

ASSESSMENT REPORT 65

ICHTHYS GAS FIELD DEVELOPMENT PROJECT, BLAYDIN POINT

INPEX BROWSE LTD

ENVIRONMENTAL ASSESSMENT REPORT
AND
RECOMMENDATIONS

by the

Environment and Heritage Division, NRETAS

May 2011

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Table of Contents

Glossary	5
Executive Summary	9
1 Introduction and Background	19
1.1 Environmental Impact Assessment Process	19
1.2 Regulatory Framework.....	20
1.3 Environmental Impact Assessment History.....	21
1.4 Ecologically Sustainable Development	22
1.5 Territory 2030 Strategy.....	24
2 The Proposal	25
2.1 The Proponent	25
2.2 Project description	25
2.2.1 Offshore infrastructure	27
2.2.2 Nearshore infrastructure	28
2.2.3 Onshore infrastructure	28
2.3 Construction activities	29
2.3.1 Dredging.....	29
2.3.2 Installation of nearshore infrastructure	30
2.3.3 Installation of onshore infrastructure	31
2.4 Operational activities	32
3 Regional Setting	38
3.1 Physical	38
3.2 Biological.....	39
3.3 Socio-economic	40
3.4 Cultural/Historical.....	40
4 Environmental Impact Assessment	42
4.1 Introduction.....	42
4.2 Issues outside the scope of the assessment.....	43
4.3 Alternative options	45
4.3.1 Product loading jetty.....	45
4.3.2 Dredge spoil disposal	47
4.3.3 Shipping Channel and Walker Shoal.....	48
4.4 Walker Shoal Impacts.....	50
4.5 Dredging and dredge spoil disposal.....	51
4.5.1 Predictive modelling	51
4.5.2 Habitat mapping	54
4.5.3 Establishing zones of impact.....	55

4.5.4	Sensitive marine habitats (corals and seagrass)	56
4.5.5	Maintenance dredging requirements	57
4.5.6	Darwin Harbour dredging policy.....	58
4.6	Biodiversity impacts.....	58
4.6.1	Underwater noise	58
4.6.2	Vessel collision and dredge entrainment	62
4.6.3	Cumulative marine impacts.....	64
4.6.4	Shorebirds / Wader birds.....	65
4.6.5	Barramundi	66
4.6.6	Mud crabs	67
4.6.7	Significant terrestrial habitats.....	67
4.7	Emissions, discharges and wastes	69
4.7.1	Hydrotest water	69
4.7.2	Waste water discharge	70
4.7.3	Oil Spills	73
4.7.4	Noise.....	74
4.7.5	Air emissions	75
4.7.6	Greenhouse gas emissions.....	76
4.8	Cultural impacts.....	80
4.9	Socio-Economic impacts	82
4.9.1	Impact on housing market.....	83
4.9.2	Accommodation strategy	84
4.9.3	Cost of living.....	84
4.9.4	Employment.....	85
4.9.5	Health	85
4.9.6	Impact of temporary workforce.....	86
4.9.7	Tourism	86
4.9.8	Visual Amenity.....	87
4.10	Infrastructure and services	88
4.10.1	Road and Traffic Impacts	88
4.10.2	Water supply.....	88
4.11	Safety hazards	89
4.12	Decommissioning	90
4.13	Environmental Management Program.....	91
5	Conclusion	95
6	References:	96
	Appendix 1	97

Glossary

AAPA	Aboriginal Areas Protection Authority
AFANT	Amateur Fisherman's Association of the NT
AHD	Australian Height Datum
AIMS	Australian Institute of Marine Science
aMDEA	activated methyldiethanolamine
AMSTECI	Association of Mitigation Studies for Top End Cyclones Inc.
ANZECC	Australian and New Zealand Environment Conservation Council
CEMP	Construction Environmental Management Plan
CH ₄	Methane
CO ₂	Carbon dioxide
CPF	Central Processing Facility - offshore
CSD	Cutter-suction dredge
DCC	Darwin City Council
DCM	Department of the Chief Minister (NT Government)
DHAC	Darwin Harbour Advisory Committee
DoR	Department of Resources (NT Government)
DPC	Darwin Port Corporation
DPI	Department of Planning and Infrastructure (NT Government)
draft EIS	draft Environmental Impact Statement
EA Act	NT <i>Environmental Assessment Act (1982)</i>
EAAP	NT <i>Environmental Assessment Administrative Procedures (1984)</i>
ECNT	Environment Centre NT
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement, consisting of the draft EIS and the Supplement (to the draft EIS)
EH Division	Environment and Heritage (EH) Division, of NRETAS
EMP	Environmental Management Plan
EPA	Environment Protection Authority of the Northern Territory
EPL	Environment Protection Licence under the WMPC Act
EPBC Act	Australian <i>Environment Protection and Biodiversity Conservation Act (1999)</i>
ESD	Ecologically Sustainable Development
FEED	Front-End Engineering Design
FIFO	Fly-in, fly-out
FPSO	Floating production, storage and offtake facility - offshore
GHG	Greenhouse gas

GSP	Gross State Product
HIA	Health Impact Assessment
HSE	Health, Safety and Environment
H ₂ S	Hydrogen sulphide
JPDA	Joint Petroleum Development Area
LAT	Lowest astronomical tide
LDC	Larrakia Development Corporation
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MEG	Monoethylene Glycol
MOF	Materials offloading facility
NES	Matters of National Environmental Significance (EPBC Act)
NLC	Northern Land Council
NO _x	Oxides of Nitrogen
N ₂ O	Nitrous Oxide
NRETAS	Department of Natural Resources, Environment, the Arts and Sport (NT Government)
NT	Northern Territory
NOI	Notice of Intent
OEMP	Operational Environmental Management Plan
OSCP	Oil Spill Contingency Plans
QRA	Quantitative Risk Assessment
Responsible Minister	NT Minister for Lands and Planning
RO	Reverse osmosis
SEL	Sound Exposure Level
SEWPac	Australian Government Department of Sustainability, Environment, Water, Population and Communities
SIMP	Social Impact Management Plan
SO _x	Oxides of Sulfur
SO ₂	Sulfur Dioxide
Supplement	Supplement to the draft Environmental Impact Statement
the Minister	NT Minister for Natural Resources, Environment and Heritage
the Project	Ichthys Gas Field Development Project
the proponent	INPEX Browse Ltd
TPWC Act	<i>Territory Parks and Wildlife Conservation Act</i>
TSHD	Trailer suction hopper dredge
WMPC Act	<i>Waste Management and Pollution Control Act (NT)</i>
WWF	World Wildlife Fund

Units and Symbols

%	Percent
/d	Per day
/h	Per hour
/L	Per litre
dB re 1 μ Pa	Decibels re 1 micro pascal (underwater noise)
dB(A)	Decibels (A-weighted)
$^{\circ}$ C	Degrees Celsius
MMbbl	Million barrels
ms	Millisecond
ha	Hectare
kg	Kilogram
km	Kilometre
km ²	Square kilometre
L	Litre
μ s	Microsecond
m	Metre
m ³	Cubic metre
m ³ /h	Cubic metres per hour
M	Million
Mm ³	Million cubic metres
mg	Milligram
ML	Mega litres
mm	Millimetre
MPa	Mega Pascals
Mt	Mega tonne
t	Metric tonne

Definitions

CO²-equivalent: A unit of greenhouse gas emissions calculated by multiplying the actual mass of emissions by the appropriate Global Warming Potential. This enables emissions of different gases to be added together and compared with CO₂.

dB(A): decibels, A-weighted scale; unit used for most measurements of environmental noise; the scale is based upon typical responses of the human ear to sounds of different frequencies.

PM₁₀: The fraction of dust with a particle size of 10 μ m or less; a health indicator for the fine particles of respirable dust capable of being inhaled into the lungs.

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Executive Summary

Environmental impact assessment (EIA) is the process of defining those elements of the environment that may be affected by a development proposal and analysing the risks associated with the potential impacts that have been identified. This Assessment Report (the Report) assesses the environmental impact of the Ichthys Gas Field Development Project, Blaydin Point (the Project).

The EIA process effectively allocates risk between the proponent, the government and the community. Some risks associated with this project will be temporary, for example some construction risks and some of the risks associated with sediment from dredging. Some impacts will be permanent, for example the visual impact and changes to the sea floor due to dredging. Some impacts, for example greenhouse gas emissions will be ongoing. Complex impacts, for example, the precise nature of the impacts from dredging are not predictable and so will need to be carefully monitored and adaptively managed. A series of treatments for some of the more complex risks are described below in this summary. Initially 17 management plans are recommended to ensure that risks are minimised. These treatments will ensure that the proponent will be able to minimise impacts, that Government will be able to monitor and control uncertainties and the public will be informed of the Project as it develops.

INPEX Browse Ltd (INPEX) proposes to develop the Ichthys Field in the Browse Basin off the north-west coast of Australia to produce liquefied natural gas (LNG), liquefied petroleum gas (LPG) and condensate. The proposal includes the installation and operation of offshore extraction and processing facilities in the Ichthys Field, an onshore liquefaction (LNG) and fractionation (LPG) facility at Blaydin Point, Darwin, and a 935km pipeline to transport the gas from the offshore facilities to the onshore facilities.

The Project has been assessed jointly by the Northern Territory Government under the *Environmental Assessment Act 1982* and the Australian Government under the *Environment Protection and Biodiversity Conservation Act 1999*. The Northern Territory Government was responsible for assessing the nearshore and onshore aspects of the proposal. Some assessment overlap with matters of national environmental significance occurred where species were listed under both NT and Commonwealth legislation. The Northern Territory Government led the assessment on these matters.

This Report forms the basis of advice to the Minister for Natural Resources, Environment and Heritage on the environmental issues associated with the project. The Minister is required to make comment and/or recommendations with regard to the proposal to the Minister for Lands and Planning (the responsible Minister) in the first instance.

The Report is based on a review of the draft Environmental Impact Statement (draft EIS), Supplement to the draft EIS (Supplement), and comments from the public and Northern Territory Government agencies on the draft EIS. Government guidelines and Government and public responses to the EIS have been rigorous and the Supplement responded accordingly. There is still a lack of data to fully assess all impacts so a comprehensive environmental management program, comprising a series of management plans and targeted projects, will need to be implemented to monitor and minimise impacts.

The following plans will be important in mitigating risks associated with the project:

- Acid Sulfate Soils Management Plan
- Air Emissions Management Plan
- Bushfire Prevention Management Plan
- Cetacean Management Plan
- Decommissioning Management Plan
- Dredging and Dredge Spoil Disposal Management Plan
- Heritage Management Plan
- Greenhouse Gas Management Plan
- Liquid Discharges, Surface Water Runoff and Drainage Management Plan
- Onshore Spill Prevention and Response Management Plan
- Piledriving Management Plan
- Blasting Management Plan
- Quarantine Management Plan
- Social Impact Management Plan
- Traffic Management Plan
- Vegetation Clearing, Earthworks and Rehabilitation Management Plan
- Waste Management Plan

This Project has garnered the greatest number of public submissions of any project assessment in the NT. Comments received were not just about Project specifics but more broadly demonstrated the complex tensions between people's aspirations for Darwin Harbour and the region, and the very considerable economic opportunity offered by such a development.

Recommendations arising from this assessment address methods to identify, mitigate and offset environmental impacts as far as possible.

Major Issues

This Project assessment has considered a wide range of factors and community interests in analysing the potential impacts associated with such a large and complex development. The major issues associated with the Project, and measures identified to address them, are:

- The levels of uncertainty that exist in predicting the extent and nature of potential impacts due to the need for data specific to Darwin Harbour. There is significant uncertainty associated with the effects of Project activities in the nearshore environment such as dredging, dredge spoil disposal and blasting. Further modelling, collection of baseline information and intensive monitoring by the proponent is required to determine the significance of, and appropriate responses to, key impacts. This will be expressed through a dredging plan and other monitoring and management activities which need to be approved by Government.

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- The potential for dredging and dredge spoil disposal to significantly impact the ecological communities of the nearshore environment in Darwin Harbour and the regional coastline. The majority of impacts from these activities are likely to be temporary and some degree of recovery in affected ecosystems is expected. The extent and timing of recovery is, however, uncertain. There will also be permanent changes to the Harbour within and directly adjacent to the dredged footprint. The proponent is required to monitor the activities and implement adaptive management actions to ensure impacts remain within predicted, acceptable levels through a dredging plan to be approved by Government, and other management plans and monitoring and research activities.
 - The potential for a sustained increase in underwater noise associated with Project activities to affect iconic species in the Harbour, particularly coastal dolphins. It is expected that Project activities will challenge these species, adding pressure to their small and susceptible populations in the Harbour. Research funding, further demonstration of mitigation methods and a relevant offset have been recommended, particularly if the proponent is required to blast.
 - The proposed discharge to Darwin Harbour of contaminated waste water, particularly sewage, on an ongoing basis for the life of the Project. Further investigation of land-based disposal options is expected in the first instance. The proponent will require a licence under the Waste Management and Pollution Control Act to discharge contaminants at levels that must meet water quality objectives for the Harbour.
 - The potential cumulative impacts on Darwin Harbour and regional marine ecosystems from Project activities. The construction period for the Project is lengthy and when combined impacts of underwater noise, movement of vessels, turbidity and sedimentation and dredging activity over a sustained period has the potential to be considerably greater. Added to permanent loss or modification of habitat in the Harbour, such as the removal of Walker Shoal on the basis that it reduces risks associated with damage to ships, and ongoing operational impacts, the effects are difficult to predict. It is expected that there will be significant residual detriment to the Harbour and the proponent is expected to implement relevant programs to minimise and/or offset this detriment.
 - The significant greenhouse gas (GHG) emissions from Project operations. The Proponent has committed to a number of technical abatement options to reduce GHG emissions. Emissions will, however, be significant from a Northern Territory and national perspective. Large scale GHG reductions could potentially be achieved through geosequestration or offsets. GHG emissions will be regulated by licence under the *NT Waste Management and Pollution Control Act* until appropriate national regulation to reduce GHG emissions is in place. Regulation will be informed by a Greenhouse Gas Management Plan, which is expected to prominently feature commitments to GHG offsets.
 - The risk of negative social impacts such as the extra load on health and police services, the cost of living, and housing affordability. A social impact management plan developed by the proponent in collaboration with Government is considered the appropriate mechanism to manage these risks and to ensure that the benefits of the Project are maximised.

Conclusions

The environmental impacts of the project can be managed by delivering the commitments made in the EIS and the Supplement and by rigorously applying the recommendations and management plans and strategies described in this assessment.

Although the likely impacts of the Project have been identified and are relatively well understood, there remains a high level of uncertainty in terms of the precise nature and extent of impacts and changes, particularly to the ecology of Darwin Harbour and the region. This uncertainty is largely due to the gaps in data informing the environmental impact assessment process. Consequently, the proponent, government and community will be reliant on intensive, post-assessment monitoring to determine the significance of, and appropriate responses to, key impacts. These monitoring requirements are captured in the commitments made by the proponent and recommendations of this Report.

The less predictable impacts such as the modification of habitats and cumulative effects on significant species in the Harbour will need to be managed to an acceptable level. The proponent should demonstrate that it can achieve this by fully implementing its management program with effective monitoring and appropriate adaptive management tools. These programs will need to be rigorous and based on sound, scientific information, and form the basis for relevant regulatory approvals. Given the high profile of this Project, it is essential that the community are kept informed of ongoing monitoring programs and the implementation of required management actions.

This Report identifies areas where, despite efforts to mitigate impact, residual environmental detriment is anticipated, such as the loss of monsoon vine forest and the cumulative effects of the Project on significant marine biota in Darwin Harbour. The proponent will be expected to implement appropriate offsets to reduce this residual detriment or improve protection for relevant environmental aspects elsewhere.

Based on its review of the EIS and the proponent's response to submissions from relevant Northern Territory Government agencies, affected stakeholders and the public, and an understanding of the economic benefits of the project, the Environment and Heritage Division considers that the project can be managed within the bounds of acceptable environmental impacts, provided that the environmental commitments, safeguards and recommendations detailed in the EIS, this Assessment Report and in the final management plans are implemented and managed under the environmental management program for the project and are subject to regular reporting and compliance auditing.

List of Recommendations

Recommendation 1

The proponent shall ensure that the proposal is implemented in accordance with the environmental commitments and safeguards:

- ☐ Identified in the Ichthys Gas Field Development Project's Environmental Impact Statement (draft EIS and Supplement); and
- ☐ Recommended in this Assessment Report.

All safeguards and mitigation measures outlined in the Environmental Impact Statement are considered commitments by INPEX Browse Ltd and its joint venture partners.

Recommendation 2

The proponent shall advise the Minister of any changes to the proposal in accordance with clause 14A of the Environmental Assessment Administrative Procedures, for determination of whether or not further assessment is required.

Recommendation 3

Further hydrodynamic and sediment transport modelling on a refined dredging proposal is required in consultation with the dredging contractor.

Recommendation 4

Prior to the commencement of dredging, INPEX should conduct particle tracer studies based on the expected dredge spoil characteristics to validate the modelling predictions for fate of dredged sediments during dredging in the Harbour and offshore spoil disposal.

The studies should account for variations in tidal cycles.

Recommendation 5

The dredging and dredge spoil disposal management plan is to be informed by the hydrodynamic modelling and sediment transport modelling, and particle tracer studies. The plan should include monitoring of sedimentation and water quality and appropriate ecological indicators. Contingencies to manage dredging in the event that there is a significant departure from predicted impacts need to be specified in the plan. The plan should be developed in consultation with an expert panel (in accordance with Recommendation 24).

Long term monitoring of the spoil ground to determine the dispersion and fate of this spoil over an appropriate timeframe should be included in the management plan.

Recommendation 6

An ecological monitoring program must be developed in consultation with NRETAS and an expert panel (in accordance with Recommendation 24) to detect impacts on significant biological communities associated with dredging and dredge spoil disposal.

Recommendation 7

A reactive monitoring program must be developed in consultation with NRETAS and an expert panel (in accordance with Recommendation 24) to respond to dredging and spoil disposal impacts on significant communities. The program should include:

- ☐ Monitoring of appropriate coral species;
- ☐ Monitoring of sediment plume impacts on existing sea grass communities in the Harbour;
- ☐ Water quality parameters that account for spatial variability of turbidity, typical for the macrotidal environment of the Harbour;
- ☐ Continuation of INPEX's current water quality program to improve the association between logger turbidity and sample sediment concentrations;
- ☐ Determination of appropriate trigger values of turbidity and sediment concentration for biodiversity protection;
- ☐ Monitoring of sedimentation rate; and
- ☐ Appropriate contingency measures where impact is detected.

Recommendation 8

If INPEX must implement the drill and blast contingency for removing hard rock, a management plan to protect coastal dolphins, dugongs and turtles must be developed in consultation with NRETAS and an expert panel (in accordance with Recommendation 24). The management plan must demonstrate, through sound scientific studies, the effectiveness of measures to minimise risks, detect fauna and manage impacts.

Recommendation 9

INPEX will continue to fund and support research into coastal cetaceans in Darwin Harbour and the wider region to determine the importance of Darwin Harbour for the regional coastal cetacean population and the potential impacts of the Project, particularly drill and blast if it is to be used, on these populations.

Recommendation 10

Relevant EMPs are to be amended to include measures for minimising vessel interactions / collisions with dolphins, turtles, dugongs and other large marine fauna. The relevant plans should include:

- ☐ details on procedures to reduce the risk of vessel strikes on large marine vertebrates (marine turtles, dugongs and cetaceans) such as speed limits;
- ☐ requirements for installation of propeller guards on vessels associated with the Project;
- ☐ details on procedures for monitoring and reporting of vessel strikes on large marine vertebrates; and
- ☐ plans to monitor for stranded, injured or dead large marine vertebrates.

Recommendation 11

In managing marine turtles during dredging activities, the dredging and dredge spoil disposal management plan should:

- ☐ Include details on procedures to manage and monitor entrainment of marine turtles; and
- ☐ Include details for monitoring of stranded turtles at the time of dredging and ensure the involvement of NRETAS Marine Wildwatch.

Recommendation 12

An appropriate offset is necessary to compensate for the residual detriment posed by Project activities to the ecological communities and marine fauna within Darwin Harbour. The scale of offset should be commensurate with the scale of residual detriment. If blasting is required, the offset must be increased to compensate.

Recommendation 13

A monitoring program must be developed in consultation with NRETAS and an expert panel (in accordance with Recommendation 24) for sedimentation in mangrove communities of Darwin Harbour. The program should be informed by the sediment transport modelling and particle tracer studies and be included in the dredging and dredge spoil disposal management plan.

Recommendation 14

An offset for loss of monsoon vine forest on Blaydin Point is recommended. All activities associated with offsetting the residual detriment of clearing monsoon vine forests should:

- ☐ be in perpetuity; and
- ☐ include a management plan that demonstrates environmental benefits.

Recommendation 15

Appropriate controls to mitigate risks from hydrotesting waste water must be included in the Liquid Discharges, Surface Water Runoff and Drainage Management Plan for Government approval. In preparing the plan, INPEX should also:

- ☐ Investigate options for land-based disposal where practicable; and
- ☐ Select chemical additives that have the lowest practicable risk to the marine environment.

Recommendation 16

An air monitoring program is required for the life of the Project. The program will be developed as a requirement of the Environment Protection Licence under the *Waste Management and Pollution Control Act*.

The following point-source emissions testing should be conducted for the program:

- ☐ Quarterly monitoring for the first year of operation and annual thereafter for NO_x (plus temperature, flow, O₂, moisture) at each stack servicing the compressor turbines, power turbines, and hot oil heaters; and
- ☐ Quarterly monitoring for the first year of operation and annual thereafter for SO₂ (plus temperature, flow, O₂, moisture) at each stack servicing the acid gas incinerators.

Recommendation 17

That INPEX submit to the Northern Territory Government a Greenhouse Gas Management Plan covering onshore GHG emissions prior to commissioning of the onshore gas processing plant. The GHG Management Plan should be submitted within a timeframe that enables its consideration in the issue of an Environment Protection Licence under the *Waste Management and Pollution Control Act*.

Recommendation 18

That the Greenhouse Gas Management Plan include, but not necessarily be limited to, the following:

- ☐ An updated greenhouse gas inventory for the proposal;
- ☐ Measures adopted to mitigate greenhouse gas emissions;
- ☐ Demonstration of the adoption of current best practice in the design and operations of the onshore gas processing plant in terms of GHG emissions by benchmarking technology against other national and overseas facilities;
- ☐ Commitments to periodic review and, where practicable, continuous improvement in technology and operational process to further mitigate GHG emissions per tonne of LNG produced;
- ☐ A report on the status of investigations into geosequestration; and

-
- Commitments to measures to offset the GHG emissions from the onshore gas processing plant, preferably including measures implemented in the Northern Territory.

Recommendation 19

INPEX should conduct a diver inspection/verification of anomalies identified in the data from remote sensing surveys.

Additionally, to ensure the dredging footprint is adequately surveyed for unlocated maritime heritage, INPEX should consider:

- providing previously unavailable remote sensing raw data for further analysis; and
- Completing the magnetometer survey of the navigation channel, turning basin, berthing pocket and MOF footprint in Darwin Harbour.

Recommendation 20

A Social Impact Management Plan (SIMP) is to be developed by INPEX in collaboration with NT Government. The SIMP must address social issues that have been raised in the EIS and this assessment report. The SIMP should also be informed by the outcomes of a Health Impact Assessment undertaken as part of the accommodation village assessment process.

Recommendation 21

The Blaydin Point gas facility must incorporate best-practice water conservation measures into the design. The proponent must commit to continuous improvement in minimising potable water use.

Recommendation 22

Prior to decommissioning, the proponent should lodge a notice with the Minister for the Environment (or the appropriate authority at the time of decommissioning) for assessment under the relevant legislation at the time outlining the proposed action and its significance to the environment.

Recommendation 23

All Environment Management Plans for the Ichthys Gas Field Development Project are to be submitted to Government for approval prior to commencement of any works for which the plans apply.

In preparing each plan, the proponent will include any additional measures for environmental protection and monitoring contained in this Assessment Report and Recommendations. The plans shall be referred to relevant Northern Territory Government agencies and key stakeholders for review prior to finalisation. The plans shall form the basis for approvals and licences issued under relevant legislation.

The proponent should provide public access to final environmental management plans and a reporting mechanism to inform compliance with the plans.

Recommendation 24

An expert panel should be formed to provide objective and expert support in the development of appropriate management plans and monitoring programs for dredging and dredge spoil disposal, and for blasting if required, as recommended in this Report. The final form of the expert panel will be determined in agreement between Government and the proponent.

1 Introduction and Background

This report assesses the environmental impact of the Ichthys Gas Field Development Project, Blaydin Point (the Project).

INPEX Browse Ltd (INPEX) proposes to develop the Ichthys Field in the Browse Basin off the north-west coast of Australia to produce liquefied natural gas (LNG), liquefied petroleum gas (LPG) and condensate. The proposal includes the installation and operation of offshore extraction and processing facilities in the Ichthys Field, an onshore liquefaction (LNG) and fractionation (LPG) facility at Blaydin Point, Darwin, and a 935km pipeline to transport the gas from the offshore facilities to the onshore facilities.

This Environmental Assessment Report (the Report) is based on a review of the draft Environmental Impact Statement (draft EIS), Supplement to the draft EIS (Supplement), and comments from the public and Northern Territory Government agencies on the draft EIS. The draft EIS and Supplement are collectively referred to as the EIS.

The EIS can be viewed on the Department of Natural Resources, Environment, the Arts and Sport (NRETAS) website at:

<http://www.nt.gov.au/nreta/environment/assessment/register/inpex/index.html>

1.1 Environmental Impact Assessment Process

Environmental impact assessment (EIA) should:

- identify potential impacts on the environment (where environment is defined broadly according to the *Environmental Assessment Act*); and
- evaluate the risks of those impacts occurring.

Through its assessment of Project risks the proponent must demonstrate:

- that these risks can be satisfactorily managed within acceptable levels e.g. impacts would not result in long term environmental detriment; and
- the effectiveness/feasibility of management measures in a precautionary/risk management framework.

Assessment gives weighted consideration to:

- values and risks;
- estimation of the likelihood of success of preventative and remedial measures; and
- the validity and comprehensiveness of programs established to provide ongoing measures of the environmental effects of the proposed development.

This assessment considers that risks can be more reliably evaluated where there is a substantial baseline of relevant information. Where this information is limited or not available, risk assessment is inevitably constrained and far less precise, and it is appropriate to use the precautionary principle in the evaluation of possible impacts. If potential impacts are understood with a reasonable level of certainty, monitoring programs can be better informed to detect impacts, and management measures can be more effectively targeted to address those impacts.

This Report evaluates the adequacy of commitments and environmental safeguards proposed by the proponent to avoid or mitigate the risks of potential impacts identified in the assessment process. The safeguards may be implemented at various levels within the planning framework of a project and include (among other approaches):

- Design and layout of buildings and other infrastructure on the site/s;
- Management of construction activities; and
- Management of processes used in operations of the facility (e.g. inputs and outputs).

A list of commitments made by the proponent is provided in Chapter 12 of the draft EIS. Additional safeguards are recommended in this Assessment Report where appropriate.

The contents of this Report form the basis of advice to the NT Minister for Natural Resources, Environment and Heritage (the Minister) on the environmental issues associated with the project.

1.2 Regulatory Framework

Environmental assessment was undertaken in accordance with the requirements of the Northern Territory *Environmental Assessment Act 1982* (EA Act).

The proposal was also declared a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as it was considered likely to have significant impacts on the following controlling provisions:

- Sections 18 and 18A (Listed threatened species and communities);
- Sections 20 and 20A (Listed migratory species); and
- Sections 23 and 24A (Commonwealth marine waters).

As the proposal is located partly in Commonwealth waters, the NT and Australian Governments assessed the project collaboratively rather than under the bilateral agreement. Assessment was therefore undertaken in accordance with Clause 8 of the Environmental Assessment Administrative Procedures (EAAP) of the Northern Territory and to meet the requirements as provided for in Chapter 4 Division 6 of the EPBC Act of the Australian Government.

Responsibilities within the assessment process were divided between the jurisdictions as follows:

- The Australian Government was responsible for all aspects of the offshore proposal including the majority of the pipeline route, as well as the matters of National Environmental Significance (NES) within the nearshore and onshore portions of the project; and
- The Northern Territory Government was responsible for assessing the nearshore and onshore aspects of the proposal. Some assessment overlap with NES matters occurred where species were listed under both NT and Commonwealth legislation. The NT Government led the assessment on these matters.

This Report forms the basis of advice to the Minister on the environmental issues associated with the project and informs the decision as to whether or not the project should proceed. The Minister is required to make comment and/or recommendations with regard to the proposal to the Minister for Lands and Planning (the responsible Minister) in the first instance.

The responsible Minister will then make a determination as to whether or not development consent in the form of a development permit under the *Planning Act* will be issued to INPEX Browse Ltd, to develop the site at Blaydin Point for a LNG gas processing facility.

As well as a development permit, INPEX Browse Ltd will need to obtain a number of other permits, licenses and approvals under various Northern Territory legislation including an Environment Protection Approval and Licence under the *Waste Management and Pollution Control Act* (WMPC Act) to construct and operate the onshore gas facility respectively and a pipeline licence under the *Energy Pipelines Act* to construct the gas pipeline through NT Waters to the Blaydin Point facility. The operation will be licensed as a Major Hazard Facility by NT Worksafe. The Australian Government Minister for Sustainability, Environment, Water, Population and Communities (Australian Government Minister) will need to consider the Project for an approval decision under the EPBC Act.

A more complete list of Government approvals and relevant legislation for the regulation of the proposal is provided in Table 1-2, Chapter 1 of the draft EIS. It must be noted that the most appropriate legislative process for undertaking some of the construction activities in the nearshore environment, including dredging, dredge spoil disposal and blasting, is still being determined.

1.3 Environmental Impact Assessment History

On 28 March 2008, INPEX Browse Ltd (INPEX) submitted a *Notice of Intent* for the Ichthys Gas Field Development Project, Blaydin Point to the Minister. On 29 April 2008, the Minister determined that the project required formal assessment at the EIS level. Draft Guidelines were prepared and advertised on 18 August 2008 and underwent a 3-week public exhibition period. This extended period was to accommodate the swearing in of new ministers following the 2008 Northern Territory election. Final EIS Guidelines were issued to the proponent on 17 September 2008.

