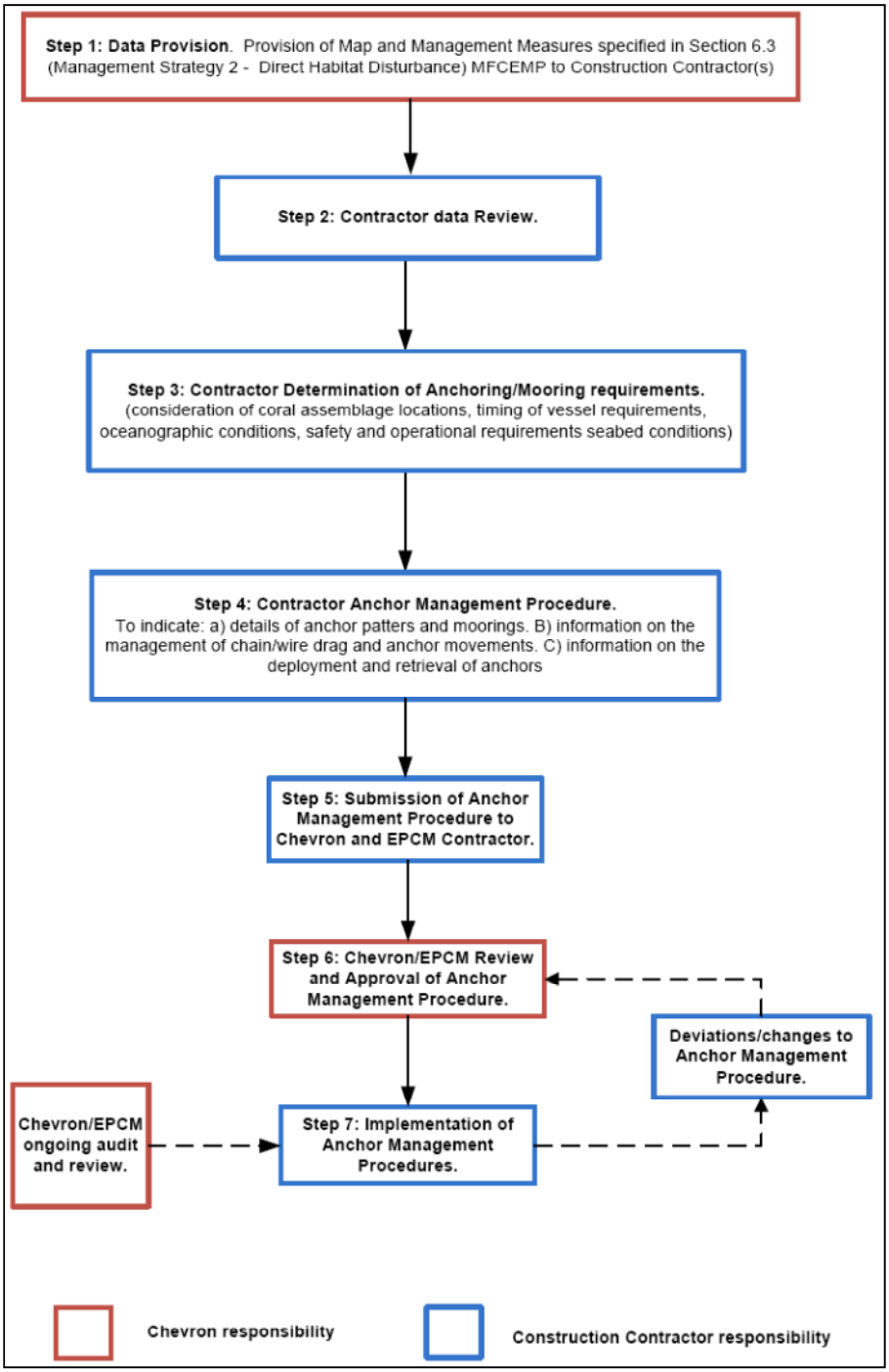


Figure 6-1 Process for Development of Internal Anchor Management Procedure

6.4 Management Strategy 3: Water Quality

Management Measures	Responsibility	Timing
Measures relevant to Reclamation Activities		
Monitoring of water quality and sedimentation and potential impacts to coral health from the reclamation activities will be encompassed within the water quality and coral health monitoring programs as described within the DSDMMP.	Chevron Australia	Ongoing during construction
Material from the mainland and Barrow Island to be used in the construction of the MOF berms will be screened to minimise fines, or where not screened a filter layer (geotextile) will be place on the outside of the berm to minimise fines spreading to the environment.	Construction Contractor	Ongoing during construction
Pipelines will be routinely maintained to minimise leakage of turbid water during pumping of material to the reclamation area, where practicable.	Construction Contractor	Ongoing during construction
Settling areas will be used within the MOF during reclamation to minimise release of fines with decant water.	Construction Contractor	Ongoing during construction
A filter layer (geotextile/graded material) will be used in construction of the Pioneer MOF Platform (and other areas where reclamation is required and there is potential for the berm to pass fine material) to manage the release of fines from the core material into the marine environment.	Construction Contractor	Ongoing during construction
The placement of the fill during reclamation will be primarily at or near high tides, where practicable.	Construction Contractor	Ongoing during construction
The coarser sand fraction of material will be used for reclamation where practicable to assist in reducing the turbidity levels of the decant water.	Construction Contractor	Ongoing during construction
The MOF berm will include a weir box to manage discharge of decant water.	Construction Contractor	Ongoing during construction
Current and forecasted meteorological and oceanographic information will be considered in the daily work plan.	Construction Contractor	Ongoing during construction
Available water quality and coral health data will be considered in the daily work plan.	Construction Contractor	Ongoing during construction
Measures relevant to Drilling Fluids and Cuttings		
Seawater will be used during drilling as part of pile installation. No synthetic-based muds will be used as a drill lubricant.	Construction Contractor	Ongoing during construction

Monitoring Requirements	Monitoring of impacts to water quality and coral health from reclamation activities and sea bed preparation for the LNG Jetty will be encompassed within the monitoring program, as described in the DSDMMP.
Reporting Requirements	Reporting of water quality and sedimentation and coral health monitoring results is addressed in Section 8.0 of the DSDMMP.

Management Triggers for dredging and spoil disposal activities (Condition 21.4, Statement No. 800 and Condition 14.4 of EPBC Reference: 2003/1294 and 2008/4178) are addressed within the DSDMMP (Condition 20, Statement No. 800 and Condition 14 of EPBC Reference: 2003/1294 and 2008/4178). Should Management Triggers be exceeded as a result of dredging and/or reclamation activities, a number of responsive management measures will be considered (DSDMMP, Table 6.2). Those relevant to reclamation activities include:

- Reduce or cease overflow from MOF reclamation area during periods when the dredge plume is considered likely to lead to further impacts.
- Optimisation of disposal location based on metocean conditions and location of affected corals.

6.5 Management Strategy 4: Noise and Vibration (including Drilling, Marine Blasting and Impact Piling)

Management Measures	Responsibility	Timing
Blasting-specific Measures		
The blast management procedure shown in Figure 6-2 will be implemented by the Construction Contractor in the event that marine blasting is required.	Construction Contractor	Ongoing during blasting
An exclusion zone of 2000 m for whales and 1000 m for other Key Receptor Species will be adopted.	Construction Contractor	Ongoing during blasting
An appropriate number of support vessels will be used to traverse the radius of the exclusion zone looking inwards and outwards to locate any Key Receptor Species during drill and blast activities.	Construction Contractor	Ongoing during blasting
Stem blast holes with gravel (or similar material) to seabed level after the charge is in place, prior to blasting.	Construction Contractor	Ongoing during blasting
Blasting will be delayed if Key Receptor Species are sighted within the exclusion zone.	Construction Contractor	Ongoing during blasting
A maximum allowable charge of 50 kg per delay shall be specified.	Construction Contractor	Ongoing during blasting
Sequential charges shall be used to minimise cumulative impacts of the explosives.	Construction Contractor	Ongoing during blasting
Drill method and detonation system will be selected to avoid sympathetic detonation between blast holes.	Construction Contractor	Ongoing during blasting
Removal of surface kill e.g. fish (if evident) shall occur following each blast.	Construction Contractor	Ongoing during blasting
Blasting shall be undertaken during daylight hours only.	Construction Contractor	Ongoing during blasting
Piling-specific Measures		
The piling management procedure shown in Figure 6-3 will be implemented by the Construction Contractor during impact piling activities.	Construction Contractor	Ongoing during piling
An exclusion zone of 2000 m for whales and 500 m for other Key Receptor Species will be adopted during impact piling activities.	Construction Contractor	Ongoing during piling
To minimise the risk to Key Receptor Species within close proximity to the source, carry out 'soft-start' at the commencement of impact piling. This will allow animals in close proximity to source to move away and not be suddenly exposed to violent noise.	Construction Contractor	Ongoing during piling
Impact piling will not occur at night if there have been three or more cetacean-instigated shutdown situations during the preceding 24-hour period.	Construction Contractor	Ongoing during piling
General Measures (including drilling)		
Noise-generating equipment (including vessel engines, drill and piling equipment) will be routinely maintained and inspected to reduce unnecessary increases in noise levels from equipment.	Construction Contractor	Ongoing during construction
Avoid leaving engines, thrusters and auxiliary plants in stand-by or running mode unnecessarily, where possible.	Construction Contractor	Ongoing during construction
All vessels shall operate in accordance with appropriate industry and equipment noise and vibration standards.	Construction Contractor	Ongoing during construction
Monitoring Requirements	A Marine Fauna Observer (MFO) will monitor for Key Receptor Species during the marine blast and impact piling programs.	
Reporting Requirements	See Section 8.2 for relevant reporting requirements.	

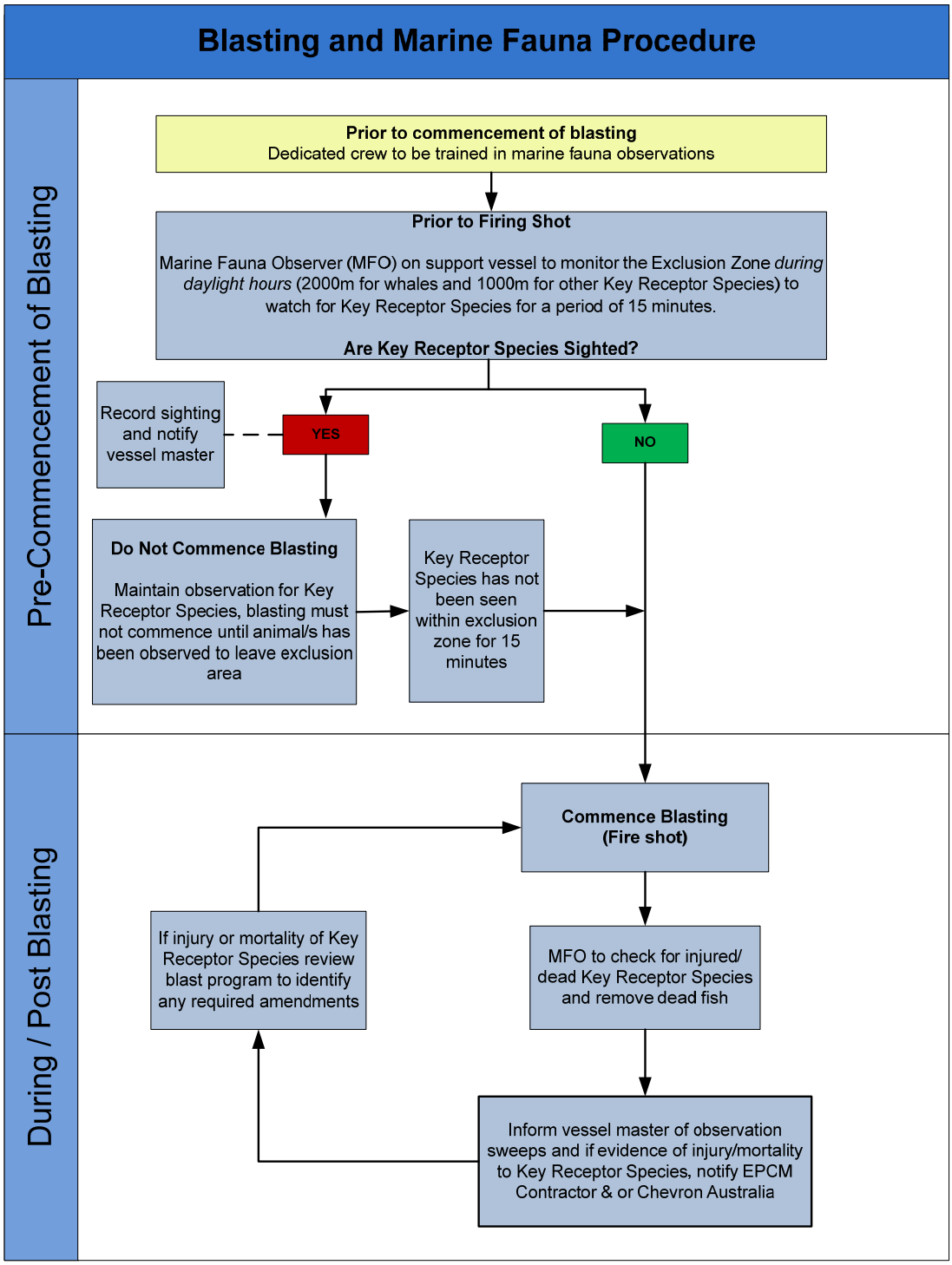


Figure 6-2 Blasting and Marine Fauna Management Procedure

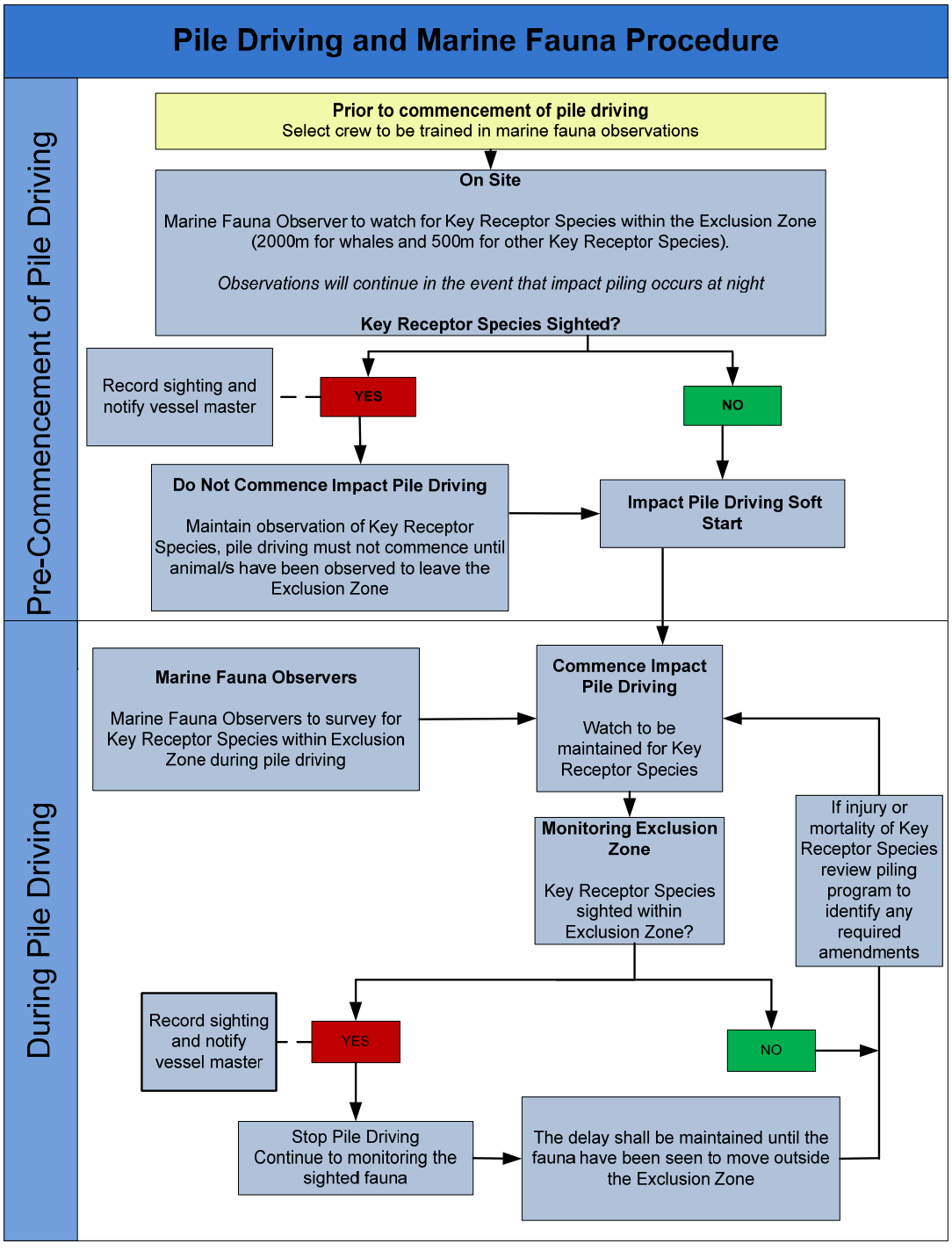


Figure 6-3 Impact Piling and Marine Fauna Management Procedure

6.6 Management Strategy 5: Artificial Light Spill

Management of artificial light spill is addressed in the LTMTMP (Condition 16 Statement 800 and Condition 12 of EPBC Reference: 2003/1294 and 2008/4178) (Chevron Australia 2009c).

