DARWIN LNG OPERATIONS ENVIRONMENTAL MANAGEMENT PLAN

DLNG/HSE/PLN/001

Revision History

Revision	Date	Description	Preparer & Title	Reviewer & Title	Approver & Title *
0	31/10/2005	Issue for approval by NT DNRETA	J.Martin Environment Specialist	D. Ratcheva Environment Specialist	U. Doring HSE Manager
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* Approver signature only required for release of new version.

Authorisations

Document approval and release for distribution

Position Title	Name	Signature	Date
VP Operations, Drilling and Supply Chain	David Boyle		18/9/18
Darwin Operations Manager	Filippo Meacci		3/9/18
Document Custodian	Daniel Thompson		31/8/18

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SYMBOLS AND ACRONYMS

^{o}C	Degrees Celsius
%	Percent (percentage)
ABU	ConocoPhillips Australasian Business Unit
ABU-W	ConocoPhillips Australasian Business Unit West
AGI	Acid gas incinerator
ALARP	As Low As Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AS/NZS	Australian Standard / New Zealand Standard
BH1	(groundwater) Bore hole 1
BOG	Boil-off Gas
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
BUD	Beneficial Use Declaration
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2-e	Carbon Dioxide equivalent
ConocoPhillips	ConocoPhillips Australia Pty Ltd (formerly Phillips Petroleum Company Australia Pty Ltd)
CMT	Crisis management team
CN	Conservation
CPI	Corrugated Plate Interceptor
CSM	Conceptual Site Model
DAF	Dissolved Air Flotation
dB (A)	A-weighted sound levels in Decibels
DEC	Department of Environment and Conservation
DHWQO	Darwin Harbour Water Quality Objectives
DIPE	Former (Northern Territory) Department of Infrastructure, Planning and Environment
DLNG	Darwin LNG
DPIR	Department of Primary Industry and Fisheries (Northern Territory)
DPO	Deferred production opportunity
DV	Development
EDI	Electrodeionisation
EDP	Exceptional Development Permit
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
ENVID	Environmental Impact Identification
EPBC	Environment Protection and Biodiversity Conservation
EPA	Environment Protection Authority
EPL	Environment Protection Licence

EPO	Environmental Protection Objective
ERP	Emergency Response Plan
ERT	Emergency response team
GHG	Greenhouse Gas, means carbon dioxide, methane, nitrogen dioxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride. Only the former three GHGs are of relevance to the DLNG Plant as it does not emit hydrofluorocarbons, perfluorocarbons or sulphur hexafluoride
GPS	Global positioning system
GT	Gas turbine
H_2S	Hydrogen Sulphide
Ha	Hectare
HSE	Health, Safety and Environment
HSEMS	Health, Safety and Environment Management System
HVAC	Heating, Ventilation and Air Conditioning
IMT	Incident management team
IOSC	Integrated Operations Support Centre
Km	Kilometre
KPI	Key Performance Indicator
L	Litre
LED	Light emitting diode
LNG	Liquefied Natural Gas
LP	Low Pressure
LPG	Liquefied Petroleum Gas
m	Metre
m^3	Cubic metre
m^3/h	Cubic metres per hour
mm	Millimetre
mg	Milligram
mg/L	Milligram per litre
mg/Nm^3	Milligram per normalised cubic metre
$\mu g/m^3$	Micrograms per cubic metre
µg/L	Micrograms per litre
µS/cm	microSiemens per centimetre
MEB	Medical Entomology Branch
MPN/100 mL	Most probable number of coliform per 100mL
MTPA	Million Tonnes per Annum
n.d.	No date
N_2O	Nitrous Oxide
NATA	National Association of Testing Authorities
NEPM	National Environment Protection Measure
NGER	National Greenhouse and Energy Reporting
NGL	Natural Gas Liquids (NGL produced by the DLNG Plant will comprise LPG) and condensate)
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NPI	National Pollutant Inventory
NRETAS	Natural Resources, Environment, the Arts and Sport

NT EPA	Northern Territory Environment Protection Authority
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
NRU	Nitrogen Reinjection Unit
NSW	New South Wales
NT	Northern Territory
NTU	Nephelometric turbidity units
ODS	Ozone Depleting Substances
OEMP	Operations Environmental Management Plan
OPRALOG	Operations Production Reporting and Approval log
OSPG	Onsite Power Generation
OSRL	Oil Spill Response Limited
P&ID	Process and Instrumentation Diagram
PER	Public Environmental Review
PERC	Powered Emergency Release Coupler
PFAS	Per- and poly-fluoroalkyl sulfonates
PFOS	Per- and poly-fluorooctane sulfonates
PFHxS	Per- and poly-fluorohexane sulphates
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter (diameter less than 2.5 microns)
PM_{10}	Particulate Matter (diameter less than 10 microns)
POG	Process Operating Guideline
PSV	Process Safety Valve
ppb	Parts per billion
ppm	Parts per million
ppt	Parts per thousand
PV	Pressure valve
PWC	(Northern Territory) Power and Water Corporation
QA	Quality assurance
QC	Quality control
RO	Reverse osmosis
RR	Residual risk
SD	Sustainable development
SDS	Safety Data Sheet
SIP	Standard Isolation Procedures
STP	Sewage Treatment Plant
SOx	Sulphur oxides
SO_2	Sulphur dioxide
SOCS	Site of Conservation Significance
SOP	Standard Operating Procedure
TAHS	Turbine Air Humidification System
Train	LNG processing section of the plant
TV	Television
UXO	Unexploded Ordinance
VOC	Volatile Organic Compound

WALFA	West Arnhem Land Fire Abatement Project
WHRUs	Waste heat recovery units
WM&PC Act	Waste Management and Pollution Control Act (NT)
WoNS	Weed of National Significance

1 INTRODUCTION

1.1 BACKGROUND

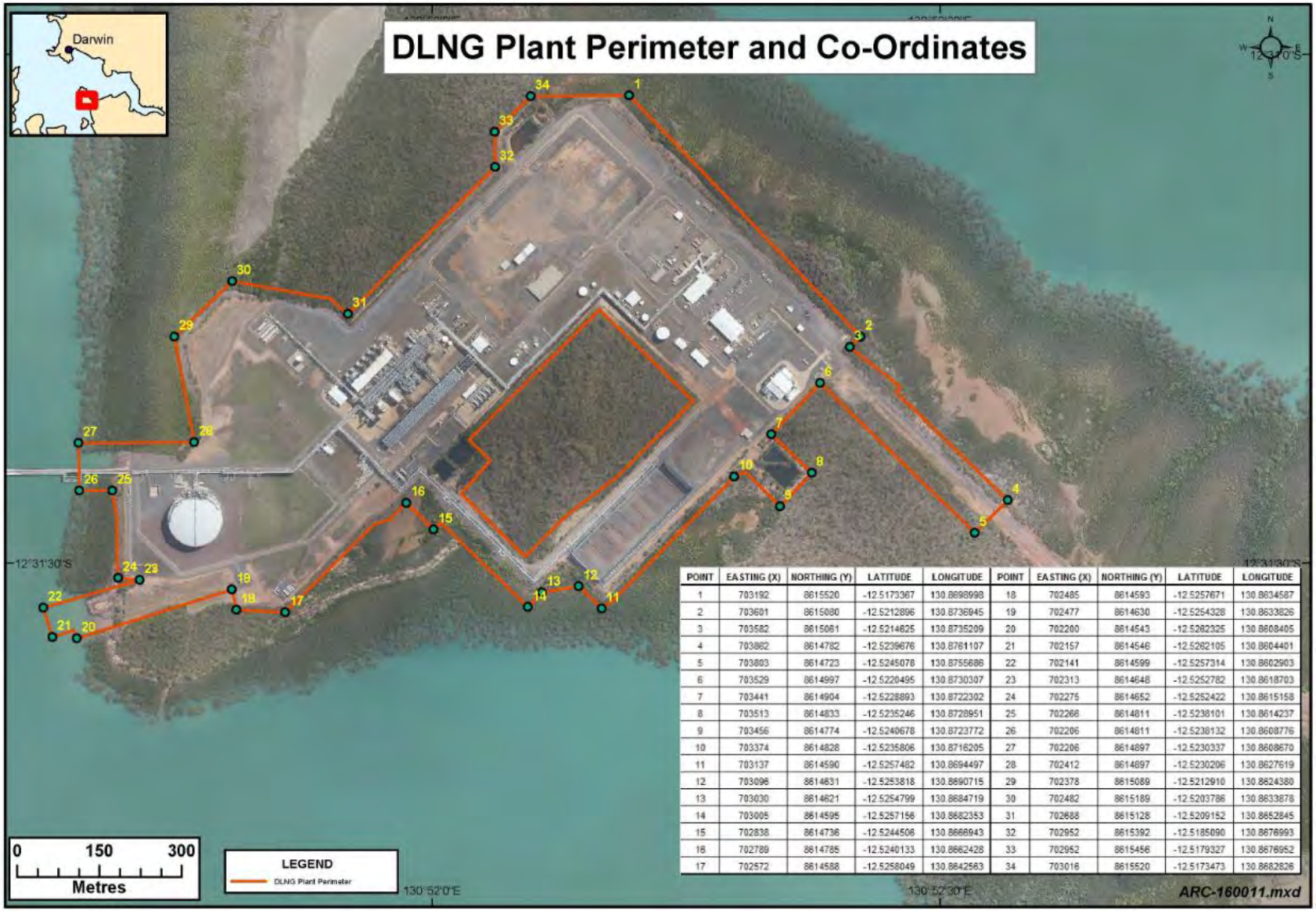
ConocoPhillips Pipeline Australia Pty Ltd (ConocoPhillips) operates the DLNG Plant on behalf of DLNG Pty Ltd. Construction of the Darwin LNG (DLNG) Plant commenced in June 2003 and the plant was commissioned in the first quarter of 2006 when LNG sales commenced.

The DLNG Plant receives dry natural gas from the ConocoPhillips operated Bayu-Undan Field (located in the Timor Sea Joint Petroleum Development Area) via the 502 km long Bayu-Darwin Pipeline, for the purpose of producing LNG for export. The point of sale of the LNG product is when the LNG is loaded onto purpose built LNG carriers, provided by the LNG buyers, at the DLNG Plant jetty. The LNG is shipped to Japan by the buyers and used for power generation and gas distribution and sales to residential, industrial and commercial customers.

The DLNG Plant is located at Wickham Point on the Middle Arm Peninsula in Darwin Harbour. The DLNG Plant (Figure 1-2) is located approximately 6 km south to south-east of Darwin, and 4 km north of Channel Island Power Station (Figure 1-1). Access to the DLNG Plant site is via Wickham Point Road, from Channel Island Road along Middle Arm Peninsula.

The DLNG Plant has a maximum instantaneous capacity, or nameplate capacity, equivalent to 3.7 million tonnes per annum (MTPA). The 3.7 MTPA DLNG Plant is the first train of a nominal 10 MTPA LNG Plant.

Figure 1-1: DLNG Plant Regional Map



POINT	EASTING (X)	NORTHING (Y)	LATITUDE	LONGITUDE	POINT	EASTING (X)	NORTHING (Y)	LATITUDE	LONGITUDE
1	703192	8615520	-12.5173367	130.8698998	18	702485	8614593	-12.5257671	130.8634587
2	703601	8615080	-12.5212896	130.8736945	19	702477	8614630	-12.5254328	130.8633826
3	703582	8615061	-12.5214625	130.8735209	20	702200	8614543	-12.5262325	130.8608405
4	703862	8614782	-12.5239676	130.8761107	21	702157	8614546	-12.5262105	130.8604401
5	703803	8614723	-12.5245078	130.8755686	22	702141	8614599	-12.5257314	130.8602903
6	703529	8614997	-12.5220495	130.8730307	23	702313	8614648	-12.5252782	130.8618703
7	703441	8614904	-12.5228893	130.8722302	24	702275	8614652	-12.5252422	130.8615158
8	703513	8614833	-12.5235246	130.8728951	25	702266	8614811	-12.5238101	130.8614237
9	703456	8614774	-12.5240678	130.8723772	26	702206	8614811	-12.5238132	130.8608776
10	703374	8614828	-12.5235806	130.8716205	27	702206	8614897	-12.5230337	130.8608670
11	703137	8614590	-12.5257482	130.8694497	28	702412	8614897	-12.5230206	130.8627619
12	703098	8614831	-12.5253818	130.8690715	29	702378	8615089	-12.5212910	130.8624380
13	703030	8614621	-12.5254799	130.8684719	30	702482	8615189	-12.5203786	130.8633878
14	703005	8614595	-12.5257156	130.8682353	31	702688	8615128	-12.5209152	130.8652845
15	702838	8614736	-12.5244506	130.8668943	32	702952	8615392	-12.5185090	130.8676993
16	702789	8614785	-12.5240133	130.8662428	33	702952	8615456	-12.5179327	130.8676952
17	702572	8614588	-12.5258049	130.8642563	34	703016	8615520	-12.5173473	130.8682826

Figure 1-2: DLNG Plant Perimeter and Coordinates

1.2 PURPOSE AND SCOPE OF THE OPERATIONS ENVIRONMENTAL MANAGEMENT PLAN

The purpose of the Operations Environmental Management Plan (OEMP) is to ensure implementation of the Environmental regulatory requirements associated with operation of the DLNG facility. The OEMP:

- Defines the battery limits of the facility;
- Describes all credible environmental risks and risk management controls associated with the operation of the DLNG facility;
- Documents the DLNG facility Operations Environmental Management Strategies through defining environmental performance objectives and performance criteria; and
- Outlines the interactions to other related HSEMS documentation that implements the requirements of the 15 HSEMS standard elements and the Environmental Management Strategies.

1.3 OEMP STRUCTURE AND CONTENT

The NT EPA 'Guidelines for the Preparation of an Environmental Management Plan' (NT EPA, 2015) were used to define the content and structure of the OEMP. Table 1-1 maps out the specific sections within the OEMP that directly address the Guideline requirements.

The below information outlines the OEMP content and provides a brief description:

- **Section 1 – Introduction** – provides an overview of the DLNG Plant and outlines the purpose and scope of this OEMP.
- **Section 2 – ConocoPhillips Environmental Management Framework** – describes how elements of the ConocoPhillips Health, Safety and Environment Management System (HSEMS) framework are implemented and relate to the management of the DLNG Plant.
- **Section 3 – Environmental Legislation and Other Requirements** – describes the relevant environmental legislation, standards or permits/licences that apply to the DLNG Plant operational activities.
- **Section 4 – Facility Description** – defines the operating context and provides an overview of the DLNG Plant operational activities.
- **Section 5 – Existing Environment** – describes the socio-economic and environmental setting for the DLNG Plant.
- **Section 6 – Conceptual Site Model** – provides a conceptual site model for DLNG Plant operations and potential impact pathways and receptors.
- **Section 7 – Environmental Risk Assessment** – describes the environmental risk assessment process and summarises the findings of the DLNG Plant Operations risk assessment.
- **Section 8 – Environmental Management Strategies** – documents the environmental management strategies that will be implemented to manage DLNG Plant Operations, including performance objectives, targets, key performance indicators, and the key processes for their implementation within the Australian Business Unit (ABU) HSEMS framework.
- **Section 9 – Implementation Strategy** – describes key roles and responsibilities, and the arrangements for measuring, monitoring and reporting environmental performance to ensure that environmental management strategies are implemented, maintained and are effective.

- **Section 10 – Emergency Response Arrangements** – outlines the emergency response arrangements.
- **Section 11 – References** – lists the references cited in the OEMP.
- **Attachments 1, 2 and 3** – include current versions of the EDP (EDP02/0015) and the Environmental Protection Licence (EPL) (EPL217-01) and their respective and open commitments register. The EIS and PER open commitment registers are also provided.

Table 1-1: Cross-Reference to the NT EPA Guideline for the Preparation of an Environmental Management Plan

EMP Characteristic	Addressed?	OEMP Section
EMP Style: Is the EMP presented in a way that:		
Is accurate, clearly presented and unambiguous?	Yes	The structure and content of the OEMP is accurate and clearly presented
Is auditable?	Yes	Section 8 (Environmental Management Strategies) presents the environmental performance objectives, targets and key performance indicators in a tabular format for ease of auditing.
Provides a well-defined and clear document structure?	Yes	Section 1.3 (OEMP Structure and Content) outlines the sections of the OEMP and provides a brief description of their content
Presents information in tables, maps, plans and diagrams?	Yes	Various – tables and figures/diagrams have been used throughout the OEMP to summarise and present key information clearly and concisely
References information sources?	Yes	References are provided for all technical sources and monitoring reports
EMP content: Does the EMP contain:		
Content and a level of information that is commensurate with the significance of an issue or level of risk?	Yes	The level of detail and discussion provided is commensurate with the environmental risk and potential impact. For example, greater emphasis on describing and assessing the key emission and discharges is provided in Section 4 (Facility Description) and Section 7 (Environmental Risk Assessment; specifically Table 7-1), respectively.
Clear statements of commitment?	Yes	Section 8 (Environmental Management Strategies) provides clear statements of commitment
A project overview including clearly defined project scope?	Yes	Section 1.1(Background) Section 4 (Facility Description)
Key project contacts (EMP, emergency)?	Yes	Section 4.1 (DLNG Facility)
An outline of legal requirements, approval conditions and recommendations from any environmental impact assessment?	Yes	Section 3 (Environmental Legislation and Other Requirements)
An overview of the existing environment?	Yes	Section 5 (Existing Environment), specifically: • Section 5.1 (Local Socio-Economic Context) describes the land tenure/zoning, land uses and Indigenous/ European heritage values • Section 5.2 (Environmental Conditions) describes the general environmental characteristics of the area surrounding the DLNG Plant and conservation values.
A conceptual site model (CSM)?	Yes	Section 6 (Conceptual Site Model)

EMP Characteristic	Addressed?	OEMP Section
An environmental risk assessment that: • is informed by the CSM • justifies risk ranking • acknowledges uncertainty • justifies acceptable risk levels • is based on recognised risk standards	Yes	Section 7 (Environmental Risk Assessment) assesses and justifies all planned/unplanned risks associated with DLNG operations. The outcomes of the risk assessment are provided in Table 7-1. The robust risk assessment process applied is based on the recognised Australian Standard/New Zealand Standard International Organisation for Standardisation and is described in Section 7.2 (Methodology)
For each environmental aspect or issue: • environmental objective(s) • performance criteria • management actions • timing and responsibility for implementation	Yes	Section 8 (Environmental Management Strategies) provides individual strategies for each environmental aspect and includes environmental performance objectives, criteria (targets and key performance indicators), management actions (i.e. controls) and responsibilities
Corrective actions and contingencies?	Yes	Section 9.1.5 (Environmental Incident/Non-Compliance Reporting)
Clear monitoring objectives and a monitoring plan capable of achieving them?	Yes	Section 9.1.3 (Monitoring) describes the environmental monitoring programs implemented for DLNG operations
Reporting commitments, timing and responsibility?	Yes	Section 9.1.4 (Reporting)
Audit commitments, timing and responsibility?	Yes	Section 9.1.6 (Environmental Audits and Reviews)
EMP review commitments, timing and responsibility?	Yes	Section 1.4 (OEMP Ownership and Review)
Staff training and EMP awareness raising commitments?	Yes	Section 9.1.2 (Training and Competencies)
A communication strategy for project implementation?	Yes	Section 9.1.8 (Stakeholder Consultation)
EMP as a management tool: Does the EMP:		
Define the relationship between the EMP and overall environmental management framework or system?	Yes	Section 2 (ConocoPhillips Environmental Management Framework)
Provide for the proper management of environmental risks?	Yes	Section 7 (Environmental Risk Assessment), specifically Table 7-1 which outlines risk management controls and mitigation, and takes into consideration whether the risk is acceptable and reduced to as low as reasonably practicable. Section 8 (Environmental Management Strategies) provides clear statements of commitment to manage the potential risks and impacts.
Provide for implementation of outcomes from the environmental impact assessment process?	Yes	Section 8 (Environmental Management Strategies) Section 9 (Implementation Strategy)
Provide for implementation of legislative requirements including conditions of approval?	Yes	Section 8 (Environmental Management Strategies) Section 9 (Implementation Strategy)
Utilise operational control plans to illustrate management measures?	Yes	Section 8 (Environmental Management Strategies)
EMP preparation:		
Consulted with stakeholders and documented the outcomes?	N/A	Section 9.1.8 (Stakeholder Consultation)

EMP Characteristic	Addressed?	OEMP Section
		As the OEMP has been updated as part of the 5-year review cycle, stakeholder consultation was not undertaken for the project. ConocoPhillips implements and maintains a Stakeholder Consultation and Communication Plan, which includes a strategy for communicating with persons who are likely to have a real interest in, or be affected by, the activity. A Complaint Log will also be maintained as a central register for any complaints received regarding DLNG Plant operations.
Consulted with the NT EPA?	Y	ConocoPhillips has consulted with the NT EPA regarding this 5-year review of the DLNG OEMP.

1.4 OEMP OWNERSHIP AND REVIEW

The DLNG OEMP is a controlled document residing in the Australian Business Unit West (ABU-W) HSEMS. The ABU-W Health, Safety and Environment (HSE) Department is responsible for ensuring that the OEMP and other related ABU HSEMS documents (Section 2.1) are reviewed and revised to maintain their accuracy and currency.

This OEMP was developed and reviewed by qualified environmental professionals.

Reviews and revisions of the OEMP and associated ABU-W HSEMS documents are to be undertaken in accordance with the document control requirements of the ABU-W HSEMS. The OEMP is to be updated every five years, at a minimum.

A review and/or revision of the OEMP shall be performed whenever one or more of the following circumstances arise:

- Changes in relevant regulatory requirements and/or industry codes and standards;
- Changes in HSE management practices and/or operational management of the facilities;
- Changes in plant performance or significant modification of the facilities; and
- Additional relevant information regarding environmental hazards and risks becomes available from sources including, but not limited to, operational experience, environmental surveys and monitoring data.

A minor review would involve minor non-material changes, which would not change the environmental risk profile or environmental management strategies required, these would not be subject to regulatory submission. A major review would be when material changes occur whereby there's significant changes to the environmental risk profile and management of that risk. These major reviews would be provided to the regulator in line with Condition 25 of EPL217-01.

2 CONOCOPHILLIPS ENVIRONMENTAL MANAGEMENT FRAMEWORK

2.1 CORPORATE POLICIES

The key ConocoPhillips Corporate policies pertaining to the environmental management of the DLNG Plant operations are the Sustainable Development Position, the Climate Change Position, and the ConocoPhillips Company Health, Safety and Environment Policy which is fully covered in the Australasia Business Unit HSE Policy. The policies are endorsed at the highest level of management in the corporation, i.e. the ConocoPhillips President and Chief Executive Officer.

ConocoPhillips recognises the importance of sustainability and greenhouse gas (GHG) management and they are considered within the ABU-W HSEMS (Section 2.2.1). The ABU-W has also developed a local Climate Change Management Plan to manage all aspects of climate change associated with its ABU-W projects.

The corporation's Sustainable Development Position and Climate Change Position are available from the ConocoPhillips website: http://www.conocophillips.com/about-us/sustainability-approach/policies-positions/ .

2.2 ABU-WEST POLICIES

2.2.1 HSEMS

DLNG operates under the ConocoPhillips Health, Safety and Environment Management System (HSEMS) framework to protect people, assets and the environment.

The HSEMS comprise 15 individual elements. The elements are interrelated and the full implementation of each element is essential for the effective functioning of the system as a whole. The 15 elements are based on the continuous improvement cycle with a central core of Policy and Leadership, and the phases of Plan, Do, Assess and Adjust. Each phase includes one or more key elements, as shown in**Error! Reference source not found.**:

- PLAN: Hazards, risks, and regulatory requirements are identified in these elements. These elements also identify the risk mitigation requirements that will be built-out in the DO phase and provide for the establishment of strategic plans, goals and objectives.
- DO: Describes the specific implementation tools needed to manage the risks and requirements identified in the PLAN phase.
- ASSESS: Describes detailed monitoring and auditing to ensure that risks and requirements are being identified, assessed, and managed.
- ADJUST: Provides for modification of the HSEMS and its implementation in order to adjust for strengths, gaps and opportunities for improvement identified in the ASSESS phase.

The ConocoPhillips HSEMS Standard does not dictate how the management system should be implemented; only what it must include. The HSEMS provides the overarching framework to ensure that HSE issues are managed in a consistent manner across ConocoPhillips ABU-W, and establishes a risk-based, risk-appropriate, targeted improvement process.

The ConocoPhillips ABU-W HSEMS manual is the overarching business unit process and sets element goals for the individual assets to achieve. This document provides a link between the Corporate (ConocoPhillips) HSEMS and the ABU-W HSEMS.

The DLNG Plant operations are also managed under the ConocoPhillips ABU-W Health, Safety and Environment and Sustainable Development (HSE & SD) Policy (Figure 2-2). This HSE & SD Policy directs development of the other elements of the DLNG HSEMS.

Figure 2-1: ABU HSEMS Elements

ConocoPhillips

AUSTRALIA BUSINESS UNIT - WEST

Health, Safety, Environment & Sustainable Development Policy

Our people are our most valuable asset and management is committed to providing a safe and secure workplace for them to work. We are collectively and individually responsible for maintaining a safe work environment.

We are committed to conducting our operations in an environmentally sound manner and in harmony with the surrounding community. We strive to be recognised as a valued and welcomed member of the community in which we operate.

To achieve these commitments, we support the following fundamental principles through our demonstrated actions:

- No work is so urgent or important that we cannot take the time to do it safely.
- Work in compliance with applicable regulations and laws to contribute to the prevention of injuries, releases, environmental impacts and property loss or damage.
- All employees and contractors have the authority and the responsibility to stop work, if concerns exist about safety, security, the environment or property loss, without regard to loss of production.
- Working safely and in a fit state, is a condition of employment and each employee and contractor is responsible for their own safety and the safety of those around them.
- All incidents are to be immediately reported. We will treat all incidents as opportunities to learn and prevent recurrence.
- We will safeguard our operations from process safety incidents by implementing systems to ensure the integrity and reliability of our equipment and operational capability.
- Managers and supervisors will demonstrate visible and active leadership that engages all employees and contractors to manage HSE performance with clear authorities, accountabilities and expectations.
- Provide employees with the capabilities, knowledge and resources necessary to instil personal ownership and motivation to achieve HSE excellence.
- Provide relevant safety and health information to contractors and require them to provide proper training for the safe and environmentally sound performance of their work.
- Employees and contractors are involved in comprehensive HSE audits and incident investigations to seek timely corrective action.
- Sustainability is a factor in our ongoing operations as well as in planning and execution of future projects.
- Business is conducted in a way that contributes to economic growth, a healthy environment and vibrant communities in the areas we operate.
- Employee participation and ownership in community activities is encouraged.

The success of the Australia Business Unit - West is dependent on fulfilling these commitments to our employees, our contractors and the communities in which we operate.

David Boyle
VP Operations, Drilling & Supply Chain

Chris Wilson
President

Michael Gardiner
VP Finance

Simon Wragg
VP HSE

Frank Krieger
VP Exploration & Development

Alison Smith
VP Human Resources

David J. Bridges
VP Legal

Mike Nazroo
VP Commercial

Steve Ovenden
VP Growth

Jose Lobato Goncalves
Timor-Leste Country Manager

Kayleen Ewin
VP Sustainable Development, Communications, External Affairs & Corporate Affairs.

Alice Barnett
AP & ME Regional IT Lead

February 2017

Figure 2-2: ABU HSE & SD Policy

2.2.2 Related Documentation and Associated Management Plans

Figure 2-3 shows supplementary documentation supporting the requirements of the 15 HSEMS standard elements and the environmental management strategies. The supporting documentation is presented in terms of inputs to and outputs from the this OEMP. Key supporting documentation referenced within this OEMP is presented below in Table 2-1 for context.

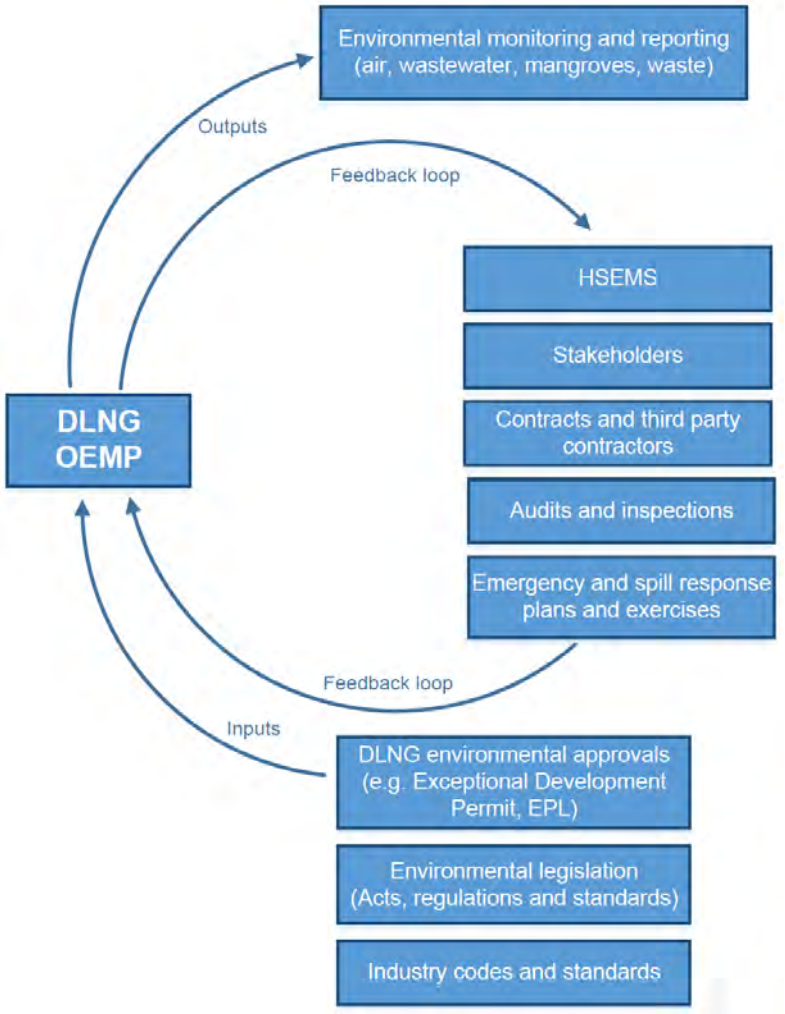


Figure 2-3: Relationship between Key Documents and the OEMP

Table 2-1: Key ConocoPhillips Corporate and ABU-W Supporting Documentation

Document Title	Document Number	Purpose
Corporate Documents		
Corporate HSEMS Standard	n/a	Provides the overarching framework to ensure that HSE issues are managed in a consistent manner across ConocoPhillips, and establishes a risk-based, risk-appropriate, targeted improvement process
Corporate HSE Risk Matrix Standard	n/a	Define the corporate risk criteria for use in qualitative risk assessments to promote consistency in risk ranking across ConocoPhillips.
Corporate HSE Risk Matrix Guideline	n/a	A supplemental resource for the Risk Matrix Standard, the guideline provides a qualitative tool for evaluating the risk posed by various hazards and their respective consequences.

Document Title	Document Number	Purpose
ABU-W Documents		
ABU-W HSE Management System Manual	ALL/HSE/MAN/001	Provides a detailed overview the HSEMS implemented within the ConocoPhillips ABU-W organisation. The manual references the ABU-W programs, policies, procedures, and roles and responsibilities in place to meet the requirements of the corporate HSE Management System standard.
ABU-W Chemical Management Procedure	ALL/HSE/PRO/044	Ensure all chemicals (hazardous and non-hazardous) used undergoes a HSE assessment prior to purchase and use.
ABU-W Industrial Hygiene Exposure Assessment Plan	ALL/HSE/PRO/061	Provides a systematic strategy for identifying, evaluating and controlling potential employee exposure to hazards presented by chemical, physical and biological health stressors.
ABU-W Waste Management Plan	ALL/HSE/PLN/004	Outlines the requirements for management of wastes produced by the DLNG Plant and offshore the Bayu-Undan Field.
ABU-W Naturally Occurring Hazardous Process Contaminants	ALL/HSE/PRO/043	Details requirements for the management of personal exposure to specific hazardous process contaminants to ensure that exposure to these contaminants is controlled to within established exposure standards, and to comply with ConocoPhillips' Occupational Health Standard.
ABU-W Risk Management Procedure	ALL/HSE/PRO/040	Provides guidance and instructions on the processes to be applied for the identification, analysis and management of risks across ABU-W operations and associated activities.
ABU-W Crisis and Incident Management Plan	ALL/HSE/ER/001	Defines the organisational responsibilities, actions, reporting requirements and management processes to be applied in the event of an emergency or crisis situation occurring.
ABU-W Incident Reporting and Investigation Procedure	ALL/HSE/PRO/003	Outlines the requirements for the effective management and response to incidents. The procedure ensures that incidents and near misses are reported and investigated to identify preventative and corrective actions that are tracked to closure.
ABU-W Environmental Monitoring and Reporting Procedure	ALL/HSE/PRO/066	Provides an overarching framework to define how environmental data is captured, verified and reported across the ABU's activities.
ABU-W Environment Plan Management of Change Procedure	ALL/HSE/PRO/090	Provides guidance and instructions on the process to be applied to the assessment ABU-W Environmental Management Plans and Environment Plans.
ABU-W Contractor HSE Management Process	ALL/HSE/PRO/016	Describe the HSE management requirements to be undertaken for the different categories of contracts during the various phases of the contracting process within ABU-W.
ABU-W HSE Auditing and Inspection Procedure	ALL/HSE/PRO/031	Establishes the minimum requirements and provides the methodology and guidance for the planning, preparation, execution, reporting and close-out of HSE audits carried out across all areas of ConocoPhillips ABU-W.
DLNG Documents		
DLNG Oil Pollution Emergency Plan	ALL/HSE/ER/009	Describes the framework for a response to a hydrocarbon spill and details the processes and response strategies which may be considered.

Document Title	Document Number	Purpose
DLNG Waste Management Procedure	ALL/HSE/PRO/071	Provides facility specific processes and practices for the management of waste produced from DLNG facility in support of the overarching ABU-W Waste Management Plan objectives.
Approved DLNG Chemicals and Hazardous Substances Register	DLNG/HSE/REG/001	Provides a central register all of chemicals and hazardous substances approved for use at the DLNG Plant.
DLNG Marine Terminal Handbook	DLNG/OPS/HBK/0001	Provides industry best practices and risk mitigation steps to eliminate all injuries, incidents and accidents while maintaining an efficient marine operation.
Emergency Response Plan (ERP) – Darwin LNG	ALL/HSE/ER/002	Describes the roles and responsibilities of ConocoPhillips personnel and contractors in the event of an emergency, or situation which may impact on the facility.

3 ENVIRONMENTAL LEGISLATION AND OTHER REQUIREMENTS

3.1 ENVIRONMENTAL LEGISLATION AND STANDARDS

A list of key environmental Northern Territory (NT) and Commonwealth legislation and standards pertaining to the operation of the DLNG Plant is summarised in Table 3-1. This list is not exhaustive, and requirements are subject to change.

Controlled copies of NT environmental protection legislation can be found at the NT Legislation website: https://legislation.nt.gov.au/.

Table 3-1: Summary of Key Environmental Legislation and Standards Applicable to DLNG Plant Operations

Act / Regulation / Standard	Objectives/Provisions	Relevance to DLNG Plant Operations
NT Legal Requirements		
Bushfires Management Act 2016 (NT)	The Act establishes the Bushfires Council and provides for the prevention and control of bushfires in the NT.	Permits are required to light fires (e.g. for purpose of onsite incineration of packaging waste). Fire breaks to be maintained between vegetation and other flammable materials, and ignition sources.
Dangerous Goods Act 2012 and Dangerous Goods Regulations 2017 (NT)	This Act relates to the handling of certain dangerous goods (DG) within the Northern Territory.	Regulations stipulate requirements for the safe handling, storage and transportation of dangerous goods, including provision of adequate training for personnel, and suitable dangerous good hazard labelling, dangerous good storage facilities and onsite emergency response capability. Division 2. Requirements for obtaining a Licence to store dangerous goods – applicable to DLNG Plant site. Division 4. Requirement to notify authorities of a Dangerous Occurrence.
Darwin Port Corporation Act 2015 and Port By-Laws (NT)	Clause 16. Functions of Darwin Port Corporation. Darwin Port Corporation is responsible for the movement of all vessels within the Port limits. Port officers act as Agents for the prevention, management and control of pollution by oil in this jurisdiction. Clause 29. Directions for movement and control of vessels within the Port, including traffic, mooring and anchoring of vessels.	Operation of the LNG loading facilities, as defined in the DLNG Marine Terminal Handbook and Emergency Response Plans, to be compliant with Darwin Port Corporation requirements.
Environmental Assessment Act 2013 (NT)	The Act provides for the assessment of the environmental effects of development proposals and for the protection of the environment.	Monitoring and assessment of activities on site that have the potential to cause harm.
Environmental Offences and Penalties Act 2011 (NT)	The Act defines levels and penalties for environmental offences.	Penalties in the event of causing environmental harm.
Fisheries Act 2017 (NT)	It is illegal to pollute waters where the effect of the substance is that fish or aquatic life are injured, detrimentally affected or the habitats, food or spawning grounds are detrimentally affected.	Controls on offsite discharges to Darwin Harbour from DLNG Plant site are required to prevent water pollution.
Heritage Act 2011 (NT)	The Act provides for the recording, declaration, conservation and protection of heritage and archaeological places and objects. Approval must be sought and obtained before heritage sites or artefacts can be disturbed or removed.	A European heritage sites survey of the DLNG Plant site was conducted prior to clearance for construction. Sites remaining in situ are marked and must not be disturbed. A survey for heritage sites must be conducted prior to any future site clearance work.