The draft EIS for the project underwent an 8-week public exhibition period from 15 July 2010 until 9 September 2010. A total of 1488 submissions were received on the draft EIS. The majority (1353 submissions) were template submissions generated from the Australian Marine Conservation Society web site.

From the public and Government submissions received, a range of issues were identified associated with specific technical aspects of the Project and its environmental impacts, as well as broader community issues such as employment and social infrastructure needs. There were also statements of support for the project and acknowledgement of its perceived benefits from some organisations. Issues have been grouped broadly into the following categories:

- Biodiversity impacts;
- Noise;
- Risk;
- Value to NT society;
- Alternative locations / proposals;
- Pollution and waste;
- Greenhouse gas emissions;
- Regulatory responsibility and cost;

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- Site rehabilitation;
 - Resource use;
 - Provision of supporting infrastructure;
 - Blasting and dredging;
 - Sedimentation;
 - Social Impacts on Darwin region;
 - Sustainability;
 - Offsets;
 - Adequacy/quality of information contained in the draft EIS; and
 - Impacts on tourism.

A more detailed list of issues raised is included in Appendix 1 of this Report.

INPEX lodged the Supplement in response to the submissions with the Environment and Heritage Division (of NRETAS) (EH Division) on 6 April 2011. The Supplement was circulated amongst Government agencies for comment and INPEX then published the Supplement in accordance with EPBC Act requirements on 19 April 2011. The Minister advised the proponent that he would extend the assessment period beyond the standard 35 days under clause 14(4)(c) of the EAAP. This extension accounted for a number of public holidays that fell within the assessment period. The EH Division prepared this Report, and provided the Report to the Minister. The Minister issued final advice and recommendations on the project to the responsible Minister and the Australian Government Minister on 17 May 2011, 42 calendar days after receipt of the Supplement.

1.4 Ecologically Sustainable Development

The Australian Government affirmed its commitment to sustainable development at United Nations conferences on environment and development, notably via the Rio Declaration and Agenda 21 in 1992 and the Johannesburg Declaration at the United Nations 2002 World Summit. Australia reaffirmed its commitment at the Summit to promote the integration of the three components of sustainable development—economic development, social development and environmental protection—as interdependent and mutually reinforcing pillars.

Australia developed the National Strategy for Ecologically Sustainable Development (ESD) identifying four national principles. The Strategy also identified ways to apply the principles to a range of industry sectors and issues such as climate change, biodiversity conservation, urban development, employment, economic activity, and economic diversity and resilience.

In December 1992 the NT Government endorsed the National Strategy and agreed, along with all other States and Territories, to the Intergovernmental Agreement on the Environment.

The Strategy defines ESD as:

‘Using, conserving and enhancing the communities’ resources so that ecological processes, on which life depends, are maintained and the total quality of life now and in the future can be increased.

ESD is development that aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations.’

The NT Environment Protection Authority (EPA) has defined six principles of ESD for the Northern Territory (NT EPA 2010). In addition to the four national principles (to which the NT is already a signatory) the EPA recommended the principles of integration as well as public participation. The NT Government is considering the EPA's recommendations.

The principles of ESD as defined in the National Strategy are:

ESD Principle	Definition
Precautionary principle	Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
Inter- and intra-generational equity	The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of present and future generations.
Conservation of biological diversity and ecological integrity	The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making
Improved valuation, pricing and incentive mechanisms	Should be promoted to ensure that the costs of environmental externalities are internalised and that the polluter bears the costs associated with environmental pollution.

In response to the draft EIS, some submissions raised issues relating to the application of ESD principles – specifically the precautionary principle (where data collection was perceived to be lacking), and the principle of biodiversity conservation (in respect to vegetation removal and potential impacts to marine biodiversity).

The EPBC Act requires that in considering economic and social matters, the Minister must take into account the principles of ESD. The Supplement states that INPEX recognises that it has a responsibility to support these principles and that it has a duty of care both to the natural environment and to the communities in which it operates.

INPEX has included in the Supplement a discussion of the Project's consistency with goals and principles of ESD (Section 4.12, page 156). It refers to examples of where the principles of ESD have guided INPEX's project planning (to minimise disturbance), its approach to information and data collection (drawing upon the precautionary principle), and INPEX's public participation and consultation in developing the Project.

To achieve the objective of ESD, the Project needs to continually be informed and guided by the ESD principles. Accordingly, the assessment of this proposal, its potential impacts (positive and negative) and the management measures used to enhance positive and reduce negative impacts will be undertaken in the context of ESD principles.

Subsequent decision-making processes by approval bodies also need to be guided by ESD principles and the continued project design and development, as well as the development and implementation of management and monitoring programs by INPEX, should all aim to meet the objective of ESD.

1.5 Territory 2030 Strategy

Territory 2030 is a 20-year strategic plan for the Northern Territory developed by an independent Steering Committee and launched on 3 December 2009.

The Territory 2030 Strategic Plan was produced as a road map for the future. Developed in consultation with the Territory community, Territory 2030 is a means to setting priorities and guiding government's efforts over the next two decades.

As the principal policy document for the NT it is appropriate that the Project is considered and assessed within the framework of Territory 2030. Identified as one of the issues requiring immediate focus is the priority "kick-starting key projects and initiatives", recognising the lasting difference of key initiatives and projects to the community because of their ability to create benefits beyond their initial investment. The INPEX project is recognised as bringing economic opportunity to the Northern Territory and Australia – it is anticipated that the NT Gross State Product (GSP) would experience an average increase of about 18% each year and the project would create significant new employment opportunities, generating considerable growth in exports and a stronger balance of trade, and further stimulating economic activities and industry development.

The Territory 2030 document also identifies a "wellbeing framework" as a key initiative for the NT suggesting a balanced decision making model that considers the economic, social and environmental impacts of every funding and policy decision made by government. The Territory 2030 document brings together targets across a range of priority areas (education; society; economic sustainability; health and wellbeing; the environment; and knowledge, creativity and innovation). This ensures that policy and decision-makers critically examine the tensions that exist between and across some of the targets. Accordingly, when decisions are made, all impacts (positive and negative) across targets are taken into consideration.

It is appropriate to apply these same decision making principles when making an assessment and decision on the INPEX project. Where appropriate, the Report will draw from, and refer to, the targets contained in the Territory 2030 document when reviewing and assessing the key elements of the INPEX proposal.

Importantly, Territory 2030 is, over the medium to longer term, intended to work as a whole-community plan. Accordingly, it is anticipated that the private and community sectors will share ownership of, and become directly involved in, progressing targets within the plan. Industries and organisations will be encouraged to "own" targets and contribute to them in meaningful ways. This provides the opportunity for INPEX to offset some of the challenges that arise through its Project by contributing to other targets (such as employment, and investment in "green energy" targets to overcome increases in emissions).

2 The Proposal

2.1 The Proponent

INPEX's parent company INPEX CORPORATION has been involved in the development of oil and gas resources for more than four decades and has been steadily increasing its exploration and development activities in many countries around the world. It is, for example, currently taking part in a number of projects in Australian waters. These include the Van Gogh and Ravensworth oil extraction projects in the southern part of the North West Shelf in Western Australia, and, until it ceased production in October 2009, the nearby Griffin Fields oil and gas project. INPEX is also a partner in the Bayu–Undan oil and gas project in the Timor Sea Joint Petroleum Development Area (JPDA).

In early 1998, INPEX CORPORATION (as Indonesia Petroleum, Ltd.) bid for a petroleum exploration permit for permit area WA-285-P in the northern Browse Basin about 200km off Western Australia's Kimberley coast, at the western edge of the Timor Sea. This petroleum exploration permit was awarded to INPEX CORPORATION on 19 August 1998. The subsidiary company INPEX Browse, Ltd. was established immediately after the grant of the permit and became the permit holder, 100% equity holder and Operator.

The company's drilling program from March 2000 to February 2001 in the north-western portion of the permit area resulted in a significant gas and condensate discovery in the Ichthys Field. Shortly afterwards INPEX commenced the Ichthys Gas Field Development Project.

In August 2004 the original permit expired and a new permit, WA-285-P R1, was issued for a reduced area.

In 2006 INPEX transferred a 24% participating interest in the Project to Total E&P Australia (Total). Total has had a long-standing partnership with INPEX elsewhere in the world and also has experience with LNG and LPG projects in other countries.

In September 2009 Retention Lease WA-37-R was awarded to INPEX as the Operator of the Ichthys Field. The area covered by the lease is approximately 912km².

2.2 Project description

The Ichthys Field is located within the WA-285-P exploration permit area in the Browse Basin, 440km north of Broome and 800km south-west of Darwin. It is an area of approximately 800km² with water depths ranging from 90m to 340m.

Estimates of the recoverable hydrocarbon resource indicate over 10 trillion cubic feet of gas and around 300 million barrels (MMbbl) of condensate. INPEX expects that approximately 25 million tonnes (Mt) of LPG will be extracted from this gas during gas processing. The carbon dioxide content averages 8.6% in the Brewster Member and 16.8% in the Plover Formation.

It is proposed that the hydrocarbon gas and liquids be extracted from up to 50 sub-sea wells to a floating platform or central processing facility (CPF), in-situ. Condensate and produced formation water would be transferred from the CPF to a Floating Production and Storage Offloading vessel (FPSO). Condensate would be stabilised and stored within the FPSO for periodic offloading to export tankers.

Produced formation water would be treated at the FPSO to meet regulatory requirements and disposed of offshore.

Gas with a small quantity of condensate would be transported from the CPF via subsea pipeline (approximately 930km) to an onshore gas processing facility at Blaydin Point on Middle Arm Peninsula in Darwin Harbour.

The submerged pipeline is proposed to follow the Bayu-Undan pipeline route through Darwin Harbour. It would then continue past Wickham Point before approaching a suitable shore crossing point where it would proceed east onshore through Middle Arm Peninsula to Blaydin Point. The sub-sea pipeline would be trenched and possibly rock-armoured to ensure stability and protection and suitable subtidal sands may be required as bedding and backfill material.

The gas processing facility proposal consists of the following components:

- A gas reception area;
- Two LNG liquefaction trains;
- An LNG fractionation plant;
- A condensate stabilisation plant;
- Gas turbines for power generation;
- LNG, LPG and condensate storage facilities;
- A product offloading jetty;
- Emergency gas flare systems (ground flares);
- A materials offloading facility (MOF);
- A wastewater treatment plant; and
- Roads, utilities and other infrastructure (workshops, office, control room, storage, etc).

Liquids (condensate and LPGs) would be separated and processed, and gas treated and liquefied. All products would then be stored for later export via an offloading jetty. Design life of the processing plant would be nominally 40 years with an LNG processing capacity of approximately 8 Mt/annum.

It is expected that 2-3 tankers of LNG and 1-2 tankers of LPG would be exported each week, and one condensate ship every month.

Construction activities would include:

- Dredging for a navigation channel, ship-turning basin and the pipeline approach. An estimated 16 million m³ of material could be dredged and would need to be disposed of in a suitable spoil ground;
- Processing facility assembly consisting of the on-site construction of purpose-built modules and the importation of pre-assembled modules;
- Increased shipping movements including heavy-lift vessels and barges, pipe-laying vessels and pipe transport barges, cargo ships and dredging vessels. The MOF would be used for heavy-lift vessels and the East Arm Wharf would be used for general cargo;
- Clearing of approximately 362ha of vegetation, including removal of monsoon vine forest and infilling of mangroves, at the Blaydin Point site;

-
- The import and storage of some earth and rock material to complete earth works. Borrow material may be sourced from a location on Middle Arm Peninsula. Concrete batching would also take place on site;
 - The use of public utilities such as water and electricity for construction and operation;
 - Construction of a wastewater treatment plant;
 - Road transport of construction materials and equipment;
 - Workforce in the order of 2000 to 3000, primarily fly-in fly-out (FIFO) with local content where possible, housed in a construction camp external to the Blaydin Point site, and possibly in residences around Darwin and Palmerston where available.

Construction and operation of the proposed LNG facility in Darwin would produce the following waste streams and emissions:

- Construction wastes including packaging, waste oils, steel offcuts, putrescibles and sewage;
- Dredge spoil from the initial dredging campaign and maintenance dredging operations;
- Air emissions, including greenhouse gases, such as sulphur oxides, nitrogen oxides, carbon dioxide, carbon monoxide, methane, particulates, and volatile organic compounds; and
- Hydrotest and treated process waste water discharge into the nearshore environment.

The offshore component of the proposal would be administered under Australian Government legislation and the nearshore and onshore facilities under Northern Territory legislation.

2.2.1 Offshore infrastructure

Subsea infrastructure at the offshore development area will consist of the following:

- approximately 50 subsea wells drilled from between 12 and 15 drill centres, developed over a period of 40 years; and
- control umbilicals, service lines and wet-gas, corrosion-resistant infield flowlines.

The subsea infrastructure will be tied back to a floating CPF by a series of flexible risers, flowlines and umbilicals. The CPF in turn will be connected to a FPSO facility by a transfer system consisting of flexible risers and flowlines as well as by a communications umbilical. Both the CPF and FPSO will be moored in position for the expected 40-year life of the Project.

These facilities will provide the following services:

- The CPF will be used for gas–liquid separation; gas dehydration; gas export; future inlet compression; and export of a co-mingled stream of condensate, monoethylene glycol (MEG) and water to the FPSO (the MEG is used to prevent the formation of hydrates, primarily between methane and water); and
- The FPSO will be used for condensate dewatering and stabilisation, condensate storage and export, MEG regeneration, and produced-water treatment.

The offshore components also include approximately 900km of gas export pipeline which will connect the offshore infrastructure with the onshore gas facility.

The offshore components of the Ichthys proposal are outside the scope of the Northern Territory assessment process and will be assessed by the Australian Government.

2.2.2 Nearshore infrastructure

Nearshore infrastructure will consist of the following:

- an approximately 27km length of the subsea gas export pipeline from the mouth of Darwin Harbour parallel to the existing Bayu–Undan Gas Pipeline to the western side of Middle Arm Peninsula (Figure 1);
- a pipeline shore crossing on the western side of Middle Arm Peninsula south of the Darwin LNG pipeline crossing;
- a materials offloading facility on Blaydin Point at the mouth of the Elizabeth River for receiving prefabricated gas-processing modules and some construction materials;
- a product loading jetty on the north-western end of Blaydin Point with one berth for LNG export and one for LPG and condensate export;
- a shipping channel, approach area, turning basin and berthing area for the product tankers; and
- a dredge spoil disposal ground outside Darwin Harbour, 12km north-west of Lee Point.

Further detail on the nearshore infrastructure for the Project is contained in Chapter 4, Sections 4.3 (gas export pipeline) and 4.4 of the draft EIS.

2.2.3 Onshore infrastructure

Onshore infrastructure will consist of the following:

- a 6 km long onshore pipeline corridor from the shore crossing area to the Blaydin Point gas processing plant site (Figure 2);
- a gas reception area with a pig receiver and a slug catcher;
- two gas liquefaction trains (each producing approximately 4.2Mt/a of LNG);
- gas treatment facilities (for acid gas removal, dehydration, and mercury removal);
- a propane and butane fractionation plant;
- a condensate stabilisation plant;
- utilities distribution and storage (power generation, fuel, water, nitrogen, compressed air);
- storage tanks (two tanks for LNG; two large and one small tank for condensate; and one tank each for propane and butane) and LNG and LPG recovery units for boil-off gas;
- an emergency gas flare system consisting of a ground flare and enclosed tankage flares;
- a wastewater drainage and treatment system; and

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- various other installations, including a warehouse, workshops, a fuel storage area, firefighting facilities, a guard room and security buildings, and a control room.

Onshore permanent supporting facilities such as communications, security and administration buildings will be located in a combined operations complex at the end of the Blaydin Point access road near the causeway area in the central part of Middle Arm Peninsula.

A more-detailed description of the facilities on Blaydin Point is contained in Chapter 4, Section 4.5 of the draft EIS and updated in Section 3.3 of the Supplement.

2.3 Construction activities

2.3.1 Dredging

INPEX intends to conduct a dredging program within Darwin Harbour. The purpose of the dredging is as follows:

- to extend the existing safe shipping access from the vicinity of East Arm Wharf to the proposed product loading jetty at Blaydin Point;
- to provide a turning basin large enough to permit the safe manoeuvring of ships that are more than 350m in length overall;
- to provide a safe approach and departure area to and from the product loading jetty;
- to provide two berthing pockets at the product loading jetty to accommodate two product export tankers;
- to provide an approach apron with a berthing pocket capable of accommodating up to four barges at any one time at the module offloading facility area; and
- to provide a trench to accommodate the subsea gas export pipeline to Middle Arm Peninsula.

The dredging program would be carried out by a dredging contractor engaged after conclusion of the environmental assessment process. Only a limited number of specialised dredging companies with the capacity to undertake the scale of dredging required for the Project are available worldwide. Therefore, until the dredging contractor has been engaged, INPEX have provided conceptual dredging methods and the dredging program will only be finalised once the contractor has been appointed.

Preliminary estimates outlined in the draft EIS indicated a total of 16.9Mm³ of material would be generated during the dredging program. Estimated volumes from various components originally included:

- 15.1Mm³ from the shipping channel, turning basin and berthing area (Figure 3);
- 1.2Mm³ from the module offloading facility (Figure 3); and
- 0.6Mm³ from the subsea section of the gas export pipeline from the mouth of Darwin Harbour to Middle Arm Peninsula.

This has been reduced by 1Mm³ due to reduced under-keel clearance requirements with the revised total now around 16Mm³. The dredged spoil would be transported to the offshore spoil disposal ground outside Darwin Harbour (Figure 4). A number of dredging vessels are required and these would operate for 24 hours a day and 7 days a week during specified periods.

The draft EIS stated that drilling and blasting would also be necessary to fracture hard rock intrusions existing within the dredge footprint, which were initially considered immovable by conventional dredging methods. As discussed later, a drill and blast program may no longer be required.

Walker Shoal, which lies at the entrance to the proposed shipping channel, is the most significant of the hard rock intrusions. As the top of the Shoal rises to 4.2m below lowest astronomical tide (LAT), INPEX's base case is to remove the Shoal to allow for safe navigation. INPEX explored options to realign the shipping channel in order to avoid the Shoal, but claim that the constraints posed by the heritage-listed wreck of the coal hulk *Kelat*, the hazards posed to shipping navigation in the future and the proximity of the East Arm Wharf facilities prevent any realignment.

The conceptual dredging program would require the following vessel types:

- a trailing suction hopper dredger (TSHD);
- a cutter-suction dredger (CSD);
- a backhoe dredger or a grab dredger;
- self-elevating drilling platforms for the drill-and-blast operations, if required; and
- hopper barges.

Further detail is provided in Section 4.4.4 of the draft EIS. Alternative shipping channel alignments to avoid removal of Walker Shoal are discussed in Section 4.10.1 of the Supplement. Key potential impacts as a consequence of the dredging and removal of the Shoal include sedimentation and turbidity effects to flora and fauna, including threatened and data deficient species, habitats and ecosystems; degradation of water quality; restrictions to recreational activities in the Harbour; increased underwater ambient noise levels and blast impacts on marine fauna; diminished visual amenity of the Harbour; increased marine traffic; and disturbance to maritime heritage.

The impacts of dredging and the removal of Walker Shoal are discussed further in Sections 4.5 and 4.6 of this Report.

2.3.2 Installation of nearshore infrastructure

Product loading jetty

The deck level of the product loading jetty will be approximately 16m above LAT. There will be two berths along the jetty, one solely for LNG loading and the other for propane, butane and condensate loading. Based on safety assessments there will be a separation distance of 500m between the berths.

The most likely construction method would involve pile driving and installation of concrete prefabricated deck sections using cranes on jack-up barges until the desired jetty length is reached. The pipe racks for the jetty trestle would be transported by self-propelled module transporters over land.

The piles, precast deck beams and other materials would be brought to the jack-up barge by a support barge. Rock anchors to stabilise the piles might also be required. These would be installed after the deck sections are installed.

Materials offloading facility

The plan for the MOF is to construct with steel sheet piles, or with a concrete deck on steel piles, or using a combination of these two methods. Various design techniques are being considered for a causeway to the facility. The techniques may include use

of granular fill compacted in layers sourced from the site or from a local quarry, or by a combination of these two, together with the installation of rock armouring along the causeway for support and protection from wave action. Since the draft EIS was published, the MOF design has been refined and now includes a finger wharf and mooring dolphins added to the end of the loading berth to improve accessibility for the period when modules and associated materials are being offloaded.

Nearshore pipeline

The pipeline route through Darwin Harbour will be excavated using a backhoe dredger. The trench will be relatively shallow (to a depth of 3m) and will form a gutter that will provide stability to the pipeline.

The pipeline inside the Harbour will likely require partial burial and rock-armouring to minimise any risk of damage.

Rock-armouring will be put in place over the top of the pipeline once it has been constructed on the seabed. Approximately 850 000t of rock, which will likely be sourced from existing quarries, will be transported by road to East Arm Wharf where specialised rock-dumping vessels will take it offshore for dumping directly over the pipeline.

The construction techniques considered for the pipeline shore crossing included open-trench excavation, micro-tunnelling and horizontal directional drilling. These techniques are all described in more detail in Section 4.3.2 of the draft EIS.

The key potential impacts associated with construction of nearshore infrastructure include: direct and indirect affects on habitat from increased turbidity and sedimentation; loss of habitat; potential acid sulphate sediments; disturbance of maritime heritage; waste generation and spills; restrictions to recreational use of the Harbour; underwater noise from piling; and increased marine traffic.

2.3.3 Installation of onshore infrastructure

The construction of the gas-processing facilities and supporting infrastructure in the onshore development area will take place over a period of five to six years. The onshore development area, consisting of the LNG, LPG and condensate processing plant area, the flare pad, the administration area, the construction laydown areas, borrow area and the onshore pipeline route and easement, will require approximately 413ha of land.

The construction approach for the onshore infrastructure will be to install a combination of prefabricated gas-processing modules and facilities constructed on site.

Prior to installation and hook-up of the modules, significant site preparation and civil works will need to be undertaken. Vegetation on the site will be cleared. Earthworks to level the site will involve relocating material cut from around the borrow pit at Blaydin Point and from other material sources if required.

The key potential impacts from construction of the onshore facility are likely to be clearing of 362ha of native vegetation, including significant mangroves and monsoon vine forest; management of storm water and sediment; exposure of acid sulphate soils; disturbance of culturally significant sites; noise; dust; greenhouse gas (GHG) emissions from plant and machinery; and social impacts associated with the temporary workforce.

2.4 Operational activities

The pipeline from the Ichthys Field will arrive at the Blaydin Point site through the onshore arrival facility. The purpose of this facility is to separate the feed into gas and liquid streams and to deliver these streams at a constant pressure to the LNG trains and a condensate stabilisation system. Gas supply for start-up power generation is also taken off here.

Condensate stabilisation reduces vapour pressure of the condensate (liquid stream) by heating to liberate the lighter hydrocarbon elements as vapours that can be mixed with feed gas for the LNG trains. Mercury is then removed and the stabilised condensate is then stored ready for export.

Mercury is also removed from LNG feed gas before it is sent to the acid-gas removal process for chemical separation of carbon dioxide (CO₂) and sulfur compounds such as hydrogen sulfide (H₂S) using activated methyldiethanolamine (aMDEA). These compounds are then flashed off from the aMDEA (which can be recharged for reuse) and then incinerated to emit sulfur dioxide, carbon dioxide and water vapour.

Water is then removed from the gas stream through the dehydration unit to prevent the formation of hydrates in the liquefaction process and the dry gas moves through the mercury guard bed, which backs up the initial mercury removal process. The mercury bed material from the mercury removal unit and guard bed has to be disposed of by a specialised contractor at an approved facility.

A LPG recovery system extracts the heavier components or LPGs from the dry gas stream through demethanisation and distillation. The removed LPG is then sent to the fractionation unit to produce streams of ethane, propane, butane and condensate. Some of these fractions are used as refrigerant and fuel in the process but the majority is stored and exported as saleable LPG and condensate product. Any remaining light hydrocarbon fractions from fractionation – primarily methane – join the main gas stream for LNG production at the liquefaction and refrigeration unit.

After LPG separation, the predominantly-methane feed gas stream will be compressed in the inlet gas compressor of the main cryogenic heat exchanger, cooled against air and four levels of propane chilling, then directed to the main cryogenic heat exchanger and associated refrigeration where the gas will be chilled to -160°C and liquefied at nearly atmospheric pressure to create LNG. The final LNG product is stored in cryogenic tanks ready for export.

Ancillary activities and infrastructure to support the operation would include water supply, fuel storage, power generation, waste water treatment system, and a ground flare.

The key impacts from the operation of the plant include GHG and other atmospheric emissions, approximately 2ML/d of potable water use from Darwin's water supply, nutrients and other contaminants from discharge of waste water into Darwin Harbour, hazardous waste disposal, visual amenity, ongoing social impacts and noise.

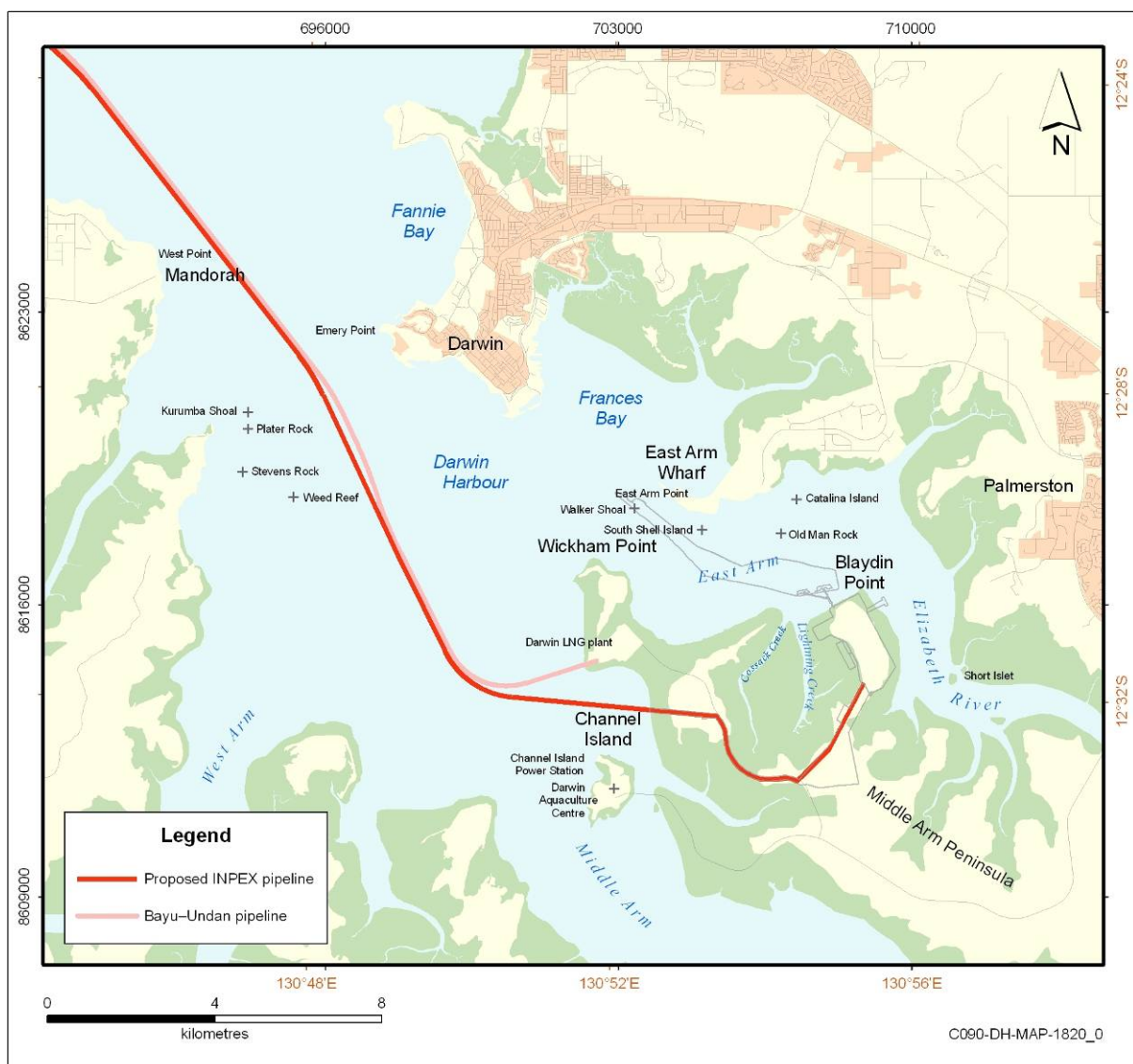


Figure 1: Gas export pipeline route through Darwin Harbour to Blaydin Point (draft EIS)