6.7 Management Strategy 6: Hydrocarbon Spills and Management

Management Measures	Responsibility	Timing
Where practicable, hazardous material storage areas shall be designed to handle the volumes and operating conditions (both normal and upset conditions) specifically required for each substance, including product identification, transportation, storage, control and loss prevention (e.g. bunding and drainage).	Construction Contractor	Prior to mobilisation and ongoing during construction
Industry standards, port authority, and pollution prevention regulations shall be adhered to during refuelling, transfer, storage and handling of hazardous materials (e.g. bunding, level gauges, overflow protection, drainage systems and hardstands).	Construction Contractor	Ongoing during construction
Hazardous materials (including hazardous waste) shall be stored in appropriately labelled and contained drums or tanks. An up-to-date list of MSDSs shall be available and stored with relevant products.	Construction Contractor	Ongoing during construction
Detailed refuelling procedures, shall be developed by the Construction Contractor prior to commencement of work on site and shall include, but not be limited to, the following requirements where practicable: • fuel transfer to occur in accordance with port authority and pollution prevention regulations • specific safety boundaries to be used when refuelling • refuelling to be undertaken in fair weather conditions, as far as reasonably practicable (i.e. allowing for safety requirements during cyclone watch and warning stages) to reduce risk of spills • open communication channels to be maintained during refuelling • instructions for visual monitoring; and emergency response procedures.	Construction Contractor	Prior to mobilisation
Personnel involved with refuelling or fuel transfer shall be trained in their roles, functions and responsibility, including emergency response prior to engaging in refuelling or fuel transfer.	Construction Contractor	Prior to mobilisation and ongoing during construction
All vessels greater than 400 gross tonnage shall have bilge oil/water separators that comply with the requirements of Annex I of MARPOL 73/78 and Part II of the *Protection of the Sea (Prevention of Pollution from Ships) Act 1993* (Cth) to ensure that oil concentrations in discharges are less than 15 ppm.	Construction Contractor	Prior to mobilisation and ongoing during construction
Drainage from decks and work areas with potential for oil, grease or hydrocarbon contamination shall be collected and processed through an appropriately maintained oil/water separator and managed according to International Oil Pollution Prevention (IOPP) procedures prior to discharge, or stored for onshore disposal.	Construction Contractor	Ongoing during construction

Management Measures	Responsibility	Timing
Sufficient and appropriate equipment, materials and resources shall be available in a timely manner to: • prevent spills to marine environment from working machinery (e.g. spill trays, one-way valves or other spill prevention features) • respond to spills to the marine environment • respond to spills to ground (on board vessels).	Construction Contractor	Ongoing during construction
The Construction Contractor will comply with and align spill response preparedness with the relevant requirements of the Chevron Marine Oil Pollution Plan (MOPP).	Construction Contractor	Ongoing during construction
All relevant personnel shall be trained in spill prevention, response and reporting.	Construction Contractor	Prior to mobilisation and ongoing during construction
Specified vessels shall have a current International Oil Pollution Prevention Certificate (IOPP) issued by the State in which the vessel is registered and an approved Shipboard Oil Pollution Emergency Plan (SOPEP).	Construction Contractor	Ongoing during construction
If relevant vessels do not have an existing approved SOPEP, the vessel shall prepare a vessel-specific Spill Contingency Plan (SCP) that bridges to the Chevron Australia MOPP to ensure an effective, integrated response to any spill	Construction Contractor	Ongoing during construction
Onboard spills shall be contained and cleaned up immediately and shall not be washed overboard. Product MSDSs shall be adhered to during clean-up.	Construction Contractor	Ongoing during construction
Terrestrial-based hydrocarbon spill management (MOF causeway and WAPET Landing): • Spill clean-up kits will be deployed at designated locations on the MOF causeway. • Vessel refuelling tankers will have spill clean-up kits. • All vehicle refuelling will be undertaken by trained personnel and in accordance with a vehicle refuelling procedure.	Construction Contractor	Ongoing during construction
Monitoring Requirements	Audits of each vessel's hydrocarbon handling procedures and equipment, including spill kits, will be undertaken on a regular basis during construction by the EPCM Contractor and/or Chevron Australia.	
Reporting Requirements	Spills will be documented and reported in accordance with the Chevron Incident Reporting Procedure.	

6.8 Management Strategy 7: Solid and Liquid Waste Management

Management of solid and liquid wastes is addressed in the Solid and Liquid Waste Management Plan (Condition 30, Statement No. 800 and Condition 20, EPBC Reference: 2003/1294 and 2008/4178) (Chevron Australia 2009e).

6.9 Management Strategy 8: Biosecurity

Management Measures	Responsibility	Timing
Construction Contractor will be required to produce a Quarantine Management Plan (QMP) to cover the Marine Facilities construction fleet, with the purpose of systematically documenting the quarantine management practices and procedures the Contractor will undertake that link to the Chevron Quarantine Management System (QMS). The QMP will comply with the Gorgon Gas Development quarantine commitments, which prevent the introduction and establishment of both marine and terrestrial non-indigenous species (NIS) on Barrow Island and surrounding waters.	Construction Contractor	Prior to and during construction
Monitoring Requirements	Monitoring and surveillance of construction vessels by quarantine project inspectors will be undertaken to ensure quarantine compliance with the QMS and allow for continuous improvement strategies to be implemented.	
Reporting Requirements	As required by the QMS	

6.10 Management Strategy 9: Atmospheric Emissions

Management Measures	Responsibility	Timing
Where incinerators are permitted to be used on vessels, the requirements of Annex VI of MARPOL 73/78 shall be met.	Construction Contractor	Prior to and during construction
All diesel engines on vessels shall comply with the requirements for NO_x emissions specified in Regulation 13 of Annex VI of MARPOL 73/78.	Construction Contractor	Prior to and during construction
Incineration of material prohibited under Regulation 16 of Annex VI of MARPOL 73/78, e.g. contaminated packaging materials and polychlorinated biphenyls (PCBs), shall not be undertaken on board vessels.	Construction Contractor	Prior to and during construction
All vessels shall comply with the requirements for ozone depleting substances (ODS) specified in Regulation 12 of Annex VI of MARPOL 73/78, including the prohibition of deliberate release of ODS and ODS in new installations except for new installations containing hydrochlorofluorocarbons (HCFCs), which are permitted until 1 January 2020.	Construction Contractor	Prior to and during construction
Monitoring Requirements	Audits of compliance with MARPOL 73/78 will be undertaken on a routine basis by the EPCM Contractor and/or Chevron Australia during construction.	
Reporting Requirements	N/A	

7.0 Implementation

7.1 Environmental Management Documentation

7.1.1 Overview

Figure 1-3 in Section 1.6.4 of this Plan shows the hierarchy of environmental management documentation within which this Plan exists. The following sections describe each level of documentation in greater detail.

7.1.2 Chevron ABU OE Documentation

As part of the Chevron ABU, the Gorgon Gas Development is governed by the requirements of the ABU Operational Excellence Management System (OEMS), within which a number of Operational Excellence (OE) Processes exist. The Gorgon Gas Development will implement internally those OE Processes (and supporting OE Procedures) that apply to the Gorgon Gas Development's activities, where they are appropriate and reasonably practicable.

The key ABU OE Processes taken into account during the development of this Plan, with a description of the intent of the Process, are:

- **HES Risk Management Process** (Chevron Australia 2007): Process for identifying, assessing and managing health, environment and safety (HES), operability, efficiency and reliability risks related to the Gorgon Gas Development.
- **Environmental Stewardship Process** (Chevron Corporation 2007): Applies during the Operations Phase of the Gorgon Gas Development. Process for ensuring all environmental aspects are identified, regulatory compliance is achieved, environmental management programs are maintained, continuous improvement in performance is achieved, and alignment with ISO 14001-2004 (Standards Australia/Standards New Zealand 2004) is achieved.
- **Contractor HES Management Process** (Chevron Australia 2008a): Process for defining the critical roles, responsibilities and requirements to effectively manage contractors involved with the Gorgon Gas Development.
- **Competency, Training and Assessment Process** (Chevron Australia 2006a): Process for ensuring the workforce has the skills and knowledge to perform their jobs in an incident-free manner, and in compliance with applicable laws and regulations.
- **Incident Reporting and Investigation Process** (Chevron Australia 2008b): Process for reporting and investigating incidents (including near misses) to reduce or eliminate root causes and prevent future incidents.
- **Emergency Management Process** (Chevron Australia 2007a): Process for providing organisational structures, management processes and tools necessary to respond to emergencies and to prevent or mitigate emergency and/or crisis situations.
- **Compliance Assurance Process** (Chevron Australia 2006b): Process for ensuring all HES and OE-related legal and policy requirements are recognised, implemented and periodically audited for compliance.

7.1.3 Gorgon Gas Development Documentation

7.1.3.1 Ministerial Plans and Reports

In addition to this Plan, a number of other plans and reports have been (or will be) developed for the Gorgon Gas Development that are required under State and/or Commonwealth Ministerial Conditions (refer to Figure 1-3). These documents address the requirements of specific Conditions and provide standards for environmental performance for the Gorgon Gas Development. Those documents specifically referenced within this Plan include:

- Coastal and Marine Baseline State and Environmental Impact Report (EPBC Reference: 2003/1294 and 2008/4178 Condition 11 Statement No. 800 Condition 14) (Chevron Australia 2009b)
- Dredging and Spoil Disposal Management and Monitoring Plan (EPBC Reference: 2003/1294 and 2008/4178 Conditions 14; Statement No. 800 Condition 20) (Chevron Australia 2009a)
- Long-term Marine Turtle Management Plan (EPBC Reference: 2003/1294 and 2008/4178 Condition 12; Statement No. 800 Condition 16) (Chevron Australia 2012)
- Terrestrial and Marine Quarantine Management System (EPBC Reference: 2003/1294 and 2008/4178 Condition 8; Statement No 800 Condition 10) (Chevron Australia 2009f)
- Solid and Liquid Waste Management Plan (EPBC Reference: 2003/1294 and 2008/4178 Condition 20; Statement No. 800 Condition 30) (Chevron Australia 2009e).

7.1.3.2 Impact Mitigation Strategies

Impact Mitigation Strategies (IMSs) are aspect-based management standards that accompany the activity-specific Environmental Management Plans (EMPs). The IMSs document the detailed management requirements associated with potential impacts for the Gorgon Gas Development. Each IMS covers a particular environmental aspect that requires management (e.g. light, noise and vibration, atmospheric emissions, etc.).

Personnel (including contractors and subcontractors) involved in that particular scope of work are internally required to comply with the IMSs where reasonably practicable. The IMSs also document requirements for contractors to develop internal work scope EMPs for the Gorgon Gas Development, which include work procedures to mitigate their impacts (such as step-by-step procedures and work method statements).

7.1.3.3 Contractor and Subcontractor Documentation

A variety of internal contractor and subcontractor documentation will be developed, including documents such as task-specific work procedures, work method statements and Job Hazard Analyses. These detailed documents will specify the way activities shall be performed in a step-by-step manner. These procedural documents are therefore specific to the Gorgon Gas Development and Jansz Feed Gas Pipeline (where required) and include any environmental requirements that are detailed in higher level documentation relevant to the contractors'/subcontractors' scope of work (i.e. the IMSs and EMPs described in the previous sections)

7.2 Training and Inductions

All personnel (including contractors and subcontractors) are required to attend environmental inductions and training relevant to their role on the Gorgon Gas Development. Training and induction programs facilitate the understanding personnel have of their environmental responsibilities, and increase their awareness of the management and protection measures required to reduce potential impacts on the environment.

Chevron Australia has prepared the ABU Competency, Training and Assessment Process (Chevron Australia 2006a) to deal with the identification and assessment of required competencies for environmental roles and which it internally requires its employees, contractors, etc. to comply with.

Environmental training and competency requirements for personnel, including contractors and subcontractors, are maintained in a Gorgon Gas Development HES training matrix.

8.0 Auditing, Reporting and Review

8.1 Auditing

8.1.1 Internal Auditing

Chevron Australia has prepared the internal Compliance Assurance ASBU – Standardized OE Process (Chevron Australia 2006b) to manage compliance, and which it internally requires its employees, contractors, etc. to comply with. This Process will also be applied to assess compliance of the Gorgon Gas Development against the requirements of Statement No. 800 and EPBC Reference: 2003/1294 and 2008/4178 where this is appropriate and reasonably practicable.

An internal audit schedule has been developed and will be maintained for the Gorgon Gas Development (with input from the Engineering, Procurement and Construction Management [EPCM] Contractors) that includes audits of the Development's environmental performance and compliance with the Ministerial Conditions. A record of all internal audits and the audit outcomes is maintained. Actions arising from internal audits are tracked until their close-out.

Under EPBC Reference: 2003/1294 and 2008/4178, Condition 24 also requires that the person taking the action must maintain accurate records of activities associated with or relevant to the Conditions of approval and make them available on request by DEWHA (now SEWPaC). Such documents may be subject to audit by DEWHA (now SEWPaC) and used to verify compliance with the conditions of approval.

Any document that is required to be implemented under this Plan will be made available to the relevant DEC/DEWHA (now SEWPaC) auditor.

8.1.1.1 Marine Disturbance Footprint

As required by Statement No. 800 Condition 17.4.ii and Condition 13.4.ii EPBC Reference: 2003/1294 and 2008/4178, Chevron Australia is required to:

> '*ensure that construction of the marine facilities listed in Condition 17.2 does not cause Material or Serious Environmental Harm outside the Marine Disturbance Footprint associated with those facilities (except from the generation of turbidity and sedimentation from dredging and spoil disposal)'*

To verify that construction activities have not caused Serious or Material Environmental Harm outside the MDF, the following compliance measures are proposed:

- Verification that the Marine Facilities listed in Condition 17.2 have been constructed in accordance with engineering design.
- EPCM Contractor and/or Chevron Australia shall audit compliance Construction Contractor's approved anchor management procedures.

8.1.2 External Auditing

Audits and/or inspections undertaken by external regulators will be facilitated via the Gorgon Gas Development Regulatory Approvals and Compliance Team. The findings of external regulatory audits will be recorded and actions and/or recommendations will be addressed and tracked. Chevron Australia may also undertake independent external auditing during the Gorgon Gas Development.

Under EPBC Reference: 2003/1294 and 2008/4178, Condition 23 also requires that upon the direction of the Minister, the person taking the action must ensure that an independent audit of compliance with the Conditions of approval is conducted and a report submitted to the Minister. The independent auditor must be approved by the Minister prior to the commencement of the audit. Audit criteria must be agreed to by the Minister and the audit report must address the criteria to the satisfaction of the Minister.

8.2 Reporting

8.2.1 Compliance Reporting

Condition 4 of Statement No. 800 and Condition 2 of EPBC Reference: 2003/1294 and 2008/4178 requires Chevron Australia to submit a Compliance Assessment Report annually to address the previous 12-month period. An audit table is provided in Appendix 3 to assist with auditing for compliance with this Plan for Statement No. 800, EPBC Reference: 2003/1294 and 2008/4178.

8.2.2 Environmental Performance Reporting

Condition 5.1 of Statement No. 800, and Condition 4 of EPBC Reference: 2003/1294 and 2008/4178 require that Chevron Australia submits an Environmental Performance Report to the Western Australian Minister for the Environment and to the Commonwealth DEWHA (now the Department of Sustainability, Environment, Water, Population and Communities [SEWPaC]) respectively, on an annual basis, for the previous 12-month period.

In addition, under Condition 5.3 of Statement No. 800 and Condition 4.2 for EPBC Reference: 2003/1294 and 2008/4178 every five years from the date of the first annual Report, Chevron Australia shall submit to the Western Australian Minister for the Environment an Environmental Performance Report covering the previous five-year period.

Specific details on the content of the Environmental Performance Report are defined in Condition 5.2 and Schedule 3 of Statement No. 800, and Schedule 3 of EPBC Reference: 2003/1294 and 2008/4178.

The information in the Environmental Performance Report will also partly meet the requirements of Condition 3.7 of EPBC Reference: 2003/1294 and 2008/4178.

8.2.3 Routine Internal Reporting

The Gorgon Gas Development will use a number of routine internal reporting formats to effectively implement the requirements of this Plan. Routine reporting is likely to include daily, weekly and/or monthly HES reports for specific scopes of work. These reports include information on a number of relevant environmental aspects, such as details of environmental incidents (if any), environmental statistics and records, records of environmental audits and inspections undertaken, status of environmental monitoring programs, tracking of environmental performance against performance indicators, targets and criteria, etc.

Internal reporting requirements specific to this plan are included within Table 8-1.

Table 8-1 Internal Reporting Requirements

Report	Developed By	Submitted To	Timing	Content
Marine Fauna Observations	Contractor	Chevron Australia	Routinely	Records of marine fauna observations and interactions
Vessels anchoring outside anchor management procedure	Contractor	Chevron Australia	As soon as practicable	Details of the incident
Injury or mortality of Key Receptor Species	Contractor	Chevron Australia	As soon as practicable	Details of the incident

8.2.4 Incident Response and Reporting

Chevron Australia has prepared the ASBU Emergency Management Process (Chevron Australia 2007a) and Incident Investigation and Reporting Process (Chevron Australia 2008b),

which it internally requires its employees, contractors, etc. to follow in the event of environmental incidents. These processes will also be internally applied to environmental incidents identified in this Plan, where this is appropriate and reasonably practicable.

Note that under Condition 3.2.7 of EPBC Reference: 2003/1294 and 2008/4178, reports will be made in respect of significant impacts detected by the monitoring programs under this Plan, whether or not the impact is caused by the Gorgon Gas Development.

The environmental incidents, reporting requirements and timing specific to this Plan are provided in Table 8-2. The external reporting requirements for marine turtle incidents (injury or mortality) are included within Section 10.4.4 of the LTMTMP (Chevron Australia 2012).

Table 8-2 Incident Reporting Requirements

Incident	Reporting to	Timing
Report any detected mortality of any marine fauna declared under section 14 (2) (ba) of the *Wildlife Conservation Act 1950* (WA)	DEC	Details of detected mortality within 48 hours of observation
Harm or mortality to EPBC Act Listed Marine Fauna attributable to the Gorgon Gas Development	DEWHA (now SEWPaC)	Within 24 hours of detection
Material or Serious Environmental Harm detected outside the Marine Disturbance Footprint (attributable to the Gorgon Gas Development)	DEC/DEWHA (now SEWPaC)	Within 48 hours of detection or as soon as reasonably practicable.
Significant Impacts detected by the monitoring program for matters of National Environmental Significance (attributable to the Gorgon Gas Development)	DEWHA (now SEWPaC)	Within 48 hours of detection or as soon as reasonably practicable.

8.3 Review of this Plan

Chevron Australia is committed to conducting activities in an environmentally responsible manner and aims to implement best practice environmental management as part of a program of continuous improvement. This commitment to continuous improvement means Chevron Australia will review this Plan every five years and more often as required (e.g. in response to new information).

Reviews will address matters such as the overall design and effectiveness of the Plan, progress in environmental performance, changes in environmental risks, changes in business conditions, and any relevant emerging environmental issues.

If the Plan no longer meets the aims, objectives or requirements of the Plan, if works are not appropriately covered by the Plan, or measures are identified to improve the Plan, Chevron Australia may submit an amendment or addendum to the Plan to the Minister for approval under Condition 36 of Statement No. 800.

If Chevron Australia wishes to carry out an activity otherwise than in accordance with the Plan, Chevron Australia will update the Plan and submit it for approval by the Minister in accordance with Condition 25 of EPBC Reference: 2003/1294 and 2008/4178. The Commonwealth Minister may also direct Chevron Australia to revise the Plan under Condition 26 of EPBC Reference: 2003/1294 and 2008/4178.