Act / Regulation / Standard	Objectives/Provisions	Relevance to DLNG Plant Operations
NT Major Hazard Facilities Standard and Code of Practice	This Code is adopted as best practice guidance by NT WorkSafe, to guide industry to implement and document a systematic process of hazard identification, risk assessment, control and evaluation to ensure the safety of a major hazard facility.	The DLNG Plant Operator committed to develop and submit a Safety Report to the NT WorkSafe, documenting the measures taken to ensure the safe operation of the DLNG Plant (a major hazards facility).
Marine Pollution Act 2016 and Marine Pollution Regulations 2015 (NT)	The objective of the Act is to protect the marine and coastal environment from ship/boat sourced pollution. This includes litter/ rubbish, hydrocarbons and substances that may be hazardous to the marine environment (including substances that may be in ballast and grey water).	Operation of LNG carriers and support vessels at the LNG loading facilities, as defined in the Darwin LNG Marine Terminal Handbook and Emergency Response Plans, to be compliant with requirements of this Act.
Northern Territory Aboriginal Sacred Sites Act 2013 and Regulations 2013 (NT)	This Act creates the Aboriginal Areas Protection Authority, which issues (Sacred Sites) Certificates for specific areas. These certificates advise of sacred sites within an area. Approval must be sought and obtained before sacred sites can be disturbed or destroyed.	An Aboriginal sites survey of the DLNG Plant site was conducted prior to clearance for construction. Sites remaining in situ are marked and must not be disturbed. A survey for Aboriginal sites must be conducted prior to any future site clearance work.
Planning Act 2017 and Planning Regulations 2016 (NT)	Provides for the planning and control of the use and development of land, which may or may not be subject to a planning instrument. The planning instrument is the NT Planning Scheme which consists of Development Provisions (town plans which specify land zoning), Land Use Objectives (planning policy) and Incorporated Documents.	Development and use of area defined as 1860, 1870, 1871, 1872 and 1873, Wickham Point, Hundred of Ayers, must be in compliance with the conditions of Exceptional Development Permit EDP02/0015 and subsequent Variations to the Permit. An application must be submitted to obtain changes to Permit conditions.
Public Health Act 2011 and Public Health (General Sanitation, Mosquito Prevention, Rat Exclusion and Prevention) Regulations 1967 (NT)	This regulation prescribes requirements for waste and sewage management, and site housekeeping to prevent pollution of water courses, discourage breeding of mosquitos and rats, and mosquito prevention such as drainage works and maintenance of drainage systems to avoid ponding of water and reed growth.	Approval is required to install septic tanks and sewage treatment facilities on site. The DLNG Plant has obtained approval to install and operate a tertiary sewage treatment plant. Site housekeeping procedures to ensure appropriate storage and handling of waste, and inspection and regular cleaning and treatment of potential mosquito and feral rat breeding habitats.
Soil Conservation and Land Utilisation Act 2016 (NT)	Makes provision for the prevention of soil erosion and for the conservation and reclamation of soil.	Activities on site that may lead to erosion and sedimentation, or disturbance of sediments must be controlled to minimise adverse impacts.
Territory Parks and Wildlife Conservation Act 2014, By-laws and Regulations (NT)	An Act to establish Territory Parks and other Parks and Reserves, and to study, protection, conservation and sustainable utilisation of wildlife. "Wildlife" means: (a) animals and plants that are indigenous to Australia; (b) animals and plants that are indigenous to the Australian coastal sea or the sea-bed and subsoil beneath that sea; (c) migratory animals that periodically or occasionally visit Australia or the Australian coastal sea;	Wildlife (i.e. fauna) are present on Wickham Point. DLNG Plant site activities must be conducted so as to avoid disturbance and minimise adverse impacts to fauna and their habitat. Feral animal surveillance monitoring and control processes are to be undertaken on the DLNG Plant site.

Act / Regulation / Standard	Objectives/Provisions	Relevance to DLNG Plant Operations
	(d) animals and plants of a kind introduced into Australia, directly or indirectly, by Aboriginals before the year 1788; and (e) other animals and plants as are prescribed. The management of wildlife is to be carried out in a manner that promotes: (a) the survival of wildlife in its natural habitat; (b) the conservation of biological diversity within the Territory; (c) the management of identified areas of habitat, vegetation, ecosystem or landscape to ensure the survival of populations of wildlife within those areas; (d) the control or prohibition of (i) the introduction or release of prohibited entrants into the Territory; and (ii) any other act, omission or thing that adversely affects, or will or is likely to adversely affect, the capacity of wildlife to sustain its natural processes; and (e) the sustainable use of wildlife and its habitat. Section 48. Feral animal control areas. The Minister may declare an area of land in respect of the wildlife, habitat, ecosystem, vegetation or landscape to be a feral animal control area. Section 49 (1). The Director may, by notice in writing, require the owner or occupier of land in a feral animal control area to undertake the measures specified in the notice for the control or eradication of a feral animal on the land. Section 43 (1). All wildlife that: (a) is in a park, reserve, sanctuary, wilderness zone or area of essential habitat; or (b) is a vertebrate that is indigenous to Australia, is protected wildlife. (2) The Regulations may prescribe species of wildlife that are protected wildlife. Section 66 (1). A person must not take or interfere with protected wildlife unless the person is authorised to do so under this Act.	
Waste Management and Pollution Control Act 2016 and Waste Management and Pollution Control (Administration) Regulations 2014 (NT)	The Act places general environment protection duties on persons to not undertake an activity that pollutes or might pollute the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.	Schedule 2 describes that an Environment Protection Licence is required to operate premises for processing hydrocarbons so as to produce, store and/or despatch liquefied natural gas where the premises are designed to produce more than 500,000 tonnes annually. The Environment Protection Licence and subsequent variations issued for the DLNG Plant stipulates performance and reporting criteria.
Environment Protection (National Pollutant Inventory) Objective 2004 (NT) (established under the *Waste Management*	The Environment Protection Objective provides for implementation of Commonwealth National Environment Protection Measures (NEPMs) in conjunction with the *National Environment Protection Council (NT) Act*, which provides for the establishment of a National Environment Protection Council.	NPI NEPM includes substances that will be emitted from the DLNG Plant. Clause 3 Environment Protection (NPI). Objective: The occupier of premises at which a reporting threshold for a substance is exceeded during a reporting period must provide a report in an approved form to NT

Act / Regulation / Standard	Objectives/Provisions	Relevance to DLNG Plant Operations
and Pollution Control Act 2016 and)	The Environment Protection (National Pollutant Inventory) (NPI) Objective pertains to emissions of solid, gaseous and liquid substances (as defined by column 1 of the NPI NEPM) to the environment in pure form or contained in other matter. The Objective also outlines the requirements to annually calculate and report emissions to the NPI.	EPA by 30 September for the previous reporting period (1 July to 30 June).
Water Act 2016 and Water Regulations 2008 (NT)	Provides for the investigation, use, control, protection, management and administration of water resources within the NT. Under this Act, the waters of Darwin Harbour (and the marine reaches of rivers draining into it) were declared to have "beneficial uses" for the protection of aquatic ecosystems, recreational water quality and aesthetics. It is an offence under this Act to pollute the declared waterways and impact on the beneficial uses. Section 74. Licence is required to discharge waste to natural waters. An Application for a Waste Discharge Licence is required for wastewater discharges to Darwin Harbour and creeks or rivers draining into the Harbour.	Darwin Harbour (and marine reaches of rivers and creeks draining into the Harbour) are declared Beneficial Uses for the purposes of "Aquatic Ecosystem Protection and Recreational Water Quality and Aesthetics". DLNG operations to assess Jetty Outfall water quality against mid-estuary Darwin Harbour Water Quality Objectives. Where the Darwin Harbour Water Quality Objectives (DHWQO) cannot be met for the Jetty Outfall, site specific values will be developed (in accordance with EPL217-01).
Weeds Management Act 2013 and Regulations 2013 (NT)	The Act classifies weeds and requires specific weeds to be dealt with under the provisions of the Act. Section 9 (1). The owner and occupier of land must: (a) take all reasonable measures to prevent the land being infested with a declared weed; (b) take all reasonable measures to prevent a declared weed or potential weed on the land spreading to other land; and (c) within 14 days after first becoming aware of a declared weed that has not previously been, or known to have been, present on the land, notify an officer of the presence of the declared weed. (2) The owner and occupier of land on which a declared weed or potential weed is present must comply with a weed management plan relating to the weed. (3) The owner and occupier of land on which a potential weed is present must dispose of the weed only on the land or at a designated weed disposal area.	There is potential for introduction of declared weeds to the DLNG facilities site via vehicular and pedestrian traffic, and wind-borne incursions. The site environmental monitoring procedures must include surveillance for and management of declared weeds.
Work Health and Safety (National Uniform Legislation) Act 2016 and Regulations 2017 (NT)	The Act promotes occupational health and safety in the Territory to prevent workplace injuries and diseases, and to protect the health and safety of the public in relation to work activities. A Safety Management Plan is required under the Act.	An employer is required to take a constructive role in promoting improvements in work health and safety practices as assisting persons conducting businesses or undertakings and workers to achieve a healthier and safer working environment A licence is required for the operation of certain facilities.
Commonwealth Legal Requirements		

Act / Regulation / Standard	Objectives/Provisions	Relevance to DLNG Plant Operations
Environment Protection and Biodiversity Conservation Act 1999	Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), any development requires assessment if it has the potential to affect one or more of nine Matters of National Environmental Significance, which are: • World Heritage properties • National Heritage places • Wetlands of international importance (listed under the Ramsar Convention) • Listed threatened species and ecological communities • Migratory species protected under international agreements • Commonwealth marine areas • The Great Barrier Reef Marine Park • Nuclear actions (including uranium mines) • A water resource, in relation to coal seam gas development and large coal mining development.	Of relevance to DLNG, there are 37 listed threatened species and 62 migratory species indicated as potentially occurring or having habitat within the area, under the EPBC Protected Matters Search Tool as occurring within 10 km of DLNG.
National Greenhouse and Energy Reporting Act 2007 National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015	The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) introduces a single national reporting framework for the reporting and dissemination of information about the GHG emissions, GHG projects, and energy use and production of corporations. Under the NGER Act, there are two types of thresholds at which corporations are required to participate – facility thresholds and corporate thresholds. Each type of threshold has a GHG and an energy threshold. If a corporation exceeds any one or more of the four thresholds for each year, registration is required. Organisations that exceed these thresholds must report their GHG emissions, energy production; and energy consumption. The safeguard mechanism requires businesses that have facilities with direct emissions of >100,000 tonnes of carbon dioxide equivalence a year to keep net emissions at or below baseline emissions levels.	DLNG is required to report annually on GHG emissions, energy consumption and energy production to the Commonwealth government.
National Environment Protection (Ambient Air Quality) Measure (Commonwealth)	The National Environment Protection Measure for Ambient Air Quality, established in 1998, specifies standards and goals for ambient levels of "criteria" air pollutants considered to be general indicators of air quality in urban airsheds. The Ambient Air Quality NEPM requires that each Australian jurisdiction reports on general air quality, breaches and trends based on monitoring network data. In 2015, the Ambient Air Quality NEPM was varied to: • Amend the status of the annual average and 24-hour average $PM_{2.5}$ 'advisory reporting standards' to 'standards'; • Include an annual average PM_{10} standard of 25 $\mu g/m^3$; • Include an aim to move to annual average and 24-hour $PM_{2.5}$ standards of 7 $\mu g/m^3$ and 20 $\mu g/m^3$ by 2025; • Initiate a nationally consistent approach to reporting population exposure to $PM_{2.5}$;	See reporting requirements listed for Environment Protection (NPI) Objective 2004.

Act / Regulation / Standard	Objectives/Provisions	Relevance to DLNG Plant Operations
	• Replace the five-day exceedance of the 24-hour $PM_{2.5}$ and PM_{10} standards with an exceptional event rule.	
National Environment Protection (National Pollutant Inventory) Measure (Commonwealth)	The national environment protection goals established by this NEPM are to assist in reducing the existing and potential impacts of emissions of substances and to assist government, industry and the community in achieving the desired environmental outcomes set out in Clause 5 of the NEPM by providing a basis for: (a) the collection of a broad base of information on emissions of substances on the reporting list to air, land and water; and (b) the dissemination of information collected to all sectors of the community in a useful, accessible and understandable form.	Australian industrial facilities using more than a specified amount of the substances listed on the NPI reporting list are required to estimate and report emissions of these substances annually. The NPI database can be viewed at: http://www.npi.gov.au/.
National Environment Protection (Air Toxics) Measure (NEPM) (Commonwealth)	The Air Toxics NEPM is intended to facilitate management of air toxics in ambient air that will allow for the equivalent protection of human health and wellbeing. The NEPM lists five priority substances: benzene, toluene, xylenes, benzo-a-pyrene (as a marker for Poly Aromatic Hydrocarbons) and formaldehyde. Other substances may be included in the future.	Although this NEPM will not carry monitoring obligations on jurisdictions, it requires the NT Government to undertake a desk-top assessment of air toxic "hot spots" and identify possible sites that may be prioritised for monitoring for air toxic pollutants.
Industrial Chemicals (Notification and Assessment) Act and National Industrial Chemicals Notification and Regulations 1990 (Commonwealth)	Industrial chemicals are regulated by the Australian Government, administered by the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) and located within the Office of Chemical Safety. NICNAS is the Australian Government regulatory authority for industrial chemicals. It provides a national notification and assessment scheme to protect the health of the public, workers and the environment from the harmful effect of industrial chemicals; and assesses all chemicals new to Australia and assesses those chemicals already used (existing chemicals) on a priority basis, in response to concerns about their safety on health and environmental grounds.	Material Safety Data Sheets (SDS) are required for all industrial chemicals onsite. SDSs required for products produced by DLNG Plant.
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989 and Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995	The purpose of the Act is to implement the requirements of the Vienna Convention and the Montreal Protocol, through a system of controls on the manufacture, import, distribution, use and export of substances that deplete ozone in the atmosphere.	DLNG Plant to avoid use of ozone depleting substances.

3.2 DLNG PLANT ENVIRONMENTAL APPROVALS

3.2.1 Environmental Impact Statement/Public Environment Report

The DLNG Plant received initial primary approvals from the Commonwealth and NT Environment Ministers in early 1998. The original proposal comprised a single train Plant to produce LNG at a maximal rate of 3 million tonnes per annum (MTPA) and included:

- a subsea pipeline;
- land-based facility for liquefaction of natural gas and storage of LNG;
- marine loading facilities; and
- a dedicated fleet of ships to transport LNG product.

The 3 MTPA proposal was assessed as an Environmental Impact Statement (EIS) and approved under a set of recommendations, as outlined in the NT Government Assessment Report No. 24. The assessment also considered the effects of potential future expansion to an LNG plant of 9 MTPA nominal capacity. In the event that an expansion of the LNG Plant is proposed, it was recommended that the revised project design be submitted to the NT Government for further assessment under the NT *Environmental Assessment Act 1982*.

In March 2002, ConocoPhillips submitted a revised proposal for an expansion to a maximum 10 MTPA plant (comprising two trains, each with a maximal output of 5 MTPA) that could receive and process natural gas from additional offshore fields. The 10 MTPA project involved the following major components:

- LNG processing trains comprising gas processing facilities, product storage tanks and facility infrastructure and utilities;
- LNG loading jetty to transfer product to tankers for shipping to market;
- construction dock for transfer of building materials and heavy equipment;
- access road; and
- shoreline crossing from the Bayu-Undan to Darwin gas export pipeline to the DLNG facility on Wickham Point.

The 10 MTPA proposal was assessed as a Public Environmental Review (PER) and was approved under the NT *Environmental Assessment Act 1982* and concurrently reviewed under the Administrative Procedures approved under the Commonwealth *Environment Protection (Impact of Proposals) Act 1974*.

ConocoPhillips referred the proposed expansion to the Commonwealth for a determination under the EPBC Act. On 20 September 2002, the Commonwealth advised that the proposal would be reviewed under the *Environment Protection (Impact of Proposals) Act 1974* and not the EPBC Act, given the original assessment was undertaken under the former Act.

The NT Government provided infrastructure support for the plant, including the provision of an access road along Middle Arm Peninsula and a water supply line to the property boundary.

Construction of the DLNG Plant began in June 2003, with commissioning and first LNG sales in 2006.

The NT Government Environment Assessment Report and PER are available from the NT EPA's website: https://ntepa.nt.gov.au/home.

The commitments within the NT Government Environment Assessment Report and PER are captured and tracked in the ConocoPhillips Compliance Point – commitments registers system, included in Attachment 1.

3.2.2 Exceptional Development Permit

The EDP allows schemes which would otherwise be prohibited under the NT Planning Scheme to progress under specific conditions. Issued by the Minister for Lands and Planning the holder of the permit (DLNG Pty Ltd) must comply with the EDP throughout the construction, operation and decommissioning phase of the development.

The DLNG EDP 02/0015 was issued by the Northern Territory Minister for Lands and Planning on 11 November 2002 for the development of a 10 MTPA LNG Plant in two stages. Subsequent Variation Permits have been issued and currently the permit is operated under EDP02/0015G issued on 9 November 2016.

The EDP details conditions for air emissions, emergency response, flora and fauna management, waste management, water and waste water management, heritage protection requirements and visual amenity considerations. The current EDP is included in Attachment 2.

The commitments within the EDP which are open are captured and tracked in the ConocoPhillips Compliance Point – commitments registers system. Commitments which have subsequently been closed or were relevant for commissioning are not actively tracked. The commitments register is provided in Attachment 2.

3.2.3 Environment Protection Licence

The EPL is issued under Section 34 of the NT *Waste Management and Pollution Control Act 2016*. The EPL is required for DLNG as it is operating premises for processing hydrocarbons so as to produce, store and/or dispatch liquefied natural gas or methanol in excess of 500,000 tonnes annually.

The DLNG EPL-LNG 01 was issued by the Executive Director of the NT EPA on 9 December 2005 for the production of LNG and natural gas liquids at the DLNG production plant at Wickham Point, with nameplate production capacity equivalent to 3.7 MTPA. Subsequent licenses have been issued as follows:

- EPL-LNG 01 issued 25 September 2009;
- EPL 54-02 issued 7 October 2010;
- EPL 54-03 issued 12 July 2012;
- EPL 54-04 issued due to minor administrative changes;
- EPL 54-05 issued due to minor administrative changes;
- EPL 54-06 issued due to minor administrative changes;
- EPL 54-07 issued as a temporary licence as part of the EPL renewal process;
- EPL 54-08 issued as a temporary licence as part of the EPL renewal process;
- EPL217 issued 18 September 2017.
- EPL 217-01 issued 19 July 2018, and supersedes EPL 217.

This EPL provides an Environment Protection Objective (EPO), Beneficial Use Declaration (BUD) and specific Environmental Interests related to the site. The EPO is a statutory instrument to establish principles on which:

a) Environmental quality is to be maintained, enhanced, managed or protected;

b) Pollution, or environmental harm resulting from pollution, is to be assessed, prevented, reduced, controlled, rectified or cleaned up; and

c) Effective water management is to be implemented or evaluated.

Beneficial Use Declaration (BUD) is a legislated process that reduces the effects of water pollution and assists in the protection and management of water. The community decides how a particular water body should be used by choosing on one or more Beneficial Use categories.

The EPOs and BUDs relevant to the EPL are detailed as:

- Declaration of Beneficial Uses and Objectives, Darwin Harbour Region, Northern Territory Government Gazette No. G27, 7 July 2010;
- Declaration of Beneficial Uses and Objectives, Elizabeth-Howard Rivers Region Groundwater, Northern Territory Government Gazette No. G27, 7 July 2010; and
- National Environment Protection (National Pollutant Inventory) Objective.

Environmental Interests highlight sensitivity of the surrounding land use and environment associated with the location of the approved activity and represent an interest to the NT Government and the community. The Environmental Interests are detailed as:

- In conducting the Licensed Activity, the licensee shall do all things reasonable and practicable to ensure the Licensed Activity does not adversely affect the ambient air quality of the Darwin region;
- The volume of wastewater discharged to Darwin Harbour from the Licensed Activity will be reduced over the life of the licence; and
- Sites of Conservation Significance (SOCS), Darwin Harbour SOCS Number 6.

Cultural Interests are also recognised in the EPL:

- It is the licensee's responsibility to contact the Aboriginal Areas Protection Authority, appropriate land council or other governing body and ensure that any Authority Certificates required as a result of conducting the licensed activity are obtained and complied with.

EPL217-01 commenced on 19 September 2017 and expires on 18 September 2022. The licence can be renewed between 90 and 30 days prior to the expiry date.

The specific conditions that are relevant to this OEMP are included within this document. Of particular relevance is Condition 24, as referenced below, as this relates directly to the requirement for an OEMP. The EPL217-01 is included in full, together with the commitments register in Attachment 3.

24 The licensee must implement an auditable Operational Environmental Management Plan (OEMP). The OEMP must:

24.1 be prepared in consideration of the NT EPA Guideline for the Preparation of an Environmental Management Plan;

24.2 include environmental management strategies for managing greenhouse gas emissions;

24.3 include measures to ensure:

a. continuous improvement in environmental management practices and environmental performance for the licensed activity;

b. the minimisation of emissions, discharges and wastes as far as is reasonable and practicable for the licensed activity; and

c. management of foreseeable environmental risks and hazards for non-routine situations including corrective responses to prevent and mitigate environmental harm, including a contingency plan for shut down for maintenance or other reasons.

24.4 be certified by a Qualified professional with the experience and qualifications to be able to assess the environmental risks associated with carrying out the licensed activity and to assess the adequacy of the OEMP to facilitate compliance with the conditions of this licence; and

24.5 not be implemented or amended in a way that contravenes or is inconsistent with any condition of this licence.

4 FACILITY DESCRIPTION

This section defines the operating context for environmental management of the DLNG Plant and associated activities, including the inherent engineering design features of the facility.

4.1 DLNG FACILITY

Dry natural gas (predominantly methane) is imported via a subsea pipeline from the Bayu-Undan offshore facility. The primary activity at the DLNG Plant is the liquefaction of natural gas, using the "ConocoPhillips Optimised Cascade Process", to produce LNG. Export of the LNG from DLNG is via transfer to LNG carrier vessels. A summary of the key DLNG Plant details is provided in Table 4-1.

By-products which are produced by the DLNG Facility include natural gas liquids (NGLs), by-product gas with helium and dry natural gas for the domestic market. The production rate, method of transfer and receiving market per product are detailed in Table 4-2.

Table 4-1: DLNG Plant Details

Facility Name:	Darwin LNG Facility
Facility Location:	Wickham Rd, Wickham Point, NT
Facility Owners	ConocoPhillips Australia (Operator) Santos Inpex Eni Tokyo Electric Chibu Electric
Specific Area:	Sections 1860, 1870, 1871, 1872 and 1873 Wickham Point, Hundred of Ayers (excluding The BOC Group sub lease area)
Registered Facility Operator:	ConocoPhillips Pipeline Australia Pty. Ltd.
Major Hazard Facility Licence Number:	NT-MHF 35388
Australian Business Number:	60 093 316 959
Person in Charge:	Darwin Operations Manager
Contact Details:	24 hour community telephone line: 1800 199 423 24 hour emergency line (Operations Supervisor): 08 8919 1603 General queries: Dan Thompson Environment Supervisor 08 6363 2328 0477 703 869 Daniel.v.thompson@cop.com

Table 4-2: Detail of DLNG Products and By-products

Product	Transport Method	Receiving Market	Frequency	Production Rate
Dry natural gas	LNG carrier vessels	South-east Asia market	Continuous	3.7 million tonnes per annum
Natural gas liquids (NGL)	Road tankers	Domestic market	Once holding tank reaches capacity (795 m^3)	1,600 tonnes equivalent per annum
Dry Natural gas	Pipeline	Domestic market (Power and Water Corporation (PWC))	As requested	As requested (not more than 75 million standard cubic feet /day or 2,308,000 million British Thermal Units)
By-product gas (approximate composition 95% nitrogen 3% helium)	Pipeline	BOC Helium Plant at Wickham Point	Continuous	Approximately 200,000 tonnes equivalent per annum

4.1.1 DLNG Facility Battery Limits

The DLNG Facility is defined by the following battery limits:

- Incoming feed gas (natural gas) from the Bayu-Undan offshore facility – the upstream flange of the pipeline isolation valve (commonly known as the beach valve);
- Export LNG to LNG carrier ships - the “loading breakaway coupling” at the loading arms on the loading jetty;
- Export domestic natural gas to PWC – downstream flange of last isolation valve at DLNG boundary; and
- Export by-product gas to BOC Helium Plant at Wickham Point) – downstream flange of last isolation valve at DLNG boundary.

The battery limits are shown in Figure 4-1, these battery limits also define the scope of this OEMP.

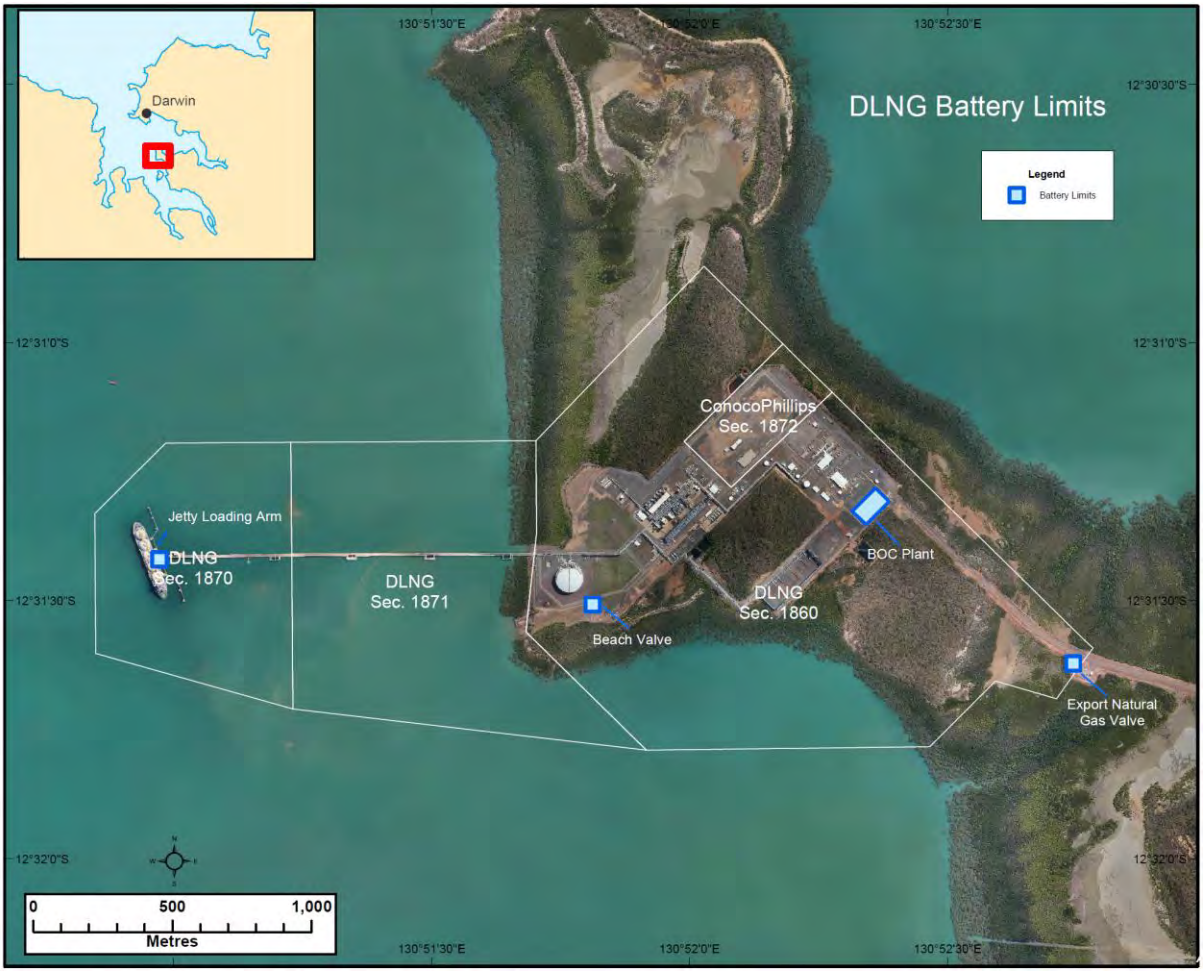


Figure 4-1: DLNG Facility Battery Limits

4.1.2 DLNG Facility Key Components

The DLNG Plant site occupies an area of approximately 65 hectares. The first train for the DLNG Plant is roughly in the centre of the site (shown in Figure 4-2, noting the numbers in the figure do not correlate with the unit numbers listed below), with the LNG storage tank and jetty (partially shown in Figure 4-2) to the west of the DLNG Plant. The second train is not yet built but the footprint is cleared to the east of the first train.

DLNG comprises of a gas processing facility which includes units for:

- gas receiving facilities (including beach valve, pig receiver and meter station for the Bayu-Undan to Darwin Gas Export Pipeline) (Unit 11);
- acid gas removal (Unit 12);
- dehydration and mercury removal (Unit 13);
- propane refrigeration (Unit 14)
- ethylene refrigeration (Unit 15); and
- liquification, methane compression and nitrogen rejection (Unit 16).

Utilities and process support facilities include:

- flare, vent and incineration systems (Unit 19);
- refrigerant storage (Unit 20);
- diesel storage and NGL Storage and Transfer (Unit 21);
- fuel gas system (Unit 22);
- LNG storage and loading (Unit 24);
- effluent/stormwater/sewage treatment (Unit 29);
- onsite power generation facility (OSPG) and standby generation (Unit 31);
- lube oil cooling water system (Unit 32);
- firewater system and firefighting station (Unit 33);
- plant/instrument air (Unit 35);
- demineralisation water plant/water systems (service water) (Unit 36);
- turbine air humidifier system (TAHS) (Unit 37);
- steam generation system (Unit 38);
- Hot oil system;
- Security guardhouse;
- Administration offices;
- First aid building;
- Laboratory;
- Warehouse and storage compounds;
- Maintenance workshop; and
- Telecommunications infrastructure.

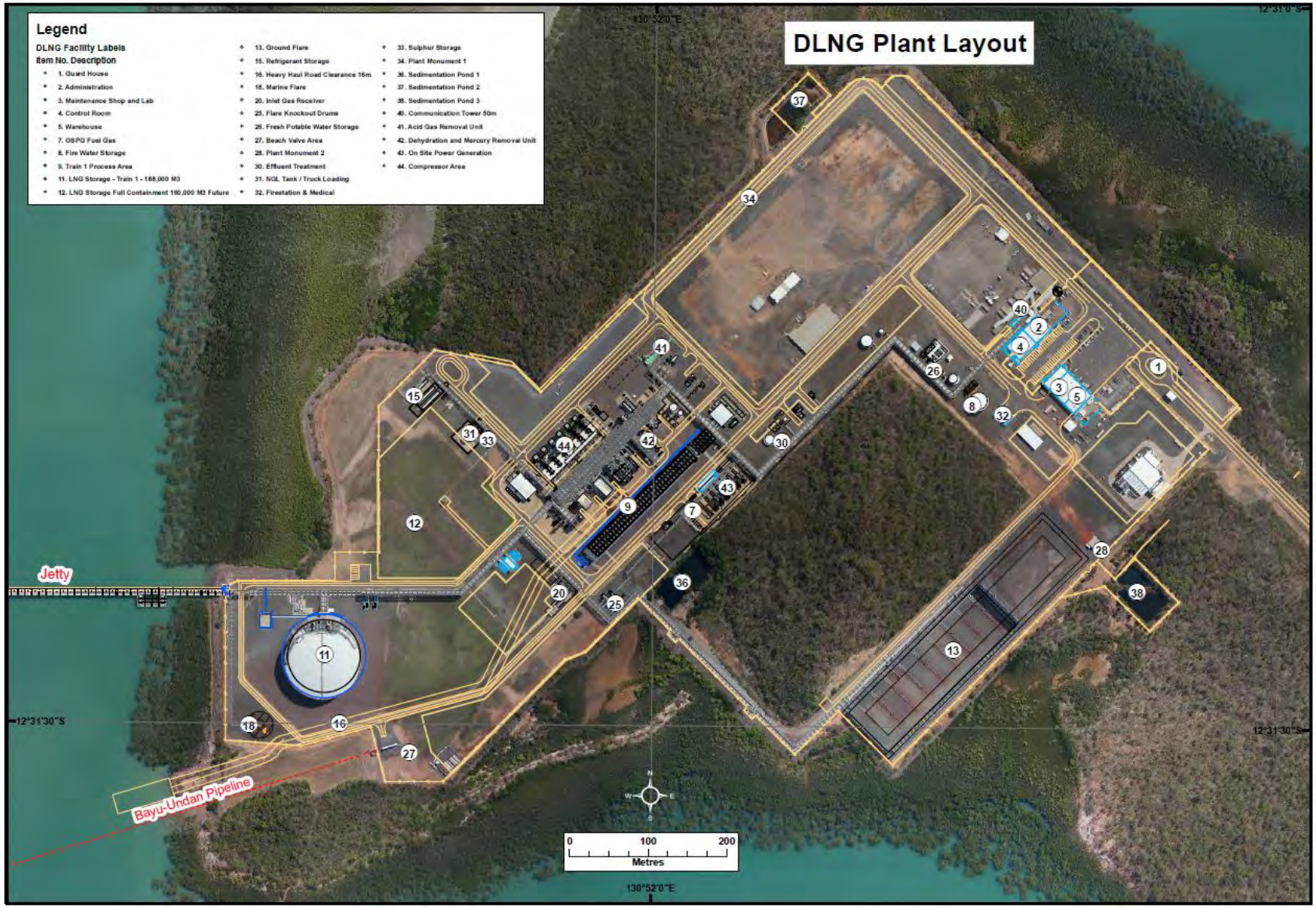


Figure 4-2: DLNG Plant Layout

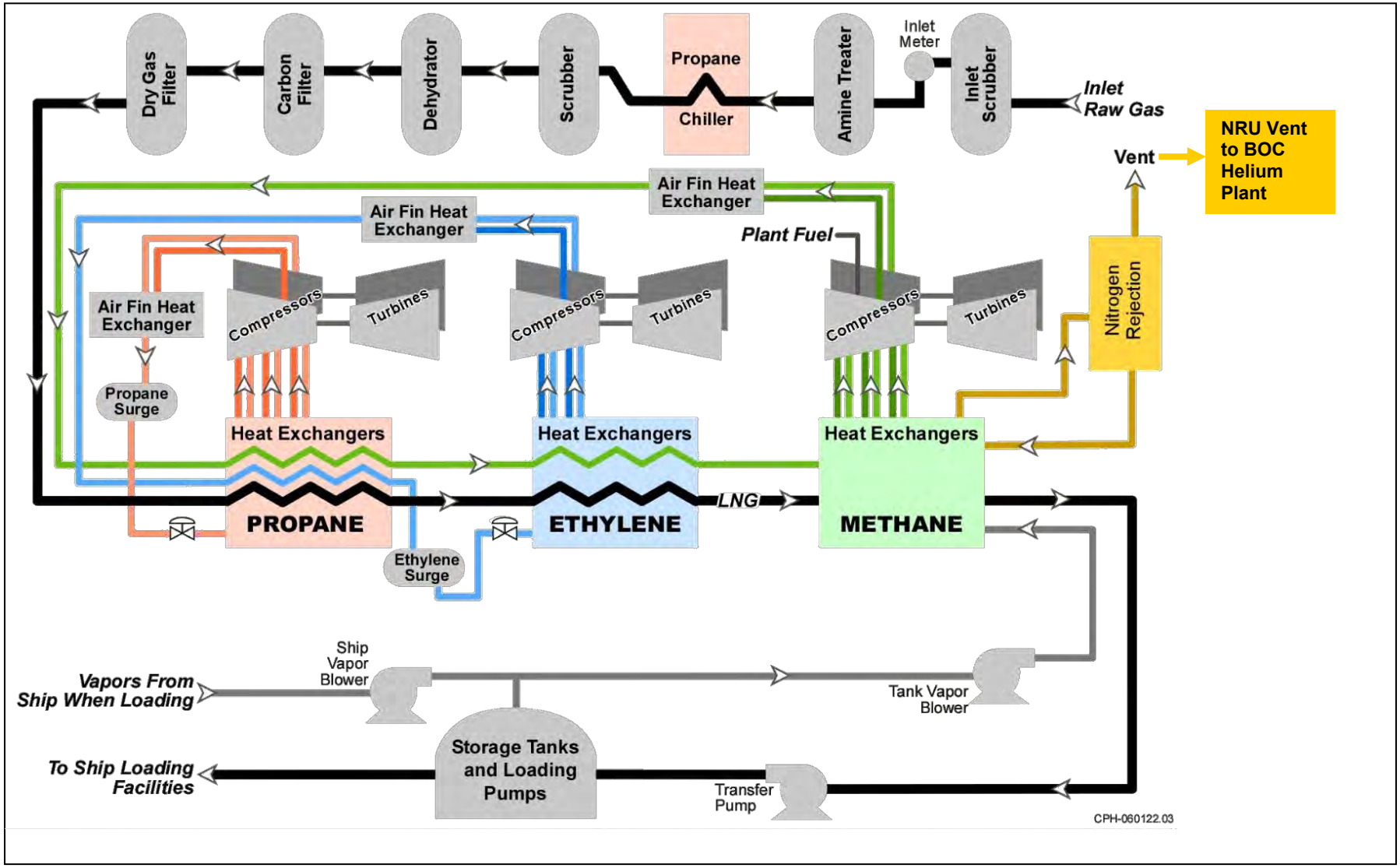


Figure 4-3: DLNG Plant Process Schematic

4.2 OVERVIEW DLNG PLANT PROCESSES

The Plant is operated on a continuous 24-hour cycle, with a maximum normal full-time workforce of 130 day-shift and 21 night-shift personnel. Planned shutdown of the Plant for maintenance may occur in conjunction with an offshore production maintenance, LNG carrier dry-dock or scheduled inspection of the plant to meet regulatory requirements.

