Report and recommendations of the Environmental Protection Authority

Wheatstone Development - Gas Processing, Export Facilities and Infrastructure

Chevron Australia Pty Ltd

Report 1404

June 2011

Environmental Impact Assessment Process Timelines

Date	Progress stages	Time (weeks)
20/10/08	**Level of Assessment set**	
26/07/10	**Proponent Document Released for Public Comment**	**92**
4/10/10	**Public Comment Period Closed**	**10**
11/5/11	**Final Proponent response to the issues raised**	**31**
13/6/11	***EPA report to the Minister for Environment (including 2 weeks consultation on conditions)**	**4**
15/6/11	**Publication of EPA report**	**2 days**
29/6/11	**Close of appeals period**	**2**

STATEMENT ON TIMELINES

Timelines for an assessment may vary according to the complexity of the project and are usually agreed with the proponent soon after the level of assessment is determined.

In this case, the Environmental Protection Authority met its agreed timeline objective of 10 weeks for the completion of the assessment and provision of a recommendation to the Minister.

Dr Paul Vogel
Chairman
13 June 2011

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EPA Report 1404: Wheatstone Development - Gas Processing, Export Facilities and Infrastructure

Summary and recommendations

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for Environment on the key environmental factors and principles for the proposal by Chevron Australia Pty Ltd (Chevron), to construct and operate a 25 million tonne per annum (Mtpa) liquefied natural gas (LNG) plant, a domestic gas plant and to construct marine facilities to support the proposal.

Section 44 of the *Environmental Protection Act 1986* (EP Act) requires the EPA to report to the Minister for Environment on the outcome of its assessment of a proposal. The report must set out:

- The key environmental factors identified in the course of the assessment; and
- The EPA's recommendations as to whether or not the proposal may be implemented, and, if the EPA recommends that implementation be allowed, the conditions and procedures to which implementation should be subject.

The EPA may include in the report any other advice and recommendations as it sees fit.

The EPA is also required to have regard for the principles set out in section 4A of the *Environmental Protection Act 1986.*

Key environmental factors and principles

The EPA decided that the following key environmental factors relevant to the proposal required detailed evaluation in the report:

(a) Sub-tidal Benthic Habitat;

(b) Intertidal Benthic Primary Producer Habitat (BPPH);

(c) Marine fauna;

(d) Flora and vegetation;

(e) Greenhouse gases;

(f) Air emissions;

(g) Recreation and aesthetics; and

(h) Tourism and fishing related industry.

There were a number of other factors which were relevant to the proposal, but the EPA is of the view that the information set out in Appendix 3 provides sufficient evaluation.

The following principles were considered by the EPA in relation to the proposal:

(a) the precautionary principle;
(b) the principle of intergenerational equity;

(c) the principle of the conservation of biological diversity and ecological integrity;
(d) principles relating to improved valuation, pricing and incentive mechanisms; and
(e) the principle of waste minimisation.

Conclusion

The EPA has assessed the proposal for the Wheatstone Development and believes that the proposal can be implemented with appropriate management to limit environmental impacts to an acceptable level.

Sub-tidal Benthic Habitat

Implementation of the proposal would result in unavoidable impacts to sub-tidal Benthic Primary Producer Habitat and other benthic communities, some of which would be permanent but the majority of which are predicted to recover within five years. Impacts are predicted based on modelling results for which there is always some degree of uncertainty. Impact predictions have been based on results from dredging in Singapore and scientific literature about turbidity and sedimentation relationships to benthic habitat impact. This may be the best information that the proponent can obtain, but there is still uncertainty as to how this information relates to local conditions. The frequency of cyclones in the Onslow area also creates the risk of unpredictable and additional impact.

The uncertainty generated in modelling is compounded by the lack of information about the final design and plant/equipment to be selected. This is a common issue in large industrial proposals where, for financial decision making purposes, environmental approval precedes front-end engineering and detailed design. In addition, the future expansion of the plant using feed gas from unknown sources adds to the uncertainty.

In view of these uncertainties, the EPA has recommended detailed conditions (conditions 6, 8 and 13) with the aim of limiting loss of sub-tidal benthic habitat to as low as reasonably practicable and to ensure as high a standard of monitoring and management as practicable. Condition 7 requiring State of the Marine Environment Surveys is also recommended to confirm that predicted losses are not exceeded and predicted recoveries of benthic habitat occur.

Turbidity and sedimentation generated by the proposal can impact coral spawning and larvae survival rates. The EPA believes that turbidity-generating activities should be suspended three days prior to the predicted commencement of mass coral spawning, or as soon as mass coral spawning is detected if prior to the predicted time, and remain suspended for 7 days from the commencement of mass coral spawning. This is included in recommended conditions 6 and 8.

As some information was not available and uncertainties remain, the EPA's recommended conditions (including the residual impacts and risk management measures) reflect these gaps in knowledge and uncertainties. The EPA considers that with the implementation of the recommended

conditions, impacts to benthic habitat would be minimised and, while noting that there would be a reduction in abundance, productivity and geographic distribution at a local scale, the EPA's objectives would be met.

Intertidal Benthic Primary Producer Habitat (BPPH)
Implementation of the proposal would result in unavoidable, and mostly permanent, impacts to intertidal BPPH. The EPA notes that the proposal has been sited to avoid impacts to the regionally significant mangrove community at the Ashburton River Delta and that, to a certain extent, the proposal is constrained by the location of the Materials Offloading Facility (MOF) and the extent of the Strategic Industrial Area.

The EPA acknowledges that there would be losses of intertidal BPPH in excess of its guidelines and that there is lack of knowledge and uncertainty in the impact these losses may cause to the Hooley Creek mangrove system.

The EPA is also aware that the location of the MOF is likely to cause coastal impacts and the extensive filling of the site to avoid flooding is likely to change surface water flows, both from flooding and tidal inundation. These impacts require management and monitoring to ensure that there is no unpredicted loss of BPPH. The EPA therefore has recommended conditions to manage and monitor impacts to intertidal BPPH (conditions 9 and 14).

As some information was not available and uncertainties remain, the EPA's recommended conditions (including the residual impacts and risk management measures) reflect these gaps in knowledge and uncertainties. The EPA considers that with the implementation of the recommended conditions, impacts to intertidal benthic primary producer habitat would be minimised and, while noting that there would be a reduction in abundance, productivity and geographic distribution at a local scale, the EPA's objective would be met.

Marine fauna
There are a number of protected species that utilise the proposal area and surrounds. Although the proponent considers that the residual risk of impact to protected marine fauna is low, the EPA is of the opinion that insufficient weight has been given the to the status of the species as protected species. Species are listed under the Environment *Protection and Biodiversity Conservation Act 1999* and the Western Australian *Wildlife Conservation Act 1950* because there is already, or could be in the medium term future, a high risk of extinction of the species.

The recording of significant numbers of resting or milling pods suggests that whales may be resting offshore of the Onslow area during their southern migration. Mothers and calves are of particular concern as humpback whales use complex vocalisations and it is possible that communication between mothers and their calves helps to keep them close together. Noise from piling activities may cause disruption of mother and calf communications and stress to the animals. As a precaution, the EPA recommends condition 10-9 that

marine pile driving be suspended at night during the peak southern migration of mother and calf humpback whale pods.

The EPA is of the view that further consideration should be given to the management of impacts to protected species, in particular, light impacts to turtles and hatchlings and, therefore, recommends conditions 10 and 11. There is no evidence that any planning for the minimisation of lighting for the facility or in the placement of flares has been undertaken.

Risks that would impact all species are hydrocarbon spills in the marine environment and increased recreational impacts to species and habitats. A Marine Oil Pollution Plan would be required by other legislation and recreational impacts are considered under the factor for Recreation and Aesthetics.

The EPA notes that there is a lack of knowledge on critical habitats for humpback whales, dugongs and snubfin dolphins in the Pilbara region.

As some information was not available and uncertainties remain, the EPA's recommended conditions (including the residual impacts and risk management measures) reflect these gaps in knowledge and uncertainties. The EPA considers that with the implementation of the recommended conditions, impacts to marine fauna would be minimised and, while noting that there may be a temporary reduction in abundance and geographic distribution at a local scale, the EPA's objective would be met.

Flora and vegetation

Approximately 3300 ha of terrestrial vegetation would be cleared and this is unavoidable for the implementation of the proposal. There is opportunity for the early rehabilitation of 935 ha, consisting of the borrow sites and a 15 m width along the approximately 75 km long domestic gas pipeline corridor. Other rehabilitation would not be possible until facilities are decommissioned.

While there are some species of conservation significance that may be impacted, the EPA considers that it is unlikely that any species would suffer extinction or a vegetation unit would be lost as a result of implementation of the proposal. The EPA notes that there is a lack of taxonomic knowledge for the genera *Abutilon, Bonamia, Eriachne, Euphorbia, Polygala, Sida* and *Triumfetta* in the Pilbara. The EPA considers that the management of weeds is important, particularly in the proposed addition to the Cane River Conservation Park. The EPA recommends conditions 16 for weed management and 17 for progressive rehabilitation.

As some information was not available, the EPA's conditions (including the residual impacts and risk management measures) reflect these gaps in knowledge. The EPA considers that with the implementation of the recommended conditions impacts to flora and vegetation would be minimised and, while noting that there would be a reduction in abundance, productivity and geographic distribution at a local scale, the EPA's objectives would be met.

Greenhouse gases
Emissions of greenhouse gases from the proposal would be approximately 10 Mt/a. This would increase Western Australia's greenhouse gas emissions substantially. The EPA considers that best practice design and operation should be implemented to minimise greenhouse gas emissions and considers that the current best practice for an equivalent location is represented by the emission intensity from the Pluto project which is expected to be 0.26 tonne $CO_{2\,e}$/tonne LNG. The EPA recommends an initial target of 0.26 tonne $CO_{2\,e}$/tonne LNG with further improvements to be made over time (condition 19).

In the absence of Commonwealth legislation for greenhouse gas emissions the EPA expects that as a minimum, the proponent should offset the reservoir CO_2 released. Should Commonwealth legislation come into force, this requirement would be extinguished if it is non-complementary to the Commonwealth's greenhouse gas reduction legislation applicable to the proposal (condition 19).

The EPA considers that, with the implementation of the recommended condition, greenhouse gas impacts would be reduced and the EPA's objective to minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions, would be met.

Air emissions
Air emissions from the proposal are predicted to meet National Environment Protection Measure (NEPM) standards, except for dust when high levels of background dust are experienced.

Nevertheless, the EPA expects the proponent to implement best practice for a liquefied natural gas/domestic gas facility. The EPA notes that further development in the Ashburton North Strategic Industrial Estate is expected. To ensure that best practice is implemented and that future cumulative emissions do not exceed NEPM standards, the EPA recommends condition 18.

The EPA considers that, with the implementation of the recommended condition, the EPA's objective to ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards would be met.

Recreation and aesthetics
The EPA acknowledges that there would be both impacts to recreational pursuits and impacts from recreation to the environment from the proposal. Aesthetic amenity would be impacted by a large visible plume in the nearshore region during dredging which may take up to four years. This impact is largely unavoidable.

The EPA understands that the proponent is setting up a Fisheries and Tourism Working Group Panel with recreational fishing representatives and

the Department of Fisheries (DoF) to address impacts to recreational fishing and encourages the proponent to continue working with the community.

To reduce the impact to recreational sites, the EPA recommends condition 9 which requires the proponent to manage littoral transport to prevent reduction in the recreational value of beaches, reduction in the integrity and performance of the Onslow seawall and reduction in the integrity and values of heritage sites.

The EPA notes that the proponent would provide funding during the construction of the initial phase of the proposal to the Department of Environment and Conservation (DEC) to manage the impacts and risks associated with additional visitation to island nature reserves and mainland coastal areas and also for the management of visitors to the Cane River Conservation Park within the vicinity of the proposal. The proponent would also fund the DoF to assist in ensuring that recreational fishers comply with bags limits and size limits in the coastal and estuarine environment within the vicinity of the proposal (condition 22).

The EPA considers that with the implementation of these actions and conditions, the EPA's objectives to ensure that existing and planned recreational uses are not compromised and to maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge would be met.

Tourism and fishing related industry

The EPA acknowledges that there may be impacts to the tourism and fishing related industries from the proposal, particularly the Onslow Managed Prawn Fishery and the Mackerel Island Dive Resort.

However, the EPA does not see its role as that of an advisor or mediator on matters that may be resolved by a commercial agreement between stakeholders. The EPA notes that the proponent has committed to working with the community to address their concerns and is setting up a Fisheries and Tourism Working Group Panel with commercial fishing and tourism operators and the DoF to address impacts from the proposal. The EPA recommends that this Group continues to work through outstanding issues with the objective of concluding satisfactory outcomes with the participants before the commencement of dredging.

Environmental Management Plans

In this assessment the EPA has had to recommend a number of conditions requiring management plans. This is because the proponent has not completed its management plans. This is not the EPA's preference and nor is it normal practice. The level of assessment of Environmental Review and Management Program requires management plans for the key environmental factors to be included in the ERMP, so that comment may be made on proposed management during the public review. These management plans could be further refined as a result of submissions and the EPA's assessment.

It is the EPA's expectation that by the end of the assessment, agreed management plans would have been prepared by the proponent and that there would not be the requirement to recommend conditions for the preparation of key management plans. The recommendation that this proposal could be implemented is conditional upon environmental management plans being finalised to the Office of the EPA's Chief Executive Officer's satisfaction.

Proposed residual impacts and risk management measures

While the proponent has endeavoured to minimise the impacts of the proposal, the EPA recognises that the following significant residual marine and terrestrial environmental impacts and risks remain, including:

Marine

Habitat/species	Potential permanent/direct loss (ha)	Potential temporary/indirect loss (ha)
Seagrass	10	2963
Coral	37	22.4
Macroalgae	250	4018
Filter feeders	2272	904

In addition, there are residual risks of impact to marine habitat for dugong, dolphins, turtles and sawfish, and further risk of impacts to those species and megafauna (including whales) from noise and vessel strike.

Near shore / Wetland

Habitat/species	Potential permanent loss (ha)
High tidal mud flats	108
Mangroves/Hooley Creek	4
Algal mats/Hooley Creek & Four Mile Creek system	52

Further, significant risks have been identified as a result of additional recreational fishing pressure, particularly during the construction phase of the proposal.

Terrestrial

Habitat	Potential permanent loss (ha)
Native vegetation	3300
Cane River Conservation Park and proposed extensions	265
Locally significant native vegetation	3

In addition, there are residual risks associated with the increased visitation to offshore island nature reserves and the Cane River Conservation Park and its proposed extensions.

To manage these residual environmental impacts and risks, the proponent has proposed the following additional measures:

Research projects to:

- improve the understanding and management of the impacts of dredging on tropical marine communities;
- improve the understanding of west Pilbara marine habitats, connectivity and recovery potential following natural and human induced disturbance;
- identify and improve management of critical habitat for threatened marine species including humpback whales, dugongs and snubfin dolphins in Pilbara waters; and

Management projects for addressing:

- the impacts and risks associated with increased visitation to island nature reserves managed under the *Conservation and Land Management Act 1984* within the vicinity of the Project;
- additional recreational fishing pressure within the vicinity of the Project; and
- impacts and risks associated with increased visitation to the Cane River Conservation Park and proposed extensions.

In addition, the proponent would maintain a contingency fund for the purposes of remediating impacts to offshore islands and the Cane River Conservation Park and proposed extensions where impacts can be reasonably attributed to the Wheatstone project.

The EPA has concluded that the proposed residual impacts and risk management measures sufficiently address the residual environmental impacts and risks of the proposal on the State's biodiversity assets.

In order to ensure these additional measures are transparent and auditable, the EPA has recommended that they be included in the recommended conditions (refer condition 22).

Recommendations

The EPA submits the following recommendations to the Minister for Environment:

1. That the Minister notes that the proposal being assessed is for the construction and operation of a 25 million tonne per annum liquefied natural gas plant, a domestic gas plant and marine and terrestrial infrastructure to support the proposal;
2. That the Minister considers the report on the key environmental factors and principles as set out in Section 3;
3. That the Minister notes that the EPA has concluded that it is likely that the EPA's objectives would be achieved provided there is satisfactory implementation by the proponent of the recommended conditions set out in

Appendix 4 (and summarised in Section 4) and of the EPA's recommendations to the Department of Conservation and Environment;

4. That the Minister notes that the EPA has made a number of recommendations to the Department of Environment and Conservation regarding works approvals and licensing in Section 5 of this Report; and
5. That the Minister imposes the conditions and procedures recommended in Appendix 4 of this report.

Conditions

Having considered the information provided by the proponent and in this report, the EPA has developed a set of conditions that the EPA recommends be implemented if the proposal by Chevron Australia Pty Ltd to construct and operate a 25 Mtpa LNG plant, a domestic gas plant and to construct marine facilities to support the proposal, is approved for implementation.

These conditions are presented in Appendix 4. Matters addressed in the conditions include the following:

a) condition 5 'Final Marine Infrastructure Plan' to show the location and design of the marine components of the proposal;

b) condition 6 'Construction of Marine Facilities' to define the required and target Environmental Protection Outcomes from dredging and spoil disposal and to require a Dredging and Dredge Spoil Placement Environmental Monitoring and Management Plan;

c) condition 7 'State of the Marine Environment Surveys' to determine the pre-development Baseline state, the mid-term of marine works state and post-development state(s) of the marine environment;

d) condition 8 'Trunkline Installation' to define the actual trunkline route, require a Trunkline Route and Infrastructure Plan detailing the environmental impact of the chosen route, set the impact footprint and zones of impact of the trunkline and require a Trunkline Installation Environmental Monitoring and Management Plan;

e) condition 9 'Coastal Processes' to require implementation of the proposal in a manner that minimises changes to littoral transport and the development and implementation of an approved Coastal Processes Monitoring and Management Plan;

f) condition 10 'Marine Fauna Interaction – Pile Driving, Dredging and Marine Construction Vessels and Offshore Accommodation Vessel and Onshore Facility Light Sources' to require dedicated Marine Fauna Observers and trained crew members for dredging and piling operations, lodge cetacean records with the National Cetacean Sighting and Strandings Database, limit work vessel speeds, set conditions for the commencement and suspension of piling operations and require a Conservation Significant Marine Fauna Interaction Management Plan and an Underwater Noise Monitoring and Review Program;

g) condition 11 ‘Marine Drilling and Blasting Activities’ to require that these operations are managed to minimise adverse impacts to marine fauna;

h) condition 12 ‘Introduced Marine Pests’ to prevent, detect and control marine pests;

i) condition 13 ‘Marine Outfalls’ to define the location of outfalls from onshore facilities and the Offshore Accommodation Vessel, the quality of waste water discharges and the environmental quality objectives to be met;

j) condition 14 ‘Mangrove, Algal Mat and Tidal Creek Protection’ to set the limits of mangrove and algal mat loss and require the development and implementation of an approved Mangrove and Algal Mat and Tidal Creek Protection Management Plan, which includes consideration of sawfish;

k) condition 15 ‘Terrestrial Fauna’ to manage the impact of pipeline trenches on terrestrial fauna;

l) condition 16 ‘Weeds’ to prevent the introduction of new weeds into the proposed extension to the Cane River conservation park and to undertake weed control and rehabilitation, where necessary;

m) condition 17 ‘Rehabilitation’ to require progressive rehabilitation and the development of completion criteria for rehabilitation;

n) condition 18 **‘**Emissions to Air’ to require best practice for minimising emissions of volatile organic compounds and oxides of nitrogen emissions, optimising the smokeless capacity of flares and minimising non emergency flaring of gas;

o) condition 19 ‘Greenhouse Gas Abatement’ to require the development and implementation of an approved Greenhouse Gas Abatement Program and the offsetting of the emission of reservoir carbon dioxide to the atmosphere;

p) condition 20 ‘Public Availability of Data’ to require all validated environmental data to be made publicly available, except where it can be demonstrated it is confidential commercially sensitive information;

q) condition 21 ’Decommissioning’ to set decommissioning criteria prior to closure; and

r) condition 22 ‘Residual Impacts and Risk Management Measures’ to be implemented to address the residual environmental impacts and risks of the proposal to seagrass, coral, mangroves, marine and estuarine fauna, algal mats, vegetation and conservation areas.

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1. Introduction and background

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for Environment on the key environmental factors and principles for the proposal by Chevron Australia Pty Ltd (Chevron), to construct and operate a 25 million tonne per annum (Mtpa) liquefied natural gas (LNG) plant, a domestic gas plant and to construct marine facilities to support the proposal. The proposal includes an export pipeline to provide feed gas from the offshore production facilities to the onshore gas processing facility, marine facilities including a shipping channel, Materials Offloading Facility (MOF) and Product Loading Facility (PLF), a multi-purpose infrastructure corridor, which incorporates an access road to the site as well as the domestic gas pipeline connecting to the existing Dampier-to-Bunbury Natural Gas Pipeline (DBNGP), LNG and condensate product storage, power generation, water supply, waste disposal, an accommodation village and associated support facilities.

The Wheatstone proposal would process gas from the Wheatstone and Iago gas fields initially. This would involve the gathering and processing of natural gas and natural gas condensate in offshore Commonwealth waters. Gas from other yet to be identified sources might be processed at a later stage. This assessment does not address activities in Commonwealth waters, except in so far that a hydrocarbon spill in Commonwealth waters may impact Western Australian waters, islands or coastline.

The proposal is being formally assessed as the construction and operation of the onshore facilities would have the potential to cause significant impacts to the terrestrial environment and the construction and operation and maintenance of the marine facilities would have the potential to cause significant impacts to the marine environment. The proposal is also being assessed by Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) under the Environment Protection and *Biodiversity Conservation Act 1999* (EPBC Act) due to the proposal's potential impacts to matters of national environmental significance.

Further details of the proposal are presented in Section 2 of this report. Section 3 discusses the key environmental factors and principles for the proposal. The Conditions to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 provides Other Advice by the EPA, Section 6 presents the EPA's Conclusions and Section 7 the EPA's Recommendations.

Appendix 5 contains a summary of submissions, the proponent's response to submissions and is included as a matter of information only and does not form part of the EPA's report and recommendations. Issues arising from this process, and which have been taken into account by the

EPA, appear in the report itself. Appendix 5 also contains other information provided to the EPA by the proponent which the EPA has taken into consideration when forming its opinion.

2. The proposal

The Wheatstone proposal would be situated at Ashburton North, a proposed industrial estate 12 kilometres south west of the town of Onslow (Figure 1: Location of all proposal components). The land was previously pastoral, with the plant site located on the Urala pastoral lease and part of the infrastructure corridor and the accommodation village located on the Minderoo pastoral lease. The Shire of Ashburton has recently proposed an amendment to its Town Planning Scheme to rezone the Wheatstone site as well as the common-user port facility to 'Strategic Industrial' and also to rezone land for the associated land uses of the proposal.

Gas would be supplied to the onshore gas processing facility from the wells located in Commonwealth waters. Operations in Commonwealth waters do not form part of this assessment. Initially the Wheatstone and Iago fields would supply gas and, in future this might be supplemented by yet to be identified fields. The gas would be brought onshore via trunklines and microtunnels at the shoreline crossing. The corridor for the route of the first trunkline is shown in Figure 2: Trunkline corridor location. The final route for the trunkline has not been determined but would be within the corridor. The routes of other trunklines are unknown as the gas field locations are unknown and are not included in this assessment. Future trunklines would need to be considered as a new or change to proposal. The construction method for the trunkline has not been determined and may be trenching with backfill or surface laying with rock armouring.

To service the onshore facilities and for export of gas and condensate a materials offloading facility (MOF) and a product loading facility (PLF) with three berths would be dredged and constructed (Figure 3: Nearshore Marine Facilities). To access these facilities a channel and turning basin would be dredged. The construction of these facilities and the installation of the first trunkline would require the dredging of approximately 48 Mm^3 of spoil material. The spoil material would be dumped at sea at locations A, B, C D and E (Figure 1).

The site for the onshore facilities would require approximately 8.5 Mm^3 of fill material which would be obtained from the adjoining Onslow Salt site (Figure 1). The onshore facilities would consist of a Liquefied Natural Gas (LNG) processing plant, consisting of up to six trains with a total of 25 million tonne per annum capacity, using the ConocoPhillips Optimised Cascade® LNG technology or equivalent and a domestic gas (Domgas) processing plant/s. Initially one Domgas plant is proposed for the first two trains. Additional Domgas plants might be required when the proposal is expanded. The final layout of the onshore facilities is yet to be determined and would be within the site outline.