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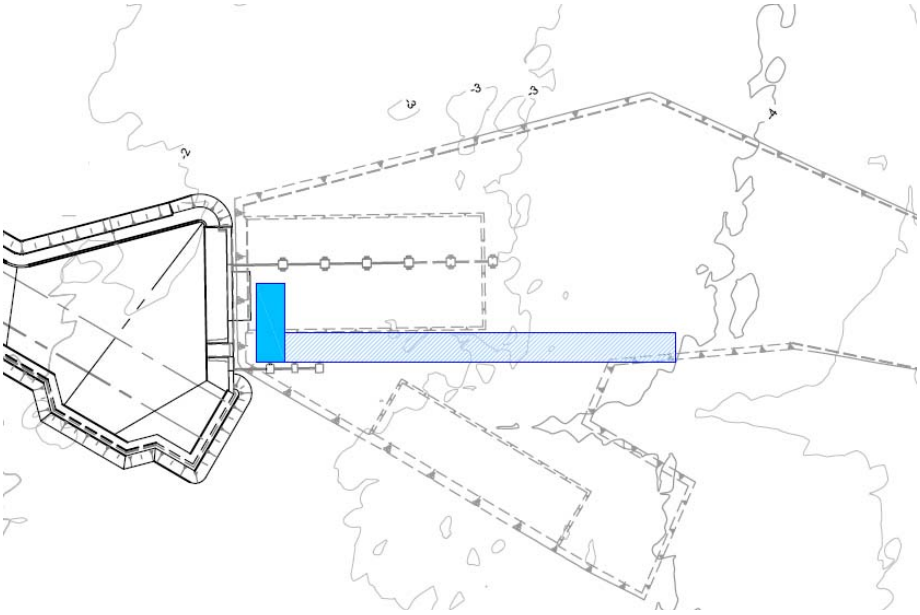
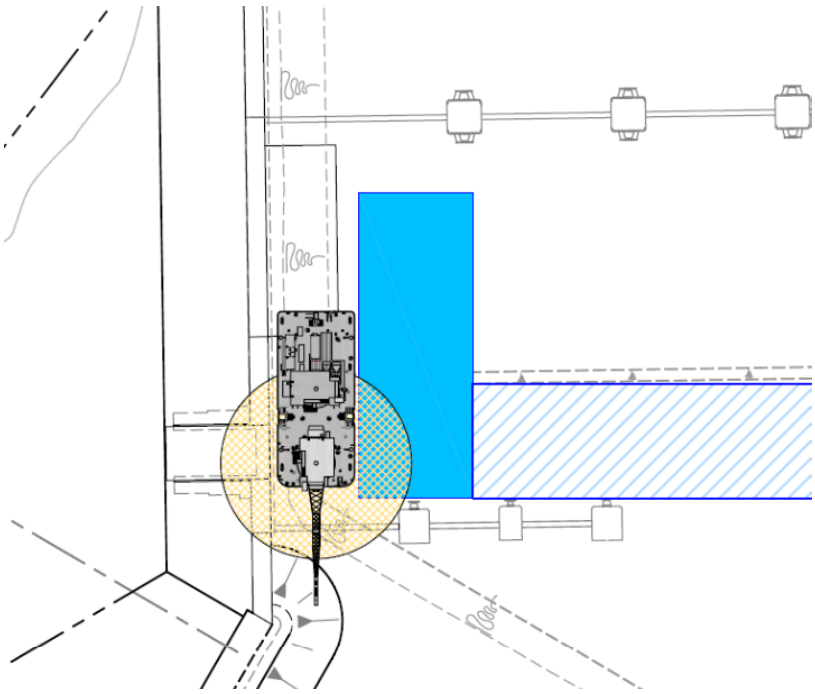
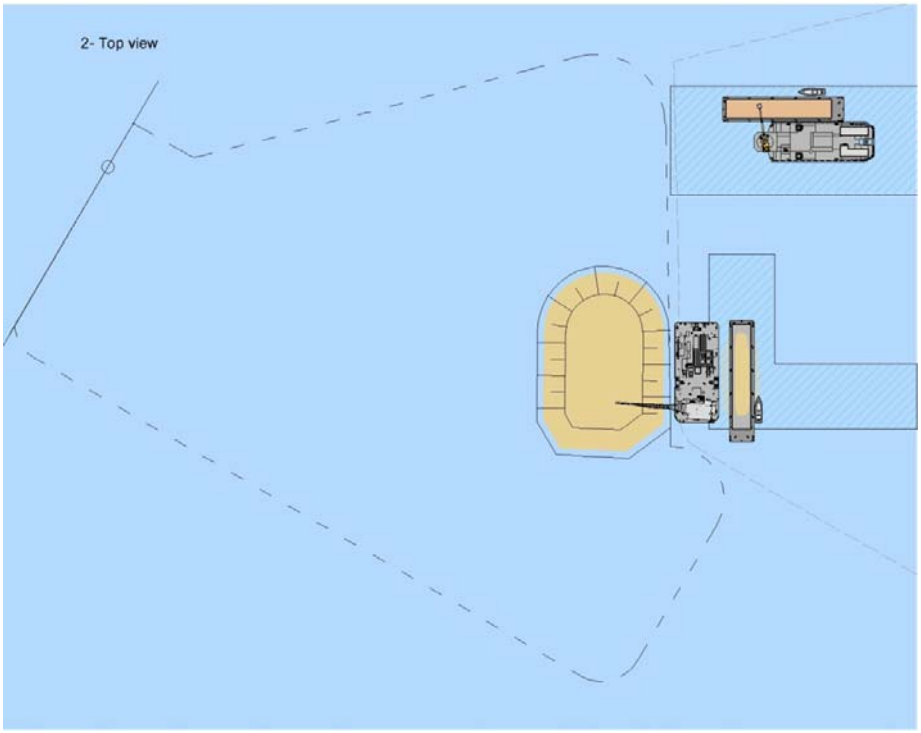
Appendix 1 Pioneer MOF Construction Sequence



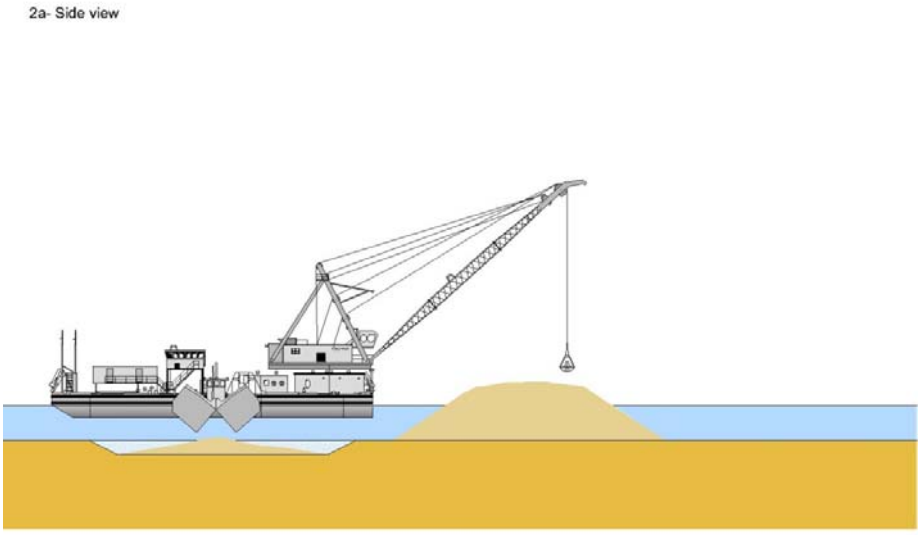
Backhoe Dredge dredges an access channel from the 4 m contour to the MOF area. Along with the channel, a rehandle pit is also dredged.



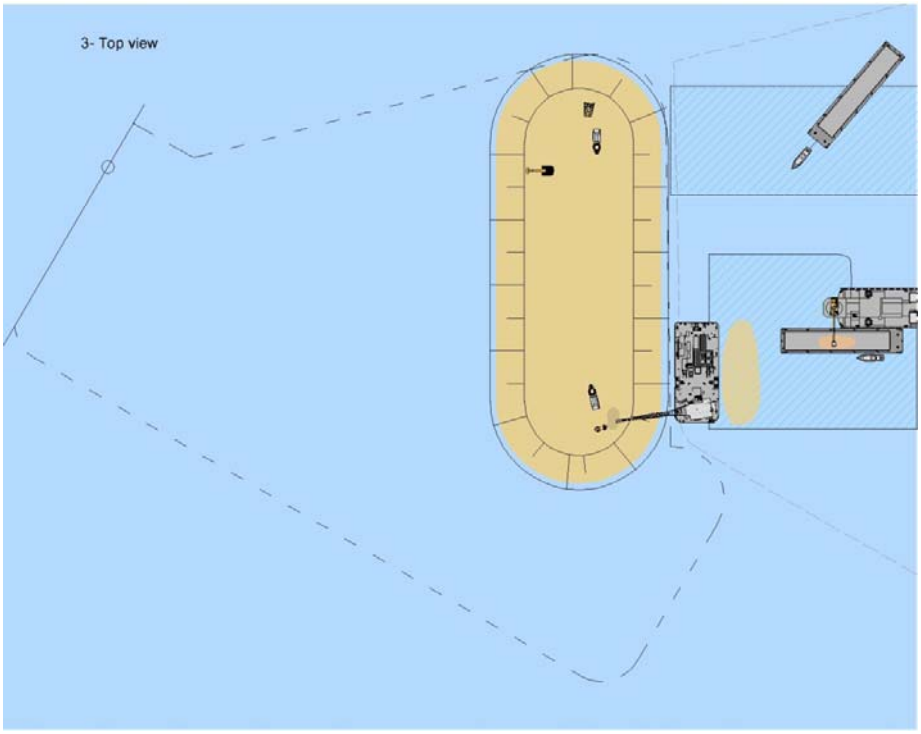
MOF Bund construction then commences using dredged materials from the MOF dredging footprint which have been placed into the rehandle pit.



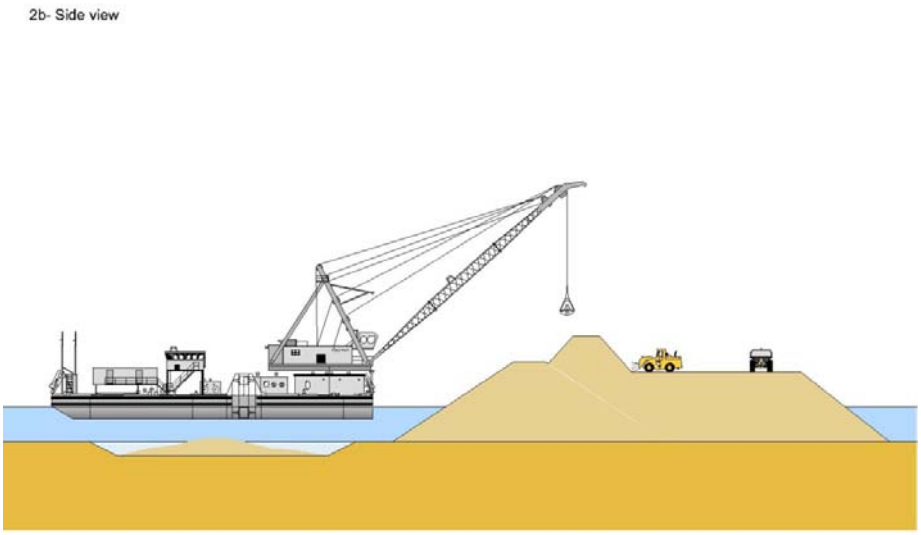
Grab dredge rehandles material ashore whilst access for the barges transporting the armour materials is dredged.



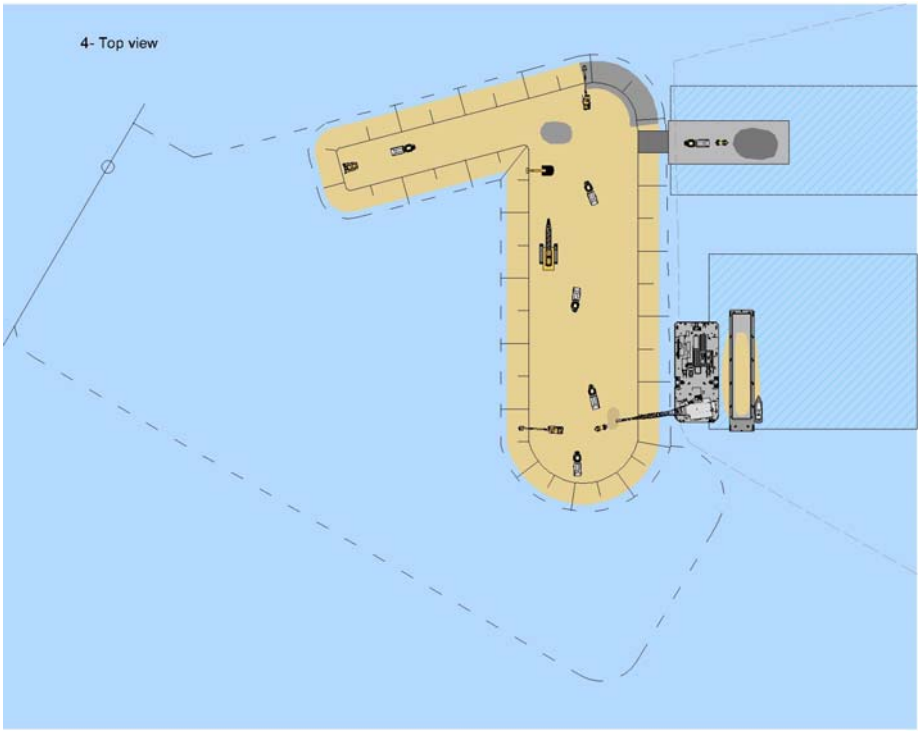
Grab Dredge commences MOF Bund construction using dredged materials from the MOF dredging footprint.



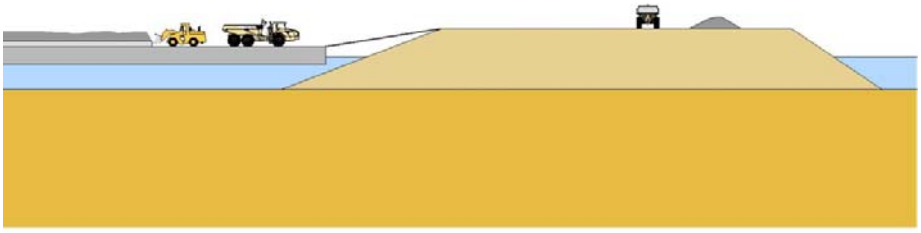
Backhoe dredge continues to dredge the MOF channel area.



Once a stable platform has been created, land-based earthmoving equipment can be used to extend the MOF construction. Grab dredge continues to rehandle materials ashore.

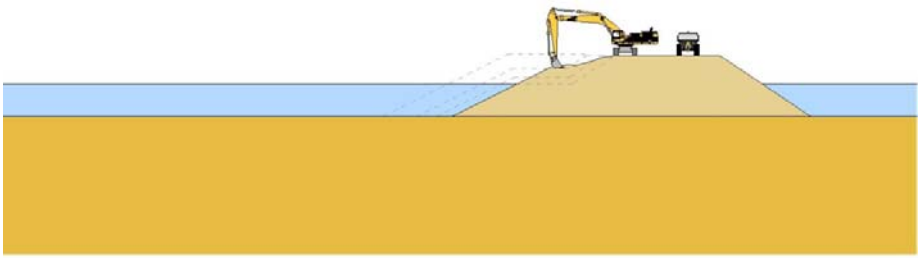


3- Side view



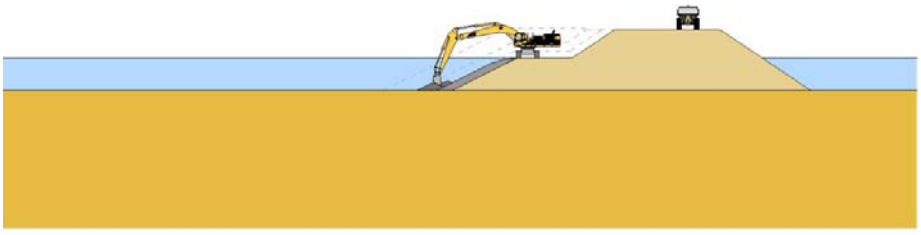
Armour rock used for the protection of the outer side of the MOF area can be barged in from the mainland on flat-top ramp barges.

4- Side view

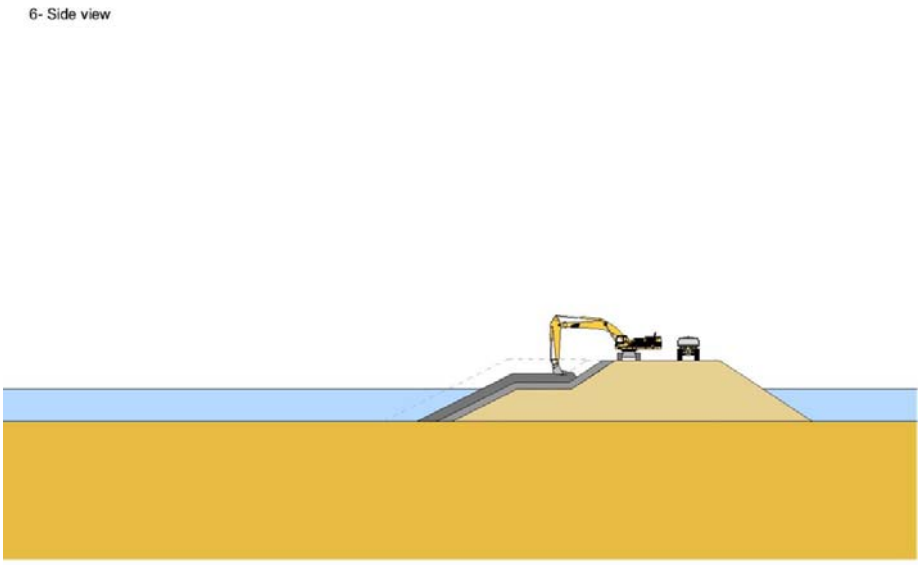


Preparation of the bunds for the placement of armour rock.