The DLNG Plant process is described below and process flow summarised in Figure 4-3. The DLNG train utilises six turbines arranged with two identical gas turbine driven propane compressor sets in parallel, two identical gas turbine driven ethylene compressor sets in parallel and two identical gas turbine driven methane compressor sets in parallel. The allows for the DLNG Plant if required to be operated at half capacity, to allow for any maintenance requirements while the DLNG Plant continues to operate safety and efficiently.

4.2.1 Receiving and Metering

The inlet feed gas preparation uses standard treatment processes tailored for the Bayu-Undan gas feed composition and condition. The gas is heated slightly to bring it to ambient temperature, as the gas drops slightly in temperature as it travels through the 502 km pipeline. The gas pressure is also slightly reduced to aid the DLNG Plant process.

4.2.2 Pre-treatment

Feed preparation consists of acid gas removal, dehydration and mercury removal.

Acid Gas Removal
Feed gas contains carbon dioxide (CO_2) and traces of hydrogen sulphide (H_2S). These gas components are what is referred to as sour and/or acid gas.

The removal of CO_2 from the feed gas is important to eliminate any freezing problems within the downstream liquefaction system, as CO_2 will freeze within the system and block the flow of gas. The removal of H_2S is important for meeting LNG specifications that are required by DLNG customers. The system used to remove the acid gas components is a regenerated amine system (an absorber). The feed gas enters the bottom of the absorber and passes through the amine solution where the acid gas is absorbed into the solution to leave a natural gas stream to exit the top of the absorber. The 'rich' amine which includes the acid gas is then passed to the amine regeneration system where the acid gas is released from the amine solution creating a 'lean' amine solution which loops back to the absorber for reuse. The acid gas passes through the amine reflux drum and then to the acid gas vent or acid gas incinerator (AGI) dependant on operating system.

The AGI heats the acid gas to a minimum of 810°C to allow for combustion, atmospheric emissions produced consist of carbon dioxide (CO_2), sulphur dioxide (SO_2), nitrous oxide (N_2O), oxides of nitrogen (NO_X), carbon monoxide (CO), methane (CH_4) and to a lesser extent particulate matter (PM), hydrogen sulphide (H_2S) and benzene[1].

The acid gas vent can either be cold, which is direct discharge into the atmosphere from a flue stack or hot, which is discharging into an operating compressor turbine stack (U1621 and U1611).

The AGI and acid gas vent atmospheric emissions are depicted in Figure 4-6, with details of the emission sources provided in Table 4-4, while emission monitoring is further detailed in Section 9.1.3.1.

Dehydration
Treated feed gas leaving the acid gas removal unit is chilled prior to entering the dryer inlet separator for separation of any condensed hydrocarbons and water. Residual traces of water

[1] Future H_2S and benzene atmospheric emissions volumes will be dependent on approval if hot venting is provided by the NT EPA.

vapour are removed from the feed gas to prevent the formation of ice crystals in the gas during liquefaction, and are retained within molecular sieve dehydrators.

The dryers are regenerated by back-flowing clean, dry feed gas (heated using waste heat from methane GT compressor exhaust). The adsorbed water is stripped off the bed together with heavy hydrocarbons (if present), restoring the adsorption capacity of the molecular sieve. The hot, wet regeneration gas leaving the dehydrator is cooled and passes to a knock out drum where the condensed water is separated and sent to the regeneration gas knockout drum, whilst remaining waste water is sent to the waste water tank. The regeneration gas is re-circulated and combined with fresh feed gas and the feed gas from the dehydrators.

Mercury Removal
The mercury removal beds contain special sulphur impregnated activated carbon. This final feed gas treatment step removes any trace amounts of mercury to prevent potential damage to downstream heat exchangers. At this point the gas is very dry and free of impurities and will be sent to the liquefaction section of the DLNG Facility.

The activated carbon bed has the capacity to last for the design life and are yet to be replaced since the start of DLNG Operation. Spent carbon, containing mercury, will be managed as a regulated waste when required.

4.2.3 Liquefaction

Following feed preparation, the gas is subsequently fed to the refrigeration system where it is liquefied as the LNG product. This is achieved through a series of propane and ethylene chilling and compression units. Heavier hydrocarbons and NGL are removed during the chilling process. A small amount of NGL (as liquefied petroleum gas (LPG) and/or condensate) may occasionally be recovered and is sold as a fuel product periodically when economic volumes are accumulated. Following chilling and liquefaction, the LNG is sent to storage in the LNG tank before being piped to the jetty facility for loading onto LNG carriers.

The compressor turbines produce atmospheric emissions consisting of CO_2, SO_2, N_2O, NO_X, CO, CH_4 and to a lesser extent PM. The NOx limit is set at 50 ppm within the control system resulting in minimised optimal NOx and CO exhaust emissions. While position indicators are fitted on fuel gas vent solenoids to detect uncontrolled venting from the system. The locations of the primary atmospheric emission sources in the DLNG Plant are depicted in Figure 4-6, with details of the emission sources provided in Table 4-4 while emission monitoring is further detailed in Section 9.1.3.1.

Propane and ethylene required for the refrigerant process are imported by truck and loaded into the onsite storage.

4.2.4 Flare and Vent Systems

The flare and vent system includes:

- **a ground flare system (comprising one wet and one dry flare)**

  The wet flare burns the waste hydrocarbon streams that may contain water vapour and/or free liquid hydrocarbons. The dry flare handles cryogenic hydrocarbons (gas and liquid), during scenarios where hydrocarbons need to be removed from the process.

- **a marine flare**

  The marine flare combusts LNG vessel vapours during scenarios of a hot ship or off spec vessels is to be loaded, under these scenarios the ships LNG tank vapours cannot be utilised within the process. If the boil-off gas (BOG) compressor is out of service, the marine flare will be utilised to combust any BOG from the LNG storage tank.

- **a natural gas liquids (NGL) flare, and**

  The NGL flare is used when the NGL is tested and found to be out of specification and unsuitable for sale.

- **an AGI.**

  The AGI is designed to treat the acid gas stream created from the acid gas removal unit, discussed in Section 4.2.2. The incinerator is also equipped to burn flash gas.

4.2.5 Nitrogen Rejection Unit

Nitrogen is removed from the feed as stream using a dedicated cryogenic nitrogen reinjection unit (NRU). This stream includes a proportion of helium, of economically viability, thus this waste stream is sent to a helium extraction plant. On occasion when the flow is too high for the helium plant, the difference is released to the atmosphere. The extraction plant is located within the perimeter of the plant site close to the main entrance; this facility takes an inert gas stream from the LNG Plant and extracts trace helium. The helium plant is owned and operated by BOC and is not part of the DLNG plant facilities and thus is outside the scope of this OEMP.

4.2.6 LNG Storage and Loading

DLNG has one double walled LNG storage tank, with a capacity of approximately 188,000m^3, a diameter of approximately 90 m and a height of approximately 47.3 m used to store the LNG product. The LNG storage tank is designed and tested to meet requirements of the National Fire Protection Association standard for the production, storage, and handling of LNG (NFPA 59A) and relevant Australian standards.

The LNG storage tank is equipped with loading pumps, level gauges, level transmitters, relief valves, vents, temperature elements, and other instrumentation to ensure safe and environmental sound operations.

The LNG product is pumped from the LNG storage tanks to the jetty via a loading line and transferred to the ship via loading arms. A vapour recovery system captures boil-off vapour that is generated during ship loading from the LNG storage tanks and the chilled LNG loading lines, returning this stream back to the liquefaction section of the DLNG Plant.

It is expected that all boil-off gas generated during ship loading can be returned to the production process; however, depending on the thermal condition of the ship upon arrival and ship's vapour composition, some may be directed to the marine ground flare.

The activities of LNG Carrier will not be undertaken by or under the direct control of ConocoPhillips and so are not addressed by this OEMP.

4.2.7 Utilities Supply

4.2.7.1 Power Generation

Power generation is provided by five turbine generators, two of which are duel fuel (gas/diesel). A diesel fuelled black-start generator is also available. The gas is supplied from the DLNG gas which powers the Plant and administration buildings.

A small quantity of electricity from the Darwin grid is purchased from PWC and used to power offices onsite. In 2009, infrastructure was installed to allow the DLNG Plant to supply back-up gas to the utility provider, PWC. Operational control of piping and associated infrastructure falls under the responsibilities of the utility provider, for facilities outside the DLNG lease.

Three boilers were originally commissioned, currently one boiler is operational. The other two boilers are redundant and have been disconnected from the process operating system. The boilers generate steam used in the DLNG Plant as a heating medium.

The power generation and boiler units produce atmospheric emissions consisting of CO_2, SO_2, N_2O, NO_X, CO, CH_4 and to a lesser extent PM.

The power generation and boiler unit emissions are depicted in Figure 4-6, with details of the emission sources provided in Table 4-4, while emission monitoring is further detailed in Section 9.1.3.1.

4.2.7.2 Water Supply

The PWC supplies fresh water for firewater, general water use in buildings and lube oil cooling. Some of the purchased water is further treated to produce demineralised water, for use in the plant processes such as gas turbine NO_x control, steam plant, CO_2 absorber overhead water wash, amine solution and gas turbine blade washing.

The demineralisation plant has a rated capacity of 51 m^3/hr, with inflowing water going through the following steps: greensand filtration, cartridge filters, reverse osmosis (RO) (two passes) and electrodionisation (EDI) before entering a storage tank ready for distribution.

The greensand filter primary purpose is to remove dissolved iron and manganese, the cartridge filters remove residual chlorine from the water, before the RO pass 1 anti-scalant (sodium bisulphate) is dosed into the stream. Both RO first and second pass have three filters with two trains used during normal operations and a third used on stand-by, to allow for unit cleaning. The EDI units are a final polishing step to remove any additional inorganic compounds.

Both the RO systems produced two streams of water, one a treatment stream and a second waste reject stream. The reject stream includes all the inorganic compounds and components essentially too large to pass through the filter. The RO pass 1 reject water is sent to a holding tank, before being discharged to the jetty outfall. The RO pass 2 reject water is feed back into the system before the RO first pass for retreatment.

The demineralisation plant process produces two separate waste discharge streams (further defined in Table 4-3 and shown in Figure 4-4 while discharge monitoring is further detailed in Section 9.1.3.2):

- RO reject which is discharged to the jetty outfall; and
- Greensand filtration backwash water which is discharged via a stormwater drain into the Sediment Pond 1.

Discharge to the Jetty Outfall is dependent on RO reject tank levels, which in turn is dependent on demineralisation water requirements, currently discharge occurs on average every 50 minutes for 30 minutes. The Jetty Outfall discharge point is located 1.3kms along the Jetty, discharging directly to the Darwin Harbour.

Discharge frequency to the Sediment Pond 1 via the greensand filter is based on backwash frequency, which on average runs through a backwash cycle every 6 hours.

4.2.7.3 Wastewater Treatment

At DLNG there is a dedicated effluent treatment system which treats the two streams (show in Figure 4-4):

- effluent from bathroom and kitchen facilities via the Sewage Treatment Plant (STP); and
- oily water via the oil/water separation and solids removal system (corrugated plate interceptor (CPI) and dissolved air flotation (DAF))

Wastewater from bathroom and kitchen facilities flows into the STP, which utilises biological treatment (extended aeration/activated sludge) to reduce nutrient and biological loads and suspended solids. A sand filter is the final treatment step which polishes the water. This treated water is sent to the irrigation holding tank prior to discharge onto the irrigation area.

The oily water separator receives oily water from process area sumps (such as the washdown sump, AGI sump and laboratory sump) and aims to physically separate oils from water using CPI

and DAF processes. The end products are a waste oil stream and a treated water stream. The waste oil is stored onsite and disposed offsite via a licence contractor, while the treated water is sent to the irrigation holding tank for discharge onto the irrigation area.

A third stream, which is TAHS and boiler blowdown water, is sent to the irrigation holding tank for discharge onto the irrigation area.

Irrigation frequency and timing is based on tank level height. This is an authorised discharge point as defined in Table 4-3 and shown in Figure 4-5 while discharge monitoring is further detailed in Section 9.1.3.2.

The fate of irrigation water is complex, being exposed to evapotranspiration with a portion inferred discharge to Darwin Harbour via groundwater discharge.

4.2.7.4 Stormwater Management

Three dedicated stormwater settling (sedimentation) ponds are in place to capture and settle stormwater runoff from process areas and site roads. Six clean water discharge points which comprise 'clean' runoff water (i.e. runoff that is generated by surface flow across areas of the plant outside any of the process areas) are located around the site perimeter. The locations of the authorised wastewater discharge points are detailed in Figure 4-5.

The sediment pond outfalls discharge indirectly to the Darwin Harbour via the mangrove ecosystem.

Table 4-3: Authorised Wastewater Discharge Points

Authorised Discharge Point	Description	Location	Discharge Stream
SC 2914	Jetty Outfall (composite sampler)	12.5235 S 130.8500 E	Demineraliser (RO) plant reject water
SC 2920	Jetty Outfall	12.3121 S 130.5154 E	
SC 2913	Irrigation water (composite sampler)	12.5217 S 130.8680 E	TAHS/boiler blowdown and water from the treated water holding tank (including tertiary treated sewage effluent and process water treated through the CPI and DAF)
SC 2919	Irrigation water	12.3121 S 130.5154 E	
SC 2915	Sedimentation pond outfall 1	12.5236 S 138.8670 E	Stormwater runoff from process area (including the RO green sand filter backwash discharge).
SC 2916	Sedimentation pond outfall 2	12.5175 S 130.8690 E	Stormwater runoff from site roads and administration areas
SC 2917	Sedimentation pond outfall 3	12.5237 S 130.8730 E	Stormwater runoff from site roads and administration areas

Note – Clean stormwater discharges do not form part of the authorised discharge locations as they are assumed not to be impacted.

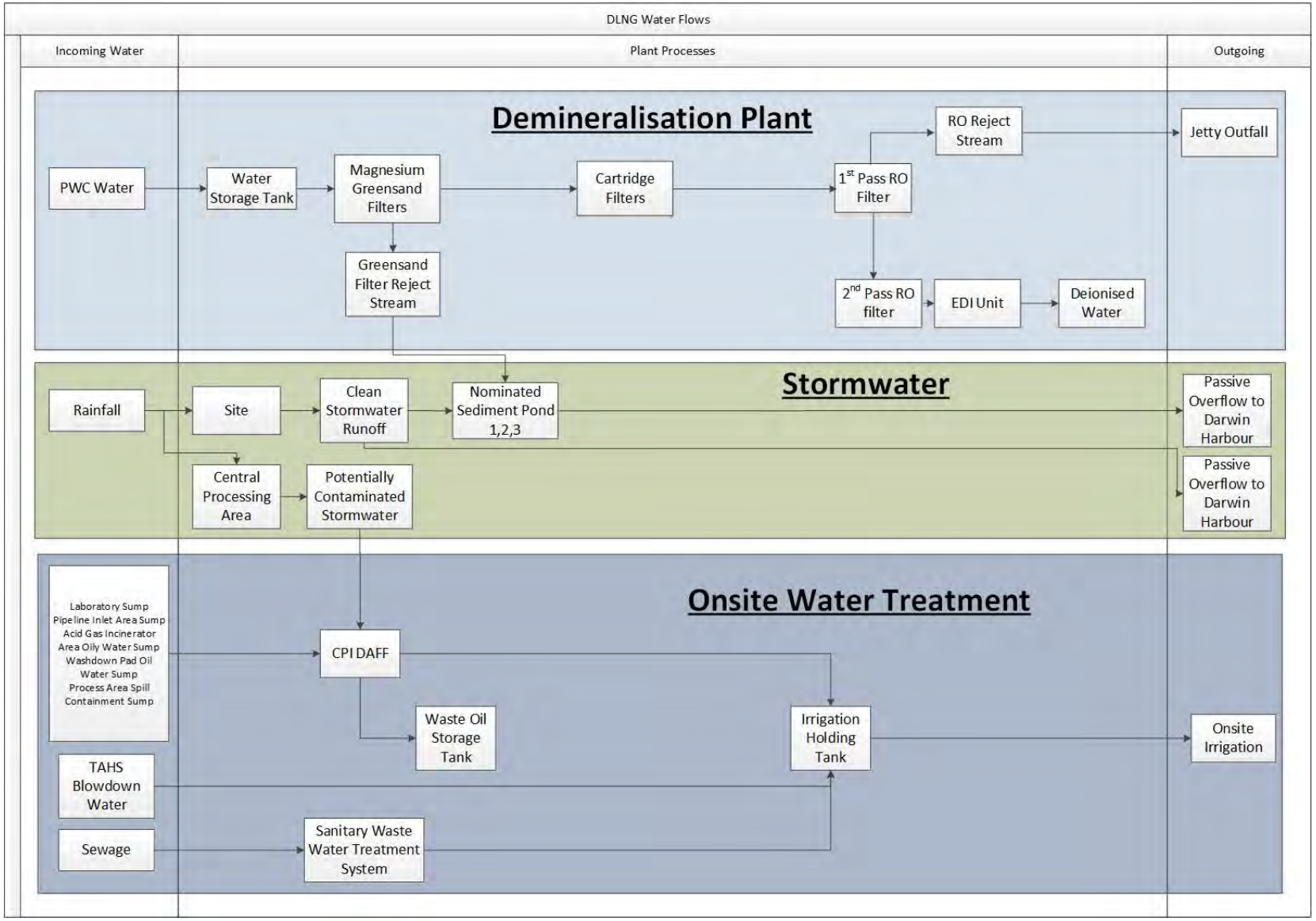


Figure 4-4: DLNG Water Process Flow

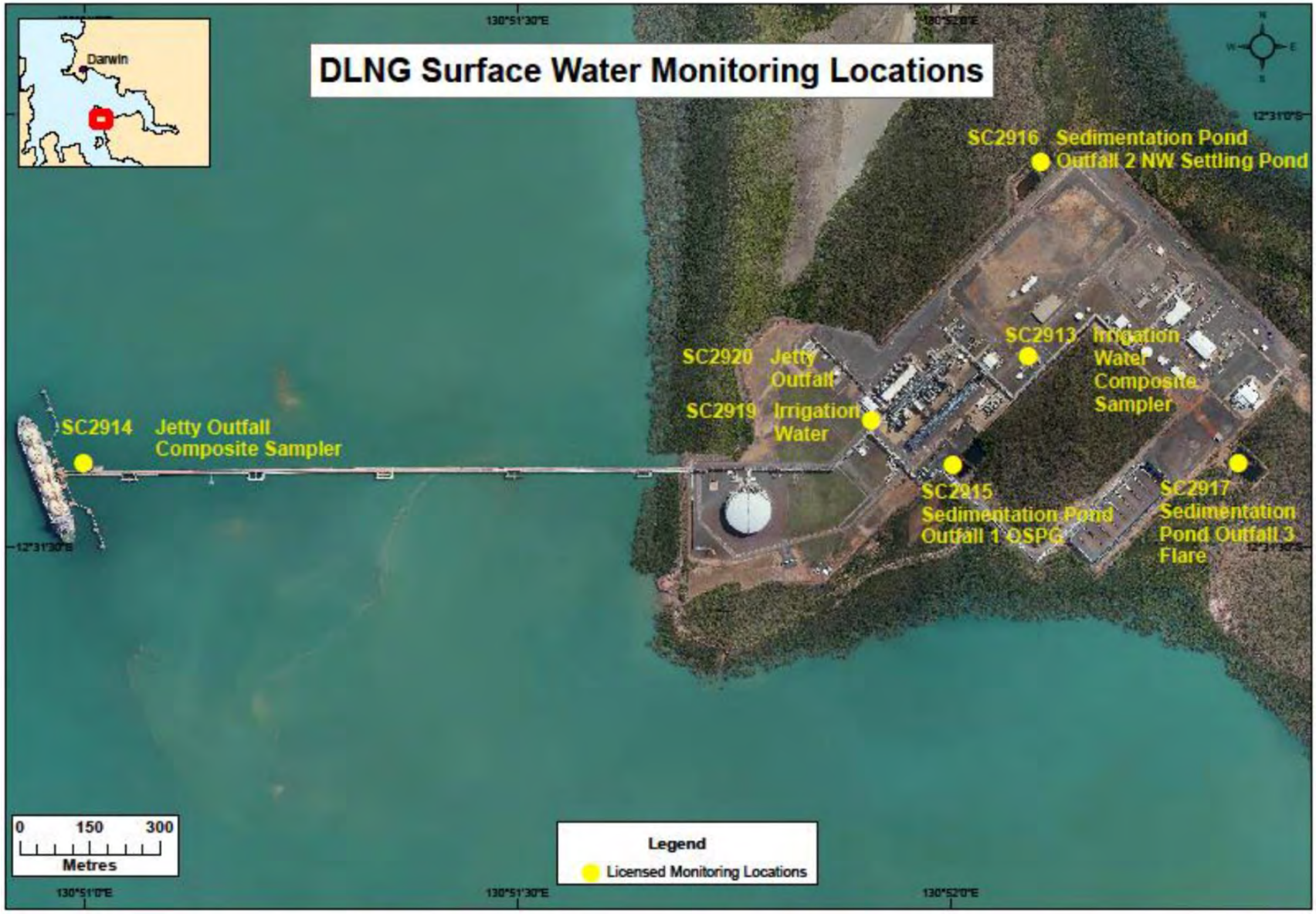


Figure 4-5: DLNG Plant Authorised Wastewater Discharge Points

4.2.8 Atmospheric Emissions

The locations of the primary atmospheric emission sources in the DLNG Plant are depicted in Figure 4-6, with details of the emission sources provided in Table 4-4 while emission monitoring is further detailed in Section 9.1.3.1.

Table 4-4: DLNG Atmospheric Emission Sources

Emission Sources	Authorised Discharge Point	Operation/ Process	Description
Gas Compressor Turbines	Units 1411, 1421, 1511, 1521, 1611, 1621	Refrigeration Gas Compression	Fuel gas is used in the liquefaction process to fuel refrigeration turbines.
Power Generation Turbines	Units 3101, 3102, 3103, 3104, 3105	Onsite Power Generator	Fuel gas is used in power generation. Two of the five turbines are duel fuel (gas/diesel) which is primarily utilised during shutdowns or black starts.
Flaring	K1901, K1902, K1903	Pilot gas, Wet, Dry and Marine Flare	Flaring of gas can occur during full or partial blow-down, emergency shutdown, plant re-start, export-vessel cool down and pressure safety valve operation.
Process Boilers	B3801	Steam Generation	Fuel gas is used in the boilers to generate steam.
Acid Gas Incinerator	K-1904	Acid gas combustion	Native CO_2, SO_2, NOx and CO are discharged from the Acid Gas Incinerator.
Venting from the Acid Gas Removal Unit Vent	Acid gas vent: V1207	Acid Gas Vent (CO_2 Removal)	If the AGI unit is shutdown this stream including native CO_2 and some minor amounts of H_2S and Benzene are vented through the acid gas cold / hot vent.
Nitrogen Removal Unit Vent	Nitrogen rejection unit: SP-1611		The NRU vent stream is routed to the adjacent BOC Helium plant on a permanent basis, to provide feedstock for helium production. If the vent stream exceeds methane thresholds, it is rerouted back into the process.

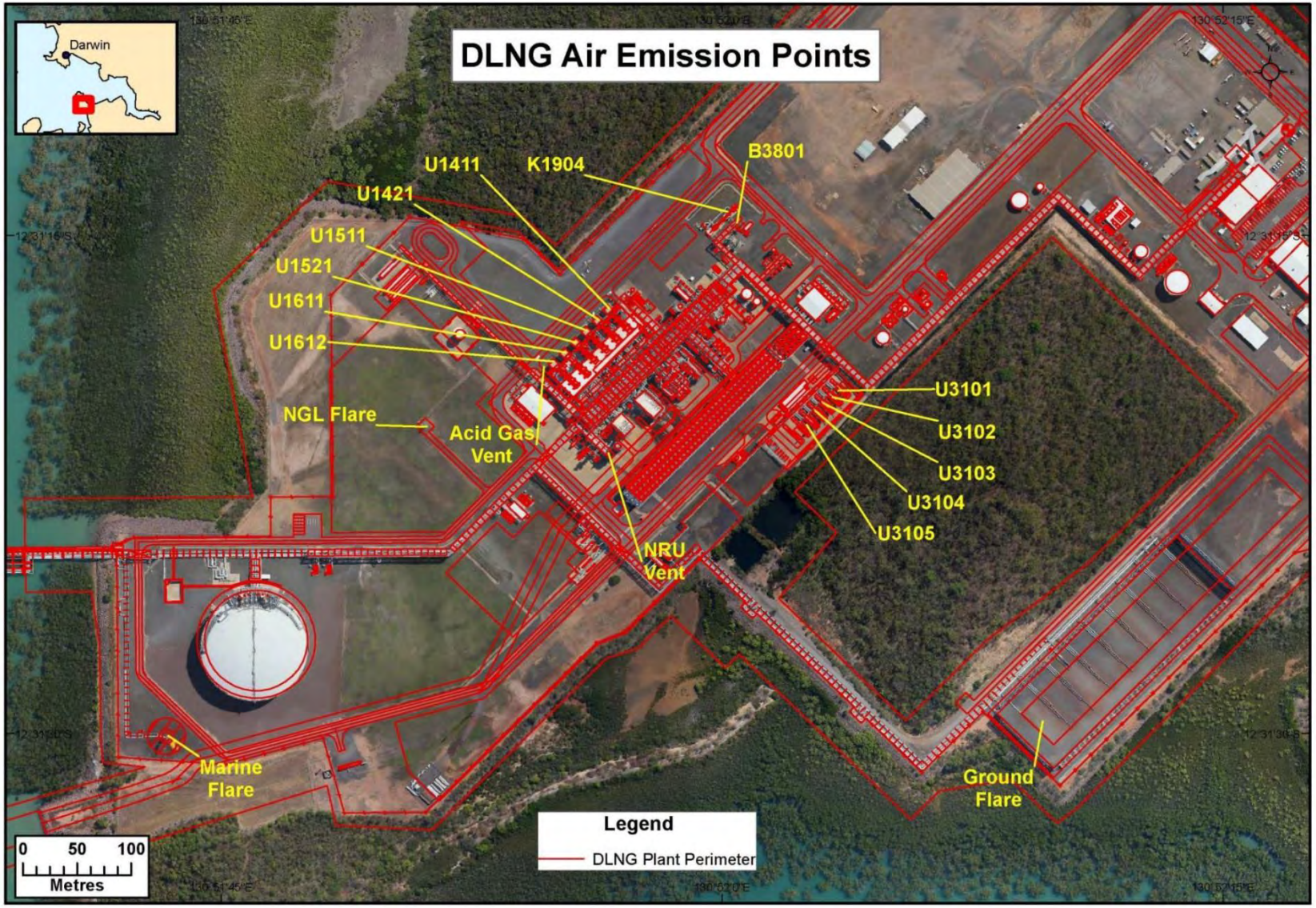


Figure 4-6: DLNG Plant Authorised Air Emission Point Sources

4.2.9 Chemical Management at DLNG

Various chemicals are required as part of DLNG operations. All chemicals to site require Chemical Approval in line with the ABU-W Chemical Management Procedure. All chemicals are stored and managed in accordance with SDS specifications. DLNG has a designated Dangerous Goods Facility for the storage of dangerous goods.

Products including chemicals, lubricants, fuels, paints, solvents and compressed gases used during operational activities will be managed to minimise the environmental impact associated with their transport, handling, storage, use and disposal. This includes:

- maintenance-related products (e.g. lube oils, paints, solvents, degreasers and compressed gases);
- process-related chemicals (e.g. propane, ethylene, methane, resins, oxygen scavenger, mercury-removal absorbents and amine);
- utilities-related products (e.g. fuel gas, diesel, potable water treatment chemicals, hypochlorite, corrosion and scale inhibitor and biocides and refrigerants);
- LNG Plant products (LNG and NGL);
- domestic cleaning chemicals;
- safety-related chemicals (e.g. dry powder, firefighting foam and CO_2); and
- laboratory reagents (e.g. solvents, bases and acids).

4.3 GREENHOUSE GAS EMISSION MANAGEMENT

4.3.1 Efficiencies in DLNG Plant Design

As-built features of the DLNG Plant to reduce GHG and air pollutant emissions include:

- Installation of the GE LM2500+G4 aero-derivative turbines have a high relative thermal efficiency and therefore lower fuel consumption when compared to industrial turbines used in other LNG processes.
- NRU vent flow directed to a helium plant adjacent the DLNG Plant unless there is a trip associated with a higher than normal methane content, in which case it would be directed back into the process for further treatment (since May 2010).
- Waste heat recovery system has been installed to recover heat from four gas turbine exhausts. The heat recovery systems supplement the boiler in the generation of steam.
- Boil of gas compressors have been installed to recover vapour displaced from the LNG tank and the LNG carrier tanks during loading operations, so as to minimise flaring from the marine flare during LNG carrier loading.

Unplanned flaring events are captured by the deferred production opportunity (DPO) process. The volume of gas flared and reasoning for events is also recorded. If an investigation is triggered, then the DPO process is used to track the status and outcomes of the investigation.

GHG emissions associated with the DLNG Plant are reported annually in accordance with the requirements of the NGER Act. GHG emissions are calculated based on operational metered data and emissions data recorded at the Plant, and with reference to the default NGER factors in Method 1 (as detailed in Part 4 of Schedule 1 of the Measurement Determination). The NGER method is technically reviewed by qualified energy consultants. Emission volumes are also managed against the DLNG specific emissions baseline, as calculated by the Commonwealth Clean Energy Regulator.

4.3.2 Further detail on GHG emission management strategies is provided in Table 8-1.West Arnhem Land Fire Abatement Project

Since 2006, DLNG has supported the West Arnhem Land Fire Abatement (WALFA) project; a carbon offset program in which fire management practices are implemented over 28,000 km^2 of native savanna vegetation. This project allows ConocoPhillips to offset some of the GHG emissions generated by the DLNG Plant, in the order of 100,000 tonnes per annum of CO_2 offsets.

To reduce emissions of GHG, the key objectives of the WALFA project have been to substantially increase the extent of early season burning using strategically prescribed fires. This preventative approach helps manage for, and limit the extent and severity of, late season fires, thereby reducing the overall area and amount of fuels burnt.

Through this project, Indigenous ranger groups in West Arnhem Land (NT) have offset more than 1.5 million tonnes of CO_2-e through early dry-season burning and helped prevent large uncontrolled bushfires late in the dry-season.

The WALFA project also offers economic, environmental, social and cultural outcomes for local Indigenous community members through the protection of culturally significant rock art and enabling Traditional Owners and Countrymen to return to the land by providing sustainable employment opportunities.

5 EXISTING ENVIRONMENT

The socio-economic and environmental setting of the DLNG Plant is described in the Darwin LNG Plant Draft Environmental Impact Statement (Phillips Oil, 1997) and the Darwin 10 MTPA LNG Facility Public Environmental Report (Phillips Petroleum, 2002). This existing context has been updated to reflect the current setting around the operational DLNG facility and surrounds.

The following key information provides the context for the environmental management strategies presented in Section 8.

5.1 LOCAL SOCIO-ECONOMIC CONTEXT

5.1.1 Land Use and Zoning

The NT Planning Scheme Litchfield zoning map shows the area occupied by the DLNG Plant at Wickham Point (Sections 1860 and 1870 to 1871, Hundreds of Ayers) is zoned for Future Development (Figure 5-1; NT Government, 2017a).

A significant proportion of Middle Arm Peninsula, to the south and east of Wickham Point, is gazetted for Conservation (CN) land use where further industrial development is restricted. Additional surrounding land uses are zoned for Development (DV).

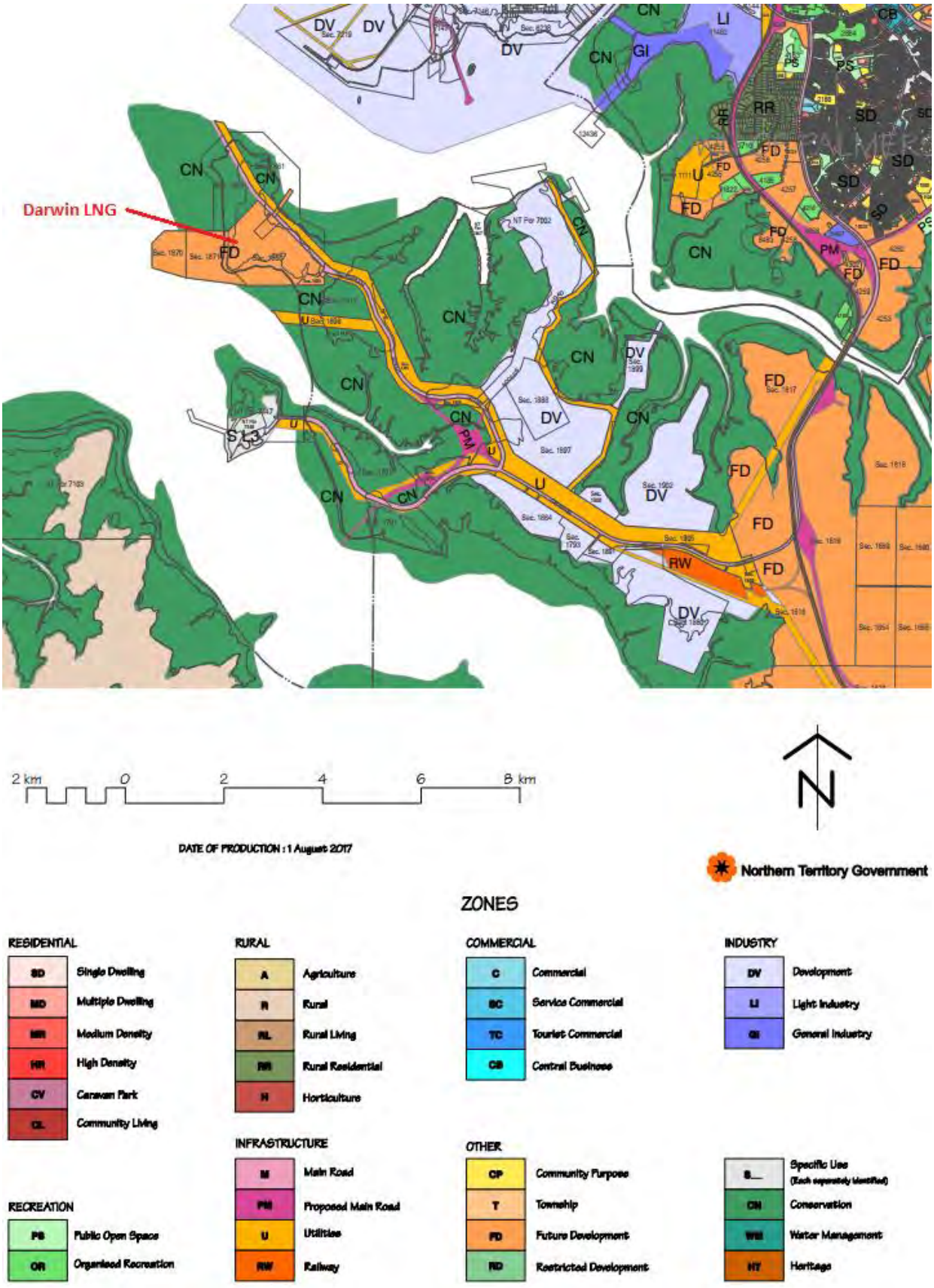
5.1.2 Local Population and Land Uses

The nearest major residential populations in proximity to the DLNG Plant include Palmerston to the north-east of Middle Arm Peninsula (approximately 10 km by direct line of sight from the DLNG site), and the Darwin central business district (approximately 6 km by direct line of sight from the DLNG site) (see Figure 1-1). The DLNG Plant is only visible from the Darwin city waterfront and is geographically separated from residential/urban residential areas.

Current land uses of Middle Arm Peninsula in the vicinity of the DLNG Plant include:

- The operational BOC Helium plant, which is located adjacent to DLNG;
- Industrial land use at Channel Island (Power and Water Corporation (PWC) power station, LPG storage and unloading facility, and the Darwin Aquaculture Centre);
- INPEX LNG plant at Blaydin Point, to the east of Wickham Point;
- Extractive industries to source aggregate for construction/development projects, to the east/south-east of DLNG; and
- Recreational uses, reflecting the popularity of Darwin Harbour for recreational boating and fishing. Elizabeth River Bridge is a popular local fishing location, and a boat ramp for recreational boat users exists on Channel Island.

The Wickham Point Accommodation Facility and the INPEX LNG Plant are DLNG Plant's nearest neighbours.



(source: NT Government, 2017a)

Figure 5-1: DLNG Plant Location and Adjacent Land Use Zoning Map

5.1.3 Darwin Harbour Uses

The most intensive use of Darwin Harbour is commercial shipping, recreational boating and fishing, tourism and naval activities.

East Arm Port is to the north-east of Wickham Point. It is a significant active Port development used by a range of maritime industries.

There is a high-level of recreational fishing effort in the NT with effort totalling in the order of 150,502 days and is mostly boat-based (81%) (NT Department of Primary Industry and Fisheries (DPIR) 2014)). Darwin Harbour accounted for 27% of the total fishing effort in the NT (DPIR 2014). The most commonly caught species include barramundi, various snapper species, baitfish, catfish and mud crabs.

Fishing tourism is important to the NT's economy and there are several fishing clubs throughout the NT (DPIR 2014), who utilise the harbour.