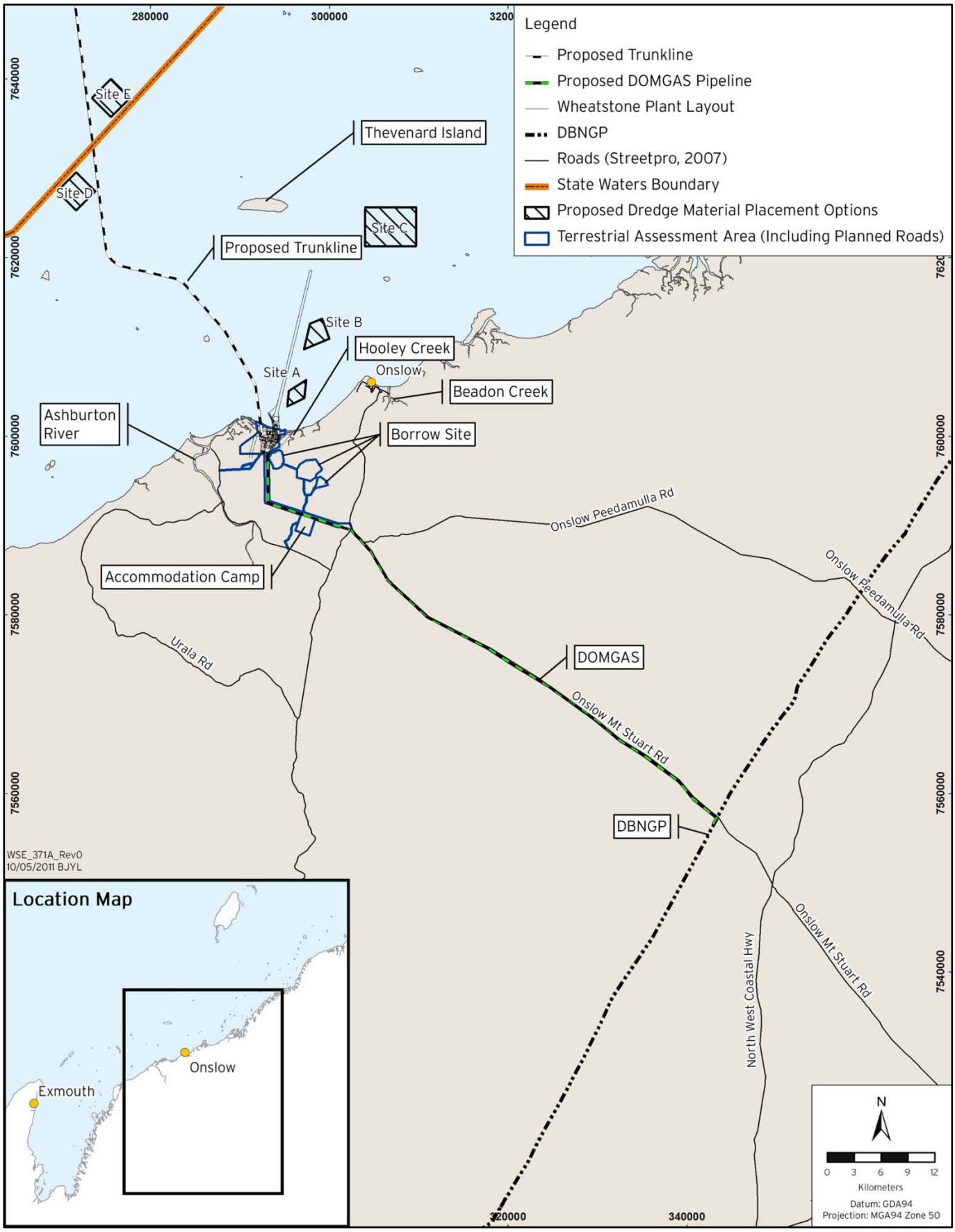


Figure 1: Location of all proposal components

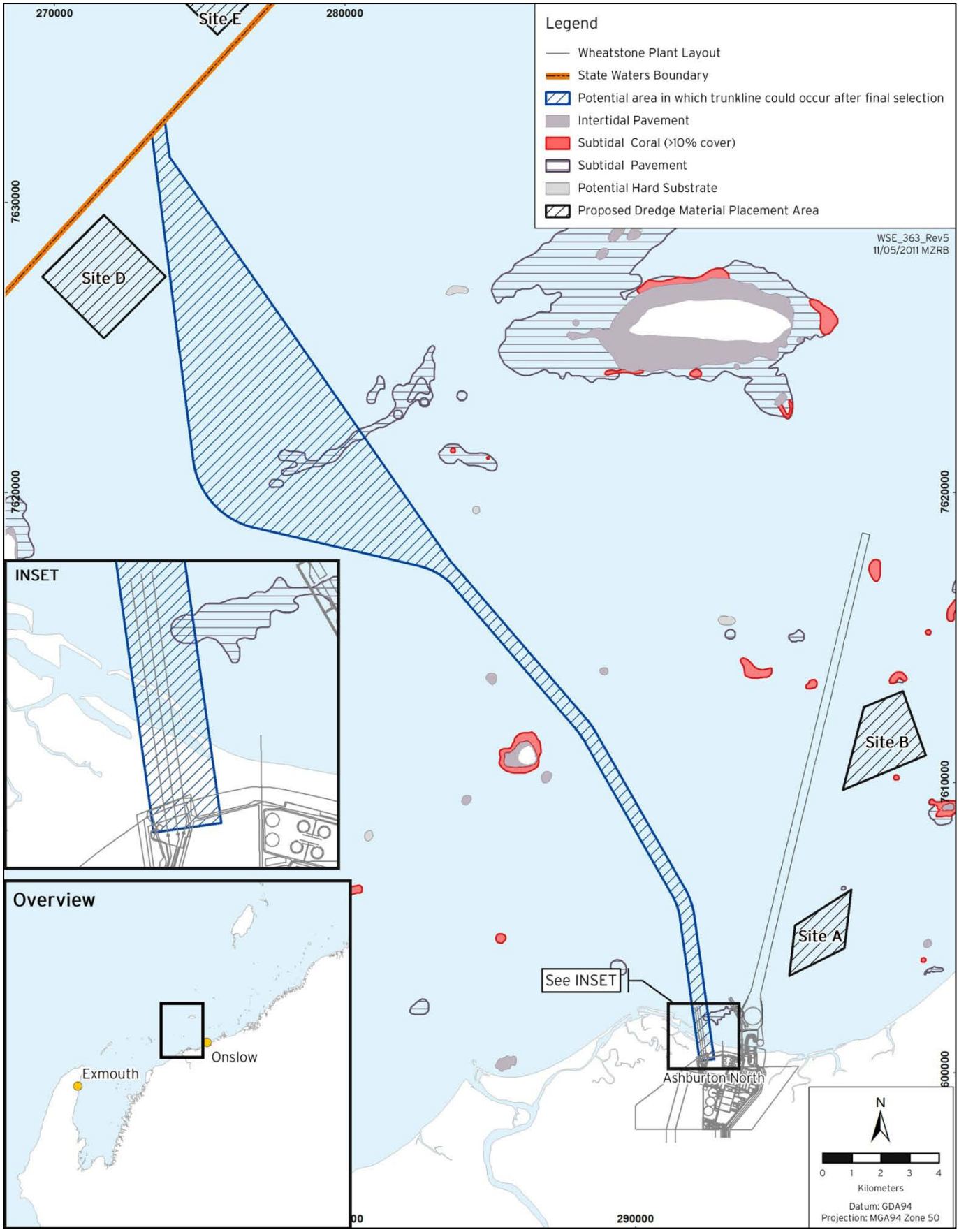


Figure 2: Trunkline corridor location

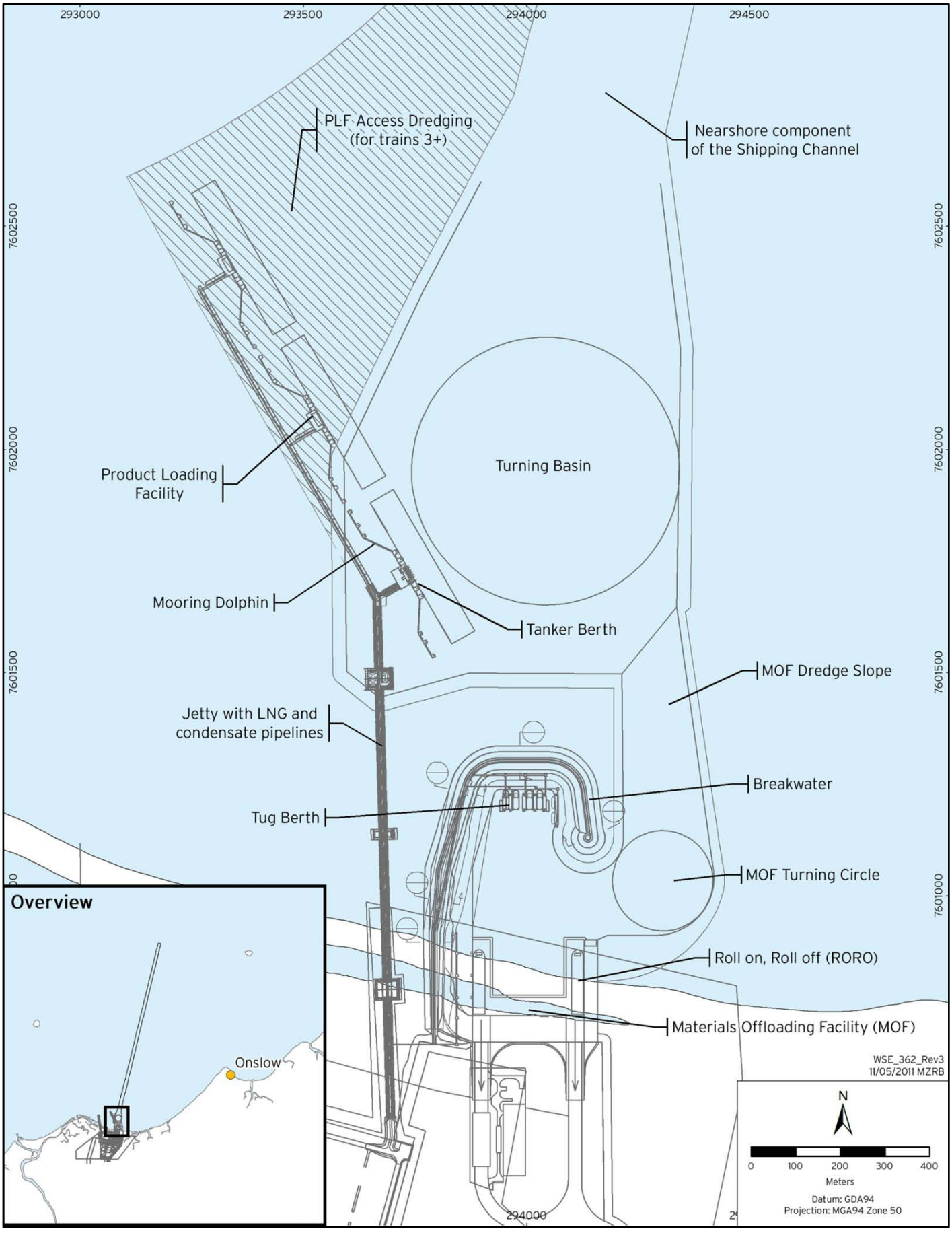


Figure 3: Nearshore marine facilities

The LNG processing equipment would consist of:

- inlet facilities/stabiliser systems;
- the Acid Gas Removal Unit (AGRU);
- dehydration and mercury removal systems;
- liquefaction and methane compression circuits, including the Nitrogen Rejection Unit (NRU) and gas compression turbines; and
- heavy hydrocarbon removal and fractionation systems.

In addition to the LNG processing equipment there would be:

- nominally nine gas turbine generators for power generation. These would be aero derivative turbines (LM6000 or equivalent) with dry low NOx combustion system meeting a specification of 15 ppm NOx emission or lower at 15% O_2 for the initial two trains. Subsequent turbines would need to meet the standards applying at the time of construction of the expanded plant;
- three wet and three dry and two marine high efficiency elevated flares (at least 125 m), unless there were environmental reasons for alternative flares;
- a thermal oxidizer on each train for the destruction of any sulphide acid gas components and benzene, toluene, ethyl-benzene and xylene (BTEX) if present;
- refrigerant storage;
- diesel storage and distribution;
- up to four condensate storage tanks of 120 000 m^3 and pipelines;
- LNG storage tanks of 180 000 m^3 up to a maximum of four tanks and pipelines;
- pentane storage and handling;
- nitrogen storage;
- reverse osmosis (RO) plants;
- water treatment plant;
- mono ethylene glycol (MEG) recovery unit for trains 3 and subsequent;
- firewater storage;
- stormwater ponds;
- seawater intakes and outfalls;
- infrastructure corridor The site would be serviced by a 20 km Shared Infrastructure Corridor (SIC), which includes an access road off Onslow Road servicing both the accommodation village and the plant site. An upgrade to a number of local roads would also be required; and
- a 30 m pipeline corridor for Domgas pipeline/s from the Domgas plant/s to the Dampier to Bunbury Natural Gas Pipeline to the Onslow-to-Mt. Stuart Road.

General facilities might include:

- an operations centre building comprising reception area, administration (offices), central control room, training centre, canteen and emergency command centre;

- main gate security;
- a maintenance centre workshop;
- a laboratory ;
- concrete batching plant;
- telecommunications and fibre optic line;
- a fire station;
- warehousing and lay down areas;
- a medical centre; and
- an accommodation village

In addition to permanent installations, there would the following temporary construction installations:

- a water intake at Beadon Creek with a pumping/loading station. This would be decommissioned after approximately eight months' operation;
- a compaction water pumping station and RO plant situated on the beach at Ashburton North SIA with an intake at the beach to be decommissioned after approximately 16 months' operation;
- construction water RO plant situated in the MOF area with an intake at the MOF and a nearshore outfall to be decommissioned after approximately 40 months' operation;
- up to 25 MW of diesel generators;
- access roads to areas such as the fill removal area. All temporary access roads would be rehabilitated after use;
- a laydown area adjacent to the first two trains which would become the site of future trains;
- a possible temporary lagoon for hydrotest water, which would be discharged to the construction outfall;
- offshore accommodation vessel. Several locations have been proposed for the offshore accommodation vessel. The offshore accommodation vessel would be in operation for approximately four years.

Design features that influence environmental impacts include:

- waste heat recovery units installed on the refrigeration compressor gas turbines to provide the heat required for the LNG and Domgas process equipment;
- capture and use of energy recovered from the pressure let down in the liquefaction section of the onshore gas processing facility;
- selection of LNG process train technology and size so as to facilitate the use of aero derivative gas turbines;

Initial construction would service two trains only. Later expansion at a yet to be determined date would include:

1. construction of additional trains;

2. dredging and construction for an additional two berths and turning basin area which could be in excess of 4 Mm^3. This volume is included in the 48 Mm^3 total for the proposal;
3. the installation of further trunklines, which would need to referred to the EPA when the routes are established;
4. the deepwater (20 m) outfall for produced formation water. The location of this outfall is yet to be determined, currently it is shown on the trunkline route;
5. other Domgas plants if the domestic gas requirement is maintained;
6. possible additional facilities for subsequent train construction (e.g. additional accommodation, laydown areas, surface water storage capacity, RO plant capacity, etc.)

The main characteristics of the proposal are summarised in Table 1 below. A detailed description of the proposal is provided in Chapter 2 of the ERMP (Chevron, 2010) and in the Final EIS/Response to Submissions (Chevron, 2011).

Table 1: Summary of Key Proposal Characteristics

Element	**Description**
Nearshore facilities	(Figure 3)
Shipping channel	Up to 18 km long navigation channel and turning basin for access to the PLF (nearshore component of the shipping channel shown in Figure 3).
Product loading facility (PLF)	Up to 2.5 km long, with export facilities for up to 3 LNG tankers or up to 2 LNG tankers and 1 condensate tanker. Includes jetty and mooring dolphins.
Materials Offloading Facility (MOF)	Includes the associated breakwater, access channel, turning circle and basin, roll on, roll off facilities and tug berths.
Dredge Spoil disposal site A	Up to 1.5 Mm^3 in 4 km^2
Discharge lines	Up to 2 x wastewater lines from the onshore facilities to the PLF or within the area designated as Moderate Level of Environmental Protection.
Offshore facilities	
Shipping Channel	Up to 18 km long navigation channel and turning basin for access to the PLF (offshore component of the shipping channel not shown in Figure 3).
Dredge Spoil disposal	

Element	Description
sites B C D E	 Up to 3 Mm^3 in 5 km^2 Up to 40 Mm^3 in 24 km^2 Up to 40 Mm^3 in 9 km^2 Contingency only **Note:** Although the combined available capacity of the approved Dredge Spoil disposal sites exceed 48 Mm^3, the maximum of dredge spoil authorised for disposal by this Statement shall not exceed 48Mm^3.
Produced Water Outfall	1 x produced water line up to 50 km long from onshore facilities to 20 m depth contour.
Other marine facilities	
Dredging	Up to 18 km long navigation channel, turning basin and MOF and tanker berths with up to 45 Mm^3 of dredge spoil. Up to 3 Mm^3 dredge spoil for the trunkline.
Trunkline	One subsea partially buried pipeline to the shore crossing
Trunkline shore crossing	Up to 6 tunnels installed by micro-tunnelling technique up to 1400 m long.
Offshore Accommodation Vessel	Vessel for accommodation for marine construction workers.
Onshore Facilities	
LNG plant	Located in Ashburton North Strategic Industrial Area (ANSIA)
Throughput	Up to 25 MTPA (foundation plant up to 9 MTPA)
Components	Up to 6 LNG trains
No. of storage tanks	Up to 4 x 180,000 m^3 LNG tanks
	Up to 4 x 120,000 m^3 condensate tanks
No. of flares	Up to 8 elevated flare structures: • 3 x high pressure (minimum height 125 m); • 3 x low pressure (minimum height 45 m); and • 2 marine flares (minimum height 45 m)
Footprint	Total disturbance onshore – approximately 3,300 ha comprised of: • LNG plant approximately 1010 ha; • Shared Infrastructure Corridor (including construction village area) approximately

Element	Description
	1,000 ha; • Roads and fill sources approximately 980 ha; and • Domgas line approximately 320 ha.
Utilities	Construction power generation – 15 MW from on site diesel generators. Operations power generation – approximately 400 MW. Construction water usage – approximately 6,134,000 m^3 (excluding hydro test water) Operations water usage – approximately 150 m^3/hr potable water.
Discharges	Produced Water (PW) offshore outfall approximately 13,200 m^3/day (starting from commissioning of LNG trains 3 to 6). Storm water – approximately 9,600 kL/day. Cooling water – none (air cooled). Flaring – no routine flaring other than pilot. Construction sewage – approximately 78 m^3/hr. Operations sewage – approximately 18 m^3/hr. Construction RO Brine – approximately 433 m^3/hr. Operations RO Brine – approximately 234 m^3/hr. Construction waste – up to 11,800 tonnes/year disposed of to a licensed 3rd party waste facility (no onsite incineration). Operations waste – up to 1,600 tonnes/year disposed of to a licensed 3rd party waste facility (no onsite incineration).
Domgas plants	Up to four
Capacity	Approximately 15% of heating value of LNG produced
Domgas pipeline	Up to 2 pipelines in a 60 m wide corridor approximately 75 km long connecting to the existing Dampier to Bunbury Natural Gas Pipeline (DBNGP)
Accommodation Village	
Location	Approximately 5 km inland from LNG facility in the ANSIA
Capacity	Construction - approximately 5000 people. Operations – approximately 400 people
Utilities	Construction power generation - approximately 10 MW from onsite diesel generators Operations power generation – electrical power delivered from LNG facility.

Element	Description
	Construction and operations water usage – included LNG facility figures.
Discharges	Construction sewage - approximately 76 m^3/hr recycled where possible for dust suppression Operations sewage – approximately 18 m^3/hr to waste water outfall Construction waste disposal – approximately 5,500 tonnes/year disposed of to a licensed 3rd party waste facility (no onsite incineration). Operations waste – approximately 175 tonnes/year disposed of to a licensed 3rd party waste facility (no onsite incineration

Abbreviations

ha	hectares	m	metres
hr	hour	m^3	cubic metres
kg	kilograms	Mm^3	million cubic metres
km	kilometres	MW	megawatts (10^6 watts)
km^2	square kilometres		

Since release of the ERMP, a number of modifications to the proposal have been made by the proponent. These include:

- maximum predicted impacts to benthic communities have changed from that predicted in the ERMP and in the Response to Submissions due to re-estimations;
- four stages of water supply for the construction stage of the proposal have been described:
    1. potable water would be trucked to site for 6-8 months;
    2. an intake of seawater would operate at Beadon Creek for 6-8 months and/or an open seawater intake;
    3. a compaction water RO plant and seawater pumping station and/or groundwater bore would operate at the beach at Ashburton North for 8–24 months; and
    4. a construction water RO plant, intake and outfall would operate in the MOF area for approximately 40 months.
- open trenching for the shore crossing of the trunkline has been discarded in favour of microtunnelling;
- an alternative to the design for the Materials Offloading Facility, which was shown in the Response to the Submissions. This alternative design and original design have now been discarded and the MOF design replaced with the design, 2D, shown in this Report;

- an offshore accommodation vessel has been included as an accommodation option. Three alternative mooring sites have been proposed;
- disposal of dredge spoil onshore has been discarded as an option in favour of offshore dumping; and
- the option of an onshore incinerator for waste disposal has been removed from the proposal.

New and revised information provided for the assessment and available in the Response to Submissions (attached as Appendix 5) includes:

Appendix FA -	Underwater environmental noise assessment: Wheatstone piling;
Appendix FB -	Biomass attributes of intertidal habitats In the Hooley Creek area;
Appendix FC	Geological heritage features of the Onslow embayment: coastal landforms, coral reefs & wrack lines;
Appendix FD	A description of megafauna distribution and abundance in the SW Pilbara using aerial and acoustic surveys – final Report 2010;
Appendix FE	Dugong aerial survey report;
Appendix FF	Assessment of marine matters of national environmental significance;
Appendix FG	Satellite telemetry of nesting flatback turtles from Ashburton island;
Appendix FH	Onslow prawn managed fishery response;
Appendix FI	Hydrocarbon spill sensitivity mapping;
Appendix FJ	MOF layout change;
Appendix FK	Requirement notice report;
Appendix FN	BPPH loss assessment report;
Appendix FO	Updates to hydrocarbon spill modelling;
Appendix H1	Baseline soil quality and landforms assessment;
Appendix O6	Draft marine fauna management plan;
Appendix FP	Des Mills independent peer review closeout report;
Appendix S1	Draft Dredging and Spoil Disposal Management Plan (DSDMP) Capital Dredge and Disposal Program;
Appendix S2	Draft Trunkline Dredging and Spoil Disposal Management Plan; and

additional information provided to the EPA during the assessment.

The potential impacts of the proposal initially predicted by the proponent in the ERMP document (Chevron, 2010) and their proposed management are summarised in Risk Assessment Tables 1.5 – 1.7 (Executive Summary) of the proponent's document.

3. Key environmental factors and principles

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for Environment on the key environmental factors relevant to the proposal and the conditions and procedures, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

The identification process for the key factors selected for detailed evaluation in this report is summarised in Appendix 3. The reader is referred to Appendix 3 for the evaluation of factors not discussed below. A number of these factors, such as terrestrial fauna, groundwater and heritage, are relevant to the proposal, but the EPA is of the view that the information set out in Appendix 3 provides sufficient evaluation.

It is the EPA's opinion that the following key environmental factors for the proposal require detailed evaluation in this report:

(a) Sub-tidal Benthic Habitat;

(b) Intertidal Benthic Primary Producer Habitat (BPPH);

(c) Marine fauna;

(d) Flora and vegetation;

(e) Greenhouse gases;

(f) Air emissions;

(g) Recreation and aesthetics; and

(h) Tourism and fishing related industry.

The above key factors were identified from the EPA's consideration and review of all environmental factors generated from the ERMP document and the submissions received, in conjunction with the proposal characteristics.

Details on the key environmental factors and their assessment are contained in Sections 3.1 - 3.8. The description of each factor shows why it is relevant to the proposal and how it would be affected by the proposal. The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

The following principles were considered by the EPA in relation to the proposal:

(a) the precautionary principle;
(b) the principle of intergenerational equity;
(c) the principle of the conservation of biological diversity and ecological integrity;
(d) principles relating to improved valuation, pricing and incentive mechanisms; and
(e) the principle of waste minimisation.

3.1 Sub-tidal Benthic Habit

Description

Benthic habitat

Benthic primary producer habitats are defined in Environmental Assessment Guideline (EAG) No. 3 (EPA, 2009) as seabed communities within which algae (e.g. macroalgae, turf and benthic microalgae), seagrass, mangroves, corals or mixtures of these groups are prominent components. Currently there is no specific EPA guidance for considering short-term reversible impacts on benthic primary producer habitat or other categories of benthic habitat (e.g. filter feeder communities). The EPA expects proponents to predict the extent and the potential ecological consequences of impacts on sessile filter feeder communities. Marine benthic filter feeder communities are important secondary producers within the marine ecosystem.

For dredging, Draft EAG 7 (EPA, 2010) should be read in conjunction with EAG 3. The objective of Draft EAG 7 is to provide a spatially-based assessment framework to guide proponents in the clear and consistent representation of predicted impacts associated with marine dredging proposals. Draft EAG 7 applies to all benthic communities and habitats, including filter feeder communities. Draft EAG 7 defines zones of high impact (ZoHI), moderate impact (ZoMI) and influence (ZoI).

Dredging and spoil disposal, waste discharges and spills can cause losses of benthic habitat in the marine environment through direct impact, loss of water quality (particularly elevated levels of suspended sediment and reduced light penetration) and sedimentation. In the risk assessment conducted by the proponent, the additive residual risk (after the application of proposed management measures) to marine water quality and to benthic habitat from all potential impacts was found to be high.

Impact Zones, Local Assessment Units and predicted benthic habitat losses from direct impact, dredging and spoil disposal

The proponent has modelled turbidity and sedimentation levels in the surrounding ocean predicted to result from dredging. The proponent has also established tolerance criteria for corals (and assigned the same criteria to filter feeders) and seagrasses (and assigned the same criteria to macroalgae). Based on the tolerance criteria the proponent has determined zones of high impact, moderate impact and influence as required in Draft EAG 7 for marine dredging proposals.

The ZoHI is the area immediately about the proposed dredging and dumping areas where indirect impacts are predicted to be severe and irreversible. This zone defines the area where mortality of, and long term serious damage to, biota and their habitats would be predicted. The proponent has defined the ZoHI for corals as greater than 30% loss and for seagrasses as greater than 50 % loss, which is considered not be reversible within five years.

The ZoMI is described in Draft EAG 7 as the zone where sub-lethal effects on key benthic biota would be predicted, but there should be no long term damage to, or modification of, the benthic organisms, the communities they form or the substrates on which they grow. The proponent has defined the ZoMI for corals as up to 30% loss of corals on a reef. For seagrasses, macroalgae and filter feeder communities the ZoMI is the area within which benthic habitat is predicted to suffer partial mortality (up to 50% loss close to the channel and <1% loss at the extremes). Mortality would occur within the area, but would not include all individuals. The outer border of the zone is drawn so that no mortality would be predicted to occur immediately outside of the ZoMI. The proponent expects benthic habitat to recover from this level of impact within five years.

The ZoI is the area where at some time during the proposed dredging and spoil placement activities small changes in sediment-related environmental quality beyond the natural ranges which might be expected, however, the intensity and duration is such that no detectible effects on benthic biota or their habitats should be experienced.

The zones of impact are depicted in Figures 5, 6 and 7 for the dredging and spoil disposal required for the MOF, PLF, turning basin and channel (capital dredging). For coral, worst case impact zones have not been based on the dredge modelling results but on a distance from dredging. The proponent considers that due to the inherent uncertainties of modelling, information from other dredging campaigns and potential long term impacts from shipping, this approach provides a more realistic impact and is in accordance with the definition of the ZoHI in Draft EAG 7. The proponent would, however, manage dredging activities to try to achieve only 50% loss of corals in the ZoHI and no loss of corals in the ZoMI (Chevron, 2011b). The position of the channel has not been determined so an infrastructure “bubble” of 1 kilometre (km) width has been assumed for the 260 metre (m) wide channel. The ZoHI is at the narrowest point approximately 2 km wide, stretching to approximately 4 km where influenced by the spoil disposal sites.