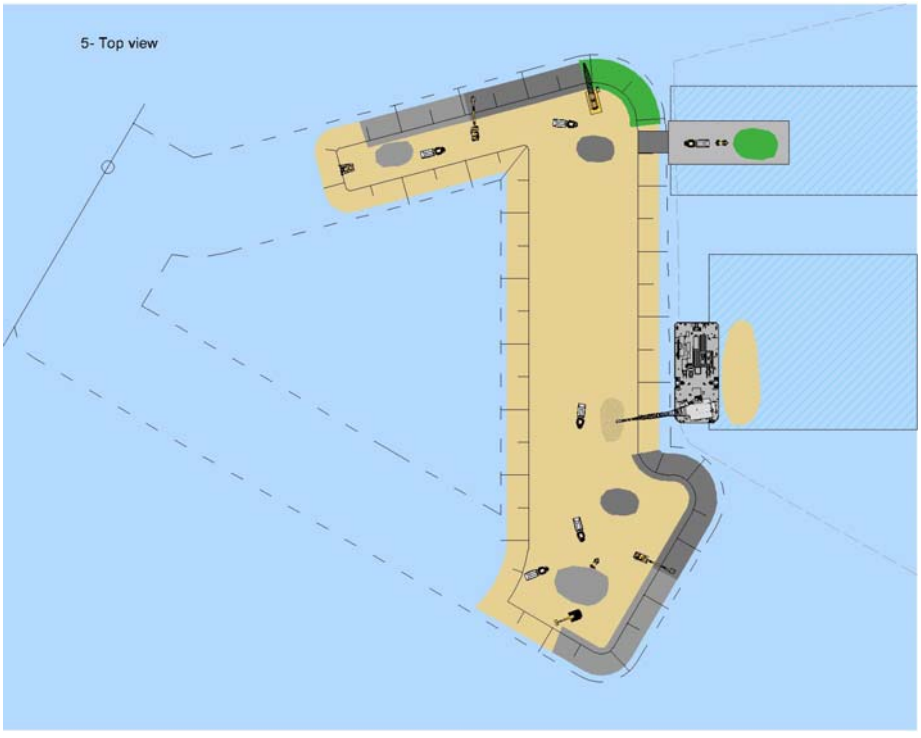
5- Side view



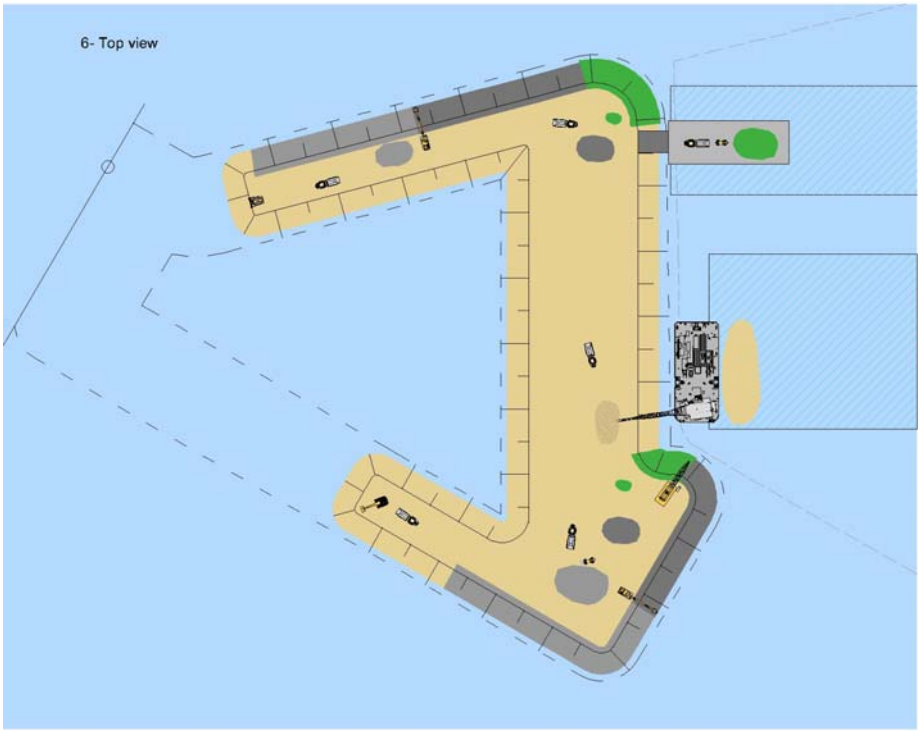
Placement of filter rock.



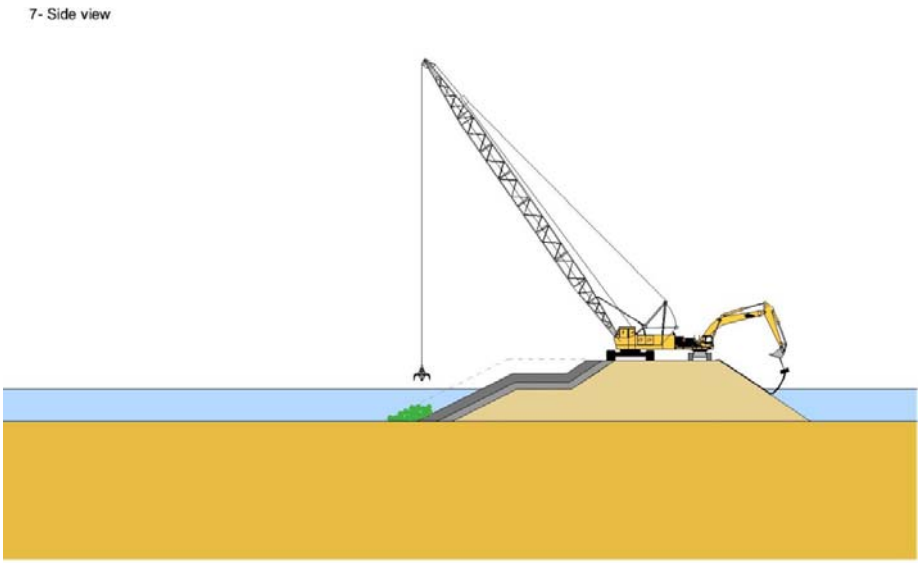
Placement of secondary armour.



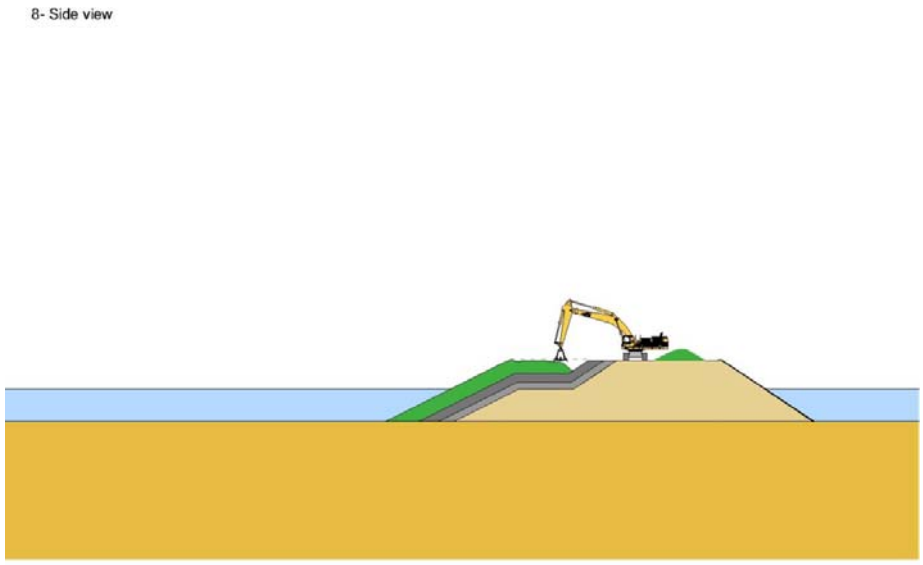
Dredged material continues to be rehandled ashore for use in the construction of the MOF bunds in conjunction with the placement of armour materials.



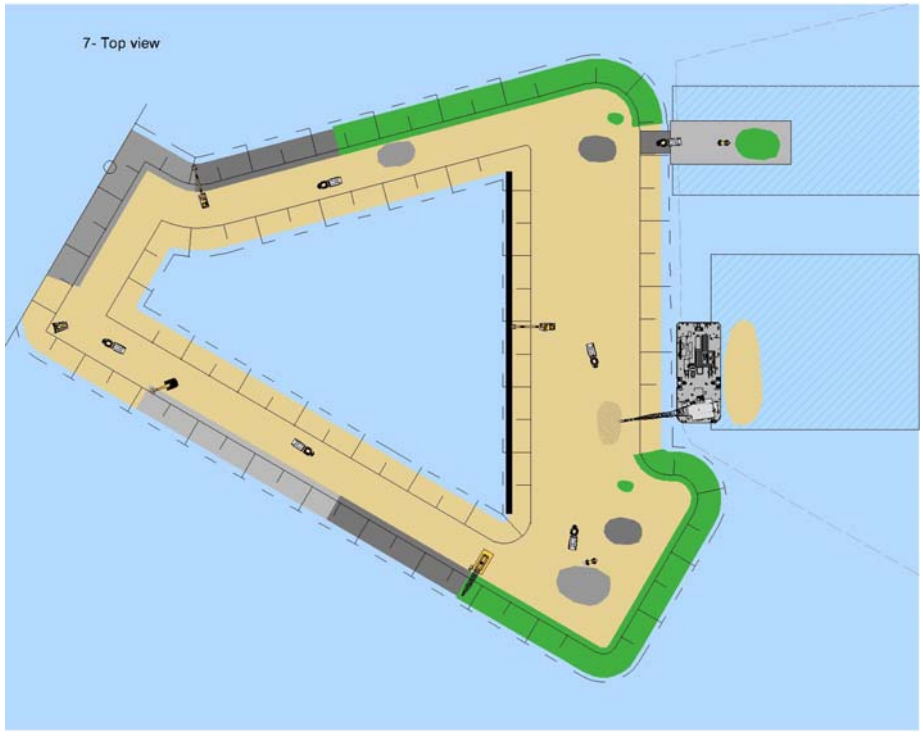
Land-based equipment, and where necessary, the grab dredge can be used to place the armour materials for the MOF area.



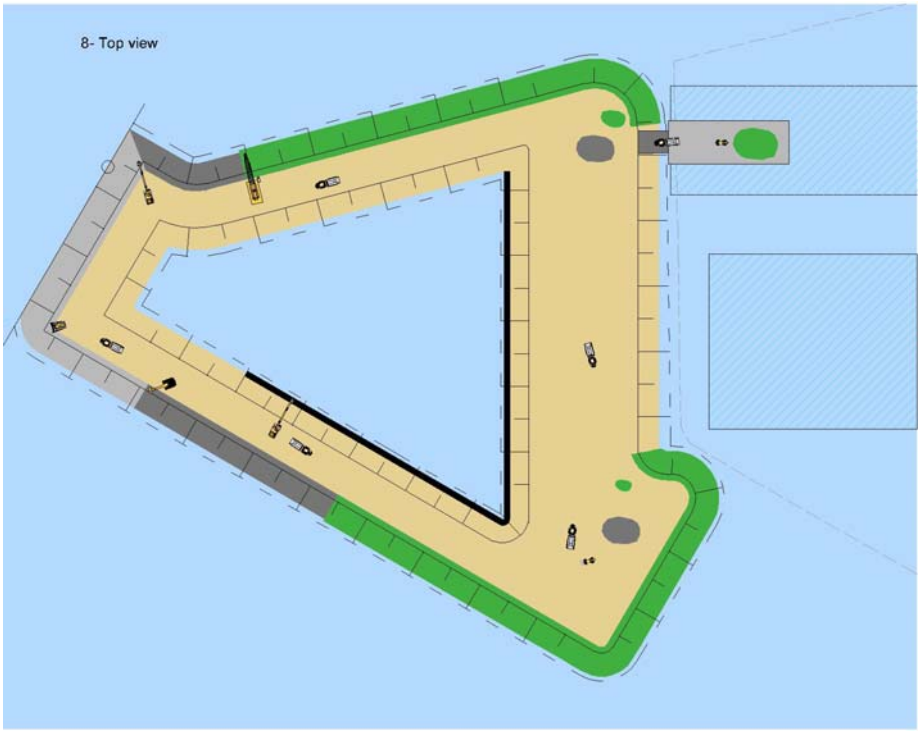
Armour stone placement at the toe of the bund using a land-based crane.



Placement of armour on the upper levels using a backhoe.



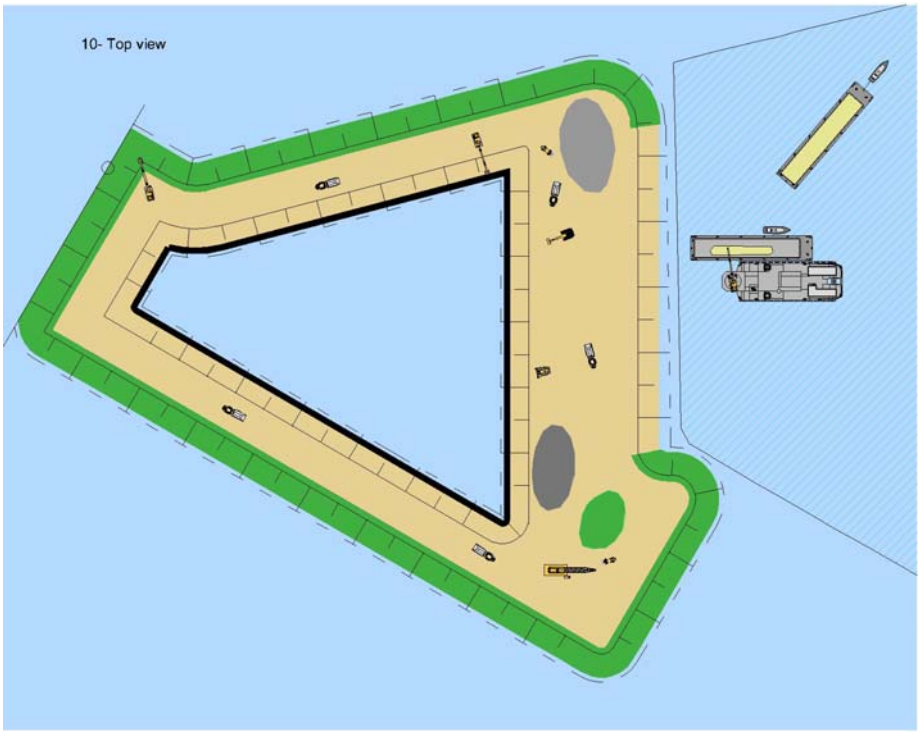
Armour placement continues



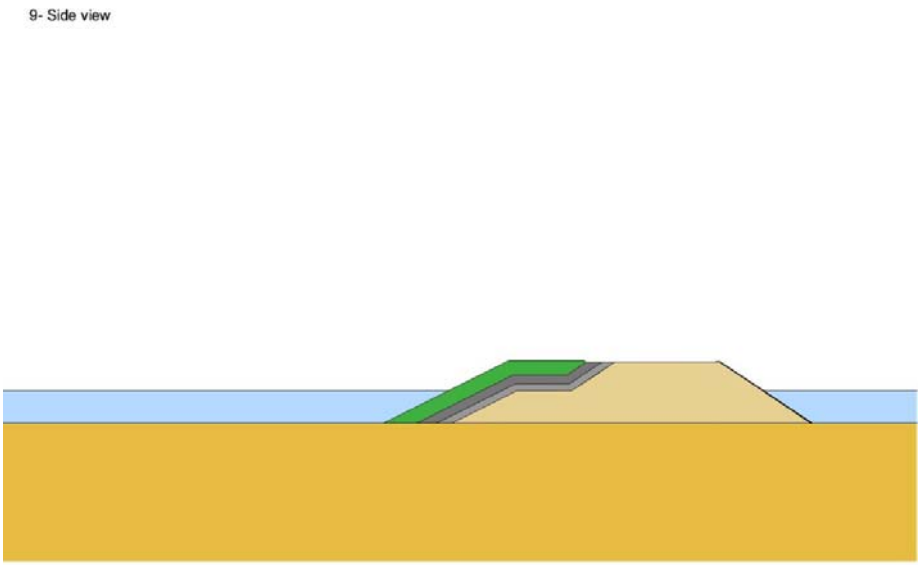
Lining of the bunds inner wall with geotextile material prior to filling the inner MOF area with dredged materials pumped ashore from the TSHD.

Finalising the placement of armour on the MOF.

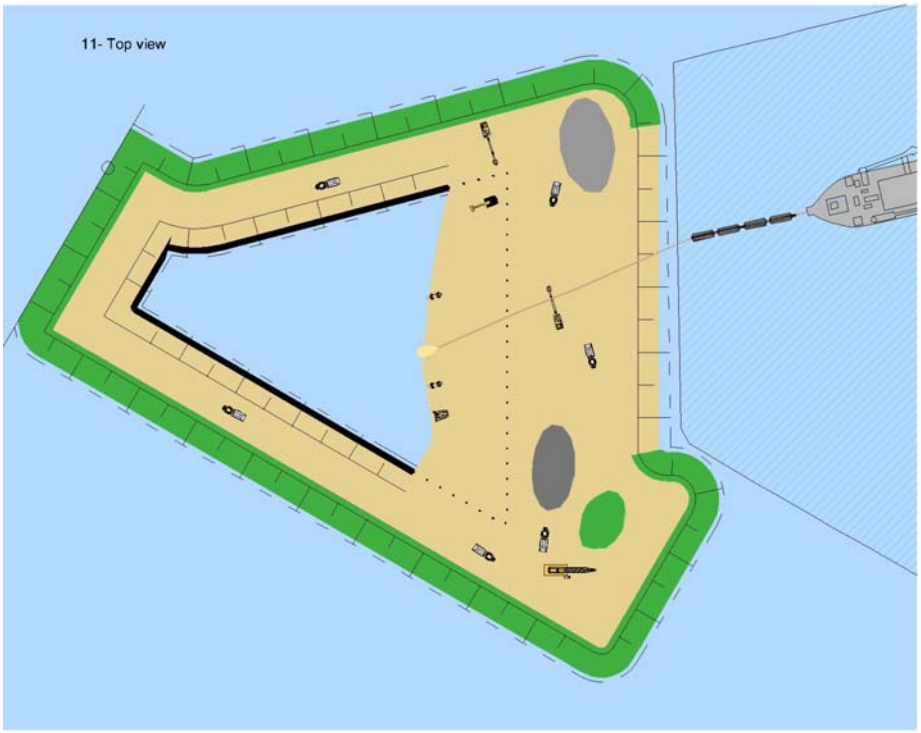
BHD/CSD perform dredging of Civil Interface works.



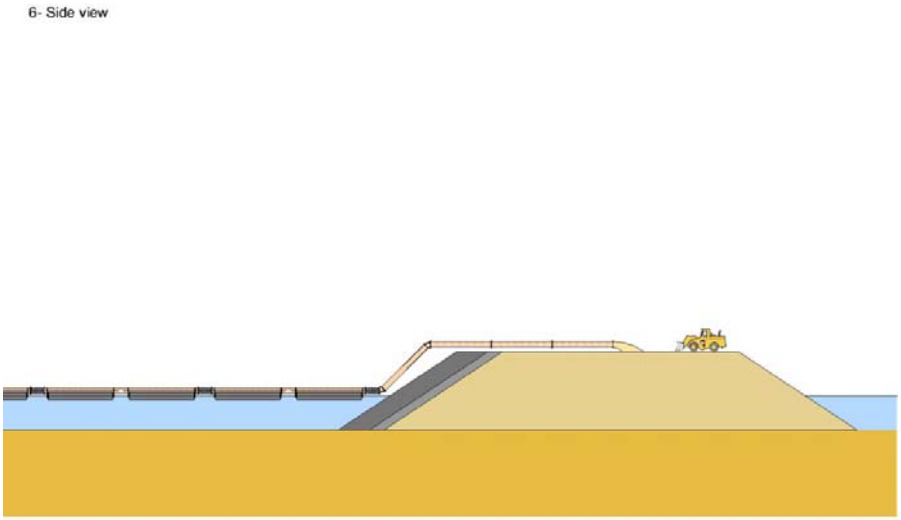
After the removal of the crushed materials with the BHD, access will be available for the MOF construction and pump ashore activities using the TSHD.



Profile of MOF revetment complete with armour stone.



Pump ashore activities are scheduled to take place during high water periods.



Materials dredged by TSHD from the LNG berths and access channel can be pumped ashore into the MOF area to be used as fill material.

MOF area is prepared for the installation of the abutment structures. Armour material, along with fill material, is stockpiled on the MOF area.

Once trimmed to the correct profile, armour material will again be placed for protection.

Re-armouring of the trimmed area continues.

Upon completion of the armouring works, a crane barge is used to place the abutment caissons.

Once caissons are in place, armour materials from behind can be removed and stockpiled on the MOF.

Armour material from behind caissons continues to be removed.

Fill material, which has previously been stockpiled on the MOF, is then placed behind the caissons.

Pioneer MOF Platform completed.