5.1.4 Indigenous Heritage Values

Wickham Point is considered to be of particular significance for the Larrakia people. The significance of Wickham Point to Aboriginal people includes:

- It has played a part in particular periods of Aboriginal history;
- Aboriginal people may have been buried on Wickham Point in the past;
- Adjacent marine areas are used as a source of food; and
- Wickham Point is of spiritual significance to all Larrakia people.

No exact Aboriginal burial grounds are known on Wickham Point. It is possible that burials occurred near the Leprosarium site at the northern extremity of the peninsula (Figure 5-2). This site is well away from the DLNG Plant site and is not to be disturbed.

A number of middens discovered within and adjacent to the plant boundary were subject to investigation, in consultation with the former Heritage Branch of DIPE (Figure 5-2). Shell middens are the most commonly recorded type of archaeological site in the Darwin region.

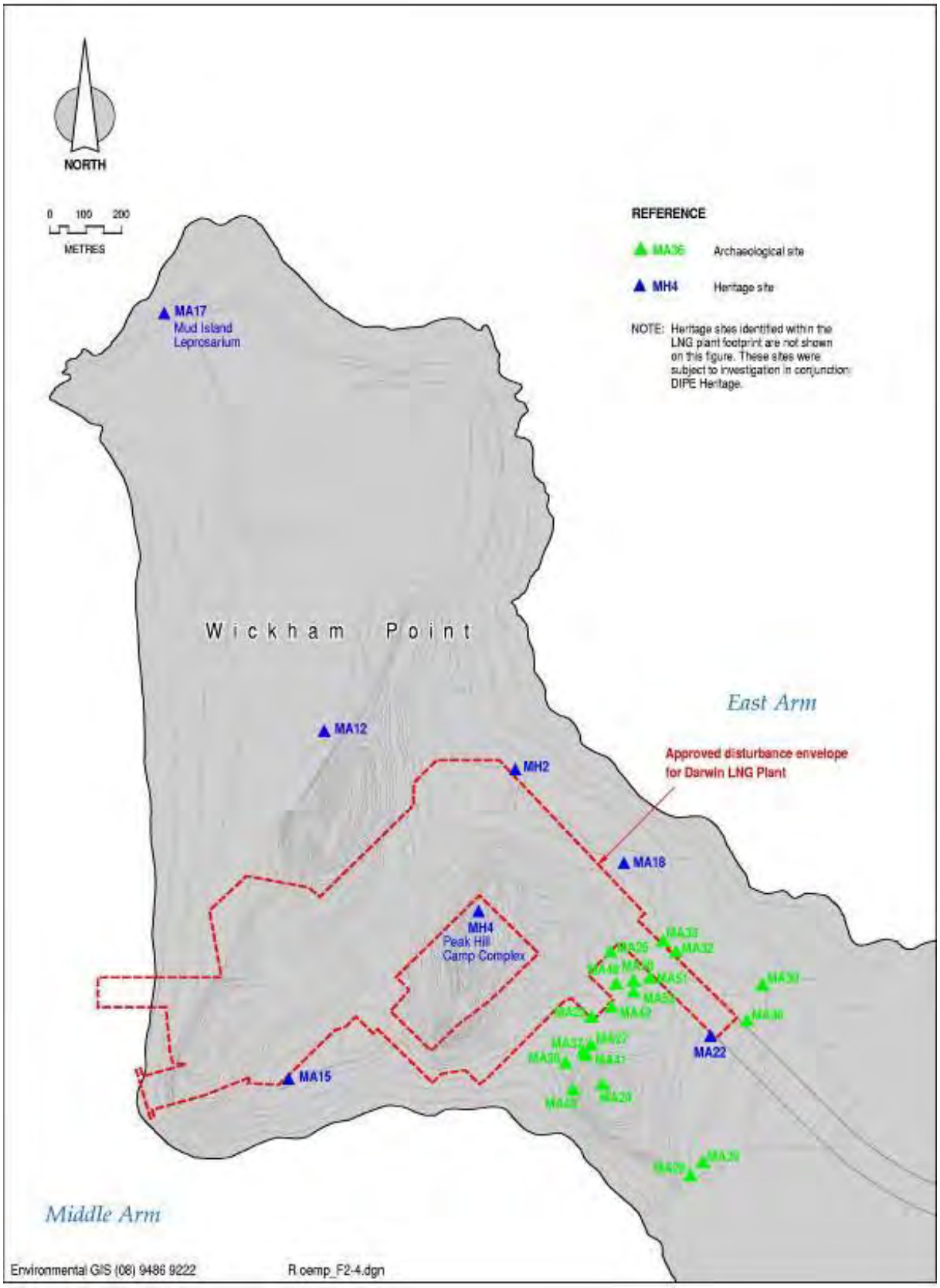


Figure 5-2: Known Heritage and Archaeological Sites Adjacent to the DLNG Plant Site

5.1.5 European Heritage Values

Wickham Point and other areas surrounding Darwin Harbour have significant European heritage values. An archaeological study of Wickham Point confirmed the area holds some significance as a training base for the Z-Force military during World War II, and artefacts (including concrete slabs from a relic search light camp) have been recorded on Peak Hill and surrounding areas. These artefacts have since been documented and temporarily stored off-site. Interpretative signage has been established at the Esplanade Park in the centre of Darwin.

The remains of the 'Mud Island' leprosarium are located on a sandy beach ridge forming the northern extremity of Wickham Point. This is well away from the DLNG Plant site and will not be disturbed.

Unexploded ordnance (UXO) has been found on Wickham Point, remaining from Z-Force activities, and Japanese aerial attacks and bombing of Darwin in 1942. Discovered UXO have been removed and surveys were undertaken during the DLNG Plant construction phase to ensure the DLNG Plant site is clear of UXO.

5.2 ENVIRONMENTAL CONDITIONS

5.2.1 Climate and Meteorology

Darwin is situated in the monsoonal (wet/dry) tropics of northern Australia and experiences two distinct seasons: a hot, wet season from November to April and a warm, dry season from June to September. May and October are transitional months between the wet and dry seasons.

Distinctive seasonality of rainfall is the most distinguishing feature of the regional climate. A pre-wet season transitional period, commonly referred to as the build-up, occurs during October and November. Irregular thunderstorms characterise this period prior to the onset of more predictable rain systems associated with monsoonal troughs that occur in the wet season. Average annual rainfall for the Darwin region is 1,723 mm over an average of 94.2 rain days, with most rainfall occurring during the wet season (Bureau of Meteorology 2017).

The strongest winds and heaviest rainfall are associated with the passage of tropical cyclones. These occur at any time during the period November to April, and occur on average once every two years. Prevailing winds during the wet season are light west to north-westerly, freshening in the afternoon due to sea breezes. Prevailing winds in the dry season are the south-easterly trade winds.

5.2.2 Noise

Noise modelling undertaken by Bechtel (2001) for the PER predicted noise from the operational LNG plant will not exceed a limit of 70 dB (A) on the property boundary. Levels at Darwin are predicted to be well below 45 dB (A) during normal atmospheric conditions. Noise surveys were undertaken by SVT (2006) to measure background (ambient) and construction noise at and around the DLNG Plant site. The noise surveys also allowed validation of the outputs of the 2001 noise modelling. The results indicated that typical minimum noise levels at commercial/residential areas (e.g. Darwin city, East Arm, Durack, Palmerston) ranged between 34.2 decibels A-weighted (dB (A)) and 41.0 dB (A) (SVT, 2007).

5.2.3 Air Quality

Air quality in the Darwin region is influenced by a range of natural and anthropogenic activities and emission sources, including local industry, traffic on urban roads and bushfires (Katestone, 2016). In the 2015/2016 National Pollutant Inventory (NPI) reporting period, 22 facilities within a 20 km radius of Darwin reported emissions to the NPI with five facilities reporting emissions the same pollutants also emitted by the DLNG Plant (Katestone, 2017).

The NT EPA has established an air quality monitoring network in Darwin and its surrounds (Palmerston and Winnellie) to measure particular matter (PM_{10}), carbon monoxide (CO), sulphur

dioxide (SO_2), nitrogen dioxide (NO_2), nitrogen oxide (NO) and ozone. The NT EPA's annual reports to the National Environment Protection Council indicate that Darwin has good air quality (Katestone, 2016). The most critical air pollutant is PM_{10} considering the magnitude of measurements relative to the air quality standard. The most significant source of PM_{10} is bushfires that occur predominantly during the dry season.

Baseline ambient air quality monitoring was undertaken by Darwin LNG in 2004-05, and a follow up study of similar scope was conducted in 2008. Further monitoring was undertaken in 2016 over a twelve-month period and involved monitoring ambient concentrations of NO_2, CO, SO_2, PM_{10}, benzene, toluene and p-xylene. The 2016 monitoring program showed that air emissions in the Darwin airshed were below relevant air quality standards and guidelines for NO_2, CO, SO_2, benzene, toluene and p-xylene (Katestone, 2017). Some exceedances were recorded for hydrogen sulphide (H_2S) (single occurrence) and PM_{10} (multiple, these exceedances were the result of bushfires in the region).

Modelling of air emissions from hot venting of acid gases has also been undertaken (Katestone, 2016) with the results predicting ground-level concentrations of benzene and H_2S to be well below the air quality criterion and objectives at all sensitive receptors.

5.2.4 Geology and Geomorphology

5.2.4.1 Wickham Point Geology and Soils

The bedrock consists of meta-sediments that have metamorphosed and undergone one major deformation, producing steep dips and resulting in the pervasive north-north-east strike of the strata. The Burrell Creek Formation present on Wickham Point consists of a sequence of phyllite, siltstone, shale, sandstone and conglomerate.

Parts of the Koolpinyah surface are present on the peninsula, and take the form of laterite deposits on bench areas of lower slopes or the flanks of the ridges and as extensive platforms near sea level. There is a prominent ferricrete pavement near sea level that extends seawards out to the low tide level. It forms a capping on the shallow near shore reefs.

Offshore subsurface stratigraphy is represented by 5 m to 9.5 m of sediment in the DLNG Plant jetty head area, underlain by phyllite and meta-siltstone of the Burrell Creek formation.

5.2.4.2 Darwin Harbour Sediments

There are three main sources of sediment input to Darwin Harbour:

- Breakdown of rocks in the catchment area by weathering and erosion;
- Remobilisation of existing sediments, including partially consolidated sediments; and
- Sediments of biogenic origin, including those derived from corals.

Most harbour sediments are a mixture of all three types. There is a general annual cycle of sediment deposition during the wet season and erosion during the dry. The seabed of Darwin Harbour is dominated by gravel with a scour zone in the centre of the harbour. The intertidal area off the point has fine sands and silts.

Tidal mudflats adjacent to Wickham Point comprise mangrove flats and salt flats. The mudflats are composed of Quaternary marine alluvium, commonly with shell fragments and organic matter in the mangrove zone and salt crusting on the salt flats. A broad intertidal flat lies in front of the western mangrove fringe of Wickham Point. An expanse of exposed pavement supporting three intertidal rock stacks occurs at the southern tip of Wickham Point.

5.2.5 Hydrology and Hydrogeology

Early Proterozoic sediments of the Burrell Creek Formation, comprising shale, siltstone, sandstone, and phyllite underlie the DLNG Plant site on Wickham Point. Outcrop is limited to two

small sandstone ridges. A fine-grained sandy colluvium forms scree slopes on the base of the ridges.

The Burrell Creek Formation, which underlies the peninsula, is generally impermeable and holds only limited water in fractures. Minor volumes of groundwater may be retained in the colluvium during the wet season. Groundwater stored in the colluvium and fractures is likely to be utilised by the vegetation or lost through evaporation.

Several small creek lines flow from upland areas of Wickham Point to the harbour during the wet season.

Biannual monitoring of groundwater has been undertaken since 2015 of both onsite groundwater and an offsite reference bore. The monitoring shows that standing water levels fluctuate between approximately 0.5 m and 4.0 m relating to the seasonal rainfall cycles, with a higher groundwater water table in the wet season compared to the dry season. The groundwater pH is mostly acidic with a range of 3.9 to 6.7, conductivity range recorded is from 109 to 82,000 µs/cm, the variation is dependant again on seasons (rainwater is a freshwater input) and on bore locality with respect to Darwin Harbour. Generally, the site groundwater has a lower conductivity given the irrigation water freshwater input is consistent throughout the year. In regard to heavy metals, the monitoring shows levels are naturally elevated across the site bore and the reference bore, reflective of the geology of the area. All metals (except arsenic, iron and manganese), on average, are higher at the offsite reference bore compared to onsite groundwater likely indicating the irrigation water causes dilution of natural concentrations.

Total phosphorus concentrations range from below detection limit (0.05 mg/L) to 1.5 mg/L and total nitrogen concentrations range from below detection limit (0.2 mg/L) to 9.6 mg/L. Comparative to the reference bore some onsite bore record elevated nutrient concentrations.

5.2.6 Darwin Harbour

5.2.6.1 Estuarine Oceanography

Darwin Harbour is characterised by a macro tidal regime. Tides are predominantly semidiurnal (two highs and two lows per day). The lowest spring tides of the year occur during October, November and December.

The Harbour is considered well protected, with wind-generated waves typically less than 0.5 m in height, with periods of 2 - 5 seconds. The majority of waves are generated in the harbour or in Beagle Gulf. Predicted wave heights during cyclones would be around 3 to 3.5 m.

Extreme high water levels at Wickham Point, taking into account cyclone storm surge, cyclone wave set-up and astronomical tide, are estimated to be 3.8 m (10 year return period), 5.1 m (100 year) and 6.4 m (1,000 year).

5.2.6.2 Estuarine Physico-chemical Characteristics

Water salinity in Darwin Harbour varies considerably during the year, due to greater freshwater inputs during the wet season. The median salinity throughout the harbour is between 32 to 36.6 parts per thousand (ppt), as reported by the 2015 Darwin Harbour Report Card (Fortune, 2016a), with surface and bottom depths having similar salinity. Salinity in the middle of the harbour can decrease to 27 ppt at the height of monsoonal inflow during March. Salinity in the arms are more influenced by freshwater inflow and can be as low as 17 ppt. The water at this time is highly stratified, with the bottom salinity being as much as 12 ppt higher than on the surface.

Ambient water temperature recorded in Darwin Harbour in 2015 ranged between 22 ºC and 33 ºC for the year (Fortune, 2016a). During the dry season neap tide sampling average temperatures ranged from 26ºC and 28 ºC (Fortune, 2016a).

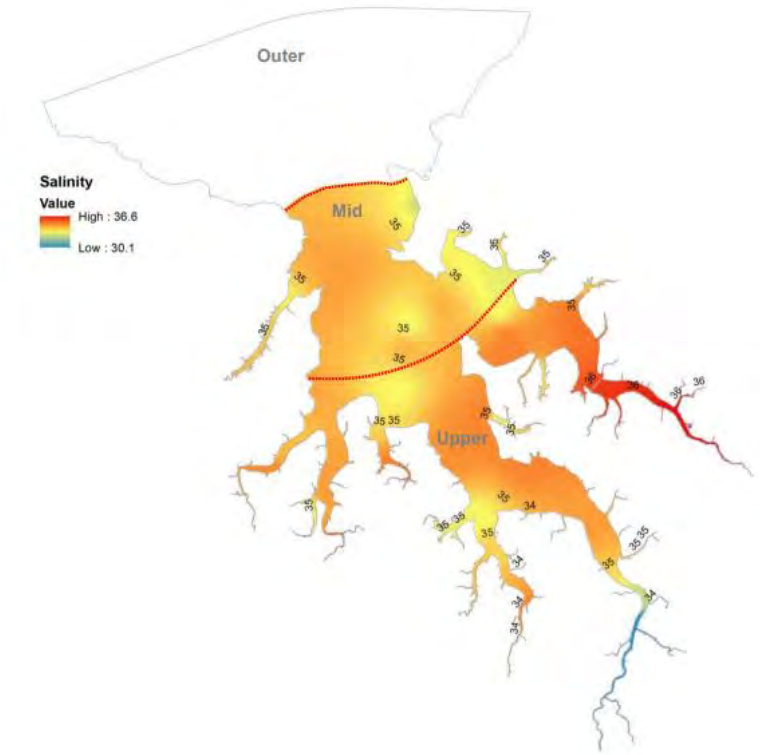
Light levels reaching the sea surface in Darwin Harbour are relatively high. The turbidity of the water rapidly dissipates light and light levels even a few metres below the surface can be very low. This is particularly so during the wet when turbidity levels are very high.

5.2.6.3 Water Quality

The water quality in Darwin Harbour is generally in very good to excellent condition (Fortune, 2016b). Studies conducted by the Department of Land Resource Management Aquatic Health Unit have shown that many water quality parameters in the harbour are affected by seasonal, spatial and tidal factors (e.g. turbidity, total suspended solids and chlorophyll a) (Fortune, 2015). Examples demonstrating the seasonal variation are provided in Figure 5-4 and Figure 5-3.

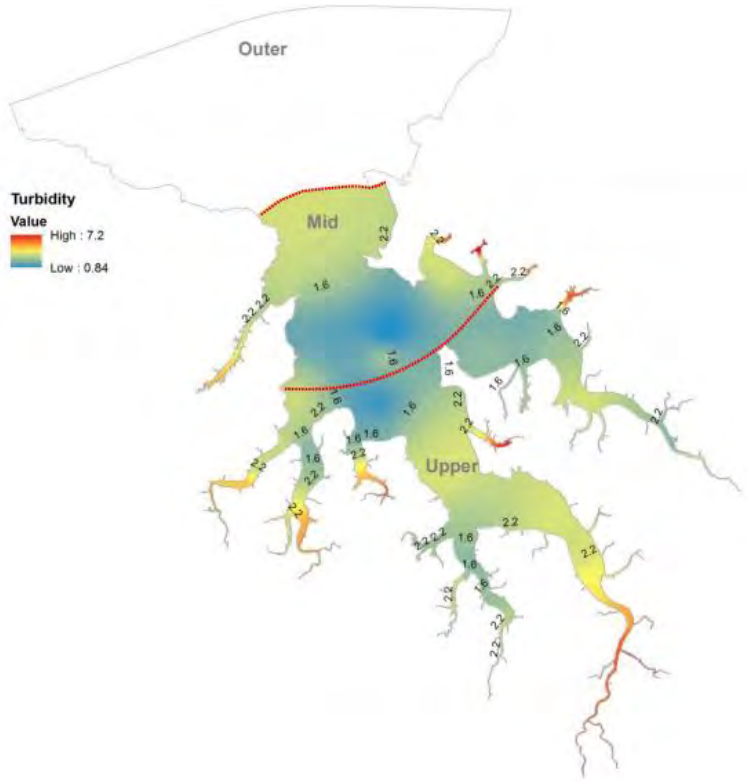
Current levels of nutrient discharges have not greatly affected water quality in the harbour. This is a likely result of dilution factors and the harbour's strong tidal current flow regime. The waters of Darwin Harbour were declared to have beneficial uses for the protection of aquatic ecosystems, recreational water quality and aesthetics under the *Northern Territory Water Act* in 1996, in accordance with the objectives and criteria defined in the former Australian and Zealand Environment and Conservation Council, and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC and ARMCANZ) Guidelines (2000).

Objectives for surface water quality have been produced due to Darwin Harbour having Declaration of Beneficial Uses (Department of Natural Resources, Environment, the Arts and Sport (NRETAS), 2010). As such the Darwin Harbour Water Quality Objectives (DHWQO) are provided for specific parameters present in discharge to the harbour. Given the location of the DLNG site the interim ambient guideline values and water quality objectives for priority indicators of the Darwin Harbour are for the mid-estuary region.



(source: Fortune, 2015)

Figure 5-3: Interpolated Salinity (ppt) Map of Darwin Harbour



(source: Fortune, 2015)

Figure 5-4: Interpolated Turbidity (NTU) Map of Darwin Harbour

5.2.6.4 Sediment Quality

Geochemical investigations of marine sediments at the head of the LNG loading jetty and along the length of the construction dock were undertaken in 2002 prior to construction, and again in 2011 as part of post-construction environmental monitoring. Further sediment sampling was undertaken in 2015 as part of operations. The findings indicated concentrations of all metals except arsenic were below ANZECC and ARMCANZ (2000) screening levels at all sites (Jacobs, 2015). Elevated concentrations of arsenic (above the ANZECC and ARMCANZ (2000) screening levels) were recorded at all sites in the 2015 survey, which is consistent with findings from the previous surveys. Arsenic is known to be commonly found at high natural levels in Australia (National Assessment Guidelines for Dredging 2009, cited in Jacobs, 2015), with the source being geological, consistent with other observations of sediment quality in Darwin Harbour. The levels of arsenic present are also unlikely to be bioavailable to any significant extent or result in toxic effects to marine biota (Jacobs, 2015). Hydrocarbons were generally low or below the analytical detection limit in all samples (Jacobs, 2015). All samples tested for tributyltin (TBT) were below detection limits.

5.2.6.5 Mangrove Ecosystem

The mangrove community surrounding the DLNG facility compromises predominately of *Rhizophora* and *Sonneratia* species and to a lesser extent *Aegialitis, Avicennia, Osbornia* and *Aegiceras.*

Monitoring of mangroves in the vicinity of the DLNG Plant has been ongoing since construction in 2006. Data collected indicates that mangroves adjacent to the DLNG site are in a healthy condition with no significant deterioration or stress related to the operation of the DLNG Plant (AECOM, 2016). The data also shows that the key parameters of canopy density, tree condition, sedimentation/erosion (sediment heights) and groundwater conditions have remained largely unchanged during the operation phase (URS, 2016).

Chemical analysis of mangrove sediment and fauna (mudwhelk) samples has been undertaken annually as part of the Mangrove Monitoring Program.

Concentrations of all metals analysed in mangrove sediments have been recorded below the ANZECC and ARMCANZ (2000) Interim Sediment Quality Guideline trigger values at all sites, with the exception of zinc concentrations in some years at one particular location (within 60 m of the sedimentation pond 1 outfall) (AECOM, 2016).

Metal concentrations detected from the mangrove biota (mudwhelk) samples were generally below the recommended Maximum Levels or Generally Expected Levels of metals in molluscs for human consumption (Food Standards Australia New Zealand, 2005) at all sites and for all years (2006-2016) (AECOM, 2016). The only exceptions were copper and zinc concentrations, which were periodically above the Generally Expected Level at some sites. Copper occurs naturally in molluscs, being present in the blood as haemocyanin, and can therefore give a high concentration in molluscs from unpolluted waters. There has been no evidence of any hydrocarbon contamination within the mangrove sediments and mudwhelks sampled (URS, 2016).

5.2.6.6 Marine Habitats

Rocky intertidal shores predominant the margins of headlands of Darwin Harbour. Extensive mangrove assemblages occur in the upper intertidal zone, with mud and sand flats in the lower intertidal zone. There are few sandy beaches in the harbour.

Coral communities occur at limited locations in Darwin Harbour where the substrate is rocky in the lower intertidal and subtidal zones. The subtidal rocks are dominated by algal communities. The coral communities occurring in Darwin Harbour are considered to be at the limit of their tolerance because of the turbid harbour water quality.

Seagrasses in Darwin Harbour are known to occur off Mandorah, Talc Head, Weed Reef, Wickham Point and between Channel Island and the mainland. The seagrasses are typically very sparse, primarily comprising *Halodule uninervis* and *Halophila decipiens* with some *Halophila ovata* and *Cymodocea serrulata*.

5.2.7 Vegetation Communities of Wickham Point

The vegetation located on Wickham Point, Middle Arm Peninsula, comprises extensive intertidal areas supporting mangrove forests and salt flats that completely surround two upland or hinterland areas rising to a maximum elevation of 32 m at Peak Hill.

The hinterland areas surrounding the DLNG Plant are largely vegetated with dry monsoon rainforest. Limited areas of paperbark-dominated woodland occur on Wickham Point. The major plant community is monsoon rainforest, also known as dry rainforest, which covers the majority of Wickham Point.

The intertidal areas include:

- Seaward mangrove area;
- Shoreline mangrove area;
- Tidal creek mangrove area;
- Mid tidal flat mangrove area;
- Hinterland fringe mangrove area;
- Mixed species low woodland; and
- Samphire/salt flat.

The hinterland areas include:

- Beach;
- Dry rainforest (dense canopy);
- Dry rainforest (mid-dense canopy);
- Littoral woodland;
- Melaleuca woodland; and
- Sedgeland and grassland.

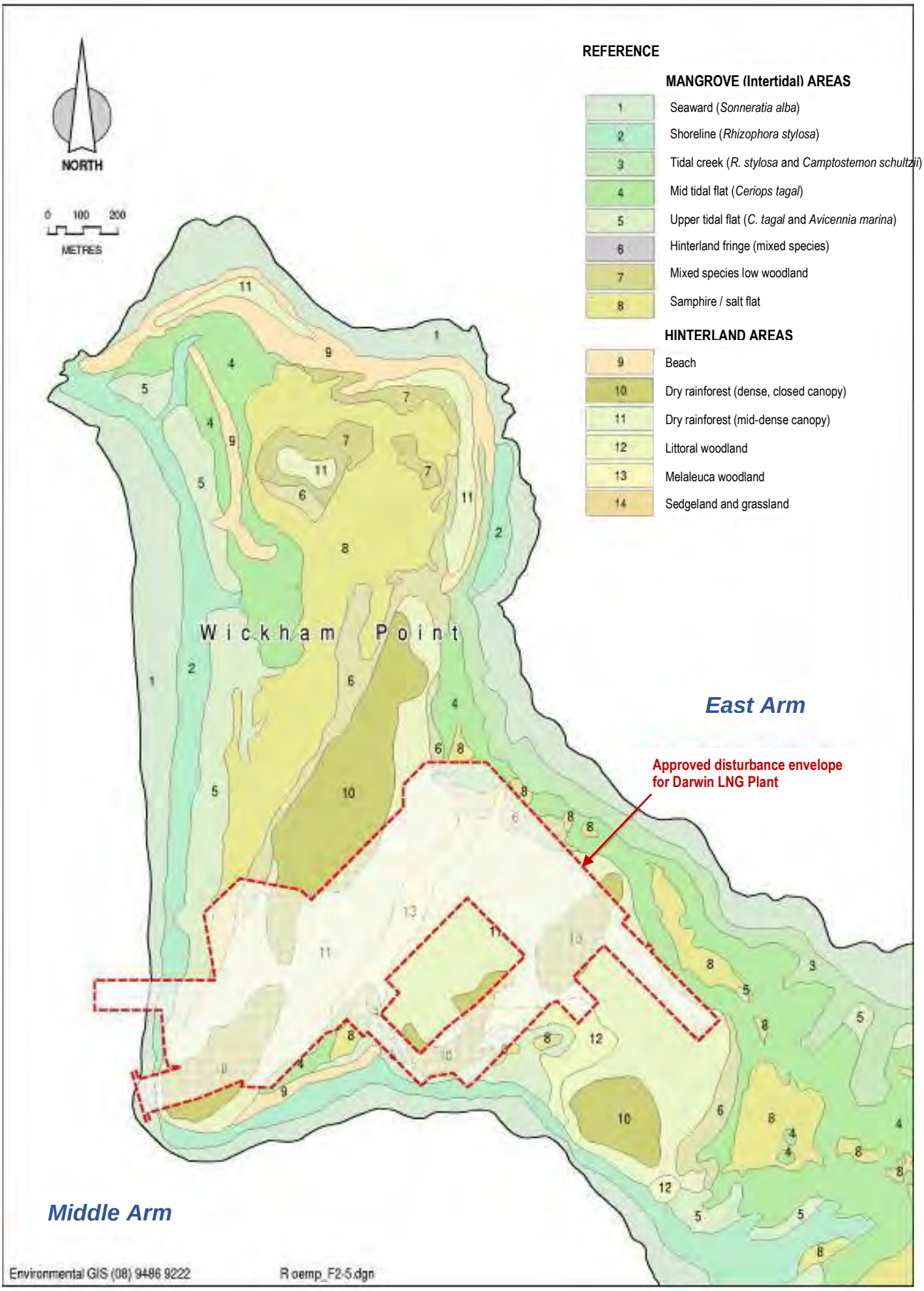


Figure 5-5: Vegetation Communities of Wickham Point

5.2.7.1 Weeds

Weeds are widespread throughout the NT region, including Darwin and Middle Arm Peninsula, with a vast number of records being reported on the NT Governments' Natural Resource Maps (NT Government, 2018). There are 40 declared weeds known to occur in the NT.

Annual weed management (mapping and control) is undertaken at the DLNG Plant and has identified five introduced species within the site (Greening Australia, 2015):

- Mission grass (*Cenchrus polystachios*) – this species is listed as a declared weed under the NT *Weeds Management Act 2001* and recognised as a key threatening process under the Commonwealth EPBC Act;
- Gamba grass (*Andropogon gayanus*) – declared weed under the NT *Weeds Management Act 2001,* is recognised as a key threatening process under the Commonwealth EPBC Act and is listed as a Weed of National Significance (WoNS);
- Lantana (*Lantana camara*) – declared weed under the NT *Weeds Management Act 2001* and is recognised as a WoNS;
- Calopo (*Calopogonium mucinoides*); and
- Passiflora (*Passiflora foetida*).

The weeds are recorded at various locations around the perimeter area and along Wickham Point Road. These weeds are able to active colonise disturbed areas and are spread via animal vectors (e.g. birds) (Greening Australia, 2015).

5.2.8 Fauna

Five fauna habitat types are recognised and described at Wickham Point. These include eucalyptus open forest; mangroves, margins and samphire; monsoon rain forest; paperbark woodland; and intertidal flats. Fauna records below were gathered through field surveys during September 1996 (dry season) and February 1997 (wet season). Reference to existing documentation and databases were also made, further details are available in Appendix I of the Draft EIS (Philips Oil, 1997).

5.2.8.1 Amphibians

All recorded frog species have been found in Eucalyptus open forest during the wet season. Frogs are common in waterlogged areas with sedges. The most common species are Brown Tree Frog *(Litoria rothi*) and Dwarf Tree Frog *(L. bicolor).*

5.2.8.2 Reptiles

Eleven species of reptiles have been recorded for the site, including one species of crocodile, and 10 lizard species. The most commonly recorded species are small skinks of the genus *Carlia*, of which three species have been observed. *Carlia munda* was the most abundant, and was found in all non-marine habitats. *Carlia amax* was only observed around rocky areas in the monsoon vine thickets. Two skinks, *Glaphromorphus darwiniensis* and *G. douglasi*, were observed to be generally confined to the monsoon vine thickets and paperbark forest habitats.

Estuarine crocodiles (*Crocodylus porosus*) occur in Darwin Harbour and are occasionally seen on the mudflats and in the small mangrove creeks around Wickham Point.

Four species of water snake are specialised for life in mangroves, and are very likely to occur in this area. These species are Bockadam (*Cerberus rhynchops*), White-bellied Mangrove Snake (*Fordonia leucobalia*), Richardson's Mangrove Snake (*Moron richardsoni*) and Little File Snake (*Acrochordus granulatus*).

5.2.8.3 Birds

Ninety species of birds have been recorded in the study area during field surveys. An additional 93 species are known to occur in Darwin Harbour. These are likely to be present at Wickham Point. The birds most commonly observed during previous surveys include Bar-shouldered Dove (*Geopelia humeralis*), Sulphur-crested Cockatoo (*Cacatua galerita*), Helmeted Friarbird (*Philemon buceroides*) and Yellow Oriole (*Oriolus flavocinctus*).

More bird species (57 species) were observed in mangrove-associated habitats than in any of the other habitats. The next richest habitat was Eucalyptus open forest.

A great deal of seasonal variation was observed in bird species composition and numbers between two field surveys undertaken in the vicinity on the DLNG Plant site in September 1996 (dry season survey) and February 1997 (wet season survey). Similar numbers of species were observed in each seasonal survey (67 in the dry; 62 in the wet), but only 38 species were recorded on both field surveys, indicating the area has a very high proportion of transient or seasonal migrant species compared to residents. These species are made up of groups such as migratory waders and other wet season visitors. A number of wet season visitors have been recorded during September, which is the usual time for the arrival of seasonal migrants.

Large nesting mounds of the Orange-footed Scrubfowl are a prominent feature of Wickham Point.

5.2.8.4 Mammals

Fifteen mammal species (including two introduced species) have been recorded at Wickham Point during field surveys in September 1996 and February 1997. The Northern Brown Bandicoot (*Isoodon macrourus*) is a common species at Wickham Point. Agile Wallabies (*Macropus agilis*) are occasionally observed around the mangrove fringes and their tracks are seen on the samphire flats.

Microchiropteran (insectivorous) bats have been recorded frequently in Eucalyptus open forest, over tributaries and water bodies and using flyways on mangrove/open forest ecotones. Flying Foxes (*Pteropus alecto*) are occasionally observed in mangrove areas.

Indo-Pacific Humpback Dolphins (*Sousa chinensis*) and Irrawaddy River Dolphins (*Orcaella brevirostris*) are commonly observed in the harbour. Dugongs (*Dugong dugon*) are known to occur in Darwin Harbour, and in the vicinity of East and Middle Arms.

5.2.8.5 Fish

There are no permanent freshwater habitats on Wickham Point or the adjacent mainland peninsula. Wet season freshwater habitats are present in some areas of the mainland peninsula. It is likely that these seasonal freshwater areas provide breeding sites for some estuarine and coastal freshwater fishes.

Harbour waters support a high abundance of resident and transient pelagic tropical fish species. A survey of the Darwin Harbour fish communities was undertaken in 2011 to assess species richness and fish abundance in the Harbour waters (Gomelyuk, 2012). The survey recorded a total of 108 fish species from 41 families with 33 species contributed to 90% of total fish abundance. The five most prevalent species contributed to 51% of all recorded fish and consisted of trevallies, threadfin breams, ponyfishes and batfishes (Gomelyuk, 2012). The coral and deeper filter feeder communities in the Harbour were observed to support the most diverse and abundant fish assemblages. The highest fish biodiversity and abundance was recorded at the Harbour entrance, in the area to the south-west from Channel Island, and at South Shell Island (Gomelyuk, 2012).

5.2.8.6 Introduced Species

Cats are established at Wickham Point and were probably well established before the construction of the DLNG Plant. They currently appear to be present in relatively low numbers. Unless there is any indication of a significant increase in cat numbers or there is identification of a specific threat posed by cats to the survival of any vulnerable native species, there is no reason to implement a cat control program at this time.

Wild dogs are known to occur in the area as evident from tracks, scats and DLNG Plant staff observations. These animals will continue to use the area and the number of wild dogs, although relatively low, will fluctuate in response to seasonal variations and resource availability. As with cats, until proven as a pest or threat to site operations or a threat to the environment of Wickham Point no action to manage these animals is currently required.

Cane toads are established at Wickham Point and may pose a threat to populations of native predators. No indication of detrimental impacts by cane toads on the environment has been reported.

Browsing ants (*Lepisiota frauenfeldi*) were found at Darwin Port and two neighbouring sites in 2015. The species is not established in Australia. Browsing ants form large colonies and pose a threat as they eat and displace native ant species, as well as other insects (NT Government, 2017b).

The Port of Darwin has been determined to be free of introduced marine pest species, with the exception of a sea squirt (*Didemnum perlucidum*) which was confirmed during surveys undertaken for the construction of the Ichthys LNG facility.

5.2.8.7 Biting Pests

Biting insects (mosquitoes and midges) are common at Wickham Point. The mosquito *Ochlerotatus vigilax* is considered to have the greatest potential as a pest and disease vector in the area. It and several other species are known to be vectors for Ross River virus and Barmah Forest virus. The freshwater mosquito, *Culex annulirostris*, is known to occur on Wickham Point, albeit in low numbers, this mosquito can be a vector of Murray Valley encephalitis. Substantial numbers of biting midges breed in the Wickham Point area.

A biting insect monitoring programme was undertaken by the Northern Territory Department of Health and Community Services Medical Entomology Branch (MEB) (2004) during the

construction phase. A post-construction follow-up inspection was undertaken on the site by MEB at the end of 2005, and recommendations provided for on-going site management during the operations phase.

5.2.9 Conservation Values

The Port Darwin wetlands (NT029 Port Darwin) are listed as a Nationally Important Wetland under the Directory of Important Wetlands in Australia. The wetland is significant as it demonstrates a good example of a shallow branching embayment of the Top End Region, supporting one of the largest discrete areas of mangrove swamp in the NT. The site includes the entire embayment (where less than 6 m deep at low tide) of Port Darwin and encompasses 48,000 hectares (of which at least 16,000 ha are mangroves) (DoEE, 2017). The wetlands also provide a major nursery area for estuarine and offshore fish and crustaceans in the Beagle Gulf region (DoEE, 2017).

The Darwin Harbour is recognised as a NT Site of Conservation Significance (SOCS Number 6), with the SOCS encompassing the DLNG Plant and surrounds. The SOCS includes the tidal flats (222 km²) within the Harbour from East Point around to West Point and a buffering terrestrial area (527 km²) (NRETAS, n.d.). The site is recognised for its ecological values as it supports a range of estuarine, freshwater and terrestrial environments including extensive areas of tidal mudflats and one of the largest and most diverse areas of mangroves in the NT (NRETAS, n.d.). The Darwin Harbour environments support a diverse range of terrestrial and marine fauna species, including a number which are listed as threatened under the EPBC Act.

All of the conservation areas in Darwin Harbour are distant from the DLNG Plant site. These include the East Point and Doctor's Gully Aquatic Life Reserves, Charles Darwin National Park and the Channel Island coral community.