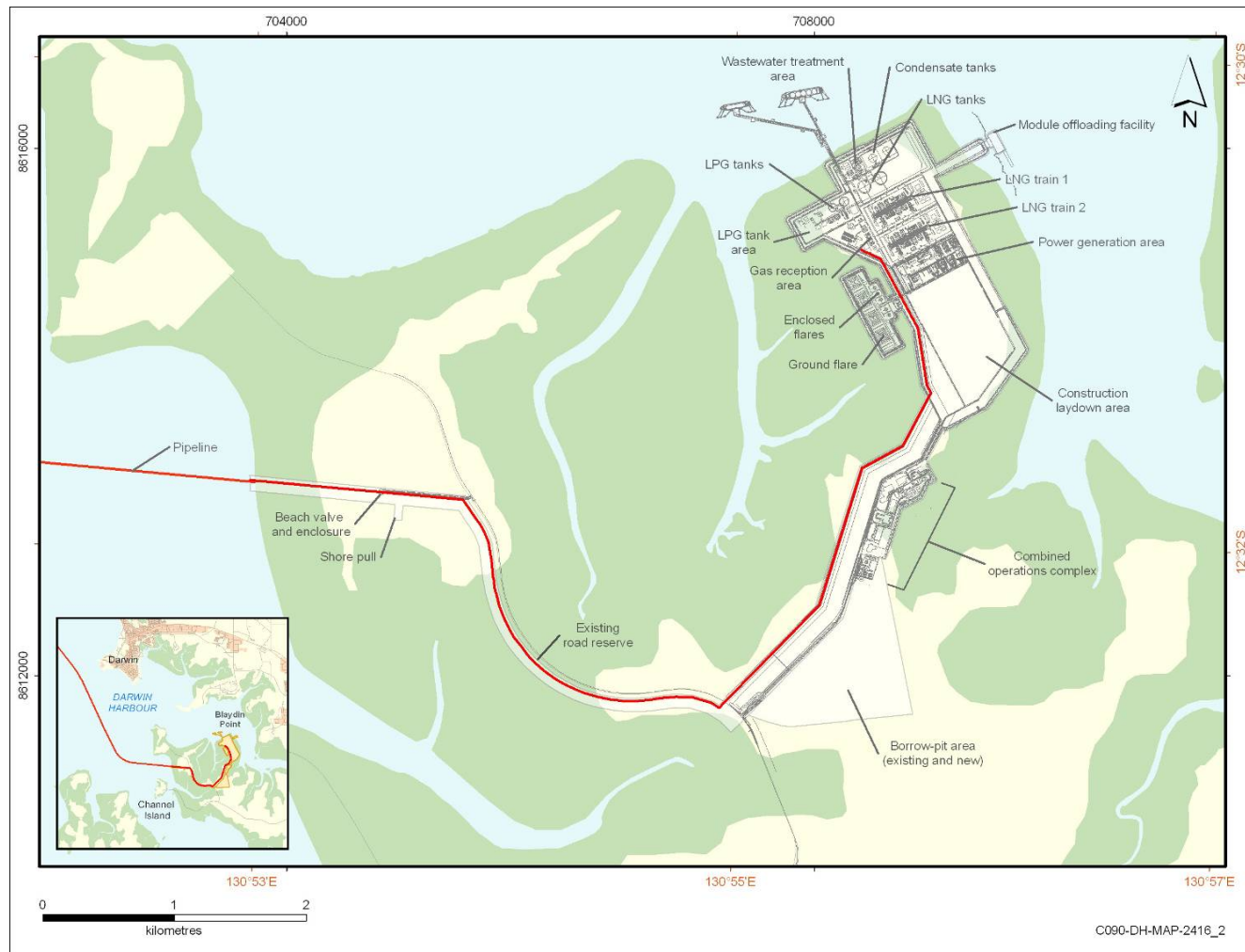


Figure 2: Layout of onshore development infrastructure (Supplement)

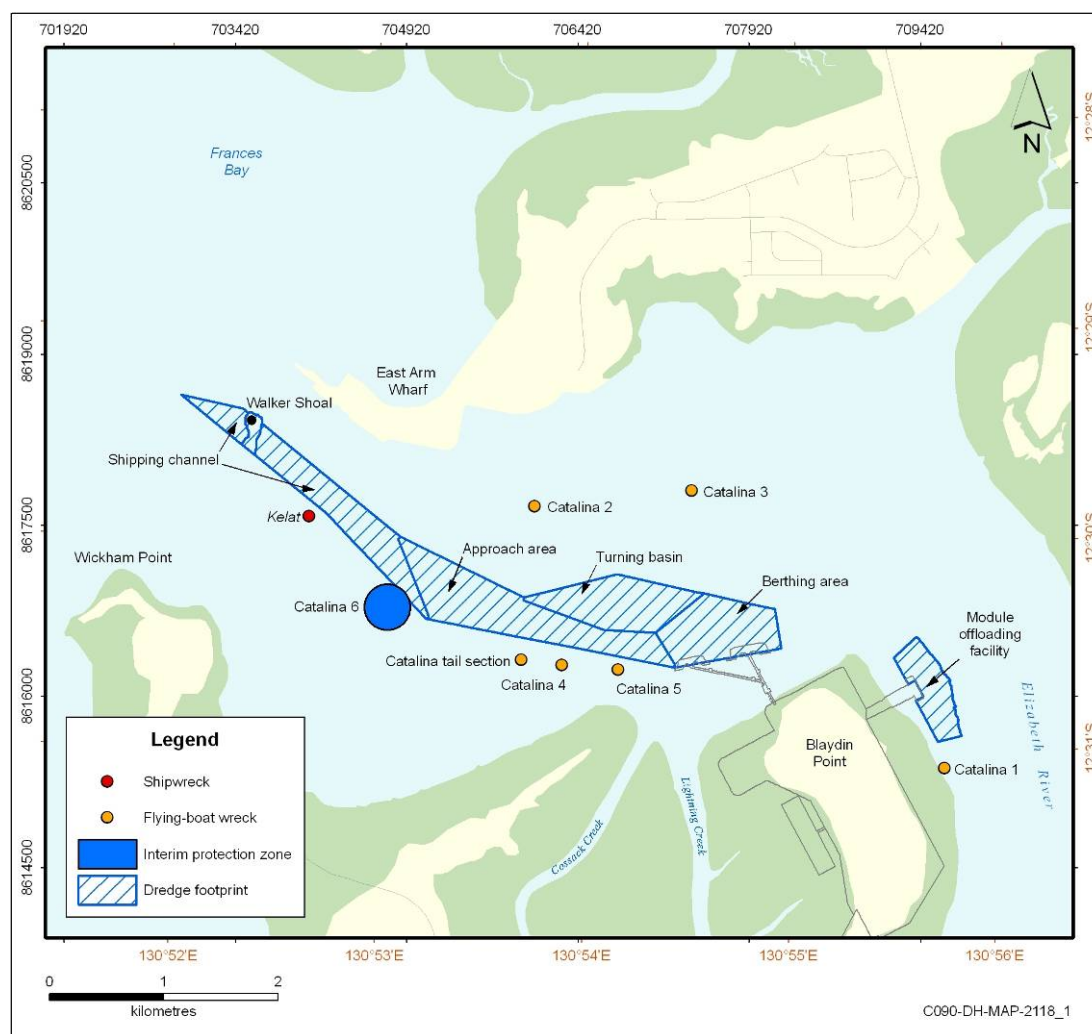


Figure 3: Short jetty concept and indicative dredged shipping channel (Supplement)

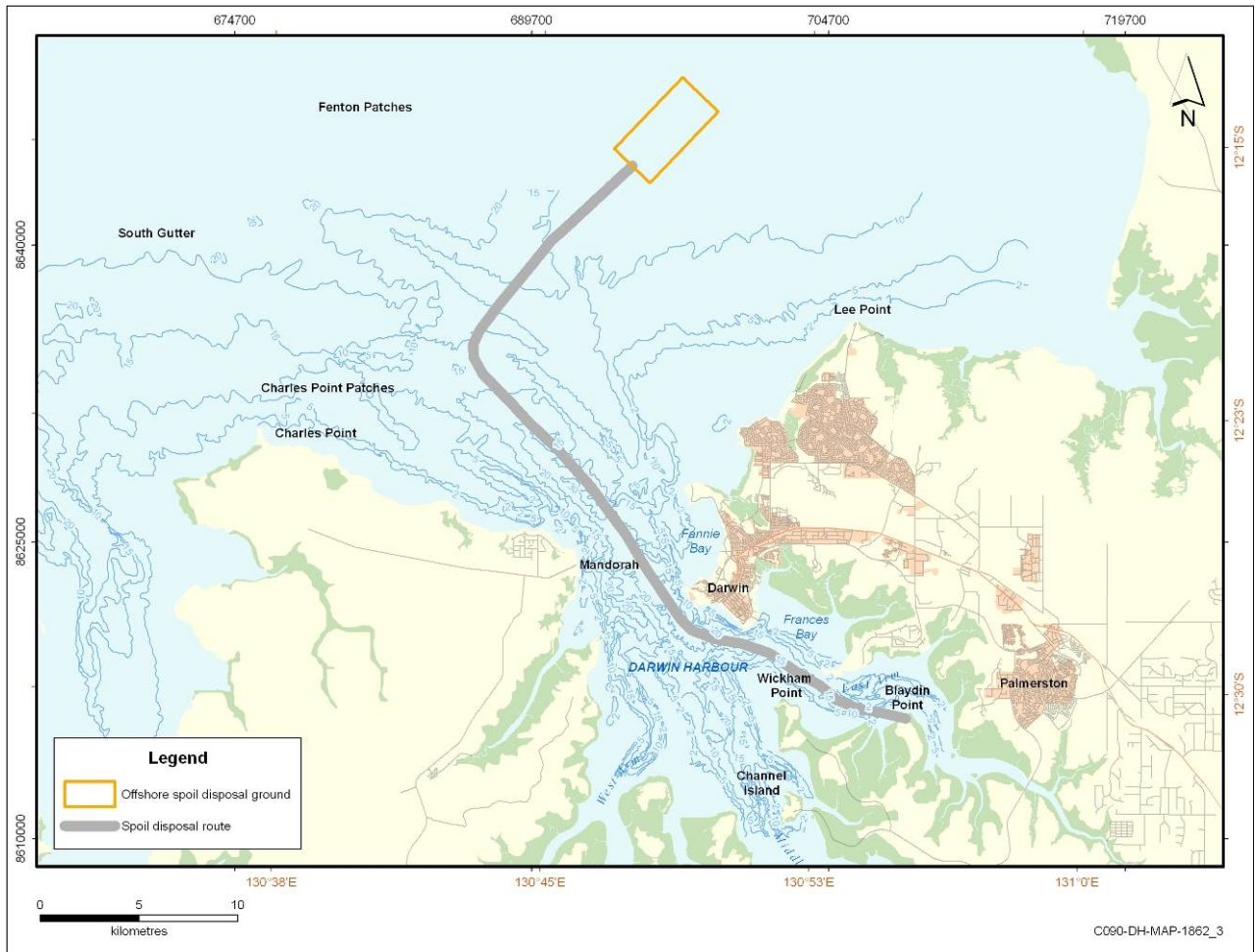


Figure 4: Dredge spoil disposal ground (draft EIS)

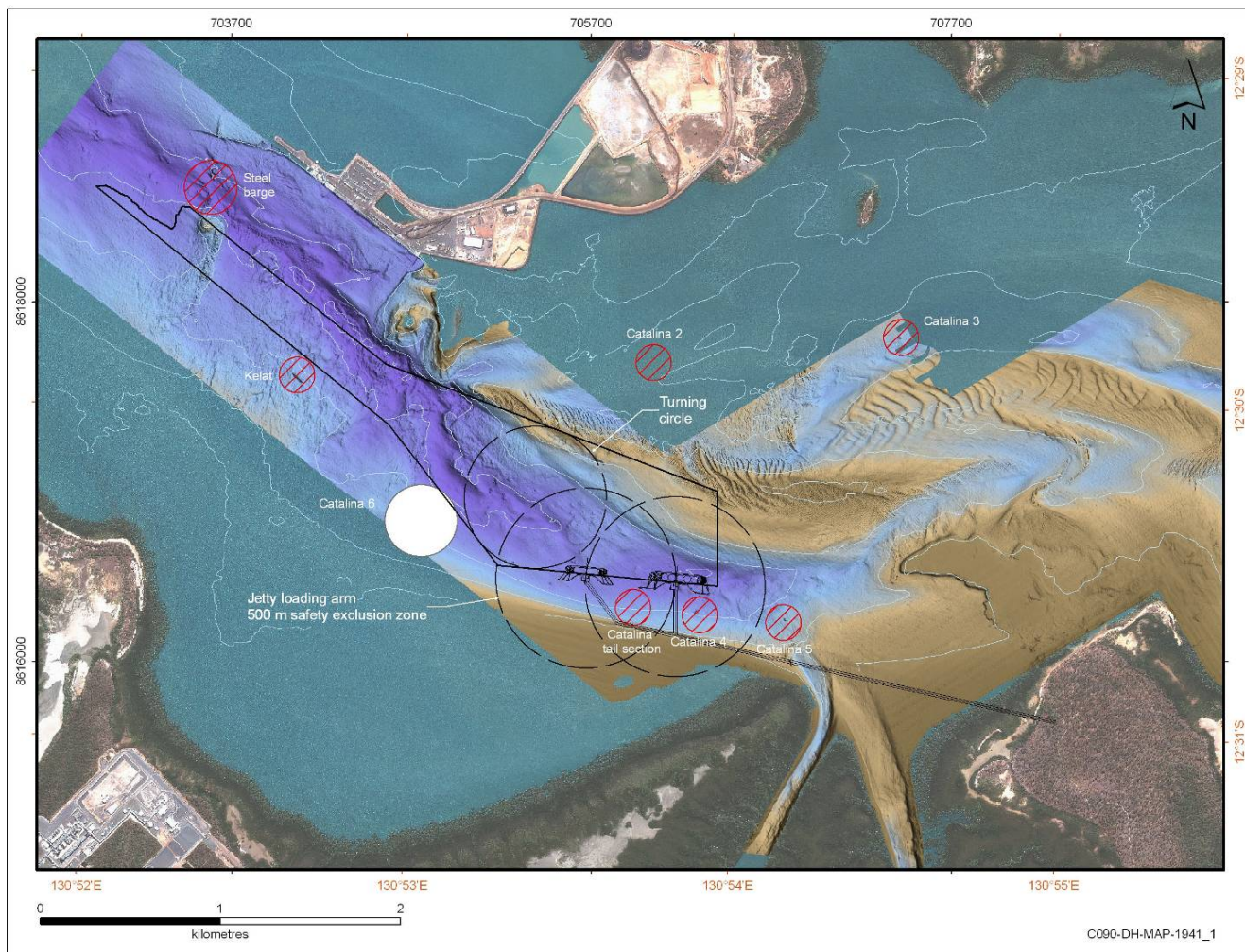


Figure 5: Long jetty concept

3 Regional Setting

3.1 Physical

Darwin Harbour is a large ria system about 500km² in extent. The Harbour is fed by three main arms arising from its catchment—East Arm, West Arm and Middle Arm—that merge into a single unit, along with the smaller Woods Inlet, before joining the open sea. Large freshwater inflows to the Harbour occur from January to April during the ‘Wet season’.

The nearshore portion of the pipeline route, some 27km long, extends from the mouth of Darwin Harbour to the low-water mark at the pipeline shore crossing south of Wickham Point on the western shore of Middle Arm Peninsula (Figure 1). The proposed pipeline route for the Project runs adjacent and parallel to the existing Bayu–Undan Gas Pipeline. Seabed features near the pipeline route include Kurumba Shoal, Plater Rock and Weed Reef to the west of the alignment. Channel Island is located in Middle Arm, around 1.5km south-west of the proposed pipeline shore crossing.

The nearshore development area also includes the marine environment below the low-water mark around Blaydin Point. This area is located on the southern bank of East Arm, at the mouth of the Elizabeth River. Subsea features of this area include South Shell Island, Old Man Rock and Walker Shoal, which is proposed to be removed. Immediately to the west of Blaydin Point on Middle Arm Peninsula are two narrow tidal creeks known as Lightning Creek and Cossack Creek (Catalina Creeks).

An offshore site 15–20km north of the mouth of Darwin Harbour is also considered to be part of the nearshore development area as INPEX proposes to use this site as a disposal area for material dredged from Darwin Harbour (Figure 4). Surveys of this area recorded a flat featureless seabed of silt–sand, at water depths of 15–20m.

The coastline of the outer section of the Harbour is comprised mainly of sandy beaches and rocky foreshores. Within the Harbour, shores are characterised by extensive intertidal mud flats and mangroves. Corals exist in several areas within the Harbour.

The main channel of the Port of Darwin is around 15–25m deep. The channel favours the eastern side of the Harbour, with broader, shallower areas occurring on the western side. The channel continues into East Arm, towards Blaydin Point, at water depths of more than 10m below LAT; the bathymetry in this area has been modified by dredging for the development of East Arm Wharf.

Mean sea level is approximately 4.0m above LAT. Spring tides can produce tidal ranges of up to 7.5m, while the neap-tide range can be as low as 1.4m. Tidal excursions and flows are large and produce strong currents. Sediments of the seabed vary from fine muds to coarse sands, shell grit and coral rubble. Hard rock outcrops are also present.

Many wrecks are found within Darwin Harbour. These include ships and aircraft from World War II, wrecks from cyclones and deliberately scuttled boats for use as fishing and diving sites.

The onshore development area is proposed for Blaydin Point on the northern side of Middle Arm Peninsula above the low-water mark (Figure 2). Blaydin Point is a low-lying peninsula, which juts out into East Arm. At its highest, the peninsula rises to approximately +10m Australian Height Datum (AHD). Blaydin Point is separated from

the mainland by a salt flat, across which a low causeway has been constructed by INPEX to provide access to Blaydin Point during spring-tide periods. This salt flat is sub-aerially exposed, except during spring tides when it becomes inundated to a depth of approximately 1m for periods of up to an hour. Blaydin Point is currently undeveloped. The onshore development area also extends on to the main area of Middle Arm Peninsula and includes the proposed onshore pipeline corridor leading from the western shore of the peninsula across country to Blaydin Point.

Middle Arm Peninsula is currently traversed by a road and services corridor leading to the Darwin LNG plant at Wickham Point as well as to a power station and an aquaculture centre on Channel Island.

3.2 Biological

Darwin Harbour has a diverse assemblage of species typical of the Indo-west Pacific Biogeographical province. Protected species in the Harbour include turtles, sea-snakes, sea horses, dugongs and several species of coastal dolphin, including the snub-fin dolphin. These species are all listed under the Australian Government EPBC Act and some under the *Territory Parks and Wildlife Conservation Act* (TPWC Act).

Coral communities occur where the substrate is rocky in the lower intertidal and shallow subtidal zones and hydrodynamic conditions permit. The intertidal platform between Channel Island and the mainland is listed on the Register of the National Estate and has been declared a Heritage Place under the NT *Heritage Conservation Act 1991*. This declaration was based on the presence of an unusually diverse coral community.

Other intertidal communities include rocky shores and pavements, sand beaches and sand and mud flats.

Other areas of conservation significance include the Charles Darwin National Park, Casuarina Coastal Reserve, East Point Aquatic Life Reserve and Doctor's Gully Aquatic Life Reserve.

Blaydin Point is considered to be part of the Darwin Coastal Bioregion. The flora of the Blaydin Point 'island' is dominated by woodland and monsoon vine forest with fringing patches of mixed species low woodland and *Melaleuca* forest. The woodland community mostly consists of *Eucalyptus miniata* (Darwin woollybutt) and *E. tetrodonta* (Darwin stringybark) with mixed mid-storey including *Cycas armstrongii*, which is listed as vulnerable under the TPWC Act.

Blaydin Point is fringed by an extensive mangrove community, typical of the majority of the shoreline of Darwin Harbour.

A total of 148 vertebrate species were recorded in the fauna survey conducted on Blaydin Point, including nine species of mammal (of which four were bats), 106 birds, 22 reptiles and 11 frogs. None of the animal species recorded in field surveys of the onshore development area are listed as threatened under the TPWC Act or EPBC Act. Publicly available databases suggest, however, that there are a number of threatened animal species that could potentially occur in and around the onshore development area. These are: northern quoll, water mouse, red goshawk, partridge pigeon, red-tailed black-cockatoo, gouldian finch and floodplain monitor. Most of these are unlikely to occur at the Blaydin Point site.

The Project would result in clearing of approximately 133ha of *Eucalyptus* woodland, 61ha of monsoon vine forest, 73ha of *melaleuca* communities, and 95ha of mangroves and high-intertidal communities.

3.3 Socio-economic

The total population in the NT in 2006 was estimated to be about 192 898 with 106 000 of those people living in the Darwin region. The nearest community to Blaydin Point is Palmerston, with a population in 2006 of about 25 000. In 2006, approximately 5% of the NT Aboriginal population lived in the Darwin region and this has been increasing. Based on 2004 population estimates, by 2021 the Northern Territory's population is expected to grow to between 215 300 and 279 200 people with the greater part of this growth likely to occur in the Darwin region. The age structure of Darwin's population is much younger than that of the general Australian population.

At present, there is limited heavy industry in the Darwin region. The Darwin LNG facility operated by ConocoPhillips is adjacent to the Blaydin Point site at Wickham Point. Other major industry occupies land in the region of East Arm Port, which has become a major point of export for access by the resource sector to Asia. Other important industries in the Northern Territory are commercial fishing, tourism, the pastoral industry, mining and defence.

Darwin Harbour is widely used for a variety of activities. Commercial fishing effort is low in the Harbour whereas recreational fishing is a well established activity, concentrating on mud crabs, barramundi and a wide variety of reef fish. Aquaculture activities focus on prawns and pearl oysters. Scuba diving and boating are other important recreational activities that occur in the Harbour.

Blaydin Point itself is undeveloped and has been used for limited recreation purposes.

3.4 Cultural/Historical

Middle Arm Peninsula is within the traditional country of the Larrakia people. According to INPEX's draft EIS, the majority of the archaeological sites and objects recorded in the area are associated with past Aboriginal use of marine resources and contain shells either as a midden (mound of debris) or a scatter. Other sites also have stone artefacts present on the surface. Most sites are located within 300m of the shoreline.

Eight sites and one isolated artefact are located close to, or within, the boundary of the onshore development area. These sites are protected under the *NT Heritage Conservation Act*.

The Aboriginal Areas Protection Authority (AAPA) identified six sacred sites in the vicinity of the nearshore development area. Sacred sites are surrounded by "restricted works" areas in which, under the provisions of the *Northern Territory Aboriginal Sacred Sites Act* (NT), no land or maritime development works of any kind are allowed.

Three non-Aboriginal historical sites were identified within the onshore development area. These sites are associated with World War II structures and artefacts but of which very little remains.

Six Catalina flying-boat wrecks are located in the vicinity of the nearshore and onshore development areas. A number of World War II shipwrecks sunk in Japanese air raids are located near the pipeline corridor through Darwin Harbour. The *SS Ellengowan*, which is the oldest known shipwreck in Darwin Harbour and is one of the earliest examples of shipping associated with European settlement in the area, is located south of the proposed pipeline shore crossing for the onshore processing

plant. The wreck of the coal barge *Kelat*, built in 1881, is located near the entrance to INPEX's proposed shipping channel. It was damaged during the Japanese air raid on Darwin in 1942 and sank five days later. These are protected under the *Heritage Conservation Act* and / or the *Historic Shipwrecks Act*

4 Environmental Impact Assessment

4.1 Introduction

The purpose of this Report is to evaluate the Project and to determine whether it can proceed without unacceptable environmental impacts. This is achieved by identifying the potentially-significant risk of an environmental impact occurring as a result of Project components and activities, and evaluating the proponent's corresponding safeguards or prevention measures to remove or mitigate the risks. Where the proposed safeguards are considered insufficient, or where a safeguard is deemed particularly important, recommendations are made in this Report to add to or emphasise those commitments made by the proponent.

The environmental acceptability of this project is based on analysis of the following from the EIS:

- Adequacy of information outlining the proposal (particularly which components or activities are likely to impact the environment);
- Adequacy of information on the existing environment (particularly environmental sensitivities);
- Adequacy of information on the range and extent of potential impacts and the risks of those impacts occurring within the Project context; and
- Adequacy of the proposed safeguards to avoid or mitigate potential impacts.

Conclusions and recommendations are then based on comments from the review of the draft EIS by relevant government agencies and the public, and responses from the proponent to those comments in the Supplement.

In this Report, the recommendations (in **bold**) are preceded by text that identifies concerns, suggestions and undertakings associated with the project. For this reason, the recommendations should **not** be considered in isolation.

As minor and insubstantial changes are expected in the design and specifications of the proposal following the conclusion of the EIS process, it will be necessary for approval mechanisms to accommodate subsequent changes to the environmental safeguards described in the EIS and the recommendations in this Report. If the proponent can demonstrate that such changes are not likely to significantly increase the risks of an impact on the environment, an adequate level of environmental protection may still be achieved by modifying the conditions attached to relevant statutory approvals governing this project. Otherwise, further environmental assessment may be required.

Therefore, subject to decisions that authorise / permit the project to proceed, the primary recommendations of this assessment are:

Recommendation 1

The proponent shall ensure that the proposal is implemented in accordance with the environmental commitments and safeguards:

- **Identified in the Ichthys Gas Field Development Project's Environmental Impact Statement (draft EIS and Supplement); and**
- **Recommended in this Assessment Report.**

All safeguards and mitigation measures outlined in the Environmental Impact Statement are considered commitments by INPEX Browse Ltd and its joint venture partners.

Recommendation 2

The proponent shall advise the Minister of any changes to the proposal in accordance with clause 14A of the Environmental Assessment Administrative Procedures, for determination of whether or not further assessment is required.

4.2 Issues outside the scope of the assessment

A number of submissions to the draft EIS included issues associated with aspects of the proposal that are beyond NTG jurisdiction or could not be considered the responsibility of the proponent and are therefore deemed outside the Project scope in the NT. This section provides some consideration of these aspects.

Offshore gas field

Environmental assessment of all Project components within Commonwealth waters, including the majority of the pipeline route, is the responsibility of the Australian Government under the EPBC Act. INPEX requires an approval from the Australian Government Minister under this Act.

LNG Gas facility site selection

Blaydin Point on Middle Arm Peninsula is zoned for Development under the NT Planning Scheme. This followed an amendment to the Planning Scheme in 2007 (Amendment 37) and INPEX's decision to revisit alternative sites for the processing facility due to the time constraints and uncertainty relating to INPEX's preferred Maret Islands option in the Kimberley region (draft EIS, Section 4.1.2).

The Darwin region is an attractive site for the Project as it is close to pre-existing services and infrastructure (transport, communications, health, education, housing, etc), supporting industry and port facilities, and access to an established labour market. There is relevant industry experience in Government and the community based on projects such as the Darwin LNG plant at Wickham Point. Darwin is also considered to be a gateway to Asia, INPEX's principal export market.

Part of the Northern Territory Government's economic development strategy for the Territory is securing additional LNG developments.

Land is an important element to attract further LNG developments. The Northern Territory Government undertook a high level site scan to identify suitable sites for further LNG development. Key elements in selecting a site included:

- Certainty regarding the ability of the Northern Territory Government to offer tenure in a timely manner;
- Proximity to deep water;
- Suitable zoning for the site;
- Adequate separation from other developments and residential sites;
- Reasonable proximity to workforce, services and utilities; and
- Comparative development cost.

This scan identified Middle Arm, specifically Blaydin Point as the only available site, due to technical and other constraints for other possible locations, to attract further LNG development to the Northern Territory.

The Northern Territory Government, aware that INPEX was reviewing its site selection for the Ichthys LNG onshore development, took the opportunity to offer Blaydin Point as an alternative site.

INPEX undertook a preliminary assessment of the site and determined that it was technically feasible. Subsequently, INPEX determined that it would proceed with Front End Engineering and Design (FEED) and environmental assessment on the Blaydin Point site.

Accommodation Village

The draft EIS estimates a construction workforce of between 2000 and 3000 at the peak of the five- to six-year construction period. INPEX proposes to construct a dedicated accommodation village to house most of the workforce. Normal operations and periodic maintenance accommodation for personnel will also be required during the operations phase. An accommodation strategy is being developed to identify and investigate accommodation requirements and options during the operations phase (See Section 4.9.2 of this Report). In addition, INPEX indicate that part of the accommodation village may be needed during the operations phase to support accommodation requirements during maintenance shutdowns when personnel requirements increase.

A number of potential locations for the accommodation village were presented to INPEX by both the private sector and Government. The preferred location was chosen from a short list of sites with consideration of stakeholder input and the criteria listed below:

- There should be land potentially available for development.
- The area of available land should be sufficient to accommodate a workforce of 2000–3000 people.
- There should be access to adequate transport infrastructure.
- The location should have access to and be in close proximity to domestic utilities such as power, water and sewerage.
- The location should be in proximity to the onshore development area at Blaydin Point.

INPEX made a decision to seek approvals for the accommodation village separately from the environmental assessment process for this Project claiming that the village would have to be completed and available prior to the start of construction of the onshore component of the Project.

INPEX initially applied for a lease over Crown land on parcels 2819, Part Lot 2818 and Part Lot 273 in the Hundred of Bagot, along Howard Springs Road, for the accommodation village. Issues were raised by the community and Government during the lease application process under the *Planning Act* and INPEX responded to some Government concerns. INPEX then gained approval to undertake surveys and geotechnical investigations on the site.

Although the accommodation village itself is being assessed separately, discussion of the social impacts associated with the operation of the village and the workforce for the Project was included in the draft EIS (Chapter 10). The social issues which INPEX aimed to address included increased pressure on local infrastructure,

increased traffic, and social interactions between the local community and the new workforce.

Social issues associated with the Project are discussed later in this Report (Section 4.9) and will require further analysis by Government during assessment of the accommodation village.

INPEX is yet to lodge a Development Application under the *Planning Act* for construction of the village. The application would be considered as a notification under the EA Act. The significance of environmental factors such as the impacts of clearing native vegetation, sediment management on the site, water supply and sewage would be considered to determine the level of assessment. The Minister would also need to consider social, cultural and economic matters in making a determination.

Marine Supply Base and Rock Load-out Facility

As INPEX has yet to decide on the location of the mainland supply base, it has not been described in detail in the draft EIS. Existing facilities are being investigated but a new mainland supply base may be required which would be subject to a separate environmental assessment process. Locations being investigated include Darwin, Broome, Point Torment near Derby, and Derby. The mainland supply-base location will be determined during the detailed-design phase of the Project. The NT Government proposes to construct a marine supply base and rock load-out facility at East Arm Wharf as part of the East Arm Expansion Project. The proposal is undergoing separate environmental assessment at the EIS level under the bilateral agreement between the Australian and NT Governments.

Source of fill and rock armour

INPEX will require approximately 150 000m³ of fill for the Blaydin Point site after available sources have been used. Approximately 850 000t of rock will be required to armour the submerged section of the gas export pipeline through the Harbour. Most of this material is expected to be available from existing quarries.

Assessment of material sources not already approved will be undertaken through processes outside of this assessment.

4.3 Alternative options

There are a number of components associated with the onshore gas facility that contribute disproportionately to key potential impacts for Darwin Harbour and the community. As a result, INPEX has explored alternative options for these components in an attempt to find the most acceptable option from a business case while taking into account social and cultural issues as well as the Harbour environment. This presents a very complex challenge for decision makers as discussed below.

4.3.1 Product loading jetty

Two jetty concepts were considered by INPEX during the early FEED phase: a short jetty, with a position and orientation as indicated in Figure 2; and a long jetty, approximately 3km long with a westerly orientation directly across the entrance to Lightning and Cossack creeks (Figure 5). INPEX's preferred option is for the shorter jetty.