Appendix 2 Outcomes from the Environmental Risk Assessment for the MFCEMP

Appendix 2.1: MFCEMP-specific Environmental Risk Assessment

Note: C = Confidence; L = Likelihood

ID No.	Ecological Element	Hazard	Top Event of Concern	Causes	Consequences Without Safeguards	Safeguards in Place	Safety			Environment			Health			Recommendations	Remarks
							C	L	Risk	C	L	Risk	C	L	Risk		
1	Marine Fauna (Turtles)	Note: **Turtle Risk Assessment previously undertaken.** Summary provided in Appendix 2.4				Safeguards have been transferred into this Plan											
2	Marine Fauna e.g. whales, dolphins, dugongs, marine reptiles (excluding turtles), fish, seabirds	Physical presence	Marine Fauna collision/vessel strike	Vessel movements – barges, heavy lift ships, jack-up barges, (reclaimed material), refuelling barges, marine construction support vessel	Marine megafauna (e.g. whales, dolphins, dugongs) injury or mortality					6	3	**8**					***Assumptions:*** Assumes worst case credible scenario of one or two dugong or dolphin deaths over the duration of the Marine Facilities construction period. ***Risk Justification:*** Consequence = 6 (Incidental) assessed under Listed Species or Evolutionary Significant Units ecological element. The mortality of one or two dugong/dolphins is predicted to result in only localised and short-term decrease in abundance and not have any significant or long-term effects on population viability/ abundance or distribution. Likelihood = 3 (Seldom) – Based on previous marine construction projects in Western Australia, there have been a limited number of reportable marine megafauna mortalities. The likelihood of mortality occurring with safeguards in place may result in fauna mortality within the lifetime of construction activities.
		Marine Fauna avoidance/attraction	Construction of MOF, RO brine intake and outfall pipelines, LNG Jetty and WAPET Landing, acting as a physical barrier	Change in local abundance/distribution of mobile fauna through construction of MOF and jetty, causing localised changes in fauna behaviour/movement; i.e. restricting preferential patterns of movement or access to certain waters						6	1	**6**				N/A	***Assumptions:*** Assumes limited and localised disruption or behavioural changes to a small number of highly mobile fauna and not general species or communities. The longer term/ operational presence of the MOF, causeway and jetty have not been assessed in this construction-related EMP. ***Risk Justification:*** Consequence = 6 (incidental) assessed under Listed Species or Evolutionary Significant Units ecological element. By the very nature of construction, consequences are predicted to result in localised and short-term behavioural impacts. Likelihood = 1 (likely). The physical presence of the construction facilities during the construction phase is likely to result in the listed consequences occurring.

ID No.	Ecological Element	Hazard	Top Event of Concern	Causes	Consequences Without Safeguards	Safeguards in Place	Safety			Environment			Health			Recommendations	Remarks
							C	L	Risk	C	L	Risk	C	L	Risk		
				Turbidity generated from construction of the Marine Facilities and RO Brine Structures (**not including dredging activities**)	Direct effects on fish including irritation of fish gills and damage to fish eggs and larvae (depending on the nature of suspended sediments)					6	1	**6**					As above. The consequences of impacts to fish are likely to be localised and unlikely to result in significant impacts to fish populations or longer term survival.
			Artificial light spill	Artificial lighting requirements for construction vessels, jack-up barges and land-based excavators/other construction equipment building MOF platform and LNG Jetty, marine construction support vessel	Change in local abundance/distribution of mobile marine fauna through either attraction or avoidance of marine construction area	Implementation of **Long-term Marine Turtle Management Plan**				6	1	**6**				N/A	***Assumptions:*** A small proportion of the total marine fauna or avifauna population within the wider Barrow Island waters will be affected. ***Risk Justification:*** Consequence = 6 (incidental) assessed under Listed Species or Evolutionary Significant Units ecological element. Lighting from vessels and land-based construction equipment will be temporary, and thus long-term (+5 years) effects are not considered likely. Any impacts to species abundance is expected to be short-term. Likelihood = 1 (likely). With safeguards in place, night-time lighting from vessels and construction activities will occur and therefore it can be reasonably expected that the event may occur during construction.
					Greater concentration of adaptable species leading to increased mortality of food source (e.g. Silver Gulls known to respond to increased feeding opportunities on turtle hatchlings around light sources)					6	1	**6**				N/A	As above
					Temporary displacement/attraction of avifauna due to temporary land-based lighting at night on MOF and jetty attracting insects					6	1	**6**				N/A	As above
					Increased incidents of avifauna collisions/interaction with vessels and equipment due to light attraction (e.g. juvenile Wedge-tailed Shearwaters known to be attracted to light).					6	1	**6**				N/A	As above
					Increased incidents of marine fauna collisions/interactions with vessels and equipment (e.g. Bottlenose Dolphins known to congregate in lit areas at night to assist in hunting)					6	1	**6**				N/A	As above

ID No.	Ecological Element	Hazard	Top Event of Concern	Causes	Consequences Without Safeguards	Safeguards in Place	Safety			Environment			Health			Recommendations	Remarks
							C	L	Risk	C	L	Risk	C	L	Risk		
		Seabed disturbance	Reduction in habitat available to marine fauna due to direct physical disturbance/removal of habitat	Physical disturbance from the construction of the Marine Facilities, RO Structures, installation of moorings and vessel anchoring	Impacts to marine fauna through **direct** physical disturbance of seabed habitat **(above approved limits)** e.g. localised loss of habitat for foraging and feeding, loss of aggregation area					5	4	**8**				N/A	***Assumptions:*** Permanent loss of benthic habitat. ***Risk Justification****:* Consequence = 5 (Minor) assessed under General species and communities (not listed/ threatened fauna) ecological element. The loss of a relatively small area of benthic habitat is likely to result in localised and long-term changes in species abundance. It is likely that species will adapt to the presence of the Marine Facilities over time and the localised ecosystem will potentially change with new benthic species establishment on artificial surfaces (rock boulders/jetty piles), which will lead to a localised change in fauna distribution. Likelihood = 4 (unlikely). With safeguards and restrictions in place, the area of seabed disturbed will be within approved regulatory limits. It would therefore be reasonable to expect that seabed disturbance beyond approved limits will not occur during the construction period.
			Reduction in habitat available to marine fauna due to indirect turbidity/ sedimentation impacts (from MOF and WAPET Landing construction activities: rock dumping or de-watering activities, from LNG Jetty activities) **NOTE: Excludes turbidity/ sedimentation effects from dredging**	Physical disturbance from construction of MOF, LNG Jetty and WAPET Landing	Impacts to marine fauna through **indirect** loss of seabed foraging habitat (above approved limits) through increased turbidity or sedimentation e.g. smothering of seabed and disturbance to marine fauna – avoidance of area impacted. **NOTE: Excludes turbidity/ sedimentation effects from dredging and dredge spoil disposal**					5	4	**8**					As above. *Additional Assumptions:* Based on likely construction activities, the opportunity for significant suspension of fines material from reclamation and jetty construction activities is likely to be limited and not impact marine fauna or benthic habitats beyond approved regulatory limits.
		Physical presence	Vibration and noise impacts on Marine Fauna	Vibration and noise emissions generated by construction vessels, rock armouring activities and land-based excavator movements (i.e. excavators, compactors and rollers operating on the causeway)	Noticeable change (through visual observations) in abundance/distribution of marine fauna and avoidance of construction area Disruption of fish breeding activities due to stress, disruption of schooling behaviour or avoidance of an area where construction activities are being undertaken					6	1	**6**				N/A	***Assumptions:*** Cumulative noise impacts to marine fauna from multiple noise sources over an approximate 30-month construction period. ***Risk Justification:*** Consequence = 6 (Incidental) assessed under Listed Species or Evolutionary Significant Units ecological element. Considered a low consequence because the majority of mobile marine fauna are likely to exhibit avoidance behaviour and avoid areas where noise is elevated above background noise. *Likelihood* = 1 (Likely). It is inevitable that noise will be generated from construction vessels and equipment.

ID No.	Ecological Element	Hazard	Top Event of Concern	Causes	Consequences Without Safeguards	Safeguards in Place	Safety			Environment			Health			Recommendations	Remarks
							C	L	Risk	C	L	Risk	C	L	Risk		
			Shock waves and vibration impacts to Marine Fauna	Shock waves, noise and vibration from MOF drill and blasting (tug pens and MOF channel, WAPET Landing, pile installation)	Mortality or physiological impacts to marine megafauna (permanent and/or temporary hearing loss) Mortality or physiological effects to fish including damage to fish larvae and eggs					5	2	**6**					***Assumptions:*** Based on interpretation of geotechnical data, it is unlikely that drilling and blasting will be required for Marine Facilities construction. It is assumed that drilling and blasting will result in a worst case scenario of mortality of one or two dugongs or dolphins. ***Risk Justification:*** Consequence = 5 (Minor) assessed under Listed Species or Evolutionary Significant Units ecological element. Depending on the species of marine fauna impacted, potential consequences could be localised and long term in relation to population viability for a small resident population located in Barrow Island waters. Likelihood = 2 (Occasional). The potential exists for marine fauna to be impacted (mortality) with safeguard measures in place, particularly for fauna that can spend long periods of time submerged under the sea surface and can potentially go undetected for a period of time.
					Behavioural impacts to marine fauna (avoidance of area due to disturbance)					6	2	**7**					***Assumptions:*** Risk ranking was based on short-term (i.e. under 5 years) avoidance of blasting area by marine fauna. ***Risk Justification:*** Consequence = 6 (Incidental) The majority of marine fauna will exhibit a temporary behavioural response to blasting; only prolonged effects will have ecological significance (i.e. distributional/abundance changes or population effects). Likelihood = 2 (Occasional). Even with safeguard measures in place, the potential exists for marine fauna to demonstrate avoidance behaviours.
		Discharges to marine environment. **Note: Waste Management Risk Assessment previously undertaken. (see Section 4.4.7)**	Solid waste discharge into marine environment	Overboard discharge	Ingestion by marine fauna leading to physiological effects or mortality	Implementation of the Solid and Liquid Waste Management Plan										N/A	N/A

ID No.	Ecological Element	Hazard	Top Event of Concern	Causes	Consequences Without Safeguards	Safeguards in Place	Safety			Environment			Health			Recommendations	Remarks
							C	L	Risk	C	L	Risk	C	L	Risk		
		Discharges to marine environment	Hydrocarbon spills on surface or reaching shoreline (moderate spill >1000 L)	Hydrocarbon spills from construction vessels during refuelling, groundings, collisions or general spillage	Marine fauna/avifauna suffer physiological effects or mortality through encountering surface or shoreline slick					2	6	**7**					***Assumptions:*** Based on worst case credible scenario (i.e. meteorological conditions that prevent the spill from dispersing rapidly resulting in widespread ecological impacts). Discharge from temporary and permanent RO plant are covered in the RO Brine Discharge EMP (G1-NT-REP-X0001483). ***Risk Justification:*** Consequence = 2 (Severe). Assessed under Listed Species or Evolutionary Significant Units ecological element. Worst case spill scenario may lead to significant and persistent changes in species behaviour and abundance across multiple locations around Barrow Island, including marine conservation reserves and marine parks. Likelihood = 6 (Rare). With appropriate safeguards and mitigation measures in place, the opportunity for this event and consequences to arise is considered rare.
		Discharges to marine environment	Rupture of WA Oil export pipeline causing major crude oil spillage	Rupture of pipeline caused by vessel collision, equipment placement or anchoring on pipeline	Marine fauna/avifauna suffer physiological effects or mortality through encountering surface or shoreline slick					2	6	**7**					***Assumptions***: Based on worst case credible scenario (i.e. meteorological conditions that prevent the spill from dispersing rapidly resulting in widespread ecological impacts). ***Risk Justification:*** As above
3	Marine Pest Species	Introduction of marine non-indigenous species (NIS) **Note: Quarantine Risk Assessment previously undertaken**		Construction vessels, LNG Jetty/ MOF facilities	Loss of native species and/or habitats through competition and predation by NIS	Implementation of **MFCEMP and Quarantine Management System**										All construction and support vessels will comply with Australian Quarantine and Inspection Service (AQIS) and requirements of the MFCEMP with respect to inspection for marine pest species.	N/A
4	Benthic Primary Producer Habitat (BPPH)	Physical Presence	Physical disturbance or removal of BPPH	MOF: reclamation and rock armouring LNG Jetty: construction, anchor dragging. WAPET Landing reclamation and rock armouring	Direct loss of BPPH (**above approved limits**) through physical disturbance during construction activities					5	5	**9**					***Assumptions:*** Risk assessment based only on loss of BPPH beyond approved limits. ***Risk Justification:*** Consequence = 5 (Minor) as assessed under Restricted and Significant Benthic Primary Producer Communities ecological element. Additional removal of benthic habitat (corals etc.) beyond approved regulatory limits is likely to result in localised and long-term decrease in abundance or impact on communities and/or habitats. Likelihood = 5 (Remote). Loss of benthic habitats through reclamation, MOF and LNG Jetty construction beyond approved limits is not considered realistic.

ID No.	Ecological Element	Hazard	Top Event of Concern	Causes	Consequences Without Safeguards	Safeguards in Place	Safety			Environment			Health			Recommendations	Remarks
							C	L	Risk	C	L	Risk	C	L	Risk		
				Mooring installation and anchoring of construction vessels and marine construction support vessel	Direct loss or disturbance to BPPH (**above approved limits**) as a result of vessel anchoring					5	4	**8**					***Assumptions:*** Risk assessment based only on loss of BPPH beyond approved limits. ***Risk Justification:*** Consequence = 5 (Minor) as assessed under Restricted and Significant Benthic Primary Producer Communities ecological element. Additional removal of benthic habitat (corals etc.) beyond approved regulatory limits is likely to result in localised and long-term decrease in abundance or impact on communities and/ or habitats. Likelihood = 4 (Unlikely). Loss of benthic habitats through vessel anchoring beyond approved limits is considered unlikely with confirmed safeguards in place.
				Vessel groundings	Localised impacts to BPPH through direct physical contact of vessels with seabed					5	4	**8**					As above
		Altered Water Quality or Sediment Deposition Regimes	Generation of turbidity plume resulting in reduced light and/or increased sedimentation	Rock armouring, dredge reclamation/de-watering discharge, drilling of piles	Indirect loss or disturbance to BPPH (**above approved limits**) as a result of altered water quality and/or increased sedimentation					6	3	**8**				N/A	***Risk Justification:*** Consequence = 6 (Incidental) as assessed under Restricted and Significant Benthic Primary Producer Communities ecological element. Turbidity generation from MOF and jetty construction (excluding dredging) is expected to be limited in comparison to the overall dredge and dredge spoil disposal program (refer to DSDMMP). Any effects to benthic habitats are likely to be temporary and localised. Likelihood = 3 (Seldom). Under worst case/exceptional weather, tide and current conditions, environmental effects may occur.
				Seabed preparation as part of LNG Jetty construction	Indirect loss or disturbance to BPPH (**above approved limits**) as a result of altered water quality and/or increased sedimentation					6	3	**8**				N/A	***Assumptions:*** Assumes three jack-up barges working concurrently. ***Risk Justification:*** As above

ID No.	Ecological Element	Hazard	Top Event of Concern	Causes	Consequences Without Safeguards	Safeguards in Place	Safety			Environment			Health			Recommendations	Remarks
							C	L	Risk	C	L	Risk	C	L	Risk		
		Discharges to the marine environment	Hydrocarbon spills (impacts to **corals, seagrass and macroalgal** communities)	Hydrocarbon spills from vessels (e.g. refuelling spills, groundings, collisions)	Acute and chronic toxicity to corals, seagrass or macroalgae through contamination of intertidal reef or sediments Smothering of intertidal marine flora and coral					4	4	**7**				N/A	***Assumptions:*** Only spills with discharges containing hydrocarbons > 1000 L considered here as having significant impacts on BPPH. ***Risk Justification:*** Consequence = 4 (Moderate) as assessed under Restricted and Significant Benthic Primary Producer Communities ecological element. Potential environmental effects are likely to result in widespread and long-term decreases in abundance of BPPH. BPPH (such as macroalgae) are likely to be relatively resilient to marine diesel spills on the surface although corals will be less resilient and will also be impacted by shading effects from surface slicks. Likelihood = 4 (unlikely). With safeguard measures in place benthic habitats are unlikely to be effected by a hydrocarbon spill. Habitats located in shallower waters or in the intertidal zone are considered more susceptible.
			Hydrocarbon spills (impacts to **Mangrove** Communities)	Hydrocarbon spills from vessels (e.g. refuelling spills, groundings, collisions)	Acute and chronic toxicity to mangroves and associated fauna through contamination of water and sediments					5	5	**9**				N/A	***Assumptions:*** Only spills with discharges containing hydrocarbons > 1000 L considered here as having significant impacts on BPPH. ***Risk Justification:*** Consequence = 5 (Minor) as assessed under Restricted and Significant Benthic Primary Producer Communities ecological element. Potential environmental effects are likely to result in localised and long-term decrease in abundance of mangroves. Mangroves are likely to be more resilient to effects of hydrocarbon spills compared to other BPPH. Likelihood = 5 (Remote). Mangroves are situated ~5 km from project activities. Metocean conditions would have to be exceptional to allow spill to significantly impact mangroves.
			Pollution from discharged wastes **Note: Waste Management Risk Assessment previously undertaken. (see Section 4.4.7)**	Incorrect disposal of solid and liquid waste	Acute toxicity to BPPH through contamination or smothering from wastes; change in BPPH composition through eutrification from wastes	Implementation of the Solid and Liquid Waste Management Plan										N/A	N/A
5	Marine water and sediment quality	Altered Water and Sediment Quality	Increased turbidity	Turbidity generated by MOF, WAPET Landing and jetty construction activities (drilling, rock armouring, construction vessel prop wash, erosion of MOF bunded area) and de-watering of	Reduction in water quality (turbidity)					6	1	**6**				N/A	***Assumptions:*** Based on likely construction activities, the opportunity for significant suspension of fines material from reclamation and jetty construction activities is likely to be limited in comparison to dredging and dredge spoil disposal activities (refer to DSDMMP). ***Risk Justification:*** Consequence = 6 (Incidental) as assessed under Marine Water Quality

ID No.	Ecological Element	Hazard	Top Event of Concern	Causes	Consequences Without Safeguards	Safeguards in Place	Safety			Environment			Health			Recommendations	Remarks
							C	L	Risk	C	L	Risk	C	L	Risk		
				reclamation area													ecological element. Given the nature of construction activities, turbidity effects will result in localised and short-term minor reductions in water quality. Likelihood = 1 (Likely). Even with safeguards in place, localised elevation in turbidity is likely to occur.
			Release of contaminants from dredge material into MOF/causeway reclamation area	Placement of dredged material into MOF platform area and pumping of dredge material into causeway/MOF reclamation area.	Pollution or contamination of marine sediments and water column resulting in exceedance of guidelines (ANZECC/ARMCANZ; DEWHA [now SEWPaC])					6	5	**10**				N/A	***Assumptions:*** Preliminary site investigations have demonstrated contaminants are of low risk. Commentary from Preliminary Site Investigation (PSI) for sediments at MOF location: 'This surface sediment unit had thicknesses ranging from 0 to 0.5 m (most common in the MOF area) to 0.5–4.5 m further offshore, with >2 m values found on the deep flank areas in and near the LNG Jetty alignment and part of the shipping channel). The characteristics of this unit reported by Worley (Chevron Australia 2006) are summarised as follows: • Composed of crystalline limestone and calcarenite fragments (15–43%), skeletal bioclasts (forams, mollusc shells, coral, coralline algae, bryozoans, sponge spicules, echinoid fragments) and a low quartz content (usually <2% and always below ~11%). • Calcium carbonate contents between 91 and 99%, with carbonate gravel content up to 31% (retained by 2.36 mm sieve), including occasional cemented coralline pieces ranging up to cobble size (at MV45). • Fines content (passing 0.075 mm sieve) typically less than 12% (range 2 to 20%) and comprising mostly silts with little clay.' ***Risk Justification:*** Consequence = 6 (Incidental) as assessed under Foreshore and Seabed (subtidal and intertidal) ecological element. In the unlikely event of seabed contamination, it will be localised and contained within the MOF bunded area. Likelihood = 5 (Remote) due to the absence of any contaminants of concern found in marine sediments.
			Changes to sediment Particle Size Distribution (PSD)	Deposition of fines from MOF construction (reclamation and rock dumping)	Changes to sediment PSD and seabed in vicinity of marine construction activities					6	1	**6**				N/A	Refer to reduction in water quality (turbidity) above as the justification for risk assessment rankings is the same.