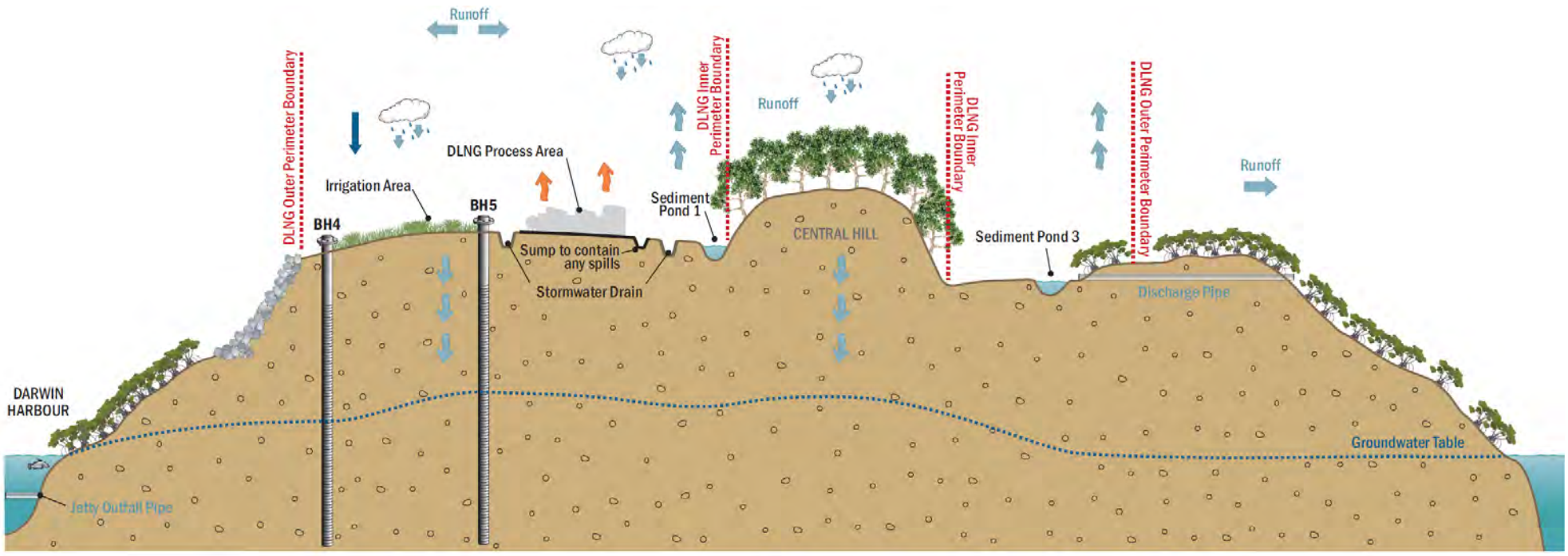
The coral community at Channel Island is listed on the Register of the National Estate[2] and has been declared a Heritage Place under the Northern Territory *Heritage Conservation Act* 1991. The declaration is based on the presence of a relatively diverse coral community, which demonstrates that a coral based community can survive in a highly turbid environment with large tidal variations.

[2] The RNE was closed in 2007 and is no longer a statutory list. However, it is maintained on a non-statutory basis as a publicly available archive and educational resource.

6 CONCEPTUAL SITE MODEL

A conceptual site model representing the key sources of risks, emissions and discharges, potential impact pathways and receptors is presented in Figure 6-1, in both a schematic and tabular form. The model has been developed consistent to the NT EPA 'Guidelines on Conceptual Site Models' (NT EPA, 2013).

The conceptual site model was used in support of the risk assessment process, as discussed in Section 7.



Source	Emission or Discharge (Risk Factor)	Pathway	Receptor			
			Human Health and Community (Including Recreational Values)	Marine Waters (Darwin Harbour) and Wetlands (Port Darwin)	Vegetation and Flora	Fauna
Stack emissions from operation of LNG processing and onsite power generation equipment	Air pollutants and GHG emissions (as per EPL217)	Air	✓		✓	✓
Flaring – marine, ground and NGL flare						
Venting from operation of LNG processing equipment and acid gas venting						
Fugitive air emissions from storage tanks, and the operation of equipment and vehicles						
Failure, rupture, leaks or release from gas or HVAC systems	Air pollutants, GHG emissions and ozone depleting substances					
Operation of LNG processing, onsite power generation equipment and marine vessel activities generating noise, heat and light emissions	Noise, heat and light		✓			✓
Onsite irrigation of plant wastewater	Wastewater discharged (as per EPL217)	Surface water	✓	✓	✓	✓
Discharge of reverse osmosis reject wate via the jetty outfall						
Discharge of stormwater runoff (collected from hardstand areas and onsite stormwater drains) from the sedimentation ponds						
Accidental contamination of stormwater from overflow of process area spill containment	Hydrocarbons and process chemicals					
Accidental hydrocarbon/chemical spills and unplanned releases (due to failure, rupture or leaks) from equipment, process area or jetty	Hydrocarbons, amine, LNG, process chemicals and hydraulic fluid					
Onsite irrigation of Plant wastewater	Wastewater discharged (as per EPL217)	Groundwater	✓	✓	✓	
Accidental hydrocarbon/chemical spill and unplanned release (due to failure, rupture or leaks) from equipment and process area	Hydrocarbons, process chemicals, diesel fuel and hydraulic fluid					
Onsite irrigation of Plant wastewater	Wastewater discharged (as per EPL217)	Land	✓	✓	✓	
Operation of LNG processing and onsite power generation equipment generating vibrations	Ground vibrations		✓			✓
Discharge of stormwater runoff from stormwater drains	Sediment			✓	✓	
Accidental hydrocarbon/chemical spill and unplanned release (due to failure, rupture or leaks) from equipment and process area	Hydrocarbons, process chemicals, diesel fuel and hydraulic fluid		✓	✓	✓	✓
Fire/explosion from operation of LNG processing and onsite power generation equipment	Explosion, loss of vegetation and fauna				✓	✓
Unauthorised access within the site perimeter	Introduction and/or propagation of weeds, disturbance to vegetation		✓	✓	✓	
Consumables and general waste generated from Plant operations	Non-hazardous and hazardous solid and liquid waste					

Figure 6-1: DLNG Conceptual Site Model

7 ENVIRONMENTAL RISK ASSESSMENT

7.1 INTRODUCTION

DLNG Plant operations poses a potential source of risk to the surrounding environment. The environmental risk assessment process is used to evaluate the likelihood of impacts occurring and the likely resulting severity of consequences upon the environment. This process facilitates the assessment of controls potentially applicable to the activity that poses a potential hazard to the environment, and of measures to mitigate the severity of the impact, arising from either planned or unplanned events. The process provides essential input into the assessment of controls and mitigation measures that ensures that the level of risk posed by operational activities to the environment is reduced to an acceptable level and is as low as reasonably practicable (ALARP).

This section details the methodology, outcomes (consequence and likelihood) of the operations environmental risk assessment and links to the OEMP's proposed management measures.

7.2 METHODOLOGY

7.2.1 Overview

ConocoPhillips ABU-W seeks to minimise environmental impact through the active and progressive elimination of hazards and the reduction of risk. This objective is achieved through a systematic and integrated approach to risk management in order to reduce risks to a level that is ALARP.

The environmental hazard identification and risk assessment process applied to the DLNG Plant is based on ConocoPhillips' ABU-W Risk Matrix Standard (ALL/HSE/PRO/040). The ConocoPhillips risk assessment process aligns with the principles of Australian Standard/New Zealand Standard International Organisation for Standardisation (AS/NZS ISO) 31000:2009 Risk Management – Principles and Guidelines (Standard) (AS/NZS ISO, 2009) and Handbook 203:2006 Environmental Risk Management – Principles and Process (Guide) (AS/NZS ISO, 2006).

Key steps in the risk assessment process include:

- Establishing the context with regard to relevant ConocoPhillips management systems (Section 2), legislation/standards (Section 3), project operations/activities (Section 4), existing environment (Section 5) and relevant stakeholder context (Section 9.1.8);
- Identification of hazards/risks associated with the project that may impact the environment, with consideration of ConocoPhillips' operational experience;
- Describing the potential environmental impacts;
- Identification of the existing hazard/risk control measures in place;
- Assessment of the risk with existing control mitigation measures in place to determine the inherent risk. This involves assigning a consequence rating to the potential impact and assessing the likelihood of the potential environmental impact occurring (Figure 7-1);
- Identification and consideration of potential additional control mitigation measures to reduce the risk to ALARP and acceptable level;
- Assessment of risk with any additional control measures in place to determine the residual risk and evaluate if the risk has been reduced to ALARP and is acceptable; and
- Application of further additional controls if needed.

The environmental aspects and sources of risk have been determined on the basis of the DLNG Plant description, facility piping and instrumentation diagrams (P&IDs), operating and maintenance procedures and environmental performance since production operations commenced.

ConocoPhillips Risk Matrix 5x5 (2017)

	Consequence Severity				
	Level 1	**Level 2**	**Level 3**	**Level 4**	**Level 5**
Safety Impact (Appendix B)	Minimal Health effects (First Aid Case or less)	Minor health effects (Restricted Workday Case, Medical Treatment case)	Significant health effects (Loss workday Case without permanent impairment)	Major health effects (Permanent Impairment)	Severe health effects (Fatality and/or multiple hospitalisation
Industrial Hygiene (Appendix E)	Please consult your BU Industrial Hygiene representative and refer to Appendix E for more details				
Environmental Impact (Appendix C)	• Negligible environmental impact • Small contained release that stays onsite	• Minor environmental impact • Onshore release limited to facility and adjacent area • Offshore release mitigated through natural processes	• Moderate environmental impact • Release affects a large offsite area including sensitive habitats • Localized surface/ground water contamination	• Major environmental impact • Catastrophic release impacting sensitive ecosystems, drinking water supplies and/or recreational areas • Widespread surface / ground water	• High environmental impact • Catastrophic release impacting sensitive ecosystems, drinking water supplies, fishing and/ or recreational areas
Financial Loss (Asset damage, Litigation & Environmental remediation)	0-25,000 USD	25,000-250,000 USD	250,000-2,500,000 USD	2,500,000-25,000,000 USD	25,000,000+ USD
Business Interruption	0-25,000 USD	25,000-250,000 USD	250,000-2,500,000 USD	2,500,000-25,000,000 USD	25,000,000+ USD
Public Notification	No Communication to the Public	Select Local Communication	Shelter in Place Notification	Evacuation notification to selected areas of a community	Complete area evacuation
Negative Public Exposure or Reputational Damage	No external coverage	Local coverage	State/Provincial coverage	Persistent Regional coverage	Persistent National coverage
Social Impact (Appendix D)	• No restriction on access and no impact on operations. • Negligible impact to/from key stakeholders. • Issue resolved quickly.	• Brief restriction on access and minor impact to operations • Minor impact to/from key stakeholders • Issue resolved in a minimum amount of time	• Temporary restriction on access and moderate impact to operations • Moderate impact to/from key stakeholders • Issue resolved in a moderate amount of time	• Permanent partial restriction on access and major impact to operations • Major impact to/from key stakeholders • Issue will take a significant amount of time to resolve.	• Extended permanent loss of access and loss of operations •Severe impact to/from key stakeholders •Damage is permanent

		• Consequence Severity				
		Level 1	**Level 2**	**Level 3**	**Level 4**	**Level 5**
LIKELIHOOD	**Frequent (5)**	**RR II**	**RRII**	**RRIII**	**RRIV**	**RRIV**
	Probable (4)	**RR I**	**RR II**	**RR III**	**RR III**	**RR IV**
	Rare (3)	**RR I**	**RR II**	**RR II**	**RR III**	**RR III**
	Remote (2)	**RR I**	**RR I**	**RR II**	**RR II**	**RR II**

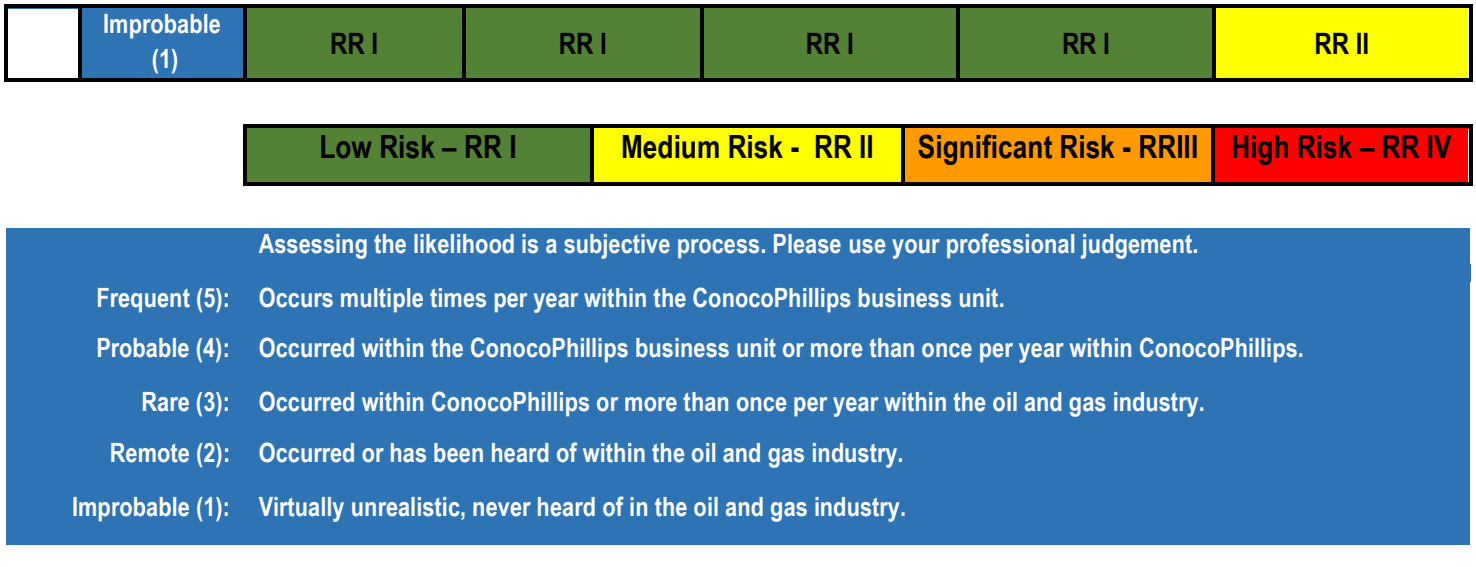


Figure 7-1: Risk Matrix

7.2.2 Risk Identification

An environmental impact identification (ENVID) workshop was undertaken on 29 November 2017 in accordance with the ABU-W Risk Management Procedure (ALL/HSE/PRO/040) to identify and assess risks associated with DLNG operations. The ENVID workshop was attended by a multidisciplinary team of experienced specialists, including advisors from ConocoPhillips and external environmental advisors. The core team of specialists had sufficient breadth of knowledge, training and experience to reasonably assure that risks and associated impacts were identified and assessed. The workshops were informed by:

- A detailed understanding of the environmental and socio-economic setting of the DLNG Plant, as described in Section 5; and
- The knowledge, training and experiences of environmental and technical personnel at the workshop.

7.2.3 Risk Analysis

The environmental risk assessment process is a qualitative risk-screening tool for evaluating the environmental risks posed by DLNG operations. Risks are rated or ranked by identifying the consequence of each risk and then electing the likelihood of each consequence occurring. ConocoPhillips assesses the risk in two key stages:

- Inherent risk analysis – assessment of the potential environment, socio-economic and cultural consequences and the likelihood of consequence occurring with the application of existing control measures (e.g. relevant legislation, ConocoPhillips and contractor procedures, standards, etc.) for each credible risk source scenario; and
- Residual risk analysis – re-assessment of the inherent risk following the application of additional controls/mitigation measures (e.g. hardware controls (engineering), operating personnel competencies, operating plans and procedures, and emergency response plans and arrangements). The residual risk is an indication of the significance of an environmental, socio-economic or cultural impact, taking into account the management approach expected to be applied throughout the activity to achieve acceptable outcomes.

Two key factors underpin the environmental risk assessment:

- The severity of the consequences in the event that impact does occur; and

- The likelihood of receptors at risk being impacted.

The level of risk is determined by establishing the potential consequence of an impact on an environmental, socio-economic or cultural receptor resulting from an aspect of DLNG operations. In evaluating the level of consequence of a potential event, the following factors have been considered:

- Extent of impacts: whether the impact affects the local or wider regional environment;
- Frequency and duration of the impact: how often the impact will occur and how long it will interact with the receiving environment; and
- Sensitivity of the receiving environment: nature importance (local, national or international significance) and the sensitivity or resilience to change of the receptor that could be affected. This also considers any laws, regulations or standard aimed at protecting the receiving environment.

The risk analysis frames the assessment of controls that could be applied during execution of activities that pose a potential hazard to receptors. It also provides a framework to identify the measures to mitigate the severity of the impact arising from either planned or unplanned events. The process provides essential input into the assessment of controls and mitigation measures that ensures that the level of risk posed by a particular activity to a sensitive receptor is acceptable and reduced to ALARP.

7.2.4 Risk Evaluation

The evaluation of the environmental risks was undertaken in the context of acceptability and ALARP, which are described in detail below.

7.2.4.1 Demonstration of Acceptability

ConocoPhillips takes into account a range of considerations when evaluating the acceptability of environmental impacts and risks associated with its projects, including:

- The principles of ecologically sustainable development;
- Other requirements, including relevant environmental legislation, international agreements and conventions, guidelines and codes of practice;
- Internal context – alignment with ConocoPhillips ABU-W HSEMS, ABU-W HSE&SD Policy and company standards and systems; and
- External context – potential environmental consequence and stakeholder expectations.

7.2.4.2 Demonstration of ALARP

ConocoPhillips considers risks are reduced to ALARP when the cost and effort required to further reduce risk is disproportionate to the risk benefit gained. In all cases, residual risk must be reduced to low or medium. The demonstration of ALARP includes consideration of the following:

- Compliance with relevant legislation, accepted industry codes and standards, including standard industry practice and guidelines;
- Implementation of effective management system controls;
- Incorporation of barriers/control measures commensurate with the potential impact and risk from the activity; and

- Confirmation that the cost/benefit/sacrifice and effort of adding further barriers/control measures is grossly disproportionate to the potential reduction in risk. This is achieved through the identification and evaluation of further measures to determine those appropriate for implementation (i.e. practicable).

To demonstrate ALARP the following process is followed:

- Low residual risk (i.e. RR I): 'Acceptable' level of risk utilising standard industry practice to control the risk. The activity also meets legislative requirements, regulator expectations and industry guidelines. No additional mitigation controls are required as they are not reasonably practicable (i.e. disproportionate to the benefit obtained);

- Medium residual risk (i.e. RR II): 'Acceptable' level of risk with controls verified to reduce the risks and impacts to ALARP. Industry best practice is applied for these risks. No additional mitigation required where controls can be verified as functional. ALARP should be evaluated, as necessary; and

- Significant residual risk (i.e. RR III) and High residual risk (i.e. RR IV): Not 'ALARP' without the use of industry best practice and the implementation of industry benchmarking, local and international guidelines/ standards and stakeholder engagement. The risk will be managed utilising prevention and/or mitigation with priority and the issue promoted to appropriate management level with commensurate risk assessment detail.

The assignment of inherent and residual risk is based on the level of understanding of the different project aspects informed by:

- observed experience and monitoring during operations of the DLNG facility;

- the availability of detailed scientific literature;

- the availability of relevant guidelines and standards; and

- industry experience and project definition on specific wastes, emissions and discharges.

Through a risk-based process, an informed assessment to assign a residual risk level is required, including acknowledged uncertainties or gaps such as a lack of definitive information on a specific factor, the requirement for modelling associated with specific routine or unplanned activities or the level of detailed design. Where relevant, additional knowledge gathering is undertaken as part of the risk-based process to address identified gaps in the form of:

- modelling studies to inform the assessment of potential impacts from discharges;

- targeted engagement with recognised industry experts in key areas to further inform understanding of a specific issue, in addition to published literature; and

- interpretation of the environmental context of the DLNG facility and surrounds, building on the ongoing environmental monitoring and management.

As new information becomes available and risk reduction measures are applied, the risk assessment process allows for review of risk levels to determine residual risk. This has been taken into account to inform the updated risk basis to refine the level of uncertainty.

7.3 SUMMARY OF KEY OUTPUTS

Potential environmentally hazardous events are identified for five broad environmental effects categories:

- Atmospheric Emissions (GHGs, air pollutants, ozone depleting substances, and associated emissions of noise and heat);

- Liquid Discharges (wastewater, process contaminants and liquid hydrocarbons);

- Vegetation and Ecosystems (including the effects of heat, noise and vibration);
- Waste Management (handling and disposal); and
- Socio-Economic (effects on community stakeholders) and Cultural Heritage.

The qualitative risk assessment identified a total of 46 potential risks. Eighteen were assessed as 'medium' and 28 assessed to be 'low' residual risk. Table 7-1 shows the risk assessment, with management controls and mitigation measures for each of the potential risks.

Table 7-1: Environmental Hazards, Potential Effects and Risk Assessment

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
Atmospheric Emissions (GHGs, Air Pollutants, Ozone Depleting Substances and Associated Emissions of Noise and Heat)											
A1	Planned – Fuel gas consumption by Refrigerant Compressor Turbines	Stack emissions – Exhaust and GHG emissions from refrigerant compressor turbines	The refrigerant compressor turbines are the most material source on site contributing approximately 50% of the total GHG inventory. Hot exhaust gas discharge causes a local effect on microclimate in the vicinity of the facilities.	• Refrigerant compressor turbines run on fuel gas produced at the plant. Fuel gas is the cleanest fuel that could be used at the DLNG Plant. (A1.1) • Installation of GE LM2500+G4 aero-derivative refrigerant compressor turbines that have a high thermal efficiency (lower fuel consumption). (A1.2) • Four of the 6 exhaust gas stacks are equipped with waste heat recovery units (WHRUs) on the refrigerant compressor turbines, designed to recover heat to generate steam for use in processing operations. (A1.3) • Water injection is implemented to reduce NOx emissions which is monitored through regular exhaust gas compositional analysis. (A1.4) • Operations undertaken in accordance with the Process Operating Guideline (POG) which describes the method of efficient operation of key equipment. (A1.5) • Stack emissions monitoring completed on a biannual frequency. (A1.6)	2 Minor	5 Frequent	RR II Medium	Ambient air monitoring undertaken to verify ground concentrations of key emissions. Ambient air monitoring results undertaken in 2016 showed that air emissions in the Darwin airshed were below relevant air quality standards and guidelines for NO_2, CO, SO_2, benzene, toluene and p-xylene. There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	5 Frequent	RR II Medium
A2	Planned – Fuel consumption by the OSPG Solar Taurus 60's Turbines	Stack emissions – Exhaust and GHG emissions from the OSPG gas turbines (Note two of the five OSPG turbines are able to be dual diesel/feed gas-fuelled. Diesel is only used during emergencies)	Onsite power generation accounts for approximately 5% of the total GHG emissions inventory. Hot exhaust gas discharge causes a local effect on microclimate in the vicinity of the facilities.	• Primary fuel source for all units is fuel gas, with three of the five turbines running on feed gas only. Diesel use is primarily for emergency use only. (A2.1) • OSPG Solar Taurus 60's fitted with Solonox II technology for NOx control. (A2.2) • Regular annual maintenance undertaken of key equipment to ensure efficient combustion. (A2.3) • Stack emissions monitoring completed on a biannual frequency. (A2.4)	1 Negligible	5 Frequent	RR II Medium	Ambient air monitoring results undertaken in 2016 showed that air emissions in the Darwin airshed were below relevant air quality standards and guidelines for NO_2, CO, SO_2, benzene, toluene and p-xylene. There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Negligible	5 Frequent	RR II Medium
A3	Planned – Fuel consumption by the process boiler	Stack emissions – Exhaust and GHG emissions from boiler stack	The boiler is operated continuously and contributes to approximately 1% of the total GHG inventory. Hot exhaust gas discharge causes a local effect on microclimate in the vicinity of the facilities.	• Boiler annual maintenance completed in line with planned maintenance philosophy. (A3.1) • Stack emissions monitoring completed on a biannual frequency. (A3.2) • WHRU's used as the primary supply of steam to the plant, to minimise boiler requirement. (A3.3)	1 Negligible	5 Frequent	RR II Medium	Ambient air monitoring results undertaken in 2016 showed that air emissions in the Darwin airshed were below relevant air quality standards and guidelines for NO_2, CO, SO_2, benzene, toluene and p-xylene. It is considered that additional risk management or mitigation controls to further reduce the impacts and risks are not required. The residual risk is considered acceptable and ALARP.	1 Negligible	5 Frequent	RR II Medium

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
A4	Planned – Acid gas disposal via AGI	Stack emissions – Exhaust and GHG emissions from AGI stack (80% CO_2, 3% O_2, the remaining composed of combustion components NO_x, SO_2, CO, H_2O)	The AGI contributes to approximately 40% of the total GHG inventory when the AGI is the primary disposal method of acid gas. Hot exhaust gas discharge causes a local effect on microclimate in the vicinity of the facilities.	• Equipment is operated at an optimum temperature range (notionally 810ºC) to achieve complete combustion. (A4.1) • Annual maintenance undertaken on equipment to ensure efficient combustion. (A4.2) • Stack emissions monitoring completed on a quarterly frequency. (A4.3)	2 Minor	5 Frequent	RR II Medium	Ambient air monitoring results undertaken in 2016 showed that air emissions in the Darwin airshed were below relevant air quality standards and guidelines for NO_2, CO, SO_2, benzene, toluene and p-xylene. One exceedance was recorded for H_2S (single occurrence during process upset and not representative of steady state). It is considered that additional risk management or mitigation controls to further reduce the impacts and risks are not required. The residual risk is considered acceptable and ALARP.	2 Minor	5 Frequent	RR II Medium
A5	Planned – Fuel consumption (diesel) by operations processes e.g. three firewater pumps, auxiliary air compressors, the stand-by diesel generator and the black start diesel generator	Stack emissions – Exhaust gas emissions from the stand-by diesel and black start generators	GHG emissions and air pollutants from fuel combustion. The stand-by diesel generator and the black start generator are only used occasionally (i.e. 1 hour per week during testing and then emergency use only).	• Use of ultra-low sulphur diesel fuel. (A5.1) • Regular annual maintenance undertaken to ensure efficient combustion. (A5.2)	1 Negligible	5 Frequent	RR II Medium	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Negligible	5 Frequent	RR II Medium
A6	Planned – Operation of ground (wet and dry) flare – purge and pilot gas flaring	Flaring of hydrocarbons through the wet and dry flares (routine flaring emissions, including during planned shutdowns)	Flaring accounts for approximately 2% of the total GHG emissions inventory. Minor residual heat and light radiation from ground flare to surrounding vegetation and environment. Exhaust gas from the ground flare creates a plume of hot gas, which dissipates under the effects of plume buoyancy and winds.	• Radiation shield installed around ground flare to prevent radiation, heat and light amenity effects to surrounding vegetation, piping, roads and site staff. (A6.1) • Plant design and operational monitoring to achieve flaring efficiency, inclusive of (A6.2): ○ Plant design (flare tip efficiency). ○ Flare Knock-out Drums (wet and dry ground flares) for liquids recovery. ○ Low pressure (LP) Flare system for LP hydrocarbon emissions. ○ Flame sensors for monitoring safe operation of flare pilots. ○ Closed Circuit TV flare pilots monitoring. • Provide Darwin International Airport air traffic control with planned flaring activity a minimum 1 hour prior to commencement. (A6.3)	1 Negligible	5 Frequent	RR II Medium	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Negligible	5 Frequent	RR II Medium

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
A7	Planned – Operation of the marine flare (flare purge gas, flaring of LNG carrier cold down vapours and LNG tank vapours)	Flaring of excess LNG vapour through the dedicated marine flare, including fuel gas, used for purge and pilot gas	Annual GHG emissions due to routine flaring through the marine flare system (i.e. ship loading operations and fuel gas flare purge) amount to approximately 1% of the total GHG emissions inventory Emission of air pollutants such as NOx and CO. Radiation, light and heat impacts to adjacent environment.	• The LNG vapour recovery system is designed to recover the LNG boil off vapour during ship loading operations to reduce the volume of gas sent to the marine flare. (A7.1) • Unit 24 LNG ship loading procedure – requires two BOG compressors to be running during ship loading, which increases the efficiency of loading operations and reduces flaring. (A7.2) • Unit 24 Cargo Operations Gassing Up of Inert Tankers and/or Extended Cool down of Warm Inert or Off-Spec Ships Procedure – outlines safe method of ensuring ship meets DLNG requirements for ship loading including process for flaring. (A7.3) • Regular annual maintenance undertaken of key equipment to ensure efficient combustion. (A7.4) • Design and siting of the flare, including: (A7.5) o Relatively low height of marine flare and partial shielding by the LNG tank to reduce the radiation effects and light spillage to surrounding marine and terrestrial environments. o The siting of the flare takes into consideration the location of surrounding vegetation, i.e. an adequate buffer for fire mitigation is maintained. • DLNG Marine Terminal Handbook (restrictions on venting from cargo tanks within Port of Darwin and minimise night-time flaring during LNG offloading). (A7.6)	1 Negligible	5 Frequent	RR II Medium	Some low clearing of vegetation in the vicinity of the marine flare is undertaken to ensure an adequate buffer is maintained to prevent fires occurring. The residual risk is considered acceptable and ALARP.	1 Negligible	5 Frequent	RR II Medium
A8	Planned – Flaring to NGL flare to combust NGL vapours during truck loading operations	Flaring of NGL from the NGL flare.	Intermittent combustion emissions from operation of the NGL flare	• Equipment is operated within design specifications during normal operations to achieve complete combustion. (A8.1) • Flare ignited as part of the NGL loading procedure, i.e. operated on a needs basis. (A8.2)	1 Negligible	5 Frequent	RR II Medium	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Negligible	5 Frequent	RR II Medium
A9	Planned – Venting of nitrogen rich gas through the nitrogen vent	Venting of methane and nitrogen through the nitrogen vent (occurs when the helium plant trips, as this results in the NRU waste stream being vented to atmosphere)	Intermittent venting of GHG (methane and nitrogen) to atmosphere. Total annual NRU flow is approximately 23 kNm^3, of this 19 kNm^3 is sent to BOC. The remainder is vented through the NRU vent.	• Monitoring of methane content – once a certain threshold is reached (>10%), the high methane content of the NRU stream is diverted back into the system for further processing. (A9.1) • Option to send high methane content NRU vent to flare. (A9.2)	1 Negligible	5 Frequent	RR II Medium	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Negligible	5 Frequent	RR II Medium
A10	Planned – Acid gas hot venting when AGI is offline	Hot venting of acid gas, containing 6% H_2O, 90% CO_2, with the remaining 4% composed of benzene, H_2S, and methane	Venting of CO_2 and methane to the atmosphere. Increase in benzene and H_2S emissions. Decline in local air quality, resulting in a local effect on the microclimate in the vicinity of the facilities.	• EPL217-01 details the number of days the AGI is down for maintenance per year (no more than 55 days) and hence limits the number of hot venting days. (A10.1) • Vented through exhaust of refrigerant compressor turbine Unit 1611 and Unit 1621 to aid dispersion. (A10.2) • Monitoring of acid gas composition on a quarterly basis. (A10.3) • Acid gas hot venting trial requirements prescribed in EPL217-01 Appendix C. (A10.3)	2 Minor	5 Frequent	RR II Medium	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	5 Frequent	RR II Medium

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
A11	Planned – Equipment maintenance venting associated within Process Safety Valves	Venting of nitrogen and residual hydrocarbons through the flare system or through local equipment vents	Venting of nitrogen and residual hydrocarbon gases (methane and VOCs) to atmosphere. Minor GHG emissions. Highly localised and temporary decline in air quality.	• Standard Isolation Procedures (SIPs)/Standard Operating Procedures (SOPs) implemented to verify maintenance is undertaken in the correct manner, including: (A11.1) o Prior to maintenance, all process fluids will either be drained or flared where possible to minimise venting of hydrocarbons to atmosphere (equipment maintenance procedures).	1 Negligible	5 Frequent	RR II Medium	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Negligible	5 Frequent	RR II Medium
A12	Planned – Storage of fuels (e.g. diesel)	Fugitive VOC emissions from diesel storage tanks	Minor emissions of volatile hydrocarbons (typically peaking during fuel loading operations, when the vapour space in the storage tanks is displaced by liquid).	• Vents typically located on tank tops to facilitate dispersion of volatile emissions and provide segregation from potential ignition sources. (A12.1)	1 Negligible	4 Probable	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Negligible	4 Probable	RR I Low
A13	Planned – Production operations	Fugitive emissions from equipment including piping connectors, valves, flanges and calibration gases	Fugitive emissions from valves, flanges, pump seals, connectors and other equipment contribute to VOC emissions from the DLNG plant.	• Monitoring of key fugitive emissions sources, including: (A13.1) o Process monitoring system (pressure and temperature controls), gas detection systems and line of sight detectors. o Once per shift walkaround – visual inspection of key operating equipment. o Corrosion testing. • Fugitive emissions register – used to record/monitor emissions (targeted) and identify any leakages. The register is also used determine maintenance/repair requirements and priorities. (A13.2) • Maintenance/repair requirements are managed through SAP. (A13.3) • Plant design considers the selection of appropriate materials (valve specifications, flange minimisation). (A13.4)	1 Negligible	4 Probable	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Negligible	4 Probable	RR I Low
A14	Unplanned – Plant emergency shutdown and maintenance resulting the need to flare through the ground flare (partial or full blowdown)	Increased flaring emissions through the wet and dry flares (non-routine flaring emissions)	Majority of flaring is non-routine flaring from the ground flare with associated increase in emissions of air pollutants such as NOx, SO_2 and CO. Increase in noise levels over 'background' noise levels. Minor residual heat and light radiation from ground flare to surrounding vegetation and environment.	• There are safety systems in place (Safety Instrumented System and the Independent Safety Instrumented System) which prevent over pressurisation of the system and hence reduce the flaring requirement. (A14.1) • Improvements made on the advanced process control has made production more reliable, resulting in a decrease in flaring. (A14.2) • Unplanned events of flaring are recorded through the Deferred Production Opportunity process, which triggers investigation to reducing the reoccurrence of the event. (A14.3)	2 Minor	5 Frequent	RR II Medium	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	5 Frequent	RR II Medium

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
A15	Unplanned – Upset/ maintenance flaring through the marine flare	Increased flaring emissions from the marine flare (non-routine flaring as a result of BOG trips or triggering of the Emergency Shutdown Process)	Annual GHG emissions due to non-routine flaring through the marine flare system have been estimated at approximately 5,000 tonnes CO_2-e per annum. Associated increase in emissions of air pollutants such as NOx, SO_2 and CO. Night-time flaring could attract/ disrupt the local fauna habitat due to light acting as an attractant.	• BOG compressors are used to manage (i.e. receive) excess gas within the LNG tank to prevent flaring. (A15.1) • Regular annual maintenance undertaken on BOG compressors to minimise trips. (A15.2) • SOPs have been implemented to avoid upset conditions. (A15.3)	2 Minor	4 Probable	RR II Medium	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	4 Probable	RR II Medium
A16	Unplanned – Accidental release of hydrocarbon gas from the process and/ or utilities areas	Release of hydrocarbons to atmosphere (due to over-pressurisation)	Release of GHG (methane) and volatile organic hydrocarbons (ethane etc.) via Process Safety Valves (PSVs) to atmosphere.	• Inventory isolation (Emergency Shutdown Valves) and plant emergency depressurisation through the ground flare. (A16.1) • Gas and fire detection and emergency response systems to prevent escalation of an incident to a significant event. (A16.2) • Regular equipment inspections and preventative maintenance. (A16.3) • Process control system – Safety Instrumented System and Independent Safety Instrumented System. (A16.4)	2 Minor	2 Remote	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	2 Remote	RR I Low

A17	Unplanned – Accidental release of refrigerants (propane and ethylene) from storage areas (i.e. non-process related)	Unplanned leaks – Release of refrigerants (propane and ethylene) to atmosphere	Propane is not recognised as a primary GHG and has no ozone depleting potential. However, it is known to react with NOx to form ozone and other photochemical oxidants.
			Ethylene is a naturally occurring gas with no known GHG or air pollutant.
			Flammable gas, which if not ignited, will rapidly disperse in the atmosphere.
				• Monitoring of refrigerant storage areas, including: (A17.1)
				  ○ Process monitoring system and alarms have been installed to detect any releases.
				  ○ Equipment inspections, including corrosion testing.
				  ○ Once per shift walkaround – visual inspection of key operating equipment.
				• Emergency shutdown and inventory isolation. (A17.2)
				• Gas and Fire Detection Systems. The fire and gas systems were upgraded in 2017. (A17.3)
				• Plant design considers the selection of appropriate materials. (A17.4)
				• Preventative annual maintenance undertaken, as required. (A17.5)
					2
					Minor
						2
						Remote
							RR I
							Low
								The rupture/burst discs for the Pressure Safety Elements in the propane dehydration mercury removal unit have been removed, thereby reducing the potential for this unplanned event to be triggered.
								The residual risk is considered acceptable and ALARP.
									2 Minor	2
										Remote
											RR I
											Low

A18	Unplanned – Heating, ventilation and air conditioning (HVAC) system loss of containment	Release of refrigerant from permanent buildings' HVAC systems	Release of R134A and FM200 to atmosphere. R134A has a high global warming potential, but is not an ozone depleting substance (ODS).	• Use of a licensed contractor for the annual maintenance of the HVAC systems. (A18.1) • No ODSs are used at the DLNG plant. (A18.2) • The ABU-W Chemical Management Procedure includes a stringent chemical approval process to limit the use of chemicals which are ozone depleting and have a global warming potential. (A18.3)	1 Negligible	3 Rare	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Negligible	3 Rare	RR I Low