For seagrass and macroalgae the zones of impact have been predicted from the capital dredge modelling and are not the same as those for corals which have been predicted on a distance from dredging basis (Figure 6).

Zones of impact for the trunkline have not been depicted as the location of the trunkline has not been determined. The proponent has proposed the following zones shown in Table 2, based on the distance from the trunkline:

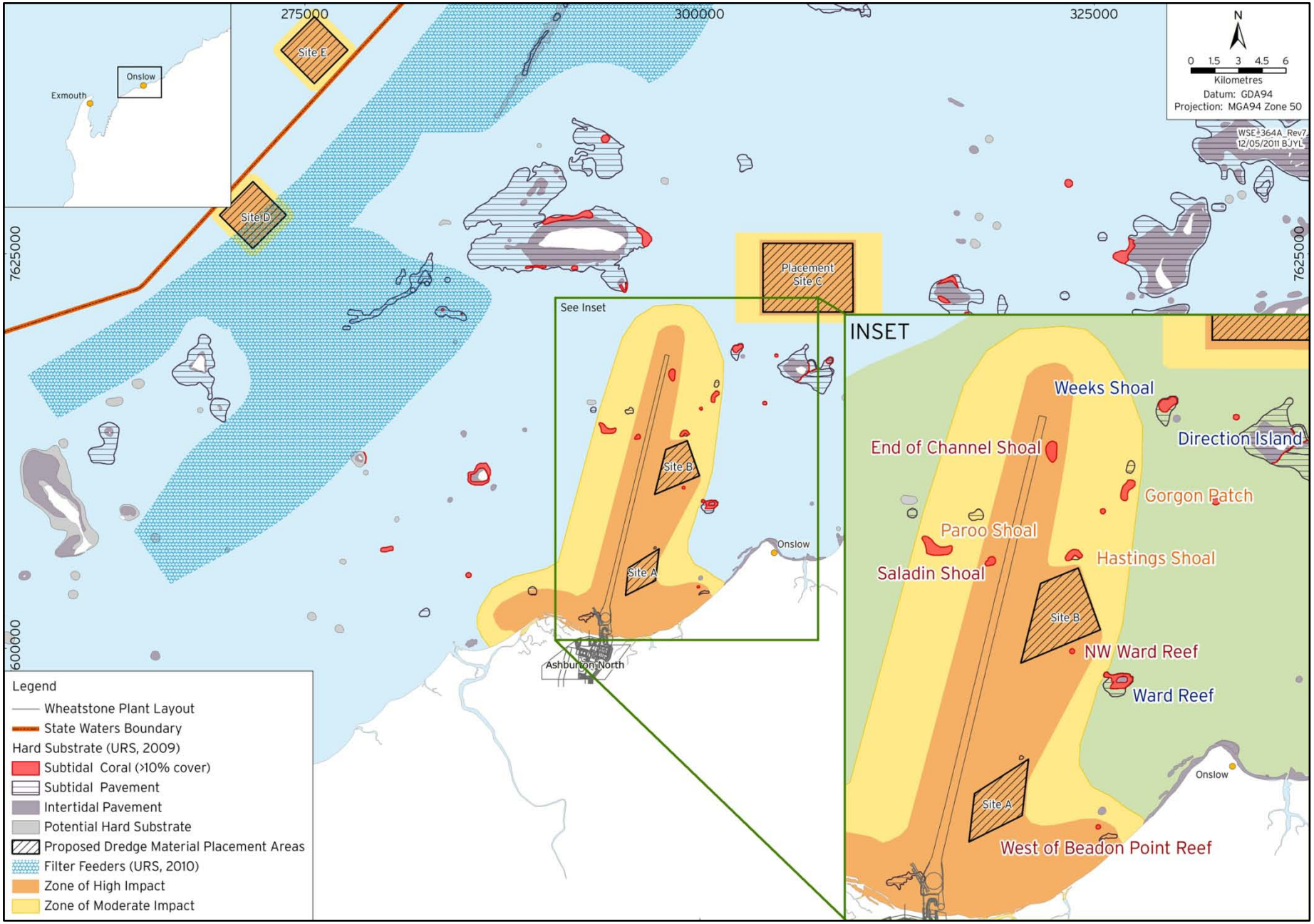


Figure 4: Zone of impact for corals and filter feeders for capital dredging

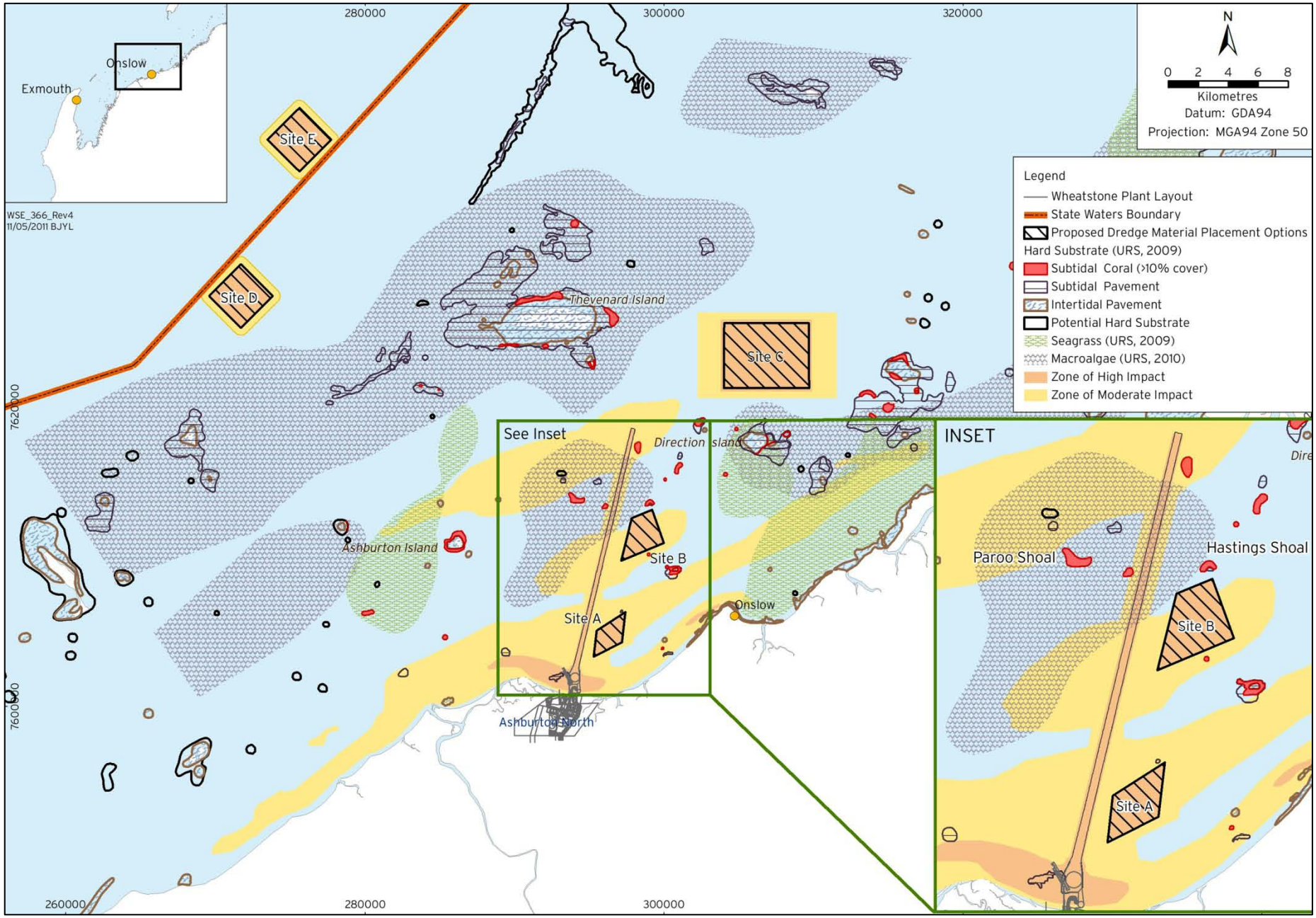


Figure 5: Zone of impact for seagrass and macroalgae for capital dredging

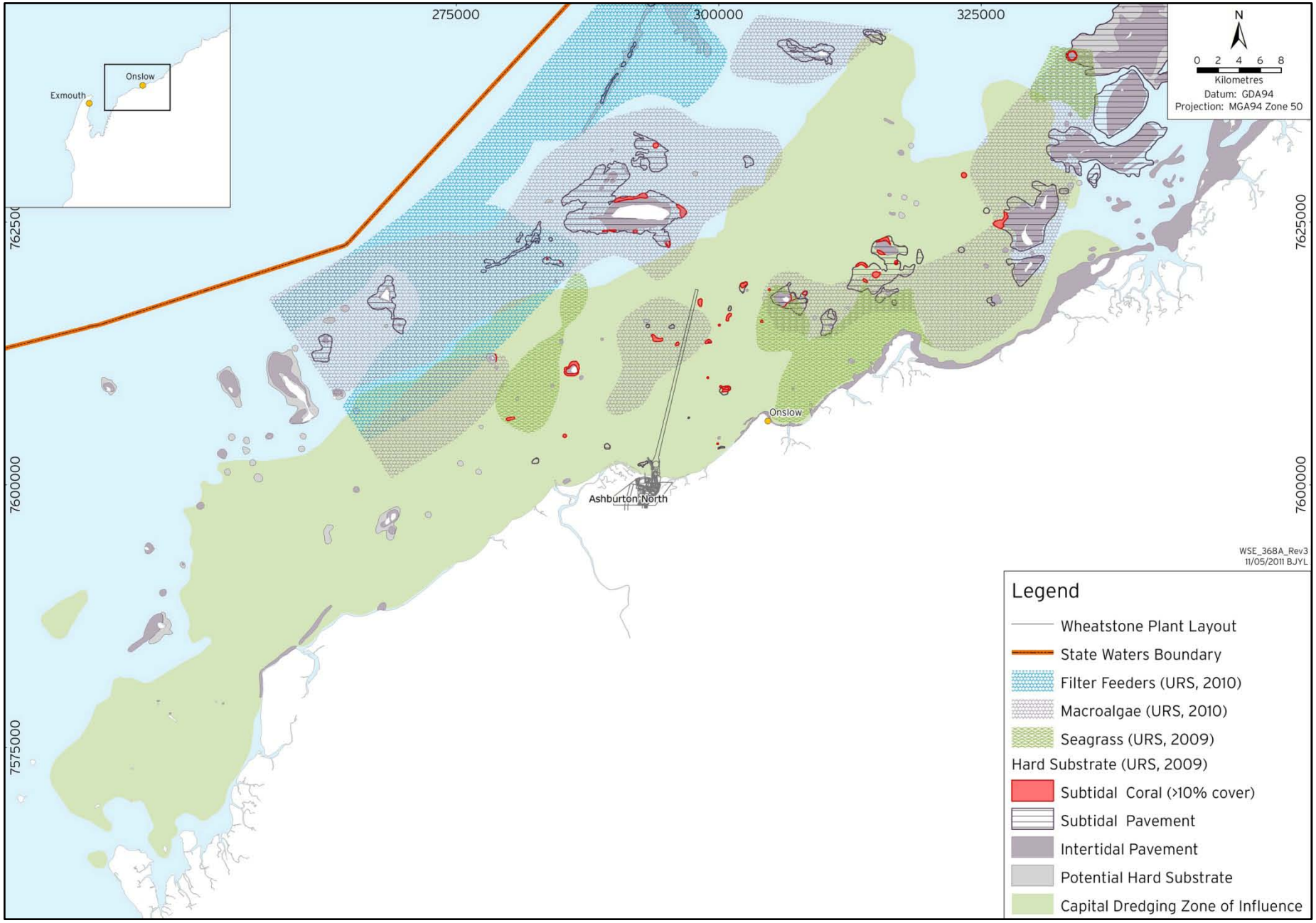


Figure 6: Zone of Influence for capital dredging

Table 2: Zones of impact for the trunkline

	Zone of High Impact	Zone of Moderate Impact	Zone of Influence
Coral	525 m from the centre of the trunkline	1000 m from the boundary of the ZoHI	Based on modelling outputs
Filter Feeders	525 m from the centre of the trunkline	1000 m from the boundary of the ZoHI	Based on modelling outputs
Seagrass	25 m from the centre of the trunkline	None	Based on modelling outputs
Macroalgae	None	1025 m from the centre of the trunkline	Based on modelling outputs

No corals are located in the zones of high or moderate impact of the trunkline.

Five potential spoil dumping sites have been proposed, A, B, C, D and E as shown in Table 3 and Figure 4.

Table 3: Characteristics of Dredge Spoil Placement Sites

Site	Assumptions	Mean bed level change (m)	Site depth (m)	Area (Km^2) (approx)	Capacity (Mm^3)
Nearshore Dredge Spoil Placement Sites					
A	For use to establish temporary access channel. Approximately 1 Mm^3 of dredged spoil would be placed by CSD using a diffuser just above the seabed. The naturally deep water areas are the primary target for placement within site A.	0.375	<7	4	1.5
B	Contingency site B may be used for placing weak rock removed from the PLF navigation channel and basin by the backhoe dredge.	0.6	10-12	5	3
C	The primary placement site. Spoil placed either by TSHD or split hopper barges.	1.7	12-15	24	40
Offshore Dredge Spoil Placement Sites					
D	Primary placement site for approximately 300 000 m^3 fine material from cleanup operations. Material placed by either TSHD or split hopper barges but lower preference than nearshore site C.	4.45	38-48	9	40
E	Same as offshore site D, but lowest preference due to higher sailing distances. Unlikely to be used and would be retained for contingency only.	Contingency only	>40	9	40

Impacts to benthic habitat would also be caused by spoil disposal due to direct impact and generation of turbidity during the dumping operation

and remobilisation during high energy events. Sediment plume modelling of the spoil dumps has been undertaken for disposal operations and the proponent has included the zones of impacts from the dumping operations in Figures 5, 6 and 7.

,

There is the potential for further impact to benthic habitat from the loss of fines from the spoil sites over the long-term during non-cyclonic and cyclonic conditions. It is predicted that fine material would be released after placement as there are smaller particles in the spoil than occur naturally at the disposal sites. The size of particles at the disposal site indicates the size of particle that is stable at that site under natural conditions. It is predicted that the dumps would become self-armouring as fines are lost. The proponent considers that while there would inevitably be some migration of placed material away from the placement site in the directions of dominant transport mixing, the amount of material lost is likely to be insignificant compared to the fines released during the placement operation, except under cyclonic conditions (Chevron, 2010).

Under cyclonic conditions the mobility of material on the seabed increases by an order of magnitude. The proponent considers that during cyclones fine particles would be suspended from the sea floor across the region and combined with the fine sediments contributed by the Ashburton River, the incremental contribution from the spoil ground areas would be insignificant (DHI, 2011b).

EAG 3 provides the framework for the environmental impact assessment of proposals on benthic primary producers. The cumulative loss values are the sums of proposed and historic loss/serious damage for each different benthic primary producer habitat (BPPH) within a defined sub-ecosystem scale area termed a 'local assessment unit' (LAU). Application of this spatial framework is based around six categories of marine ecological protection and quantitative cumulative loss guidelines for benthic primary producer habitat have been recommended for each category. Cumulative Loss Guidelines (CLG) are percentage values against which the calculated cumulative loss for each different BPPH are evaluated (EPA, 2009).

The proponent has proposed LAUs (Figure 7: Revised local assessment unit boundaries) and predicted the worst case percentage of cumulative loss of benthic habitat that would occur in each LAU from capital dredging, trunkline dredging and spoil disposal as shown in Table 4. Permanent loss has been defined in EAG 3 as a loss that would not recover within five years, while a reversible loss is one which would recover within five years.

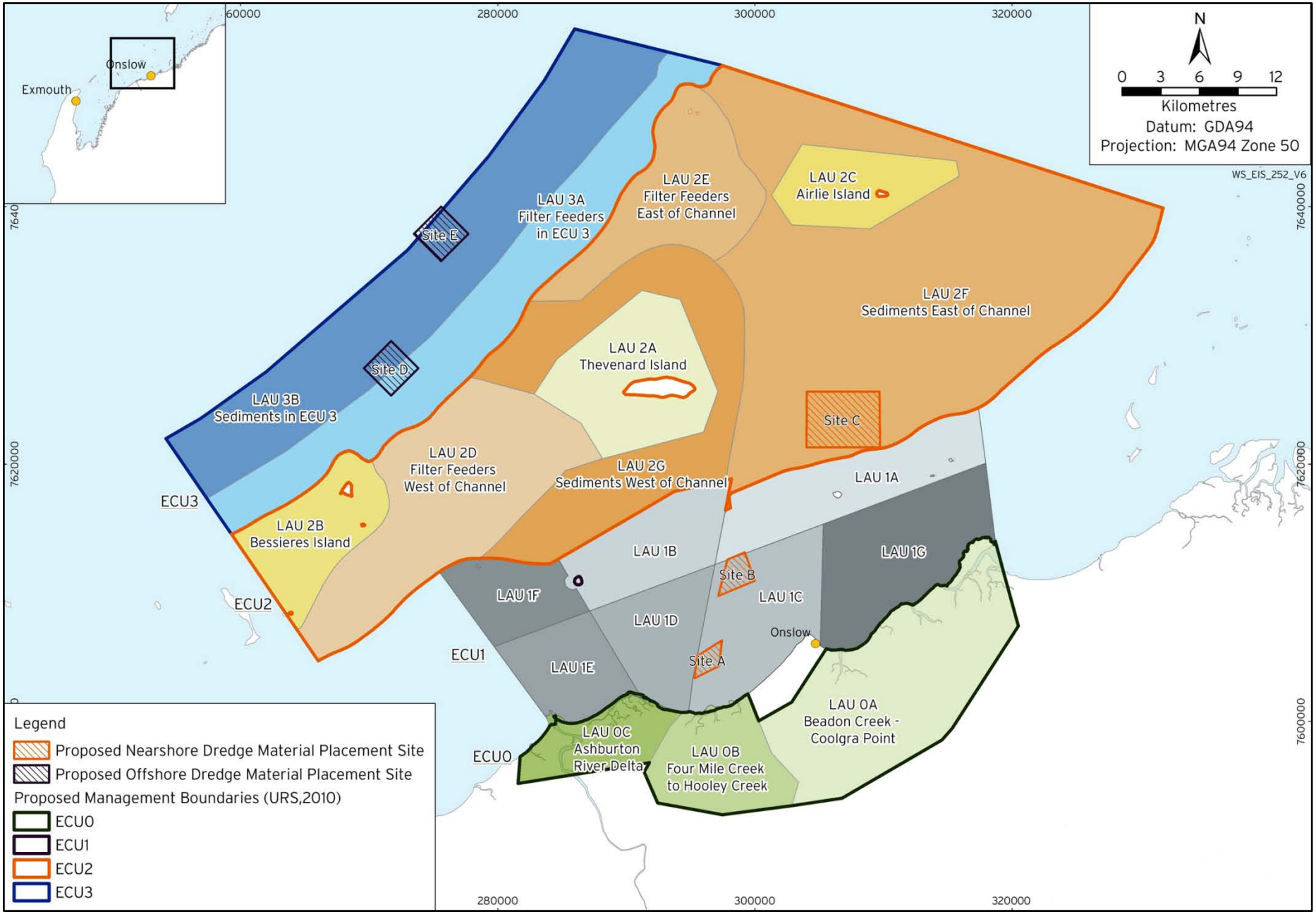


Figure 7: Revised local assessment unit boundaries

Table 4: Proposed LAUs and benthic habitat impacts

LAU	Descriptor	CLG loss	Permanent loss	Reversible loss
1A	Offshore Corals (and other BPPH) to east of channel and within port limits	5%	9.6% of corals	4.6% of corals
1B	Offshore Corals (and other BPPH) to west of channel and within port limits	5%	6.9% of corals and 6.2% of macroalgae	10% of corals 24% of macroalgae
1C	Nearshore corals within inner port area between navigation channel and Beadon Point	10%	14% of corals	None
1D	Nearshore BPPH (primarily macroalgae) within innerport area between channel and western port limits	10%	Nil	46% of macroalgae
1E	Nearshore seagrasses to west of channel and port limits	5%	Nil	Nil
1F	Offshore corals and seagrasses west of port limits	5%	Nil	1.5% of seagrass
1G	Sediments and Seagrasses to east of Onslow	5%	Nil	12.6% of seagrass
2A	Thevenard Island: the hard substrate shoals surrounding Thevenard Island and the coral, sponge and macroalgal communities that they support.	N/A	Nil	Nil
2B	Bessieres Island: the hard substrate shoals surrounding Bessieres Island and the coral, sponge and macroalgal communities that they support.	N/A	Nil	Nil
2C	Airlie Island: the hard substrate shoals surrounding Airlie Island and the coral, sponge and macroalgal communities that they support	N/A	Nil	Nil
2D	Filter feeders west of channel: the sand veneered limestone pavement that supports sponge/ascidian filter feeders and occurs to the west of Thevenard Island.	5%	6.3% of filter feeders	10.5% of macroalgae 6% of filter feeders
2E	Filter feeders east of channel: the sand veneered limestone pavement that supports sponge/ascidian filter feeders and occurs to the east of the navigation channel in the vicinity of Rosily Shoals.	N/A	Nil	Nil
2F	Sediments east of channel: all sand/gravel substrates supporting low abundance ephemeral seagrasses and/or ephemeral foliose brown algae.	N/A	Nil	Nil
2G	Sediments west of channel: all sand/gravel substrates supporting low abundance ephemeral seagrasses and/or ephemeral foliose brown algae	5%	0.7% of seagrass	10% of seagrass and 25% of macroalgae
3A	The variable filter feeding communities (sponge, sea whips, hydroids and sea fans) that inhabit the pavement and sand veneered pavement which occurs between 20 and 40 m CD.	5%	4.9% of filter feeders	2.9% of filter feeders 1.4% of macroalgae
3B	The soft substrates that occur below 40 m CD and support burrowing infauna and a red microalgal mat.	N/A	Nil	Nil

The maximum total losses of BPPH that would occur are predicted to be:

- Corals 37 ha of permanent loss and 22.4 ha of reversible loss;
- Seagrass 10 ha of permanent loss and reversible loss of less than 50% of a 2963 ha area (less than 1481.5 ha mortality);and
- Macroalgae 250 ha of permanent loss and reversible loss of less than 50% of a 8036 ha area (less than 4018 ha mortality);

The proponent considers that there have been no historical losses of significant sub-tidal benthic habitat (Chevron, 2010).

The cumulative loss guidelines are exceeded in:

- LAU 1A as the loss of 9.6 % of corals exceeds the guideline value of 5%;
- LAU 1B as the loss of 6.9% of corals and 6.2 % of macroalgae both exceed the guideline value of 5%; and
- LAU 1C as the loss of 14.0% of coral exceeds the guideline value of 10%.

No other coral reefs are predicted be impacted by dredging and spoil placement including Serrurier, Bessieres, Thevenard, Ashburton, and Airlie Islands, Brewis, Herald and Ward Reefs, and Weeks and Roller Shoals. No impact to water quality or benthic habitat is predicted to occur within the 'Important Reef Areas' of Serrurier, Thevenard and Airlie Islands.

The loss of filter feeders is predicted to be 2272 ha of permanent loss and reversible loss of less than 50% of a 1808 ha area (less than 904 ha mortality). The total area of filter feeder community in LAUs 2D and 3A is 18 409 ha and 19 908 ha, respectively. The permanent loss of filter feeder community at LAU 2D is 6.3% and at LAU 3A is 4.9%. There is no guideline value applying to the loss of filter feeders.

The proponent believes that stopping dredging to mitigate impacts to coral gametes (eggs and spawn) during a mass spawning event is unnecessarily during the Wheatstone dredging. Reasons for this include:

- the small amount of coral reef resources in the proposal area;
- there are very few reefs close to the proposed channel (most reefs are >3 km from the channel); and
- the potential for the dredge to operate in sections of the 16km long dredge channel that will ensure that the dredge plume does not contact with the floating gametes.

The proponent claims a preliminary modelling study had demonstrated that this strategy was feasible (Chevron, 2011d).

Management of benthic habitat losses from direct impact, dredging and spoil disposal

The following management measures are proposed by the proponent:

- during sediment transport by the Trailing Suction Hopper Dredge (TSHD) and barges, the level of the overflow pipe would be raised to its highest point to reduce the potential for spillage;
- hopper dewatering would be confined to areas away from sensitive receptors, where reasonably practicable;
- TSHDs would be fitted with a turbidity reducing valve within the overflow pipe;
- where sensitive receptors are at risk from TSHD dredging operations, restricted overflow might occur;
- diffusers would be utilised during offshore dredge material placement via the Cutter Suction Dredge (CSD);
- fine material would be managed based on experience during the capital dredging program and, when practicable, material with high fines content would be placed at placement sites in deeper waters;
- graded rock material with reduced fines content would be used for armouring;
- where reasonably practicable the works would be managed to optimise the under-keel clearance of the TSHD to reduce sediment re-suspension via propeller wash;
- a buffer of 0.5 nautical miles would be maintained around coral reefs to the east of the approach channel to limit stress associated with resuspension of sediment from propeller wash;
- during the early stages of the dredging programs the accuracy of the impact predictions presented in the Draft EIS/ERMP and the Final EIS/RTS would be validated. This would include the validation of the dredge plume model predictions with regard to sediment plumes;
- a tiered, responsive monitoring and management approach would be implemented in order to minimise the likelihood that any potential impacts to BPPH would exceed the allowable limits;
- gross sedimentation rates would be monitored at all water quality and coral health monitoring sites to assist in the interpretation of potential impacts to BPPH. Net sedimentation might be monitored adjacent to coral health monitoring sites using a simplified approach such as a graduated marker peg;
- water quality would be monitored to quantify temporal and spatial scale of impact associated with dredging in relation to baseline data;
- water quality and coral health data would be collected from sites located within the Zone of High Impact, when possible, in order to develop predictive links between water quality and coral health;
- monitoring of water quality and coral health would be undertaken on a frequent basis: fortnightly downloading of water quality data (collected at 30 minute intervals) and a fortnightly snapshot of coral health at three sites located within the Zone of Moderate Impact and at representative sites within the Zone of Influence;
- monitoring would also be undertaken at Serrurier, Thevenard and Airlie Islands which have ecologically significant reef areas to

confirm that no impact to benthic habitats occur in these areas; and
- the proposed monitoring approach is relevant for the first 12 months of monitoring and management only, and may be refined using an adaptive approach at the end of this period following a review of all available data at that stage.