ID No.	Ecological Element	Hazard	Top Event of Concern	Causes	Consequences Without Safeguards	Safeguards in Place	Safety			Environment			Health			Recommendations	Remarks
							C	L	Risk	C	L	Risk	C	L	Risk		
			Release of TBT paint from vessel hulls into water column and contamination of seabed sediments	TBT from vessel hulls	Contamination of marine sediments					5	5	**9**				N/A	***Risk Justification:*** Consequence = 5 (Minor) as assessed under Foreshore and Seabed (subtidal and intertidal). In the unlikely event that vessels with TBT paints are present within the construction area and the TBT becomes detached from the vessel hull, localised contamination may occur requiring long-term remediation efforts given the toxicity and persistence of TBT in the marine environment. Likelihood = 5 (Remote). No vessels will have TBT paints.
			Discharge of brine wastewater stream into marine environment	Generation of water onboard construction vessels (including marine construction support vessels)	Localised increase in salinity in vicinity of discharge point	N/A				6	4	**9**				N/A	***Risk Justification:*** Consequence -= 6 *(*Incidental) as assessed under Marine Water Quality ecological element. Discharge of brine is likely to result in minor and short-term impacts on water quality. Likelihood = 4 (Unlikely). Based on low discharge volume, tidal flow and the majority discharged in deep water (approx 12 m and over).
			Discharge of nutrients – generation of high nutrient concentrations and Organic Loading	Disturbance of sediment containing high concentrations of organic material/nutrients	Localised pollution or contamination of marine sediments and water column Lowering of dissolved oxygen in water column Plankton blooms Localised increases in turbidity					6	5	**10**				N/A	***Risk Justification:*** Consequence = 6 (Incidental) as assessed under Foreshore and Seabed (subtidal and intertidal). Discharge of sediments containing high organic material concentrations will be localised and short-term. Likelihood = 5 (Remote). Based on sampling results, the opportunity for the consequences occurring is considered remote.
			Generation of Potential Acid Sulfate Soils (PASS)	Acid Sulfate Soils (ASS) in fine sediment layer disturbed and reacting with oxygen during MOF reclamation	Production of acid sulfates, lowering of pH in disposed sediments and potential release of other contaminants through acidification processes					6	5	**10**				N/A	***Assumptions:*** PASS was not tested for during the sampling and analysis of marine sediments to be dredged as part of the Sea Dumping Permit Application process. It is assumed that PASS is not an issue for marine construction activities given to neutralising capacity of sea water and limestone. Sediment sampling onshore did not detect any PASS within surface sediments. ***Risk Justification:*** Consequence = 6 (Incidental) as assessed under Foreshore and Seabed (subtidal and intertidal). In the event that ASSs are generated, it is anticipated that they can be readily remediated. Likelihood = 5 (remote) based on neutralising capacity of sediments.

ID No.	Ecological Element	Hazard	Top Event of Concern	Causes	Consequences Without Safeguards	Safeguards in Place	Safety			Environment			Health			Recommendations	Remarks
							C	L	Risk	C	L	Risk	C	L	Risk		
		Hazardous spills affecting water column or sediments	Major Hydrocarbon spill (WA Oil export pipeline rupture)	Hydrocarbon spill from impact to WA Oil export line from marine vessel grounding, dragged anchors or dropped objects	Widespread spill with significant contamination of water column and sediments					3	5	**7**					***Assumptions:*** Based on worst case credible scenario (i.e. meteorological conditions that prevent the spill from dispersing rapidly resulting in widespread ecological impacts. ***Risk Justification:*** Consequence = 3 (Major). A significant hydrocarbon spill has the potential to result in minor and long-term reduction in water quality across multiple locations around Barrow Island, including marine conservation reserves. Likelihood = 5 Remote. The risk of trunkline rupture and widespread water quality impacts is considered remote with safeguards in place
			Hydrocarbon spills >1000 L (marine sources)	Discharges containing hydrocarbons and other pollutants from construction and dredging vessels	Widespread pollution of water column or contamination of marine sediments from spills >1000 L					4	4	**7**					***Assumptions:*** Based on worst case credible scenario (i.e. meteorological conditions that prevent the spill from dispersing rapidly resulting in widespread water quality effects). ***Risk Justification:*** Consequence = 4 (Moderate) as assessed under Marine Water Quality ecological element. Potential environmental effects are likely to result in minor and long-term reduction in water quality across multiple locations, but outside marine conservation reserves. Likelihood = 4 (unlikely). With safeguard measures in place, water quality impacts are unlikely to occur. Habitats located in shallower waters or in the intertidal zone are considered more susceptible.
			Hydrocarbon spills <1000 L (marine sources)		Localised pollution of water column or contamination of marine sediments from spills <1000 L					6	1	**6**					***Assumptions:*** Based on worst case credible scenario (i.e. meteorological conditions that prevent the spill from dispersing rapidly. ***Risk Justification:*** Consequence = 6 (Incidental) as assessed under Marine Water Quality ecological element. Spill sizes will be small and therefore localised. Likelihood = 2 (occasional). With safeguard measures in place, a small hydrocarbon spill may occur.
		Solid or liquid waste affecting water column or sediments (solid and liquid waste)	**Note: Waste Management Risk Assessment previously undertaken**	Incorrect disposal of solid and liquid waste	Local or widespread pollution of water column or marine sediments	Implementation of the Solid and Liquid Waste Management Plan										N/A	N/A

ID No.	Ecological Element	Hazard	Top Event of Concern	Causes	Consequences Without Safeguards	Safeguards in Place	Safety			Environment			Health			Recommendations	Remarks
							C	L	Risk	C	L	Risk	C	L	Risk		
6	Soils and geology (terrestrial)	Soil contamination	Hydrocarbon spill (on MOF/causeway)	Accidental spill from refuelling or leak from fuel tank on land-based construction equipment	Potential localised contamination of soil					6	2	**7**				N/A	***Assumptions:*** Based on worst case credible scenario (i.e. meteorological conditions that prevent the spill from dispersing rapidly). ***Risk Justification:*** Consequence = 6 (Incidental) as assessed under Foreshore and Seabed (subtidal and intertidal) ecological element. Spill sizes will be small and therefore localised. The MOF causeway will be located approx 6 m above LAT which will, to a certain extent contain the migration of spilled hydrocarbons. Likelihood = 2 (occasional). With safeguard measures in place, a small hydrocarbon spill may occur.
7	Air quality (SO_2, NO_x, ozone depleting substances (ODS), BTEX, hydro-carbons)	Atmospheric pollutants	Vehicle emissions, incinerators, power generation	Emissions from diesel engines/ construction vessels, incinerators and power generation	Substantial quantities of smoke particulates and greenhouse gases emitted					6	1	**6**				N/A	N/A

Appendix 2.2: Chevron Integrated Risk Prioritization Matrix (used for DSDMMP-specific Risk Assessment and Waste Management Risk Assessment)

Chevron Integrated Risk Prioritization Matrix

For the Assessment of HES & Asset Risks from Event or Activity

Likelihood Descriptions & Index (with confirmed safeguards)

Likelihood Descriptions	Likelihood Indices		Legend
Consequence can reasonably be expected to occur in life of facility	1	Likely	6 5 4 3 2 1
Conditions may allow the consequence to occur at the facility during its lifetime, or the event has occurred within the Business Unit	2	Occasional	7 6 5 4 3 2
Exceptional conditions may allow consequences to occur within the facility lifetime, or has occurred within the OPCO	3	Seldom	8 7 6 5 4 3
Reasonable to expect that the consequence will not occur at this facility. Has occurred several times in industry, but not in OPCO	4	Unlikely	9 8 7 6 5 4
Has occurred once or twice within industry	5	Remote	10 9 8 7 6 5
Rare or unheard of	6	Rare	10 10 9 8 7 6

Decreasing Likelihood

Legend applies to identified HES risks
(see guidance documents for additional explanations)

1, 2 , 3, 4 - Short-term, interim risk reduction required. Long term risk reduction plan must be developed and implemented.

5 - Additional long term risk reduction required. If no further action can be reasonably taken, SBU management approval must be sought to continue the activity.

6 - Risk is tolerable if reasonable safeguards / management systems are confirmed to be in place and consistent with relevant requirements of the Risk Mitigation Closure Guidelines.

7, 8, 9, 10 - Manage risk. No further risk reduction required. Risk reduction at management / team discretion.

Consequence Descriptions & Index (without safeguards)

Decreasing Consequence/Impact

Consequence Descriptions	Consequence Indices	6 Incidental	5 Minor	4 Moderate	3 Major	2 Severe	1 Catastrophic
Safety		**Workforce:** Minor injury such as a first-aid. *AND* **Public:** No impact	**Workforce:** One or more injuries, not severe. *OR* **Public:** One or more minor injuries such as a first-aid.	**Workforce:** One or more severe injuries including permanently disabling injuries. *OR* **Public:** One or more injuries, not severe.	**Workforce:** (1-4) Fatalities *OR* **Public:** One or more severe injuries including permanently disabling injuries.	**Workforce:** Multiple fatalities (5-50) *OR* **Public:** multiple fatalities (1-10)	**Workforce:** Multiple fatalities (>50) *OR* **Public:** multiple fatalities (>10)
Health (Adverse effects resulting from chronic chemical or physical exposures or exposure to biological agents)		**Workforce:** Minor illness or effect with limited or no impacts on ability to function and treatment is very limited or not necessary *AND* **Public:** No impact	**Workforce:** Mild to moderate illness or effect with some treatment and/or functional impairment but is medically manageable *OR* **Public:** Illness or adverse effect with limited or no impacts on ability to function and medical treatment is limited or not necessary.	**Workforce:** Serious illness or severe adverse health effect requiring a high level of medical treatment or management *OR* **Public:** Illness or adverse effects with mild to moderate functional impairment requiring medical treatment.	**Workforce** (1-4): Serious illness or chronic exposure resulting in fatality or significant life shortening effects *OR* **Public:** Serious illness or severe adverse health effect requiring a high level of medical treatment or management.	**Workforce** (5-50): Serious illness or chronic exposure resulting in fatality or significant life shortening effects *OR* **Public** (1-10): Serious illness or chronic exposure resulting in fatality or significant life shortening effects.	**Workforce** (>50): Serious illness or chronic exposure resulting in fatality or significant life shortening effects *OR* **Public** (>10): Serious illness or chronic exposure resulting in fatality or significant life shortening effects.
Environment		Impacts such as localized or short term effects on habitat, species or environmental media.	Impacts such as localized, long term degradation of sensitive habitat or widespread, short-term impacts to habitat, species or environmental media	Impacts such as localized but irreversible habitat loss or widespread, long-term effects on habitat, species or environmental media	Impacts such as significant, widespread and persistant changes in habitat, species or environmental media (e.g. widespread habitat degradation) .	Impacts such as persistant reduction in ecosystem function on a landscape scale or significant disruption of a sensitive species.	Loss of a significant portion of a valued species or loss of effective ecosystem function on a landscape scale.

The above legend applies only to HES risks, where risk levels 1-6 are actionable and mandatory.
For risks that may result in facility damage, business interruption, loss of product, the "Assets" category below should be used.
Asset risk reduction is at the discretion of management. Under no circumstances may a direct or indirect translation of Asset loss to HES consequences, or between any discrete categories of HES consequences be inferred.

Consequence Descriptions & Index (without safeguards)

Consequence Descriptions	Consequence Indices	6 Incidental	5 Minor	4 Moderate	3 Major	2 Severe	1 Catastrophic
Assets (Facility Damage. Business Interruption. Loss of Product)		Minimal damage. Negligible down time or asset loss. Costs < $100,000.	Some asset loss, damage and/or downtime. Costs $100,000 to $1 Million.	Serious asset loss, damage to facility and/or downtime. Costs of $1-10Million.	Major asset loss, damage to facility and/or downtime. Cost >$10 Million but <$100 Million.	Severe asset loss or damage to facility. Significant downtime, with appreciable economic impact. Cost >$100MM but <$1billion.	Total destruction or damage. Potential for permanent loss of production. Costs >$1billion

This matrix is endorsed for use across the Company.
It is not a substitute for, and does not override any relevant legal obligations.
Under no circumstances should any part of this matrix be changed or modified, adapted or customized.
This matrix identifies health, safety, environmental and asset risks and is to be used only by qualified and competent personnel.
Where applicable it is to be used within the Riskman2 structure and governance of an OE Risk Management Process. If applied outside of these Processes, it is also mandatory to manage identified intolerable risks and comply with the Risk Mitigation Closure Guidelines.

Appendix 2.3: Gorgon RiskMan2 Environmental Consequence Interpretive Guideline

Consequence Indices and Ecological Elements	6 INCIDENTAL	5 MINOR	4 MODERATE	3 MAJOR	2 SEVERE	1 CATASTROPHIC
RiskMan2 Guidance [Ref.1]	**Impacts such as localised[1] or short-term effects[2] on habitat, species or environmental media.** **NB: This consequence level is equivalent to environmental harm[7] as defined in the WA Environment Protect Act [Ref. 2]**	**Impacts such as localised[1], long-term[3] degradation of sensitive habitat or widespread[4], short-term impacts to habitat, species or environmental media.** **NB: This consequence level is equivalent to material environmental harm[8] as defined in the WA Environment Protect Act [Ref. 2]**	**Impacts such as localised[1], but irreversible habitat loss or widespread[4], long-term[3] effects on habitat, species or environmental media.** **NB: This consequence level is equivalent to serious environmental harm[9] as defined in the WA Environment Protect Act [Ref. 2]**	**Impacts such as significant, widespread[4] and persistent changes in habitat, species or environmental media (e.g. widespread habitat degradation).** **NB: This consequence level is equivalent to serious environmental harm[9] as defined in the WA Environment Protect Act [Ref. 2]**	**Impacts such as persistent reduction in ecosystem function on a landscape scale[5] or significant disruption of a sensitive species.** **NB: This consequence level is equivalent to serious environmental harm[9] as defined in the WA Environment Protect Act [Ref. 2]**	**Loss of a significant portion of an ecosystem species, or loss of effective ecosystem function on a landscape scale[5].** **NB: This consequence level is equivalent to serious environmental harm[9] as defined in the WA Environment Protect Act [Ref. 2]**
TERRESTRIAL ENVIRONMENT						
Soil and Landform[6]	**Degradation and Contamination** Localised and short-term soil contamination or degradation of soil integrity or specific soil characteristic(s). **Recharge Patterns** Localised and short-term disturbance to recharge patterns that can be readily remediated. **Landforms and Habitat** Localised and short-term disturbance to well-represented landforms that can be readily remediated.	**Degradation and Contamination** Localised and long-term **or** widespread and short-term soil contamination or degradation/ loss of soil integrity or specific soil characteristic(s). **Recharge Patterns** Localised and long-term **or** widespread and short-term disturbance to recharge patterns. **Landforms and Habitat** Localised and long-term **or** widespread and short-term disturbance to well-represented landforms. Localised and short-term disturbance to a sensitive habitat.	**Degradation and Contamination** Localised and irreversible **or** widespread long-term soil contamination or degradation/ loss of soil integrity or specific soil characteristic(s). **Recharge Patterns** Localised and irreversible disturbance to surface/ groundwater recharge patterns. **Landforms and Habitat** Localised and irreversible **or** widespread long-term loss of well-represented landform habitats. Localised and long-term disturbance to a sensitive habitat.	**Degradation and Contamination** Significant, widespread and persistent soil contamination or degradation/ loss of soil integrity or specific soil characteristic(s). **Recharge Patterns** Significant, widespread and persistent disturbance to surface/ groundwater recharge patterns. **Landforms and Habitat** Significant, widespread and persistent changes to well-represented landform habitats, or widespread, long-term disturbance to sensitive habitats.	**Degradation and Contamination** Significant and persistent soil contamination or degradation of soil integrity or loss of specific soil characteristic(s) across the whole of Barrow Island. **Recharge Patterns** Significant and persistent change in surface/ groundwater recharge patterns across the whole of Barrow Island. **Landforms and Habitat** Significant and persistent losses of well-represented or unique/ sensitive landform habitats across the whole of Barrow Island.	**Degradation and Contamination** Significant, widespread and persistent soil contamination or degradation of soil integrity/ loss of specific soil characteristic(s) on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Recharge Patterns** Significant, widespread and persistent change in recharge patterns on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Landforms and Habitat** Significant, widespread and persistent loss of well-represented and unique landform habitats on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region)
Surface and Groundwater Quality	**Surface and Groundwater Quality** Localised and short-term reduction in surface and groundwater quality that can be readily remediated.	**Surface and Groundwater Quality** Localised, but long-term reduction in surface and groundwater quality. Widespread short-term reduction in surface and groundwater quality that can be remediated.	**Surface and Groundwater Quality** Localised and irreversible reduction in surface and groundwater quality. Widespread long-term reduction in surface and groundwater quality, requiring significant remediation efforts.	**Surface and Groundwater Quality** Significant, widespread and persistent reduction in surface and groundwater quality.	**Surface and Groundwater Quality** Significant and persistent reduction in surface and groundwater quality across the whole of Barrow Island.	**Surface and Groundwater Quality** Significant, widespread and persistent reduction in surface and groundwater quality on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).
Air Quality	**Air Quality Standards[10]** Localised, short-term and minor exceedance of air quality standards.	**Air Quality Standards[10]** Minor, localised and long-term **or** minor widespread, short-term exceedance of air quality standards. Major, localised and short-term exceedance of air quality standards.	**Air Quality Standards[10]** Minor, widespread and long-term exceedance of air quality standards. Major, widespread and short-term exceedance of air quality standards.	**Air Quality Standards[10]** Significant, widespread and long-term exceedance of air quality standards, resulting in minor, but persistent reduction in air quality across multiple locations on Barrow Island.	**Air Quality Standards[10]** Significant and persistent reduction in air quality standards across the whole of Barrow Island.	**Air Quality Standards[10]** Significant and persistent reduction in air quality on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).
Restricted Flora and Vegetation Associations	**Abundance and Structure** Localised and short-term decrease in abundance or impact on vegetation association structure. Sub-lethal physiological impacts. **Viability** Localised and short-term reduction in taxon or vegetation association viability.	**Abundance and Structure** Localised and long-term **or** widespread and short-term decrease in abundance or impact on vegetation association structure. **Viability** Localised and long-term **or** widespread and short-term reduction of taxon/ vegetation association viability.	**Abundance and Structure** Localised and irreversible **or** widespread and long-term decrease in abundance or impact on vegetation association structure. **Viability** Localised and irreversible **or** widespread and long-term reduction of viability of taxon or vegetation association on Barrow Island.	**Abundance and Structure** Significant, widespread and persistent decrease in abundance of flora or impact on vegetation association structure. **Viability** Significantly reduced viability of taxon or vegetation association across multiple locations on Barrow Island.	**Abundance and Structure** Loss of a significant portion of the entire taxon on Barrow Island or significant and persistent disruption to vegetation association abundance and structure. **Viability** Near extinction of taxon or vegetation association on Barrow Island.	**Abundance and Structure** Extinction on Barrow Island, and/ or significant and persistent decrease in abundance of flora or loss of effective vegetation association structure on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Viability** Extinction on Barrow Island, and/ or significantly reduced viability (near extinction) on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).
General Flora and Vegetation Associations	**Abundance and Structure** Localised and short-term decrease in abundance or impact on vegetation association structure. Sub-lethal physiological impacts. **Viability** Localised and short-term reduction of taxon or vegetation association viability.	**Abundance and Structure** Widespread and short-term **or** localised and long-term decrease in abundance or impact on vegetation association structure. Sub-lethal to lethal physiological impacts. **Viability** Localised and long-term **or** widespread and short-term reduction of taxon or vegetation association viability.	**Abundance and Structure** Widespread and long-term decrease in abundance or impact on vegetation association structure. **Viability** Localised and irreversible reduction in viability **or** widespread and long-term reduction of viability of taxon or vegetation association.	**Abundance and Structure** Significant, widespread and persistent decrease in abundance or impact on vegetation association structure. **Viability** Significant and persistent reduction in viability of taxon or vegetation association across multiple locations on Barrow Island.	**Abundance and Structure** Extinction of taxon on Barrow Island or significant and persistent disruption to vegetation association and structure. **Viability** Extinction of the entire taxon or vegetation association on Barrow Island.	**Abundance and Structure** Extinction of taxon or vegetation association or loss of effective vegetation association structure on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Viability** Extinction/ near extinction of taxon or vegetation association on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).
Listed Fauna, including Listed Subterranean Fauna (listed and threatened species)	**Behaviour** Short-term behavioural impact to protected fauna within local area.	**Behaviour** Long-term behavioural impact to protected fauna within local area **or** widespread short-term behavioural impact to protected fauna.	**Behaviour** Widespread and long-term behavioural impact to fauna.	**Behaviour** Significant and persistent change in fauna behaviour across multiple locations on Barrow Island.	**Behaviour** Significant and persistent change in fauna behaviour across the whole of Barrow Island.	**Behaviour** Significant and persistent change in fauna behaviour on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).