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
Liquid Discharges (Wastewater, Process Contaminants and Liquid Hydrocarbons)											
D1	Planned – Effluent, stormwater and sewage treatment and discharge	Use of Plant wastewater effluents for onsite irrigation	Potential for soil and groundwater contamination with salts, heavy metals, nutrients (nitrogen and phosphorus), traces of hydrocarbons, microbiological constituents and traces of process chemicals. Ecotoxic effects on marine environment, if chemicals are released to Darwin Harbour (secondary receptor).	• Routine sampling completed on treated effluent for various analytes, frequency of analysis is based on the associated environmental risk per analyte. (D1.1) • Oily water from the DLNG Process area, including stormwater, is processed through the Corrugated Plate Interceptor (CPI) and Dissolved Air Flotation (DAF) Treatment System to reduce hydrocarbon content in discharge water. The DAF is operated per design specifications. The oil portion from the separation process is diverted to a waste oil tank for offsite disposal. (D1.2) • Effluent wastewater from DLNG is treated through an Activated Sludge Sewage Effluent System, which is operated per design specifications and per the Operations Manual. (D1.3) • Dilution of CPI and sewage treatment plant effluents with TAHS/boiler blowdown water. (D1.4) • Continued implementation of the DLNG Groundwater monitoring program and Mangrove Monitoring Program to monitor any long-term environment impacts of irrigation practises. (D1.5) • Monitoring of discharge volumes and flow rate. (D1.6) •	2 Minor	2 Remote	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	2 Remote	RR I Low
D2	Planned – Process water discharge	Discharge of RO reject water to Darwin Harbour	Reverse Osmosis (RO) Plant reject water is discharged to the harbour via the Jetty Outfall. The RO reject water is essentially potable water containing elevated concentrations of ions. This discharge will result in a small change in water quality, experienced in the immediate vicinity of the jetty outfall only. There will be some increase in the concentration of some ions, but these will be diluted to background concentrations within the immediate vicinity of the jetty. Ecotoxic effects on marine environment, if chemicals are released to Darwin Harbour.	• Feed water to the RO Plant is potable water quality, sourced from the utility provider. (D2.1) • During normal operations of the DLNG demineralised water plant, the RO reject water quality is relatively stable and predictable, however dependant on potable water quality. (D2.2) • RO Plant operated within design envelope. (D2.3) • Water quality is monitored and reported on a monthly or annual basis dependant on analyte risk profile. (D2.4) • Development of a Jetty Outfall Performance Improvement Plan, which aims to better understand and potentially minimise the extent and impact of discharges to Darwin Harbour from the Jetty Outfall. The Performance Improvement Plan is subject to NT EPA approval prior to implementation and is a requirement of EPL217-01. (D2.5) • Effluent is discharged from the end of the jetty at a deep enough location to prevent exposure during low tides, with the discharge point located at 6 m below Lowest Astronomical Tide. (D2.6) • Monitoring of discharge volume and flow rate. (D2.7)	1 Negligible	4 Probable	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Negligible	4 Probable	RR I Low

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
D3	Planned – Stormwater discharge from sediment ponds	Discharge of stormwater from Sedimentation Ponds 1, 2 and 3 to Darwin Harbour via mangroves	Potential for sediment carry over from the DLNG site to harbour, resulting in increased sediment deposition in the mangrove communities surrounding the plant site. Potential change to mangrove ecosystem, such as fauna and tree stress, density and diversity changes, as a result of increase in fresh water inflows, excess sediment and addition of salts, hydrocarbons or heavy metals. Ecotoxic effects on marine environment, if chemicals are released to Darwin Harbour.	• Sedimentation ponds built during the DLNG Plant construction phase to control sediment carry over from stormwater run-off to the harbour. (D3.1) • Sedimentation ponds designed to handle the worst-case rainfall event. Sedimentation is via gravity separation. (D3.1) • Sediment ponds were divided in two by a rock wall in 2012 to improve discharge water quality, by increasing the residence time. (D3.1) • Routine inspection and maintenance is undertaken on the stormwater drains and ponds. (D3.1) • Water quality monitoring for suspended solids and pH undertaken monthly during discharge. Further analytes to determine water quality are monitored on a monthly or annual basis dependant on analyte risk profile. (D3.2) • Continued implementation of the DLNG Mangrove Monitoring Program to monitor, if any, downstream impacts. (D3.3)	2 Minor	2 Remote	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	2 Remote	RR I Low
D4	Planned – Stormwater discharge from clean stormwater outfalls, NGL bund and LNG containment sump	Discharge of stormwater via clean stormwater outfalls, NGL bund and LNG sump to harbour	Influx of fresh water to harbour, affecting the salinity of the immediate receiving water environment only.	• Sumps are maintained clean and any spills pumped out, with oily water treated though the CPI/DAF system. (D4.1) • Once per shift walkaround – visual inspection of key operating equipment. (D4.2) • Inspection program for the NGL tank where rainfall events have occurred. Visual and olfactory observations undertaken prior to discharge. Inspection recorded in OPRALOG. (D4.3) • Continued implementation of the DLNG Mangrove Monitoring Program to monitor, if any, downstream impacts. (D4.4)	1 Negligible	4 Probable	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Negligible	4 Probable	RR I Low

D5	Unplanned – Diesel spill during diesel loading/ transfer operations or from a diesel storage tank leak (within any area of the Plant)	Spill – Overflow of diesel to clean stormwater	Contamination of stormwater drain with diesel. If spill occurs in the wet season, potential for diesel carry over to harbour via clean storm water ditch outlet.
			Minor transient contamination with hydrocarbons. Diesel will eventually biodegrade in the marine environment.
			Localised soil contamination, and ecotoxic effect on land based ecosystems and vegetation and fauna communities within site perimeter.
				• Sump valves are always in the closed position unless clean bund stormwater is drained to the clean stormwater ditches. (D5.1)
				• Once per shift walkaround – visual inspection of key operating equipment. (D5.2)
				• Sumps are maintained clean and any spills pumped out with oily water treated though the CPI/DAF system. (D5.3)
				• Bulk fluid transfer/loading operations include: (D5.4)
				  ○ Bulk fluid transfers undertaken in bunded areas.
				  ○ Verification of volumes of bulk fluids transferred between vessels and facilities.
				  ○ Use of dry break hoses for liquid wastewater transfer operations (road tanker off takes).
				  ○ Operator required to be present in the area during fuel transfers.
				• In the event of a spill, the DLNG Emergency Response Plan (ERP) will be implemented to ensure environmental harm is minimised. (D5.5)
					2
					Minor
						3
						Rare
							RR II
							Medium
								There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2
									Minor
										3
										Rare
											RR II
											Medium

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
D6	Unplanned – Amine spill during loading operations	Spill – Overflow of amine to clean stormwater drain	Contamination of clean stormwater drain with amine (generation of hazardous liquid and solid waste). If spill occurs in the wet season, potential for amine carry over to harbour via clean stormwater ditch outlet. Direct effects include fish mortality (amine is toxic to marine life) or indirect effects of bioaccumulation in the ecosystem.	• Below ground sump valves are always in the closed position unless clean bund stormwater is drained to the clean stormwater ditches. (D6.1) • Once per shift walkaround – visual inspection of key operating equipment. (D6.2) • In the event of a spill, the DLNG ERP will be implemented to ensure environmental harm is minimised. (D6.3)	2 Minor	4 Probable	RR II Medium	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	4 Probable	RR II Medium
D7	Unplanned – Process area hydrocarbon or chemical spill	Spill – Overflow of process area spill containment sump to clean stormwater drains	Discharge of potentially contaminated stormwater with traces of hydrocarbons and process chemicals to harbour. Ecotoxic effects on marine fauna (through ingestion of contaminated water). No noticeable impact on water quality or ecosystem health is expected.	• Process control – Safety Instrumented System and Independent Safety Instrumented System. (D7.1) • Gas detection system to detect loss of hydrocarbons from vessels and pipelines. (D7.2) • Process area spill containment sump is designed and maintained to impound 612 m^3 of runoff (contaminated stormwater) from the DLNG process area. (D7.3) • Oil skimmer fitted in process area spill containment sump. Sump pump starts and stops automatically on high and low levels in the sump. (D7.4) • Once per shift walkaround – visual inspection of key operating equipment. (D7.5) • Sumps are maintained clean and any spills pumped out with oily water treated though the CPI/DAF system. (D7.6) • In the event of a spill, the DLNG ERP will be implemented to ensure environmental harm is minimised. (D7.7) • Appropriate chemical and hazardous substance segregation and storage onsite in a specific hazardous storage facility. (D7.8) • ABU-W Chemical Management Procedure, ALL/HSE/PRO/044. (D7.9) • Secondary containment for chemicals and hydrocarbon liquids stored on DLNG site. (D7.10) • Approved chemicals and hazardous substances recorded on DLNG Approved Chemicals and Hazardous Substances Register, DLNG/HSE/REG/001. (D7.11) • Consumption of chemicals to be tracked via DLNG inventory stock control records. (D7.12)	2 Minor	2 Remote	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	2 Remote	RR I Low

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
D8	Unplanned – Spill of LNG from loading operations	Spill – Discharge/ overflow of LNG to harbour	Minor and temporary contamination with hydrocarbons. LNG will evaporate on contact with water (due to heat absorption from ambient air and water).	• Process monitoring (pressure, temperature and flow monitoring). (D8.1) • Operator attendance and visual monitoring of loading operations at jetty. (D8.2) • Equipment inspections prior to loading operations. (D8.3) • Preventative maintenance schedule. (D8.4) • Once per shift walkaround – visual inspection of key operating equipment. (D8.5) • In the event of a spill, the DLNG ERP will be implemented to ensure environmental harm is minimised. (D8.6)	2 Minor	2 Remote	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	2 Remote	RR I Low
D9	Unplanned – Total failure of a loading arm and the associated powered emergency release coupler (PERC) automatic shutoff system	Spill of LNG liquid during LNG loading onto LNG carrier This scenario assumes that the failed loading arm section is positioned above water (typically the arm stretches across an open water gap of 3 m between the jetty's edge and the ship's edge)	Between 117 – 167 m^3 of LNG released from primary containment (based on loading rate of 7,000 – 10,000 m^3/h and a one minute event duration based on incident detection and response time). Minor and temporary contamination with hydrocarbons. LNG will evaporate on contact with water (due to heat absorption from ambient air and water). There is an aggressive reaction due to the phase transfer.	• Pre-loading inspections of the loading arms and the associated PERC automatic shutoff system, as per 'Routine Testing of Double Ball Valves and PERC' and 'LNG Storage and Loading Normal Operation' Operating Procedures. (D9.1) • Operator attendance and visual monitoring of loading operations at the jetty. (D9.2) • Remotely controlled emergency shut-down valves, initiated by the shutdown loading, shut off the LNG supply to the loading arms. (D9.3) • Automatic and manual means to shut down the LNG transfer pumps and stop the transfer of LNG to the LNG loading arms. (D9.4) • Loading operations to be shut down in an emergency arising from the LNG carrier. (D9.5) • Water curtains on the tanker will expedite vaporisation of LNG and secondary hazards. (D9.6) • In the event of a spill, the DLNG ERP will be implemented to ensure environmental harm is minimised. (D9.7)	2 Minor	1 Improbable	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	1 Improbable	RR I Low
D10	Unplanned – Activation of PERC during ship loading operations (e.g. resulting from ship emergency or ship moving outside loading envelope)	Spill of LNG from loading arm to harbour This scenario assumes the distance/angle limit is exceeded, causing the loading arms to be switched on	Up to 50 L per loading arm or 100 L in total for the two LNG loading arms. LNG vapour release to atmosphere from return vapour arm.	• The mooring lines on the carrier have tension sensors and alarms to DLNG Marine Terminal Building Control Room and the Tanker's Control Room. (D10.1) • Mooring and loading requirements are reiterated at the pre-load meeting, including the need for visual watch by dedicated LNG carrier crew members on deck during the loading operation. (D10.2) • An alarm is sounded when the ship moves from its berthing location, followed by an emergency shut-down if the ship continues to move outside the working envelope if loading operations are not complete. (D10.3) • LED site boards are installed to communicate tanker positioning and movements. (D10.4) • Loading operations disallowed or suspended in non-permissive weather conditions, with operating limits defined in the DLNG Marine Terminal Handbook. (D10.5)	2 Minor	2 Remote	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	2 Remote	RR I Low

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					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
D11	Unplanned – LNG loading arm hydraulic line failure	Spill of hydraulic fluid to harbour	Up to 20 L of hydraulic oil discharged into the sea if the location of the failed section of hydraulic line is close to the edge of the jetty. Impact on individual marine species (including oiling and ingestion).	• Use of vegetable oil for loading arm hydraulic fluid. (D11.1) • LNG loading arm design – small number of small diameter hydraulic lines. (D11.2) • Hydraulic lines to LNG loading arms routed above jetty to allow containment of spills. (D11.3) • An operator is in attendance at the area during loading operations and will trip the hydraulic fluid pumps in the event of a loss of containment. Remote control of the operations from the Tanker Control Room and the DLNG Marine Terminal Building Control Room can also be employed to immediately stop loading operations if a leak is identified. (D11.4) • 5-yearly hose replacement schedule (D11.5) • Regular inspection and planned maintenance of hydraulic system to prevent malfunction in operation and potential spills from primary containment. (D11.6)	2 Minor	2 Remote	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	2 Remote	RR I Low
D12	Unplanned – Failure of hydraulic hose on the hydraulically operated gangway between the jetty and the LNG carrier	Spill of hydraulic fluid to harbour	Approximately 20 L lost direct to sea as there is no containment provided for the hydraulic hoses on the gangway. Impact on individual marine species (including oiling and ingestion).	• Use of vegetable oil for loading arm hydraulic fluid. (D12.1) • Flexible small diameter hose. (D12.2) • Regular 6-month inspection and planned maintenance of hydraulic system to prevent malfunction in operation and potential spills from primary containment. (D12.3) • An operator will be in attendance at the area during loading operations and will trip the hydraulic fluid pumps in the event of a loss of containment. Remote control of the operations from the Tanker Control Room and the DLNG Marine Terminal Building Control Room can also be employed to immediately stop loading operations if a leak is identified. (D12.4) • Five yearly hose replacement schedule. (D12.5)	2 Minor	2 Remote	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	2 Remote	RR I Low
Vegetation and Ecosystems											
E1	Planned – Production operations	Noise from process machinery (refrigerant compressor and OSPG turbines, compressors, pumps, generators etc.), flaring and Loading Jetty	Minor noise disturbance to native fauna outside the plant perimeter. Noise disturbance to marine life in the harbour area around the jetty.	• Thermal/acoustic insulation (lagging) provided for the noisiest of the compressor lines, including the propane and ethylene recirculation lines. (E1.1) • No mechanical equipment located close to the DLNG Plant boundaries, including the water edge. (E1.2)	2 Minor	2 Remote	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	2 Remote	RR I Low

E2	Planned – Production operations	Heat emissions from processing plant and flares	Thermal pollution impacts to fauna and vegetation from processing activities.	• Plant design and operations includes: (E2.1)
				  ○ WHRUs installed on 4 of 6 refrigerant compressor turbines exhaust stacks.
				  ○ The ground flare is enclosed with radiation/thermal shield.
				  ○ Use of the marine flare is minimised through installation of the BOG compressors and ship loading procedures.
					2
					Minor
						2
						Remote
							RR I
							Low
								There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2
									Minor
										2
										Remote
											RR I
											Low

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
E3	Planned – Production operations	Light emissions from processing plant and flares	Light intrusion from the plant to the adjacent mangrove and terrestrial vegetation habitats. Disturbance of marine and terrestrial fauna by light and noise, and/or attraction of fauna to site perimeter. Visual effects from the marine flare could attract/disrupt local marine fauna during night time ship loading and flaring operations.	*Note, light is a safety requirement for night operations.* • Plant design – The main process flare is at ground level and fenced off with shielding panels to prevent light spill to surrounding area. (E3.1)	2 Minor	2 Remote	4 Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	2 Remote	4 Low
E4	Planned – Stormwater management and erosion control	Surface water runoff – Sediment deposition into adjacent mangrove areas	Sediment deposition from DLNG Plant site via stormwater drains or from erosion of perimeter embankments may be deposited into adjacent mangrove areas.	• Sedimentation ponds are maintained to allow water residence time for sediment removal by gravity prior to stormwater runoff into mangrove areas. Build-up of sediment with time is periodically removed to reduce sediment load. (E4.1) • Plant design – operational areas are predominantly hardstand or contain a vegetative cover to minimise sediment runoff. (E4.2) • Continued implementation of the DLNG Mangrove Monitoring Program to monitor, if any, downstream impacts. (E4.3)	2 Minor	2 Remote	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	2 Remote	RR I Low

E5	Planned – Vehicle and equipment movements onto Wickham Point	Introduction/ transmission of invasive weed species inside DLNG boundary perimeter	Introduction of invasive weeds and plant pathogens.
			Propagation of invasive introduced species resulting in a balance shift in the local ecosystem.
			Displacement of native flora and vegetation assemblages in surrounding areas of Wickham Point.
				• Darwin LNG Weed Management and Monitoring Plan, which includes: (E5.1)
				  ○ Annual monitoring of weeds in the DLNG plant site and lease area.
				  ○ Active weed management through herbicide application by ground services contractor.
				• Register of listed weeds, including surveyed GPS coordinates of known infestations and status of treatment, maintained and reviewed on an annual basis. (E5.2)
					2
					Minor
						2
						Remote
							RR I
							Low
								There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2
									Minor
										2
										Remote
											RR I
											Low

E6	Unplanned – Spills and releases of hydrocarbons and chemicals	Spill runoff into either terrestrial or marine environment	Toxic effects on flora and fauna from direct contact with hydrocarbons and other chemicals.	• Plant design includes: (E6.1)
				  ○ Bunding/secondary containment for chemical and fuel storage in Dangerous Goods Facility and Waste Transfer Facility.
				  ○ Secondary containment in process and utilities areas.
				• Spill kits and a spill trailer available and stock maintained onsite to minimise the environmental impact of any spills. (E6.2)
				• ABU-W Chemical Management Procedure used to assess chemical selection. (E6.3)
				• Continued implementation of the DLNG Groundwater monitoring program and Mangrove Monitoring Program to monitor, if any, downstream impacts. (E6.4)
				• Completion of site assessment for PFAS and pre-cursors to PFOS and PFHxS. (E6.5)
				• Phase out of PFAS/PFOS across the DLNG site in 2012. (E6.6)
					2
					Minor
						4
						Probable
							RR II
							Medium
								There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2
									Minor
										4
										Probable
											RR II
											Medium

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating

E7	Unplanned – Fires/ explosions	Propagation of fire to surrounding bushland	Temporary fire damage to potentially large area of terrestrial ecosystems on Wickham Point and associated significant vegetation and fauna.	• Plant design includes: (E7.1)
				  ○ Separation distances between Plant and adjacent perimeter line, and maintenance of fire breaks on property boundary.
				  ○ Fire fighting systems (automatic and manual).
				  ○ Process control and emergency shutdown and depressurisation systems.
				  ○ Fire and gas detection system and alarms.
				  ○ Grounding of equipment for lightning strikes to prevent fire propagation.
				• Contact details available onsite for external fire fighting resources. (E7.2)
				• Ongoing weed management to minimise high fuel load risk undertaken on a needs basis. (E7.3)
					3
					Moderate
						2
						Remote
							RR II
							Medium
								There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	3
									Moderate
										2
										Remote
											RR II
											Medium

E8	Unplanned– Unauthorised access to surrounding bushland from inside site perimeter	Disturbance of surrounding bushland from inside site boundary	Unauthorised disturbance of vegetation along site boundary, leading to ecosystem degradation and breach of facility operating approvals.	• Site perimeter fencing installed and maintained. (E8.1)
				• DLNG HSE site induction includes an environmental component which informs the workforce of: (E8.2)
				  ○ Sensitive habitats adjacent to the DLNG Plant.
				  ○ Native fauna likely at DLNG and promotes reporting of sightings.
				• Manned 24/7 security office to monitor boundary of DLNG. Plant security serves to control general public access in areas surrounding the DLNG Plant. (E8.3)
					2
					Minor
						2
						Remote
							RR I
							Low
								There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2
									Minor
										2
										Remote
											RR I
											Low

E9	Unplanned – Vehicle movements or general operations	Native fauna interaction associated with Plant activities	Vehicle interaction with terrestrial fauna causing injury or mortality.
			Trapping of fauna in plant equipment.
				• DLNG HSE site induction includes an environmental component which informs the workforce of: (E9.1)
				  ○ Sensitive habitats adjacent to the DLNG Plant.
				  ○ Native fauna likely at DLNG and promotes reporting of sightings.
				• Vehicle speed limits. (E9.2)
				• Native species rehabilitation and relocation facilitated through NT Department of Parks and Wildlife as required. (E9.3)
					2
					Minor
						2
						Remote
							RR I
							Low
								There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2
									Minor
										2
										Remote
											RR I
											Low

E10	Unplanned – General operations	Plant site activities that attract feral/pest animals Vehicle and equipment movements onto site.	Introduction of feral/pest animals into surrounding ecosystems. Disturbance to native fauna habitat. Translocation of diseases by feral animals	• Perimeter security fencing installed and maintained. (E10.1) • Pest baiting completed onsite if required. (E10.2) • Onsite general waste bins provided and routinely collected to avoid feral animal attraction. (E10.3)	2 Minor	2 Remote	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2 Minor	2 Remote	RR I Low

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
Waste Management (Handling and Disposal)											

W1	Generation of non-hazardous waste
	(e.g. inorganic sludge, paper, plastics and glass from administration officers and workshops, molecular sieve waste and ceramic balls from dehydration units)
		Inappropriate handling and disposal of non-hazardous waste	Contamination of environment (soil and/or water resources) with non-hazardous waste.	• DLNG Waste Management Procedure outlines waste management and disposal requirements, including: (W1.1)
				  ○ Waste segregation including recycling facilities onsite prior to offsite disposal, with the provision of general and recycling waste bins at DLNG Plant.
				  ○ Waste manifest and tracking system for all wastes, to a standard which is compliant with EPL217-01 Conditions 70 and 71.
				  ○ Disposal of non-hazardous waste in accordance with regulatory requirements.
				  ○ Regular removal of wastes by licenced contractor.
				• Waste management contractor selection and auditing processes in place. (W1.2)
				• Once per shift walkaround – visual inspection of Plant site to identify any waste materials. (W1.3)
					2
					Minor
						2
						Remote
							RR I
							Low
								There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2
									Minor
										2
										Remote
											RR I
											Low

W2	Generation of hazardous waste
	(e.g. mercury removal unit, oily sludge/ water, pigging waste, medical waste from First-Aid, waste lubricating oils, spent oils and solvents)
		Inappropriate handling and disposal of hazardous waste	Contamination of environment (soil and/or water resources) with hazardous waste.	• DLNG Waste Management Procedure outlines waste management and disposal requirements, including: (W2.1)
				  ○ Waste segregation onsite prior to offsite disposal and the designated Hazardous Waste Transfer Facility.
				  ○ Waste manifest and tracking system for all wastes, to a standard which is compliant with EPL217-01 Conditions 70 and 71.
				  ○ Disposal of hazardous waste in accordance with regulatory requirements.
				  ○ Waste management contractor selection and auditing processes.
				  ○ Hazardous waste removed and disposed of by a licensed contractor.
				• ABU-W Chemical Management Procedure used to assess chemical selection. (W2.2)
				• ABU-W Naturally Occurring Hazardous Process Contaminants Procedure outlines requirements for management of these contaminants. (W2.3)
				• Correct labelling of hazardous waste and storage as outlined in the DLNG POG. (W2.4)
					2
					Minor
						2
						Remote
							RR I
							Low
								There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	2
									Minor
										2
										Remote
											RR I
											Low

Socio-Economic and Cultural Heritage											
S1	Planned – Marine activities	Restricted fishing and recreational boating access in the vicinity of the DLNG Plant	Reduced access to local fishing resources in the vicinity of the DLNG marine terminal (restricted access and safety zones limiting access of vessels to the DLNG jetty).	• Consultation and Communication Plan. (S1.1) • Community complaints are monitored and logged. (S1.2) • Navigation aids installed on Wickham Point and LNG loading jetty (signage, beacons, lights). (S1.3) • Marine radio channels and other communication systems. (S1.4)	1 Negligible	4 Probable	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Negligible	4 Probable	RR I Low

Element Number	Operational Activity	Environmentally Hazardous Event/Aspect	Potential Environmental Effect/Risk (of Operating As-Built Facility)	Risk Management Controls and Mitigation	Inherent Risk			Consideration of Additional Controls and Acceptability/ ALARP	Residual Risk		
					Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
S2	Planned – Production and shipping operations	Noise and visual amenity	Noise and visual impacts on Darwin City (waterfront). Minor disturbance to surrounding land users.	• Consultation and Communication Plan. (S2.1) • Community complaints are monitored and logged. (S2.2) • Notifications to the public regarding marine flare activities. (S2.3)	1 Minor	2 Remote	RR I Low	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	1 Minor	2 Remote	RR I Low
S3	Unplanned – unauthorised disturbance outside facility boundary including vandalism, clearing or fire	Disturbance to sites of Indigenous and European heritage values (such as Indigenous middens and remnant World War II artefacts)	Loss of cultural amenity and sites of historical significance for Aboriginal and/or Australian/European communities.	• Security fence maintained and patrols completed of the DLNG Plant's fence line. (S3.1) • No clearing/disturbance outside the current disturbance footprint. (S3.2) • Sites of cultural significance noted on area drawings and signage in specific areas of significance to restrict public access. (S3.3) • Development of a pictorial interpretive display located on the Darwin Esplanade. (S3.4) • Wickham Point Archaeological Sites Register. (S3.5) • Engagement with Larrakia Liaison Committee. (S3.6)	3 Moderate	2 Remote	RR II Medium	There are no reasonable additional risk management or mitigation controls that would further reduce the impacts and risks. The residual risk is considered acceptable and ALARP.	3 Moderate	2 Remote	RR II Medium

8 ENVIRONMENTAL MANAGEMENT STRATEGIES

This section of the OEMP outlines strategies to manage potential environmental effects and risks associated with DLNG production operations, and to ensure compliance with regulatory requirements and ConocoPhillips policies and processes.

Environmental management strategies for DLNG operations are provided for all environmental aspects and risks/impacts and are categorised into the following groups: Atmospheric Emissions; Liquid Discharges; Vegetation and Ecosystems; Waste Management and Socio-Economic.

The environmental management strategies establish environmental outcomes, environmental performance standards and measurement criteria referred to in the *Petroleum (Environment) Regulations* 2016, which support the *Petroleum Act* (NT). Environmental objectives defined in the environmental management strategies are based on identified environmental hazardous events, associated environmental effects and assessed risks, corporate policies and performance objectives, and applicable legal requirements.

Environmental performance objectives, performance criteria and management measures are defined as follows:

- **Environmental Performance Objective** – Specific environmental performance objectives tailored to the operational context to meet legal requirements, corporate performance commitments and standards of operation;

- **Performance Criteria** – A level of performance expressed as a tangible, measurable objective, against which actual performance can be compared, including a goal expressed as a quantitative standard, value or rate. Performance criteria include targets and key performance criteria to measure the achievement of the environmental objective; and

- **Risk Management Controls and Mitigation** – Management controls and mitigation measures that will be implemented to achieve the environmental objective and performance criteria. These correspond to the management controls as outlined in Table 7-1, and have been cross-referenced accordingly.

The environmental management strategies are presented in Table 8-1.

Table 8-1: Environmental Management Strategies

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
Atmospheric Emissions (GHGs, Air Pollutants, Ozone Depleting Substances and Associated Emissions of Noise and Heat)						
Stack emissions – Exhaust and GHG emissions from process equipment: • Refrigerant compressor turbines • OSPG gas turbines • Process boiler • AGI • Stand-by diesel and black start generators	A1	Air emissions from process equipment are kept as low as operationally feasible Monitoring of stack emissions completed to industry standard level	A1.1	Only fuel gas is used to operate the refrigerant compressor turbines under normal operations	DLNG Operations Supervisor	DLNG Operations Team Lead
			A1.2	GE LM2500+G4 aero-derivative refrigerant compressor turbines operated and maintained	Rotating Equipment Engineer	Principal Rotating Equipment Engineer
			A1.3	WHRUs remain online while refrigerant turbine compressors are operational	Rotating Equipment Engineer	Principal Rotating Equipment Engineer
			A1.4	NOx emissions remain below the concentration and emission rate trigger values for the refrigerant compressor turbines	Rotating Equipment Engineer	Principal Rotating Equipment Engineer
			A1.5	Operation of key DLNG Plant equipment aligns with the POG	DLNG Operations Supervisor	DLNG Operations Team Lead
			A1.6	Compliance with EPL217-01 Condition 63, specifically maintaining a monitoring program for discharges to air	Operational Environmental Specialist	Environmental Supervisor
				Compliance with EPL217-01 condition 43, specifically ensuring emission rate and concentration limits specified in the licence are not exceeded	DLNG Operations Team Lead	Darwin Operations Manager
	A2		A2.1	Only fuel gas is used to operate the OSPG turbines under normal operations	DLNG Operations Supervisor	DLNG Operations Team Lead
			A2.2	Solonox II technology fitted and operational on the OSPG Solar Taurus 60's	Rotating Equipment Engineer	Principal Rotating Equipment Engineer
			A2.3	Regular annual maintenance of key equipment to ensure efficient combustion	Maintenance Coordinator	DLNG Operations Supervisor

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
			A2.4	Compliance with EPL217-01 Condition 63, specifically maintaining a monitoring program for discharges to air	Operational Environmental Specialist	Environmental Supervisor
				Compliance with EPL217-01 condition 43, specifically ensuring emission rate and concentration limits specified in the licence are not exceeded	DLNG Operations Team Lead	Darwin Operations Manager
	A3		A3.1	Planned annual maintenance of boiler stack to ensure efficient operations is completed	Maintenance Coordinator	DLNG Operations Supervisor
			A3.2	Compliance with EPL217-01 Condition 63, specifically maintaining a monitoring program for discharges to air	Operational Environmental Specialist	Environmental Supervisor
				Compliance with EPL217-01 condition 43, specifically ensuring emission rate and concentration limits specified in the licence are not exceeded	DLNG Operations Team Lead	Darwin Operations Manager
			A3.3	WHRU's used as the primary supply of steam to the plant, to minimise boiler requirement	DLNG Operations Supervisor	DLNG Operations Team Lead
	A4		A4.1	AGI to be kept at optimal temperature range (notionally 810^{o}C) during normal operations to enable complete combustion	Operations Specialist	DLNG Operations Team Lead
			A4.2	Regular annual maintenance of key equipment to ensure efficient combustion is completed	Maintenance Coordinator	DLNG Operations Supervisor
			A4.3	Compliance with EPL217-01 Condition 63, specifically maintaining a monitoring program for discharges to air	Operational Environmental Specialist	Environmental Supervisor
				Compliance with EPL217-01 Condition 43, specifically ensuring emission rate and concentration limits specified in the licence are not exceeded	DLNG Operations Team Lead	Darwin Operations Manager

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
	A5		A5.1	The diesel and black start generators are fuelled only by ultra-low sulphur diesel	Operations Technician	DLNG Operations Supervisor
			A5.2	Regular annual maintenance of key equipment to ensure efficient combustion is completed	Maintenance Coordinator	DLNG Operations Supervisor
Planned flaring activities of the: • Dry and wet ground flares • Marine flare • NGL flare	A6	Restrict access to the flaring system	A6.1	Radiation shield installed and maintained around the ground flare	Maintenance Coordinator	DLNG Operations Supervisor
		Air emissions associated with flaring kept as low as operationally feasible	A6.2	Flare designed and operational monitoring undertaken to maintain efficient flaring	Operations Technician	DLNG Operations Supervisor
		Planned flaring will be communicated to all relevant parties before commencement	A6.3	Darwin International Airport air traffic control notifications provided for all planned flaring with >1 hours' notice	External Relations Advisor	Darwin Operations Manager
	A7	Flaring emissions are kept as low as operationally feasible Minimise impacts to the adjacent environment from operation of marine flare	A7.1	LNG vapour recovery system operational during ship loading operations	DLNG Operations Supervisor	DLNG Operations Team Lead
			A7.2	Two BOG compressors run during ship loading, as outlined in the Unit 24 LNG ship loading procedure	DLNG Operations Supervisor	DLNG Operations Team Lead
			A7.3	Flaring during ship loading undertaken in accordance with Unit 24 Cargo Operations Gassing Up of Inert Tankers and/or Extended Cool down of Warm Inert or Off-Spec Ships Procedure	DLNG Operations Supervisor	DLNG Operations Team Lead
			A7.4	Regular annual maintenance of key equipment to ensure efficient combustion is completed	Maintenance Coordinator	DLNG Operations Supervisor
			A7.5	Flare design and location takes into account environmental considerations	DLNG Operations Team Lead	Darwin Operations Manager

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
			A7.6	Flaring from the marine flare undertaken in accordance with the DLNG Marine Terminal Handbook, specifically minimising venting from cargo tanks and night-time flaring where possible	DLNG Operations Supervisor	DLNG Operations Team Lead
	A8		A8.1	NGL flaring equipment to be operated within design specifications during normal operations to enable complete combustion	DLNG Operations Supervisor	DLNG Operations Team Lead
			A8.2	NGL flare operated on a needs basis, in accordance with the NGL loading procedure	DLNG Operations Supervisor	DLNG Operations Team Lead
Planned venting of: • Nitrogen rich gas through the NRU vent • Acid gas through the AGI (hot and cold venting) • Nitrogen and residual hydrocarbons through Process Safety Valves	A9	Air emissions associated with venting are kept as low as operationally feasible	A9.1	High methane content gas (>10%) within the NRU stream is diverted back into the system and further processed	Operations Specialist	DLNG Operations Team Lead
			A9.2	High methane content gas is flared where possible, instead of being vented	Operations Specialist	DLNG Operations Team Lead
	A10		A10.1	Compliance with EPL217-01 Condition 49, specifically ensuring that the AGI unit is not in repair and maintenance for more than 28 days at any one time and no more than 55 days per year	DLNG Operations Team Lead	Darwin Operations Manager
			A10.2	Gas is vented through the exhaust of refrigerant compressor turbine Unit 1611 and Unit 1621	DLNG Operations Supervisor	DLNG Operations Team Lead
			A10.3	Compliance with EPL217-01 Condition 47.2, specifically undertaking hot venting in accordance with the conditions outlined in the Darwin LNG Acid Gas Hot Venting Trial	DLNG Operations Team Lead	Darwin Operations Manager
	A11		A11.1	Maintenance of the Process Safety Valve undertaken in accordance with the SIPs/SOPs, including draining or flaring of process fluids prior to maintenance	Maintenance Coordinator	DLNG Operations Supervisor

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
Fugitive emissions from: • Diesel storage tanks • Equipment, including piping connectors, valves, flanges and calibration gases	A12	Minimise fugitive emissions from the DLNG Plant	A12.1	Vents located on tank tops to facilitate dispersion of volatile emissions and provide segregation from potential ignition sources	DLNG Operations Supervisor	DLNG Operations Team Lead
	A13		A13.1	Monitoring of key fugitive emissions sources, including: • Process monitoring system (pressure and temperature controls), gas detection systems and line of sight detectors • Once per shift walkaround – visual inspection of key operating equipment • Corrosion testing	Maintenance Coordinator	DLNG Operations Supervisor
			A13.2	Fugitive emissions register records/monitors emissions (targeted) and is used to identify any leakages and determine maintenance/repair requirements and priorities	Operations Technician	DLNG Operations Supervisor
			A13.3	Maintenance/repair requirements for fugitive emission leaks are entered and tracked through SAP	Maintenance Coordinator	DLNG Operations Supervisor
			A13.4	Plant design considers the selection of appropriate materials (valve specifications, flange minimisation).	DLNG Operations Team Lead	Darwin Operations Manager
Unplanned flaring from the: • Dry and wet ground flares • Marine flare	A14	Minimise unplanned flaring events	A14.1	Safety systems in place (Safety Instrumented System and the Independent Safety Instrumented System) are operational to prevent over pressurisation and hence the requirement to flare	DLNG Operations Team Lead	Darwin Operations Manager
			A14.2	Advanced process control maintained and operational during normal operations	Operations Specialist	DLNG Operations Team Lead
			A14.3	Unplanned flaring events recorded through the Deferred Production Opportunity process and investigated	Operations Facilities Engineer	DLNG Operations Supervisor

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
	A15		A15.1	Excess gas within the LNG tank is routed to the BOG compressors to prevent increased flaring at the marine flare	DLNG Operations Team Lead	Darwin Operations Manager
			A15.2	Regular annual maintenance undertaken on the BOG compressors	Maintenance Coordinator	DLNG Operations Supervisor
			A15.3	BOG compressors operated in accordance with the SOPs	DLNG Operations Supervisor	DLNG Operations Team Lead
Unplanned emissions of hydrocarbon gas from PSVs	A16	No unplanned releases of hydrocarbon gas	A16.1	Inventory isolation (Emergency Shutdown Valves) and plant emergency depressurisation capability through the ground flare	DLNG Operations Team Lead	Darwin Operations Manager
			A16.2	Gas and fire detection and emergency response systems are installed and maintained to prevent escalation of an incident to a significant event	DLNG Operations Team Lead	Darwin Operations Manager
			A16.3	Regular inspection of key process and/or utility areas and preventative maintenance undertaken as required	Maintenance Coordinator	DLNG Operations Supervisor
			A16.4	Safety systems in place (Safety Instrumented System and the Independent Safety Instrumented System) are operational to prevent over pressurisation and hence the requirement to flare	DLNG Operations Team Lead	Darwin Operations Manager
Unplanned leaks – Release of refrigerants from: • Storage areas • HVAC system	A17	No release of refrigerants which have a high global warming potential	A17.1	Monitoring of refrigerant storage areas, including: • Process monitoring system (pressure and temperature controls), gas detection systems and line of sight detectors • Equipment inspections, including corrosion testing • Once per shift walkaround – visual inspection of key operating equipment	DLNG Operations Supervisor	DLNG Operations Team Lead