Loss of benthic habitat from discharges of waste or spills

Discharges to the marine environment

The proponent proposes that the following wastes would be discharged to the marine environment:

- during construction: RO brine, treated sewage and treated hydrotest water used for onshore tank testing during construction, at a nearshore location;
- during operations: process water, RO brine and treated sewage and stormwater at an outfall located at the PLF or within the area designated as Moderate Level of Environmental Protection; and
- for trains subsequent to trains 1 and 2: produced water at a depth of approximately 20 m potentially located on the trunkline route.

The exact location of the outfalls has not been determined and the effluent streams for both the construction and operational phases of the proposal are not fully characterised at present. It is possible that RO brine and treated hydrotest water might contain biocide and antiscalant residue and that treated process water would contain low level hydrocarbons.

In addition, liquid wastes would be discharged from an offshore accommodation vessel include RO brine, domestic grey water, treated sewage and cooling water from the generators. The amount and nature of liquid waste would be assessed when the offshore accommodation vessel specifications are known. Liquid wastes would be treated to relevant standards then released to the environment in accordance with regulations. Approvals for discharges would be sought through Works Approval applications to the DEC.

For nearshore outfalls the proponent has proposed that they would be contained within the moderate ecological protection zone that is applied in the port waters with a low ecological protection area within 200 m of the diffuser.

For the produced water outfall the proponent has proposed a low ecological protection area within 200 m of the diffuser, after which a high ecological protection area would apply.

Following the implementation of appropriate management (and contingency plans) it is possible that discharges into the nearshore marine environment may increase nutrients in the water, resulting in eutrophication. The proponent considers the residual environmental risk

for this as “Very Low” as increases in nutrients in the water would be limited to localised areas adjacent to the outfall locations.

The proponent considers the risk of loss of benthic habitat from waste discharges to the marine environment low and no irreversible impacts were predicted.

Hydrocarbon leaks and spills
The proponent considers that benthic habitat such as corals, seagrass and macroalgae are not very susceptible to acute impacts by hydrocarbon leaks and spills as a very small proportion of corals, seagrasses and macroalgae are only exposed to the sea surface during a Low Astrological Tide. Therefore, benthic habitat would be impacted only if a spill or leak event coincides with such a tidal event. It is also possible that a hydrocarbon leak or spill that occurs during the annual mass coral spawning period might impact on coral propagules that are dispersed by currents on the water’s surface. However, the proponent considers that as corals only mass spawn for brief periods in the Pilbara region this is unlikely to occur.

Management of loss of benthic habitat from discharges of wastes or spills
Waste discharges to the marine environment
The management for discharge of waste to the marine environment would be in accordance with the Wheatstone Project Waste Management Plan (WMP) and adherence to the requirements of the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Cth) and MARPOL (Marine Pollution) 73/78 Convention Annex IV (sewage) and Annex V (Garbage). The WMP has not been prepared as yet.

Discharges from outfalls would be managed to meet the predicted ecological protection zones.

To prevent eutrophication from increased nutrients in water the proponent would monitor nutrient levels in discharge water prior to release.

For produced water discharge the proponent would characterise the produced water and select the outfall location and diffuser design for adequate dilution and dispersion. The proponent would also determine the ecotoxicity of the produced water and the concentration below which no detrimental effect on marine biota is predicted. The produced water concentrations would be monitored prior to discharge (Chevron, 2010).

Hydrocarbon leaks and spills
The proponent has undertaken hydrocarbon spill sensitivity mapping to determine which environmental receptors are at greatest risk in the event of a spill from the PLF and MOF. The hydrocarbon sensitivity map identified a number of sensitive features in the Proposal area, including corals reefs at Thevenard Island, Ward Reef and Ashburton River. The

map would provide identification of priority areas for protection in event of a spill (Chevron, 2011).

To manage the impacts of offshore spills the proponent would develop and implement a Marine Oil Pollution Plan (MOPP) approved by the Department of Mines and Petroleum and Department of Transport. The MOF would be designed to allow for a boom to be placed across the entrance to retain any spill of hydrocarbons. Safety features would be included at offshore wells to prevent a loss of well control.

The proponent has also committed that:

- the main hydraulic system on each dredging vessel would be equipped with standard low pressure alarms and shut down systems to minimise hydrocarbon loss in the event of a burst hydraulic hose;
- detailed refuelling procedures would be developed by the dredge contractor prior to commencement of work on site and would include the following requirements:
    - fuel transfer to occur in accordance with port authority and pollution regulations;
    - specific safety boundaries used when refuelling;
    - requirement of refuelling to be undertaken in fair weather conditions to reduce risk of spills;
    - requirement for open communication channels to be maintained during refuelling;
    - instructions for visual monitoring; and
    - emergency response procedures.
- personnel involved with refuelling or fuel transfer would be trained in their roles, functions and responsibility, including emergency response prior to engaging in refuelling or fuel transfer.

Maintenance dredging

For the original MOF design the ERMP predicted that under average conditions which prevail during summer, the eastward littoral drift was likely to generate sediment infill of the MOF channel at a rate of between 50 000 to 100 000 m^3 per annum. It was predicted that the MOF channel might require annual dredging while less frequent dredging might be required every three to five years for other dredged areas. This dredging, in addition to the MOF channel dredging, might be equivalent to approximately 300 000 m^3/year. The estimate of total planned maintenance dredging for 25 years of operation is in the region of about 10-15 Mm^3 (Chevron 2010). The MOF design has been altered to design 2D since the publication of the ERMP. This design would lead to “much higher sedimentation in the MOF approach channel and basin” (DHI, 2011a).

Under cyclonic conditions, modelled simulations of a direct hit from a Cyclone Vance (1999) scale event resulted in approximately 1 Mm^3 of infill into the dredged areas from the single event. The infill material is likely to consist of soft sediments.

The proponent proposes that if a TSHD is used for maintenance dredging, dredged material would be disposed either at placement site C (if sandy) or at placement site D (if high in fines content). If a CSD is required to clear the MOF channel, dredged material would be pumped to placement site A. The proponent considers that neither placement site A nor site C presently support significant amounts of benthic habitat and no benthic habitat damage would be anticipated from regular re-use of these sites. Site D supports filter feeder habitat, but the proponent considers that the small volumes of fine material to be disposed at this location would be most unlikely to cause any irreversible loss of benthic habitat at this location.

The proponent further considers that maintenance dredging would be a short term activity and as the habitats which occur in the proposal area routinely experience elevated turbidity on a seasonal basis the turbidity generated by maintenance dredging would pose little risk to the limited benthic habitats which occur adjacent to the nearshore parts of the channel. The proponent has not modelled turbidity impacts arising from maintenance dredging.

Management of maintenance dredging

The proposed dredge management plan provides no specific measures for the management of maintenance dredging. The ERMP states that surveys would be undertaken to confirm natural turbidity, sedimentation rates and contamination levels.

Submissions

Department of Environment and Conservation (DEC): A summary of the DEC's recommendations can be found in Appendix 3. Recommendations that the EPA considers of high importance are:

- mitigation or offsets are needed for BPPH where guideline values are exceeded;
- extent of mortality of coral shoals in ZoHI should be specified, in the ZoI the net live cover of benthic habitats should not fall below 100%, and there should be no water quality changes or sedimentation outside ZoI, to ensure dredge plumes do not reach marine reserves;
- in ZoMI impacts should be zero for filter feeders and for regionally significant coral communities around offshore islands;
- a benthic health monitoring program should be required prior to completion of assessment;
- in the ZoMI monitoring of seagrass to prove recovery within 5 years and if not, active rehabilitation or contingency offset measures;
- conditions based on specific amounts of habitat to remain based on predicted losses;
- during maintenance dredging there should be no mortality of BPPH outside of dredged areas and monitoring should be undertaken; and
- there was insufficient information provided for mitigation measures with regard to discharges, effluent toxicity testing of discharges, monitoring, and cumulative impacts modelling for works approvals / licensing.

Department of Transport (DoT): A summary of the DoT's recommendations can be found in Appendix 3. Concerns that the EPA considers of high environmental importance are:

- disposal site A was unlikely to be suitable for slurry dumped directly from a CSD and that disposal sites B and C were unlikely to be stable;
- dredge plume modelling had not been calibrated and validated against field water quality data;
- conditions requiring collection of plume data and review of model and management, and the use of adaptive management with forecasting a week in advance and modification of dredge activities were needed;
- the proponent should be required to contribute to scientific research by data collection (data to be publicly available);
- the statement that local habitats are adapted to dredge related sedimentation and turbidity is incorrect as natural turbidity duration is not comparable with dredging;
- there was low confidence in boundaries of 100% mortality zone;
- there was no proper consideration of natural turbidity and sedimentation and compounding dredging impacts.

Dampier Port Authority (DPA): a summary of the DPA's concerns can be found in Appendix 3. Issues that the EPA considers of high environmental importance are:

- more information is required regarding: the MOF diesel storage and transport, shore crossing method and location, about the offshore outfall, about the location and capacity of the seawater intake which should be sized for all future users, about onshore spoil disposal, and on maintenance dredging ;
- hydrodynamic modelling results should be provided showing optimisation of MOF and channel configuration to minimise maintenance dredging;
- DPA is concerned about the location of spoil dumps A & B and spoil mobilisation during cyclones and channel blockage,
- management of maintenance dredging; and
- Dredge Plume Management – concerns raised about modelling, material sizes, overflow rates, duration of scenarios, weather conditions and light deprivation.

Department of Fisheries (DoF): a summary of the DoF's concerns can be found in Appendix 3. Issues that the EPA considers of high environmental importance are:

- literature indicated seagrass recovery time in Queensland of about 10 years and seagrass/macroalgal recovery in Exmouth Gulf of 2-3 years, suggesting the projected recovery time is unrealistic: and
- dredging impacts are not the same as a cyclone and recovery cannot be extrapolatesd between the two.

Conservation Council of Western Australia (CCWA) and Wilderness Society (WS) submitted that Studies, Modelling, Management and

Mitigation Measures and Environmental Conditions should be industry best practice.

Cape Conservation Group Inc (CCG): a summary of the CCG's concerns can be found in Appendix 3. Concerns that the EPA considers of environmental importance are:

- measures to prevent condensate leaks and the management of oil spills; and
- comparing volumes dredged for Dampier Salt channel and Wheatstone in making assumptions about impacts based on Dampier Salt channel.

Assessment

The EPA's environmental objective for this factor is to maintain the abundance, diversity, geographic distribution and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

Loss of benthic habitat from dredging and spoil disposal

The EPA notes the concern of DoT that there was low confidence in the predicted high impact zone as it was stated that near-field sediment transport could not be modelled accurately and the concerns of the DPA about the dredge modelling. The dredge modelling was peer reviewed by Dr Des Mills who provided two reports (Mills, D. 2010a and Mills, D. 2010b) Both reports raised technical issues about the modelling and these were addressed in responses from the modellers (DHI 2010a and DHI 2010b). The independent reviewer's reports were a thorough and detailed examination of the modelling. The proponent has addressed the issues raised to the best of its ability. However, all modelling is based on assumptions that may not be accurate and has some level of uncertainty. This is recognised in Draft EAG 7, which states that "Predictive uncertainty is an essential consideration for the EPA when assessing impacts based on those predictions". The EPA has some concerns about the uncertainty attached to modelling, particularly as the modelling was based on data from Singapore which may not yield the same results for conditions experienced in the local marine environment.

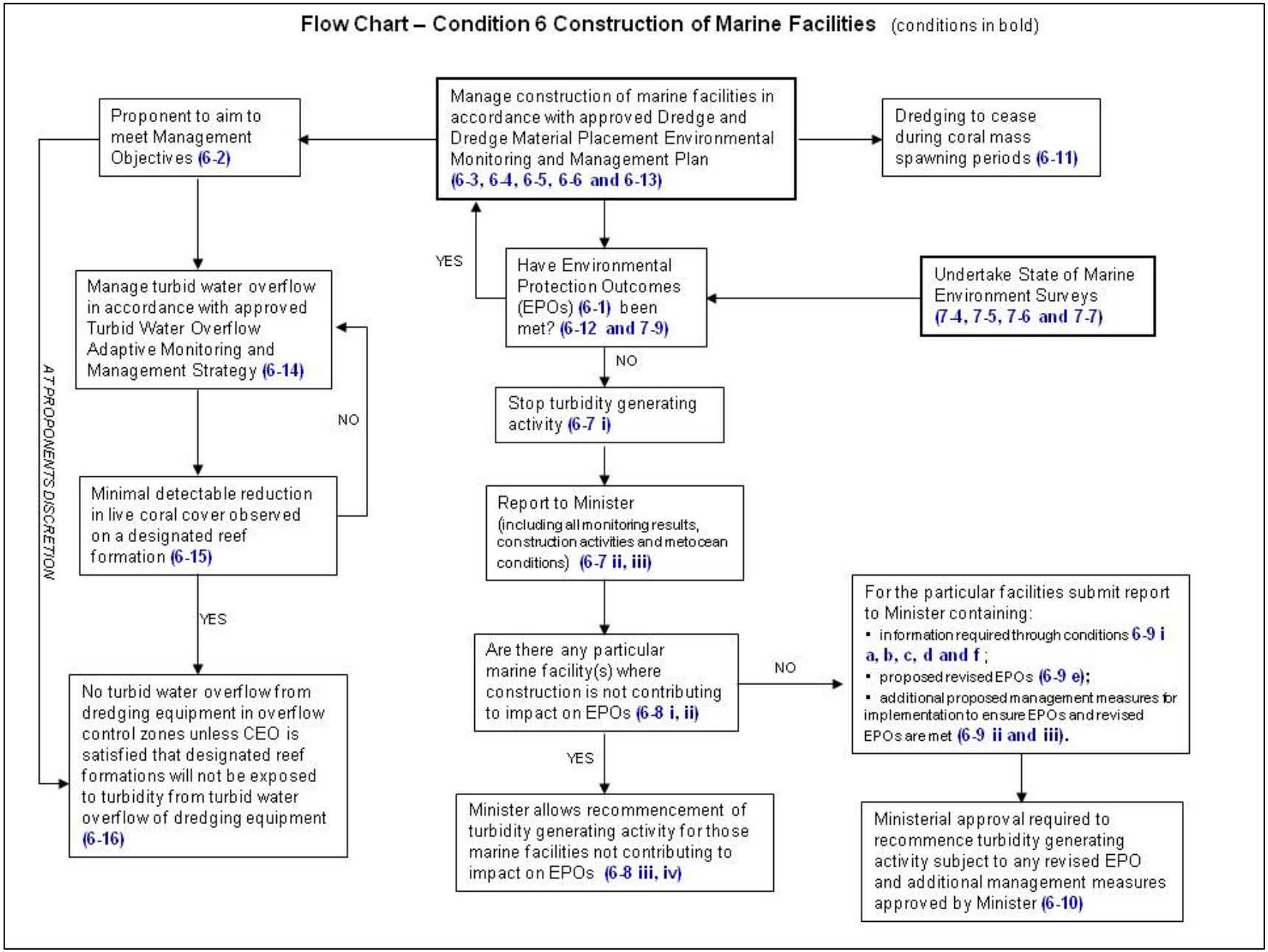
Since the publication of the ERMP the proponent has adopted a "distance from impact" approach for the prediction of worst case impacts to corals rather than rely upon modelling. This has, in part, come about because of the release of the EPA's Draft EAG 7 in October 2010, which describes the zone of high impact as being in proximity to the dredging location and also from the proponent's experience in other projects. Draft EAG 7 has also lead to the redefining of the criteria for the zones of high and moderate impact. This has lead to an increase in the predicted worst case impact to corals from that predicted in the ERMP. The EPA accepts this approach. In further discussions with the DoT, the DoT has confirmed that it has no objections to the proposal proceeding. It is expected that in the execution of the dredging the proponent would determine whether the modelling or distance approach is the more

accurate (recommended condition 6-5). As condition 6 is lengthy, a flow chart for the condition is provided below.

The EPA notes that the worst case predictions do not reflect the proposed management measure of planned commencement of overflow in the designated 'no overflow zones' previously proposed in the ERMP as the base case for the proposal. The EPA considers that a level of management commensurate to that proposed in the ERMP should be implemented to ensure minimisation of environmental impacts. The EPA has recommended conditions 6-14, 6-15 and 6-16 requiring that if overflow is allowed in the designated zones such that the reefs Paroo Shoal, Hastings Shoal and Gorgon Shoal, including south-west Gorgon Shoal, may be exposed to turbidity, the proponent shall implement an adaptive monitoring and management strategy and if a detectible reduction of live coral cover at the reefs is found, shall implement overflow control zones. The specific provisions for adaptive management recommended in condition 6-14 are based on management for marine reclamation works in Singapore which are described in Doorn-Groen, 2007. The proponent submitted this reference to give assurance about the merits of the proposed adaptive management approach.

The EPA recommends condition 6-2 to formalise the proponent's commitment to design and execute turbidity-generating activities associated with the construction of marine facilities with the aim of meeting the management objectives of protection of at least 50% of the baseline live coral cover within the ZoHI and protection of all live coral cover within the ZoMI. Whilst condition 6-1, which stipulates the allowable losses of benthic habitat in all zones, would allow for all live coral cover to be irreversibly lost in the ZoHI and 30% of live coral cover to be reversibly lost in the ZoMI, the aim of meeting the lower management objectives should ensure that losses are substantially less than these maximum allowed losses. If the proponent were to meet the management targets the impacts to corals would be reduced to the levels originally predicted in the ERMP. The higher limits for coral loss in condition 6-1 have been allowed in recognition of the fact that there is uncertainty in dredge plume modelling and impact prediction. These conditions are formulated in terms of the amount of coral to be protected as the EPA, and the DEC, believe that this approach provides better protection for the environment. The EPA recommends, as also recommended by the DEC, that all benthic habitat should be protected outside of the zones of high and moderate impact unless otherwise approved by the Minister for Environment.

The EPA notes that the predicted impacts of the proposal do not meet the recommended guidelines for BPPH in EAG 3 and that there would be permanent residual impacts to BPPH. The higher impacts have been accepted by the EPA as the proponent has designed the proposal to try to avoid impacts to significant BPPH and would minimise the impact as far as practicable if the recommended conditions are implemented and because the EPA does not believe that the loss of BPPH is so severe as to compromise the ecological function of the regional marine environment.



Flow Chart of condition 6

The level of assessment for this proposal was set at Environmental Review and Management Program. It is the EPA's expectation that Public Review documents for an ERMP contain completed management plans for the key environmental factors. These management plans could be further refined as a result of submissions and the EPA's assessment. It is the EPA's expectation that by the end of the assessment, agreed management plans would have been prepared and that there would not be the requirement to recommend conditions for the preparation of key management plans. The EPA is concerned to note that the Dredging and Dredge Spoil Placement Management Plan (DSPMP) is only 70% complete and therefore the EPA has to recommend that conditions 6-3, 6-4, 6-5 and 6-6 requiring a Dredging and Dredge Spoil Placement Management Plan to be prepared and implemented. This plan would include:

- description of the monitoring sites;
- monitoring parameters, including light attenuation and sediment deposition, to allow for near-real time dredge and dredge overflow management, including validation and calibration of the numerical dredging models that may be used to assist in dredge management;
- frequency of monitoring;
- the statistical power value of the monitoring;
- pre-defined overflow control zones
- trigger indicators and values;
- a risk-based tiered management approach;
- management measures to be implemented at trigger levels;
- characterisation and spatial definition of the ZoI;
- coral reproductive status monitoring;
- calculations of loss of dredge spoil from site C;
- measures to be undertaken to minimise the impact of placement and losses after placement from spoil sites in State waters; and
- reporting requirements.

The EPA also recommends conditions 6-7 to 6-10 for the suspension of turbidity-generating activities should the requirements of condition 6-1 not be met and for the recommencement of dredging.

The EPA notes that the preliminary modelling study regarding coral spawning and the proponent's proposed management for mass spawning events have not been provided. The EPA is aware that impacts to coral spawn and larval survival may occur due to elevated suspended sediments in the water column and elevated sedimentation. These impacts may occur at various stages of fertilization, planulae development, settlement and post-settlement. Therefore, the EPA believes that turbidity-generating activities should be suspended three days prior to the predicted commencement of mass coral spawning, or as soon as mass coral spawning is detected if prior to the predicted time, and remain suspended for 7 days from the commencement of mass coral spawning. This is included in recommended condition 6-11.

Condition 6-12 applies the benthic habitat loss limits to maintenance dredging.

The recommended conditions for reactive monitoring refer to corals in particular as these are considered to be the benthic primary producers most sensitive to turbidity and sedimentation. However, irreversible and reversible losses of other benthic primary producers and filter feeders are also predicted. These benthic habitats are of importance as habitat for marine fauna and primary productivity. The EPA considers it important that the impacts to these habitats are also monitored and, noting the concerns of the DoF and DEC, that it is shown that reversible losses recover within the five year period predicted. The EPA, therefore, recommends condition 7 for state of the environment surveys to take place pre-development for a baseline, mid-term in the capital dredging and trunkline installation programs, post-development within three months following completion of marine works and a second post-development survey, if necessary.

Recommended condition 6 applies to the capital dredging program, i.e. the product loading facility (PLF), the materials offloading facility (MOF), the navigation channels, turning basins and tanker berths and the pipelines for marine discharge of liquid wastes. In addition, the proponent anticipates that dredging would be required for the initial trunkline supplying gas to the onshore plant and also carrying a communications cable. The route and construction methods for the trunkline installation and stabilisation have not yet been confirmed. The EPA, therefore, recommends condition 8-1 to 8-4 to define the route and predict the impacts to benthic habitat for the installation of the trunkline

The proponent has assumed a worst case for the dredging based on the trunkline being installed into a trench dredged by cutter suction dredge (CSD) pumping directly into adjacent hopper barges with overflow and has modelled the dredge plume from this dredging (DHI, 2010). The EPA notes that since the publication of the ERMP, the proponent has changed the predicted ZoHI and ZoMI for the trunkline, thus changing the impacts to benthic habitats. However, impacts are still based on the use of a CSD, which creates the largest impact. Should other equipment be used for the trunkline trenching, impact would be reduced still further. The EPA recommends condition 8-5 to encourage the use of equipment that would minimise the impact of the trunkline installation and reduce the zones of impact. The recommended zones of impact of 50 m for the ZoHI and 500 m for the ZoMI from the centre-line of the trunkline, are based upon previous experience from other pipeline laying projects.

There is a corridor proposed for the trunkline route. The modelling shows that for all alternative routes in the corridor Ashburton Reef is at potential risk of impact under certain conditions. For more easterly routes Brewis Reef was identified at potential risk of impact under certain conditions. Appropriate management and mitigation measures would be necessary

to mitigate these risks during trunkline construction. The EPA notes the proponent's commitment that there would be no loss of benthic biota from the reefs of Ashburton Island and Brewis Reef and recommends that this is required by condition 8-6. Recommended conditions 8-7 and 8-8 set the limits and management objectives for impacts to benthic habitat. In addition, conditions have been recommended for a Trunkline Installation Environmental Monitoring and Management Plan (conditions 8-9 to 8-12) as this plan is currently only 70% complete. If the required environmental outcomes are not being met, recommended conditions 8-13 to 8-16 allow for the suspension and resumption of turbidity-generating activities.

There may also be synergistic effects of simultaneous dredging of the navigation channel and trunkline installation. The scale of impact would depend on the trenching method employed, the time of year that work is undertaken and the stage of progress for the channel dredging operations. Potential management options include:

- avoiding overlapping plumes from other dredging activities, either by avoiding simultaneous dredging and/or dredging in areas along the same plume extension direction;
- targeting seasons with the least risk of impacts, e.g. summer conditions when dredging east of Ashburton Island; and
- reducing total sediment release and release rates, e.g. through the choice of construction methodology or adapting methods of release reduction during the pipe laying.

The EPA notes the management options available to mitigate impacts from simultaneous dredging and expects that effective management would be implemented taking into account the minimisation of risk to turtles during turtle nesting and hatchling season. Simultaneous dredging is addressed in recommended condition 8-8, requiring cumulative impacts to meet objectives for capital and trunkline dredging.

Concerns about the stability of spoil sites A and B, particularly under cyclonic conditions, have been expressed by the DPA and also by the DoT, which had concerns about A, B and C spoil disposal sites. The stability of the spoil grounds is questioned as there is uncertainty about the size distribution of particles in the dredged material and the spoil could potentially be composed of a large volume of fine material which is finer than the existing sediment at the disposal sites. The EPA notes that the proponent considers that the dredged material would contain non-dissociated lumps of material and cohesive lumps of clays, making the particle size larger than the fully dissociated material and, therefore, more stable. Some fines would also be lost to the dredge overflow. The proponent does acknowledge, however, that some fines would be lost from the disposal sites until the dumps become 'armoured' with larger particles on the outside of the dump. Worst case estimations under cyclonic conditions, based on complete reworking of the spoil dumps and resuspension of particles finer than those naturally occurring at the spoil site, predict that 5% of sites A and B (75 000 m^3 and 150 000 m^3,

respectively) and 10% of site C (4 million m^3) might be resuspended (DHI, 2011b).

The EPA notes that the proponent considers that whereas cyclonic conditions can cause some damage to local habitats, the habitats can be considered, overall, to be adapted to these conditions. However, there is some uncertainty in this assumption as the local habitats are adapted to the consolidated and coarse grain armoured existing seabed conditions. A large quantity of freshly deposited unconsolidated dredge material containing fine particles placed on the seabed would increase the availability of mobile sediment and the amount of fine particles impacting the benthic habitats.

The EPA notes that this dredging campaign is not typical of campaigns previously assessed by the EPA in that it is some three times larger than previous assessments and that the spoil to be dredged in the nearshore area contains a large amount of fines that have been deposited over a long period by the Ashburton River. A 24 km^2 spoil site in relatively shallow water is not typical. Due to the uncertainties that have been raised about the stability and potential impacts of the disposal sites A, B and C, the EPA recommends condition 6-5 requiring the calculations of loss of dredge spoil from site C under metocean conditions typical of the location and predictions of fate and environmental impact of dredge spoil calculated to be lost following completion of marine works. Management measures to be undertaken to minimise the impact of placement and losses after placement, from spoil sites in State waters are also required in the recommended condition.