A number of submissions requested that INPEX revisit the long jetty concept for the product loading jetty to reduce dredging volumes.

The location of Blaydin Point in Darwin Harbour provides limited alternatives for approach by ships. Unlike Wickham Point and East Arm Port, which have adjacent naturally-deep channels, the approach to Blaydin Point is relatively shallow and constricted. There are significant submerged World War II heritage features scattered around the approach and the Point is bounded by the Elizabeth River and two tidal creeks (Lightning and Cossack Creeks), which are considered important areas for some recreational fishers. These are some of the tensions that contribute to the complexity in determining the location of the product loading jetty for the Project, both for the proponent and the Government decision maker.

INPEX consulted with key stakeholders and identified the following design influences:

- maintaining access to Catalina creeks for recreational fishing;
- ensuring the protection of World War II Catalina flying boat wrecks located north west of Blaydin Point;
- minimising the visual amenity impact of the jetty;
- minimising the ecological impact of the jetty; and
- minimising congestion and shipping risks at East Arm Wharf.

INPEX also considered its own safety and technical requirements in making a decision.

INPEX developed a decision-support process to assist in determining which of the concepts should be selected as the preferred jetty option. The EIS indicates that this process integrated principles of sustainable development into the decision making and clarified the objectives, drivers and priority considerations for selecting the most appropriate jetty design. INPEX claimed that for the evaluation, economic weightings were set to zero so that the decision support process was not influenced by costs associated with the alternative jetty concepts. A description of the decision-support process can be found in the Supplement, Section 4.10.2.

INPEX's process acknowledges that outcomes for the ecology and short term amenity of the Harbour would be better if the long-jetty concept were adopted. This is due to the considerable reduction in the volumes of sediment that would require dredging; early estimates put this at less than half the volume of spoil that would be dredged from the short-jetty concept.

However, INPEX's decision process identified that the health, safety and security, socio-political, Project risk and technical viability categories all scored better for the short-jetty concept.

The Supplement outlines the key advantages of the short jetty concept as follows:

- a reduction in the risk of recreational vessels travelling into the jetty safety exclusion zones and taking potentially unsafe short cuts under the jetty trestle;
- a reduction in safety risks from the Project's product loading jetty because of the increased separation distances for vessels berthing at East Arm Wharf;
- a reduction in the long-term impact on visual amenity from Darwin's central business district and other vantage points around Darwin Harbour;
- the elimination of the need for jetty piledriving and jetty construction works in close proximity to the World War II Catalina flying boat wrecks and its associated risks;

-
- a reduction in leak paths for products (LNG, LPGs and condensate) from the jetty loading lines;
 - potential for access to Lightning and Cossack Creeks maintained; and
 - significantly reduced piledriving operations with reduced noise impacts on marine fauna.

INPEX claim that the short-term environmental and social disadvantages caused by an increased dredge volume with the short jetty are mitigated by improved safety outcomes, a reduction in long-term visual amenity impact, and a reduction in the extent of the area excluded by safety requirements for recreational users in East Arm.

The latter point was one of contention, particularly for the Amateur Fisherman's Association of the NT (AFANT), as the draft EIS did not provide assurance that access to the Catalina Creeks would be guaranteed with the short jetty, despite access being one of INPEX's key social factors in determining the selection of this option. Some draft EIS respondents viewed the exclusion of recreational anglers from the Catalina Creeks as a positive arguing that they could become Marine Protected Areas, Conservation Reserves and nurseries for the fish and crabs of Darwin Harbour.

However, INPEX's preliminary quantitative risk analysis (QRA) indicates that public access to recreational fishing areas in the Catalina Creeks can be maintained with safety exclusion zones likely to apply to the eastern "fingers" of Lightning Creek. Access is still subject to the results of the final QRA to be completed in the detailed-design phase and the demonstration to, and acceptance by, the Northern Territory safety regulator, NT WorkSafe, that safety risks to the public engaged in recreational activities in this area are as low as reasonably practicable.

Selection of either jetty option will result in impacts, both direct and indirect. The most significant impacts from the preferred short-jetty option are predicted to occur as a result of the substantially increased dredge volumes. The concern for decision-makers is whether the risks of impact to Darwin Harbour from dredging can be managed to acceptable levels. Analysis of these risks has been undertaken in the relevant sections of this Report and includes the management measures proposed by INPEX to mitigate these risks. Section 4.5 of this Report discusses the modelling predictions, habitat mapping and analysis of impacts to significant habitats that has been undertaken by the proponent to determine the ecological risks of dredging for the Project.

4.3.2 Dredge spoil disposal

Concerns were raised in submissions to the draft EIS about the potential impacts to habitats and fisheries in Darwin Harbour, Shoal Bay, Clarence Strait and Adam Bay from suspended sediments originating at the dredge spoil disposal ground. In particular, barramundi and mud crab spawning were considered to be issues as well as the long-term stability of the spoil in the disposal site.

Material dredged from Darwin Harbour will need to be relocated to ensure that the completed channel remains clear of sediment and navigable in the short to medium term. INPEX was encouraged to explore options to dispose of dredge spoil on shore as a preferred option. Preliminary geotechnical studies by the proponent initially indicated that approximately 80% of the material would be suitable for use as fill for reclamation activities. At the time, a major expansion of the East Arm Port area was

proposed and it was apparent that mutual benefits to INPEX and Government were possible and were keenly anticipated. However, a number of barriers arose. INPEX continued to undertake geotechnical investigations and studies on the dredge material and found that the consolidated phyllite material below the soft sediments was easily macerated into fine, unconsolidated material when mechanically disturbed. Dredging methods that might be used to maintain material integrity, such as backhoe dredging, were not practical to transfer consolidated spoil for land-based disposal. Added to this was the inability for the Port to accept unconsolidated sediments due to the engineering challenges presented in reclaiming this material for hardstand use in the medium term. Additionally, it became apparent that Government would not be ready to take any material that became available due to the timing of planning and approval processes.

In order to identify a suitable location for offshore dredge spoil disposal, INPEX consulted with NRETAS, the Department of Planning and Infrastructure (DPI), the Darwin Port Corporation (DPC), AFANT and local shipping companies. The draft EIS states some of the key concerns raised through consultations included the following:

- the possibility of impacts from sediment remobilisation on to Darwin's northern beaches and at Fannie Bay, and on to sensitive seagrass beds adjoining these beaches;
- the possibility of creating navigation hazards for vessels entering and leaving Darwin Harbour;
- the possibility of sediment remobilising back into Darwin Harbour or into the DPC-proposed Charles Point Patches navigation channel and thus interfering with safe navigation;
- the possibility of sediment remobilisation adversely affecting fishing grounds in the inner Charles Point Patches and Charles Point area as well as disrupting recreational fishing boat movements between these areas and the outer fishing grounds of South Gutter and Fenton Patches;
- the possibility of disturbing significant maritime heritage sites such as the wreck of the Booya; and
- the possibility of sediment remobilisation adversely affecting recreational fishing activities at the series of artificial reefs off Lee Point.

In addition, the shortest possible distance to the spoil disposal ground was preferred, to minimise vessel travel times and to avoid extending the overall duration of the dredging program in Darwin Harbour.

Issues identified with the proponent's predictive modelling and habitat mapping and recommendations for this component of the Project are discussed in Section 4.5 of this Report.

4.3.3 Shipping Channel and Walker Shoal

INPEX states that a critical component of the project is the ability to efficiently and safely move, berth and load product tankers at the proposed product loading jetty. As with the alternative options for the jetty (see Section 4.3.1 of this Report), there are a number of tensions associated with determining the optimal channel alignment for safe navigation to Blaydin Point.

At the entrance to INPEX's proposed navigation channel in the vicinity of East Arm Wharf, submerged in 4.2 metres of water at LAT sits the hard rock intrusion known locally as Walker Shoal.

Walker Shoal in its natural state is a potential navigational safety hazard and an impediment to future expansion of the East Arm Wharf facility. INPEX considers that the Shoal would not allow safe transit for the Project's product tankers, regardless of tidal height. Groundings on the Shoal would also be possible for the majority of larger vessels transiting to and from East Arm Wharf should they accidentally pass over this hazard. One possible consequence of vessel grounding on Walker Shoal would be loss of containment of fuel oil or product, which could have a significant adverse environmental impact on Darwin Harbour.

INPEX proposes to fracture and remove this shoal to facilitate safe navigation to the product loading jetty. INPEX presented the worst-case scenario for the fracturing of Walker Shoal in the draft EIS. The original proposal required that all hard rock in the Shoal (60 000m³) would need to be fractured by drill and blast methods involving the use of 300kg charges three times each day for 57 weeks. The blasting program was based on assumptions derived from preliminary geotechnical data and, at the time, the apparent absence of alternative techniques that were suited to the task of removing the very hard rock forming the Shoal.

INPEX's proposal to drill and blast Walker Shoal was not viewed favourably by a large number of respondents to the draft EIS. Questions were asked about alternatives to avoid the need for removal of Walker Shoal and there were many comments about the impacts to fauna in the Harbour, in particular, marine mammals and turtles.

As a result of respondents concerns about the need to remove the Shoal, INPEX explored alternative shipping channel options in the Supplement to avoid the Shoal, including:

- Option 0 - Moving the shipping channel to the north of Walker Shoal;
- Option 1 - Swinging the shipping channel 200m to the south of the Shoal;
- Option 2 - Moving the shipping channel 400m to the south; and
- Option 3 - Moving the shipping channel 650m to the south.

A full explanation of the options is given in the Supplement (Section 4.10.1, page 146).

Option 0 was discounted immediately by INPEX as the product tankers would breach the safety requirement of a 500m exclusion zone around LNG tankers by coming too close to vessels moored at East Arm Wharf.

Table 1 illustrates the factors that informed INPEX's decision on a preferred option and the current base case for removing Walker Shoal.

Table 1: Comparison of shipping channel alignment alternatives to avoid Walker Shoal

Factors	Base case	Option 1	Option 2	Option 3
Additional dredge volume		0.5 – 1Mm ³	3 – 4Mm ³	5 – 6Mm ³
Volume of hard rock	60 000m ³	60 000m ³	40 000m ³	Unknown, hard rock assumed

Table 1 illustrates the apparent additional dredge spoil volumes associated with more southerly realignments of the shipping channel from Walker Shoal. INPEX argued that the potential ecological benefits of preserving Walker Shoal would be countered by the significant increases in dredge spoil from channel realignment. However, an

additional alternative involving a combination of the long-jetty option (discussed in Section 4.3.1 above) and realignment of the channel south of the Shoal was suggested in a number of submissions. This configuration could arguably have resulted in a net reduction in dredging volumes, not an increase as claimed by the proponent. Added to that, this option would appear to reduce hard rock volumes by 30% or more, a significant benefit. While there are other aspects of this option that would counteract the benefits, such as the ongoing hazard presented by the Shoal to navigation, and the safety and visual amenity issues of the long jetty, INPEX has missed an opportunity to demonstrate that all viable alternatives were comprehensively evaluated.

INPEX concluded that Walker Shoal needed to be removed and continued to pursue alternative methods to remove it. Following further geotechnical investigations involving drill core sampling of the Shoal and investigation of alternative techniques for fracturing the hard rock, INPEX re-evaluated the requirement for blasting as the primary means for removing the Shoal. The current proposal is to use a specialised cutter suction dredge with the capacity to remove hard rock greater than 50 mega pascals (MPa). INPEX claims that seven such dredgers will exist when required and this increases the chances of successfully sourcing one for the dredging campaign. As a back-up to the 'jumbo' dredge, INPEX have proposed to use a drop chisel or hydraulic hammer (hydro-hammer) to fracture stubborn rock. INPEX is confident that these techniques will succeed. If this is the case, blasting would not be necessary. A no-blasting alternative is strongly supported by all parties; however, INPEX cannot guarantee that all hard rock can be removed by alternative means. The proponent therefore maintains the need for a blasting approval in the event that all other methods to remove the hard rock prove inadequate during actual works.

INPEX are seeking approval for a total of four weeks of drill and blast as a contingency for removal of about half of the high-strength rock at Walker Shoal. This is considered by INPEX to be a conservative (worse-case) scenario and INPEX states that it is likely that all rock will be successfully fractured and removed by alternative methods.

4.4 Walker Shoal Impacts

As drill and blast techniques remain a contingency option, these are discussed within the EIS in the context of potential impacts in Darwin Harbour. INPEX acknowledges that the following impacts are likely to occur as a result of removing Walker Shoal:

- Loss of hard substrate habitat type;
- Changes to hydrodynamics; and
- Injury and possible mortality of marine fauna.

The Supplement places the removal of Walker Shoal into context in terms of loss of habitat from the Harbour. Removal of Walker Shoal would result in a predicted loss of 0.07% of hard substrate (at equivalent depth). Surveys of other hard substrate areas in the Harbour indicated that the ecological communities on Walker Shoal are not unique and that there are three other shoals in the area with similar ecological function that will not be disturbed. Further information on habitat mapping for the Project, which was used to define the extent of habitat loss and indirect impacts of dredging on habitats and key biological communities, is contained in Section 4.5.2 of this Report.

NRETAS questioned the assessment of the potential alteration of hydrodynamics and tidal energy from the removal of Walker Shoal. There were concerns that the potential for altered bathymetry and the resulting change of deposition sites in East

Arm were not properly considered. INPEX stated that the alterations to the bathymetry of East Arm for the Project predicted through the nearshore geomorphological modelling, which included consideration of the removal of Walker Shoal, would result in only small decreases in the flushing rate at some locations, but no significant alteration to the flushing capacity of East Arm and Elizabeth River as a whole. INPEX conducted a more detailed review of the model under the 'no Walker Shoal' condition, which supported the original predictions (Supplement, Section 5.2.2.11, page 321).

In considering the complex range of competing issues associated with navigation to Blaydin Point, in particular the hazard that Walker Shoal presents to shipping, and INPEX's decision to use drill and blast only as a fall-back, there is no longer a strong case to realign the channel and preserve the Shoal. The permanent loss of a relatively small area of Darwin Harbour habitat appears to be justified when weighed up against the ongoing risk of a grounding event resulting in the potential loss of containment of LNG or LPG in the Harbour.

Management of the activity by the proponent to ensure impacts are within acceptable levels is essential. INPEX has committed to management measures to reduce the risk of environmental harm to as low as reasonably practicable within a *dredging and dredge spoil disposal management plan*. Provisional plans were provided in the draft EIS and further development of these plans will occur in consultation with regulatory authorities. If blasting is required, INPEX has committed to develop a final *blasting management plan* that would include best-practice methods for management of blasting impacts. However, there are considerable concerns that remain with a blasting program, including the potential impacts of underwater noise. Underwater noise issues associated with blasting are discussed further in Section 4.6.1.

The risks associated with dredging and their management are considered in Sections 4.5.4 and 4.6.2 of this Report.

4.5 Dredging and dredge spoil disposal

The significant dredging campaign proposed by the proponent (summarised in section 2.3.1 of this Report and detailed in Chapter 4 of the draft EIS) prompted considerable interest from respondents to the draft EIS. Concerns raised in submissions included the effects on various habitats within the Harbour and associated ecological communities, as well as effects on water quality. A number of respondents also raised the issue of cumulative impacts to the Harbour; the reliability and uncertainty of the predictive modelling; and the potential differences between the dredging concept in the EIS and the actual campaign. These issues are discussed in more detail below.

It must be noted that INPEX has revised the required depth of dredging since the draft EIS was published. A reduction in the required under-keel clearance of product transport ships from 2m to 1.5m has resulted in a reduction of estimated dredge spoil volumes of approximately 1 Mm³ or 6% of the estimated total dredge spoil volumes with the short jetty option.

4.5.1 Predictive modelling

Respondents on this issue were concerned about the various assumptions made by INPEX in selecting the model used and determining the model inputs, and the relevance of model predictions given that the dredging methodologies would differ from those described in the EIS.

Early in the project assessment, INPEX used a 3-dimensional model. The algorithms in the model were complex requiring modelling to be conducted over a lengthy timeframe. The outputs of the initial business case dredging campaign modelled showed significant impact on the Harbour environment as the business case was essentially a worse-case scenario. Factors such as the overflow of turbid water from the trailer suction hopper dredge contributed to significant sediment inputs to the Harbour. INPEX determined that further modelling runs would be needed to predict the impacts of more environmentally-responsible scenarios. To ensure that the public could consider an improved dredging concept within the EIS timeframe, NRETAS agreed that INPEX could use a 2-dimensional model, based on the assumption that the Darwin Harbour water is well-mixed.

The proponent relied heavily on assumptions to draw conclusions about the potential impacts of dredging and spoil disposal due to the lack of measured data. It is acknowledged that this is customary practice as detailed facts about all aspects of a complex environment can never be fully known. Throughout the assessment process, INPEX asserted that all assumptions used in the predictive modelling were either appropriate, as determined through peer-reviewed literature or measured data, or were deliberately conservative to provide a buffer against inherent uncertainty. However, some of the assumptions made in predicting impacts were not clearly evident in the draft EIS making it difficult to assess their conservatism or otherwise.

NRETAS and the Australian Government Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) contracted a number of consultants to review the modelling. Both the Australian Institute of Marine Science (AIMS) and WorleyParsons questioned assumptions made by the proponent, particularly within the sediment transport modelling.

INPEX has since provided more details of the conservative assumptions as claimed (Supplement, Section 4.1.3.2, Table 4-5, page 47) and on the advice of WorleyParsons conducted sensitivity analyses on the sediment transport model to test the effects on some assumptions by varying the assumed values. The assumptions claimed to be conservative include:

- loss rates from various types of plant such as the trailer suction hopper dredge draghead; cutter suction dredge cutter head and spoil placement; backhoe dredge; and barge dumping;
- critical shear stress values for erosion and deposition;
- values assumed for spoil deposition and re-suspension at the spoil ground;
- exclusion of freshwater flows originating from the catchment, therefore assuming no change in seaward sediment transport in the Wet season;
- enhanced duration and continuous operation assumed in schematisation of the dredging program;
- exclusion of intertidal sediment erosion from raindrop agitation and runoff, arguably enhancing assumed deposition values;
- exclusion of wind-wave action in mangrove areas, therefore enhancing deposition values in the intertidal zone; and
- coarse grain size for offshore disposal represented by 'fine sand', therefore assuming enhanced sediment re-suspension in offshore areas.

INPEX also claims to have established conservative impact thresholds for habitats in the development of indicative zones for predicting the extent of impacts. This will be discussed further in Sections 4.5.2 and 4.5.3 of this Report.

INPEX therefore considers that the outputs of the modelling for suspended sediment, and sedimentation intensity and distribution, overestimate the potential magnitude of environmental impacts and is confident that the predictions of potential impacts encompass the full range of activities and risks that may occur as a consequence of the proposed dredging activities.

Nevertheless, the proposed dredging campaign is significant in scale and duration. As will be discussed, there remain a number of concerns not least of which is the uncertainty of relying on modelling predictions to determine the likely areas impacted by such a large dredging proposal.

The dredging tender released by INPEX specified that the method of dredging selected by the successful contractor should not result in any significant change to the predicted levels of impact described within the draft EIS.

INPEX has committed to further sediment dispersion modelling once the dredging and spoil disposal design is finalised. Following this modelling, it is considered prudent that INPEX conduct particle tracer studies to provide physical validation of the predictions in respect of the fate of simulated dredge material. This should be conducted for both dredging activities in the Harbour and for off shore spoil disposal.

Modelling and tracer studies need to inform the final dredging and dredge spoil disposal management plan, which will require approval by Government.

Further, if changes to the proposed dredging occur that result in changes to the predicted environmental significance of the proposal, then INPEX is required to submit a variation under clause 14A of the EAAP for reassessment under the EA Act, in accordance with Recommendation 2 of this Report.

Recommendation 3

Further hydrodynamic and sediment transport modelling on a refined dredging proposal is required in consultation with the dredging contractor.

Recommendation 4

Prior to the commencement of dredging, INPEX should conduct particle tracer studies based on the expected dredge spoil characteristics to validate the modelling predictions for fate of dredged sediments during dredging in the Harbour and offshore spoil disposal.

The studies should account for variations in tidal cycles.

Recommendation 5

The dredging and dredge spoil disposal management plan is to be informed by the hydrodynamic modelling and sediment transport modelling, and particle tracer studies. The plan should include monitoring of sedimentation and water quality and appropriate ecological indicators. Contingencies to manage dredging in the event that there is a significant departure from predicted impacts need to be specified in the plan. The plan should be developed in consultation with an expert panel (in accordance with Recommendation 24).

Long term monitoring of the spoil ground to determine the dispersion and fate of this spoil over an appropriate timeframe should be included in the management plan.

4.5.2 Habitat mapping

Concerns were raised regarding the lack of an adequate habitat map for the Darwin Harbour and wider region. A habitat map was requested to enable adequate assessment of the extent and intensity of potential impacts from dredging and dredge spoil disposal on marine habitats and the biological communities these habitats support.

The map produced by INPEX for the draft EIS was limited in extent and based on limited data, primarily substrate data, collected in large part by Government and the proponents of previous projects in the Harbour. Although INPEX undertook some sampling within the proposed footprint of the dredging and at selected coral reef features, the additional data did not contribute significantly to a wider understanding of the Harbour such as the extent of various habitat types that would potentially be disturbed or the proportion of particular habitat types that could be impacted or lost as a result of dredging and spoil disposal activities.

INPEX commissioned a number of studies following the publication of the draft EIS to provide additional information to assist the environmental assessment of the Project (Supplement, Section 4.1 Marine). Various surveys (including aerial, tow-video camera and diving) contributed to an expansion of the marine benthic data sets for nearshore habitats in Darwin Harbour and its surrounds. Biodiversity was primarily described and mapped at a broad (feeding guild) level (e.g. corals, filter feeders, seagrass).

INPEX subsequently collated and processed these and other ancillary data sets to produce an improved habitat and benthic community map of Darwin Harbour and surrounding areas predicted to be influenced by the Project. Based on this information, INPEX was able to:

- spatially map and therefore calculate areas occupied by significant communities (e.g. corals, reefs, seagrass, mudflats) in predicted zones of direct impact;
- use existing knowledge and compiled data sets to develop “models” to predict the distribution of habitat classes in the zones of impact and influence for dredging and spoil disposal; and
- identify significant habitats that could be threatened by dredging activities.

The proponent also conducted a desktop review of available data in an effort to establish appropriate benthic environmental thresholds and indicators and to assess impacts at the ecosystem level for Darwin Harbour and the wider, nearshore marine environment.

INPEX presented the habitat mapping methods to key NRETAS advisory bodies following a period of consultation prior to and during the survey period.

The improved mapping has provided INPEX with a better understanding of the areas that could be influenced by dredging and spoil disposal activities but relies largely on inferences. The habitat map could have been improved through field validation within areas predicted to be influenced by dredging and/or where monitoring for potential impacts and habitat recovery is desirable. If combined with baseline information on the environmental conditions in which particular marine habitats occur, this mapping would have enabled a more realistic assessment of the impacts to marine habitats and consequently to marine organisms reliant on those habitats.

The methodology employed, although not as comprehensive as a fine-scale sampling regime covering all areas influenced by the Project, provides a reasonable and cost-effective description of the relevant regional habitats for environmental assessment purposes.

Habitat impacts and their management, and the constraints presented by INPEX's current approach, will be discussed in subsequent sections of this Report.

4.5.3 Establishing zones of impact

As previously discussed, a number of submissions raised concerns about INPEX's ability to predict impacts to marine ecosystems. This was due in part to the gaps in knowledge about the types and extent of habitats in Darwin Harbour and the wider region, and questions about the assumptions used in INPEX's modelling, both of which have been discussed in previous sections of this assessment report.

INPEX undertook to better define the Project's predicted impacts by delineating areas that would be subject to specific levels of impact. In the EIS, these areas are termed the Zones of high and moderate impacts, the Zone of influence and the Zone of no effect. This approach closely follows that of the Western Australian Environmental Protection Authority in its marine dredging guidelines. A full definition of these zones and how they have been derived can be found in the Supplement (Section 4.1.3).

To do this, INPEX initially defined sedimentation thresholds using available literature for mangroves and seagrass. There is scant information available for Darwin Harbour. The literature used by the proponent to establish thresholds generally originates from elsewhere in Australia and other countries. This calls into question its applicability to Darwin Harbour conditions.

INPEX also established suspended sediment concentration thresholds for benthic communities (corals, seagrass, filter feeders and macroalgae) using the percentage-of-existing-condition approach. However, no threshold values were defined for soft-sediment infaunal communities as INPEX argued that the high variability in the tolerance of different species to both sedimentation and suspended sediments challenged the selection of an appropriate value. INPEX continues to question the usefulness to Project impact assessment of characterising and monitoring soft sediment benthos.

The extent of the zone boundaries was then predicted by over-laying the sediment transport modelling outputs onto the habitat map and applying statistical limits on the relevant sediment thresholds for the various habitats.

INPEX was then able to use these tools to predict the extent of impacts in various phases of the dredging program both in the Harbour and the spoil ground (Figures 4-9 – 4-13 in the Supplement).

This is considered to be a significant improvement on the approach taken for the draft EIS and an acceptable one. However, the veracity of predictions is questioned given some of the limitations associated with data sources.

One particular aspect of the approach that is considered to have major limitations is the paucity of baseline data. The EIS states that dredging and dredge-spoil disposal will impact on environmental conditions, like light availability, turbidity, suspended solids and sedimentation. However, the EIS does not provide robust baseline information to characterise the range of environmental conditions that determine ecological niches in the Project area. For example, there have been no measurements of light availability within habitats that are dependent on light for

survival (e.g. coral, algae and seagrass dominated habitats) and the turbidity dataset is very limited, particularly in light of the high spatial variability of turbidity in the Harbour.

Consequently, the risk analysis of potential impacts from dredging and dredge spoil disposal relies heavily on modelled data and INPEX's risk assessment, which INPEX draws on to prioritise impacts and determine monitoring requirements.

Considering the scale of dredging operations and its potential for impact this approach on its own does not provide certainty to decision makers that the dredging can be undertaken and managed in a way to ensure impacts will be acceptable. In developing ecological monitoring programs for the dredging campaign, INPEX will need to continue to collect water quality data to establish baseline conditions. The monitoring programs need to be robust, site-specific and have measurable, attainable and realistic objectives. To achieve this, the baseline data set must be robust enough to develop effective adaptive-management measures.

INPEX must be able to establish that the extent of impact from dredging and spoil disposal is within the range predicted by the modelling and impacts to significant habitats/species are within acceptable levels. Monitoring should also determine the recovery of disturbed habitats within zones of moderate impact and influence.

The detail of the environment monitoring programs for the receiving environment will be developed in consultation with regulatory authorities prior to the commencement of construction activities within a Government approval as part of INPEX's Environmental Management Program, in accordance with Recommendation 23 in Section 4.13 of this Report.

Recommendation 6

An ecological monitoring program must be developed in consultation with NRETAS and an expert panel (in accordance with Recommendation 24) to detect impacts on significant biological communities associated with dredging and dredge spoil disposal.

4.5.4 Sensitive marine habitats (corals and seagrass)

Coral habitats have the highest biodiversity of marine invertebrates and fish of all marine community types, and seagrasses provide shelter and food sources for dugong and marine turtles. Both habitats belong to the most productive communities in tropical waters and are not widely distributed in Darwin Harbour.

The scientific and technical review of the draft EIS conducted by the NT Government highlighted that elevated levels of suspended sediments from dredging would likely increase light attenuation and lead to increased sedimentation in sensitive habitats. A combination of these factors can seriously impact or even kill some coral communities and sea grass meadows. Loss or degradation of these communities has the potential to significantly decrease biodiversity in the Harbour and reduce the extent of dugong feeding areas.

The most important, well-developed coral communities in the Harbour are confined to three locations (Channel Island, Wickham Point and Weed Reef). The conditions most suited for these coral 'refuges' include relatively high water clarity and low sedimentation rate, which are normally associated with highly hydrodynamic areas. Conversely, in the NT, seagrass meadows tend to occur predominantly in low intertidal to shallow, sub-tidal areas where sunlight still reaches the sea floor and where hydrodynamic conditions are such that ambient sediment deposition and

erosion processes are gradual. Sustained dredging and spoil disposal adjacent to these areas may alter these conditions.

The draft EIS did not provide adequate description and assessment of coral and sea grass communities in Darwin Harbour or data describing the essential environmental characteristics required to support these significant marine habitats. INPEX concluded that potential impacts from dredging to significant habitats were likely to be “minor” and monitoring and management actions to mitigate impacts were limited or not proposed in the EIS. It is considered that INPEX has overstated the capacity for corals and sea grass communities to recover from impacts caused by dredging in view of the limited supporting data.

INPEX has provided an outline of some relevant environmental monitoring programs and has committed to developing the detail in consultation with regulatory authorities prior to the commencement of construction activities. It is only with robust reactive monitoring programs and appropriate adaptive management measures that Government and the community will have the assurance that INPEX's claims of minimal impact can be supported.

Recommendation 7

A reactive monitoring program must be developed in consultation with NRETAS and an expert panel (in accordance with Recommendation 24) to respond to dredging and spoil disposal impacts on significant communities. The program should include:

- **Monitoring of appropriate coral species;**
- **Monitoring of sediment plume impacts on existing sea grass communities in the Harbour;**
- **Water quality parameters that account for spatial variability of turbidity, typical for the macrotidal environment of the Harbour;**
- **Continuation of INPEX's current water quality program to improve the association between logger turbidity and sample sediment concentrations;**
- **Determination of appropriate trigger values of turbidity and sediment concentration for biodiversity protection;**
- **Monitoring of sedimentation rate; and**
- **Appropriate contingency measures where impact is detected.**

4.5.5 Maintenance dredging requirements

Based on the preliminary results of the modelling it was estimated that approximately 200 000m³ of sandy material might be deposited within the proposed dredge footprint after 10 years, in which case maintenance dredging might be necessary. Extraordinary events such as cyclones may necessitate more frequent maintenance dredging. The actual volumes of sediment to be removed will be determined through annual surveys of the shipping channel by INPEX.

Any maintenance dredging will need to be supported by a notification to the Minister until a strategic plan for dredging in Darwin Harbour is developed by NT Government.