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
			A17.2	Emergency shutdown and inventory isolation capability available to minimise the volume of any unplanned releases of refrigerants	DLNG Operations Team Lead	Darwin Operations Manager
			A17.3	Gas and fire detection and emergency response systems installed and maintained to minimise the volume of any unplanned releases of refrigerants	DLNG Operations Team Lead	Darwin Operations Manager
			A17.4	Plant design considers the selection of appropriate materials for use in the refrigerant storage areas	DLNG Operations Team Lead	Darwin Operations Manager
			A17.5	Preventative annual maintenance undertaken of key equipment as required	Maintenance Coordinator	DLNG Operations Supervisor
	A18		A18.1	Licensed contractor engaged to undertaken annual maintenance of the HVAC systems	Maintenance Coordinator	DLNG Operations Supervisor
			A18.2	No ODSs used at the DLNG Plant	DLNG Operations Supervisor	DLNG Operations Team Leader
			A18.3	ABU-W Chemical Management Procedure considered in the selection of chemicals to limit the use of chemicals which have a high global warming potential	HSE Advisor	HSE Specialist - Industrial Hygiene
Liquid Discharges (Wastewater, Process Contaminants and Liquid Hydrocarbons)						
Use of Plant wastewater effluents for onsite irrigation	D1	Irrigation water quality and quantity will be maintained and monitored with reference to the EPL wastewater discharge trigger values and background water quality data	D1.1	Compliance with EPL217-01 Condition 41, specifically ensuring wastewater discharges to land do not exceed the authorised trigger limits specified in the licence	DLNG Operations Team Lead	Darwin Operations Manager
			D1.2	Separation of oil from oil water before discharge. Oil is collected and removed from site by licenced waste vendor.	Operations Technician	DLNG Operations Supervisor
			D1.3	The CPI/DAF and Activated Sludge Sewage Effluent System are constantly	Operations Technician	DLNG Operations Supervisor

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
				operated per design specifications and per the Operations Manual		
			D1.4	Effluent from CPI and sewage treatment plant is diluted with TAHS/boiler blowdown water	Operations Technician	DLNG Operations Supervisor
			D1.5	Compliance with EPL217-01 Condition 66, specifically implementation and maintenance of a monitoring program for wastewater discharges and groundwater	Operational Environmental Specialist	Environmental Supervisor
				Compliance with EPL217-01 Condition 60, specifically implementation and maintenance of a mangrove monitoring program	Operational Environmental Specialist	Environmental Supervisor
			D1.6	Compliance with EPL217-01 Condition 39, specifically the volume of water discharged on the irrigation area will not exceed 26 megalitres per year, unless notification is made to the NT EPA prior	DLNG Operations Team Lead	Darwin Operations Manager
				Compliance with EPL Condition 84, specifically measure and record time, duration, volume and flow rate of discharge	Metering Specialist	IC&E Reliability Supervisor
Discharge of RO reject water to Darwin Harbour	D2	Jetty Outfall water quality and quantity will be maintained and monitored with reference to the EPL wastewater discharge trigger values and background water quality data	D2.1	RO Plant feed water is potable water quality	DLNG Operations Supervisor	DLNG Operations Team Lead
			D2.3	Normal operations of the RO Plant are maintained	Operations Technician	DLNG Operations Supervisor
			D2.4	Compliance with EPL217-01 Condition 36, specifically ensuring wastewater discharges to Darwin Harbour do not exceed the authorised trigger limits specified in the licence	DLNG Operations Team Lead	Darwin Operations Manager
				Compliance with EPL217-01 Condition 57, specifically implementation and	Operational Environmental Specialist	Environmental Supervisor

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
				maintenance of a monitoring program for discharges to Darwin Harbour		
			D2.5	Compliance with EPL217-01 Condition 86, specifically the development and implementation of a Jetty Outfall Performance Improvement Plan	Operational Environmental Specialist	Environmental Supervisor
			D2.6	The Jetty Outfall discharge location is located >6 m below Lowest Astronomical Tide	DLNG Operations Supervisor	DLNG Operations Team Leader
			D2.7	Compliance with EPL Condition 35, specifically the volume of water discharged via the Jetty Outfall will not exceed 61 megalitres per year, unless notification is made to the NT EPA prior	DLNG Operations Team Lead	Darwin Operations Manager
				Compliance with EPL Condition 83, specifically measure and record time, duration, volume and flow rate of discharge	Metering Specialist	IC&E Reliability Supervisor
Discharge of stormwater from Sedimentation Ponds 1, 2 and 3 to Darwin Harbour via mangroves	D3	Sediment pond water quality and quantity will be monitored with reference to the EPL wastewater discharge trigger values	D3.1	Sediment ponds are constructed, inspected and maintained as required to manage worst-case rainfall events	Maintenance Coordinator	DLNG Operations Supervisor
			D3.2	Compliance with EPL217-01 Condition 36, specifically ensuring wastewater discharges to Darwin Harbour do not exceed the authorised trigger limits specified in the licence	DLNG Operations Team Lead	Darwin Operations Manager
				Compliance with EPL217-01 Condition 57, specifically implementation and maintenance of a monitoring program for discharges to Darwin Harbour	Operational Environmental Specialist	Environmental Supervisor
		No significant impacts to mangroves from sediment pond discharges	D3.3	Compliance with EPL217-01 Condition 60, specifically implementation and maintenance of a mangrove monitoring program	Operational Environmental Specialist	Environmental Supervisor

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
Discharge of stormwater via clean stormwater outfalls, NGL bund and LNG sump to harbour	D4	No discharge of contaminated stormwater runoff to Darwin Harbour	D4.1	Sumps are cleaned as required and any spills pumped out, with oily water treated though the CPI/DAF system	DLNG Operations Supervisor	DLNG Operations Team Lead
			D4.2	Visual inspection of key operating equipment during shift walkaround	Operations Technician	DLNG Operations Supervisor
			D4.3	NGL tank inspected following significant rainfall events and visual and olfactory observations undertaken prior to discharge to Darwin Harbour	Operations Technician	DLNG Operations Supervisor
			D4.4	Compliance with EPL217-01 Condition 60, specifically implementation and maintenance of a mangrove monitoring program	Operational Environmental Specialist	Environmental Supervisor
Spill – Overflow to clean stormwater from unplanned: • Diesel spill during diesel loading/ transfer operations or from a diesel storage tank leak • Amine spill during loading operations • Process area spill containment sump	D5	No diesel spills during loading/transfer operations	D5.1	Sump valves are closed unless clean bund stormwater is drained to the clean stormwater ditches to prevent release of contaminated water to the marine environment	Operations Technician	DLNG Operations Supervisor
			D5.2	Visual inspection of key operating equipment during shift walkaround	Operations Technician	DLNG Operations Supervisor
			D5.3	Sumps are cleaned as required and any spills pumped out, with oily water treated though the CPI/DAF system	DLNG Operations Supervisor	DLNG Operations Team Lead
			D5.4	Bulk fluid transfer/loading operations which include: • Bulk fluid transfers undertaken in bunded areas • Verification of volumes of bulk fluids transferred between vessels and facilities. • Use of dry break hoses for liquid wastewater transfer operations (road tanker off takes) • Operator present in the area during fuel transfers	Operations Technician	DLNG Operations Supervisor

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
			D5.5	In the event of a spill, the DLNG ERP (as referred to in EPL217-01 Condition 23) will be implemented	DLNG Operations Supervisor	DLNG Operations Team Leader
	D6	No amine spills from loading operations	D6.1	Below ground sump valves are closed unless clean bund stormwater is drained to the clean stormwater ditches	Operations Technician	DLNG Operations Supervisor
			D6.2	Visual inspection of key operating equipment during shift walkaround	Operations Technician	DLNG Operations Supervisor
			D6.3	In the event of a spill, the DLNG ERP (as referred to in EPL217-01 Condition 23) will be implemented	DLNG Operations Supervisor	DLNG Operations Team Leader
	D7	Minimise the potential for environmental impact through management of chemicals usage and disposal	D7.1	Safety systems in place (Safety Instrumented System and the Independent Safety Instrumented System) and operational to prevent loss of hydrocarbons from the process plant	DLNG Operations Team Leader	Darwin Operations Manager
			D7.2	Gas detection system installed and operational to detect loss of hydrocarbons from vessels and pipelines	DLNG Operations Supervisor	DLNG Operations Team Leader
			D7.3	Process area spill containment sump designed and maintained to impound 612 m^3 of runoff (contaminated stormwater) from the DLNG process area	Maintenance Coordinator	DLNG Operations Supervisor
			D7.4	Oil skimmer installed and operational in process area spill containment sump	Operations Technician	DLNG Operations Supervisor
			D7.5	Visual inspection of key operating equipment during shift walkaround	Operations Technician	DLNG Operations Supervisor
			D7.6	Sumps are cleaned as required and any spills pumped out, with oily water treated though the CPI/DAF system	DLNG Operations Supervisor	DLNG Operations Team Leader
			D7.7	In the event of a spill, the DLNG ERP (as referred to in EPL217-01 Condition 23) will be implemented	Materials Coordinator	Warehouse Controller

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
			D7.8	Chemical and hazardous substances appropriately segregated and stored onsite in a specific hazardous storage facility	Operational Environmental Specialist	HSE Specialist - Industrial Hygiene
			D7.9	Chemicals which have potential to be released to the marine environment will be selected in line with the ABU-W Chemical Management Procedure, ALL/HSE/PRO/044	Operations Technician	DLNG Operations Supervisor
			D7.10	Chemicals and hydrocarbon liquids stored on DLNG site have secondary containment	HSE Advisor	HSE Specialist - Industrial Hygiene
			D7.11	Approved chemicals and hazardous substances recorded on DLNG Approved Chemicals and Hazardous Substances Register	Materials Coordinator	Warehouse Controller
			D7.12	Chemical usage tracked via DLNG inventory stock control records	DLNG Operations Team Leader	Darwin Operations Manager
Spill – Discharge/ overflow of LNG or hydraulic fluid to Darwin harbour during loading operations	D8	No unplanned spills of LNG into Darwin Harbour during loading operations	D8.1	Process monitoring (pressure, temperature and flow monitoring) maintained during loading operations	DLNG Operations Supervisor	DLNG Operations Team Leader
			D8.2	Operator in attendance and visually monitoring loading operations at the jetty	Operations Technician	DLNG Operations Supervisor
			D8.3	Inspection of key loading equipment undertaken prior to loading operations	Operations Technician	DLNG Operations Supervisor
			D8.4	Regular maintenance undertaken of key equipment in accordance with the preventative maintenance schedule	Maintenance Coordinator	DLNG Operations Supervisor
			D8.5	Visual inspection of key operating equipment during shift walkaround	Operations Technician	DLNG Operations Supervisor
			D8.6	In the event of a spill, the DLNG ERP (as referred to in EPL217-01 Condition 23) will be implemented	DLNG Operations Supervisor	DLNG Operations Team Leader

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
	D9		D9.1	Pre-loading inspections of the loading arms and the associated PERC automatic shutoff system undertaken as per 'Routine Testing of Double Ball Valves and PERC' and 'LNG Storage and Loading Normal Operation' Operating Procedures	Operations Technician	DLNG Operations Supervisor
			D9.2	Operator in attendance and visually monitoring loading operations at the jetty	Operations Technician	DLNG Operations Supervisor
			D9.3	Remotely controlled emergency shut-down valves to shut off the LNG supply to the loading arms installed and maintained	DLNG Operations Team Lead	Darwin Operations Manager
			D9.4	Automatic and manual means to shut down the LNG transfer pumps available and maintained	DLNG Operations Team Lead	Darwin Operations Manager
			D9.5	Loading operations shut down in the event of an emergency arising from the LNG carrier	DLNG Operations Supervisor	DLNG Operations Team Leader
			D9.6	Water curtains on the tanker used in the event of a large spill of LNG during loading operations	DLNG Operations Supervisor	DLNG Operations Team Leader
			D9.7	In the event of a spill, the DLNG ERP (as referred to in EPL217-01 Condition 23) will be implemented	DLNG Operations Supervisor	DLNG Operations Team Leader
	D10		D10.1	The tension sensors and alarms in the Marine Terminal Building Control Room for the LNG carrier's mooring lines are operated during LNG loading operations	Operations Specialist	DLNG Operations Team Leader
			D10.2	Pre-load meeting undertaken for all LNG carrier moorings and loadings and includes the requirement for visual watch by dedicated LNG carrier crew members on deck during loading operations.	Operations Technician	DLNG Operations Supervisor
			D10.3	Alarm activated when LNG carrier ship moves from its berthing location and, if	Operations Specialist	DLNG Operations Team Leader

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
				required, emergency shut-down implemented if the ship move outside the working envelope if loading operations are underway.		
			D10.4	LED site boards installed to communicate tanker positioning and movements	DLNG Operations Supervisor	DLNG Operations Team Leader
			D10.5	Loading operations undertaken in accordance with the permissive weather conditions defined in the DLNG Marine Terminal Handbook	DLNG Operations Supervisor	DLNG Operations Team Leader
			D10.6	In the event of a spill, the DLNG ERP (as referred to in EPL217-01 Condition 23) will be implemented	DLNG Operations Supervisor	DLNG Operations Team Leader
	D11	No unplanned spills of hydraulic fluid into Darwin Harbour during loading operations	D11.1	Vegetable oil used as the hydraulic fluid for the LNG loading arm	DLNG Operations Supervisor	DLNG Operations Team Leader
			D11.2	Loading arm design includes a small number of small diameter hydraulic lines	DLNG Operations Team Lead	Darwin Operations Manager
			D11.3	Hydraulic lines to LNG loading arms routed above jetty to allow containment of spills	DLNG Operations Team Lead	Darwin Operations Manager
			D11.4	Operator in attendance at the area during loading operations and, in the event of a loss of containment, will trip the hydraulic fluid pumps. Remote control of the operations is also available from DLNG Marine Terminal Building Control Room	Operations Technician	DLNG Operations Supervisor
			D11.5	Hydraulic hoses on the gangway replaced 5 yearly as per the hose replacement schedule	Maintenance Coordinator	DLNG Operations Supervisor
			D11.6	Regular 6-month inspection and planned maintenance undertaken of hydraulic system to prevent malfunction	Maintenance Coordinator	DLNG Operations Supervisor

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
	D12		D12.1	Vegetable oil used as the hydraulic fluid for the hydraulic hoses on the gangway	DLNG Operations Supervisor	DLNG Operations Team Leader
			D12.2	Hydraulic hoses on the gangway are a flexible small diameter	DLNG Operations Team Lead	Darwin Operations Manager
			D12.3	Regular 6-month inspection and planned maintenance undertaken of hydraulic system to prevent malfunction	Maintenance Coordinator	DLNG Operations Supervisor
			D12.4	Operator in attendance at the area during loading operations and, in the event of a loss of containment, will trip the hydraulic fluid pumps. Remote control of the operations is also available from DLNG Marine Terminal Building Control Room	DLNG Operations Supervisor	DLNG Operations Team Leader
			D12.5	Hydraulic hoses on the gangway replaced 5 yearly as per the hose replacement schedule	Maintenance Coordinator	DLNG Operations Supervisor
Vegetation and Ecosystems						
Noise, heat and light emissions from processing plant and flares	E1	Noise, heat and light emissions will be kept to a minimum	E1.1	Thermal/acoustic insulation (lagging) installed and maintained for the noisiest of the compressor lines, including the propane and ethylene recirculation lines	Maintenance Coordinator	DLNG Operations Supervisor
			E1.2	No mechanical equipment located close to the DLNG Plant boundaries, including the water edge	DLNG Operations Supervisor	DLNG Operations Team Leader
	E2		E2.1	The DLNG Plant design and operations includes: • WHRUs installed on 4 of 6 refrigerant compressor turbines exhaust stacks • The ground flare is enclosed with radiation/thermal shield • Use of the marine flare is minimised through installation of the BOG	DLNG Operations Supervisor	DLNG Operations Team Leader

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
				compressors and ship loading procedures		
	E3		E3.1	The Plant design includes the main process flare sited at ground level and fenced off with shielding panels to prevent light spill to surrounding area	DLNG Operations Team Leader	Darwin Operations Manager
Surface water runoff – Sediment deposition into adjacent mangrove areas	E4	No significant impacts to mangroves from sediment pond discharges	E4.1	Sedimentation ponds maintained to allow water residence time for sediment removal by gravity prior to stormwater runoff into mangrove areas	Maintenance Coordinator	DLNG Operations Supervisor
				Periodic removal of sediment that has built up in the sedimentation ponds to reduce sediment load	Maintenance Coordinator	DLNG Operations Supervisor
			E4.2	The Plant design includes the operational areas being predominantly hardstand or containing a vegetative cover to minimise sediment runoff	DLNG Operations Supervisor	DLNG Operations Team Leader
			E4.3	Compliance with EPL217-01 Condition 60, specifically implementation and maintenance of a mangrove monitoring program	Operational Environmental Specialist	Environmental Supervisor
Introduction/ transmission of invasive weed species inside DLNG boundary perimeter	E5	Prevent the introduction and spread of weeds and plant pathogens to DLNG Plant site and lease area	E5.1	Implementation of the Darwin LNG Weed Management and Monitoring Plan, which includes: • Annual monitoring of weeds in the DLNG plant site and lease area • Active weed management through herbicide application by ground services contractor	Onsite Maintenance Support	Maintenance Coordinator
			E5.2	Register of listed weeds, including surveyed GPS coordinates of known infestations and status of treatment, maintained and reviewed on an annual basis	Operational Environmental Specialist	Environmental Supervisor

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
Hydrocarbon/chemical spill runoff into either terrestrial or marine environment	E6	Minimise the potential for environmental impact through management of chemicals usage and disposal	E6.1	The DLNG Plant design includes: • Bunding/secondary containment for chemical and fuel storage in Dangerous Goods Facility and Waste Transfer Facility • Secondary containment in process and utilities areas	DLNG Operations Supervisor	DLNG Operations Team Leader
			E6.2	Spill kits and a spill trailer available and stocks maintained onsite to minimise the environmental impact of any spills	DLNG Operations Supervisor	DLNG Operations Team Leader
			E6.3	ABU-W Chemical Management Procedure used to assess the selection of chemicals	HSE Specialist - Industrial Hygiene	HSE Team Lead
			E6.4	Compliance with EPL217-01 Condition 66, specifically implementation and maintenance of a monitoring program for wastewater discharges and groundwater	Operational Environmental Specialist	Environmental Supervisor
				Compliance with EPL217-01 Condition 60, specifically implementation and maintenance of a mangrove monitoring program	Operational Environmental Specialist	Environmental Supervisor
			E6.5	Compliance with EPL217-01 Condition 53, specifically minimising or phasing out the use of fire firefighting foams containing PFAS and pre-cursors to PFOS and PFHxS and in any case, not to use foams containing PFOS and PFHx	Emergency Response Coordinator	Crisis & Emergency Management Specialist
			E6.6	PFAS/PFOS use phased out across the DLNG site in 2012.	Operational Environmental Specialist	Environmental Supervisor
Propagation of fire to surrounding bushland	E7	No bushfires initiated from DLNG Plant activities	E7.1	Plant design includes: • Separation distances between Plant and adjacent perimeter line, and maintenance of fire breaks on property boundary	DLNG Operations Team Leader	Darwin Operations Manager

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
				• Fire fighting systems (automatic and manual) • Process control and emergency shutdown and depressurisation systems • Fire and gas detection system and alarms • Grounding of equipment for lightning strikes to prevent fire propagation		
			E7.2	Contact details available onsite for external fire fighting resources	DLNG Operations Supervisor	DLNG Operations Team Lead
			E7.3	Ongoing weed management undertaken on a needs basis to minimise high fuel load risk	Onsite Maintenance Support	Maintenance Coordinator
Unplanned disturbance to surrounding bushland and native fauna due to vehicle interactions of attraction of feral/pest animals	E8	Minimise disturbance to native flora, vegetation and fauna	E8.1	Site perimeter fencing installed and maintained	DLNG Security	Marine Specialist
			E8.2	DLNG HSE site induction includes an environmental component which informs the workforce of: • Sensitive habitats adjacent to the DLNG Plant • Native fauna likely at DLNG and promotes reporting of sightings	HSE Advisor	HSE Supervisor
			E8.3	Security office manned 24/7 to monitor boundary of DLNG and control public access	DLNG Security	Marine Specialist
	E9		E9.1	DLNG HSE site induction includes an environmental component which informs the workforce of: • Sensitive habitats adjacent to the DLNG Plant • Native fauna likely at DLNG and promotes reporting of sightings	HSE Advisor	HSE Supervisor

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
	E9		E9.2	Vehicle speed limits imposed for the DLNG Plant and sign posted	DLNG Operations Supervisor	DLNG Operations Team Leader
			E9.3	Native species rehabilitation and relocation facilitated through NT Department of Parks and Wildlife as required	Operational Environmental Specialist	Environmental Supervisor
	E10		E10.1	Site perimeter fencing installed and maintained as required	DLNG Security	Marine Specialist
			E10.2	Pest baiting completed onsite if required	Onsite Maintenance Support	Maintenance Coordinator
			E10.3	Onsite general waste bins provided and routinely collected to avoid feral animal attraction	Onsite Maintenance Support	Maintenance Coordinator
Waste Management (Handling and Disposal)						
Inappropriate handling and disposal of non-hazardous and hazardous waste	W1	No migration of non-hazardous or hazardous waste beyond the boundary of DLNG which causes environmental harm	W1.1	DLNG Waste Management Procedure outlines waste management and disposal requirements, including: • Waste segregation including recycling facilities onsite prior to offsite disposal, with the provision of general and recycling waste bins at DLNG Plant • Waste manifest and tracking system for all wastes, to a standard which is compliant with EPL217-01 Conditions 70 and 71 • Disposal of non-hazardous waste in accordance with regulatory requirements • Regular removal of wastes by licenced contractor	Operational Environmental Specialist	Environmental Supervisor
			W1.2	Waste management contractor selection and auditing processes defined and implemented	HSE Specialist Contractor Management	Logistics Team Lead

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
			W1.3	Visual inspection of Plant site during shift walkaround to identify any waste materials	Operations Technician	DLNG Operations Supervisor
	W2		W2.1	DLNG Waste Management Procedure outlines waste management and disposal requirements, including: • Waste segregation on site prior to offsite disposal and the designated Hazardous Waste Transfer Facility • Waste manifest and tracking system for all wastes, to a standard which is compliant with EPL217-01 Conditions 70 and 71 • Disposal of hazardous waste in accordance with regulatory requirements • Waste management contractor selection and auditing processes • Hazardous waste removed and disposed of by a licensed contractor	Operational Environmental Specialist	Environmental Supervisor
			W2.2	ABU-W Chemical Management Procedure used to assess the selection of chemicals	HSE Specialist - Industrial Hygiene	HSE Team Lead
			W2.3	Management of all naturally occurring hazardous process contaminants in accordance with the ABU-W Naturally Occurring Hazardous Process Contaminants Procedure	HSE Specialist - Industrial Hygiene	HSE Team Lead
			W2.4	Labelling of hazardous waste and storage undertaken in accordance with the DLNG POG	Operations Technician	DLNG Operations Supervisor
Socio-Economic and Cultural Heritage						
Restricted fishing and recreational boating	S1	Maintain open dialogue with the Darwin community	S1.1	Compliance with EPL217-01 Condition 9, specifically the implementation and maintenance of a Consultation and Communication Plan	External Relations Advisor	VP Sustainable Development

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
access in the vicinity of the DLNG Plant			S1.2	Compliance with EPL217-01 Condition 12 and Condition 13, specifically maintenance of a Complaints Log for all complaints received	External Relations Advisor	VP Sustainable Development
			S1.3	Navigation aids installed and maintained on Wickham Point and LNG loading jetty (signage, beacons, lights).	Marine Specialist	Marine Director
			S1.4	Marine radio channels and other communication systems used as required for activities in Darwin Harbour	Marine Specialist	Marine Director
Noise and visual amenity impacts to Darwin City and surrounding land users	S2		S2.1	Compliance with EPL217-01 Condition 9, specifically the implementation and maintenance of a Consultation and Communication Plan	External Relations Advisor	VP Sustainable Development
			S2.2	Compliance with EPL217-01 Condition 12 and Condition 13, specifically maintenance of a Complaints Log for all complaints received	External Relations Advisor	VP Sustainable Development
			S2.3	Notifications provided to the public regarding marine flare activities	Environmental Supervisor	External Relations Advisor
Disturbance to sites of Indigenous and European heritage values	S3	Maintain protection of undisturbed archaeological and heritage sites No physical disturbance to sites of archaeological or ethnographic significance	S3.1	Security fence maintained as required and patrols completed of the DLNG Plant's fence line	DLNG Security	Marine Specialist
			S3.2	No clearing/disturbance outside the current disturbance footprint	DLNG Operations Team Leader	Darwin Operations Manager
			S3.3	Sites of cultural significance noted on area drawings and signage in specific areas of significance to restrict public access	DLNG Operations Team Leader	Darwin Operations Manager
			S3.4	Pictorial interpretive display of archaeological/heritage values located on the Darwin Esplanade	DLNG Operations Team Leader	Darwin Operations Manager

Environmentally Hazardous Event/Aspect	Risk Element Number (Table 7-1)	Environmental Performance Objective (EPO)	Risk Management Controls and Mitigation (Table 7-1)	Performance Criteria	Responsible Person	Accountable Person
			S3.5	Wickham Point Archaeological Sites Register maintained	Operational Environmental Specialist	Environmental Supervisor
		Maintain open dialogue with traditional land owners	S3.6	Engagement with the Larrakia Liaison Committee, as per the established meeting schedule	External Relations Advisor	VP Sustainable Development

9 IMPLEMENTATION STRATEGY

9.1.1 Roles and Responsibilities

Implementation of the DLNG OEMP is the shared responsibility of ConocoPhillips employees and contractors directly or indirectly involved with DLNG operations. HSE roles and responsibilities are defined for personnel in either their position descriptions or in contractual terms and conditions.

The content of operations team position descriptions include, as applicable, items such as primary responsibilities, accountabilities, qualifications, competency, skills and experience requirements for the position.

Specific environmental performance objectives and standards are documented in the OEMP.

While most departments and groups within the ConocoPhillips ABU play a role in the implementation of the ABU HSEMS, the groups with the major share of direct involvement are the HSE department and the Operations team.

The key roles and responsibilities of ConocoPhillips personnel in relation to implementing this OEMP, specifically the environmental management strategies in Section 8, are outlined in Table 9-1. Figure 9-1 shows the organisational structure of the ConocoPhillips DLNG Operations team. These charts indicate the level and flow of reporting and communication between key project personnel.

Table 9-1: Key Roles and Responsibilities

Title (Role)	Environmental Responsibilities
DLNG Operations Manager	• Confirm that DLNG Operations are undertaken in accordance with this OEMP, including compliance with the environmental management strategies. • Provide sufficient resources to implement the environmental management strategies in this OEMP. • Ensure all operations personnel attend an environmental induction upon commencing work at DLNG. • Confirm contracts and third party contactors meet the requirements of the ConocoPhillips HSEMS and relevant standards/procedures.
DLNG Operations Team Leader/ DLNG Shutdown Team Leader	• Ensure the OEMP is implemented throughout operations. • Ensure personnel have sufficient training to apply the policies, processes, standards, and recommended procedures detailed in this OEMP. • Communicate any changes to DLNG Plant operations to the DLNG Operations Supervisor. • Ensure operational integrity and maintenance plans are sufficient to maintain the standards as detailed in this OEMP. • Liaise with the ConocoPhillips Environmental Specialist to develop environmental approval documents and environmental induction material. • Report all environmental incidents to the DLNG Operations Manager.
DLNG Operations Supervisor	• Ensure environmental induction material is presented to operations personnel. • Maintain competency of operations personnel to be able to respond to an environmental incident. • Report all environmental incidents to the DLNG Operations/Shutdown Team Leader.
Environmental Supervisor	• Confirm environmental audits are undertaken as outlined in this OEMP. • Report all environmental incidents to the DLNG Operations Manager. • Liaise with the ConocoPhillips Environmental Specialist to ensure environmental coverage during risk assessments (e.g. hazard identification workshops, Management of Change reviews). • Ensure compliance with the environmental management strategies detailed in this OEMP.

Title (Role)	Environmental Responsibilities
	• Undertake environmental audits to verify compliance with this OEMP. • Ensure environmental reporting (internal and external) is completed as outlined in this OEMP, including the Annual Return and Annual Monitoring Report for submission to the NT EPA. • Ensure OEMP is reviewed per the defined review schedule.
HSE Advisor	• Roll-out of environmental induction material to operations personnel. • Assist with the completion of First Reports of environmental incidents. • Assist the HSE Supervisor with ensuring compliance with the environmental management strategies detailed in this OEMP, including onsite audits.
Maintenance Coordinator	• Responsible for ensuring maintenance of the DLNG facility equipment is undertaken.
HSE Team Lead	• Provide guidance and assistance on the use of the ABU-W Chemical Management Procedure, as required. • Maintenance of the DLNG Approved Chemicals and Hazardous Substances Register.
Operational Environmental Specialist	• Assist with the completion of First Reports of environmental incidents. • Assist the Environmental Supervisor with ensuring compliance with the environmental management strategies detailed in this OEMP, including onsite audits. • Input into the Annual Return and Annual Monitoring Report, for submission to the NT EPA.
External Relations Advisor	• Maintain open dialogue with traditional land owners and relevant authorities with regards to environmental requirements and commitments.
All DLNG Plant staff	• Adhere to all ConocoPhillips ABU-W HSEMS requirements. • Attend the environment inductions, HSE meetings and complete training (awareness and competency) as required. • Familiarise with work methods and agreed procedures prior to conducting tasks (including the OEMP and all regulatory requirements). • Report any environmental incidents and near misses immediately to the DLNG Operations Supervisor.

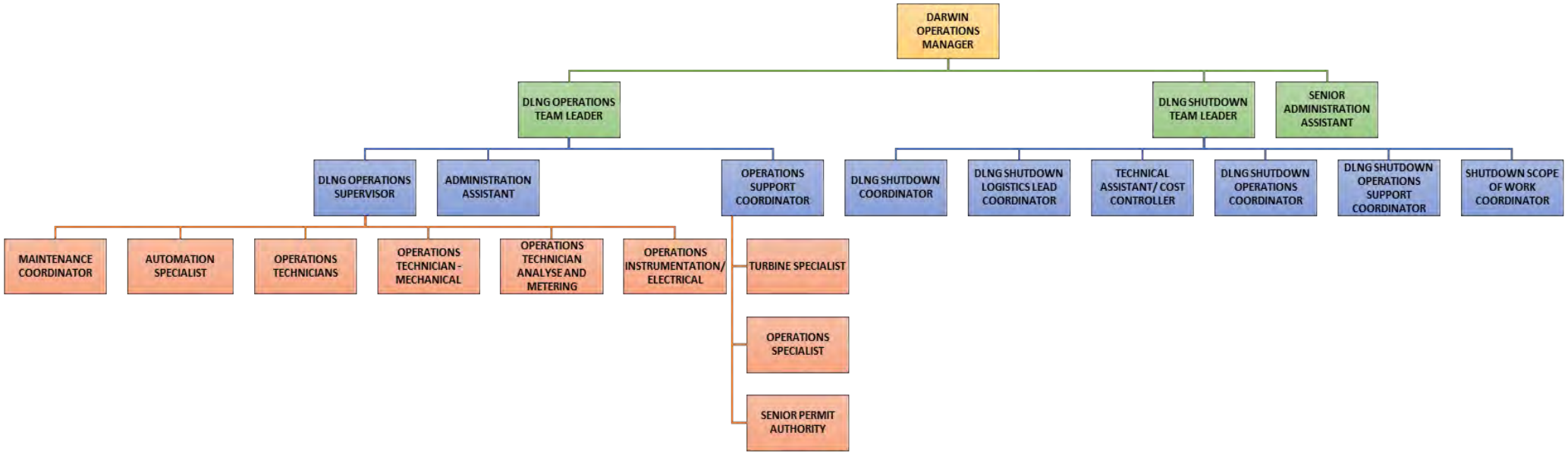

Figure 9-1: ConocoPhillips DLNG Operations Team Organisational Chart

9.1.2 Training and Competencies

Personnel engaged to work on the DLNG Plant, whether as staff or contractors, are required to attend a HSE induction and satisfactorily pass the associated competency questionnaire. The HSE induction covers the following environmental management requirements:

- Pollution prevention and housekeeping practices and procedures;
- Waste management, including segregation and handling of different wastes;
- Chemicals selection, approval and management processes and procedures; and
- Emergency Response Plan and procedures.

These requirements are reinforced through periodic workplace HSE meetings and toolbox meetings. Training and competency assessments are managed through the Training Department.

9.1.3 Monitoring

The purpose of all DLNG monitoring programs is to gather information to identify any potential impacts of operational activities on the local receiving environment, with reference to the baseline data collected prior to the start of DLNG Plant commissioning and/or comparison against selected trigger values established in EPL217-01. The sections below outline the environmental monitoring programs to be implemented, within sub Sections 9.1.3.1 to 9.1.3.5.

The ABU-W Environmental Monitoring and Reporting Procedure (ALL/HSE/PRO/066) provides detail of relevant procedures used for data recording, data quality assurance and quality control. The procedure (ALL/HSE/PRO/066) also outlines the adaptive management feedback loop of monitoring data and results back into the operational process to review, and adjust any potential environmental impact.

9.1.3.1 Atmospheric Emissions Monitoring

Objective

The majority of exhaust emissions at the DLNG Plant are by-products of the combustion of natural gas throughout the process and native CO_2 within the feed gas. The aim of the atmospheric emissions monitoring program is to determine the quality and quantity of emissions for reporting purposes but also for process optimisation.

Methodology

Atmospheric emissions from the power generation turbine, refrigerant compressor turbines and boiler stacks (Section 4.2.8) are sampled biannually while the AGI and acid gas removal unit (vent) are sampled quarterly. The emissions monitored consist of NO_X (as NO_2), CO and SO_2 for all sample points, H_2S is also sampled at the AGI and acid gas vent, and benzene is sampled at the acid gas vent only. The authorised emissions sources, type of emission, concentration limits, emission rate limit and monitoring frequency is detailed in Table 3 of Appendix B of EPL217-01, shown in Figure 9-2 below. The emission points and hence monitoring locations are shown in **Error! Reference source not found.**. An example of a sample port is shown in Figure 9-3. All sample ports are labelled for easy identification.

Air emissions stack sampling is completed by an approved third party vendor and follows a defined procedure to ensure sampling methods are consistent (N8-10000078793). Quality assurance (QA) and quality control (QC) is completed by the third party vendor. ConocoPhillips ensures atmospheric emissions sampling vendors are accredited by the National Association of Testing Authorities (NATA) and their methods align with the New South Wales (NSW) EPA Approved Methods for the Sampling and analysis of Air Pollutants in New South Wales (Department of Environment and Conservation (DEC) NSW, 2007).

NOx, SO_2, and CO concentrations (mg/Nm^3) are monitored in the field while benzene and H_2S samples are collected for laboratory analysis in a NATA accredited lab. All emission rates are calculated based on operations data available for the time of testing.

Other significant emission sources include flaring and venting associated with different process activities. The emissions from flaring and venting are estimated using NGER and NPI methods and recorded flow rates.

Outputs

Emission concentrations and rates are used for EPL annual reporting requirements, as well as NGER and NPI annual reporting requirements.

Monitoring data is used to inform continuous improvement and adaptive management in environmental management practices and environmental performance.

Table 3 – Authorised air emission points

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Release Point Number	Source	Pollutant	Concentration Limit	Maximum mass emission rate[1]	Monitoring frequency[2]
			mg/Nm^3	g/s	
U3101, U3102, U3103, U3104 and U3105	Power generation turbines	NO_x as NO_2	70 @ 15% O_2 dry	1	Biannually
		CO	32 @ 15% O_2 dry	0.4	Biannually
		SO_2	23 @ 15% O_2 dry	0.2	Biannually
U1411, U1421, U1511, U1521, U1611 and U1621	Compressor turbines	NO_x as NO_2	212 @ 15% O_2 dry	25	Biannually
		CO	70 @ 15% O_2 dry	5	Biannually
		SO_2	65 @ 15% O_2 dry	4.7	Biannually
K-1904	Acid gas incinerator	NO_x as NO_2	64 @ 15% O_2 dry	1.5	Quarterly
		CO	339 @ 15% O2 dry	3	Quarterly
		H_2S	5 @ 15% O_2 dry	0.1	Quarterly
		SO_2	194 @ 15% O_2 dry	4.6	Quarterly
V1206[5]	Solvent Regenerator Reflux Drum (Acid gas removal unit (vent)[3])	H_2S	136 Nm^3	1.5	Quarterly
		Benzene	16 Nm^3	0.18	Quarterly
B3801	Boiler	NO_x as NO_2	190 @ 3% O_2 dry	0.7	Biannually
		CO	42 @ 3% O_2 dry	0.2	Biannually
		SO_2	65 @ 3% O_2 dry	0.25	Biannually

Figure 9-2: EPL217-01 Appendix B Table 3, DLNG Authorised Air Emission Points

Figure 9-3: Example of Air Emission Sample port

9.1.3.2 Wastewater Monitoring

Objective

Wastewater monitoring is completed to ensure no long term environmental impact occurs as a result of wastewater discharges from DLNG to the environmentally sensitive receptors including the mangrove ecosystem and Darwin Harbour. Monitoring is also completed to ensure compliance with the EPL requirements and record long term trends for opportunities for process improvements.

Methodology

The wastewater discharge program comprises the collection of water samples from the jetty outfall, irrigation water and sediment pond outfalls. A wide suite of water quality parameters are monitored in each discharge water stream and the frequency of monitoring is dependent on the environmental risk profile of the parameter. Wastewater discharge monitoring location details are provided in Figure 4-5 and the frequency, analysis parameters are detailed in Table 9-2.