Site A in particular is acknowledged by the proponent to be potentially dispersive with some of the material placed at Site A likely to be mobile. However, as there are no or sparse benthic communities near the site, the proponent considers there would be little impact to benthic habitat. The EPA notes that the proponent has undertaken that Site B would only be used if it is demonstrated that, within the overall placement plan, its use minimises risk of adverse impact to the benthic habitat receptors from dispersion of fines. Any use of this site would be carefully considered. This would be informed by the early monitoring of dredging and placement activities at Site A.

The EPA notes that if spoil ground B was not used, and this is the EPA preference, it would reduce impacts to North West Ward Reef which would be in the ZoMI instead of the ZoHI. In this case a change would need to be made to the zones of impact shown in recommended condition 6 for benthic habitat.

The EPA is aware that approval for use of spoil grounds A and B is also required from the DPA, as the authority in whom the seabed area is vested. Should DPA find that these spoil grounds are unsuitable it would be open to DPA to refuse permission for them. A spoil dumping permit is also required from the Commonwealth, who would need to be satisfied

that its requirements are met. The EPA also notes that the original proposal included an option for onshore disposal of dredge spoil, which has been withdrawn on environmental impact and cost grounds. As the onshore spoil disposal is no longer in the proposal, the EPA has not assessed it and any future proposal for onshore spoil disposal would be required to be referred to the EPA for consideration. It is the EPA's view that unconfined ocean disposal of dredge spoil in WA waters should only be considered after the environmental costs and benefits of alternatives for reuse and confined disposal have been fully explored (EPA, 2010).

The EPA notes that there may be an additional impact to benthic habitat (not addressed by the proponent) from light deprivation by and anchor chains for the offshore accommodation vessel swinging and scouring the adjacent seafloor and associated habitats. The EPA recommends condition 5-4 requiring the offshore accommodation vessel to be anchored more than 500 metres from any sessile benthic filter feeder communities or benthic primary producer habitat (other than soft bottom microphytobenthos), in greater than 10 metres water depth and condition 5-5 requiring a mooring system that prevents scouring of the seafloor for the offshore accommodation vessel.

As a residual impacts and risk management measure the proponent has committed to fund scientific research with the aim of increasing the understanding of the impacts of dredging on benthic habitat in Western Australia. This has been included in recommended condition 22. Where practicable, the proponent would take account of the findings of the research project in the management of its project.

Loss of benthic habitat from discharges of waste or spills

Waste discharges to the marine environment

In 2006 the Marine Ecosystems Branch of Department of Environment (now part of the Office of the Environmental Protection Authority) produced a report to the EPA (DoE, 2006) containing recommendations for a set of Environmental Values, Environmental Quality Objectives and levels of ecological protection and where they should apply within the State marine waters from Exmouth Gulf to Cape Keraudren. These recommendations were the result of extensive public consultation undertaken in accordance with the State Water Quality Management Strategy (Government of Western Australia, 2004). The EPA subsequently endorsed the recommended environmental quality management framework to guide environmental impact assessment and waste discharge regulation until it could be more formally established through Government policy.

The recommendations in the DoE report (DoE, 2006) identified five environmental values for protection across the proposed development site:

- Ecosystem health;
- Recreation and Aesthetics;
- Fishing and Aquaculture;

- Cultural and Spiritual; and
- Industrial Water Supply.

A set of environmental quality objectives were established for each value along with levels of ecological protection for the maintenance of ecosystem health. A maximum level of ecological protection was recommended for an area adjacent to the Ashburton River Delta due to the ecological significance of the mangroves in this area. A high level of ecological protection was recommended for the remainder of the waters in the proposal site, with the exception of a small area around the Onslow Salt discharge. As a port is now proposed for the area, it is evident that some modifications to the environmental quality objectives and levels of protection would be required. The EPA therefore recommends that a moderate ecological protection zone should apply within 250 m of the edge of shipping berths and the ship turning basin and within the Marine Offloading Facility. The EPA also recognises that a maximum level of ecological protection adjacent to an industrial port would provide an unreasonable constraint on development and export activity. The EPA therefore recommends that areas of maximum ecological protection within five kilometres of the port facilities should be downgraded to a high level of ecological protection.

Information on the volumes and constituents of the proposed co-mingled wastewater discharges to the marine environment from the temporary construction activities and the permanent infrastructure, as well as from the produced water outfalls and the offshore accommodation vessel, is lacking, as is the exact location of the outfalls. It is difficult, therefore, to assess the impacts to marine water quality from the outfalls. It has therefore been necessary to require the proponent to address these information gaps through the preparation of additional reports or through the development and implementation of monitoring and management strategies. Requirements are specified in the recommended Ministerial conditions and recommendations relating to works approval and licence conditions are included under Other Advice (section 5). The EPA expects this information to include a map provided by the proponent detailing where the outfalls would be located and the environmental quality management framework (spatially allocated environmental quality objectives and levels of ecological protection) that would be used to manage all discharges from the development site and offshore accommodation vessel.

The proposed discharges from this development have the potential to cause significant impacts to the surrounding marine ecosystems if not managed appropriately. The co-mingled waste water outfall would contain oily stormwater, sewage and brine from the desalination plant. This co-mingled waste stream could cause toxic effects to marine biota, but the sewage nutrients could also increase primary production and impact on the algal communities in the area. In addition, combining sewage nutrients with a dense brine is likely to result in direct transport to benthic habitats. Produced water is likely to contain volatile and non-volatile hydrocarbons, various metals and other elements as well as process

chemicals, and is therefore likely to have a relatively high potential toxicity. Discharge in deep water would increase the opportunities for mixing and reduce potential environmental impacts. While discharges from the offshore accommodation vessel are significantly smaller than from the onshore discharges, the method of discharge is more uncertain and as a worst case could result in impacts over quite large areas of the seafloor if diffusers, or some other method for significantly diluting the discharges, are not used.

The EPA is therefore strongly of the view that the discharges be managed under Part V licence by the DEC, subject to recommended condition 13 and the EPA's recommendations provided as Other Advice (Section 5). Condition 13 sets out the acceptable area for locating co-mingled wastewater outfalls, which is within the port's moderate protection zone, and sets a low ecological protection zone within 70 m of the diffuser. The produced water outfall is recommended to be beyond the 20 m isobath and would also have a 70 m low ecological protection zone, beyond which a high level of ecological protection would apply. The EPA considers that the restriction of the low ecological protection area to 70 m from the diffuser is necessary to minimise impacts to the marine environment and meets best practice. The EPA expects the diffuser to be designed to deliver the necessary number of dilutions to achieve a high level of ecological protection within the zone of initial dilution and not to rely on far field mixing. Since the zone of initial dilution would not be expected to extend beyond 20 m from the diffuser, a low ecological protection boundary set at 70 m from the diffuser does give the proponent an additional buffer. Where a low ecological protection area adjoins a high protection area the criteria for high protection should be met at a boundary between the low and high ecological protection areas. Similarly where a low ecological protection area adjoins a moderate protection area the criteria for moderate protection should be met at a boundary between low and moderate ecological protection areas. Condition 13 also requires the prediction of the toxicity of the discharges and number of dilutions required to meet the environmental quality objectives and relevant levels of ecological protection once the proponent has the necessary additional information post commissioning, including results from whole of effluent toxicity testing.

The EPA notes that the proponent intends to adhere to MARPOL requirements for waste management in the marine environment for the offshore accommodation vessel. However, the EPA does not consider MARPOL to be applicable to a stationary source, particularly one which may be in position for up to four years. The EPA's preferred option is that all waste from the offshore accommodation vessel, both liquid and solid, be treated onshore. Failing this, any discharge from the offshore accommodation vessel should be assessed and managed in accordance with the requirements recommended in Condition 13.

Further recommendations to the DEC relating to discharge of waste to the marine environment are provided under Other Advice (Section 5).

Hydrocarbon leaks and spills
The proponent considers that there is little risk to benthic habitat from hydrocarbon spill on the ocean surface. However, hydrocarbons can become entrained in the water column and transported. Hydrocarbons could also reach lower depths if dispersants were used or contaminated particles sink to the seabed. The EPA considers it essential that the proponent develop and implement a Marine Oil Pollution Plan (MOPP). However, there is adequate legislation for the requirement of this plan under the Petroleum Act and under DoT legislation. The EPA, therefore, does not recommend a condition under the EP Act.

The EPA also recommends that due to the very short time to the escape from the MOF of any spill near the MOF entry, adequate equipment should be at hand to boom off the entry within 30 minutes of the spill.

Maintenance dredging
It is anticipated that the Port of Onslow would come under the control of the Dampier Port Authority when it is an operating port. In this case the proponentship for the port would need to be changed to the Port Authority. The Port Authority would be responsible for maintenance dredging and any conditions on maintenance dredging would need to be considered at the time of the change to the proponent.

Should any maintenance dredging be required by the current proponent during the construction phase (as might be the case after a cyclone), this would be subject to condition 6-12. Condition 6-12 requires the environmental protection outcomes in condition 6-1 to be achieved. The recommended condition would also apply for further dredging required by the expansion of the proposal to its full capacity.

Advice on the management of the operational port facility can be found in Other Advice (Section 5).

Summary
As some information was not available and uncertainties remain, the EPA's recommended conditions (including the residual impacts and risk management measures) reflect these gaps in knowledge and uncertainties. The EPA considers that with the implementation of the recommended conditions impacts to sub-tidal benthic habitat would be minimised and, while noting that there would be a reduction in abundance, productivity and geographic distribution at a local scale, the EPA's objectives would be met. The recommended conditions are:

- condition 6 relating to the management of marine works associated with construction of nearshore marine facilities;
- condition 7 relating to state of the marine environment surveys;
- condition 8 relating to the trunkline installation; The higher limits for coral loss in condition 6-1 have been allowed in recognition of the fact that there is uncertainty in dredge plume modelling.
- condition 13 relating to marine outfalls, and

- condition 22 relating to residual impacts and risk management measures.

3.2 Intertidal BPPH

Description

The proponent has described intertidal BPPH as mangroves, high tidal mud flats, consisting of bioturbated mudflats and samphire flats, and algal mats. These systems would be impacted by direct impact from construction, loss of water quality and sedimentation caused by dredging, spoil disposal and marine construction, loss of water quality from acid generation, terrestrial construction and spills, and erosion of habitat or changes to tidal and surface water flows caused by the presence of marine and terrestrial infrastructure.

The proponent has designated 3 onshore LAUs for intertidal BPPH (Figure 7). LAU0A contains the mangroves and associated samphire flats and algal mats which occur between Coolgra Point and Beadon Creek, LAU0B the mangroves and associated samphire flats and algal mats which occur between Four Mile Creek and Hooley Creek and LAU0C the mangroves and associated samphire flats of the Ashburton River Delta. No impact caused by the proposal is expected in LAU0A.

The residual risk assessment undertaken by the proponent identified the direct loss of intertidal BPPH as high risk, indirect impacts to the Ashburton River delta mangrove system as low, the trunkline shore crossing by microtunnelling as low, mortality of BPPH in Hooley Creek resulting from leak or spill from LNG processing plant as very low, mortality of BPPH due to refuelling work boats at the MOF or condensate spill during loading at PLF as medium, loss of well control (situated in Commonwealth Waters) resulting in loss of regionally significant mangrove habitat as low, with the overall additive risk as high.

Direct loss of BPPH from construction activities

Mangroves

Mangroves occur as a nearly continuous ribbon in the tidal creek systems at Hooley Creek, Middle Creek and Four Mile Creek and in a far greater area at the Ashburton River Delta. At the Ashburton River Delta there is more diversity of habitat, where salinity gradients influence the mangrove species and community structure. The Ashburton Delta mangroves are protected from the sea by barrier spit systems. Six species of mangrove are present in mangrove communities in the area. The Ashburton Delta mangroves fall under Category A “Extremely Special Areas” of EAG 3, where the cumulative loss guideline for LAUs is no direct or indirect loss of BPPH, and the creek system mangroves under Category E, where the land use is designated for development purposes and is close to the operational port area. The cumulative loss guideline for Category E is 10%. Nevertheless, the creek mangrove systems are of conservation significance as they provide habitat for the green sawfish, *Pristis zijsron,*

listed under the Environment Protection and Biodiversity Conservation (EPBC) Act as vulnerable and Rare under the WA Wildlife Conservation Act, and possibly the dwarf sawfish, *Pristis clavata,* listed as Vulnerable under the EPBC Act and as a Priority 1 species by the DEC, and are feeding areas for juvenile turtles.

It is proposed that pipelines from the offshore wells supplying the onshore plant and carrying communications would cross the shore at the eastern edge of the Ashburton River delta mangrove area. This area falls just inside the special area of EAG 3. In order to prevent disturbance to mangroves, microtunnelling has been selected as the shore crossing installation method instead of open trenching.

The proponent does not predict any impact to Ashburton Delta mangroves due to construction activities. As a result of construction of the plant and infrastructure 4 ha or 5% of the mangroves at Hooley Creek would be permanently lost.

High tidal mudflats

Two habitat types exist on the high tidal mud flats:

- bioturbated mudflats, devoid of macro-vegetation; and
- samphire flats, dominated by halophytic shrubs but with some crab burrows.

The EPBC listed species *Eleocharis papillose,* the dwarf desert spike-rush, was recorded within these flats. This species is not listed under WA legislation.

As a result of construction 108 ha or 17% of the high tidal mud flat in the Hooley Creek LAU0B would be lost. This would exceed the applicable EAG 3 guideline E for development areas of 10% of the original extent. There is no predicted loss in the Ashburton LAU0C.

The proponent provided advice from Dr Eric Paling on the loss of high tidal mudflats, which stated that it was difficult to assess the significance of any loss of the high tidal mud flat (samphires and bioturbated mud flat) due to a lack of information on their production ecology (both primary and secondary) and on the ecological connectivity, if any, between mangroves and samphires. Dr Paling inferred that the loss of high tidal mud flat would not influence the ecological integrity of adjacent mangrove systems based upon the lack of ecological effects on mangroves noted from the observed loss of 42 ha of this habitat in the Onslow Salt development and substantial losses around the Dampier and Port Hedland areas (Chevron, 2010).

Algal mats

There are expansive areas of algal mats on the mud flats in the Hooley Creek – Four Mile Creek system. Due to construction 52 ha or 6% of the current extent of the algal mats in the LAU0B would be lost. The proposal would increase the cumulative loss to 24 % of the historical extent as approximately 19% of the algal mats have already been lost

due to Onslow Salt developments. This would exceed the applicable EAG 3 guideline E for development areas of 10% of the original extent. There is no predicted loss in the Ashburton LAU0C.

Dr Eric Paling provided the following advice (Paling, 2011) about the impact of the loss of algal mats:

"Algal mats have been shown to be able to fix atmospheric nitrogen (Paling et al. 1989) and potentially provide a source of nutrients for seaward ecosystems (Paling & McComb 1994). This is the reason for their inclusion as a potentially significant intertidal habitat and BPPH unit in EAG 3. In terms of ecological value, algal mats, in addition to the above, provide a habitat for microbes, a form of fixed carbon and a food source for grazing crustaceans, particularly on high spring tides (Paling 1986)".

However, Dr Paling concluded that the loss of algal mats would not significantly impact on the functioning of the wider algal mat community or on mangrove communities as:

- the area to be removed is a relatively small proportion of the remaining area;
- the loss area would be a narrow corridor from land to seaward, so does not remove all the mat area close to mangroves;
- half of the area to be removed would be the most landward mat distribution and, therefore, the least productive;
- the functioning species and processes act in the scale of millimetres to centimetres;
- as there are only a few species of cyanobacteria present, it is unlikely that the loss would impact upon species functioning or genetic differentiation; and
- where algal mat loss has occurred, no adverse affects on adjacent mangroves or the integrity of the system have been found, for example, at the Onslow Salt, Dampier Salt and Port Hedland harbour developments.

Management for direct loss of BPPH from construction activities

To reduce construction impacts to BHHP temporary access roads constructed for fill removal would be removed after use to allow algal mat recovery. The access roads would be designed and engineered such that they can be removed and the ground surface at tidal flat level re-instated. The roads would also contain culverts to allow passage of both tide and small flood flows during their relatively short period of installation.

A monitoring program would be implemented in order to monitor both the health of mangroves and the key factors maintaining the mangrove habitat.

Loss of BPPH from dredging, spoil disposal and marine infrastructure construction

The proponent does not predict any impact to mangroves due to dredging, spoil disposal or construction of the MOF. The proponent states that mangroves are tolerant of the level of turbidity and sedimentation expected to be generated by dredging and construction activities during this proposal and, therefore, does not expect any loss of mangroves. Impacts to high tidal mudflats and algal mats are also not expected from these activities.

Loss of BPPH due to changes in water quality and spills

Acid sulphate soils

The micro-tunnelling would take place in an area of probable low potential for acid sulphate soils (Figure 8: Occurrence of acid sulphate soils). This classification has been made on the basis of three bore holes. There are nearby areas of high potential for acid sulphate soils.

During micro-tunnelling activities management of acid sulphate soil may be necessary should the soil be found to be acid generating or dewatering affect areas of acid sulphate soil. Leaching of acidic water has the potential to damage mangroves.

Fill areas have also been found to contain areas of potentially acid sulphate soils. These areas would also need management to prevent acid drainage to the creek systems.

Surface water quality

There would be the potential for BPPH to be impacted by surface water with increased turbidity from terrestrial construction activities. Sustained exposure to increased sediment concentrations and sediment loads to receiving marine environments of the West Hooley Creek and Ashburton River Delta from construction activities might impact on local marine habitats and might require management for compatibility with baseline environments.

Stormwater run-off from the plant during operations may also contain sediment.

Hydrocarbon Spills

The likelihood of a leak or spill from the onshore plant contacting the intertidal BPPH is considered by the proponent to be very low.

Impacts to BPPH may occur from offshore spills. The proponent identified that the “worst-case” modelling scenario for a leak or spill of hydrocarbons would be that originating from a trunkline leak at the shipping channel crossing. This has the potential to impact intertidal BPPH at the coast, as well as Barrow Island, Montebello Island and the Ningaloo Marine Park. However, the proponent considers that in reality, on leak detection it is likely the trunkline would be blowndown rapidly and the leak rate reduced. The condensate would also evaporate and weather reducing its toxicity.

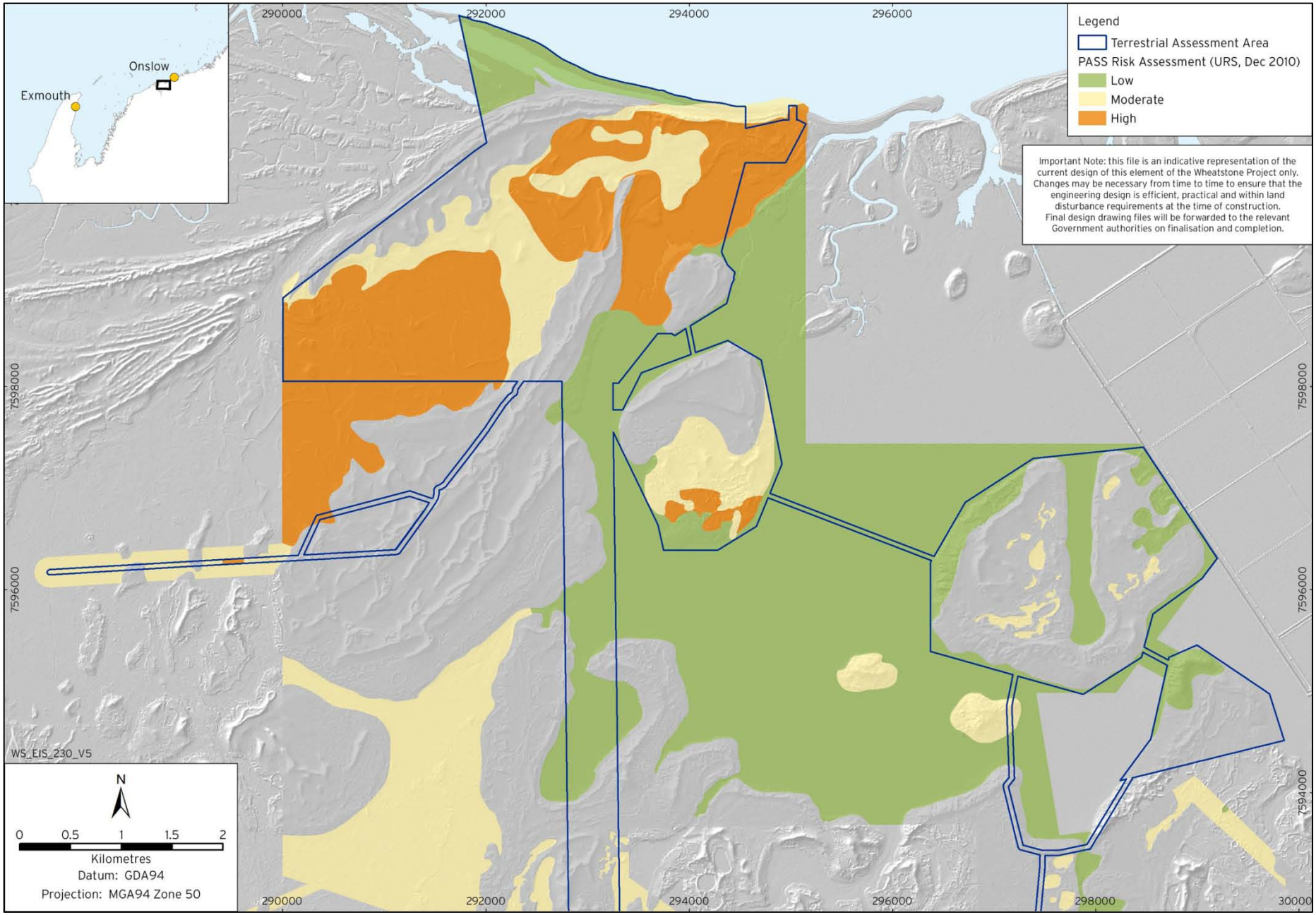


Figure 8: Occurrence of acid sulphate soils

Other scenarios that may result in hydrocarbons infiltrating the mangroves near the proposal site and impacting offshore islands included a loss of well control offshore, a condensate spill at the PLF and a diesel spill occurring at the MOF. Nearshore (i.e. at the PLF and MOF) hydrocarbon leaks and spills would pose the greatest risk to BPPH within the Ashburton River Delta and the Hooley Creek tidal creek system. The condensate leak would have the greatest area of predicted impact. No inclusion of spill response (such as boom deployment) was assumed in modelling scenarios. The close proximity of both the PLF and the MOF to mangrove habitats, means that the likelihood of adverse impacts on a large scale is high in the unlikely event that a hydrocarbon leak or spill occurs. However, the proponent considers that the overall risk to BPPH is greatly diminished by the very low probability of a hydrocarbon leak or spill occurring.

The proponent has undertaken hydrocarbon spill sensitivity mapping to determine which environmental receptors are at greatest risk in the event of a spill from the PLF and MOF. The hydrocarbon sensitivity map identified a number of sensitive features in the proposal area, including creek and river mouths (Entrance Point, Hooley Creek, Middle Creek and Four Mile Creek). These were ranked as sensitive as they provide a pathway for potential spills to come into contact with sensitive BPPH, such as mangrove habitats. The map would provide identification of priority areas for protection in event of a spill.

Hydrocarbon leak or spill, as a result of grounding of an LNG or condensate ship, was not modelled and was considered unlikely to occur.

Management of acid sulphate soils and water

The proponent has committed to producing an acid sulphate soil management plan to manage any acid sulphate soil that is found.

Management of surface water quality

To mitigate potential impacts from construction, the proposal would be designed to incorporate practicable run-off and erosion control measures. A system of drains would be constructed to divert run-off from the Plant Pad to storm water sedimentation ponds. The storm water sedimentation ponds may be used in conjunction with other engineering solutions including perimeter bunds and culverts, silt fencing, stone dikes and riprap aprons to control local run-off, erosion and sedimentation. (Chevron, 2010)

The proponent also notes that it is standard practice with Borrow Pits in the nearshore environment to remove material from the inside of the island but leave a small buffer untouched adjacent the tidal flat to manage potential for disturbance of the adjacent tidal flat and mangrove areas (i.e. so sediment run-off is contained within the borrow pit area and sediment deposition does not occur in adjacent BPPH areas) (Chevron, 2010).

For operations, all areas of the plant which are in potential contact with hydrocarbons would be drained to a treatment plant to remove any oil contained in water. In addition, all condensate and diesel tanks would be bunded to hold the required volume of fluid contents in the event of tank failure. Uncontaminated storm water would be held in sedimentation ponds prior to discharge to Hooley Creek to reduce turbidity.

Management of spills

To reduce the likelihood of leaks and spills from the onshore plant relevant Australian Standards and Codes would be implemented, where practicable, in the initial design integrity, process and utility equipment, materials handling and operating and maintenance procedures.

To manage the impacts of offshore spills the proponent would develop and implement a Marine Oil Pollution Plan (MOPP) approved by the DMP and DoT. The MOF would be designed to allow for a boom to be placed across the entrance to retain the spread of hydrocarbons. Safety features would be included at offshore wells to prevent a loss of well control.

Loss of BPPH due to changes in surface water flows and coastal processes

It is likely that the hydrodynamics of the Hooley Creek lagoon system would be modified by developments in the proposal area. There would be changes to the coastal flooding and runoff catchment areas and possible enlarging of the lagoon-ocean connection. Due to the expanded lagoon-ocean connection there is also the remote possibility of increased break-out of the Ashburton River and re-activation of the palaeochannel from Ashburton River to Hooley Creek. Surface water from sedimentation ponds would also be discharged to Hooley Creek altering the freshwater flow.

There is some potential for samphire vegetation on the high tidal mud flats to be affected by changed tidal regimes (increased or decreased inundation) due to the proposal. Samphires could also be affected by changes to salinity of their habitat.

Due to the presence of marine infrastructure, there would be accretion of sand to the west of the MOF and erosion of the coastline to the east of the MOF in the proposal area, the effects of which could potentially stretch to Onslow townsite. Potential impacts to mangroves would be caused by erosion of the Hooley Creek entrance bar and the east Ashburton River Delta chenier spit, or the closure of tidal creek entrances due to the onshore migration of dredged material placed nearshore or potential changes in the inundation patterns, affecting intertidal habitats.

With adequate management the proponent predicts that there would be no impact to Ashburton Delta mangroves, impacts to mangroves at Hooley Creek would be reduced to as low as reasonably practicable,

erosion trends would be managed, recreational values maintained and the Onslow seawall would not be impacted.