4.5.6 Darwin Harbour dredging policy

A number of respondents expressed concern about the lack of dredging policy for Darwin Harbour.

The 2003 DHAC publication “Management Issues for the Darwin Harbour Region” states that the Office of Environment and Heritage (now the Environment and Heritage Division within NRETAS) was involved in the development of two documents aimed at increasing the efficiency and effectiveness of EIA for dredging proposals: “NT Dredging and Disposal Guidelines” and “A Dredging Strategy for Darwin Harbour”. During this period a Technical Advisory Committee (TAC) for Dredging in Darwin Harbour was formed. This TAC provided advice on the Darwin LNG proposal as well as the Darwin City Waterfront Development.

The NT Government is aware that a more strategic approach to dredging needs to be taken and is working to achieve this.

4.6 Biodiversity impacts

4.6.1 Underwater noise

The Project will create additional underwater noise in various forms and intensity above current ambient levels in Darwin Harbour. Marine mammals (three species of coastal dolphins and dugongs) and marine turtles (green, hawksbill, flatback and olive ridley) are an iconic part of Darwin Harbour and may be significantly impacted by increased noise in the underwater environment.

There are a number of ways in which this could occur. Apart from direct concussion injuries from a blast; impacts from intense and/or prolonged noise, for example, temporary threshold shift (hearing loss), can have profound effects on the fitness of individual animals. These effects include masking of important signals such as echolocation signals, intra-species communication, and predator-prey cues; disrupting important behaviours through startle and repellence; or acting as an attractive nuisance. These responses individually or in combination can result in avoidance and abandonment of habitats.

Some of these effects are particularly pertinent to cetaceans. Coastal dolphins “see with sound” (echolocate). In muddy waters, sight is often of little use and these species are reliant on echolocation to explore their environment. Significantly increased underwater noise levels can compromise a dolphin’s ability to carry out normal activities.

Direct Impacts

Substantial underwater noise would be generated by a number of activities associated with construction of the Project including cutter-suction dredging and pile driving. A protracted campaign of drill and blast was originally proposed and was considered to be the most significant potential source of underwater noise in the Project. Alternative methods have since been proposed, including the use of a specialised CSD and hydro-hammer, and blasting may no longer be required. This change in methodology is considered to be a very positive outcome of the assessment process. However, INPEX will retain a reduced drill and blast option as a contingency (see Section 4.3.3 of this Report) and therefore blasting noise from a reduced campaign will still need to be considered.

Blasting is a fall-back option for INPEX in the event that the specialised CSD and hydro-hammer fail to remove all of the hard rock at Walker Shoal. The contingency blasting program, though considerably shorter in duration, is expected to be identical

to the original proposal with respect to charge sizes and blasting frequency. The explosive blast pressure wave from a 50kg charge is predicted to have an extremely high peak pressure of about 270db re 1 μ Pa at the source with very rapid rise time (<1ms). The peak pressure level received from a single blast pulse expected to cause tissue damage is 230dB re 1 μ Pa. The sound exposure level (SEL) calculated for six 50kg charges on 25ms delays is 212dB re 1 μ Pa².s; the SEL criteria for injury from blast exposure is 198dB re 1 μ Pa².s. This would suggest that if blasting was undertaken, the risks to any animals in the vicinity of the blast would be extreme.

INPEX conducted underwater acoustic modelling to predict impacts from noise generated by pile driving and blasting activities. The modelling predicted sound pressure levels and SELs at different distances from expected noise sources and applied a range of frequency weightings, representing hearing ranges for significant marine fauna, to SEL estimates. The outputs were measured against received noise criteria adopted by INPEX for marine mammals, turtles and fish from Southall et al (2007) (as cited in the Supplement). The veracity of these criteria was not able to be comprehensively verified, but the criteria are generally considered to be the best available.

INPEX conducted an assessment of pile driving noise based on the assumption that pile driving would take up to 18 months for construction of the MOF and 8 months for construction of the jetty using a single piling rig; duration would be shorter if multiple rigs were used. Pile driving results in repeated noise pulses with a hydraulic impact hammer applying 60 blows per minute (assumed) and each blow lasting 90ms. The draft EIS estimated the peak sound pressure level at the pile driving source to be about 210dB re 1 μ Pa for a typical piling operation. This exceeds the received level criteria for all marine animals and the bulk of the source noise falls within the lower to mid hearing range of the coastal dolphin species. At noise levels of this magnitude, animals are likely to suffer injury but would have to be very close to the noise source. Animals would more likely avoid the area of impact during the works if given an opportunity to move away. Although modelling appears to be conservative and actual noise received is likely to be less than predicted, pile driving is still considered to be a significant source of underwater noise in the near shore project environment.

The dredge concept includes a CSD for removal of the more-consolidated material in the Harbour. The CSD would be used primarily in Phase 6 for approximately six weeks, 24 hours per day, 7 days per week. Additionally, a specialised CSD is proposed to be used in place of drill and blast methods to remove hard rock at Walker Shoal. The Supplement provides no indicative timeline for the use of the specialised CSD. The noise source spectrum level has been assumed to be 6dB above that of a standard CSD as the underwater noise intensity is also not known. Standard dredgers normally generate low-frequency noise with source levels around 160-170dB re 1 μ Pa. Source levels from the specialised CSD are therefore not expected to exceed 180dB re 1 μ Pa, which is considered to be at the lower end of the adopted noise criteria. At these levels, direct injury to animals is unlikely but avoidance of the area by marine mammals is expected.

A drop chisel or hydraulic hammer (hydro-hammer) is proposed to be used on hard rock in the event that the specialised CSD is unsuccessful. Again, there is no estimate of duration of this method should it be required. Source noise levels from this method are pulses derived from hammer blows assumed to have similar characteristics to pile driving. The maximum source level for the hydro-hammer is estimated to be about 165dB re 1 μ Pa at a frequency of 200Hz. This is well below the underwater noise criteria for marine mammals, turtles and fish designated in the EIS and the risk of injury is considered to be very unlikely. The noise from the hydro-

hammer is of less concern than noise from piling and blasting; however, it will add to the noise levels in the East Arm area if used.

INPEX has proposed a number of measures to mitigate and manage underwater noise and blasting impacts on cetaceans, dugongs and marine turtles during Project construction, including:

- Undertaking pile driving and any blasting activities during daylight hours to maximise visibility for fauna observers. Additionally, blasting would only occur during benign sea conditions;
- Employing a 'soft start' approach when pile driving, which entails gradually ramping up the activity over five minutes;
- Using confined blasting methods, with micro-delays inserted between six, 50kg charges to reduce peak pressure levels of the total 300kg of explosive detonated during each blast;
- Maintaining watch for animals using trained marine fauna observers within a 500m radius for piledriving and 1000m for blasting;
- Observation for at least 30 minutes prior to pile driving and blasting. If any animal is observed in that period, a 20-minute watch would commence until the animal was observed to move outside the zone or not seen again within that period. The 30-minute observation period would then begin again and 'soft start' piling or blasting would not proceed until no animals were observed in this time;
- Temporary cessation of piling, once commenced, only if an animal is observed within 100m of the activity. Piling would recommence once the relevant conditions outlined above were met;
- Utilising an appropriate combination of passive and active acoustic monitoring techniques to detect and monitor the movement of large marine fauna in the work area and adjacent safe zone during blasting activities;
- Use of explosive casings to minimise toxic floating debris and retrieval of killed fish on the surface to minimise harm to scavenging or predatory fauna;
- Marine workforce induction to include information on marine mammal management requirements;
- Training of vessel masters in marine mammal interaction procedures; and
- INPEX vessels will operate at "no wash" speed when within 50 to 150m of a marine mammal and will not intentionally approach within 50m of a marine mammal.

In summary, it would appear from the modelling that the risks of significant direct impacts to marine fauna from underwater noise as a result of pile driving and dredging are relatively low and these risks can be managed through the proponent's Environmental Management Program. The Fisheries Division of DoR accepts that some fish mortality will occur if blasting is required but is accepting of this risk as the impacts are likely to be short-term. Fish deaths due to blasting will need to be recorded and reported as a requirement of any permit issued under section 16 of the *Fisheries Act* for the blasting activity.

There are still serious concerns, however, for the safety of marine mammals and turtles if drill and blast is employed. There is limited certainty that the current management measures proposed for safeguarding these species will be effective. In particular, the current dependence on marine mammal protection zones and observers is of concern. The macro-tidal environment of Darwin Harbour creates

relatively turbid, low-visibility conditions while the low surface profile and cryptic nature of some dolphin species, and the duration that some marine fauna can remain submerged, makes them very challenging to detect. INPEX's commitment to using alternative methods for breaking hard rock is supported but continued investigation of marine fauna detection techniques such as acoustic monitoring is necessary to determine a more robust detection method in the event that blasting is required. The proponent must be able to demonstrate through sound scientific studies that any mitigative strategies and monitoring techniques used can adequately safeguard these significant species.

Recommendation 8

If INPEX must implement the drill and blast contingency for removing hard rock, a management plan to protect coastal dolphins, dugongs and turtles must be developed in consultation with NRETAS and an expert panel (in accordance with Recommendation 24). The management plan must demonstrate, through sound scientific studies, the effectiveness of measures to minimise risks, detect fauna and manage impacts.

Cumulative Impact

A further risk associated with the Project is the potential indirect impacts to marine fauna of cumulative increases in Harbour noise.

The cumulative impacts of noise from concurrent sources in the Harbour, including dredging, piling and blasting, were modelled. However, Appendix S7 of the Supplement qualified that the inherent uncertainty of underwater noise propagation and the interaction of multiple noise sources made this extremely complex and a 'fraught undertaking'. Given the uncertainty associated with data deficiency, there is considered to be significant risk that cumulatively, these noise levels have the potential to adversely impact marine fauna over an extended duration, particularly if blasting is added to the underwater noise environment. A precautionary approach in protecting these fauna is therefore necessary.

As discussed previously, the key noise-generating activities are likely to provoke avoidance of the impacted area over a sustained period. It is believed that coastal dolphins could be particularly susceptible because of their reliance on echolocation.

The three species of dolphin known to occur in Darwin Harbour are present in low numbers. Detection of population trends in coastal dolphins is difficult because of the low abundances and studies have confirmed small populations are more prone to extinction than large, stable populations. Even with unbiased and precise abundance estimates, population trends in coastal dolphins are likely to be extremely difficult to detect in short-term studies unless changes in population size are dramatic (greater than 20% per year). Within this time, there is potential for an undetected, irreversible population decline. Furthermore, both Indo-Pacific humpback and snubfin dolphins are likely to exist as meta-populations (small and partially, or completely, isolated populations). Limited research by NRETAS indicates patterns of residency within the Darwin Harbour populations. This makes them susceptible to extinction if rates of dispersal between populations are adversely affected. Without knowledge of the meta-population structure, the degree of dispersal and hence, an understanding of how to manage the meta-populations, the future of these species in the Darwin region is unknown.

The underwater noise environment of East Arm is predicted to become a challenging environment for marine fauna, particularly the coastal dolphin species, and it is presumed that these species will be excluded from the Eastern part of Darwin

Harbour for an extended period during construction. The medium to long-term prospects for populations of coastal dolphin species in Darwin Harbour as a result of this exclusion are not known.

Given the iconic status of these animals, the uncertainty associated with their population structure, and the increasing pressure being placed on their environment in Darwin Harbour and elsewhere, NRETAS considers that appropriate offsets be implemented to preserve sustainable populations of coastal dolphins in the Darwin Region.

Recommendation 9

INPEX will continue to fund and support research into coastal cetaceans in Darwin Harbour and the wider region to determine the importance of Darwin Harbour for the regional coastal cetacean population and the potential impacts of the Project, particularly drill and blast if it is to be used, on these populations.

4.6.2 Vessel collision and dredge entrainment

A number of respondents, including WWF Australia, ECNT, La Laguna University, the Northern Land Council (NLC), and NRETAS raised the issue of increased injuries to, or mortalities of, marine fauna from Project-related shipping and dredging activities in the Harbour. The main concerns were boat strike to dolphins, turtles and dugongs, and the possible entrainment of marine animals, particularly turtles, in the trailer suction hopper dredge (TSHD).

Marine turtles are listed as threatened under the EPBC Act and the TPWC Act and four species are known to occur in Darwin Harbour. Large marine vertebrates are iconic and are visible to fishers, boaters and beach walkers when stranded. The stranding of injured or dead animals could attract considerable attention from the public and conservation groups.

The provisional cetacean management plan broadly outlined measures to minimise risks to coastal dolphins by requiring that INPEX vessels will:

- not intentionally approach within 50m of a dolphin;
- operate at a “no wash” speed when they are between 50m and 150m of a dolphin;
- attempt not to approach cetaceans from an angle of less than 60° into or away from the direction of travel of the cetacean(s); and
- not encourage bow-riding by cetaceans. Should any cetacean(s) commence bow-riding in front of a vessel, the vessel master will not change course or speed suddenly.

INPEX acknowledges that there could be occasions in Darwin Harbour where maintenance of approach angles or distances might not be possible and provides assurances that all efforts would be made to minimise vessel interactions with, or disturbance to, cetaceans, while still allowing operations to continue.

The proponent asserts that the increase in the number of vessels using the Harbour (1-2% monthly) as a consequence of Project construction is not significant and that typically, fast moving vessels present most risk to these animals while the larger, slower vessels present very low risk. The proponent concluded that the residual risk of vessel collisions after implementation of proposed controls was low as the probability of an incident was considered to be unlikely and only individual animals would be affected.

The management measures proposed by INPEX are borrowed from the Australian National Guidelines for Whale and Dolphin Watching. They apply to the tourism industry where observing cetaceans is the objective and their appropriateness in the context of vessel movements of various sizes specific to this Project in Darwin Harbour is questioned. While it is acknowledged that the risk of collisions with slower vessels such as ships is likely to be relatively low, particularly for dolphins, faster vessels are considered to present significantly higher risk. This is primarily due to the difficulty in seeing these animals and the consequences of collision. Additionally, there are no relevant measures proposed for dugongs and turtles.

As discussed in Section 4.6.1 of this Report, it is considered that increased mortality of some of these species could place their populations in Darwin Harbour at risk of decline and potentially, extinction. Using INPEX's definitions of 'consequence', low numbers of individuals seriously injured or killed locally within the Project construction period, could have 'massive' or even 'catastrophic' consequences for a population.

It should also be noted that sea turtles use deeper water refuges, such as dredged channels, when under threat. This makes them susceptible to large propellers from slow moving vessels (Scott Whiting pers. comm. 2011) and therefore increases the likelihood of undetected collision. Coupled with the accumulation of impact risks from other Project-related and existing sources, this will add further to the stress on marine fauna in the Harbour.

The current proposed management measures are not considered satisfactory and it is recommended that smaller, Project-related vessels should be required to moderate their speeds to lower the risks of collision and have propeller guards fitted to reduce the impacts of collision. All boat handlers associated with the Project should be educated to watch for large marine fauna and minimise vessel interactions with these fauna. Any collisions should be reported. INPEX should consider involving NRETAS Marine Wildwatch in monitoring for stranded fauna.

These additional measures must be included in the relevant management plans for approval by Government as part of INPEX's Environmental Management Program in accordance with Recommendation 23 in Section 4.13 of this Report.

Recommendation 10

Relevant EMPs are to be amended to include measures for minimising vessel interactions / collisions with dolphins, turtles, dugongs and other large marine fauna. The relevant plans should include:

- **details on procedures to reduce the risk of vessel strikes on large marine vertebrates (marine turtles, dugongs and cetaceans) such as speed limits;**
- **requirements for installation of propeller guards on vessels associated with the Project;**
- **details on procedures for monitoring and reporting of vessel strikes on large marine vertebrates; and**
- **plans to monitor for stranded, injured or dead large marine vertebrates.**

INPEX assessed the residual risk to marine turtles from TSHD entrainment as 'medium'. The Supplement states that the possibility of entrainment is 'remote'; however, monitoring detected entrainment of a marine turtle within the first 5 days of

dredging during construction of the Gorgon Project in Western Australia. Preventative measures are therefore considered necessary as a precaution.

INPEX has committed to develop practical methods to minimise marine animal entrainment risks and to provide further detailed description of management measures in the final dredging and dredge spoil disposal management plan.

Possible mitigation options offered by INPEX include:

- installing deflectors on dragheads;
- using turtle “tickler” chains on the trailing arms; and
- engaging suction of the TSHD only when the draghead is close to the substrate, not as it is raised or lowered through the water column.

The use of a combination of the above preventative measures is strongly encouraged as the practicality of monitoring in the context of INPEX’s current dredging concept may be limited. The EIS states that the dredging contractor will be required to demonstrate that the proposed management measures are effective by monitoring screens used to capture entrained fauna. Monitoring screens are typically fitted where excess water in the hopper barges is decanted before spoil disposal and INPEX proposes to retain excess water in the hopper barges (‘no-overflow’ mode) to minimise suspended sediments in the Harbour. Alternative monitoring techniques may need to be explored.

INPEX has deferred the decision to employ any of the above mitigation and monitoring measures or similar until a dredging contractor is appointed and can be consulted. Any measures determined in consultation with the contractor must be included in the dredging and dredge spoil disposal management plan as part of INPEX’s Environmental Management Program. The plan should include any practical solutions to detect turtles or turtle remains in ‘no-overflow’ mode.

Additionally, the plan should include a program to monitor for animals that have been injured or subsequently died from entrainment injuries within Darwin Harbour during dredging operations. This should include procedures for retrieval and post-mortem.

Recommendation 11

In managing marine turtles during dredging activities, the dredging and dredge spoil disposal management plan should:

- **Include details on procedures to manage and monitor entrainment of marine turtles; and**
- **Include details for monitoring of stranded turtles at the time of dredging and ensure the involvement of NRETAS Marine Wildwatch.**

4.6.3 Cumulative marine impacts

The NT Government and the community set a target within the Territory 2030 Strategy: ‘Ensure no deterioration in the health of biodiversity in the Northern Territory’

The marine environment of Darwin Harbour will be permanently impacted by the Ichthys Project. The most significant impacts are expected to occur in the construction phase associated with dredging of the navigation channel and in so doing, the removal of Walker Shoal, possibly through blasting. Some secondary

impacts may be temporary, perhaps lasting as long as the construction period and others will continue during the life of the Project. These impacts have been discussed in the previous sections of this Report.

The risks of impact to ecological communities and marine fauna have been predicted by INPEX to be 'medium' to 'low' for most Project activities; however, it is considered in some cases that the information presented has not been adequate to support these assertions of risk. There is still much uncertainty.

Furthermore, Project activities will not be carried out in isolation; the accumulation of various impacts during construction and through Project operations is considered to be significant and the implications of these additive impacts are largely unknown. When placed in the context of a Harbour that is coming under increasing development pressure, the residual detriment from the project warrants the implementation of an appropriate marine offset.

Although INPEX's influence on the Harbour will be considerable, it is recognised that INPEX is not the sole operator. Government also has a role and there is an opportunity for the NT Government and INPEX to collaborate in establishing a suitable offset that is relevant for the permanent changes that will occur to the natural environment of Darwin Harbour.

Recommendation 12

An appropriate offset is necessary to compensate for the residual detriment posed by Project activities to the ecological communities and marine fauna within Darwin Harbour. The scale of offset should be commensurate with the scale of residual detriment. If blasting is required, the offset must be increased to compensate.

4.6.4 Shorebirds / Wader birds

Two main issues were raised during the review of the draft EIS in relation to potential impacts on shorebirds. These included the effects of sedimentation from the dredging on the intertidal mudflat feeding areas, which are utilised by shorebirds and seabirds listed under the EPBC Act, and the susceptibility of shorebirds to oil spills. Other issues raised included the effect of lighting from the Project and construction of a causeway at the southern end of the Blaydin Point 'island'.

The modelling presented in the draft EIS predicts low levels of sedimentation and indicates that these levels are not likely to have a significant effect on shorebird feeding. The EIS also states that shorebirds are highly mobile and can move to unaffected areas. Consequently, no management actions were proposed for migratory bird foraging habitat.

Although the more significant shorebird sites are mentioned, Darwin Harbour is home to thousands of shorebirds spread throughout the inter-tidal habitats and there is potential for these habitats to be affected by sedimentation.

Shorebirds are mobile and do move long distances on migrations. However, banding studies show they can also be very faithful to their breeding sites in the northern hemisphere and their over-wintering final destination feeding sites in locations such as Darwin Harbour.

While the risks to shorebirds from sedimentation impacts are acknowledged to be low based on the conditions predicted by modelling for the current dredging concept,

there is the potential for parameters to change in the actual dredging campaign. There is also inherent uncertainty associated with the model and the possibility of sedimentation exceeding predicted levels needs to be considered. Furthermore, the threshold values applied to these habitats by the proponent have been questioned and will need to be determined through further baseline studies (Section 4.5).

The possible need for shorebird monitoring should be re-assessed when the dredging campaign is fully defined, further sediment fate modelling and particle tracer studies are conducted, and appropriate monitoring and adaptive management measures are being developed for sediment transport issues.

Impacts from Project dredging activities are not considered to present a significant threat to shorebirds at this stage and will be managed through other mechanisms within INPEX's Environmental Management Program (see Section 4.13).

The risk of, and potential impacts from, oil spills is discussed in Section 4.7.3 of this Report.

4.6.5 Barramundi

Increased suspended material and deposition of silt from dredging and spoil dumping operations may impact on barramundi populations, specifically on breeding and recruitment. Barramundi is a popular target for recreational fishers and is an important commercial fisheries resource in the Top End.

The draft EIS reports that suspended sediment concentrations greater than 500mg/L have an impact on larvae of most species and 100mg/L would affect some species if exposed for longer than 96 hours. It predicted a suspended sediment concentration of no greater than 20mg/L in the lower reaches of the Howard River and predicted this would not impact on the barramundi larvae and recruitment.

Subsequent to the publication of the draft EIS, a study was undertaken into the effects of simulated dredge material from Darwin Harbour on eggs and larvae of barramundi (Supplement, Appendix S5). The study provided additional information on predicted impacts on the barramundi population and presented data from experiments that were commissioned to test the survival of barramundi larvae under different suspended-sediment concentrations. The results of the experiments predicted minimal impact on barramundi larvae from elevated levels of suspended solids. The Fisheries Division of DoR is satisfied that the dumping of dredge spoil is unlikely to impact the spawning and recruitment of barramundi in the Shoal Bay area.

INPEX has committed to operate under an approved dredging and dredge spoil disposal management plan. The management plan will include water quality thresholds relevant to barramundi larvae protection. INPEX has also committed to work with regulatory agencies and other stakeholders to manage actual impacts during construction through adaptive and proactive practices.

Monitoring measures will be contained within the dredging and dredge spoil disposal management plan, which will be developed in consultation with regulatory authorities, including the Fisheries Division of DoR.

4.6.6 Mud crabs

Recreational fishing for mud crabs is considered to be a locally important pastime in Darwin Harbour. Increased suspended material and deposition of silt from dredging and spoil dumping operations has the potential to impact on mud crab populations.

According to some respondents, the draft EIS did not present adequate consideration of impacts to mud crabs. INPEX subsequently commissioned a study on the potential impacts of the Project on mud crabs in the Darwin Harbour and Shoal Bay (Supplement, Appendix S8). The study report identified and described the potential direct and indirect impacts that dredging and spoil disposal activities could have on aspects of key life history stages of mud crabs. It also provided information on mitigating factors for these potential impacts.

This study supports the prediction of a low impact from the Project on mud crab populations. The proponent's understanding of the low impact on mud crabs of high suspended-solid levels is correct. Therefore it is considered unlikely that the dumping of dredge spoil would impact the spawning and recruitment of mud crabs in the Darwin Harbour or Shoal Bay areas.

Similar to the barramundi management commitments, INPEX states that construction will be undertaken in accordance with an approved dredging and dredge spoil disposal management plan. The management plan will include water quality thresholds relevant to mud crab protection. INPEX has committed to working with regulatory agencies and other stakeholders to manage actual impacts during construction through adaptive and proactive practices.

Monitoring measures will be contained within the dredging and dredge spoil disposal management plan, which will be developed in consultation with regulatory authorities, including the Fisheries Division of DoR.

4.6.7 Significant terrestrial habitats

The construction of the onshore processing plant will require clearing of monsoon vine forest and mangroves. In addition, mangrove vegetation may be lost or degraded due to sedimentation from dredging. Both native vegetation communities have high biodiversity conservation values and are classified as significant under the *Planning Act*. Furthermore, the threatened plant *Cycas armstrongii* (Vulnerable under TPWC Act) occurs within the processing plant footprint and therefore a significant number of individuals will be destroyed.

The clearing of monsoon vine forest and mangroves appears to be unavoidable for the development of the processing plant on the Blaydin Point site. INPEX has attempted to design the site to minimise clearing and since publication of the draft EIS has reduced the clearing requirements of monsoon vine forest by 7ha; although, re-design of the administrative facilities associated with the onshore facility has resulted in an increase in the total area of mangroves and salt-marsh to be cleared.

INPEX suggests in the EIS that opportunities to reuse cycads from the clearing activities at the onshore development and accommodation village sites will be investigated during detailed design. This is encouraged.

The predicted levels of sedimentation in mangrove habitats remain unchanged following revision of the modelling. Sedimentation in mangroves as a result of dredging and spoil disposal is predicted to be greater than 100mm within two hectares of mangrove habitat. These levels have the potential to cause tree deaths in sensitive mangrove species. A further 28ha of mangroves is expected to be at risk of decreased growth or death with sedimentation levels predicted to be above 50mm

over four years. Generally, sediment deposition of 17 to 35mm per year is expected in the zones of moderate impact.

As stated in the draft EIS, if mangrove tree deaths result because of sedimentation from the dredging program, the proponent proposes to rehabilitate the affected areas after the completion of dredging activities through a combination of natural recruitment, facilitated natural recruitment and active planting. INPEX has maintained its initial approach to managing risks of sedimentation to mangroves. This assessment relies on the adequacy of model predictions and monitoring would be used to validate the model. Significant uncertainty remains in the model predictions and to a certain extent this has been acknowledged by INPEX.

To deal with this uncertainty, INPEX has proposed the following:

“Monitoring of mangrove health and sediment deposition within Darwin Harbour will be designed such that actual sedimentation can be compared with predicted sedimentation rates. It is proposed that such monitoring will be conducted at 3-monthly intervals. In the unlikely event that sedimentation rates in mangroves exceed those predicted, or mangrove health is impacted at lower levels of sedimentation than assumed in the draft EIS, the monitoring program will detect such changes early and adaptive management practices can be identified and discussed with NRETAS to facilitate protection of mangrove communities.”

Development of mangrove health and sedimentation monitoring has not progressed since publication of the draft EIS. Therefore, considerable reliance has been placed on the post-approval development of environmental management plans.

The loss of mangroves from sedimentation is an acceptable risk at current predicted levels. The model assumptions and predictions will need to be validated however, through a combination of particle tracer studies prior to commencement of works, and monitoring during dredging activities, in accordance with Recommendations 4 and 5 of this Report. A monitoring program should be included as part of the Environmental Management Program for Government approval in accordance with Recommendation 23 in in Section 4.13 of this Report.

Recommendation 13

A monitoring program must be developed in consultation with NRETAS and an expert panel (in accordance with Recommendation 24) for sedimentation in mangrove communities of Darwin Harbour. The program should be informed by the sediment transport modelling and particle tracer studies and be included in the dredging and dredge spoil disposal management plan.

The proponent has identified the potential use of offsets to manage the residual detriment associated with the loss of monsoon vine forest.

The use of offsets is a rational approach to managing the issue. It is important to note that the loss of monsoon vine forest will be permanent. The proponent has indicated that protection of monsoon vine forest *“could also be incorporated in fire management programs within the Daly River and Wagait areas”*, which would principally be designed for greenhouse gas abatement. The loss of monsoon vine forest is considered to be an acceptable risk of the Project if there is commitment to permanent protection of regionally significant monsoon vine forests, particularly in the Darwin Harbour catchment.

Recommendation 14

An offset for loss of monsoon vine forest on Blaydin Point is recommended. All activities associated with offsetting the residual detriment of clearing monsoon vine forests should:

- **be in perpetuity; and**
- **include a management plan that demonstrates environmental benefits.**

4.7 Emissions, discharges and wastes

This Report has focused on the key waste discharges from the Project, particularly in the context of Darwin Harbour as the receiving environment. INPEX is responsible for managing and disposing of all wastes generated from the construction and operation of the Project and will need to reach agreement on appropriate waste management strategies with the relevant authorities.

4.7.1 Hydrotest water

Concerns were raised through the assessment about the fate of hydrostatic test water from the pipeline and onshore facility; the use of potable, reticulated water to conduct hydrostatic testing; and the lack of information about the chemicals to be used in the water.

Hydrostatic pressure-testing is required to verify the integrity of all onshore process and storage vessels, tanks and pipework, as well as the pipeline from the Browse Field to the onshore facility. The EIS indicates that hydrotest water would be discharged during pre-commissioning as well as during the early stages of operation of the onshore facilities. In most cases, INPEX proposes to use potable water and no chemicals would be added. In these cases the water may be reused several times (e.g. to leak-test one tank after another). Where potable water is used, this is strongly encouraged as reuse will reduce pressure on Darwin's water supply (see Section 4.10.2).

Another option would be to consider the use of seawater although it is acknowledged that this would require treatment with the addition of chemicals. If the hydrotest water is chemically treated, this typically involves the addition of biocides to prevent bacterial formation, scale inhibitors to prevent the build-up of pipe scale, and corrosion inhibitors and/or oxygen scavengers to prevent internal pipe corrosion. INPEX has not determined the types or characteristics of the chemicals to be used in hydrotesting, but would undertake a chemical selection process, based on water quality, ecotoxicity and efficacy of the chemical agents with its contractor.

The EIS indicates that the gas export pipeline from the Browse Field will be tested with filtered seawater from Darwin Harbour and dewatered at the offshore facility. During dewatering, the 1 000 000m³ of treated water in the pipeline will be discharged at the offshore facility. No emergency discharge of hydrotest water from the gas export pipeline to Darwin Harbour will be necessary as was suggested in the draft EIS.

INPEX proposes to discharge hydrotest water from the onshore gas-processing facilities at either the combined outfall on the product loading jetty or through inspection pits, or similar structures, to the open-drain systems depending on water quality and the availability of the jetty outfall.