Consequence Indices and Ecological Elements	6 INCIDENTAL	5 MINOR	4 MODERATE	3 MAJOR	2 SEVERE	1 CATASTROPHIC
	Abundance Localised and short-term decrease in abundance. **Population Viability** Localised and short-term reduction of local population, no lasting effects on the whole population.	**Abundance** Localised and long–term **or** widespread, and short-term decrease in abundance. **Population Viability** Localised and long-term **or** widespread and short-term reduction in population viability.	**Abundance** Localised and irreversible **or** widespread and long-term decrease in abundance. **Population Viability** Localised and irreversible reduction in viability of population **or** widespread and long-term reduction of viability on Barrow Island.	**Abundance** Significant, widespread and persistent decrease in abundance. **Population Viability** Significantly reduced population viability across multiple locations on Barrow Island.	**Abundance** Permanent loss of a significant portion of the entire population on Barrow Island (near extinction). **Population Viability** Near extinction of taxon on Barrow Island.	**Abundance** Extinction on Barrow Island, and/ or significant reduction in abundance on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Population Viability** Extinction on Barrow Island, and/ or significantly reduced viability on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).
General Fauna, including General Subterranean Fauna (not listed/ threatened species)	**Behaviour** Short-term behavioural impact to fauna within local area. **Abundance** Localised and short-term decrease in abundance. **Population Viability** Localised and short-term reduction of population viability, no lasting effects on the whole population.	**Behaviour** Long-term behavioural impact to fauna within local area **or** widespread and short-term behavioural impact. **Abundance** Localised and long–term **or** widespread and short-term decrease in abundance. **Population Viability** Localised and long-term **or** widespread short-term reduction in population viability.	**Behaviour** Widespread and long-term behavioural impact to fauna. **Abundance** Localised and irreversible **or** widespread and long-term decrease in population abundance. **Population Viability** Localised and irreversible **or** widespread and long-term reduction of population viability.	**Behaviour** Significant and persistent change in fauna behaviour across multiple locations on Barrow Island. **Abundance** Significant and persistent changes in population abundance across multiple locations on Barrow Island. **Population Viability** Significantly reduced population viability across multiple locations on Barrow Island.	**Behaviour** Significant and persistent change in fauna behaviour across the whole of Barrow Island. **Abundance** Permanent loss of the entire population on Barrow Island (extinction). **Population Viability** Extinction of taxon/ population on Barrow Island.	**Behaviour** Significant and persistent change in fauna behaviour on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Abundance** Extinction on Barrow Island, and significant and permanent reduction in abundance on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Population Viability** Extinction or near extinction on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).
MARINE ENVIRONMENT						
Marine Water Quality	**Marine Water Quality** Localised and short-term and minor reduction in water quality.	**Marine Water Quality** Minor reduction in water quality, which is widespread and short-term **or** localised and long-term. Significant, localised and short-term reduction in water quality.	**Marine Water Quality** Minor and long-term reduction in water quality across multiple locations, but outside marine conservation reserves[11] around Barrow Island.	**Marine Water Quality** Significant and persistent reduction in water quality across multiple locations around Barrow Island, including marine conservation reserves[11], but outside marine parks[11].	**Marine Water Quality** Significant and persistent reduction in water quality across multiple locations around Barrow Island including marine conservation reserves[11] and marine parks[11].	**Marine Water Quality** Significant, persistent and widespread reduction in water quality on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).
Foreshore and Seabed (subtidal and intertidal)	**Seabed/ Sediment Contamination** Localised contamination of low toxicity, or disturbance that can readily be remediated. **Benthic Substrate** Localised and short–term impact on benthic substrate characteristics.	**Seabed/ Sediment Contamination** Localised contamination or disturbance requiring long-term remediation efforts. Widespread contamination or disturbance that can be readily remediated. **Benthic Substrate** Localised and long-term **or** widespread and short-term changes in benthic substrate characteristics.	**Seabed/ Sediment Contamination** Localised and irreversible **or** widespread and long-term contamination or disturbance outside marine conservation reserves[11] around Barrow Island. **Benthic Substrate** Localised and irreversible **or** widespread and long-term changes in benthic substrate characteristics outside marine conservation reserves[11] around Barrow Island.	**Seabed/ Sediment Contamination** Significant and persistent contamination or disturbance across multiple locations around Barrow Island, including marine conservation reserves[11], but outside marine parks[11]. **Benthic Substrate** Significant and persistent change in benthic substrate characteristics across multiple locations around Barrow Island, including marine conservation reserves[11], but outside marine parks[11].	**Seabed/ Sediment Contamination** Significant and persistent contamination or disturbance across multiple locations around Barrow Island including marine conservation reserves[11] and marine parks[11]. **Benthic Substrate** Significant and persistent change in benthic substrate characteristics across multiple locations around Barrow Island including marine conservation reserves[11] and marine parks[11].	**Seabed/ Sediment Contamination** Significant, persistent and widespread contamination or disturbance on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Benthic Substrate** Significant, widespread and persistent change in benthic substrate characteristics on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).
Restricted and Significant Benthic Primary Producer Communities	**Abundance** Localised and short-term decrease in abundance or impact on communities and habitats. **Viability** Localised and short-term reduction in community/ taxon viability.	**Abundance** Widespread and short-term **or** localised and long-term decrease in abundance or impact on communities and/ or habitats. **Viability** Localised and long-term **or** widespread and short-term reduction in community/ taxon viability.	**Abundance** Widespread and long-term **or** localised and irreversible decrease in abundance or impact on communities outside marine conservation reserves[11] around Barrow Island. **Viability** Localised and irreversible **or** widespread, long-term reduction of community/ taxon viability outside marine conservation reserves[11] around Barrow Island.	**Abundance** Significant and persistent decrease in abundance or impact on a communities and/ or habitats around Barrow Island, including marine conservation reserves[11], but outside marine parks[11]. **Viability** Significant and persistent reduction in community/ taxon viability around Barrow Island, including marine conservation reserves[11], but outside marine parks[11].	**Abundance** Significant and persistent decrease in abundance of communities/ habitats across multiple locations around Barrow Island including marine conservation reserves[11] and marine parks[11]. **Viability** Significantly and permanently reduced viability of taxon or community (near extinction) around Barrow Island including marine conservation reserves[11] and marine parks[11].	**Abundance** Significant and persistent reduction in abundance of communities/ habitats on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Viability** Extinction of communities and habitats around Barrow Island and significantly reduced viability on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands or the Pilbara region).
General Taxa and Communities (Flora)	**Abundance** Localised and short-term decrease in abundance or impact on communities and/ or habitats. **Viability** Localised and short-term reduction in community/ taxon viability.	**Abundance** Widespread and short-term **or** localised and long-term decrease in abundance or impact on communities and/ or habitats. **Viability** Localised and long-term **or** widespread and short-term reduction in community/ taxon viability.	**Abundance** Localised and irreversible **or** widespread and long-term decrease in abundance or impact on communities outside marine conservation reserves[11] around Barrow Island. **Viability** Localised and irreversible **or** widespread and long-term reduction of community/ taxon viability outside marine conservation reserves[11] around Barrow Island.	**Abundance** Significant and persistent decrease in abundance or impact on communities and/or habitats in around Barrow Island, including marine conservation reserves[11], but outside marine parks[11]. **Viability** Significant and persistent reduction in community/ taxon viability in multiple locations around Barrow Island, including marine conservation reserves[11], but outside marine parks[11].	**Abundance** Significant and persistent decrease in abundance of communities/ habitats across multiple locations around Barrow Island including marine conservation reserves[11] and marine parks[11]. **Viability** Extinction on Barrow Island, including marine conservation reserves[11] and marine parks[11].	**Abundance** Significant and persistent reduction in abundance of communities/ habitats on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Viability** Extinction or near extinction on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).

Consequence Indices and Ecological Elements	6 INCIDENTAL	5 MINOR	4 MODERATE	3 MAJOR	2 SEVERE	1 CATASTROPHIC
Listed Species or Evolutionary Significant Units	**Behaviour** Localised and short-term behavioural impact. **Abundance** Localised and short-term decrease in abundance. **Population Viability** Localised and short-term reduction in population viability.	**Behaviour** Widespread and short-term **or** localised and long-term behavioural impact. **Abundance** Localised and long-term **or** widespread and short-term decrease in abundance. **Population Viability** Localised and long-term **or** widespread and short-term reduction in population viability.	**Behaviour** Widespread and long-term behavioural impact. **Abundance** Localised and irreversible **or** widespread and long-term decrease in species abundance outside marine conservation reserves[11] around Barrow Island. **Population Viability** Localised and irreversible **or** widespread and long-term reduction of population viability outside marine conservation reserves[11] around Barrow Island.	**Behaviour** Significant and persistent change in species behaviour in multiple locations around Barrow Island, including marine conservation reserves[11], but outside marine parks[11]. **Abundance** Significant and persistent decrease in species abundance in multiple locations around Barrow Island, including marine conservation reserves[11], but outside marine parks[11]. **Population Viability** Significant and persistent reduction in population viability in multiple locations around Barrow Island, including marine conservation reserves[11], but outside marine parks[11].	**Behaviour** Significant and persistent change in species behaviour across multiple locations around Barrow Island including marine conservation reserves[11] and marine parks[11]. **Abundance** Significant and persistent reduction in species abundance across multiple locations around Barrow Island including marine conservation reserves[11] and marine parks[11]. **Population Viability** Significantly and permanently reduced population viability (near extinction) across multiple locations around Barrow Island including marine conservation reserves[11] and marine parks[11].	**Behaviour** Significant and persistent change in species behaviour on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Abundance** Significant and persistent reduction in species abundance on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Population Viability** Extinction of population around Barrow Island and/ or significantly reduced viability on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).
General Species and Communities (not listed/ threatened) (Fauna)	**Behaviour** Localised and short-term behavioural impact. **Abundance** Localised and short-term decrease in abundance. **Population Viability** Localised and short-term reduction in population viability.	**Behaviour** Widespread and short-term **or** localised and long-term behavioural impact. **Abundance** Localised and long-term **or** widespread and short-term decrease in abundance. **Population Viability** Localised and long-term **or** widespread and short-term reduction in population viability.	**Behaviour** Widespread and long-term behavioural impact. **Abundance** Localised and irreversible **or** widespread and long-term decrease in species abundance outside marine conservation reserves[11] around Barrow Island. **Population Viability** Localised and irreversible **or** widespread and long-term reduction of population viability outside marine conservation reserves[11] around Barrow Island.	**Behaviour** Significant and persistent change in species behaviour in multiple locations around Barrow Island, including marine conservation reserves[11], but outside marine parks[11]. **Abundance** Significant and persistent decrease in species abundance in multiple locations around Barrow Island, including marine conservation reserves[11], but outside marine parks[11]. **Population Viability** Significant and persistent reduction in population viability in multiple locations around Barrow Island, including marine conservation reserves[11], but outside marine parks[11].	**Behaviour** Significant and persistent change in species behaviour across multiple locations around Barrow Island including marine conservation reserves[11] and marine parks[11]. **Abundance** Significant and persistent loss of species abundance across Barrow Island including marine conservation reserves[11] and marine parks[11]. **Population Viability** Extinction on Barrow Island and/ or significantly reduced viability (near extinction) on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).	**Behaviour** Significant and persistent change in species behaviour on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Abundance** Significant and persistent loss of species abundance on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region). **Population Viability** Extinction or near extinction on a regional scale (i.e. Barrow Island, Lowendal and Montebello Islands and/or the Pilbara region).

References:

1. Chevron Corporate RiskMan2 Integrated Risk Prioritization Matrix User Guide, Version 1, Revised March 2006.
2. Western Australia *Environmental Protection Act 1986*.
3. Chevron Australia Pty Ltd, Draft Environmental Impact Statement/ Environmental Review and Management Programme for the Proposed Gorgon Development, September 2005.
4. Commonwealth of Australia, Department of the Environment and Water Resources, Environment Protection and Heritage Council, National Environment Protection (Ambient Air Quality) Measure, 2003 (as amended).
5. National Occupational Health and Safety Commission (Worksafe Australia), Exposure Standards for Atmospheric Contaminants in the Occupational Environment, Guidance Note [NOHSC:3008(1995) and National Exposure Standards [NOHSC:1003(1995), May 1995 (as amended).
6. WA Department of Environment and Conservation (DEC), Management Plan for the Montebello/ Barrow Islands Marine Conservation Reserves 200702017, Management Plan No. 55.

Definitions:

No	Term	Definition
1	Localised	Defined in Section 9, Risk Assessment Process of the EIS/ ERMP [Ref. 3] as 'the area directly affected by the Development and the immediate vicinity of the Development". Localised is therefore the area confined to the limits of the Terrestrial or Marine Disturbance Footprints and inclusive of the Cleared Terrestrial/ Marine Land Footprint.
2	Short-term	Less than 5 years.
3	Long-term	Greater than 5 years.
4	Widespread	Defined in Section 9, Risk Assessment Process of the EIS/ ERMP [Ref. 3] as "areas well outside the direct impact zone from the Development". Widespread is therefore the area outside the limits of the Terrestrial or Marine Disturbance Footprints.
5	Landscape scale	This term is equivalent to the term 'immediate region', used and defined in Section 9, Risk Assessment Process of the EIS/ ERMP [Ref. 3] as follows: "For aspects of the Development on Barrow Island or within the marine conservation reserves: Barrow Island, Lowendal Islands and Montebello Islands. For aspects of the Development offshore of Barrow Island: Pilbara Offshore Region. For aspects of the Development between Barrow Island and the mainland: Pilbara Nearshore Region. For aspects of the Development on the mainland: Pilbara."
6	Landform habitat	Landforms habitats on Barrow Island could include any of the following, e.g. creeks or dry creek beds, rocky outcrops, vegetated sand dunes, tidal flats, valleys, escarpments and exposed limestone ridges, etc.
7	Environmental harm	"Environmental harm means direct or indirect – (a) harm to the environment involving removal or destruction of, or damage to (i) native vegetation; or (ii) the habitat of native vegetation or indigenous aquatic or terrestrial animals (b) alteration to the environment to its detriment or degradation or potential detriment or degradation (c) alteration of the environment to the detriment or potential detriment of an environmental value; or (d) alteration of the environment of a prescribed kind." [Ref. 2]
8	Material environmental harm	"Material environmental harm means environmental harm that – (a) is neither trivial nor negligible; or (b) results in actual or property loss, property damage or damage costs of an amount, or amounts in aggregate, exceeding the threshold amount." [Ref. 2]
9	Serious environmental harm	"Serious environmental harm means environmental harm that – (a) is irreversible, of a high impact or on a wide scale (b) is significant or in an area of high conservation value or special significance; or (c) results in actual or potential loss, property damage or damage costs of an amount, or amounts in aggregate, exceeding five times the threshold amount." [Ref. 2]
10	Air Quality Standards	These refer to (1) the Ambient Air Quality Standards for common atmospheric pollutants (i.e. nitrogen dioxide, photochemical oxidants, sulfur dioxide and particulate matter) as listed in the National Environmental Protection Council Ambient Air Quality National Environmental Protection Measure [Ref. 4] and the National Occupational Health and Safety Commission Exposure Standards for Atmospheric Contaminants (i.e. benzene, ethylbenzene, hydrogen sulfide, carbon dioxide and carbon monoxide) in the Occupational Environment and the National Exposure Standards [Ref. 5]. The ambient air quality standards [Ref. 4] are summarised below:

Pollutant	Averaging Period	Maximum Concentration [*]	Maximum Allowable Exceedances
Nitrogen Dioxide (NO_2)	1 hour 1 year	0.12 ppm (246 µg/m^3) 0.03 ppm (62 µg/m^3)	1 day/ year
Photochemical Oxidants (as ozone, O_3)	1 hour 1 year	0.10 ppm (214 µg/m^3) 0.08 ppm (171 µg/m^3)	1 day/ year 1 day/ year
Sulfur Dioxide (SO_2)	1 hour 1 day 1 year	0.20 ppm (214 µg/m^3) 0.08 ppm (171 µg/m^3) 0.02 ppm	1 day/ year 1 day/ year
Particulates (as PM_{10})	1 day	50 µg/m^3	5 days/ year

* - measured at ground level.