Management of changes to surface water flows and coastal processes

In order to limit the potential impacts on the baseline surface water characteristics, culverts would be constructed for all 16 drainage crossings traversed by the shared infrastructure corridor.

The proponent has identified sand management as a potential management tool for changes to littoral processes, if required. The need for sand management during construction as well as in the long term has been recognised. However, no sand management plan has been formulated as yet. In the long term sand management would need to be modelled with respect to monitoring data and determined annually, as where material is placed would be crucial to the success of the management. There are various methods of moving sand under consideration.

Trigger levels for sand management or beach nourishment from an external source have been identified for the management of potential near-field erosion, westerly transport events erosion and the Hooley Creek lagoon entrance. A monitoring program would be proposed.

Submissions

The **DPA** expressed concerns:

- about the accuracy of coastal geomorphology and impacts modelling, especially longshore sand transport;
- that a better understanding of accretion and erosion and impact of cyclones is needed; and
- that a commitment to bypass sand from west to east on a regular basis is needed.

The **DEC** recommended

- a monitoring program for impacts from LNG plant and construction road to show predicted losses of benthic habitat is not exceeded;
- a management plan for mangroves, algal mat and samphires; and
- offsets for a significant impact to Hooley and 4 Mile Creek.

The **CCG** had concerns that cumulative impacts from proposal to the Ashburton River mouth mangrove system need to be assessed and requested information on precautions to prevent Ashburton River changing course to Hooley Creek and the response to such an event.

The **Department of Water (DOW)** advised that floodplain modelling was satisfactory, and the proposal would have minimal impact to 100 ARI flood levels. DOW advised for surface water that the proposed hydrocarbon management was satisfactory and that DOW guidelines for spill contingencies and response should be referenced.

The **Shire of Ashburton** was concerned that there was no adequate assessment of the build up of flood waters due to the infrastructure corridor.

The **Department of Health (DoH)** advised that recycled water use needs approval and the quality should meet guidelines and that the application of pesticides and fumigants must comply with health regulations and the project should have a pest management plan.

Assessment

The EPA's environmental objective for this factor is to maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

Direct loss of BPPH from construction activities

The EPA notes that no impact to mangroves in the Ashburton Delta area is expected and supports the use of microtunnelling for the pipeline shore crossings to prevent disturbance of the mangroves. The EPA notes that in the Hooley Creek area there would be residual loss of some mangroves but that this does not exceed the guidelines recommended in EAG 3.

The EPA notes that loss of high tidal mud flat in the Hooley Creek area would exceed the applicable EAG 3 guideline. Due to previous loss of algal mats the cumulative loss of algal mats would also exceed the EAG 3 guideline. These would be residual losses.

The EPA notes that Dr Paling advised that there is little information of the production ecology (both primary and secondary) of the high tidal mudflats and on the ecological connectivity between mangroves and samphires. Dr Paling has inferred that the loss of high tidal mud flat would not influence the ecological integrity of adjacent mangrove systems and bases this upon the lack of ecological effects on mangroves noted from the loss of 42 ha of this habitat at the Onslow Salt development and substantial losses around the Dampier and Port Hedland areas (Chevron, 2010). Nevertheless, the EPA believes that there is some uncertainty about the cumulative and longer-term impact of the additional 108 ha loss of high tidal mudflat due to this proposal.

Dr Pauling also considered that mangroves do not receive a great deal of assistance from algal mats, based on observations that where algal mat loss has occurred, no adverse affects on adjacent mangroves or the integrity of the system have been found, for example, at the Onslow Salt project where long term pre and post monitoring of mangroves associated with the operation have shown no observable impact on mangroves (Paling, 2011). The EPA is aware that monitoring of the mangroves near the Onslow Salt project salt fields has shown no significant change in condition, extent or demography between 1996 and 2010 (Biota, 2010).

There is no monitoring undertaken at the crystallisers close to the Hooley Creek system.

Notwithstanding this information, the EPA considers that uncertainties remain about the cumulative and longer-term impacts to the creek system mangroves, both from algal mat loss and hydrological regime changes.

This being the case, the EPA recommends condition 14 for Mangrove, Algal Mat and Tidal Creek Protection which specifies the limits of allowable loss of intertidal BPPH. As also advised by the DEC, recommended condition 14 includes the management and monitoring of human impacts, such as construction impacts to ensure the objectives of protecting mangroves, algal mats and sawfish habitat are met and that predicted losses of BPPH are not exceeded.

Loss of BPPH from dredging, spoil disposal and infrastructure construction

The EPA notes that the proponent does not expect any impacts from the increased marine water turbidity caused by dredging and spoil disposal. Condition 14 requiring a Mangrove, Algal Mat and Tidal Creek Protection Management Plan would serve to confirm that this prediction is correct.

Loss of BPPH due to changes in water quality and spills

Acid Sulphate Soils

Dewatering for the microtunnels may expose areas of acid sulphate soils to air and lead to acid leaching which may impact mangroves. In addition, the areas from which fill is to be sourced contain soils at high risk of generating acidity, which may also leach acid to the Hooley Creek system and intertidal BPPH. The EPA, therefore, recommends that the proponent include in its Construction Environmental Management Plan (CEMP) a detailed Acid Sulphate Soil Management Plan which includes the testing of soil for acid generating potential and the prediction of any cone of depression caused by dewatering that may affect acid sulphate soils. The EPA also recommends condition 14 for a Mangrove, Algal Mat and Tidal Creek Protection Management Plan which would include management, monitoring and reporting of generation of acidity from potential acid sulphate soil disturbance.

Changes to surface water quality

The proponent has committed to managing changes to surface water quality from turbidity and to manage contaminated and uncontaminated stormwater during construction and operation. The EPA expects that the protection of surface water quality would be addressed in the CEMP and operational environmental management plans. In addition, the DEC would be able to address pollution issues in works approval and licensing under Part V of the EP Act. The EPA provides some recommendations to the DEC in Section 5, Other Advice, of this Report.

The EPA recommends condition 14 for a Mangrove, Algal Mat and Tidal Creek Protection Management Plan which would include management

and monitoring of contaminated surface water runoff, contaminated groundwater impacts and changes in turbidity.

The proponent should note the advice from the DoH regarding the need of approval to use recycled water and for a pesticides and pest management plan.

Hydrocarbon leaks and spills

The EPA notes that the greatest risk of spill impact to intertidal BPPH is from nearshore hydrocarbon leaks at the PLF and MOF. An Oil Spill Management Plan would be required. It should be noted that cleaning up of hydrocarbon spills in intertidal BPPH would be very difficult and, therefore, in the event of a spill, urgent action must be taken to prevent the hydrocarbon entering the creek systems. However, there is adequate legislation for the requirement of this plan under the Petroleum Act and under DoT legislation. The EPA, therefore, does not recommend a condition under the EP Act.

The EPA notes that the design of the MOF has undergone several changes and that neither the design presented in the ERMP nor in the Response to Submissions is the current design (Figure 3). The design of the MOF results in differing environmental risk due to its ability to contain an oil spill within the MOF and the time to exposure of BPPH to the oil.

The amended MOF design 2D would allow for a boom to be installed across the entrance which would make it easier to retain a spill in the MOF than the previous design in Response to Submissions. However, should a spill occur near the entrance to the MOF hydrocarbons may escape the MOF within a period of 30-45 minutes and the exposure time varies only little with the seasons. The original MOF design would appear to contain any spills for a longer period. The short time until the spill escapes the MOF emphasises the need for adequate spill management and availability of equipment.

The EPA has concluded that with adequate spill management the current design, 2D, would be environmentally acceptable. The proponent would require a port development approval from the Dampier Port Authority, which would consider whether the design of the MOF meets its requirements.

Loss of BPPH due to changes in surface water flows and coastal processes

Surface water flows

The EPA notes with regard to the Shire of Ashburton's concerns about the build up of flood waters due to the infrastructure corridor, that culverts would be included for all 16 stream crossings. The EPA notes that the removal of fill areas, the creation of elevated areas and infrastructure corridors and the discharge of stormwater to Hooley Creek is likely to cause changes to surface water flows, both from stormwater and inundation from seawater. This change is likely to increase if further

development on the strategic industrial area occurs. Changes in the hydrological regime may cause changes in water availability and in salinity experience by intertidal BPPH, leading to loss or change in composition of BPPH. The EPA has, therefore, included in condition 14 the monitoring and management of changes in hydrological regime.

The EPA notes the proponent's advice in Response to Submissions that avulsion (change of path) of the Ashburton River requires blocking of the major flow path, which may occur at different parts of the river channel, but most commonly occurs near the entrance as a result of the dynamic marine environment. Due to the large scale of the main Ashburton River channel, major avulsion requires a very large volume of material to cause a blockage. The likelihood of an event large enough to cause avulsion to the Hooley Creek pathway is extremely remote (Chevron, 2011a).

Coastal processes

The EPA notes that the design of the MOF would impact coastal processes. The current design, 2D, would have more impact than the original design in that more maintenance dredging and beach replenishment would be required and a decrease in coastal stability would result. The environmental impacts related to this are changes to the Ashburton delta chenier, the Hooley Creek system, erosion of recreational beaches and potential damage to the Onslow town seawall, as well as on-going turbidity impacts to BPPH from maintenance dredging. However, the EPA is of the opinion that the current design would be environmentally acceptable provided there was adequate on-going management of coastal erosion for the life of the MOF.

The EPA notes that the Coastal Processes Management Plan that should have been completed for the assessment is only 50% complete and that no method of sand management or beach nourishment has been formulated. The EPA agrees with the DPA that information is lacking in this respect. It is therefore necessary for the EPA to recommend condition 9 requiring a Coastal Processes Monitoring and Management Plan. In order to protect intertidal BPPH and in particular mangroves, condition 9 requires the proponent to manage littoral transport to prevent:

- an erosion trend under non-cyclonic conditions in the position of the mean sea level shoreline and dune vegetation line between the Project site and Beadon Creek;
- changes to the functionality of Hooley Creek; and
- changes to the functionality of the Ashburton delta and destabilisation of the chenier that impounds the coastal lagoon east of Entrance Point;

The proponent has undertaken to provide a number of residual impacts and risk management measures for the proposal which are described in recommended condition 22 and schedule 3.

Summary

As some information was not available and uncertainties remain, the EPA's recommended conditions (including the residual impacts and risk management measures) reflect these gaps in knowledge and uncertainties. The EPA considers that with the implementation of the recommended conditions impacts to intertidal benthic primary producer habitat would be minimised and, while noting that there would be a reduction in abundance, productivity and geographic distribution at a local scale, the EPA's objective would be met. The recommended conditions are:

- condition 9 relating to coastal processes;
- condition 14 relating to mangrove, algal mat and tidal creek protection; and
- condition 22 relating to the proponent's residual impacts and risk management measures.

3.3 Marine fauna

Description

A total of 64 Threatened and Migratory marine species listed under the EPBC Act may occur in the proposal area. These consist of ten marine mammal species, six marine reptile species, five species of sharks and rays and 43 species of birds. One bird species is listed as Endangered, the Southern Giant Petrel, *Macronectes giganteus*. Since there are no major breeding or feeding areas for the Southern Giant Petrel in the vicinity of the proposal, the proponent has not considered this species in the impact assessment. The marine mammal, reptile and sharks and ray species are listed below (Chevron, 2010).

Species Name		**EPBC Act Status E:Endangered V:Vulnerable M:Migratory**	**Wildlife Conservation Act/DEC listing**
Mammals			
Blue whale [1] (includes pygmy blue whale)	*Balaenoptera musculus intermedia (and B. m. brevicauda)*	E M	Rare
Southern right whale	*Eubalaena australis*	E M	Rare
Humpback whale[1]	*Megaptera novaeangliae*	V M	Rare
Antarctic minke whale	*Balaenoptera bonaerensis*	M	
Bryde's whale	*Balaenoptera edeni*	M	
Killer whale[1]	*Orcinus orca*	M	
Sperm whale	*Physeter macrocephalus*	M	P4
Indo-Pacific humpback dolphin	*Sousa chinensis*	M	P4
Spotted / Indo-Pacific bottlenose dolphin[2]	*Tursiops aduncus*	M	

Species Name		EPBC Act Status E:Endangered V:Vulnerable M:Migratory	Wildlife Conservation Act/DEC listing
Dugong[1]	*Dugong dugon*	M	Specially protected
Reptiles			
Loggerhead turtle[1]	*Caretta caretta*	E M	Rare
Green turtle[1]	*Chelonia mydas*	V M	Rare
Leatherback turtle	*Dermochelys coriacea*	E M	Rare
Hawksbill turtle[1]	*Eretmochelys imbricata*	V M	Rare
Flatback turtle[1]	*Natator depressus*	V M	Rare
Saltwater Crocodile[1]	*Crocodylus porosus*	M	Specially protected
Sharks and Rays			
Dwarf sawfish[1]	*Pristis clavata*	V	P1
Green sawfish[1]	*Pristis zijsron*	V	Rare
Whale shark[1]	*Rhincodon typus*	V M	
Shortfin mako	*Isurus oxyrinchus*	M	
Longfin mako	*Isurus paucus*	M	

1. Species has been recorded within or near the proposal area during surveys.
2. Arafura/Timor Sea populations only. This dolphin has been referred to as the 'spotted bottlenose dolphin' rather than 'Indo-Pacific bottlenose dolphin' in this report for consistency with the EPBC Act Protected Matters search results.

The proponent identified nine national environmental significant species with the potential to experience significant impact: humpback whale, Indo-Pacific humpback dolphin, spotted bottlenose dolphin (Arafura/Timor Sea population only), dugong, flatback turtle, green turtle, hawksbill turtle, loggerhead turtle and sawfish species. The proponent considered that although the species were of high conservation status and were likely to be present in or near the proposal area at some time, long-term population decrease was unlikely because large populations were not restricted to the proposal area, nor were critical habitats present in the proposal area.

The proponent considers the residual additive risk to marine fauna from the proposal is medium. The proponent estimates that the highest residual risk to marine fauna is from increased recreation (see section 3-7) and from loss of prawn nursery area (see section 3-8).

Waterbirds

Birds including, migratory species, were surveyed in the proposal site area. Twenty six species of waterbirds were recorded with the counts for numbers of waterbird species well below any criterion of international significance, except for the Common Tern (*Sterna hirundo*). These were seen on Town Beach. Bamford (2009) concluded that the proposal area

and surrounds do not support important numbers of migratory waterbirds. No significant impacts to migratory birds would be expected.

Whales

Humpback whales occur in the proposal area during their northern migration (between June to early August), in peak numbers during the transition phase between the northern and southern migrations after calving (from early August to early September) and during their southern migration (between mid September to December).

Twenty six aerial surveys over the south-west Pilbara offshore region were undertaken by the Centre for Whale Research between May 2009 and May 2010 (CWR, 2010). Pygmy blue whales, sperm whales, killer whales, minke whales and pilot whales were also sighted over or beyond the continental slope during the aerial surveys. During their southern migration phase a large number of humpback whales appeared to be milling or resting near the proposal area (Figure 9: Swim direction of humpback whales during southern migration). Cow/calf pods were predominantly resting in the area nearshore of the 50m bathymetry for unknown lengths of time.

Acoustic surveys conducted between May 2009 and December 2009 identified the presence of humpback whales, pygmy blue whales, Bryde's whales and dwarf minke whales in the study area. Pygmy blue whales and dwarf minke whales are present in deeper waters of the offshore study area. Bryde's whales were detected on one day at a site in 43 m of water west of Onslow. Humpback whales were present at the 43 m depth nearshore monitoring site and at the offshore monitoring site.

Humpback whales are considered to be the whales at greatest risk from proposal activities as they are present in larger numbers, are found closer to shore during their southern migration and may spend longer in the vicinity of the proposal than other whales.

Mortality and behavioural change impacts to humpback whales may be caused by vessel strikes, the physical presence of infrastructure, discharges to the marine environment and noise. Besides damaging whales' hearing, noise may also disrupt communications between whales. The proponent considers the residual risk to all marine fauna from vessel strikes to be very low, from the presence of infrastructure to be very low, from discharges to the marine environment to be low to very low and from construction noise to be low.

Dugong

The proponent has undertaken one two day dugong survey and has recorded sightings of dugongs opportunistically during fortnightly whale surveys that were undertaken by the Centre for Whale Research over a twelve month period.

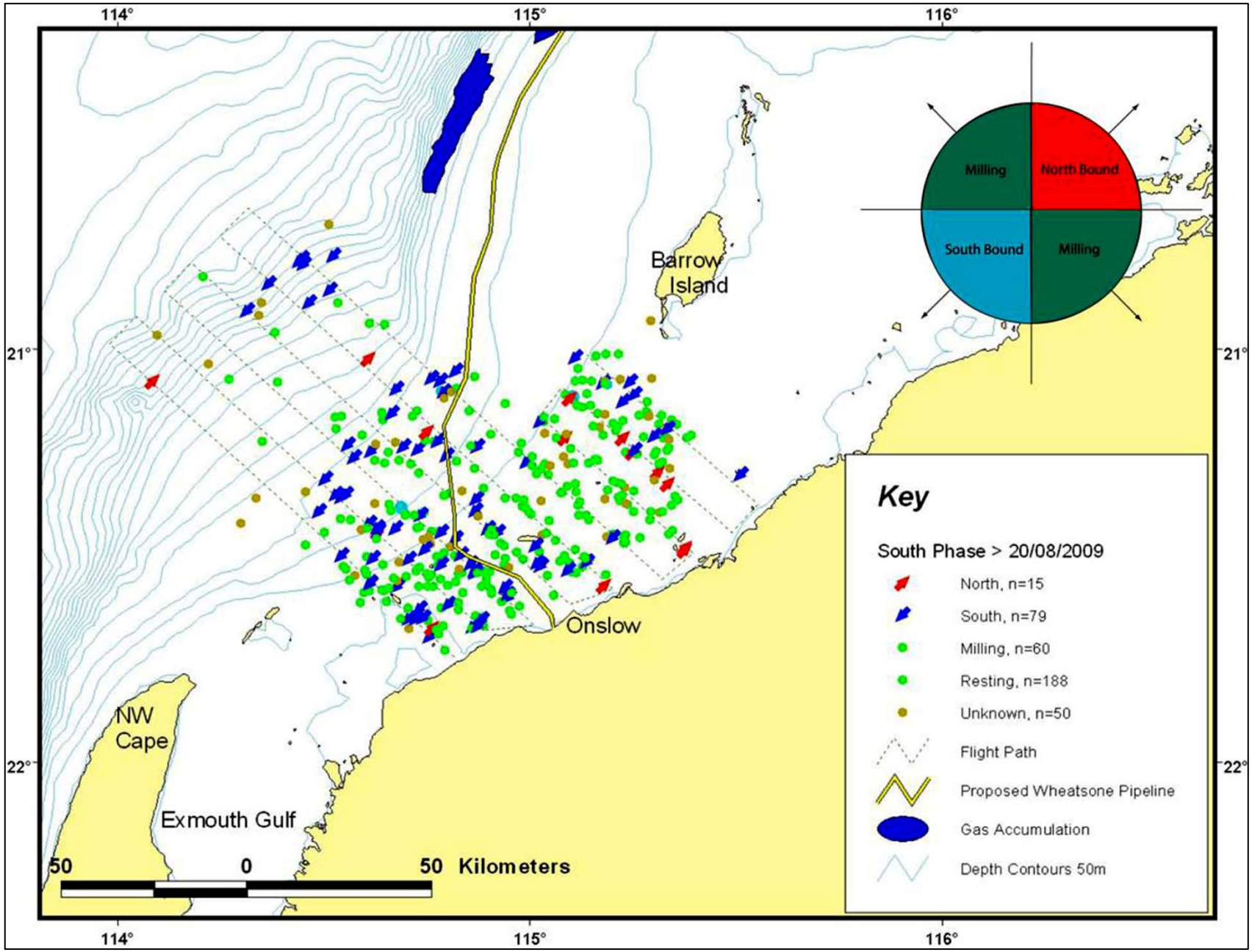


Figure 9: Swim direction of humpback whales during southern migration

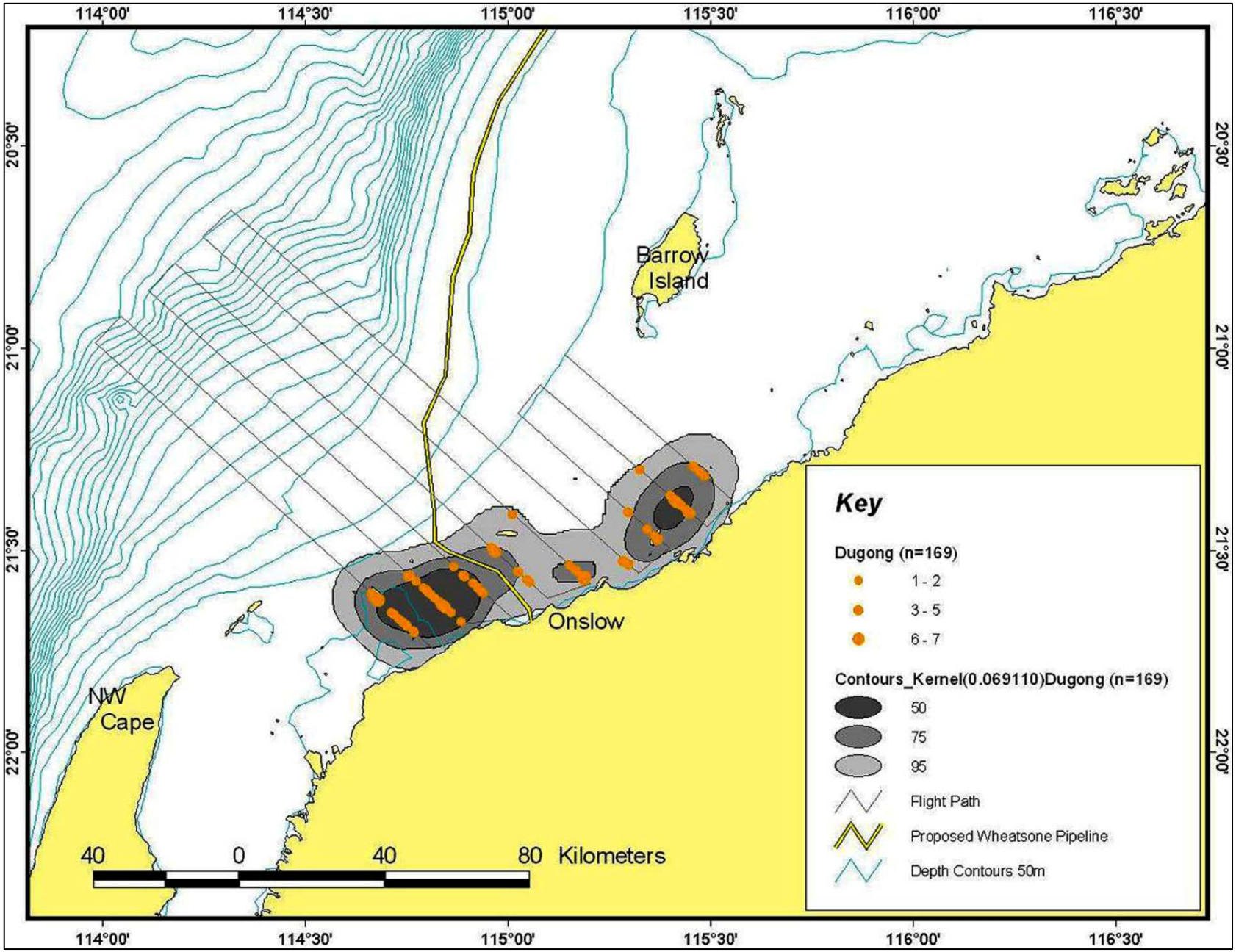


Figure 10: Distribution and relative density of dugong herds

Due to the short duration of the two day dugong survey and methodology limitations the survey report may not achieve the objectives of the survey which were to:

- quantify dugong abundance and distribution within the proposal area and in Exmouth Gulf as a regional comparison; and
- identify aggregation areas.

The two day survey found that the absolute abundance of dugongs within the proposal area was 287.

The survey undertaken by the Centre for Whale Research used survey methodology suitable for large mammals and not dugongs. Although this survey may not provide accurate numbers as the observation conditions where suited to whales not dugongs, the long-term nature of the survey provides a better indication of the expected presence and distribution of dugongs in the proposal area. The survey recorded 169 dugongs, including cow/calf pairs, and the distribution and relative density of dugongs shown in Figure 10: Distribution and relative density of dugong herds. Dugongs are reliant on seagrasses as a primary food source. The proposal would result in the predicted permanent loss of 10 ha of seagrass and temporary loss of up to 50% of 2963 ha, however, there may be additional unmapped seagrass resources lost.

Potential impacts to dugongs are mortality, behavioural change, loss of habitat and displacement from feeding areas. These impacts could occur from vessel strikes, loss of BPPH due to dredging activities, the physical presence of infrastructure, noise impact due to pile driving, blasting and dredge/construction vessels, and loss of water quality due to dredging and discharges to the marine environment. The proponent considers the residual risk to all marine fauna from the loss of BPPH to be very low.

Dolphins

A total of 1681 dolphins were sighted during the survey by the Centre for Whale Research but were not identified to species level due to difficulty in identification. Dolphins were likely to either be nearshore (<50m) species including *Tursiops spp*., *Sousa chinensis* or *Orcaella spp*. and the offshore species may include *Tursiops spp*. and *Stenella spp*. (Jenner and Jenner, unpublished data). Spatially, dolphins were predominantly sighted in the south western portion of the study area in water depths less than 50 m, although larger pods (>100 individuals) were sighted offshore.

Impacts to dolphins may be mortality and behavioural change. These impacts may be caused by vessel strikes, the physical presence of infrastructure, discharges to the marine environment and noise.

Turtles

Flatback and green turtles appear to be the main species in the proposal area. However, the Centre for Whale Research also reports hawksbill turtles in the mangrove creeks in the area and loggerheads have also been sighted. Turtle foraging was seen predominately in offshore reef

areas and was largely by juvenile green turtles (Figure 11: Turtle densities from vessel-based transect surveys in July-August 2009). Green turtles are known to feed on seagrass, algae and mangrove fruits and soft-bodied pelagic and benthic invertebrates. Flatback turtles are carnivorous and feed on soft-bodied invertebrates. Permanent loss of filter feeders from the proposal is estimated to be 2272 ha and temporary loss to be 1808 ha.