It was suggested in response to the draft EIS that INPEX investigate alternative options for disposal of hydrotest water rather than discharge to the Harbour. INPEX indicated that opportunities for irrigation to land at Blaydin Point would be limited; however, no detailed explanation was provided in the EIS. INPEX needs to provide further justification that discharge to land is not viable.

Total hydrotest discharges from the onshore facility are predicted to peak at 7200m³/d (7.2ML) when the tanks are being tested but INPEX claims that the average discharge volumes will be substantially lower than this for the duration of the six-to-nine-month pre-commissioning period.

INPEX have committed to:

- minimising the amount of water needed for hydrotesting;
- minimising the types and amounts of treatment chemicals that may need to be added; and
- assessing chemical additives to understand their environmental risks.

If discharge to the Harbour is required, INPEX will need to undertake an ecotoxicity assessment. These commitments and requirements of an Environment Protection Licence (EPL) under the WMPC Act will be undertaken through the proponent's Liquid Discharges, Surface Water Runoff and Drainage Management Plan.

Recommendation 15

Appropriate controls to mitigate risks from hydrotesting waste water must be included in the Liquid Discharges, Surface Water Runoff and Drainage Management Plan for Government approval. In preparing the plan, INPEX should also:

- **Investigate options for land-based disposal where practicable; and**
- **Select chemical additives that have the lowest practicable risk to the marine environment.**

4.7.2 Waste water discharge

A number of submissions contained comments about INPEX's requirement for liquid waste streams from the operating plant to be discharged to Darwin Harbour, particularly in view of contamination risks and the potential for reuse. Recommendations were made for closed circuit systems and on-site management, including irrigation to terrestrial sinks and reuse in the facility to reduce the demand on the local reticulated water supply. Any discharge was recommended to be tertiary treated.

INPEX intends to treat and discharge wastewater from the process water streams, the potentially-contaminated drainage system, the demineralisation plant and the sewage treatment plant, into the Harbour from the end of the product loading jetty, 300m offshore.

Volumes would fluctuate due to the co-mingling of intermittent sources and continuous streams, which are predicted as follows:

- Sewage waste and grey water would be generated throughout the life of the Project with the volumes fluctuating depending on the number of people on the site. Approximately 2–20m³/h of treated sewage will be produced during the operations phase.

-
- Demineralisation reject water from the reverse osmosis (RO) demineralisation plant will be a continuous discharge with a flow rate of between 7–16m³/h.
 - Process waste water from the processing plant will be made up almost exclusively of water drained from the bottom of condensate tanks and volumes will fluctuate depending on maintenance activities at the time. If a combined-cycle system is chosen as the preferred technology for power generation, then condensed 'steam loop bleed' water will add a continuous stream of 8-13m³/h of potable water.
 - Operational stormwater runoff from potentially-contaminated areas in the process plant would also be directed to wastewater treatment and this would fluctuate significantly between 'Wet' and 'Dry' seasons.

When accounting for all waste streams, it is estimated in the draft EIS that minimum discharge volumes from the outfall would be around 18m³/h in the Dry season. Maximum discharge is expected to be 160m³/h in Wet season peak storm events with 110m³/h of this the stormwater contribution.

The wastewater would contain a range of contaminants fluctuating according to contributions from the various liquid waste streams. Key contaminants expected include nutrients (phosphorus [P] and nitrogen [N]) and faecal coliforms from sewage; scale and salts from demineralisation; and hydrocarbons from process waste water and contaminated stormwater. Physical characteristics of the water would also vary from ambient conditions of the receiving environment. Expected contaminant characteristics of Project wastewater are provided in Table 2.

Table 2: Characteristics of liquid discharges to Darwin Harbour against water quality criteria for Darwin Harbour.

Parameters		Unit	Water Quality Objectives for the Darwin Harbour Region (Feb 2010) ¹	INPEX Estimated wastewater characteristics
pH		–	7.0-8.5	5–9
Nutrients	Total nitrogen (Total N)	µg/L	<270	≤ 40 000
	Total phosphorus (Total P)	µg/L	<20	≤ 10 000
Faecal coliform bacteria		cfu/100mL	Not specified	< 400
Total petroleum hydrocarbons		µg/L	<600 ²	≤ 10 000
BOD		mg/L	Not specified	≤ 20
Temperature		°C	Not specified	26–35 °C

1. Indicator for Environmental Use: Aquatic Ecosystem Protection and Cultural, Mid Estuary.

2. Adopted from Environmental Quality Objectives in the Netherlands, 1994

A number of physicochemical and bacteriological parameters identified in the Water Quality Objectives for the Darwin Harbour Region have not been included in INPEX's predicted characteristics for treated waste water. These include: dissolved oxygen, NO_x, ammonia nitrogen, filterable reactive phosphorus, chlorophyll α, *Escherichia coli*, and *Enterococci spp.* ANZECC Toxicant criteria (including BTEX and heavy metals) were also omitted.

AFANT were concerned about the cumulative effects of discharges from existing and future developments upstream of Blaydin Point and gave the view that treated sewage and grey water should not be discharged to the Harbour. Recent beach closures associated with *Escherichia coli* (*E. Coli*) bacterial contamination has elevated the concern about faecal contamination and sewage in the Harbour.

INPEX commits to treating sewage to a high enough standard to allow all sewage treatment plant waste water to be irrigated, however, as discussed in Section 4.7.1, INPEX claim the requirements and opportunities for irrigation on Blaydin Point are limited. INPEX predict that the operational contributions to annual loads of total N and total P (after treatment) would amount to 0.5% and 0.9% respectively, when compared with existing East Arm annual loads. This is based on INPEX meeting the estimated wastewater characteristics for total N and total P in Table 2.

The Darwin LNG plant at Wickham Point implemented a closed-circuit re-use system for normal operations with contingency for Wet season flows. Darwin LNG plant has a Waste Discharge Licence authorising dry weather harbour discharge of reject water from the demineralising RO plant and Wet season harbour discharge of reject water from the RO plant, turbine air humidifier system and boiler blowdown, and water from the treated water holding tank (including tertiary treated sewage effluent). Darwin LNG plant actively discharges reject water from the RO plant to the Harbour

year round. All other waste water is irrigated onsite. Darwin LNG operational waste water volumes were predicted to average 288m³/d,.

INPEX's proposed daily discharge rate is calculated to be approximately 432m³/d. Irrigable land surface may be a limiting factor for INPEX in undertaking similar land-based disposal to Darwin LNG. Further investigation of land-based disposal is needed to clearly demonstrate that this is not a viable option for all Project waste water, in 'Dry' season conditions. INPEX needs to explore further the potential for re-use of treated water in the process, which would potentially reduce reticulated water demand as well as discharge volumes.

If the discharge from the Harbour outfall is required after all other options are exhausted, any waste water discharge would be regulated through the Environment Protection Licence (EPL) under the WMPC Act. Discharges to the Harbour would be required to meet Water Quality Objectives for the Darwin Harbour Region. Where these are unable to be met INPEX would be expected to show just cause for seeking approval for discharge to the Harbour. All discharges to the Harbour require monitoring for a period prior to commencement of discharge to establish baseline data for determining impact of the discharge; validation of mixing zones where applicable (i.e. where water quality objectives can not be met); monitoring during the life of the activity; and during remediation of the site on cessation of the activity. Monitoring would be conditional to any approval or licence which authorises a discharge to the Harbour and would incorporate biological and chemical parameters.

INPEX should continue to seek and implement waste water reduction, re-use and treatment within the plant design and for the life of the Project in accordance with continuous improvement principles.

4.7.3 Oil Spills

The draft EIS provided a 'primary risk' assessment of the potential for hydrocarbon spills in the nearshore environment as a result of a gas export pipeline rupture or leak, a leak of condensate at the jetty and a refuelling spill at East Arm Wharf. Modelling of the expected dispersion patterns was also conducted to provide an indication of the 'secondary risk' of hydrocarbons reaching the shoreline.

The draft EIS also described the characteristics of the hydrocarbons that would be implicated in a spill. For example, INPEX claims that that 70-80% of spilled condensate would evaporate within the first day of release due to its high volatility and complete evaporation would occur within 6 hours if spilled at the sea surface.

The Montara incident in the Timor Sea and Macondo well (Deepwater Horizon) incident in the Gulf of Mexico drew the public's attention to the offshore oil and gas industry and the possibility of significant hydrocarbon contamination in the marine environment. Most of the concerns raised in the draft EIS were associated with offshore well blow-outs in the Browse Basin, however, a number of respondents were concerned that pipeline rupture scenarios had not been adequately covered.

INPEX subsequently modelled extra spill scenarios in Darwin Harbour and north-west of the Harbour associated with pipeline rupture. An increase in condensate production at the Blaydin Point site was also flagged by INPEX, with a predicted small increase in oil spill risk.

Analysis of the risks to the nearshore environment of Darwin Harbour from a worse-case pipeline rupture based on hydrocarbon characteristics and dispersion modelling predictions indicates shoreline contamination by very low volumes of condensate

would be likely; however, the likelihood of a pipeline rupture would be extremely low and the impacts very localised. Further away from the Harbour, the risk to the NT coastline is predicted to become negligible. The greater risk of spills comes from leaks of fuels and condensate at the East Arm Wharf and INPEX's product loading jetty respectively.

INPEX has an oil spill contingency plan (OSCP) that will be finalised and submitted to the NT Government for approval under the *Disaster Act* prior to the commencement of construction, commissioning and operations.

INPEX, in cooperation with industry partners, is also developing an operational and scientific monitoring program to ensure that oil spill combat efforts are effective and that timely and appropriate monitoring of environmental receptors at risk during a large oil spill is undertaken. This is more applicable to the offshore component of the proposal, however, there may be linkages with Darwin Harbour monitoring programs to ensure that baseline knowledge is available in the event of an incident. Relevant lessons arising from the Montara and the Macondo inquiries will be incorporated into the proponent's oil spill contingency plans and into the proponent's selection, resourcing and positioning of oil spill combat equipment and personnel.

Monitoring plans will be developed as part of the oil spill monitoring and management procedures. It is expected that any monitoring activities following an oil spill would include assessment of impacts on marine fauna including mammals, turtles, fish and shore birds. Long-term monitoring of fish populations following an oil spill would be required to determine whether the event caused recruitment failure.

The potential for oil spills is correctly identified as a risk in the EIS. The proponent has detailed the measures it will take to monitor and manage oil spills, including the development of site specific oil spill response plans. It is noted that the proponent has access to a significant amount of expertise and equipment in the event of an oil spill.

4.7.4 Noise

There were a few concerns relating to airborne noise attributed to the Project. These included shipping noise in the evenings, in relation to the Deckchair Cinema; impacts on Palmerston; and perceived noise modelling deficiencies.

Underwater noise issues are discussed in Section 4.6.1 of this Report.

INPEX assessed the potential impacts of noise from plant operations, emergency flaring and pile driving on the community through noise modelling. Shipping noise was not modelled.

The Deckchair Cinema, although an open-air venue, is situated in a relatively quiet area on the edge of the Darwin CBD overlooking the Harbour. A concern was raised that the standards required for background noise in cinemas could be affected by noise from LNG tankers and the accompanying tugs and no relevant noise predictions were provided in the draft EIS. INPEX used worst-case, predicted impacts in Darwin from operating plant noise (in the 25–35 dB(A) range) and the measured ambient noise levels at various locations around Darwin to conclude that noise levels at the Deckchair Cinema would not be affected by the Blaydin Point plant or shipping at night. INPEX argued that the cinema would more likely be affected by natural and other pre-existing sources (e.g. wind or traffic noise) and that shipping would be conducted similarly to current shipping from the Darwin LNG plant.

The draft EIS indicated that the operating gas plant is not expected to cause ambient noise levels in Palmerston to rise above around 40 dB(A); however, further modelling

shows that with upset flaring, noise levels could be 45-55 dB(A) in Palmerston three or four times per year for short periods if wind speed and wind direction are unfavourable at these times.

To demonstrate relative levels of noise from recognised sources, INPEX provided comparative examples of noise levels in the draft EIS. A noise level of 40 dB(A) is equivalent to “quiet radio music”, a level of 50 dB(A) is equivalent to “low conversation”, and a level of 60 dB(A) is equivalent to “normal conversation”.

It is accepted that the Project will create some noise and at times the noise levels might exceed ambient noise levels in some residential areas. The noise is not expected to be significant.

4.7.5 Air emissions

A small number of respondents to the draft EIS questioned the appropriateness of the National Environment Protection (Ambient Air Quality) Measure (Air NEPM) for the Darwin Region ambient conditions as well as the adequacy of proposed monitoring for gas facility emissions at Blaydin Point. The Territory 2030 air quality target aims to continue to meet or better national air quality standards across the Territory.

INPEX conducted an assessment of existing ambient air quality in the Darwin airshed, including inputs from Darwin LNG, the Channel Island Power Station, Weddell Power Station and other area source emissions, and then considered the additional emission sources from the Project to determine predicted ground-level concentrations of key air pollutants produced by the Project.

EH Division contracted an air quality consultant to review the air emissions modelling conducted by INPEX.

Use of the NEPM Ambient Air Quality criteria was determined by the Division’s consultant to be appropriate for the Darwin Regional airshed in the absence of specific impact assessment criteria specified for the Northern Territory, provided that:

- They are compared to 100th percentile dispersion modelling predictions; and
- Existing background concentrations of pollutants are considered.

INPEX’s predictive air quality modelling showed that after the addition of the emissions from the INPEX facilities, ground-level air quality in the Darwin region would remain well within the criteria prescribed in the Air NEPM at all times for NO_x, photochemical oxidants (as ozone (O₃)), and sulfur dioxide (SO₂). PM₁₀ could be expected to exceed the criterion at times, which is allowed for to an extent in the NEPM due to ambient spikes caused by natural events such as bushfires and dust storms.

There is a small predicted increase in levels of pollutants resulting from the Project and generally the risk of significant and wide spread air quality impacts from the Project is considered to be low. Therefore, an extensive ambient air quality monitoring program is not warranted. INPEX has committed to ambient air quality monitoring during the operations phase to validate the assumptions used in the modelling and demonstrate that ambient concentrations are broadly commensurate to the levels predicted. INPEX will also consider sampling for particulates during the Wet season and/or Dry season.

Additionally, an ongoing stack emission monitoring program is considered necessary to ensure emissions remain within prescribed limits. The air quality monitoring will

form part of the proponent's Environmental Management Program and a requirement of the EPL under the WMPC Act.

Recommendation 16

An air monitoring program is required for the life of the Project. The program will be developed as a requirement of the Environment Protection Licence under the *Waste Management and Pollution Control Act*.

The following point-source emissions testing should be conducted for the program:

- **Quarterly monitoring for the first year of operation and annual thereafter for NO_x (plus temperature, flow, O₂, moisture) at each stack servicing the compressor turbines, power turbines, and hot oil heaters; and**
- **Quarterly monitoring for the first year of operation and annual thereafter for SO₂ (plus temperature, flow, O₂, moisture) at each stack servicing the acid gas incinerators.**

4.7.6 Greenhouse gas emissions

It is estimated that the Project will emit approximately 280Mt of greenhouse gases over its 40-year lifetime. The majority of emissions (278Mt) will be emitted during the operational phase, with approximately 2Mt emitted during the construction phase (draft EIS, Section 9.6).

The draft EIS interchanges between presenting project GHG emissions as CO₂ emissions and carbon dioxide equivalent units (CO₂-e). The Supplement clarifies (Supplement, page 259) that the draft EIS has been written on the basis that GHG emissions over the 40-year life of the project are estimated to be 280Mt CO₂-e, comprising approximately 96% CO₂ and 4% other GHGs (primarily methane (CH₄) and nitrous oxide (N₂O)).

Average annual GHG emissions are estimated at approximately 7.0Mt of CO₂-e, noting that annual emissions will vary over the life of the project. On an average annual basis, 5.2Mt of CO₂-e will be emitted in the Northern Territory (74%), sourced from onshore combustion emissions and reservoir emissions (Table 3).

Table 3: CO₂-e emissions as estimated in the draft EIS

		40 year Project life (Mt)	40 year annual average, MT per annum (Mt/a)	Annual average as % of Australian emissions 2009	Annual average as % of NT emissions 2009
Construction phase		2.0	n.a.		
Operational Phase	Offshore	72	1.8		
	Onshore combustion	110	2.8		
	Reservoir gas	96	2.4		
	Onshore sub-total	206	5.2		30
	Operational sub-total	278	7.0		
Total		280		1.2	

Estimated average annual emission levels are equivalent to 1.2% of Australia's GHG emissions in 2009. Estimated onshore emission levels are equivalent to 30% of the Northern Territory's GHG emissions in 2009.

The Australian Government has committed to reduce Australia's carbon pollution to 25% below 2000 levels by 2020 if the world agrees to stabilise levels of GHG in the atmosphere at 450 parts per million or lower. If global agreement is unable to be reached on a 450 parts per million target, the Australian Government has committed to reduce Australia's emissions by between 5 and 15% below 2000 levels by 2020.

The Australian Government has also committed to a long-term GHG emissions reduction target of at least 60% below 2000 levels by 2050.

The Northern Territory Government's Climate Change Policy sets an aspirational goal of reducing the Northern Territory's emissions by 60% by 2050, compared to 2007 levels.

Average annual GHG emissions from the INPEX project would represent approximately 3.2% of the Australian Government's long term reduction target for 2050, and 76% of the Northern Territory's aspirational goal for 2050 (refer Table 4).

Table 4: Comparison of Project annual average operational GHG emissions against National and NT targets

Target	GHG Emissions Target Mt/CO ₂ -e/annum	INPEX 40-year annual average operational GHG emissions Mt/CO ₂ -e/annum	INPEX contribution as a % of Target
National target: 60% below 2000* levels by 2050	221.88	7.0	3.2%
Northern Territory goal: 60% below 2007# levels by 2050	6.879	5.2	75.6%

*According to the National Greenhouse Gas Inventory (May 2011), 2000 levels are estimated to be 554.7Mt CO₂-e.

According to the State and Territory Greenhouse Gas Inventory (2009), 2007 levels are estimated to be 17.197Mt CO₂-e.

The INPEX project would generate a significant increase in national and Northern Territory GHG emissions. The INPEX project would be the largest single industry emitter of GHG in the Northern Territory.

The draft EIS compares life cycle GHG emissions from the use of LNG and coal for electricity generation. It states that a primary advantage of the use of LNG as an energy source is that the quantity of GHGs emitted over the full life cycle is significantly less than the comparable life cycle emissions from either coal or fuel oil, as a means of delivering the same amount of energy (draft EIS, page 428). The draft EIS further states that 'in a global context, the use of Ichthys LNG to generate electricity in Asia will therefore likely result in a significant reduction in CO₂ emissions' (draft EIS, page 429). The substitution of gas for coal is questioned by a number of respondents to the draft EIS.

INPEX LNG does have the potential to replace the use of coal, which would result in a reduction of GHG emissions over the full life cycle. There is no guarantee, however, that this will be the case. As stated in the Supplement (page 253), the degree of fuel displacement by Ichthys LNG cannot be known until the LNG is consumed. The emissions generated in the consuming country are more appropriately addressed by that sovereign state.

Comparisons in the draft EIS and Supplement reveal that the project would be more emissions intensive than many other LNG projects around the world. This is largely due to the high proportion of CO₂ naturally present in the Brewster and Plover gas reservoirs, and the relatively energy-intensive offshore facilities.

The draft EIS outlines a number of technical abatement measures that have been identified for the project (draft EIS, Section 9.8). These measures represent a reduction in GHG emissions of 0.39Mt/a and have been included in INPEX's annual average production estimate of 7Mt/a. In the Supplement, INPEX commits to additional measures in its base-case design, including a combined cycle power plant for onshore electricity production and a subsea electrical power-sharing cable between the offshore infrastructure components. Emission reductions from these

measures are estimated to be 0.3 – 0.35Mt/a and 0.1 – 0.2Mt/a respectively from the annual average of 7Mt estimated in the draft EIS.

INPEX commits to producing a detailed GHG management plan prior to the commissioning of the onshore facilities that will include an updated GHG emission estimate and consolidate measures for technical emissions abatement and offsets. Benchmarking the technology of the onshore gas processing plant and related abatement measures detailed in the GHG management plan would inform the relevant NT approval under the WMPC Act.

Large scale GHG emission reductions beyond technical abatement measures could potentially be achieved through geosequestration and offsetting GHG emissions from the project. The draft EIS outlines INPEX's investigations into geosequestration of reservoir CO₂ and states that INPEX may consider its implementation if technically feasible and commercially viable.

INPEX is investigating reforestation as a GHG offset and has established a biosequestration assessment project in Western Australia. In the Supplement INPEX expresses its interest in two savanna fire management projects in the Northern Territory to achieve GHG emission reductions and biodiversity protection. INPEX states that it is continuing to examine the feasibility and cost-effectiveness of offsets, with no firm commitments made by INPEX in the draft EIS and Supplement. Submissions to the draft EIS commented on the scale of GHG offsets, with many seeking 100% offset of the project's GHG emissions. Given the significance of the project's GHG emissions, commitments to GHG offsets are expected to feature prominently in the GHG management plan to be provided by INPEX as additional measures to reduce the GHG impact of the project.

The Australian Government is pursuing the implementation of a carbon price mechanism that will start with a fixed price period for three to five years before transitioning to an emissions trading scheme. The Australian Government is aiming to commence the carbon price on 1 July 2012, subject to the ability to negotiate agreement with a majority in both houses of Parliament and pass legislation in 2011. The extent of coverage of the LNG sector in the proposed mechanism is uncertain at this point in time.

The GHG emissions from the onshore component of the Ichthys LNG project will be regulated by the Northern Territory Government through an EPL under the WMPC Act. The ongoing application of the Northern Territory regulatory framework will need to be reviewed should there be progress in establishing a national carbon pricing mechanism or alternative national regulation of GHG emissions. If, at any time in the future, the GHG emissions from the Ichthys LNG Project are regulated under national legislation to reduce GHG emissions, then INPEX may no longer be subject to Northern Territory regulation of GHG emissions.

INPEX has recognised in the draft EIS that it will be required to report its GHG emissions to the National Greenhouse and Energy Reporting System.

This assessment concludes that the project will result in a significant increase in NT and Australian GHG emissions.

Recommendation 17

That INPEX submit to the Northern Territory Government a Greenhouse Gas Management Plan covering onshore GHG emissions prior to commissioning of the onshore gas processing plant. The GHG Management Plan should be submitted within a timeframe that enables its consideration in the issue of an Environment Protection Licence under the *Waste Management and Pollution Control Act*.

Recommendation 18

That the Greenhouse Gas Management Plan include, but not necessarily be limited to, the following:

- **An updated greenhouse gas inventory for the proposal;**
- **Measures adopted to mitigate greenhouse gas emissions;**
- **Demonstration of the adoption of current best practice in the design and operations of the onshore gas processing plant in terms of GHG emissions by benchmarking technology against other national and overseas facilities;**
- **Commitments to periodic review and, where practicable, continuous improvement in technology and operational process to further mitigate GHG emissions per tonne of LNG produced;**
- **A report on the status of investigations into geosequestration; and**
- **Commitments to measures to offset the GHG emissions from the onshore gas processing plant, preferably including measures implemented in the Northern Territory.**

4.8 Cultural impacts

The potential for significant but unlocated maritime heritage to exist within the project footprint was not adequately addressed in the draft EIS.

Remote sensing surveys were conducted at the dredge spoil ground and parts of the dredge footprint in Darwin Harbour. These surveys were designed to assess the bathymetry of INPEX's proposed work area and, in particular, to detect any significant seabed features that might be impacted. INPEX did not engage the services of a maritime archaeologist during the remote sensing surveys and questions were raised about the appropriateness of the surveys to specifically detect potential maritime heritage.

Although the surveys detected high-relief wrecks, the most notable being the 'Catalina Six', many of the remaining, unlocated wrecks in the Harbour are thought to be very low-relief and might not be detected through non-targeted survey methods.

It was recommended in response to the draft EIS that the raw remote sensing data be provided to a qualified maritime archaeologist to determine whether:

- The surveys themselves were sufficient in terms of the equipment used, the areas they covered, their objectives and their calibration to identify sites; and
- Whether anomalies that had characteristic signatures (associated with maritime sites) were identified and then verified.

The scope of work for the consultancy included a review of the potential resource, an assessment of the survey work (in terms of its context, function and parameters), a review of the raw data, and a final recommendation as to whether further work was necessary.

Two consultants were engaged, URS and Cosmos Archaeology. Each consultant provided a desktop review of the potential maritime heritage resource that could exist in Darwin Harbour, a critical exercise as it defined the search objective and the risk. The reports then assessed the suitability of the various remote sensing tools to detect the potential maritime heritage as defined in the resource.

The URS report concluded that nine shipwrecks remain unlocated and that these wrecks would have been detected by the sonar methods used, had they been present. Cosmos Archaeology concluded that the unlocated resource is closer to 39 with up to 25 planes also lost in Darwin Harbour. Further, the Cosmos report concluded that the potential characteristics of some of these wrecks would limit detection using sonar, but could possibly be located through appropriately-calibrated magnetometer surveys. Both magnetometer and sonar methods are considered valid techniques, with sonar able to detect relatively high-relief anomalies and magnetometers able to detect very low-relief anomalies with high ferrous (iron) content.

It is considered that URS did not have sufficient understanding of the potential heritage resource, particularly the range of site types and the number of wrecks that might exist, to conclude that the surveys were adequate. A significant limitation of the URS assessment was the failure to recognise the mass deposition of small pearling luggers following the cyclone of 1897. These are potentially highly significant, but low relief, wrecks which need to be carefully considered in relation to this Project.

The Cosmos Archaeology report found that INPEX's remote sensing reports did not appear to have assessed the data for the potential to locate low-profile, timber-hulled wrecks. The report also found that a series of anomalies identified in the surveys had not been properly verified or were new findings based on a review of the raw data. It noted that non-targeted remote surveys or dive verification were not sufficient to identify maritime heritage and made three recommendations:

- Raw data that had not been provided previously by INPEX should be provided for further analysis;
- The magnetometer survey of Area A (the navigation channel, turning basin and berthing pocket dredging footprint) should be completed; and
- A diver inspection/verification should be carried out on the anomalies identified in the remote sensing surveys.

INPEX has not stated whether it will accept or reject the recommendations presented by either consultant.

The Heritage Branch of NRETAS has an overarching responsibility to act on behalf of the Northern Territory Government to conserve the unique and diverse cultural heritage of the Territory, including maritime heritage. This includes, but is not limited to, identifying places and objects that may warrant protection under the NT *Heritage Conservation Act*. The Branch also acts on behalf of the Commonwealth Government in administering the Commonwealth *Historic Shipwrecks Act*, which applies in Darwin Harbour. There is an obligation under this Act to notify the Australian Government of the discovery of any wreck older than 75 years old, which are automatically protected under the Act.

In light of these obligations, the Cosmos Archaeology report recommendations are supported. It would be prudent for INPEX to adopt these recommendations, in particular, the recommendation to verify the anomalies identified in the surveys. If these measures are adopted by INPEX, it would be considered that all reasonable steps have been taken to address the issue of unlocated maritime heritage.

Recommendation 19

INPEX should conduct a diver inspection/verification of anomalies identified in the data from remote sensing surveys.

Additionally, to ensure the dredging footprint is adequately surveyed for unlocated maritime heritage, INPEX should consider:

- **providing previously unavailable remote sensing raw data for further analysis; and**
- **Completing the magnetometer survey of the navigation channel, turning basin, berthing pocket and MOF footprint in Darwin Harbour.**

4.9 Socio-Economic impacts

Key priorities of Territory 2030 are “Economic Sustainability” and “Society”, which include a series of targets relevant to the INPEX project.

The INPEX project is key in meeting the following Territory 2030 targets:

The Territory continues to secure new private sector investment to drive economic growth and expansion.

Support the continued contribution of the resources sector in the NT economy.

Expand the manufacturing industry with a particular focus on gas-based industry.

Establish Darwin as a key centre for oil and gas operations, maintenance and workforce.

The development of the INPEX gas project would generate strong economic growth in the Northern Territory and Australia, creating significant new employment opportunities, generating considerable growth in exports and a stronger balance of trade, and further stimulating economic activities and industry development. This is in keeping with the Territory 2030 target “*continue to grow the Territory economy*”.

Economic analysis by the NT Government concurs with the economic benefits outlined by INPEX in the draft EIS. In summary:

- The Northern Territory GSP is expected to grow by \$4095 million annually from the base case, an increase of about 18%.
- While the GSP captures increase in output and production, the changes in private consumption expenditure in the Territory provides a useful indicator of actual expenditure in the Territory and the impact on the welfare of Territorians. The INPEX gas project is estimated to increase real private consumption in the Territory by \$175 million annually from the base case, an increase of 1.6%.
- At the peak of construction phase over 2000 jobs would be created and approximately 300 people would be employed on an ongoing basis in the operational phase of the proposed project. The proposed project would also indirectly generate significant employment in the Territory economy.

The INPEX project has the potential to assist the NT to meet a number of identified targets in the Territory 2030 document.

As set out in the Territory 2030 strategy, consideration of targets across all key priority areas is necessary and while the project meets targets outlined in “Economic Sustainability” it will have a greater net positive impact if negative impacts are identified, mitigated and managed effectively.

Impacts to the social fabric of the local and regional community are expected to be significant and consideration of these issues is required by Territory 2030, which includes the (Society) targets:

Ensure there is sufficient serviced land to support investment and population growth.

Develop Darwin as one of Australia’s most affordable cities.

Improve access to accommodation.

A balanced housing market offering good value for money and affordability, ultimately becoming one of Australia’s most affordable housing markets, across all market segments.

While the direct economic benefits and the flow-on impacts to the Northern Territory and Australia are expected to be substantial over the economic life of the project there may be negative social aspects that require careful management, such as maintaining labour availability for existing industries. The degree to which the INPEX project will impact on these aspects has been assessed to some extent in the EIS, however it is considered that ongoing review and management of impacts will be necessary.

Recommendation 20

A Social Impact Management Plan (SIMP) is to be developed by INPEX in collaboration with NT Government. The SIMP must address social issues that have been raised in the EIS and this assessment report. The SIMP should also be informed by the outcomes of a Health Impact Assessment undertaken as part of the accommodation village assessment process.