The exposure standards for atmospheric contaminants [Ref. 5] are summarised below:

Pollutant	TWA [*]	STEL [**]
Benzene (in BTEX)	1 ppm (3.2 mg/m^3	--
Ethyl benzene (in BTEX)	100 ppm (434 mg/m^3)	125 ppm (543 mg/m^3)
Hydrogen Sulfide (H_2S)	10 ppm (14 mg/m^3)	15 ppm (21 mg/m^3)
Carbon Dioxide (CO_2)	5000 ppm (9000 mg/m^3)	30 000 ppm (54 000 mg/m^3)
Carbon Monoxide (CO)	30 ppm (34 mg/m^3)	--

* - Time Weighted Average (TWA) means the average airborne concentration of a particular substance when calculated over a normal eight hour working day, for a five day working week.

** - Short-term exposure limit (STEL) means a 15 minute TWA exposure which should not be exceeded at any time during a working day even if the eight hour TWA average is within the TWA exposure standard. Exposures at the STEL should not be longer than 15 minutes and should not be repeated more than 4 times per day. There should be at least 60 minutes between successive exposures at the STEL.

11	Marine Conservation Reserves	Defined in the WA Department of Environment and Conservation (DEC) Management Plan for the Montebello/ Barrow Islands Marine Conservation Reserves [Ref. 6] as inclusive of the following (refer to Map of Sensitive Environmental Features, Barrow Island Marine Environment, Figure A5.1): • The Barrow Island Marine Park and the Montebello Islands Marine Park (highest conservation status) • Barrow Island Marine Management Area (high conservation status) north and south of Barrow Island and to the limit of the state coastal waters to the west, the Lowendal Nature Reserve to the north of Barrow Island and the Bandicoot Bay Conservation Area (for benthic primary producer habitat) on the south end of Barrow Island.

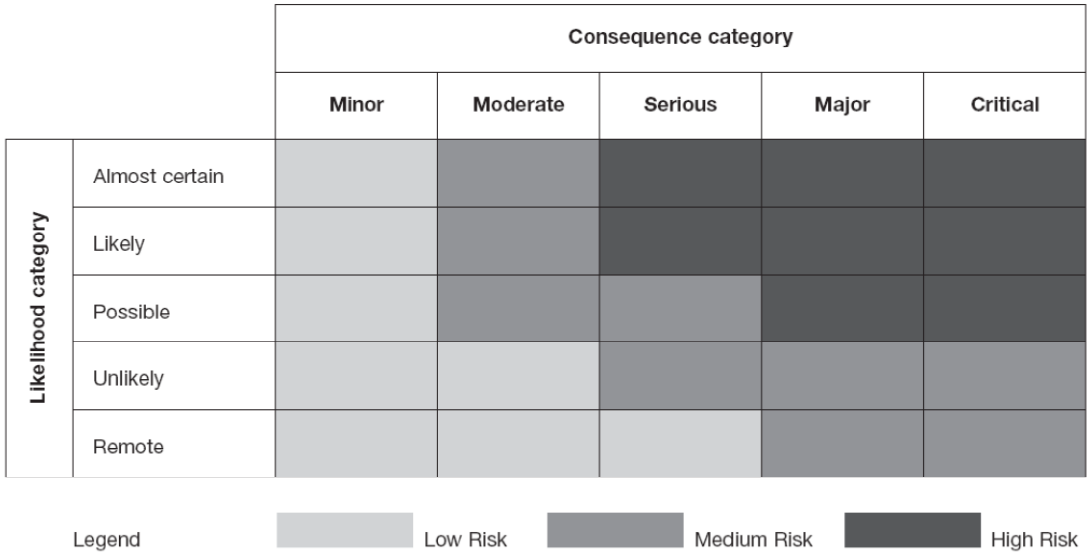
Appendix 2.4: Turtle Risk Assessment Summary Outcomes (Relevant to Marine Facilities Construction Activities only)

Proposal-related Stressor	Receptor	Risk	Species
East Coast Marine Construction Period:			
Light	Nesting	Medium	F, h
	Breeding and mating adults	Medium	F, h
	Hatchlings	Medium	F, h
	Foraging juveniles, adults	Low	F, G, H
Noise and vibration	Nesting	Low	F, h
	Breeding and mating adults	Low	F, h, g
	Foraging juveniles, adults	Low	F, G, H
Blasting	All	Medium	F, G, H
Vessels: boat strike	Breeding, foraging adults, juveniles	Medium	F, G
dredge	All (not hatchlings)	Medium	F, g, h
Liquid waste discharges: turbid waters	Foraging juveniles and adults, breeding adults	Medium	F, G, h
diesel spills >1000 L	All	Low	F, g, h
diesel spills <1000 L	All	Low	F, g, h
vessel organic and liquid discharges	Foraging juveniles and adults, breeding adults	Low	F, G, h
unplanned oil pipeline rupture	All	Low	F, G, H
chemical spills	All	Low	F, g, h

Notes: Capital letter for turtle indicates greater potential impact/risk:

F/f : Flatback Turtle
G/g : Green Turtle
H/h: Hawksbill Turtle

Appendix 2.5: Gorgon Development Environmental Risk Matrix (used for Turtle Risk Assessment)



Appendix 3 Compliance Reporting Table

Section No.	Actions	Timing
6.2	Prior to the commencement of construction, selected crew from the construction vessels will be trained as Marine Fauna Observers (MFOs) on marine turtle and marine mammal behaviour and the actions to be taken in the event of marine fauna sightings, injury or mortality.	Pre-construction
6.2	During daylight hours, operators of specified vessels will be required to maintain a Marine Fauna Observer on watch during marine operations and vessel movements. If marine fauna are spotted, moving vessels will adjust their speed and direction to avoid impacting the animal, where practicable.	Construction
6.2	In the event that injured marine fauna are sighted, the requirements of the Fauna Handling Common User Procedure will be complied with, where practicable.	Construction
6.2	A log detailing marine mammal and marine turtle sightings will be maintained on all vessels. If marine mammals or turtles at risk from construction activities are sighted, relevant vessels operating in the area will be notified and the location of marine mammals or turtles will be monitored and recorded, where practicable.	Construction
6.2	The risk of impact to marine turtles increases with an increase in vessel speed, shallow water, and reduced under keel clearance. Vessel speed >10 knots can impact on marine turtles, therefore, vessel speeds will be restricted in the Barrow Island Port Area. Within this area, vessel speeds will be under the control of the Harbour Master who will ensure that all vessels operate in a safe manner with due respect paid to ongoing operations, navigational constraints, and environmental considerations. The Harbour Master will be advised of environmental matters from onsite environmental staff, including Marine Fauna Observers as applicable. Vessel speed will also be managed based on environmental conditions (turtle abundance observed in area by Marine Fauna Observer), weather conditions, vessel manoeuvrability, and location of navigational hazards.	Construction
6.2	The marine construction workforce and all vessels will be limited to designated areas only, except for emergencies. Recreational fishing, diving, spear fishing, fossicking (i.e. collecting shells and any other biological or natural material e.g. animal bones), surfing or recreational boating will be prohibited during construction.	Construction
6.3	Construction Contractor will be provided with: • boundaries of the MDF in a suitable format (i.e. GPS coordinates) • locations of coral assemblages • latest revision of all relevant engineering drawings. This information will be available to all vessel skippers and relevant crew.	Prior to mobilisation
6.3	Construction Contractors will develop internal anchor management procedures, approved by EPCM contractor and/or Chevron Australia. This procedure will include details of, or about, the: • details of required anchor spreads • details on the management of chain/wire drag and anchor movements • details on the procedures for deployment and retrieval of anchors. The objective of the procedure will be to manage impacts to coral assemblages and to keep impacts within the MDF through effective anchor management. Figure 6-1 shows the development process for this procedure.	Prior to mobilisation
6.3	Construction Contractor will avoid any disturbance outside the MDF boundaries.	Construction
6.3	Construction Contractors will implement the approved anchor management procedures.	Construction

Section No.	Actions	Timing
6.3	Approval must be sought from the EPCM Contractor prior to setting anchors outside the approved anchor management procedure.	Construction
6.3	Where anchoring is required around coral assemblages, measures such as the use of pre-set anchors and buoyant lines will be implemented, where practicable.	Construction
6.3	Chevron and/or the EPCM Contractor shall routinely audit compliance with the anchor management procedure.	Construction
6.3	Establish mooring locations to avoid unnecessary vessel anchoring to minimise impacts to coral assemblages.	Prior to mobilisation
6.3	Locations of moorings will be selected to avoid impacts to coral assemblages where practicable.	Prior to mobilisation
6.3	The location of moorings will be approved in consultation with EPCM Contractor and Chevron Australia.	Prior to mobilisation
6.3	Conduct pre-construction planning to minimise the requirements for anchor sets in nearshore waters.	Prior to mobilisation
6.3	Construction Contractor will manage construction activities to minimise impacts to coral assemblages where practicable.	Construction
6.3	Marine construction activities will be guided by survey controls and construction design requirements where practicable.	Construction
6.3	All equipment on board vessels shall be stowed securely to prevent solid objects from falling overboard.	Construction
6.3	Dropped objects shall be reported to the EPCM Contractor as soon as practicable. Retrieval of submerged objects will be assessed in consultation with the EPCM Contractor and/or Chevron Australia.	Construction
6.4	Monitoring of water quality and sedimentation and potential impacts to coral health from the reclamation activities will be encompassed within the water quality and coral health monitoring programs as described within the DSDMMP.	Construction
6.4	Material from the mainland and Barrow Island to be used in the construction of the MOF berms will be screened to minimise fines, or where not screened a filter layer (geotextile) will be placed on the outside of the berm to minimise fines spreading to the environment..	Construction
6.4	Pipelines will be routinely maintained to minimise leakage of turbid water during pumping of material to the reclamation area where practicable.	Construction
6.4	Settling areas will be used within the MOF during reclamation to minimise release of fines with decant water.	Construction
6.4	A filter layer (geotextile) will be used in construction of the Pioneer MOF Platform (and other areas where reclamation is required and there is potential for the berm to pass fine material) to manage the release of fines from the core material into the marine environment.	Construction
6.4	The placement of the fill during reclamation will be primarily at or near high tides, where practicable.	Construction
6.4	The coarser sand fraction of material will be used for reclamation where practicable to assist in reducing the turbidity levels of the decant water.	Construction
6.4	The MOF berm will include a weir box to manage discharge of decant water.	Construction
6.4	Current and forecasted meteorological and oceanographic information will be considered in the daily work plan.	Construction
6.4	Available water quality and coral health data will be considered in the daily work plan.	Construction
6.4	Seawater will be used during drilling as part of pile installation. No synthetic-based muds will be used as a drill lubricant.	Construction

Section No.	Actions	Timing
6.5	The blast management procedure shown in Figure 6-2 will be implemented by the Construction Contractor in the event that marine blasting is required.	Construction
6.5	An exclusion zone of 2000 m for whales and 1000 m for other Key Receptor Species will be adopted (during blasting).	Construction
6.5	An appropriate number of support vessels will be used to traverse the radius of the exclusion zone looking inwards and outwards to locate any Key Receptor Species during drill and blast activities.	Construction
6.5	Stem blast holes with gravel (or similar material) to seabed level after the charge is in place, prior to blasting.	Construction
6.5	Blasting will be delayed if Key Receptor Species are sighted within the exclusion zone.	Construction
6.5	A maximum allowable charge of 50 kg per delay shall be specified.	Construction
6.5	Sequential charges shall be used to minimise cumulative impacts of the explosives.	Construction
6.5	Drill method and detonation system will be selected to avoid sympathetic detonation between blast holes.	Construction
6.5	Removal of surface kill e.g. fish (if evident) shall occur following each blast.	Construction
6.5	Blasting shall be undertaken during daylight hours only.	Construction
6.5	The piling management procedure shown in Figure 6-3 will be implemented by the Construction Contractor during impact piling activities	Construction
6.5	An exclusion zone of 2000 m for whales and 500 m for other Key Receptor Species will be adopted during impact piling activities.	Construction
6.5	To minimise the risk to Key Receptor Species within close proximity to the source, carry out ‘soft-start’ at the commencement of impact piling. This will allow animals in close proximity to source to move away and not be suddenly exposed to violent noise.	Construction
6.5	Impact piling will not occur at night if there have been three or more cetacean-instigated shutdown situations during the preceding 24-hour period	Construction
6.5	Noise-generating equipment (including vessel engines, drill and piling equipment) will be routinely maintained and inspected to reduce unnecessary increases in noise levels from equipment.	Construction
6.5	Avoid leaving engines, thrusters and auxiliary plant in stand-by or running mode unnecessarily, where possible.	Construction
6.5	All vessels shall operate in accordance with appropriate industry and equipment noise and vibration standards.	Construction
6.7	Where practicable, hazardous material storage areas shall be designed to handle the volumes and operating conditions (both normal and upset conditions) specifically required for each substance, including product identification, transportation, storage, control and loss prevention (e.g. bunding and drainage).	Prior to mobilisation and construction
6.7	Industry standards, port authority, and pollution prevention regulations shall be adhered to during refuelling, transfer, storage and handling of hazardous materials (e.g. bunding, level gauges, overflow protection, drainage systems and hardstands).	Construction
6.7	Hazardous materials (including hazardous waste) shall be stored in appropriately labelled and contained drums or tanks. An up-to-date list of MSDSs shall be available and stored with relevant products.	Construction

Section No.	Actions	Timing
6.7	Detailed refuelling procedures shall be developed by the Construction Contractor prior to commencement of work on site; these procedures shall include, but not be limited to, the following requirements (where practicable): • fuel transfer to occur in accordance with port authority and pollution prevention regulations • specific safety boundaries to be used when refuelling • refuelling to be undertaken in fair weather conditions, as far as reasonably practicable (i.e. allowing for safety requirements during cyclone watch and warning stages) to reduce the risk of spills • open communication channels to be maintained during refuelling • instructions for visual monitoring; and emergency response procedures.	Prior to mobilisation
6.7	Personnel involved with refuelling or fuel transfer shall be trained in their roles, functions and responsibility, including emergency response prior to engaging in refuelling or fuel transfer.	Prior to mobilisation and construction
6.7	All vessels greater than 400 gross tonnage shall have bilge oil/water separators that comply with the requirements of Annex I of MARPOL 73/78 and Part II of the *Protection of the Sea (Prevention of Pollution from Ships) Act 1993* (Cth) to ensure that oil concentrations in discharges are less than 15 ppm.	Prior to mobilisation and construction
6.7	Drainage from decks and work areas with potential for oil, grease or hydrocarbon contamination shall be collected and processed through an appropriately maintained oil/water separator and managed according to International Oil Pollution Prevention procedures prior to discharge, or stored for onshore disposal.	Construction
6.7	Sufficient and appropriate equipment, materials and resources shall be available in a timely manner to: • prevent spills to marine environment from working machinery (e.g. spill trays, one-way valves or other spill prevention features) • respond to spills to the marine environment • respond to spills to ground (on board vessels).	Construction
6.7	The Construction Contractor will comply with and align spill response preparedness with the relevant requirements of the Chevron Marine Oil Pollution Plan (MOPP)	Construction
6.7	All relevant personnel shall be trained in spill prevention, response and reporting.	Prior to mobilisation and construction
6.7	Specified vessels shall have a current International Oil Pollution Prevention Certificate issued by the State in which the vessel is registered and an approved Shipboard Oil Pollution Emergency Plan (SOPEP).	Construction
6.7	If relevant vessels do not have an existing approved SOPEP, the vessel shall prepare a vessel-specific Spill Contingency Plan (SCP) that bridges to the Chevron Australia MOPP to ensure an effective, integrated response to any spill.	Construction
6.7	Onboard spills shall be contained and cleaned up immediately and shall not be washed overboard. Product MSDSs shall be adhered to during clean-up.	Construction
6.7	Terrestrial-based hydrocarbon spill management (MOF causeway and WAPET Landing): • Spill clean-up kits will be deployed at designated locations on the MOF causeway. • Vessel refuelling tankers will have spill clean-up kits. • All vehicle refuelling will be undertaken by trained personnel and in accordance with a vehicle refuelling procedure.	Construction

Section No.	Actions	Timing
6.7	Regular audits of each vessel's hydrocarbon handling procedures and equipment including spill kits will be undertaken by the EPCM Contractor and/or Chevron Australia during construction.	Construction
6.9	Construction Contractor will be required to produce a Quarantine Management Plan to cover the Marine Facilities construction fleet, with the purpose of systematically documenting the quarantine management practices and procedures the Contractor will undertake that link to the Chevron Quarantine Management System.	Construction
6.9	The QMP will comply with the Gorgon Gas Development quarantine commitments, which prevent the introduction and establishment of both marine and terrestrial non-indigenous species on Barrow Island and surrounding waters.	Construction
6.9	Monitoring and surveillance of construction vessels by quarantine project inspectors will be undertaken to ensure quarantine compliance with the QMS and allow for continuous improvement strategies to be implemented.	Construction
6.10	Where incinerators are permitted to be used on vessels, the requirements of Annex VI of MARPOL 73/78 shall be met.	Pre-construction and Construction
6.10	All diesel engines on vessels shall comply with the requirements for NO_x emissions specified in Regulation 13 of Annex VI of MARPOL 73/78.	Pre-construction and Construction
6.10	Incineration of material prohibited under Regulation 16 of Annex VI of MARPOL 73/78, e.g. contaminated packaging materials and polychlorinated biphenyls, shall not be undertaken on board vessels.	Pre-construction and Construction
6.10	All vessels shall comply with the requirements for ozone depleting substances specified in Regulation 12 of Annex VI of MARPOL 73/78, including the prohibition of deliberate release of ozone depleting substances and ozone depleting substances in new installations except for new installations containing hydrochlorofluorocarbons, which are permitted until 1 January 2020.	Pre-construction and Construction
6.10	Audits of compliance with MARPOL 73/78 will be undertaken by the EPCM Contractor and/or Chevron Australia during construction.	Pre-construction and Construction
8.1.1	Any document that is required to be implemented under this Plan will be made available to the relevant DEC/DEWHA (now SEWPaC) auditor.	All Phases
8.1.2	The findings of external regulatory audits will be recorded and actions and/or recommendations will be addressed and tracked.	Construction
Table 8.2	Report details of detected mortality of any marine fauna declared under section 14 (2) (ba) of the *Wildlife Conservation Act 1950* (WA) to DEC within 48 hours of observation.	Construction
Table 8.2	Report harm or mortality to EPBC Act Listed Marine Fauna attributable to the Gorgon Gas Development to DEWHA (now SEWPaC) within 24 hours of detection	Construction
Table 8.2	Report Material or Serious Environmental Harm detected outside the Marine Disturbance Footprint (attributable to the Gorgon Gas Development) to DEC and DEWHA (now SEWPaC) within 48 hours of detection or as soon as reasonably practicable.	Construction
Table 8.2	Report Significant Impacts detected by the monitoring program for matters of National Environmental Significance (attributable to the Gorgon Gas Development) to DEWHA (now SEWPaC) within 48 hours of detection or as soon as reasonably practicable.	Construction

Appendix 4 Identification and Risk Assessment of Marine matters of National Environmental Significance (NES)