Flatback turtle nesting has been recorded at the beach west of the Ashburton River Delta and at Ashburton Island. Flatback and green turtle nesting occurs at Serrurier, Locker, Bessieres, Thevenard, Direction and Tortoise Island. Thevenard is a major rookery for the flatback turtle. Loggerhead turtle nesting has been recorded on Locker, Bessieres and Serrurier Islands. Medium density nesting was found on the east side of Ashburton Island, at Ashburton Delta beach, on the west side of Thevenard Island and the east side of Bessieres Island during a snapshot survey and census survey. High density green turtle nesting was found at Serrurier Island (Figure 12: Mainland and island turtle nesting beaches).

Six nesting turtles were tagged and tracked. One turtle was at the end of her nesting and moved out of the area. The other five showed a large amount of activity between Ashburton Delta beach and Ashburton Island and across the proposal area (Figure 13: Spatial Distribution of Flatback Turtles during the Internesting Period). The tracked turtles were also monitored for the proportion of time they spent on the seafloor in the proposal area. This could vary from 25% to 75% of the time they were in the area.

Juvenile marine turtles are likely to be found in large numbers in nearshore waters including tidal creeks, nearshore coastal waters and inlets.

Potential impacts to turtles are mortality from vessel and dredge impacts, displacement and behavioural change, and misorientation of hatchlings.

These impacts could result from vessel strike, loss of foraging habitat for juvenile turtles in creek areas and for all turtles on reef areas and in filter feeder communities, noise impacts, dredge entrainment and light impacts. The proponent considers the residual risk to turtles from dredge entrainment to be low and from light impacts to be low.

Direct impact mortality

The greatest period of vessel movements would be during the construction phase, which would take approximately three to four years to complete, and require a large number of vessels. The use of an offshore accommodation vessel to accommodate workers would increase the amount of vessel traffic in the proposal area.

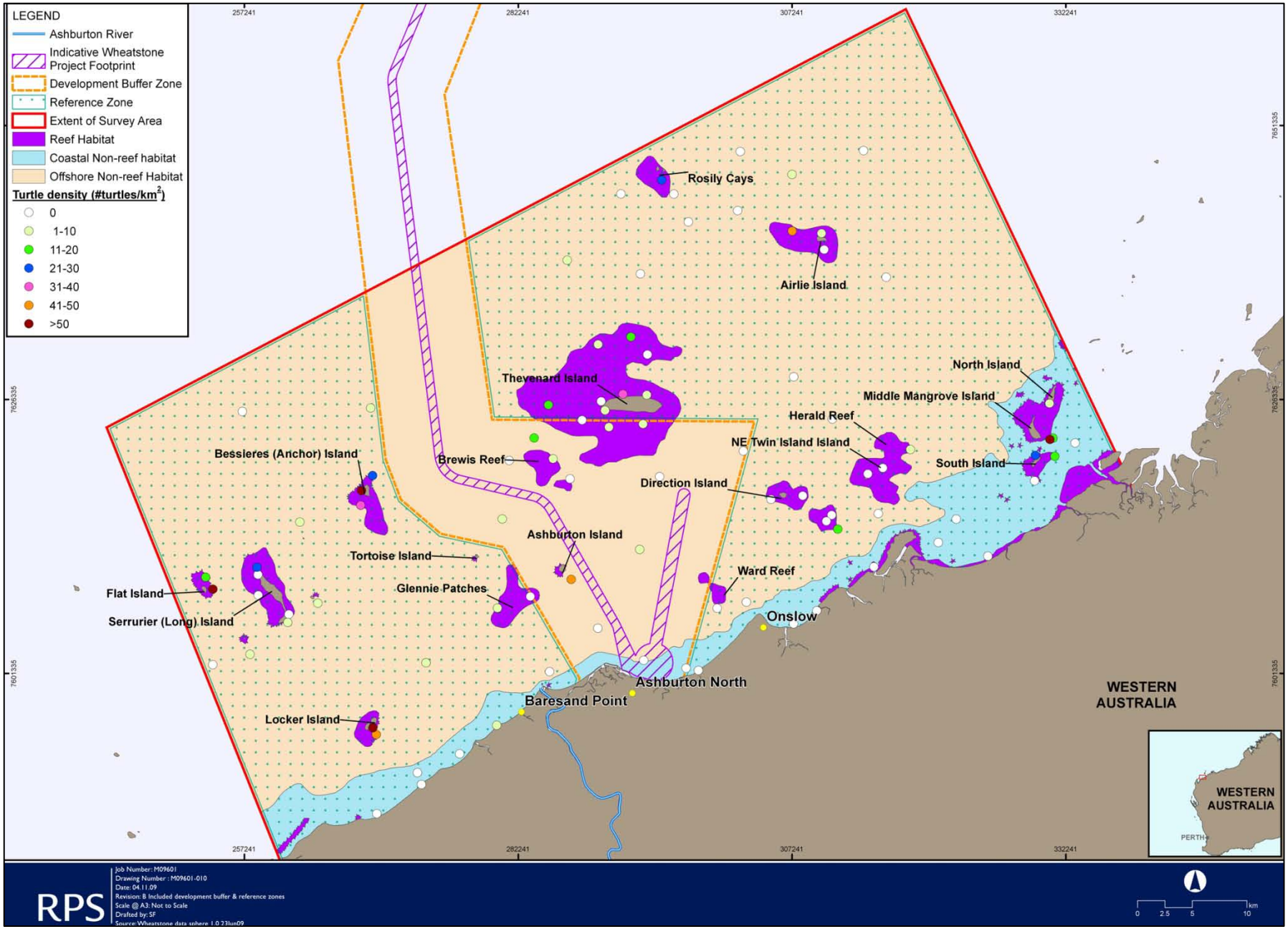


Figure 11: Turtle densities from vessel-based transect surveys in July-August 2009

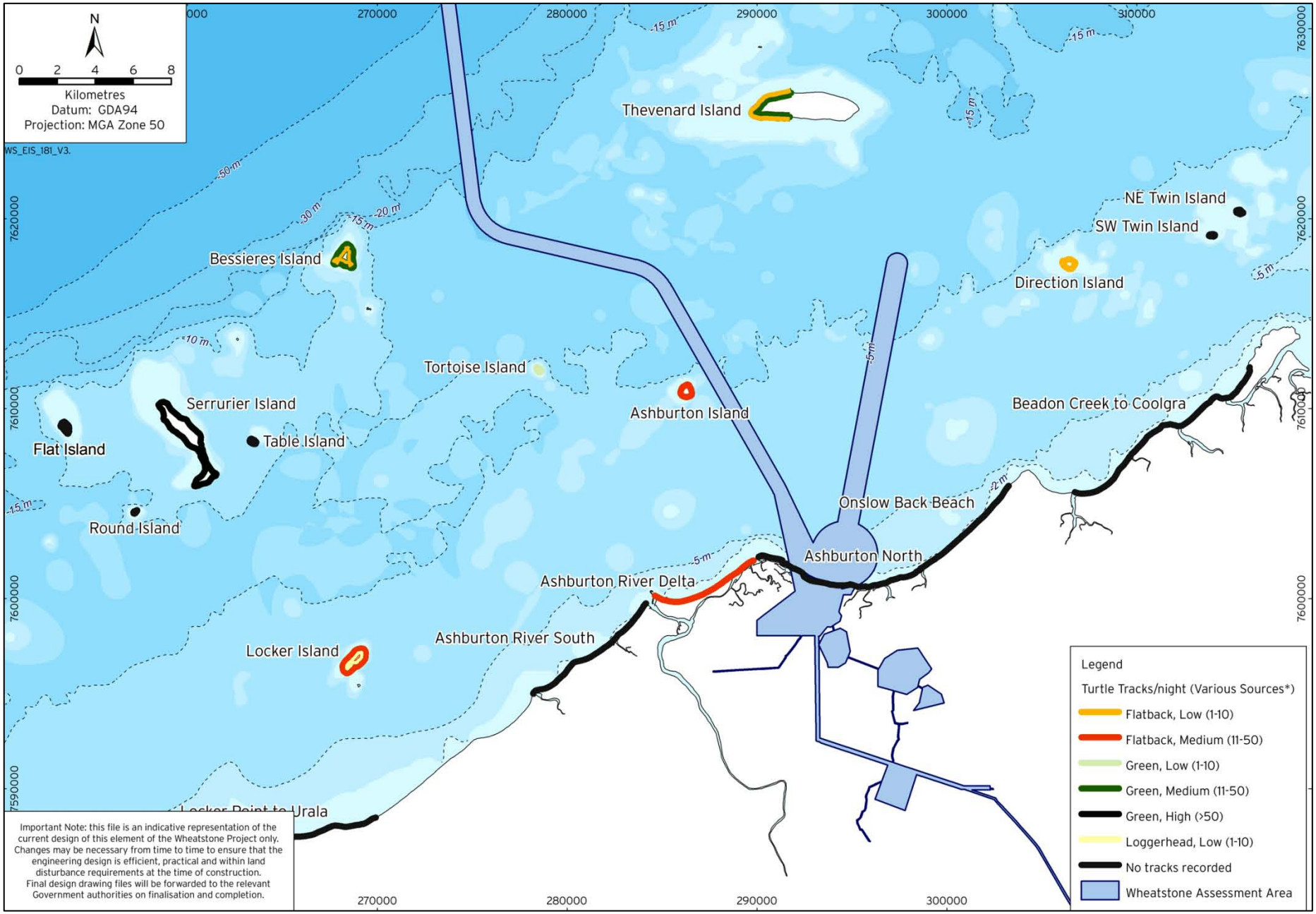


Figure 12: Mainland and island turtle nesting beaches

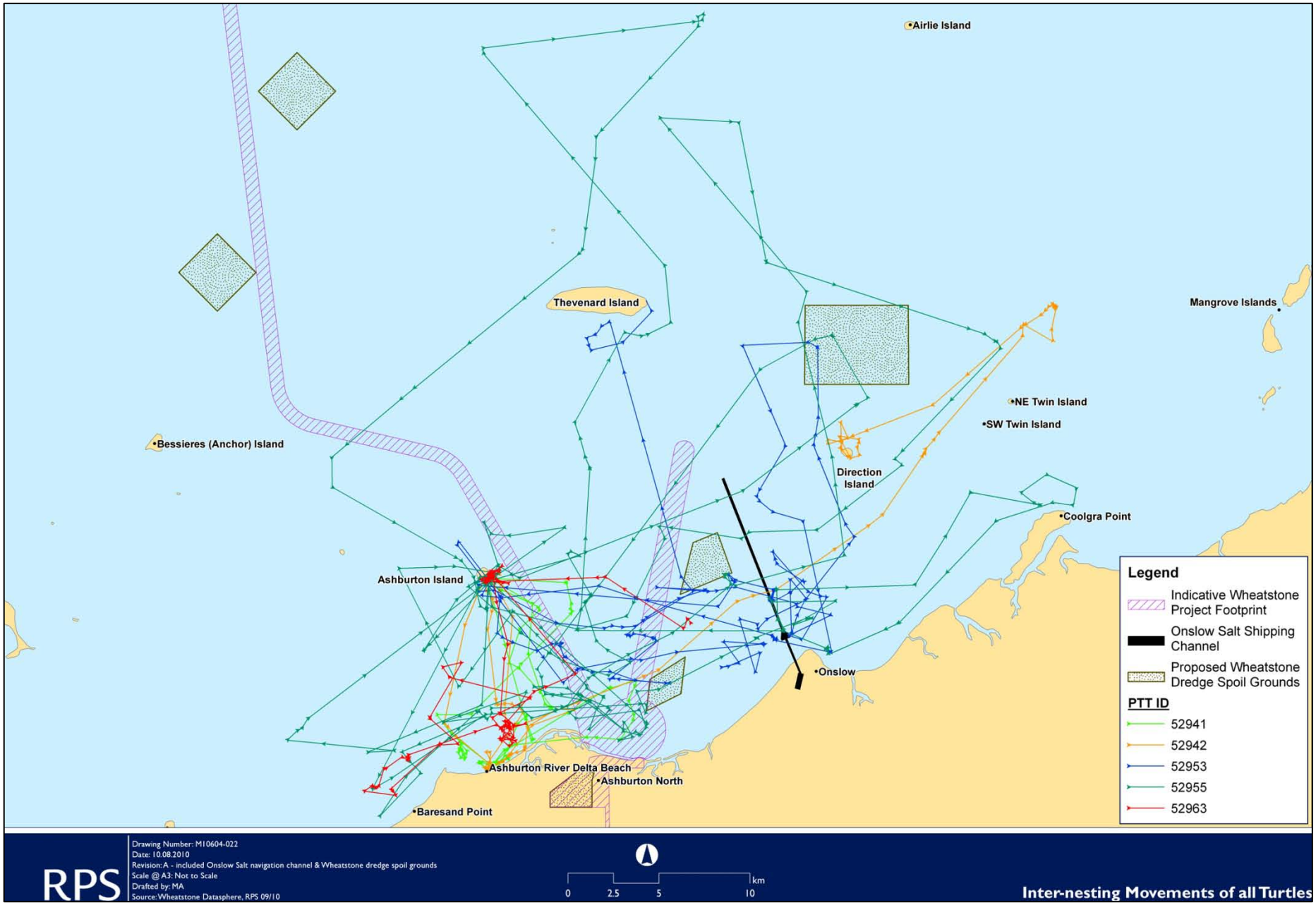


Figure 13: Spatial distribution of flatback turtles during the internesting period

Humpback Whales inhabiting the area could be vulnerable to injuries or death from collisions with vessels due to their tendency to travel or rest on the sea surface.

Based on the humpback whale surveys (Chevron, 2010) approximately five per cent of animals come within 10.5 km from the coast. The proponent considers that as the area of highest construction vessel activity would be restricted to approximately 15 km from the coast, only a small proportion of the migrating whale population has the potential to be affected. The large construction vessels mainly produce low frequency sounds which propagate well through the water, giving the animals time to avoid them. However, collisions between whales and dredge vessels have been previously reported (Best et al. 2001, Jensen & Silber 2004, quoted in Chevron, 2010). It is unlikely that whales would be affected by vessel movements during the early part of the season, when the distribution is located offshore. Whales making their return journey southward from the calving grounds would be, however, more likely to come close to shore. As such they are far more likely to encounter vessels associated with the dredging and construction of the proposal. Calves spend longer at the surface and are usually accompanied during these surface intervals by their mothers (Laist et al. 2001, quoted in Chevron 2010) increasing the time that they are susceptible to a collision, but also increasing their visibility to vessel operators. Avoidance of vessels may cause the animal to use extra energy which may be of importance to whale mothers and calves.

The container vessels that would deliver plant and construction materials may have sufficient speed not to be detected by large cetaceans before collisions occur. In the case of large cetaceans, the probability of a lethal collision increases with speed.

Dugongs inhabiting the area could be vulnerable to injuries or death from collisions with vessels due to their tendency to travel or rest on the sea surface. However, dugongs and dugong habitat have not been found to be restricted to or concentrate within proposed areas of highest construction vessel activity (Figure 10). The proponent considers that recreational boating poses a greater risk of injury or mortality to dugongs than construction vessels.

Dolphins are susceptible to strike from fast moving vessels.

Turtles are also susceptible to vessel strike when travelling on the surface. The risk to turtles increases with the speed of the vessel with most turtles unable to flee from boats travelling at 10 knots.

Management for direct impact mortality

The proponent proposes that the management of vessel interactions with cetacean, in State waters as well as Commonwealth waters, would be in accordance with the requirements for cetacean interactions specified under Part 8 of the EPBC Regulations 2000, the Australian National

Guidelines for Whale and Dolphin Watching and the State Wildlife Conservation (Close Season for Marine Mammals) Notice 1998, with the whale zones applied also to dugongs and the dolphin guidelines to turtles. The proponent would undertake the following measures, in addition to those required under the Commonwealth guidelines:

- implementation of designated vessel corridors that avoid highest densities of known turtle and Dugong use, particularly in the zone of "highest level of construction vessel activity";
- making available mapping of designated navigation areas and coordinates of marine fauna habitats to vessel masters;
- operators of specified vessels having on duty crew members that have undertaken the Marine Megafauna Training and Induction during daytime marine operations and vessel movements;
- standardised immediate informing of the vessel master should marine fauna of conservation significance be sighted within close proximity to or within the navigational path of an approaching vessel, with reasonable efforts made to avoid collision; and
- vessel logs to be maintained to record marine fauna sightings.

The following are examples of management procedures that may be considered in the event that an injury or death of marine megafauna occurs attributable to Project-related vessel movements:

- if marine megafauna are sighted, relevant vessels operating in the area may be notified and the behaviour and direction of animal(s) may be monitored and recorded; and
- caution and no-approach zoning may be reviewed and distances increased.

Displacement and behavioural change

Displacement and behavioural change may result from the physical presence of infrastructure, loss of habitat or noise impacts, particularly piling and blasting, should blasting occur.

Physical presence of infrastructure

No narrow movement corridors or migration routes have been identified in the areas where infrastructure has the potential to form a barrier to established patterns of fauna movement. The proponent considers that mobile fauna would readily swim around barriers in the sea and is at low risk of impact from the infrastructure. It is possible that there may be localised, long-term displacement of marine fauna (including protected species such as Dugongs, dolphins and turtles) that swim along the coast. However, the proponent does not predict this would lead to injury or result in effects at a population level.

Loss of habitat

It is likely that dugongs would be the species most impacted by loss of habitat as seagrass is a primary food source for dugongs. Due to dredging and spoil disposal it is predicted that 10 ha of seagrass would be lost permanently and up to 50% of the above ground biomass of an area of 2963 ha for 5 years. The area of high dugong density to the east

of Onslow is known to be coincident with seagrass meadow, part of which is predicted to be in the ZoMI, i.e. up to 50% of the area of seagrass in the ZoMI would be lost for up to 5 years. The area of high dugong density to the west of the proposal site is assumed to be coincident with seagrass meadow, although it has not been mapped as such (Figure 10). Part of this area is also within the ZoMI. As the seagrasses in the proposal area are ephemeral, hard to detect and subject to changes in location, the extent of seagrass is difficult to determine.

The proponent predicts that dugong would move to other areas to feed. However, for displaced species increased intra- and inter-specific competition could reduce the productivity and survival rates of the displaced species.

The disturbance of a small proportion of this habitat in the proposal area may have a short-term influence on the distribution of individuals while foraging. However, the proponent does not predict population level effects on dugongs.

Turtle habitat would also be impacted, however, the important reef areas around Thevenard and Ashburton Islands are not predicted to suffer any impact. Juvenile turtle habitat at Hooley Creek may suffer some impact.

Noise impacts

Humpback whales, dugongs, dolphins and turtles are susceptible to acoustic impacts from piling activities in nearshore areas during the construction phase. There is a possibility that blasting in the marine environment may be required. This could lead to displacement and behavioural change and in extreme cases, mortality.

The proponent has modelled noise impacts from pile driving (two pile drivers working simultaneously). The proponent has based one study of noise impacts on turtles as these were considered to be the most likely species in the vicinity. A second noise modelling study was carried out for humpback whales, dolphins and dugongs (Chevron 2011a Appendices FA and FL). The studies considered three impact zones from the noise source:

- Zone of Possible Physical Injury. In this area there is a possibility that the animal may suffer physical/auditory injury and/ or permanent hearing damage or hearing threshold shift (PTS);
- Zone of Possible Temporary Threshold Shift (TTS). In this area there is a possibility that the animal may suffer TTS; and
- Zone of Possible Behavioural Disturbance. In this area there is a possibility that the animal may experience hearing masking and/or behavioural change and/or avoid the area.

Behavioural responses of marine animals to underwater noise encompass all behavioural reactions and responses. These may be:

1) reflex responses that an animal would exhibit regardless of the noise stimulus;

2) alert responses or some avoidance, for example, that reflect an animal's awareness, and animals might experience hearing masking at this response level;

3) sub-lethal responses encompass the full range of observable symptoms of acute or chronic stress in individual animals that can disable an individual animal but do not kill the animal. Sub-lethal responses include increased respiration (for example, increased surfacing rates in aquatic mammals), reductions in an animal's foraging activity and foraging success, reduced body condition and reduced growth rates (which can result from reduced foraging success, but can also indicate physiological stress), reduced fecundity and reduced reproductive success (which can result from any of the other sub-lethal responses).

The behavioural disturbance concerned in the studies is based on animals' behavioural responses to underwater noise at some stages of the second response level.

For turtles the proponent found that the model results suggested that physical injury or hearing damage of turtles could occur within a 10 m range for adult turtles and 25 m range for hatchlings of piling activities and that behavioural disturbance for adult turtles could occur within a 700 m range. Behavioural disturbance for turtle hatchlings was not considered, as hatchling movements in the nearshore area are predominately determined by tides and currents. However, as a precautionary approach it was recommended that the zone of behavioural disturbance estimated for adult turtles was applied to turtle hatchlings. It should be noted that these distances were determined for a single hammer strike.

The second study for humpback whales, dugongs and dolphins considered exposure time to the piling noise. A complete piling operation was considered to take up to three hours. The proponent found that for an exposure duration of three hours, for humpback whales, dugongs and dolphins the possible physical injury zone was 400 m, the temporary hearing threshold shift (TTS) zone 2600 m and the behavioural disturbance zone 6 km.

The proponent has proposed:

- a Marine Fauna Observation Zone: The movement of marine megafauna sighted within 1500 m of the pile-hammer during or immediately prior to commencement of piling operations would be monitored;
- if a whale is present within the Marine Fauna Observation Zone for 30 minutes then pile driving activities would cease;
- a Marine Mammal Suspension Zone: Pile driving activities would cease if marine mammals are observed within 500 m of the pile hammer; and
- a Turtle Suspension Zone: Pile driving activities will cease if turtles are observed within 100 m of the pile hammer.

The proponent might need to use blasting as part of the dredging operation. However, there is a lack of detailed geotechnical data in some areas of the proposal and therefore the proponent is unable to be sure if and where blasting would be required.

Management of habitat loss and noise impacts

Physical presence of infrastructure

The presence of infrastructure for the port cannot be avoided. The port has been sited, as far as practicable, in an area of less density BPPH on the seabed and is, therefore, less likely to be frequented by marine fauna.

Loss of habitat

The proposed management for benthic habitat has been described in section 3-1.

The proponent proposes to monitor only coral for reactive management and does not intend to monitor seagrasses "reactively", i.e. seagrasses would not be monitored during dredging and dredging practices changed if impacts were greater than predicted. The proponent proposes that to infer whether dredging has been the cause of any changes observed, a before-after/control-impact sampling design would be used that incorporates suitable control and impact sites.

Following the guidance of EAG 3 (EPA 2009b), where permanent impacts are found to extend beyond approved limits (beyond the boundary of the Zone of High Impact) the likelihood of recovery of seagrass communities and BPPH would be assessed through the following measures:

i) the presence of seagrass seeds would be assessed through grab samples in areas where impacts have occurred to determine the possibility for recovery; and
ii) the particle size distribution of sediments would be assessed in areas where seagrass have been impacted to determine whether BPPH has been altered and is likely or unlikely to support recolonisation by seagrasses.

The proponent does not propose to monitor filter feeder communities reactively. Filter feeder cover would be assessed along representative transects radiating outwards from the dredging footprint within the Zone of High Impact and Zone of Moderate Impact. Data collected using this method would be used to infer the spatial extent of permanent impacts to filter feeders and to assess the predicted impacts from the dredge plume. If permanent impacts are detected within the Zone of Moderate Impact, transects would also be assessed within the Zone of Influence to determine whether any impacts to filter feeders have occurred.

Noise impacts

The proponent has committed to:

- conducting validation of the acoustical modelling;
- commencing piling operations with a slow start/partial strike to encourage marine fauna to leave the area;

- management zones as detailed above; and
- applying observation and suspension zones to each active pile driving operation, in the case of concurrent pile driving activities.

At this stage, drilling and blasting activities are not a component of the dredging and consequently potential environmental impacts, management and monitoring associated with drilling and blasting activities are not addressed.

In the event that drilling and blasting activities are required the associated impacts would be managed in a separate management plan.

Loss of water quality due to marine discharges and spills

Discharges to the marine environment

See section 3-1 for a description of discharges to the marine environment.

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The discharge of toxic substances to the marine environment can impact marine fauna indirectly through degradation of water and sediment quality. Toxic contaminants can bioaccumulate in water and in sediments which can affect the availability of suitable habitat, refugia and food. Marine fauna can also be affected by the direct ingestion of toxic substances which can result in injury and sometimes mortality (Chevron, 2010).

Nearshore wastewater streams discharged are likely to contain contaminants that could be toxic to marine fauna if present in high concentrations or exposed for long periods. Given that the toxicity of a mixture depends on the total concentration of bio-available contaminants in the water, the potential toxic effects have been considered for each outfall location. Toxic effects to marine fauna would generally be managed by treating waste discharge according to government regulations. The sand/silt substrate in the vicinity of the outfall at the PLF is well represented regionally and sensitive or protected marine fauna species are unlikely to be restricted to this location. Furthermore, the proponent considers that marine fauna that are likely to be present in the vicinity of the outfall on the PLF are considered widespread in the Pilbara region. Any toxic effects that do arise from the discharges would be localised to the area at or immediately surrounding the outfall location (Chevron, 2010).

Following the implementation of appropriate management (and contingency plans) it is possible that discharges into the nearshore marine environment may have toxic effects on marine fauna. The proponent considers the residual environmental risk for this as very low, as all discharges would be treated to within acceptable limits prior to discharge.

Hydrocarbon leaks and spills
The impact of hydrocarbon spills on the marine environment is discussed in sections 3-1 and 3-2. There would be the potential for large areas of the marine environment to be impacted by spills and subsequently the marine fauna in these areas.

Management of marine discharges and spills
Discharges to the marine environment
The proposed management for discharges to the marine environment is addressed in section 3-1, Sub-tidal benthic habitat.

Hydrocarbon leaks and spills
The proposed management for hydrocarbon spill in the marine environment is addressed in section 3-1, Sub-tidal benthic habitat.

Impacts specific to turtles
Dredge entrainment
Marine fauna are only at risk of being entrained in the dredge when they are directly beneath the drag-head when the drag-head is on the sea-bed. If the drag-head is raised above the seabed, fauna in the water column, that are not strong enough to swim away, may also be entrained if the pump continues to run while the head is lifted. Based on information from the US Army Corp of Engineers, the proponent concludes that there is very little suction around the edges of the drag-head beyond approximately 1 m. The proponent considers that large fauna such as adult turtles are generally strong enough swimmers to escape the dredge suction and reduce their risk of entrainment (Chevron, 2010). Despite their larger size, inter-nesting flatback turtles are considered to be at risk of entrainment during Project dredging because they rest on the seabed. A tagging survey of five nesting turtles has shown that they can spend between 25% and 75% of the time on the sea-bed.