Specific issues for consideration in the SIMP are discussed further in the sections below.

4.9.1 Impact on housing market

The construction workforce is expected to number between 2000 and 3000 people during the five years it will take to construct the onshore processing plant, with around 300 personnel required for the normal operations of the plant.

Potential impacts on housing affordability and availability are key issues, with stakeholder concerns that the Project, particularly during the construction phase, will place significant pressure on Darwin’s already constrained housing market.

INPEX has acknowledged and addressed the issue in the EIS, which outlines controls to manage and reduce additional pressures on the housing market. INPEX proposes to construct an accommodation village to house construction workers and is developing an accommodation strategy to identify accommodation solutions for regular personnel during the operations phase.

INPEX did not consider it practical to apply risk assessment to the effects of the Ichthys Project on the Darwin housing market as wider economic conditions also

affect property values and an accurate assessment of any impacts directly attributable to the project cannot be made.

Housing affordability is an issue also identified in Territory 2030, which includes targets aimed at achieving affordable housing markets and ensuring Darwin becomes one of the most affordable cities. The inclusion of these targets indicates a Government commitment to this issue and Government will therefore need to consider and account for INPEX's influence on housing affordability. Examples exist in other parts of the country which can be referred to – for example, the effect on housing affordability associated with the development of the LNG industry in Gladstone, Queensland.

4.9.2 Accommodation strategy

The proposed accommodation village at Howard Springs will house the majority of the construction workforce and seeks to minimise short-term impacts on the housing market that might otherwise be caused by a large influx of project personnel.

As previously discussed, the accommodation village is not considered within the scope of this assessment. The assessment of the environmental and social impacts of the accommodation village will be undertaken separately and is scheduled for later in 2011.

An accommodation strategy is being developed to identify and investigate accommodation requirements and options for regular project personnel during the operational phase, as well as for short term visitors during the construction phase. The strategy will identify means of accommodating up to 450 additional people in facilities to be developed in conjunction with private developers.

The aim of the accommodation strategy is to minimise the impact of INPEX personnel on the local housing market while maximising the opportunities to attract and retain suitable employees.

Due consideration has been given to measures to help minimise potential pressure on the housing market as a result of the Project and the overall approach is considered to be appropriate.

4.9.3 Cost of living

Territory 2030 has identified affordability as one of its targets – *Develop Darwin as one of Australia's most affordable cities* – and has stated that a sub-committee (under the auspices of the Capital Cities Committee) will be appointed to develop a strategy to achieve this goal.

The potential influence of the Project on housing affordability has already been discussed and is one of the factors that will need to be considered by the appointed sub-committee. The impact of increased demand on services resulting from the Project (due to increases in population from INPEX workforce) and the associated impact on cost of living will also need to be considered.

4.9.4 Employment

INPEX and its Ichthys Project joint venture partner Total have donated \$3 million towards the construction of a trade training centre in recognition of the Larrakia people who are the traditional owners of the land and sea where the proposed INPEX onshore plant will be located (Blaydin Point). The Larrakia Trade Training Centre (the Centre) was officially opened in April 2011.

The Centre will provide training and facilitate employment opportunities for youth from all sectors of the community including Larrakia and other Aboriginal and Torres Strait Islander peoples.

Approximately 300 students are already enrolled to learn professional skills such as electrical, automotive mechanics, metal fabrication and plumbing.

Similarly, business opportunities in the pre-construction, construction and the operational phases for the local industries and businesses have been formalised in an Industry Participation Plan.

These initiatives are in keeping with the Territory 2030 targets “*The Territory continues to grow the size and skills of its workforce to meet the growth target*”, “*increase Indigenous/ non-Indigenous business partnerships*” and “*improve Indigenous employment rates*”.

4.9.5 Health

The EIS states that ‘*the Project’s most intense socio-economic impacts are likely to be associated with the construction phase of nearshore and onshore development areas*’, and from a health perspective, it is the proposed accommodation village at Howard Springs that is of key interest. The construction of a 2000 – 3000 person accommodation village equates to the development of an entire new suburb in an existing rural area with limited infrastructure and services.

As stated earlier in this report, the accommodation village is being assessed under a separate approvals process. Social and environmental issues expected with this component of the proposal will therefore be assessed further in subsequent approval requirements.

To assist in the assessment of the accommodation village the Department of Health has requested that INPEX conduct an appropriate Health Impact Assessment (HIA) of the potential adverse effects to health from the proposed accommodation village, considering a range of potential outcomes for acute and chronic effects as well as the potential risks to the provision of health services. INPEX has undertaken extensive consultation, which will have assisted in identifying a range of environmental, social and health factors.

It is understood that INPEX has committed to undertaking a HIA of the accommodation village element of its proposal.

4.9.6 Impact of temporary workforce

As quoted in the above section, the construction phase was identified by INPEX as having the most intense socio-economic impacts, and this would include the impact of a temporary workforce, not only in terms of increased demand placed on public and private services and infrastructure but due to the integration of 2000 – 3000 people within the existing social fabric of Darwin.

The Territory 2030 document has targets specific to public amenity of centres, personal safety, road safety, social inclusion, access to healthcare services, alcohol consumption, illicit drug use, etc. In meeting these targets the potential impact of INPEX needs to be taken into account and managed. At the very minimum, an assessment needs to occur to determine potential stresses on social services (e.g. health, emergency and policing).

Some of the management measures that could be implemented include:

- Requiring workers to undertake health assessments;
- Developing a personal code of conduct for workers;
- Implementing a complaints procedure to investigate any complaints of unacceptable behaviour from construction workers and action taken where necessary;
- Drug and alcohol management procedures;
- Employing a Community Relations Manager;
- Including cross-cultural training during site induction;
- The provision of recreational facilities for construction workers.

INPEX has a role in ensuring that the negative socio-economic impacts of its temporary workforce are minimised, however, the success of any measures implemented by the company will be dependent upon management responses and measures put in place by Government.

Some of the issues to be considered by Government include the availability of health services, the adequacy of police services during construction, and the adequacy of existing recreation facilities to cater for construction workers.

There are examples within Australia that can be drawn upon to understand the potential socio-economic impacts a FIFO or temporary workforce can have on an existing community. This information can be used to undertake a social impact analysis and to develop a SIMP in accordance with Recommendation 20 of this Report. The dual role of both INPEX and the Government in managing social impacts demands a collaborative approach when developing a SIMP.

4.9.7 Tourism

A number of concerns were raised about issues that are likely to have impact on the tourism industry:

- The potential for the project to impact on the labour market which will place pressure on the availability of labour for the tourism industry;
- Impacts on housing availability and affordability (having flow on effects for seasonal influx of staff in peak tourism season);

-
- Competing demand for construction workers driving up construction costs and potential to undermine investment in new tourism infrastructure;
 - Impact on the clean, green image of the NT; and
 - Impact on tourism value of the Harbour through reduced visual amenity, marine pests and impact on marine flora and fauna.

The varied perspectives of different segments of the tourism industry were acknowledged and INPEX have committed to engage on an ongoing basis with the tourism industry to mitigate issues and maximise opportunities.

It is recognised that the Project is likely to benefit the industry through increased visitation associated with the Project workforce.

INPEX's commitment to ongoing engagement with the tourism industry is encouraged and supported.

4.9.8 Visual Amenity

Many submissions raised the issue of the visual impact of the LNG Plant on Darwin Harbour and the associated loss of amenity. The natural "look" of Darwin Harbour was seen as being important, and submissions referred to loss of visual amenity, particularly from Stokes Hill Wharf. This is also captured by the target "*our communities are more in touch with their location, climate, people and sustainability*" identified within the Territory 2030 document, which refers to the importance of urban design (relating to the amenity of a location).

INPEX acknowledges the loss of some visual amenity in Darwin Harbour because of the onshore facilities at Blaydin Point but notes that vistas will be mitigated to some extent because the project is a further 3km than the existing Darwin LNG plant when viewed from Stokes Hill Wharf.

The fact that a large proportion of Darwin Harbour remains undeveloped is significant from a tourism perspective. The NT is promoted on the basis of nature and culture and the beauty of Darwin Harbour is an important tourism asset. Accordingly, any development that reduces the visual amenity of Darwin Harbour needs careful consideration in terms of the impact on the destination from a tourism perspective. However, the location of the development is not an area of the Harbour that actively conflicts with current marine based tourism activity, other than recreational and possibly some commercial fishing tours.

The impact on the visual amenity of Darwin Harbour is a significant social issue and must be taken into consideration by INPEX when designing the site facilities. INPEX has already considered this to some extent in the design of the product loading jetty. Visual amenity is also recognised as an issue requiring consideration at the strategic planning level when Government identifies areas for specific land use types. In this respect, Government has accepted that the amenity in the East Arm area will be changed to accommodate this Project.

4.10 Infrastructure and services

4.10.1 Road and Traffic Impacts

The EIS is light in detail regarding the social and economic impacts that the transport component of the Project would have. In addition to the significant increase in wear and tear on the Darwin road network, there are likely issues with road safety traffic congestion and delays to the travelling public. The transport component of the Project may also require vehicles and personnel that are not available in the NT at present. The impact the transport component will have on the existing commuters and the flow on effects is of concern.

The Department of Lands and Planning is working closely with INPEX through the Transport Subcommittee of the Gas Taskforce. The Subcommittee is continuing to develop strategies and options to resolve transport issues and mitigate key risks that result from the flow of logistics in support of the Project.

Road transport and traffic issues will need to be managed through INPEX's traffic management plan. This plan should be prepared in consultation with Government and will form part of the proponent's Environmental Management Program, in accordance with Recommendation 23 in Section 4.13 of this Report.

4.10.2 Water supply

Concerns were raised in submissions to the draft EIS that INPEX propose to use significant volumes of potable water from Darwin's water supply during construction and operation as the current supply is being challenged by existing demand.

The draft EIS separated levels of water demand by Project phase as follows:

- Construction: potable-water demand would gradually increase to approximately 1200m³/d with increased personnel and construction requirements including service water and water required for concrete batching and dust suppression (in the Dry season).
- Precommissioning: Peak water demand for this phase would be during the tank hydro-static testing. During this period of approximately 16 months, water demand could peak at approximately 7800m³/d, which would be required 24 hours a day, intermittently for a few weeks. INPEX committed to reuse tank hydrotest water where technically feasible.
- Operations: Approximately 2000m³/d would be required over the plant's projected lifetime of approximately 40 years with some variation during periodic shutdowns.

INPEX stated that recent advice from the Power and Water Corporation (PWC) indicated that there would be sufficient capacity to accommodate the water demands of the Project, however, INPEX are continuing to investigate alternatives to using PWC water. These include incorporating water efficiency measures into the design of the onshore gas-processing facility and the preparation of a water conservation management plan that will form the framework for the identification and capture of water-efficiency, conservation and management initiatives.

Although INPEX has committed to water conservation, specific strategies such as ensuring that the onshore plant has a water reuse component on the wastewater stream have not yet been built into the project design. INPEX has indicated that its power generation may utilise air-cooling technology. This would considerably reduce

the water requirements of the plant and is supported, provided that any negative impacts specific to this technology are considered.

The Territory 2030 Strategic Plan encourages Government, industry and the community to deliver on the objectives, and meet targets where ever possible. Efficient use of water is such a target that INPEX and Government will need to work towards.

Water conservation is becoming increasingly important in the Darwin Region due to the growing demand on the resource and the need to plan for future water supply. INPEX must ensure that water conservation measures are built into the plant design and commit to continuous improvement in minimising its water use.

Recommendation 21

The Blaydin Point gas facility must incorporate best-practice water conservation measures into the design. The proponent must commit to continuous improvement in minimising potable water use.

4.11 Safety hazards

There were a number of concerns about the hazards of the proposed gas facility and the safety of LNG. Many of the questions related to structural stability of the plant and equipment, and environmental conditions impacting on plant safety and security. The design of the plant during the FEED carefully considered many of these issues (i.e. cyclonic conditions, lightning protection, tank construction, societal safety, etc). Other NT Government Agencies were also consulted in the FEED stage including the NT Police, Ambulance, Fire and Emergency Services.

Under current legislative processes within the Northern Territory, and given its size, this facility will be classed as a Major Hazard Facility, which requires a Major Hazard Facility Licence. As part of the licence requirements the proponent will be required to develop and present for acceptance a document called a Safety Case.

The Safety Case documents the operator's commitments to reducing risks to a level that is as low as reasonably practicable given current technology and safety information. The safety case describes arrangements for health and safety that are used by managers, supervisors and the workforce to understand health and safety issues and their controls.

Safety Cases address the following matters regarding the health and safety of people at or near a facility:

- Identification of hazards and assessment of risks;
- The implementation of measures to eliminate the hazards or otherwise control the risks;
- A comprehensive and integrated system for management of the hazards and risks; and
- Monitoring, auditing, review and continuous improvement.

The Safety Case will need to demonstrate that all credible major risks have been identified, control measures considered and implemented appropriately, and then provide a system whereby these controls are assessed and finally demonstrated to be adequate for the risks identified. It specifies the risk prevention measures as well as strategies for reducing the effects of any major credible accident should one occur.

The Safety Case also requires the proponent to address safety issues including: hazard identification, assessment and control of risks, safety management systems, induction training and education, emergency planning, reporting of incidents and near misses, employee responsibilities, community information and security. It is prepared in consultation with other relevant Government agencies and local councils.

This safety assessment is a separate process and will be undertaken after the environmental assessment process but prior to the commissioning of the facility and plant (first gas).

Although there will be relevant information provided by the proponent to the public in relation to dealing with emergency requirements, other information including the Safety Case cannot be released by NT Worksafe for public comment due to the legislative, security and proprietary aspects of this operation.

INPEX has provided within the draft EIS a QRA to analyse the risk of particular hazards associated with an operating facility.

To improve public confidence, it is considered that greater transparency in this process is needed. Government could achieve this by providing the community with Project-specific information about the decision-making that informs the Safety Case for the Major Hazard Facility Licence.

4.12 Decommissioning

The community expectations of a project, once it is at the end of its life are:

- the site will be decommissioned;
- the community will not be subject to the consequence of legacy issues from the former use of the site; and
- the land is suitable for a subsequent use.

This requires the proponent to consider the need to decommission the site in its initial planning, as well as how a site may be decommissioned and the likely appropriate beneficial use for the site. It is difficult to determine the requirements for decommissioning for a site at the start of a long project. This is in part due to new technologies and processes that may be developed in the intervening period and changes in community expectations leading to changes in what is considered best practice. However, consideration must be given to decommissioning early in the event that the Project does not continue for its full predicted life.

This need to consider decommissioning at the start of the project is acknowledged by INPEX in its Provisional Decommissioning Management Plan *“While the requirements of decommissioning will depend upon the regulations at the end of the useful life of the Project, consideration of decommissioning feasibility will be incorporated into the design of each facility.”*

The primary issue raised by respondents to the draft EIS was the management of waste arising from the decommissioning process. The Provisional Management Plan states that detailed waste management documents will be developed and implemented, as will a series of other management plans to address matters such as noise, dust and acid sulphate soils.

The decommissioning process outlined in Chapter 4 of the draft EIS corresponds broadly with the process agreed by the proponent and the Northern Territory Government on July 18 2008, within the *“Ichthys LNG Project Development*

Agreement". The Agreement contemplates a process for the decommissioning and eventual transfer of the site back to the Northern Territory. The Agreement stipulates the notice period, process to come to an agreed end use for the site, development and approval of a decommissioning plan, security, eventual transfer of the site to the Northern Territory Government and interaction with legislation.

The process of decommissioning the onshore facility does have the potential to significantly impact upon the environment.

Recommendation 22

Prior to decommissioning, the proponent should lodge a notice with the Minister for the Environment (or the appropriate authority at the time of decommissioning) for assessment under the relevant legislation at the time outlining the proposed action and its significance to the environment.

4.13 Environmental Management Program

A number of environmental management plans (EMPs) have been proposed through the course of the assessment process for the Ichthys Gas Field Development Project. All management plans and procedures proposed to be developed for the project must be approved by, or developed to the satisfaction of, relevant government agencies and in consultation with key stakeholders in the timeframes specified.

These approved plans and procedures will be one of the primary tools by which the proponent will implement management and monitoring commitments made in the EIS and the recommendations detailed in this Report.

The proponent employs a structured approach to the management of Health, Safety and Environment (HSE) issues via a formal and documented HSE Management Process based on a continuous improvement model as defined in internationally recognised standards (*AS/NZS ISO 14001:2004, Environmental management systems—Requirements with guidance for use*; and *AS/NZS 4801:2001, Occupational health and safety management systems—Specification with guidance for use*).

This system will form the overarching framework for the management of environmental, health and safety issues. A key component of the HSE Management Process is the development and implementation of EMPs which detail the environment protection and management measures and controls necessary to avoid, reduce or mitigate the environmental impacts of the Project.

The implementation of the HSE Management Process should provide for continual improvement in the management plans and performance of the Project as the management system elements and the requirements within each of these are applied i.e., policy, planning, implementation, audit and review.

It is vital to the performance of the project that the requirements in management processes, plans and procedures are incorporated into the proponent's tendering and contracting procedures and that all contractors are fully aware of, and act in compliance with, relevant management plans. INPEX intends to develop work instructions and procedures to support the EMPs and ensure that they are effectively implemented.

The provisional EMPs referred to in the EIS have been structured by the proponent to provide the core information required to guide the development of construction EMPs (CEMPs) and operations EMPs (OEMPs).

Provisional Environmental Management Plans (Construction and Operations) developed for onshore and nearshore activities in the EIS included:

- Acid Sulfate Soils Management Plan
- Air Emissions Management Plan
- Bushfire Prevention Management Plan
- Cetacean Management Plan
- Decommissioning Management Plan
- Dredging and Dredge Spoil Disposal Management Plan
- Heritage Management Plan
- Greenhouse Gas Management Plan
- Liquid Discharges, Surface Water Runoff and Drainage Management Plan
- Onshore Spill Prevention and Response Management Plan
- Piledriving and Blasting Management Plan
- Quarantine Management Plan
- Traffic Management Plan
- Vegetation Clearing, Earthworks and Rehabilitation Management Plan
- Waste Management Plan

A number of the above plans also apply to EPBC Act matters. The EMPs applicable to the management of impacts on the Commonwealth marine environment include:

- Provisional Decommissioning Management Plan
- Provisional Liquid Discharges, Surface Water Runoff and Drainage Management Plan
- Provisional Waste Management Plan

The EMPs applicable to the management of impacts on marine threatened and migratory species are:

- Provisional Cetacean Management Plan
- Provisional Piledriving and Blasting Management Plan.

The EMP applicable to management of impacts on terrestrial threatened and migratory species is:

- Provisional Vegetation Clearing, Earthworks and Rehabilitation Management Plan.

Any management actions contained within these plans that are applicable to the offshore area are considered to be the responsibility of the Australian and Western Australian Governments.

As the proponent is not intending to undertake drill and blast activities except as a contingency, the Provisional Piledriving and Blasting Management Plan will be

divided into two separate plans, a Piledriving Management Plan and if required, a Blasting Management Plan.

In addition to the above management plans, Recommendation 20 of this Report provides for the preparation of a SIMP collaboratively with Government. The SIMP will need to be included as part of the Environmental Management Program and will include a HIA.

Proposed monitoring programs are associated with many of the EMPs. These monitoring plans may be detailed in the management plans or developed as separate documents linked to the relevant management plans.

Another important consideration for this Project is transparency and accountability in impact management. Some regulatory instruments provide for public availability of management plans; others do not. The proximity and importance of this development to Darwin Harbour and the Darwin regional community increases the importance of transparency. Therefore, as well as seeking engagement with key stakeholders in the preparation of these management plans, the proponent is encouraged to make the final EMPs available to the wider public.

Similarly, the proponent is encouraged to continue to engage and inform the community as development progresses. It is expected that this would include reporting of monitoring outcomes and ongoing management actions to minimise impact.

EMPs are to be provided to Government for approval ahead of the activity for which the EMP is intended to manage or 'prior to the commencement of any works'. For the purposes of this Assessment Report, 'works' means any tasks which would require/cause any physical disturbance to any project area offshore or onshore. Examples include drilling, clearing vegetation above the ground surface, trenching, grading, discharging, dredging, etc.

Recommendation 23

All Environment Management Plans for the Ichthys Gas Field Development Project are to be submitted to Government for approval prior to commencement of any works for which the plans apply.

In preparing each plan, the proponent will include any additional measures for environmental protection and monitoring contained in this Assessment Report and Recommendations. The plans shall be referred to relevant Northern Territory Government agencies and key stakeholders for review prior to finalisation. The plans shall form the basis for approvals and licences issued under relevant legislation.

The proponent should provide public access to final environmental management plans and a reporting mechanism to inform compliance with the plans.

A number of key recommendations in this Report include requirements for the proponent to consult with an expert panel in developing the relevant management plans. The expert panel would be called upon to provide advice on scope and appropriate methodologies in management plans for the key issues associated with the Project. This is important where advice from objective experts is essential in developing effective monitoring programs and management tools to minimise impacts. The relevant activities for which impacts are expected to be most significant and recommendations have been provided include:

- Dredging and dredge spoil disposal; and

-
- Blasting, if required.

The form of the expert panel will need to be determined in agreement with Government and the proponent. It is expected that the model used in Chevron's Gorgon Project in Western Australia could be used for this Project.

Recommendation 24

An expert panel should be formed to provide objective and expert support in the development of appropriate management plans and monitoring programs for dredging and dredge spoil disposal, and for blasting if required, as recommended in this Report. The final form of the expert panel will be determined in agreement between Government and the proponent.

5 Conclusion

The environmental impacts of the project can be managed by delivering the commitments made in the EIS and the Supplement and by rigorously applying the recommendations and management plans and strategies described in this assessment.

Although the likely impacts of the Project have been identified and are relatively well understood, there remains a high level of uncertainty in terms of the precise nature and extent of impacts and changes, particularly to the ecology of Darwin Harbour and the region. This uncertainty is largely due to the gaps in data informing the environmental impact assessment process. Consequently, the proponent, government and community will be reliant on intensive, post-assessment monitoring to determine the significance of, and appropriate responses to, key impacts. These monitoring requirements are captured in the commitments made by the proponent and recommendations of this Report.

The less predictable impacts such as the modification of habitats and cumulative effects on significant species in the Harbour will need to be managed to an acceptable level. The proponent should demonstrate that it can achieve this by fully implementing its management program with effective monitoring and appropriate adaptive management tools. These programs will need to be rigorous and based on sound, scientific information, and form the basis for relevant regulatory approvals. Given the high profile of this Project, it is essential that the community are kept informed of ongoing monitoring programs and the implementation of required management actions.

This Report identifies areas where, despite efforts to mitigate impact, residual environmental detriment is anticipated, such as the loss of monsoon vine forest and the cumulative effects of the Project on significant marine biota in Darwin Harbour. The proponent will be expected to implement appropriate offsets to reduce this residual detriment or improve protection for relevant environmental aspects elsewhere.

Based on its review of the EIS and the proponent's response to submissions from relevant Northern Territory Government agencies, affected stakeholders and the public, and an understanding of the economic benefits of the project, the Environment and Heritage Division considers that the project can be managed within the bounds of acceptable environmental impacts, provided that the environmental commitments, safeguards and recommendations detailed in the EIS, this Assessment Report and in the final management plans are implemented and managed under the environmental management program for the project and are subject to regular reporting and compliance auditing.

6 References:

Department of the Chief Minister 2009, *Territory 2030 Strategic Plan*, Northern Territory Government.

NT EPA (2010) Ecologically Sustainable Development in the Darwin Harbour Region: Review of Governance Frameworks.

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr, C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A. and Tyack, P.L. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. *Aquatic Mammals* 33 (4): 411–521.

Appendix 1

A summarised list of issues raised from public review of the draft EIS corresponding with the individuals / organisations responsible for raising those issues. The NRETAS submission on the draft EIS is not included in this summary but can be read in its entirety on the NRETAS website: <http://www.nt.gov.au/nreta/environment/assessment/register/inpex/index.html>.

Public Submissions

Issue - Impacts	Raised By
Pollution and Waste Issues	
Noise <ul style="list-style-type: none"> Shipping noise, particularly during the evenings. Modelling of noise for SE winds is lacking (ie impact from operations and shipping on city). Increase in ambient underwater noise from shipping – direct impacts to fish and some whales (soniferous fish – reproduction, communication and foraging). No consideration of cumulative impacts of underwater noise. 	AFANT Catherine Martel Cheryl Billing Smith Christine Cox Cristina Reyes Deckchair DHAC ECNT Ed Valk Heather Moorcroft and Robert Curry Heather Ryan Helen Lindstrom HELP NT
Water <ul style="list-style-type: none"> Water pollution (in light of E coli and lack of dispersion). Claims information used for establishing current water quality out of date. Impact of blasting and dredging on water quality. Impact associated with oil spills and discharge/ spill of drilling fluids. Pollution from potentially contaminated sediments within the Harbour being disturbed. The draft EIS does not provide specific values for water quality or other wastes that might trigger a management response. Pollutant loads of hydrotest water as well as other waste waters from construction, commissioning and operation of the facility. Avoidance of discharge into the Harbour is requested or treatment of the highest quality. Cumulative impact on water quality from INPEX and other proposed and existing proposals. 	

Issue - Impacts	Raised By
<ul style="list-style-type: none"> Concern on water quality indicators used by the draft EIS and quality of discharge. The proponent must contribute financially to the development of a monitoring program that would, among other things, track water quality, including sediment load. Monitoring and adaptive management necessary to support this proposal, specifically in response to sedimentation associated with spoil disposal. Ongoing comprehensive, post and pre condition water quality monitoring programs need to be conducted in conjunction with the development of a suite of suitable triggers and management actions. 	Jodi Kirkby Morris Pizzutto Natacha Aguilar de Soto Patrick Barrie Roberta Dixon Sue Mornane Warren Clancy World Wildlife Fund DCC
Air <ul style="list-style-type: none"> Question proposed air emission limits. Management of ozone depleting substances. The appropriateness of the air quality NEPM to understand/ judge impacts to airshed is questioned. 	
Waste <ul style="list-style-type: none"> Questions waste management/ capacity associated with site as well as increase in population. Onshore waste disposal of both onshore and offshore wastes (cannot assume Shoal Bay Landfill). 	
Risk	
Risk - general <ul style="list-style-type: none"> Accuracy of risk modelling (dependent upon input data) (including relevance to the NT due to its climatic conditions). Proximity to ConocoPhillips (reference to overseas restrictions on distance limits as well as ConocoPhillips EIS and EMP). Cumulative risk arising from both ConocoPhillips and INPEX operating in such close proximity. Ensuring risk evaluation is continually reviewed. Design standards and sourcing of expertise. References DVD "The Risks and Dangers of LNG" Tim Riley and Hayden Riley. Refers to website www.lngdanger.com. Cites international examples of catastrophic failure within the industry. 	AMSTECI Duncan Dean ECNT Greg Chapman Heather Ryan HELP NT Parts 1,2, 3 and 4 Pro-forma submission Rose Kubatov

Issue - Impacts	Raised By
<ul style="list-style-type: none"> • Questions whether all potential scenarios of risk have been modelled or tested. • Judgment that the QRA falls short of the government guideline requirements. The 20 pages of the INPEX QRA is in stark contrast to the 128 pages of the 'Hazard and Risk Assessment Report' (HRAP) which Bechtel Corporation and their consultants Quest Consultants Inc. prepared for Phillips Petroleum Australia Pty Ltd as part of the March 2002 Public Environment Report for the 10 MTPA Facility at Wickham Point. • Modelling of oil spill risk omitted from draft EIS. 	The Mahonys
Risk to the population <ul style="list-style-type: none"> • Questions readiness of the community for catastrophic risk and INPEX's responsibility towards getting the community ready/ protected/ evacuated. • Questions Darwin's emergency and health capacity to respond to a catastrophic event. • Cost to Darwin being emergency ready. 	
Risk to the environment <ul style="list-style-type: none"> • From spills and vapour clouds. 	
Causes of Risk <ul style="list-style-type: none"> • Risk associated with natural phenomena (cyclone, sea surge, earthquakes) and engineering design standards to minimise risk. • Terrorism – to plant and to ships – and how this is managed. • Risks associated with shipping in the Harbour. 	