Water sampling is completed by the DLNG laboratory. Water for metals analysis is collected from a composite sampler with all other analytes collected from a flowing sample. The DLNG laboratory coordinate samples to be sent to external NATA accredited laboratories for sample analysis. Additional samples are collected and stored in the DLNG laboratory for potential resampling requirements, as a QA/QC process should further QA/QC be required to be completed by external laboratories.

All sampling and analysis is completed in line with the NSW EPA Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales (DEC NSW, 2004).

Table 9-2: EPL217-01 Appendix B Table 2, DLNG Authorised Wastewater Discharge Trigger Values

Table 2 – Authorised wastewater discharge trigger values

Parameter	Units	Discharge Location					
		Irrigation Discharge[1]		Jetty Outfall Discharge[2]		Sediment Ponds 1, 2 and 3 Discharge	
		Trigger Value	Frequency[3]	Trigger Value	Frequency[4]	Trigger Value	Frequency[5]
Field Measurements							
pH	-	pH 7-8.5	Monthly	pH 7-8.5	Monthly	pH 6-8.5	Monthly
Electrical conductivity	µs/cm	Not available	Monthly	Not available	Monthly	Not available	Monthly
Total suspended solids	mg/L	≤ 30	Monthly	≤ 30	Monthly	≤ 75	Monthly
Turbidity	NTU	n	Monthly	20	Monthly	28	Monthly
Dissolved oxygen	mg/L	Not available	Monthly	Not available	Monthly	Not available	Monthly
Temperature	°C	Not available	Monthly	Not available	Monthly	Not available	Monthly
Environmental Indicators							
Ammonia nitrogen (NH_3-N)	µg/L	20	Annual	337	Annual	94	Annual
Nitrate (NO_3-N)	µg/L	17	Annual	764	Annual	145	Annual
Nitrite (NO_2-N)	µg/L	17	Annual	27	Annual	17	Annual
Dissolved reactive phosphorous (PO_4-P)	µg/L	5	Annual	51	Annual	5	Annual
Chlorophyll-a	µg/L	2	Initial and then as required for biannual groundwater monitoring only	NA[6]	NA[6]	NA[6]	NA[6]
Biological oxygen demand	mg/L	≤ 25	Monthly	≤ 25	Monthly	≤ 25	Monthly
Total petroleum hydrocarbons	mg/L	< 6	Annual	< 6	Annual	< 6	Annual
Total nitrogen	mg/L	≤ 40	Annual	≤ 40	Annual	≤ 40	Annual
Total phosphorus	mg/L	≤ 10	Annual	≤ 10	Annual	≤ 10	Annual
E.coli	MPN /100mL	≤ 75	Initial and then as required for biannual groundwater monitoring only	≤ 75	Initial and then as required for in-field monitoring (biannually in first year)	≤ 305	Initial and then as required for in-field monitoring (biannually in first year)

Parameter	Units	Discharge Location					
		Irrigation Discharge[1]		Jetty Outfall Discharge[2]		Sediment Ponds 1, 2 and 3 Discharge	
		Trigger Value	Frequency[3]	Trigger Value	Frequency[4]	Trigger Value	Frequency[5]
Enterococci	MPN /100mL	50	Initial and then as required for biannual groundwater monitoring only	50	Initial and then as required for in-field monitoring (biannually in first year)	261	Initial and then as required for in-field monitoring (biannually in first year)
Metals & BTEX							
Arsenic	µg/L	10	Annual	Not available	Annual	Not available	Annual
Cadmium	µg/L	3.2	Monthly	5.5	Monthly	5.5	Monthly
Chromium	µg/L	10	Annual	4.4	Annual	4.4	Annual
Copper	µg/L	69	Monthly	3.0	Monthly	2.0	Monthly
Iron	µg/L	1,300	Annual	Not available	Annual	Not available	Annual
Lead	µg/L	10	Annual	4.4	Annual	4.4	Annual
Manganese	µg/L	15,500	Annual	Not available	Annual	Not available	Annual
Mercury	µg/L	0.1	Monthly	0.4	Monthly	0.4	Monthly
Nickel	µg/L	290	Annual	70	Annual	70	Annual
Silver	µg/L	1.4	Annual	1.4	Annual	1.4	Annual
Zinc	µg/L	1780	Monthly	16.0	Monthly	1000	Monthly
BTEX	µg/L	700	Monthly	700	Monthly	700	Monthly

[1] The Irrigation Discharge Trigger Values for Field Measurements, Environmental Indicators and BTEX are adopted from the Darwin Harbour Water Quality Objectives (DHWQO) and are intended to be applied at the source as Interim values for the purpose of this EPL Renewal. The Irrigation Discharge Trigger Values for Metals are interim trigger values developed by ConocoPhillips using the 80th percentile value of the current groundwater reference bore (BH1) dataset, which comprises of 16 data points including 11 consecutive data points collected as part of the development of the final site specific trigger values. The estimated completion date for the final site specific trigger values for the long term irrigation discharge management is June 2019.

[2] The trigger values are to be applied at the authorised wastewater discharge points in Table 1. The implementation of the plan described in Condition 87 of this EPL will inform the derivation of future trigger values based on modifications to the jetty outfall discharge.

[3] The monitoring frequency presented correlates to monitoring at the source. The frequency of groundwater monitoring is included in Table 4.

[4] The monitoring frequency presented correlates to monitoring pre-discharge.

[5] Monitoring to be conducted at least one month prior to first flush sediment pond discharge and monthly during sediment pond discharge events.

[6] Trigger value for Chlorophyll-a is not applicable, given the context of the nature of the discharges. Chlorophyll-a is not present in the jetty outfall discharge, therefore N/A for jetty outfall. Chlorophyll-a is an in-field response indicator to eutrophication and not a stressor or toxicant, therefore N/A for sediment ponds.

[7] The Aquatic Health Unit has advised that the DHWQO are currently being reviewed and may be released by March/April 2019. DHWQO state that "*Local guidelines in this document have been derived for physico-chemical indicators and potential stressors, and do not address toxicants (such as heavy metals). Guideline values for toxicant indicators in water and sediment will continue to be sourced from ANZECC (2000) Guidelines.*" The ANZECC guidelines advise that there was insufficient data to derive a reliable trigger value for Arsenic, Iron and Manganese.

Outputs
When results are received they are uploaded into a database which is managed by the DLNG laboratory.

Water concentration results are used for EPL annual reporting requirements, as well as NPI annual reporting requirements. Monitoring data is also used to inform continuous improvement and adaptive management in environmental management practices and environmental performance.

9.1.3.3 Groundwater Monitoring

Objective
Groundwater monitoring is completed biannually to monitor the impact, if any, of irrigation discharge water on the groundwater receiving environment.

Methodology
A groundwater monitoring program is in place at the DLNG Plant, with a focus on the constituents discharged from the effluent treatment plant, which comprises the onsite irrigation discharge of treated effluent and treated process water. A network of seven groundwater monitoring bores is established across the site, including an offsite reference bore (BH1) (Figure 9-4). Sampling and analysis is undertaken biannually (noting that sampling at BH1 will be undertaken monthly for a 24-month period before reverting to biannual monitoring, to collect data points for the establishment of site specific trigger values).

The monitoring program includes two sampling events, to capture both wet and dry season conditions. Groundwater monitoring and analysis covers standing water levels and a wide suite of water quality parameters, results are compared against previous years' data, relevant guidelines and the BH1 baseline dataset. The groundwater sampling locations and frequency is summarised in Table 9-3.

Groundwater monitoring is complete by an approved third party vendor. Further details of the groundwater monitoring program are provided in the Groundwater Monitoring Plan (March 2013).

ConocoPhillips ensures the groundwater monitoring and sampling vendor uses laboratories accredited by the NATA and their methods align with the New South Wales (NSW) EPA Approved Methods for the Sampling and analysis of Water Pollutants in New South Wales (DEC NSW, 2007).

Table 9-3: Groundwater Sampling Locations and Frequency of Sampling

Bore	Location	Monitoring Frequency
BH1	12.52388 S 130.8753 E	Monthly (until 24 months of data collected, and then biannually)
BH2	12.52099 S 130.8635 E	Biannually
BH3	12.52204 S 130.8637 E	Biannually
BH4	12.52316 S 130.8628 E	Biannually
BH5	12.52424 S 130.8638 E	Biannually
BH6	12.52455 S 130.8651 E	Biannually
BH7	12.52558 S 130.8641 E	Biannually
Analytes tested for shadow irrigation discharge requirements (as outlined in EPL217-01 Appendix B Table 2, DLNG Authorised Wastewater Discharge Trigger Values), except chlorophyll a		

Outputs
Groundwater monitoring data is provided in an annual Groundwater Monitoring Report, which details both biannual monitoring event data sets and completes trend analysis of the current years' data against previous years' data. The annual report is then summarised within the Annual Environmental Monitoring Report to NT EPA.

9.1.3.4 Mangrove Monitoring

Objective
A comprehensive Mangrove Monitoring Program is in place to detect potential off-site impacts from DLNG operations on the surrounding mangrove communities. The key objectives of this program include completion of high level surveillance and rapid assessment of mangrove health of the surrounding mangrove communities.

Methodology
Monitoring is undertaken on an annual basis and comprises two parts (

Table 9-4):

1. Mangrove surveillance – Includes measurement and recording of the following parameters: canopy density, species composition and tree density, defoliation index, relative ground levels (sediment accumulation or erosion), surveillance monitoring photographs and groundwater conditions. There are 23 mangrove monitoring sites (SS1 – SS23), as shown in Figure 9-5.

2. Chemical monitoring – Involves monitoring of hydrocarbon and heavy metal concentrations in sediment and mudwhelks to monitor for potential impacts on mangrove sediment and biota surrounding the DLNG Plant. Samples are collected from eight sites adjacent to DLNG Plant (Figure 9-5) and three control sites in Darwin Harbour (Figure 9-6).

Mangrove monitoring is completed by an approved third party vendor. Further detail on the Mangrove Monitoring Program is provided in Appendix D of EPL217-01.

Table 9-4: Mangrove Monitoring Completed per Site Location

		Groundwater monitoring (depth, TDS, pH)	**Mangrove health (canopy density, species composition and tree density and defoliation index, surveillance photography) Ground levels (sediment)**	**Sediment chemical analysis (grain size distribution, total metal (Cd, Cr, Cu, Pb, Fe, Nic, Zn) acid soluble (Zn), total hydrocarbons)**	**Mudwhelk chemical analysis (total metal (Cd, Cr, Cu, Pb, Fe, Nic, Zn) acid soluble (Zn), total hydrocarbons)**
Mangrove surveillance site	SS1	✓	✓		
	SS2	✓	✓		
	SS3	✓	✓		
	SS4	✓	✓		
	SS5	✓	✓		
	SS6	✓	✓		
	SS7	✓	✓		
	SS8		✓		
	SS9		✓		
	SS10		✓		
	SS11		✓		
	SS12		✓		

	SS13	✓	✓		
	SS14	✓	✓		
	SS15-A		✓		
	SS16-A		✓		
	SS17		✓		
	SS18		✓		
	SS19	✓	✓		
	SS20	✓	✓		
	SS21	✓	✓		
	SS22		✓		
	SS23		✓		
	SS24		✓		
Chemical Monitoring	SP1			✓	✓
	SP1A			✓	✓
	SP1B			✓	✓
	SP1C			✓	✓
	LG1			✓	✓
	LG2			✓	✓
	LG3			✓	✓
	SP2			✓	✓

Outputs
Mangrove Monitoring data is provided in an annual Mangrove Monitoring Report, which provides the datasets and completes trend analysis of current years' data against previous years data. The annual report is then summarised within the Annual Environmental Monitoring Report to NT EPA.

9.1.3.5 Weed Mapping

Objective
Weed mapping is completed to record the distribution and abundance of weed species within and along the DLNG Plant perimeter boundary. This data is then used to plan weed management through both the wet and dry seasons.

Methodology
Weed surveying is completed pre-wet season (November/December) to establish a new baseline before the predominate weed growth period, and then again mid-wet season (February) to report and record efforts and act as a feedback loop for weed management practices. The feedback loop is either positive, i.e. weed management strategies are working well, or negative i.e. management strategies are currently not effective and should be reviewed. A final survey is completed at the end of the wet season (April) to record wet season weed management efforts and describe any potential weed management required during the less productive growth period, the dry season.

As a part of weed surveying a contract vendor walks the DLNG boundary and the DLNG site while recording the GPS location and species of weed.

Outputs
After each survey event a report is developed by the third party vendor which includes maps identifying 'hot' zones per weed species. These maps are used to develop a weed management plan and track the effectiveness of weed management.

9.1.3.6 Monitoring Summary

A summary of the monitoring programs and their objectives, methods and sampling locations is provided in Table 9-5.

Table 9-5: Summary of Monitoring Programs Completed at DLNG

	Atmospheric Emissions Monitoring	Wastewater Emissions Monitoring	Groundwater Monitoring	Mangrove Monitoring	Weed Monitoring
Objective	To monitor emissions for reporting purposes and process optimisation.	To monitor emissions for reporting purposes and process optimisation.	To monitor any potential impact on the receiving environment as a result of irrigation discharge.	To monitor any potential impact on the receiving environment as a result of DLNG operations	To monitor and record weeds to determine weed control efforts required.
Data collection method	In field stack emissions sampling and NATA lab analysis and process data collection.	Sample collection by DLNG laboratory, sample sent to NATA accredited laboratories for analysis.	Groundwater sampling completed by a contract vendor on a biannual frequency.	Mangrove monitoring (surveillance and chemical monitoring) completed by a contract vendor on a biannual frequency.	In field weed surveying of location and species by contract vendor.
Data reporting method	Quarterly reports used to develop annual reports – monitoring report to NT EPA, NPI and NGER reports.	Laboratory reports, with data entered into DLNG Laboratory database. Results are included in annual monitoring report to NT EPA and NPI reporting.	Contractor vendor prepared annual groundwater report, which is included in the annual monitoring report to NT EPA.	Contractor vendor prepared annual mangrove report, which is included in the annual monitoring report to NT EPA.	Survey report generated post field data collection used internally for weed management planning.
Monitoring frequency, analysis parameters	Figure 9-2	Table 9-2	Table 9-3	Refer to the Mangrove Monitoring Program (Appendix D of EPL217-01).	Before, mid and post wet season. All weed species identified.
Sampling location map	**Error! Reference source not found.**	Figure 4-5	Figure 9-4	Figure 9-5	All of site

Figure 2
Monitoring well network

Figure 9-4: Groundwater Monitoring Bore Locations

Figure 9-5: Mangrove Monitoring Locations Adjacent to the DLNG Plant

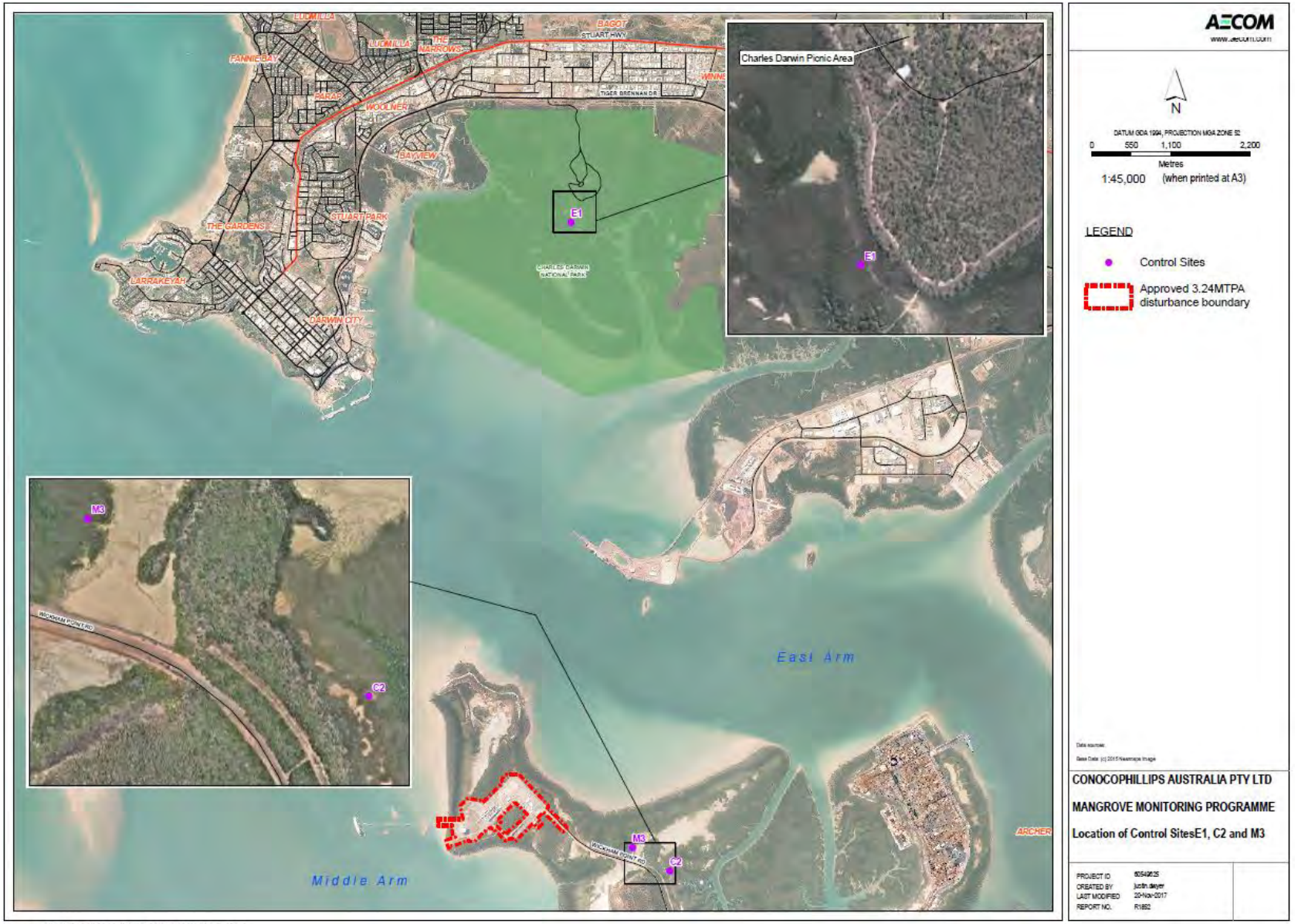

Figure 9-6: Mangrove Monitoring Control Site Locations

9.1.4 Routine Reporting

9.1.4.1 Internal Reporting

Reporting requirements associated with environmental statutory reporting requirements, performance targets and KPI's are defined in the ABU-W Environmental Monitoring and Reporting Procedure (ALL/HSE/PRO/066).

Operational performance data entry and collation is conducted via the following primary reporting systems:

- Environmental performance routine and non-routine atmospheric emissions and liquid wastewater discharges will be tracked daily and reported through monthly DLNG Operations Report;
- Operational system capture data associated with fuel consumption and production;
- ABU-W Chemical Management Procedure (ALL/HSE/PRO/044);
- Waste generation and disposal records which maintain a record of the nature, and quantities and source, of waste streams generated, as required by the EPL and DLNG Waste Management Procedure (DLNG/HSE/PRO/071); and
- Incident Reporting and Investigation Procedure (ALL/HSE/PRO/003).

Reporting roles and responsibilities, reporting standards, and records management requirements are defined in the above referenced specifications and procedures.

9.1.4.2 External Reporting

Annual Return

In accordance with the EPL, an Annual Return will be provided to the NT EPA each year within 10 business days of the EPL anniversary date (19 September).

The Annual Return will be in the NT EPA prescribed format for demonstrating and reporting compliance with the EPL conditions, and for providing information on gas production for the successive 12-month period.

Annual Monitoring Report

The Annual Monitoring Report must be submitted to the NT EPA by 30 January each year. The Annual Monitoring Report will be prepared in accordance with the requirements of the NT EPA 'Guideline for Reporting on Environmental Monitoring' (NT EPA, 2016), to include:

- tabulation of all monitoring data required as a condition of this licence;
- long term trend analysis of monitoring data to demonstrate any environmental impact associated with the activity over a minimum period of three years (where the data is available);
- an assessment of environmental impact from the activity; and
- analysis on the impacts of the Licensed Activity on ambient air quality.

If the NT EPA requires revision/amendment and resubmission of the Annual Monitoring Report, the updated report will be submitted by the date specified by the NT EPA.

Environmental Performance Reporting

Environmental performance reporting will be provided to key stakeholders, including, but not limited to:

- NT EPA (as above; and annual NPI listed substances emissions report);

- Annual reporting of NPI listed substances. Include as part of the DLNG Plant annual NPI report – due for submission by 31 March following reporting period (1 January to 31 December).

- DoEE/Clean Energy Regulator (National Greenhouse and Energy Report); and
    - Annual reporting of GHG emissions to be reported as part of the NGERS report – due for submission by 31 October following reporting period (1 July to 30 June).

- ConocoPhillips Corporate Company (Performance Assurance Reports).

Public Register

As outlined in the EPL217-01, the following documents will be available to members of the public through a register on the NT EPA's website:

- a copy of the EPL and any plans for environmental management, reports, submissions or documents required as a condition of EPL217-01; and

- a copy of the Annual Return.

9.1.5 Environmental Incident/Non-Compliance Reporting

ConocoPhillips implements a systematic approach so that all incidents and near misses are consistently, methodically and effectively investigated, as appropriate to their risk or potential severity. All incidents including near misses are reported, investigated in a timely manner and analysed to identify corrective actions/preventive measures to prevent recurrence and continuously improve HSE performance. Incident investigations are documented using a database to track actions and enable sharing of learnings.

Non-compliances may be identified through monitoring, audits, observations or incident reports. A non-compliance with the EPL includes:

- a non-compliance to any EPL condition;

- an exceedance at an authorised discharge point specified in Table 1 of Appendix B of a trigger value for wastewater discharges specified in Table 2 of Appendix B:
    - on three consecutive sampling occasions; or
    - on a single sampling occasion of three times or more the trigger value.

- an exceedance of a maximum:
    - concentration limit specified in Table 3 of Appendix B; or
    - mass emission rate limit specified in Table 3 of Appendix B.

Actions required to address non-conforming incidents and to prevent the escalation of pollution or environmental damage will be appropriate to the nature of the event.

All reportable incidents, recordable incidents, near misses and non-compliances will in the first instance be reported to ConocoPhillips HSE and in accordance with the Incident Reporting and Investigation Procedure (ALL/HSE/PRO/003). A First Report will be completed for all environmental incidents. Root cause analysis is performed for incidents as required to determine the cause and aid identification of appropriate corrective actions.

The definition of a reportable incident has been taken from the *Waste Management and Pollution Control Ac*t, Part 3, 14. A 'reportable incident' means any incident (such as an accident or malfunction) which *"causes, or is threatening to cause pollution resulting in material environmental harm or serious environmental harm"*. A reportable incident is required to be reported to the NT

EPA as soon as practicable, but not later than twenty four hours after the first occurrence of the incident or after the time the operator becomes aware of the reportable incident. The incident is to be reported via the emergency pollution hotline at 1800 064 567 or pollution@nt.gov.au. Incident reporting should be coordinated by the Operations Environment Specialist.

The Licensee is to notify the NT EPA of non-compliances of the Licence by completing the Non-Compliance Notification via NT EPA Online (or by emailing waste@nt.gov.au), as soon as practicable after (and in any case within 24 hours after) first becoming aware of the non-compliance (EPL Condition 71). The following information will be provided in the notification of non-compliance (EPL Condition 72):

- when the non-compliance was detected and by whom;
- the date and time of the non-compliance;
- the actual and potential causes and contributing factors to the non-compliance;
- the risk of environmental harm arising from the non-compliance;
- the action(s) that have or will be undertaken to mitigate any environmental harm arising from the non-compliance;
- corrective actions that have or will be undertaken to ensure the non-compliance does not reoccur; and
- if no action was taken, why no action was taken.

An Incident Investigation Report will be completed for all reportable incidents, recordable incidents and non-compliances with the EPL. The report will include the following details, in accordance with EPL217-01 Condition 78:

- the date and time when the non-compliance was detected and by whom;
- the risk of environmental harm arising from the non-compliance;
- if no action was taken, why no action was taken;
- corrective actions that have or will be undertaken to ensure the non-compliance does not reoccur;
- the action(s) that have been undertaken to mitigate any environmental harm arising from the non-compliance; and
- the actual and potential causes and contributing factors to the non-compliance.

The Incident Investigation Report for any non-compliances with the EPL will be submitted to the NT EPA within 10 business days of notification of the incident.

9.1.6 Environmental Audits and Reviews

Monitoring implementation of commitments made within the OEMP and associated approvals documents and procedures is to be validated through the audit processes of the ABU-W HSEMS.

Environmental performance auditing and review programs will be completed to:

- Confirm impacts and risks are being effectively managed;
- Ensure relevant standards and procedures are being followed;
- Demonstrate compliance with regulatory requirements, the EPL and environmental management strategies within this OEMP;

- Monitor, review and evaluate the effectiveness of ConocoPhillips' HSEMS; and
- Ensure a senior management review of performance via consideration of the audit reports.

Environmental audits and follow-up actions are conducted in accordance with the ABU-W HSE Auditing and Inspection Procedure (ALL/HSE/PRO/031). The audits will be documented, and corrective actions will be tracked to completion in accordance with this procedure.

The ABU HSE auditing process consists of a three tier auditing hierarchy:

- Tier 3 – External Audits (Corporate and Regulatory);
- Tier 2 – Internal Business Unit Audits (HSEMS policies and procedures); and
- Tier 1 – Workplace Inspections (workplace hazard identification and control).

The environmental auditing program for the DLNG Plant includes the key elements and frequencies outlined in Table 9-6.

Table 9-6: Auditing and Review Program

Audit Type	Description	Scope	Frequency
Tier 1	Daily once per shift walkaround visual inspection	Site inspection of key process areas, bunds, chemical and hydrocarbon storage areas, sumps, stormwater drains and waste areas	Daily (hazard identification as required)
Tier 2	Internal environmental compliance audit	Audit completed against EPL217-01 to inform annual return compliance reporting.	Annual
Tier 3	Regulator (e.g. NT EPA and/or NT Department of Lands and Planning) and corporate audits	Regulatory compliance with the EPL	Regulator audits – unscheduled Corporate audits – completed every 3 years
	Third party compliance audit	Compliance with EPL217-01, specifically Conditions 26 to 30 (Environmental Auditing), the *Waste Management and Pollution Control Act 2016* and *Water Act 2016*	Once every 5 years
Management review	Integrated Operations Support Centre (IOSC) Steering Committee performance reviews	Quarterly and annual review of HSE performance	Quarterly and annual
Incident investigation review	Review in line with ConocoPhillips ABU-W Incident Reporting and Investigation Procedure (ALL/HSE/PRO/003)	The objective of the incident investigation is to establish the root cause(s) of an incident and to raise and close-out corrective actions to prevent recurrence	Following an incident or training exercise

Tier 2 and 3 audits require formal documentation and a corrective action plan to be developed in consultation with senior management and other relevant action owners. Agreed audit actions and findings are entered into the IMPACT Enterprise TM incident and assessment action tracking system and tracked through to closure by the ConocoPhillips HSE Department. The results from audits are regularly reported to the senior management team via HSE steering committees to ensure that action items are addressed.

Management review of HSE compliance and performance is undertaken in accordance with the ABU HSEMS review processes described in the HSE Management System Manual (ALL/HSE/MAN/001). The IOSC HSE Steering Committee, comprising of the IOSC management team, conducts quarterly HSE performance reviews. Inputs to the review process are provided from monitoring programs, audits and inspections conducted by staff and contractors with specialist expertise in operations and HSE. External review input is provided by corporate and third party specialists, as appropriate.

9.1.7 Management of Change

ConocoPhillips has an Environment Plan Management of Change Procedure (ALL/HSE/PRO/090) to manage changes associated with EMPs. It covers the content of this OEMP, including any legislative, procedural, engineering or physical change that is permanent, temporary, prospective or retrospective that may affect the potential impacts and risks from an activity and/or the environmental performance of an activity.

The procedure defines a framework that enables changes to be considered in the merit of a number of aspects including regulatory requirements and a 'materiality test', i.e. screening for significance. The procedure also allows for changes to be appropriately assessed and managed under internal decision points or to identify when resubmission to the regulator is required.

9.1.8 Stakeholder Consultation

ConocoPhillips is committed to open and meaningful consultation with stakeholders as part of its social licence to operate and regulatory commitments.

ConocoPhillips implements and maintains a Stakeholder Consultation and Communication Plan, which includes a strategy for communicating with persons who are likely to have a real interest in, or be affected by, the activity.

The community feedback number for the DLNG Plant is: 1800 199 423 (24 hour).

A Complaint Log is maintained as a central register for any complaints received regarding DLNG Plant operations. ConocoPhillips maintains dedicated channels to ensure all complaints received are considered, assessed for their merit and appropriately responded to in a timely manner, based on the complexity of the required response.

10 EMERGENCY RESPONSE ARRANGEMENTS

10.1 EMERGENCY RESPONSE PLAN

ConocoPhillips will implement, maintain and follow an Emergency Response Plan for the DLNG Plant, as specified in Condition 14 of EPL217-01.

The ERP provides coordinated and effective response to an emergency by:

- Establishing processes to maintain a high level of emergency preparedness;
- Identifying potential emergency scenarios that could occur;
- Documenting the overall emergency response process and key interfaces;
- Outlining measures to maintain interoperability with emergency services and other support organisations;
- Detailing the procedures that will be implemented to manage emergency events; and
- Defining the roles and responsibilities of personnel in an emergency event.

The ERP outlines the measures to:

- Ensure the safety of all personnel;
- Protect the environment through effective emergency management;
- Minimise the impact of damage to equipment and assets; and
- Liaise effectively with external agencies and authorities.

ConocoPhillips has a strategic approach to emergency response, providing a tiered structure of response. The tiered structure allows the Emergency Commander to assess a situation and mobilise the appropriate level of response. Ongoing appraisal of the situation by the Emergency Response Team allows the level of response to be upgraded or reduced in a controlled and effective manner.

The ConocoPhillips Crisis and Incident Management Plan (ALL/HSE/ER/001) and DLNG ERP (ALL/HSE/ER/002) describe arrangements and reporting relationships for command, control and communications, together with interfaces to emergency services specialist response groups, statutory authorities and other external bodies.

10.2 SPILL RESPONSE

10.2.1 Spill Response Arrangements

ConocoPhillips have a DLNG ERP, as described in Section 10.1 that covers operations at the DLNG Plant.

ConocoPhillips has a three-tiered approach to spills in accordance with the severity of the spill and organisational capabilities to mount an effective spill response. The three-tiered approach allows for a smooth transition of control to NT and Commonwealth agencies in the unlikely event of, or potential for, a Tier 2 or Tier 3 response. Response tiers are defined in Table 10-1. Details specific to DLNG are outlined in the DLNG Facility Oil Pollution Emergnecy Plan (ALL/HSE/ER/009).

ConocoPhillips is a member of the Australian Marine Oil Spill Centre (AMOSC) and Oil Spill Response Limited (OSRL) and can therefore draw on equipment and industry support in the event of a spill. Procedures for calling out this assistance are detailed in the ConocoPhillips Emergency Contacts Manual.

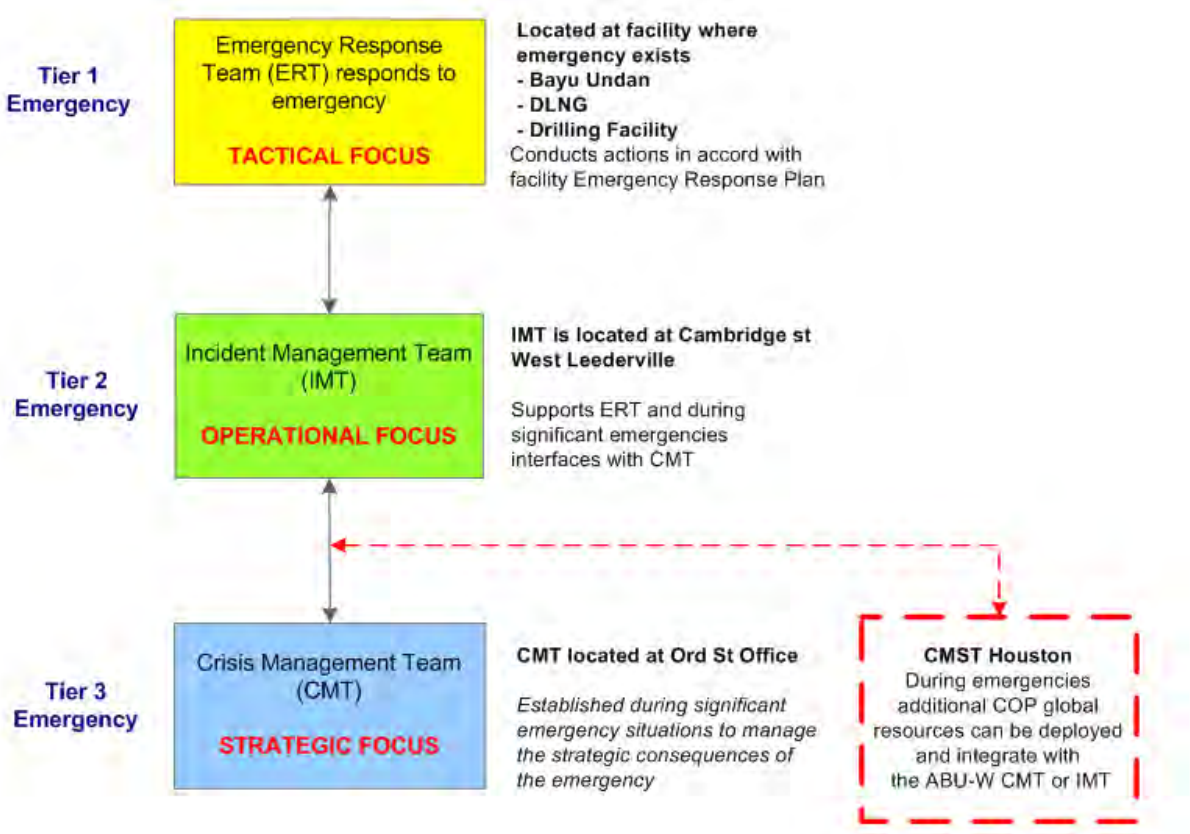

Figure 10-1: ConocoPhillips ABU-West Crisis, Emergency Management and Response Structure

Table 10-1: ConocoPhillips Crisis and Incident Management Response Tiers

Characteristic	ConocoPhillips Crisis and Incident Management Response Tier		
	Tier 1	**Tier 2**	**Tier 3**
General description and escalation criteria	An incident that has not caused severe injury to personnel or damage to assets or the environment. Incident does not threaten the safety of a facility and can be managed by the ERT and its resources	An incident that exceeds tier 1 capability and requires the assistance of the IMT and external support services/agencies If no external support is required, an incident may be classified in a higher tier if there is potential for escalation or damaging public image or government relations	An incident that exceeds tier 2 capabilities and resources and requires the assistance of the CMT Incident may attract media coverage or create public outrage and has the potential to cause, or does cause, a major impact on ConocoPhillips worldwide
AMSA National Plan levels and escalation criteria	**Level 1** Generally able to be resolved by Responsible Party through the application of local or initial response resources (first strike response)	**Level 2** Typically, more complex in size, duration, resource management and risk than Level 1 incidents. May require deployment of resources beyond the first strike response	**Level 3** Characterised by a high degree of complexity, require strategic leadership and response coordination. May require national and international response resources

Characteristic	ConocoPhillips Crisis and Incident Management Response Tier		
	Tier 1	**Tier 2**	**Tier 3**
ConocoPhillips IMT/CMT activation	On Site or Facility ERT activated	IMT activated CMT may be activated	IMT activated CMT activated
Resources at Risk			
Human	Potential for serious injuries	Potential for loss of life	Potential for multiple loss of life
Environment	Isolated impacts or with natural recovery expected within weeks	Significant impacts and recovery may take months. Monitoring and remediation may be required	Significant area and recovery may take months or years. Monitoring and remediation will be required
Wildlife	Individuals of a small number of fauna species affected	Groups of fauna species or multiple numbers of individuals affected	Large numbers of fauna (individuals and species) affected
Economy	Business level disruption	Business failure	Disruption to a sector
Social	Reduced services	Ongoing reduced services	Reduced quality of life
Infrastructure	Short term failure Non-safety/operational critical failure	Medium term failure Potentially safety/operational critical failure	Severe impairment Safety/operational critical system failure
Public affairs	Local and regional media coverage	National media coverage	International media coverage

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12 ATTACHMENT 1: ENVIRONMENTAL IMPACT STATEMENT/PUBLIC ENVIRONMENT REPORT

Commitment Register:

https://conocophillips.sharepoint.com/sites/ABUWCTT/Lists/EIS%20Commitments%20Tracking/AllItems.aspx

13 ATTACHMENT 2: EXCEPTIONAL DEVELOPMENT PERMIT 02/0015

Permit:

http://livelink-abu.conocophillips.net/livelink/livelink.exe?func=ll&objaction=overview&objid=3725472

Commitment Register:

https://conocophillips.sharepoint.com/sites/ABUWCTT/Lists/Conditions/AllItems.aspx#InplviewHash2609645c-f2f4-4731-82b2-69dc2788c6cc=FilterField1%3DPermit%255Fx0020%255FTitle-FilterValue1%3DExceptional%2520Development%2520Permit

14 ATTACHMENT 3: ENVIRONMENT PROTECTION LICENCE 217-01

Permit:

http://livelink-abu.conocophillips.net/livelink/livelink.exe?func=ll&objId=4368997&objAction=browse&viewType=1

Commitment Register:

https://conocophillips.sharepoint.com/sites/ABUWCTT/Lists/DLNG%20License%20EPL217/AllItems.aspx