Issue - Impacts	Raised By
Greenhouse Gas Emissions	
Policy Position <ul style="list-style-type: none"> • Concern that INPEX is trying to avoid GHG reporting/ tax/ policy. • Cannot make claim that proposal will reduce overall global GHG emissions. INPEX cannot demonstrate that this LNG product will in any way displace dirtier fuels. There are no Australian or international mechanisms for leaving any coal in the ground. Australia (the producer) has not committed to export any less coal, and Japan (the consumer) have not committed to shutting down any coal fired power stations. • The fact that INPEX has conformed to the NT's EIS guidelines and has avoided any commitment to action, or realistic appraisal of the project's carbon impacts is a concern. The draft EIS highlights the NT Governments failure to make any progress towards an effective policy framework for addressing carbon heavy development proposals such as this one. 	Amanda McLennan Atmospheric Solutions Brigid Oulsnam Catherine Martel Catherine Orme Christine Cox DCC Deborah Hall & Andris Bergs Debra Mills
Emissions created by the Operation <ul style="list-style-type: none"> • The INPEX project will add another 7Mt per year to the Australian account – more than a 1% increase. • Questions how INPEX will reduce CO₂ equivalent emissions. • How is plant going to be designed for energy efficiency. • Significantly increase NT contribution to global GHG emissions – NT unable to meet targets and will damage NT from tourism perspective. • The project represents a net carbon burden, a net climate detriment, and a real barrier to effective action to manage climate change. 	ECNT Ed Valk Georgia Phillips Greening Australia Helena Bond HELP NT Jaemie Page James Treloar Justin Tutty Keren Parnell Lynne Higgs

Issue - Impacts	Raised By
	M. F. McAuliffe Magdalena Szaszorowska Pawel Komisarski Maria Papadopoulou Mark Gregson Michael Cauce Morgana Robb Patrick Barrie Robert E. Rutkowski Roberta Dixon Robin Ellis S. Sankar Sean Corrigan Suzanne Rosenberg Tanya Rodden Teresa Assem Teresa Jaworska Tida Nou Tina Sykes Tourist Industry Wilderness Society WA World Wildlife Australia

Issue - Impacts	Raised By
Biodiversity Impacts	
Terrestrial <ul style="list-style-type: none"> • Limited survey work (restricted to Dry) and too much reliance on desktop studies. • Direct clearance of Monsoon Vine Forest and Mangroves (sensitive/ significant vegetation communities identified in government's Land Clearing Guidelines). • Loss of habitat and movement corridors. • Loss of feeding areas (specifically for frugivorous birds). • Weed ingress. • Claim that trees in residential areas offset removal of vegetation not acceptable. • INPEX fails to acknowledge natural values of regionally-significant monsoon vine forest – including what has been described as one of the best patches of monsoon vine forest on the Harbour foreshore. • There is a 100m corridor shown to the east of the LNG Plant on Blaydin Point. This corridor is for a future road across East Arm and years away from construction, therefore the monsoon vine forest should be retained, not cleared. Monsoon vine forest is a special eco type and should be retained where possible. • Vegetation clearing and the sealing of surfaces on Blaydin Point may reduce groundwater recharge, and in turn, lead to saltwater intrusion and impacts on groundwater-dependent ecosystems and built infrastructure. 	Alana Corr Amanda McLennan Andrew Raith Brigid Oulsnam Catherine Orme Cheryl Billing Smith Christine Cox Clive Pearce Cristina Reyes DCC Deborah Hall & Andris Bergs DHAC Dianne Rickard
Marine <ul style="list-style-type: none"> • Concern that information re dolphin numbers and movement in Harbour is incorrect. • Questions adequacy of the proposed management measures for minimising blasting impacts on dolphins, turtles and dugongs (ie spotting). • Destruction of shoals and associated impacts on marine life. • Loss of seagrasses and impacts on dugongs. • Impacts on dolphins, turtles and dugongs and marine life from blasting and shipping – not acceptable. • Cumulative impact of this development to habitat loss and impacts on marine life. • Pest species introduced in ballast water. • Shipping strike with marine mammals. • Impacts from decrease in water quality. • Impacts to migratory birds. 	Don Franklin Duncan Carson ECNT Ed Valk Francine Bartlett Gerry Wood Greening Australia Heather Moorcroft and Robert Curry

Issue - Impacts	Raised By
<ul style="list-style-type: none"> • While mangrove communities are common in the Harbour, at a global level, mangroves are now one of the most threatened tropical ecosystems—more threatened than rainforests and coral reefs. • Oil spill risks and potential impacts on biota have been inadequately evaluated through modelling and other processes. 	Heather Ryan Helen Lindstrom Helena Bond HELP NT Ian Kitney Jaemie Page Jane Herrador Jennie Renfree Jodi Kirkby John Roodenrys Judy Flynn Justin Tutty Keren Parnell Kitri Cardwell Kree Eyre Laura Smith Louise Harrison M. F. McAuliffe Magdalena Szaszorowska Maria Papadopoulou Megan Lawrance Michael Cauce

Issue - Impacts	Raised By
	Michael Webb Mirjam Kaestli Morgana Robb Morris Pizzutto Natacha Aguilar de Soto Nicolas Mialaret Patrick Barrie Rick Murray Robert E. Rutkowski Roberta Dixon Robin Ellis Roy Beames Sam Ryan Sea Darwin Sean Corrigan Susan Lloyd Teresa Assem Teresa Jaworska Tida Nou Tiffany Theden Top End Tourism Tourist Industry

Issue - Impacts	Raised By
	Wendy Sykes World Wildlife Fund
Impacts of Specific Activities	
Blasting <ul style="list-style-type: none"> • Potential impacts of blasting are not acceptable – direct death to marine mammals, turtles and fish. • Lack of scientific studies to support this part of the operations (to understand and manage impacts appropriately). • Proposed management measures ineffective for turtles and fish and limited for marine mammals. • Noise from blasting – impacting upon marine mammals, turtles and fish – foraging and communication – there are relevant studies that show impact. 	AFANT AMSTECI Andrew Raith Brigid Oulsnam Catherine Martel Catherine Orme

Issue - Impacts	Raised By
<p>Dredging – impacts</p> <ul style="list-style-type: none"> • Noise from dredging – impacting on fish and turtles as well as whales. • Lack of Dredging Policy for Darwin Harbour on which to examine the acceptability of the proposal. • Impact on SCUBA divers. • Concern about how this project sits with other potential dredging required in the Harbour. • Movement of sediment within the Harbour associated with spoil dumping. • Impacts of sedimentation on seagrasses (and dugongs). • Impacts of sedimentation on rock outcrops and corals and associated flora/ fauna. • Disturbance of existing, potentially contaminated sediment. • Impact of sedimentation on mangrove areas and their habitat value. • Impact of sedimentation on crabs. • Impacts of sedimentation on the Howard River – the only known Barramundi nursery in the Darwin Harbour. • Fate of dredge material at off-site disposal area in the event of a cyclone. 	<p>Cheryl Billing Smith Christine Cox Cristina Reyes DCC Deborah Hall & Andris Bergs Debra Mills Derek Archer DHAC Don Franklin ECNT Ed Valk Francine Bartlett Gerry Wood Greening Australia Heather Moorcroft and Robert Curry Helena Bond Ian Kitney Jaemie Page James Treloar Jane Herrador Jennie Renfree Jodi Kirkby</p>

Issue - Impacts	Raised By
	John Hart John Roodenrys Judy de Groot Keren Parnell Kitri Cardwell Kree Eyre Lindsay Mugglestone Louise Harrison Lynne Higgs Magdalena Szaszorowska Margie West Maria Papadopoulou Marnie Cooper Megan Lawrance Michael Cauce Morgana Robb Morris Pizzutto Natacha Aguilar de Soto Nicolas Mialaret Patrick Barrie Pro-forma Submission Raphael Kunzli

Issue - Impacts	Raised By
	Rebecca Savage Robert E. Rutkowski Roberta Dixon Roy Beames S. Sankar Sam Ryan Sean Corrigan Susan Lloyd Tanya Rodden Teresa Assem Teresa Jaworska The Mahony's Tida Nou Top End Tourism Warren Clancy Wendy Sykes World Wildlife Fund

Socio- Economic Impacts	
<p>Generic</p> <ul style="list-style-type: none"> • Government's failure to negotiate gas towards its own power generation. • Poor state of some Indigenous communities evidence that local population does not receive economic advantage associated with a resource development. • Community left with cost of unusable site when plant ceases to operate. • Impact on housing costs and availability. • Impact on cost of everyday household items (eg fuel). • Ability for local companies to compete to retain staff and/ or engage contracts with INPEX (including tourism). • Fly in/ fly out. • Social impacts associated with temporary workforce. • The last election result demonstrated the value of the project to Darwin society. • No evidence that it will bring value to Darwin's population. • The public should be informed of any land and capital costs and risks to be borne by Government in support of the INPEX project. These may relate to land development at Middle Arm Peninsula, road and transport corridor upgrades, and provision of enhanced emergency service response capabilities for potential accidents. 	<p>Catherine Martel DCC ECNT Heather Ryan HELP NT Parts 1,2 Sea Darwin The Mahony's Tourist Industry</p>
<p>Impacts on the Harbour</p> <ul style="list-style-type: none"> • Impact to the tourism value of the Harbour and Darwin. • Darwin Harbour has one of the richest coastal environments anywhere in the Asia Pacific region, and occurs within one of the world's least impacted marine regions. • Change to the "value" of Darwin Harbour. • Access within the Harbour (impact of exclusion zones on recreational and tourist operators). • Increase in boating traffic and associated risk. • Lack of strategic vision for Darwin Harbour. • Any development in or near Darwin Harbour must be carried out to ensure no detrimental impacts on Darwin's lifestyle or on recreational fishing. • Access must be maintained in the Harbour (East Arm) and the environmental services in the area 	<p>AFANT Angela Roodhouse Catherine Martel Cheryl Billing Smith DCC Deborah Hall & Andris Bergs Derek McCarthy Don Franklin</p>

<p>must be preserved to ensure fish, marine life and other wildlife continue to thrive there.</p> <ul style="list-style-type: none"> • The Project will change the nature of Darwin Harbour – currently a unique environment of international conservation significance (as identified by NTG). 	<p>ECNT Ed Valk Gerry Wood Greening Australia Heather Moorcroft and Robert Curry Helena Bond HELP NT Jennie Renfree Jodi Kirkby Judy Flynn Justin Tutty Louise Harrison Robert E. Rutkowski Roberta Dixon Sea Darwin Sue Mornane Susan Lloyd The Mahony's Tourist Industry</p>
<p>Societal Impacts</p> <ul style="list-style-type: none"> • Much of the employment generated by this project will be for workers from elsewhere, while local people will be confronted with a range of negative social and local economic impacts, such as increased housing stress, constriction of the labour market and trade sectors (as experienced during the Wickham Pt construction) and dramatically altered demographics. • Recognise and acknowledge the potential economic contribution that the Project can make to Australia, the Northern Territory and Darwin but, at the end of the day, it is not possible to manage a project of this magnitude without any impacts and it will be the people of Darwin who will be most affected by the development. INPEX and the Northern Territory Government have responsibility to ensure that, wherever possible, there are local benefits and these continue for the life of the project. • The workers' accommodation at Howard Springs will have an impact on the surrounding residential and retail area. Some of these affects are mentioned in the Socio-Economic Impacts however a more detailed study needs to be done. (eg the effect on the local roads due to the increase in traffic travelling to and from the accommodation village? Will there be sufficient water storage in the Whitewood Road water tank to supply the accommodation village without effecting local supplies and pressure? • Proximity to Palmerston. • Location of the workers residence. • Visual pollution. 	
<p>Impacts to Roads</p> <ul style="list-style-type: none"> • There needs to be clarification of the routes that will be used for the transport of equipment and materials and accordingly the effect this may have on transport routes. The construction of the worker's accommodation village will also have an effect on local roads. • Increase of traffic (including heavy vehicles) and associated risk. 	

Impacts on Tourism	
<p>Concerns</p> <ul style="list-style-type: none"> • NT tourism dependent upon “experiential travellers” therefore need to protect natural and cultural assets. • Impact on accommodation and short-term housing. • Tourism provides economic opportunity to remote communities, and is an industry that contributes towards preservation and enhancement of landscapes – this benefit is threatened by the INPEX proposal. The proposal will impact NT “Clean Green Image”. • This project will generate many opportunities for Tourism Development but will also create some pressures on the Tourism Industry particularly all industry that interacts with Darwin Harbour. • The draft EIS has limited reference to Tourism collectively, that operates within the Darwin Harbour. • There is limited reference to the value of Eco Tourism yet there is considerable identification of the significant plant and wildlife with in Darwin Harbour. • Scenic harbour cruises and general leisure Tourism appears to be not identified or addressed in the draft EIS. • Many operators would like the plant to be invisible and located in an area that required less construction activity on Darwin Harbour sea bed. • INPEX will compete for resources and infrastructure. • Does not recognise that tourism is more than “fishing”. 	<p>Sea Darwin Susan Lloyd Tourist Industry (Rick Murray) Tourism Top End</p>

Issues – Information presented in the draft EIS	Raised By
<p>Generic</p> <ul style="list-style-type: none"> • Inaccuracy of Maps in the draft EIS. • Does not cite or recognise eco-tourism operations on Harbour. • Tourism is only referenced as “fishing”. • Relevance and age of information/ scientific studies relied upon. • Lack of modelling to understand full impacts. • Lack of peer review on scientific studies. • The draft EIS is deficient in excluding a presentation and assessment of some important aspects of the Project, including: <ul style="list-style-type: none"> ○ The proposed accommodation village at Howard Springs; ○ Quarries for the supply of fill, rock and aggregate; ○ A rock load-out facility and stockpile area; ○ A maritime supply base; ○ A tug harbour; ○ Waste disposal resources; and ○ Utility corridors. • Information provided not sufficient to determine impact or inform management/ monitoring. • The draft EIS lacks description of the protocols and methodology on how ongoing risk identification and management will be done. • The description of impacts and risks would have been more complete had socio-economics and the conservation significance of species been considered in terms of Aboriginal cultural tradition and patterns of natural resource use. • EMPs should be included in the draft EIS and available for public scrutiny. • Information regarding acid sulfate soils should have been included in draft EIS, as well as proposed management plan. • Studies on the impact to hydrodynamics are only local to the East Arm area. Studies are needed on the exchange rates of water from East Arm and the Elizabeth River into the main body of the Harbour. • There has been no quantitative analysis of overall boat traffic in the vicinity of, or upstream of, the main nearshore project area. • The information provided in the draft EIS to examine “alternatives” is minimal and unacceptable. 	<p>Pro-forma submission</p> <p>Sophie Chapman</p> <p>HELP NT</p> <p>Heather Ryan</p> <p>Terry Lustig</p> <p>Christine Cox</p> <p>Tourist Industry (Rick Murray)</p> <p>Mirjam Kaestli</p> <p>Cristina Reyes</p> <p>Morris Pizzutto</p> <p>Sea Darwin</p> <p>Ed Valk</p> <p>Roberta Dixon</p> <p>Helen Lindstrom</p> <p>Kris Garrein</p> <p>Glen Osboldstone</p> <p>Helena Bond</p> <p>Nicolas Mialaret</p> <p>Teja Lipold & David Grace</p> <p>Cheryl Billing Smith</p> <p>Catherine Martel</p>

Issues – Information presented in the draft EIS	Raised By
<ul style="list-style-type: none"> Storm surge levels appear to be based on the Northern Territory Government's 2003 edition of the map for the "Municipality of Darwin – Darwin Storm Surge Zones" which does not take into account current sea level rise estimates and predictions / findings in order to arrive at a considered assessment of risk. 	Tida Nou Don Franklin Jaemie Page Mick Guinea
Noise <ul style="list-style-type: none"> In assessing potential underwater noise impacts on marine species the draft EIS draws only loosely on the considerable body of literature available, omits key recent references, and makes little attempt to analyse the broad thrust of the research. The draft EIS provides insufficient consideration of the impacts of blasting on Darwin Harbour marine wildlife, no underwater noise modelling has been done, proposed mitigation measures are inadequate and the proposed acoustic monitoring techniques have never been tested. 	World Wildlife Fund Brigid Oulsnam Atmospheric Solutions NLC Greening Australia John Roodenrys
Biodiversity <ul style="list-style-type: none"> Land-based flora and fauna surveys not representative. Limited study on marine organisms – no pre-disturbance, baseline studies required. A lack of detail in the Management of Marine Megafauna and in the Provisional Dredging and Dredge Spoil Disposal Management Plan. The section on important habitats for marine species and the sections on the impacts of sedimentation and other stressors on marine species are significantly deficient in terms of the references cited, lack of up-to-date information and lack of recognition of existing knowledge on critical habitats for many key species. There are also unsubstantiated claims of possible benefits. The draft EIS lacks information to support claim that Darwin Harbour is not a significant breeding or feeding habitat for dolphins and other marine species – accordingly it has incorrectly identified level of risk to these species by its operations. Whole of Darwin Harbour habitat map required. Lack of information on susceptibility of sea snakes to oil spills. More detailed information on the possible impacts of dredge spoil on coral, blue holes, fish and other marine life in the Gunn Point and Vernon Islands area should be included in the Supplementary EIS. To imply that a particular species or habitat is well represented in the Harbour and therefore some loss would be not be considered a problem, is questionable. Particularly in view of the lack of data for 	Justin Tutty Louise Harrison AFANT ECNT DCC

Issues – Information presented in the draft EIS	Raised By
<p>Darwin Harbour, along with the potential for more new harbour developments adopting the same views.</p>	
<p>Greenhouse</p> <ul style="list-style-type: none"> • The draft EIS does not adequately describe detailed sequestration and mitigation pathways, and the contribution that these pathways would make to the overall CO₂ footprint of the Project. • The additional volumes of greenhouse gases expected to emanate from the accommodation village should be quantified and reported in the EIS. • INPEX fails to acknowledge predicted increase in intensity and frequency of extreme weather, including cyclone events. (Scientific projections identified by the CSIRO report 'Climate Change Under Enhanced Greenhouse Conditions In Northern Australia' as referenced in NT Government's 'Strategy for Greenhouse Action'). It remains unclear how INPEX's commitments to engineer for anticipated cyclone activities will factor in the projected increased intensity and frequency of these extreme weather events over the project lifetime. • Why have emissions of methane (CH₄) and nitrous oxide (N₂O) and other greenhouse gases been excluded from the greenhouse assessment of the draft EIS? Methane emissions in particular will be significant, and all significant greenhouse emissions should be detailed in the EIS. • Why have venting and fugitive emissions sources been excluded from the greenhouse assessment of the draft EIS? All sources should be detailed in the EIS. • In regards to the benchmarking in relation to NT and Australian emissions, Table 9-3 should state explicitly that the project will increase Northern Territory (NT) emissions by 40% (on average) or 53% (peak) over the project life. • The greenhouse emissions benchmarking of Ichthys against similar projects should be carried out on the established basis of t CO₂-e / t LNG. This measure shows that Ichthys will be among the most carbon intensive LNG projects in the planet, and does not represent best practice. • The Draft Statement avoids mentioning the true carbon burden of downstream burning of the LNG product, and INPEX representatives were unable to provide this number to community consultations held upon release of the Draft. • INPEX offers no rationale for why they are comparing LNG to coal instead of solar. 	
<p>Dredging</p>	

Issues – Information presented in the draft EIS	Raised By
<ul style="list-style-type: none"> • Studies and modelling of dredging impacts lacking and based upon assumptions. • The draft EIS contains an inadequate and incomplete assessment of the direct and indirect impacts of dredging and dredge spoil disposal on coastal dolphins, marine turtles and dugong. • The incidence of cyclones in the Darwin area is considered in the dredge spoil dispersal modelling, however only a category 2 is mentioned. It is unclear the impact of re-mobilisation of sediments with more severe cyclones. • The draft EIS presents only a dredging concept which could be vastly different to the actual dredging operations – however the public don't get a chance to comment on the actual dredge operations. • It is unsatisfactory to rely on limited geotechnical information and present instead assumptions when describing dredge operations and potential impact. • It is difficult to find specific reference to material amounts to be transported to the offshore disposal site in both the draft EIS and appendices. • The assumption that particles > 75 µm are “coarse” is challenged based upon international standards. To make the assumption that only fines <75µm will be mobile in solution and therefore responsible for plume and sediment deposition is questioned, particularly as the draft EIS states something different when discussing offshore disposal. • Questions correct understanding of tidal movements within the whole Harbour. 	
<p>Blasting</p> <ul style="list-style-type: none"> • The draft EIS contains inadequate and incomplete assessment of the direct and indirect impacts of blasting Walker Shoal for the shipping channel and inadequate exploration of alternative channel and jetty options. 	
<p>Waste Water and pollutants</p> <ul style="list-style-type: none"> • Information regarding specific water and waste pollutants – fate, disposal methods and impact has not been provided • Marine discharges do not appear to have been assessed against the ANZECC trigger limits for marine water quality. • The draft EIS lacks substantive ecological research or measurement of ecotoxicology of some of the chemicals to be use. There is a reliance on industry-based standards and an inherent assumption 	

Issues – Information presented in the draft EIS	Raised By
<p>that the ocean provides infinite dilution for toxicants.</p> <ul style="list-style-type: none"> • MSDS documents for the chemicals to be used in bulk missing from the draft EIS and Appendices. The addition of these documents would be useful to assist in understanding specific risks associated with these chemicals to people accessing the nearby environment, if not the impacts on marine organisms. • The waste water discharges during operations are said to be continuous but quantities of the proposed discharges have not been specified or what, if any, environmental risks they may pose. 	
<p>Engineering and Design</p> <ul style="list-style-type: none"> • The proponent must demonstrate that engineering standards are set to projected exacerbation of extreme weather events, including cyclones. • There is no discussion of the impacts that increases in sea level, wave height and wave action may have on the onshore project infrastructure. Nor is there mention of any plan or an outline of actions that would be taken to avoid accidents at the onshore facilities should Darwin be threatened by these types of events. 	

Issue – Approach taken by Proponent	Raised By
<p>Consultation</p> <ul style="list-style-type: none"> • LDC acknowledges principles of support and consultation to Larrakia and other traditional owners. • LDC satisfied concerns have been addressed respecting social and cultural significance of land to be impacted by the development. • LDC satisfied with management of archaeological sites. 	<p>AFANT Larrakia Development Corporation</p>

Issue - Proposal	Raised By
Support <ul style="list-style-type: none"> • Australia needs development. • LDC has been working with INPEX to ensure benefit from the construction and infrastructure development for the Larrakia people. • The LDC is interested in the community and economic benefits that could arise from the Ichthys Gas Field Development. • LDC commends INPEX desire to maximise the opportunities for participation in the Ichthys Gas Field Project by the Larrakia and all Territorians. Wants to ensure opportunities are real and not tokenistic. • LDC commends INPEX for supporting its initiative to construct and operate a Trade Training Centre. • The Ichthys Project will bring very significant economic and development benefits to Darwin, the Northern Territory and Australia and AFANT is not opposed to the location of its main onshore processing, product shipping and offshore support activities in Darwin Harbour. 	AFANT Brendan J Anderson Larrakia Development Corporation
Benefits derived from the project <ul style="list-style-type: none"> • Proposed management measures for INPEX to adopt, including a tourism policy. • The project will bring opportunities for tourism Construction and the resulting economic activity from the project will help build the business and corporate travel market and consequently support increased airline services by full service airlines. • The project may stimulate investment in commercial tourism accommodation stocks and boost the economic development of the Top End that will generate confident investment in new Tourism Infrastructure. • Additional labour force required during construction could deliver positively to the Tourism Sector from temporary workforce and its visiting friends and relatives sector with a focus on regional dispersal. 	Top End Tourism
Alternatives	
<ul style="list-style-type: none"> • Many submissions objected to the proposal based upon the options presented. • Other sites not considered. • Submissions propose alternate sites in Harbour. • Submissions propose site sharing with ConocoPhillips. 	HELP NT Heather Ryan Pro-forma submissions

Issue - Proposal	Raised By
<ul style="list-style-type: none"> • Submissions argue WA a better option. • Alternate pipeline routes (to minimize blasting) should be examined. • Alternate options for wharf/ jetty development (to minimize dredging) should be examined. • Concern that option presented which addresses AFANT's issues comes at the cost of the environment. • Land based disposal of dredge spoil should be considered. 	<p> Duncan Carson Tina Sykes Mark Gregson Georgia Phillips Mirjam Kaestli M. F. McAuliffe Morris Pizzutto Rachel Bury Glen Osboldstone Sean Corrigan Jane Herrador Francine Bartlett Maria Papadopoulou Debra Mills Lynne Higgs Tanya Rodden Morgana Robb Marnie Cooper Patrick Barrie Meredith Tyburczy Kitri Cardwell Sam Ryan </p>

Issue - Proposal	Raised By
	Lindsay Mugglestone Rebecca Savage Magdalena Szaszorowska Pawel KomisarSKI Teresa Jaworska Teresa Assem Grahame Hubbard Julie Weston James Treloar Helena Bond Megan Lawrance Robert E. Rutkowski Ken Hooke Andrew Raith Raphael Kunzli Judy de Groot Robin Ellis Sue Pratt Cheryl Billing Smith Catherine Martel Tida Nou Catherine Orme Jaemie Page

Issue - Proposal	Raised By
	Brigid Oulsnam Michael Cauce Jennie Renfree Diane M. Kastel and family Megan Clementi Keren Parnell John Roodenrys Justin Tutty Louise Harrison Margie West AMSTECI DHAC ECNT
Sustainability Issues <ul style="list-style-type: none"> • Project does not represent “sustainable development”. • Project does not represent industry best practice. • Wastewater reuse; rainwater harvesting. • Lack of consideration of cumulative impacts. • Seeking for INPEX to demonstrate good corporate citizen. • The challenge for Darwin is to learn how to engineer a new economics that is based on sustainability, not unconstrained growth. • Seek INPEX support for broader strategic study. • Lack of recent/ relevant scientific analysis/ data to support elements of the proposal. • Compromises the success of other economically valuable sectors within the NT (ie tourism). 	Pro-forma submissions Dianne Rickard Duncan Carson Tourist Industry Cristina Reyes Sea Darwin Cynthia Miall Liz Thorton

Issue - Proposal	Raised By
<ul style="list-style-type: none"> • The onus of proof should lay with the proponent that the project will not impact, not on the population to prove environmental worth. • Not in keeping with the principles of ESD: <ul style="list-style-type: none"> ○ Biodiversity conservation and ecological protection ○ Inter-generational equity ○ Improved valuation and pricing ○ Precautionary principle 	Wendy Sykes Clive Pearce Glen Osboldstone Jane Herrador Francine Bartlett Greg Chapman Angela Snow Brian Cotgrove Helena Bond Kylie Ellis Catherine Martel Atmospheric Solutions NLC Greening Australia John Roodenrys Justin Tutty Louise Harrison DHAC ECNT DCC

Site rehabilitation <ul style="list-style-type: none"> • Post-operations land use? • Lack of rehabilitation planning and funding. 	
Resource Use <ul style="list-style-type: none"> • No information on water usage or sourcing. 	Greening Australia DCC
Provision of supporting Infrastructure <ul style="list-style-type: none"> • Impacts to existing (roads, sewage). • Costs of new. • Infrastructure required to meet water requirements. 	DCC

Issue – Operations and Regulation of the Proposal	Raised By
Offsets	
Greenhouse <ul style="list-style-type: none"> • GHG emissions offset program - locally based. • Creation of a carbon Fund. • Substantial offshore greenhouse emissions are forecast for the facility arising from the extraordinarily long pipeline and corresponding compression requirements (stated in the draft EIS as 100 MW). These should be offset to bring the greenhouse emissions intensity of the facility in line with standard / current facilities. • INPEX should commit to not waiting for governments to set an 'acceptable' level of pollution, and should instead aim to offset all their carbon emissions. • Why is geosequestration (as per Gorgon) not being considered, nor an appropriate offset strategy (as required for Pluto) developed should geosequestration be proven “infeasible”? 	Pro-Forma Submissions Duncan Carson Tina Sykes Mark Gregson Georgia Phillips Tourist Industry Sea Darwin Ed Valk

<p>Biodiversity</p> <ul style="list-style-type: none"> • Measures to compensate for the destruction of habitats. • Creation of new national parks and/ or conservation zones – suggestions of Ludmilla Bay, Bynoe Harbour – to be locally based. • Suggests that IPEX should invest into research of Dolphins. 	<p> Roberta Dixon Sean Corrigan Jane Herrador Maria Papadopoulou Debra Mills Lynne Higgs Tanya Rodden Morgana Robb Patrick Barrie Sam Ryan Lindsay Mugglestone Rebecca Savage Magdalena Szaszorowska Pawel Komisarski Teresa Jaworska Teresa Assem Grahame Hubbard Julie Weston James Treloar Helena Bond Robert E. Rutkowski Ken Hooke Kree Eyre Raphael Kunzli </p>
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	<p>Judy de Groot</p> <p>S. Sankar</p> <p>Amanda McLennan</p> <p>Suzanne Rosenberg</p> <p>Sue Pratt</p> <p>Catherine Martel</p> <p>Heather Moorcroft and Robert Curry</p> <p>Tida Nou</p> <p>Wilderness Society WA</p> <p>Catherine Orme</p> <p>Jaemie Page</p> <p>Brigid Oulsnam</p> <p>Michael Cauce</p> <p>Atmospheric Solutions</p> <p>Diane M. Kastel and family</p> <p>Megan Clementi</p> <p>Keren Parnell</p> <p>Greening Australia</p> <p>John Roodenrys</p> <p>Louise Harrison</p> <p>ECNT</p>

Regulatory responsibility and management (and cost) <ul style="list-style-type: none"> • Shipping movements and ballast; • Pollution control; • Port usage; • Risk identification and ongoing management and regulation; • Road maintenance and usage. • INPEX should work with Govt and invest in an appropriate regulatory system. • INPEX should sign up to the proposed Integrated Monitoring Program. • A technical project of this size and complexity should have a fully and independently auditable HSE Management system that ensures compliance and offers maximum environmental protection. • Regimes for assessment, compliance monitoring and enforcement of environmental requirements and objectives remain sub-standard in the NT. • Policy regime within the NT is lacking/ non-existent – dredging, Greenhouse. • Planning Scheme ineffective – zoning areas “conservation” does not guarantee their protection. • The lack of adequate regulatory environment in the NT emphasises the importance of INPEX conducting a thorough risk assessment for all aspects of its Project, and on the basis of this assessment, putting in place a comprehensive, detailed Environmental Management Program. 	Heather Ryan Sea Darwin Catherine Martel NLC Justin Tutty AFANT DHAC ECNT DCC
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NT Government Submission

Issue	Raised By
Options/ alternatives <ul style="list-style-type: none"> • Detailed reasons required for the selection/ rejection of jetty options. • Analysis required to support blasting options. 	DCM coordinated response
Studies required <ul style="list-style-type: none"> • Appropriate baseline surveys (including habitat mapping) required for areas potentially impacted by the Project – required as part of the integrated monitoring program. 	DCM coordinated response

Issue	Raised By
Monitoring <ul style="list-style-type: none"> • Indication of support for the integrated marine monitoring program noted in draft EIS. • Monitoring to extend to areas adjacent to dredge disposal areas. • Permit issued under s16 of the Fisheries Act for dredge spoil site and removal of Walker Shoal include monthly monitoring on aquatic life, including fish kills (this information then informs subsequent blasting and dredging activity). 	DCM coordinated response
Engagement <ul style="list-style-type: none"> • Determined that project will have a significant impact on Darwin and the region throughout life of project; accordingly INPEX to maintain communication with community, business and government to ensure measures proposed to ensure socio-economic benefits of the project are realised. 	DCM coordinated response
Specific Comment <ul style="list-style-type: none"> • Traffic advice; • Clarification of DHF role; • Provision of supporting information regarding waste water treatment and DHF requirements; • Clarification sought on proposed disposal method for medical waste; • Information sought on relationship of the proposal and the NT Planning Scheme; • Information provided regarding biting insect hazards; • Clarification of requirement/ role of the <i>Fisheries Act</i> as well as the <i>Radiation Protection Act</i>; • Statement that safety is a significant issue and accordingly risk identification and hazard management will be undertaken as part of the licensing of the facility (as opposed to during the EIA process?). 	