Smaller species and individuals can become entrained in the slurry sucked into the drag-head. Juvenile and sub-adult sea snakes and marine turtles are at greater risk of entrainment than adults. The movement of juvenile turtles outside of and/or between the offshore reef habitats is not well understood.

It is considered possible that a small number of turtles may become entrained in the dredge in the course of the dredging program. The significance of these deaths to the local populations is uncertain at present. However, based on evidence from the Port of Brisbane Corporation, the proponent considers that rates of entrainment are generally low, even when TSHDs are in use.

Anecdotal evidence from other parts of the world suggests that marine turtles may use the sheltered habitats created by shipping channels and thus may be susceptible to entrainment during the maintenance dredging of the channels. However, given the low densities of turtles in the area,

only a small proportion of the population would be affected. Maintenance dredging would occur over a shorter period and cover a smaller area and is considered to pose a lower risk to marine turtles than construction dredging.

Light impact

Light would be emitted from the proposal site, including from the MOF, PLF and the offshore accommodation vessel, during construction, during normal operations and during flaring. The light would be in the form of light spill and also sky glow.

Attraction to artificial lighting has the potential to affect marine turtle hatchling behaviour through interference with sea-finding behaviour and/or open-ocean finding ability. Lighting may also deter turtles from nesting. The closest nesting in the vicinity of the Ashburton North SIA is by Flatback Turtles at the Ashburton River Delta beach and Ashburton Island (approximately 4 km and 12 km from the Ashburton North SIA, respectively). It is nesting turtles and hatchlings that emerge on these beaches that are at greatest risk from the proposal light emissions.

Construction light impacts

Construction of the MOF and PLF would take approximately three years to complete and during peak periods would occur 24 hours per day. For safety reasons, night time construction would require high lighting levels. Construction lighting typically comprises bright white lights (metal halide, halogen, mercury vapour, fluorescent). The wavelengths of these lights are those found most attractive to hatchlings.

Installation of the trunkline would require construction and support vessels to be lit at night, however this activity would occur only once, and be of short duration at any given location. Light emissions from the pipelay vessels are likely to be visible on the northern, eastern and southern beaches of Ashburton Island while the vessels are working within 5 to 10 km of the island. However, given that pipelaying in the vicinity of Ashburton Island would be of short duration, the proponent expects light emissions from the trunkline laying vessels not to have a significant impact on hatchlings at Ashburton Island. The proponent considers that any nesting turtles that are disturbed from the vessel lights could potentially relocate to nest on another part of the island that is protected from the light spill.

The proposed offshore accommodation vessel would be a source of impacts. The offshore accommodation vessel would be used during the dredging program and would operate 24 hours a day, seven days a week for the duration of the 4 year marine construction program. The offshore accommodation vessel lighting could potentially be seen at nesting islands and could deter nesting females and misorientate hatchlings. The lights on the offshore accommodation vessel could also attract marine turtle hatchlings and seabirds/shorebirds, making them vulnerable to predators.

Operation

Light spill modelling of operational plant lighting demonstrates that, during normal operation (including the pilot light on the flare), the islands in the vicinity of the Ashburton North SIA would not be directly illuminated above levels of ambient starlight during a new moon. Sky glow from the Ashburton North SIA may be visible up to 50 km offshore, which includes all islands and mainland beaches between the mainland and Flat, Thevenard and Twin islands, but the expected luminance levels are very low. Hatchlings emerging from nests on the southern side of Ashburton Island may be attracted to the sky glow emanating from the proposal area; however the orientation of these hatchlings would be toward the ocean. Once the hatchlings reach the ocean, the proponent predicts that the light would become less visible and natural navigational cues, such as wave direction and alongshore currents are expected to over-ride potential attraction to sky glow.

Sky glow from the Ashburton North SIA may be visible at the Ashburton River Delta nesting beach, however hatchlings on this beach are not expected to be attracted to sky glow as the intensity of light is expected to be less than 0.001 Lux.

It is possible that some hatchlings at the Ashburton River Delta beach, upon reaching the water, would be attracted to the PLF or ships. However, this beach forms a shallow bay that shields the view of the PLF and the far eastern end of the beach (closest to the proposal area) gradates into a mangal that is unsuitable for nesting.

Flaring

Flaring is expected to occur periodically during operations. Light spill modelling undertaken within the proposal area indicates that, under worst-case conditions, light from the dry/wet flares could be perceived by a turtle approximately 8 km away as an object equivalent to the moon, although the risk of attraction to the flare increases during periods of low natural lighting (e.g. new moon). Hatchlings on Ashburton Island would be beyond the known range of effect for flaring light (Pendoley 1999, quoted in Chevron 2010).

The nesting area on the Ashburton River Delta beach is expected to be subject to flare light at intensities of up to 0.07 Lux or less from the dry/wet (and marine flare) because the first dune crest is of sufficient height to shield the area from direct light. No level of light attraction has been established for flatback turtles, however, light has been demonstrated to affect green turtle hatchling behaviour at 0.05 Lux. The spectral characteristics of flare light (i.e. higher wavelengths) means it is less attractive to flatback turtle hatchlings.

Maximum Lux perceived as a result of sky glow by a turtle hatchling in the modelled domain occurs at a point approximately 3.4 km from the flare. This would reach the nearshore area of the Ashburton River delta beach.

The maximum intensity of the sky glow is computed as being approximately 0.00001 Lux (Chevron 2010) and is one order of magnitude less than the light produced by Sirius and thus would not affect hatchlings or nesting adults.

Management for dredging impacts to turtles

As discussed in the previous section the proponent proposes to manage dredging impacts by having observation zones for fauna during dredging. In addition for turtles:

- when operating with less than 5 m under-keel clearance, the dredge would initially move slowly through the area before commencing dredging so that the noise and vibration alerts marine turtles in the vicinity and encourages them to leave. This would only be applied on dredging in new areas and not once the work area has been established;
- dredge pumps would be stopped as soon as practicably possible after completion of dredging and where practical the draghead would remain within 0.5 m of the seabed until the dredge pump is stopped;
- tickler chains on the draghead of the TSHD would be used as a management mitigation approach to reduce turtle entrainment;
- when initiating dredging, suction through dragheads would be initiated just long enough to prime the pumps, prior to drag heads engaging the seabed;
- overflow screens would be used on TSHDs to visually assess for turtles and turtle remains associated with entrainment during dredging; and
- all incidents involving turtles would be investigated and reported and adaptive management instigated if necessary.

Management for lighting impacts to turtles

Mooring at night would not take place during November to April, the turtle nesting season, within 1.5 km of nesting beaches. This distance is based on guidelines for visitors to Lady Musgrave and Lady Elliott Islands in the Great Barrier Reef World Heritage Area.

Impacts specific to sawfish

The green sawfish, *Pristis zijsron,* has been identified as occurring in lagoons of the Ashburton Delta and Hooley Creek and it is possible that the dwarf sawfish, *Pristis clavata* is also present. The proponent is proposing to undertake a sawfish tagging study in the proposal area aimed at assessing habitat utilisation and site fidelity. This would not be completed in the assessment timeframe.

A sawfish survey will be undertaken in summer 2011. Dr David Morgan (Murdoch University) who will lead the sawfish survey has indicated that summer is a suitable period for the survey because pups and adults are likely to be present during this period. One reason why sawfish have not been observed at the proposal site during December, January and February is that the proponent closes the site during the cyclone period

and/or following flooding. Although the sawfish survey has not been completed, the proponent has prepared a management framework to limit project-related impacts to sawfish. The framework is presented in the Marine Fauna Management Plan. The primary management action to protect sawfish in the proposal is to ensure no permanent impacts to potential critical habitat, such as Hooley Creek and the Ashburton Delta. However, some habitat might be lost in the Hooley Creek area.

Management for sawfish

The proponent proposes that management for sawfish would include:

- defining the critical habitat for sawfish and trying to avoid impacts to sensitive habitat as far as practicable,
- managing construction impacts;
- managing coastal processes;
- dredging and material placement would be conducted during favourable weather, tide and current conditions, as far as reasonably practicable, to reduce the risk of impact to marine fauna while in close proximity to sensitive areas;
- dredge and spoil management, including the use of tickler chain to reduce risk of fauna entrainment;
- in event of mortality, revision of existing management controls would be undertaken to investigate additional procedures; and
- crew would receive training, which would include details on procedures in the event of sighting, injury and/or death of protected marine fauna

Other species

Whale sharks

During the Centre for Whale Research surveys krill swarms were sighted in shallow waters (<50 m) during several months and at times whale sharks, which are krill predators, were also sighted. Whale sharks therefore may occur in the proposal area occasionally and would be at risk of vessel strike. Whale sharks may also be impacted by vessel noise, but are unlikely to be far enough in-shore to be impacted by pile driving noise.

Management for Whale Sharks

It is possible that whale sharks may be present in the proposal area in very low densities. There are no aggregation sites. The risk to this species is therefore, considered to be low by the proponent and they have not been included in the MFMP. Should a whale shark be sighted then management procedures as for dugong in the MFMP plan would be invoked.

Fish species

The proponent has provided very little information on fish in the proposal area, except for prawns (section 3-8 Tourism and fishing related industries). There are BPPH surveys but no information on uses of the various areas by fish and which may be critical areas for breeding, etc.

Regular evening fish choruses were heard at the 43 m depth nearshore site (expected regular demersal species) but not at a 10 m depth site.

The main impact on fish and fish stocks is likely to be from increased recreational fishing, both from personnel engaged in the proposal and from vessel crews of vessels using the port (section 3-7 Recreation and aesthetics). Impacts may also arise from entrainment in intakes of small species or larvae and from waste discharges.

Management for other species

The proponent proposed that intake pipes would have multiple screens to prevent entrapment of marine fauna in seawater intakes. Intake rates would be designed to meet a flow velocity at face of less than 0.15 m/s.

For management of waste discharges, see section 3-1 and for management of recreational fishing, section 3-7.

Introduced marine pests

The proponent has proposed the following management of the risk of introduced marine pests:

- all dredging and support vessels would be subjected to a risk assessment to assess whether the vessel presents a low, high or uncertain risk of acting as a vector for IMP. The risk assessment would be based on the vessel's recent history and origin, recent inspections, anti-fouling coating status and whether it would be undertaking a direct sail from its point of origin;
- all dredging and support vessels determined to be of uncertain or high risk would be subjected to a pre-mobilisation inspection and would not be mobilised until determined to be a low IMP risk;
- all dredges would comply with the Australian Quarantine Regulations 2000 and with the AQIS mandatory ballast water requirements; and
- in the event that IMP are identified on the dredging or support vessels during the arrival inspection or at any time while the construction vessel is on site:
    - the Department of Fisheries (DoF) and the DEC would be notified.
    - the dredging or support vessel would be moved offshore as soon as practicably possible. Within vessel operating constraints, the construction vessel should be moved to offshore waters, greater than 12 nm from shore or to a water depth greater than 50 m.
    - the dredging or support vessel would not be permitted to return to site until it has undergone treatment and re-inspection to confirm that the vessel is a low risk. The mobilisation procedure described above would be required to be followed including the mandatory arrival inspection with 48 hours of arrival on site.
    - a detailed response plan including monitoring and control measures would be developed and implemented. This plan would aim to determine if the identified species has become established and if measures to control the species are required.

Submissions

The EPA considered the following issues raised by submitters of high environmental significance. Full summaries of submissions can be found in Appendix 3. Note that some issues raised by submitters have been addressed by the proponent.

The **DEC** expressed concerns about :

- the loss and mortality of BPPH supporting dugongs and turtles;
- direct impacts to marine fauna;
- offsets for residual impacts.

The DEC recommended:

- further surveys for presence and significance of population and habitat of the green sawfish;
- improved dredge management measures to prevent impact to marine turtles;
- for dugongs, marine observers on all vessels during construction and funding of further studies of dugong occurrence and movements;
- a fauna management plan for vessel movements including specified measures;
- underwater blasting be excluded from assessment; and
- a light management plan including baseline data, zero light horizon, hatchling orientation studies, contingency measures and no light spill on turtle nesting beaches for trunkline.

The **DoF** raised concerns about:

- the methodology of the survey of Hooley Creek and north-eastern lagoon of Ashburton delta;
- the risk of introducing marine pest species which is high; and
- all vessels for the project being risk assessed for biosecurity.

The **CCG** had concerns about dugongs, relating to loss of seagrass habitat, the limited surveying for dugongs and their use of the area, risk of impacts from vessels and acoustic impacts and cumulative impacts of regional dugong displacement.

The CCG also had concerns about

- cumulative risk to flatback hatchlings,
- sky glow and impact to hatchlings;
- that further information was needed on fauna observers; and
- that the proposal does not address planning of activities with respect to migration patterns for marine species.

The CCG also recommended:

- having a system to safeguard against marine pests, bacteria, viruses and parasites.

Assessment

The EPA's environmental objective for this factor is to maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

The EPA notes that the following additional studies and reports are proposed but would not be completed prior to the EPA reporting to the Minister for Environment:

- Sawfish occurrence and habitat utilisation study (Report submission: September 2011);
- Seasonal baseline seagrass study (Report submission: September 2011) and
- Turtle hatchling behaviour baseline study (Report submission: September 2011).

These studies would address some of the concerns raised by the DEC, the DoF and the CCG.

The EPA notes that the proponent considers the residual risk of many of the proposal-related impacts to marine fauna to be low or very low. However, there are a number of protected species in the proposal area that are likely to suffer some impact during the implementation of the proposal. The species are protected as there is already, or could be in the medium term future, a high risk of extinction of the species. The best possible management and avoidance of impacts to protected species is expected.

Direct impact mortality

The EPA notes that the greatest concerns relating to vessel-fauna collisions are for humpback whales during their southern migration period, dugongs in the proposal area and turtles. The Code of Practice for Sustainable Management of Vessel-based Dugong and Marine Turtle Tourism (Birtles et al. 2005, quoted in Chevron, 2010) recommends that vessel speed limits of five knots be implemented in areas where there is a high risk of collision with turtles. This supports the need for vessel speed restrictions, marine fauna observers and designated vessel pathways in habitats that support medium to high densities of marine fauna activity.

Taking note of advice from the DEC, the EPA recommends condition 10-1 which requires dedicated Marine Fauna Observers who are on duty during daylight hours and can move independently between work vessels. In addition condition 10-3 would require every vessel undertaking construction activities to have at least one crew member trained in marine fauna observations.

To further reduce the risk of collisions the EPA recommends condition 10-4 requiring work vessel speeds not to exceed 14 knots or a lesser speed designated by the Department of Transport or a Port Authority. This speed limit is designed to protect whales in particular and would not protect turtles. In addition as advised by the DEC, recommended condition 10-10 requires a Conservation Significant Marine Fauna Interaction Management Plan to be prepared and implemented which would have the objective of managing the project to detect and mitigate to acceptable levels impacts upon marine fauna. It was the EPA's expectation that this plan would have been completed during the

assessment of the proposal, but is to date 80% complete and has not been agreed by the relevant agencies.

Displacement and behavioural change

Loss of habitat

The EPA notes the proponent's assertion in the Response to Submissions that in the Scoping Document "only dugong distribution and abundance was required to be surveyed as part of baseline data collection surveys. Information such as dugong migration, behaviour and general ecology has been documented in a detailed literature review". This is incorrect as the Scoping Document Table 5.1 states under Marine Mammals "Repeat marine mega fauna aerial surveys conducted to assess migration and use patterns" as well as under Marina Fauna Assessment "Field surveys to assess critical species habitat, seasonal use".

Dugongs may be the species most displaced due to loss of seagrass habitat. The surveys of dugongs noted that dugongs were seen in areas not known to be seagrass meadows. It is possible, therefore, that the mapping of seagrasses in the proposal area is incomplete and the estimate of seagrass loss not accurate. Further baseline studies are required and the proponent intends to undertake these studies but the results would not be presented before the EPA reports to the Minister. In order to ensure that seagrasses do recover in the predicted time further studies should be undertaken during and post dredging (condition 7).

The EPA notes that the proponent has provided a briefing note, "Seagrass Dynamics and the Consequences of Seagrass Loss on Marine Megafuana" (Chevron, 2011c). In this briefing note the proponent clarifies that the loss of seagrass would be up to 50% close to the channel and less than 1% at the outer edge of the zone and would be a reduction of above ground biomass, not a total loss. Only some areas of seagrass would be impacted in some seasons due to the direction of the current. The EPA notes that the proponent predicts no impacts to rhizomes or seeds and no impact to the benthic habitat. The proponent also predicts that the seagrasses may recover within one to three years.

The EPA notes that the proponent provides the information that dugongs, turtles and bottlenose dolphins have large home ranges and do not aggregate in the impacted areas and therefore are unlikely to suffer significant impact from displacement. The proponent considered humpback dolphins and green sawfish at higher risk of displacement, but that the area of displacement would be insignificant when compared with the area of available habitat.

The EPA accepts that the site for marine facilities has been chosen to avoid areas of important benthic habitat as far as practicable. The EPA considers that with the implementation of the recommended conditions impacts to benthic habitat would be minimised and, while there may be a temporary impact to the abundance and geographic distribution of marine

fauna on a local scale, the EPA's objective for marine fauna would be met.

In order to further scientific knowledge of regionally critical habitat for humpback whales, dugongs and snubfin dolphins in Pilbara water the proponent has undertaken to provide a number of residual impacts and risk management measures for the proposal which are described in recommended condition 22 and schedule 3.

Noise impacts

Piling

The EPA notes the two site specific underwater noise modelling studies undertaken by the proponent since the release of the ERMP (Chevron, 2011a, Appendices FA and FL). The EPA notes that for an exposure duration of three hours for the piling scenarios modelled, for humpback whales, dugongs and dolphins the possible physical injury zone was 400 m, for TTS 2600 m and for behavioural disturbance 6 km from the source planned commencement.

The EPA notes that the proposed suspension zone for piling zone for marine mammals is 500 m and the observation zone is within 1500 m of an active pile hammer. If a humpback whale is in the observation zone for 30 minutes or more piling would be suspended until it leaves or has not been sighted for 30 minutes. The EPA notes that the same zones of possible physical injury, behavioural disturbance and TTS-onset apply to dolphins and dugongs, as well as humpback whales. The EPA, therefore, recommends condition 10-5 that no pile driving commences during daylight hours until it has been verified that there is no cetacean or dugong within 1500 m from the planned piling operation for 30 minutes prior to piling commencing.

The proportion of resting or milling pods (Figure 9) suggests that whales may be resting offshore of the Onslow area during their southern migration. Mothers and calves are of particular concern as humpback whales use complex vocalisations and it is possible that communication between mothers and their calves helps to keep them close together. The lack of understanding relating to whale communications does not allow a rigorous assessment of potential communication masking. Piling noise may cause disruption of mother and calf communications and stress to the animals. Both TTS-onset and behavioural disturbance may occur in the observation zone for marine mammals. At night it would be impossible to implement the 1500 m observation zone and even a whale at 500 m may not be seen. The EPA is strongly of the opinion that piling operations should be suspended at night during the peak southern humpback whale migration period and recommends condition 10-9.

The EPA also recommends condition 10-1 to observe and maintain a log of fauna behaviours, in particular any behaviours that could be interpreted as a display of disturbance or distress when fauna can be observed.

The EPA notes the proponent's commitment to management zones for pile driving and considers that a dedicated Marine Fauna Observer should monitor these zones. Condition 10-1 is recommended.

Appendix FA considers noise impacts to turtles but is for a single hammer strike only and not for piling of extended duration. The EPA notes that the proponent has not taken into account behaviour changes of turtles from noise which could occur at levels considerably less than those for hearing damage. The proponent has also not proposed an observation zone for turtles and the EPA recommends that condition 10-5 includes a 300 m observation zone for turtles. The EPA also recommends condition 10-1 to observe and maintain a log of fauna behaviours, in particular any behaviours that could be interpreted as a display of disturbance or distress which applies to turtles, as well as other marine fauna.

The EPA recognises that hatchling turtles and site attached fish would be unlikely to move away from pile driving operations. As the zone of behavioural change has not been predicted, the impact to nesting turtles is uncertain. The EPA recommends condition 10–10 for a Conservation Significant Marine Fauna Interaction Management Plan, which would include the identification of stressors to marine fauna (including noise) and management measures for avoiding or managing these stressors.

As underwater noise modelling contains some uncertainties the EPA recommends condition 10-16, requiring an Underwater Noise Monitoring and Review Program. This program would improve the knowledge of sound signals from pile driving and the accuracy of the current modelling and identify how the accuracy of modelling may be improved.

Blasting

The EPA notes that as it has not yet been established whether blasting would be required or not, or at what location it may be required, no management for blasting has been proposed. The EPA recommends condition 11 requiring a marine drilling and blasting management plan. This plan would need to be prepared in consultation with the DEC, DoT, DoF and the Commonwealth Department of Sustainability, Water, Environment, Population and Communities.

The proponent should note that the EPA recommends that blasting activities are timed to avoid the peak nesting/hatchling seasons for marine turtles and northern and southern migration for humpback whales.

Impacts due to marine discharges and spills

Marine discharges

Section 3-1 provides discussion of marine discharges.

The proponent considers the risk of impacts to marine fauna from marine discharges to be very low outside the 'mixing' zones, however, neglects to consider the impacts for which approval is being sought. Within the

zones of reduced ecological protection there would be impacts to marine fauna. Within the LEPA, large changes beyond natural variation in the natural diversity of species and biological communities, rates of ecosystem processes and abundance/biomass of marine life are permitted and the 80% species protection guideline triggers apply for potentially bio-accumulating toxicants in water.

Within the MEPA small changes beyond natural variation in ecosystem processes and abundance/biomass of marine life are permitted and the 90% species protection guideline triggers apply for potentially bio-accumulating toxicants in water.

While the larger, mobile marine fauna are unlikely to be significantly impacted by the marine discharges if they are managed to the limits recommended by the EPA, there is the potential for benthic communities and pelagic fish, if they remain for some time in the vicinity of the outfall, to be impacted. Of concern would be bio-accumulation of toxicants in fish that may then move up the food chain.

The EPA recommends condition 13 to limit the impact to water quality from discharges and hence any potential impacts to fauna. Condition 13-12 requires that the toxicity of the waste is predicted and whole of effluent toxicity testing is undertaken to determine the actual toxicity of the produced effluent at all outfalls to ensure that ecological protection zones are met.

Hydrocarbon leaks and spills
Hydrocarbons may impact all marine species and the EPA considers it essential that the proponent develop and implement a Marine Oil Pollution Plan (MOPP). However, there is adequate legislation for the requirement of this plan under the Petroleum Act and under DoT legislation. The EPA, therefore, does not recommend a condition under the EP Act.

The EPA also recommends that due to the very short time to the escape from the MOF of any spill near the MOF entry, adequate equipment to get at hand to boom off the entry within 30 minutes of the spill.

Impacts specific to turtles
The EPA notes that according to turtle surveys carried out by RPS (RPS, 2010a) the nesting beach at the Ashburton River Delta, with an estimated 21-34 tracks/night during the December peak, appears to support lower levels of flatback turtle nesting than Barrow Island, where an average of approximately 52 flatback turtle tracks/night has been recorded during the January peak (Pendoley Environmental 2008) and that densities of flatback turtle tracks on Ashburton Island in December 2009 were comparable with average densities of flatback turtle tracks on Barrow Island beaches during the January peak (52 flatback turtle tracks/night; Pendoley Environmental 2008). However, given the limited area of available nesting habitat on Ashburton Island, compared with Barrow

Island, the total number of turtles nesting is likely to be much lower on Ashburton Island. The EPA concludes that, although these beaches may not support the number of nesting turtles found on Barrow Island, they are not insignificant nesting beaches. As the surveys were undertaken at different times of the year it is difficult to make a direct comparison of importance. Mean flatback turtle hatching success (80.9%) at the sites surveyed in the proposal area was slightly lower than for Barrow Island (84.9% (Foster 2008)), but was still relatively high.

Dredge entrainment

The EPA notes that the tracking survey carried out by RPS (RPS, 2010b) found that "inter-nesting flatback turtles spent large proportions of their time at the sea floor and less time near the sea surface. There were no obvious areas where the turtles were more or less likely to spend time on the sea floor or near the sea surface". There is the possibility of entraining both adult nesting turtles on the seabed and hatchlings and it is appropriate that this risk be minimised through management.

The EPA notes that the proponent has agreed to many of the recommendations for entrainment management made by the DEC, including tickler chains on TSHDs and overflow screens. The EPA recommends that dredge entrainment be managed by the Conservation Significant Marine Fauna Interaction Management Plan required in recommended condition 10-10.

Light impact

The EPA considers that the management of artificial light impacts has not been adequately addressed in the proposal. It does not appear that EPA Environmental Assessment Guideline 5 (EAG 5) has been fully applied with respect to artificial light mitigation. One of the objectives of the guideline is to ensure that the design of new projects avoids and minimises to the fullest extent possible the deleterious effects of light. As the guideline states "the starting point for design should be to locate developments sufficiently far from the coast to ensure that lights (or light glow) are not visible from nesting beaches or the adjacent sea. Initial design of a new project which is visible from habitats used by nesting or hatchling turtles should start with zero artificial lights as the base case. Only essential lighting should be added to the design where absolutely necessary. This means that facilities near habitats used by nesting or hatchling turtles should not simply be based on designs acceptable elsewhere." There is no evidence that any planning for the minimisation of lighting for the facility or in the placement of flares has been undertaken.

Due to the longevity and long time until breeding commences of turtles, the effects of lighting impacts to turtles may not be evident until after the light is introduced and then after analysis of monitoring undertaken over a twenty year or more period. While the impacts of lighting from the proposal on turtles are uncertain, the proposal cannot be viewed in isolation. The Ashburton North area is designated as an industrial area

and more light sources would be added as the area is developed. Further development of the Onslow town site would also add to light impacts in the area. It is important that light from the proposal is minimised to reduce cumulative impacts.

Light impacts during the construction phase have also not been adequately addressed. Other than a statement that "light emissions from the pipelay vessels are likely to be visible on the northern, eastern and southern beaches of Ashburton Island while the vessels are working within 5 to 10 km of the island" (Chevron, 2010) there is no indication of the light emitted from all construction vessels and the anticipated impacts over the four year construction period. The only management proposed seems to be to turn off unnecessary lights and anchor vessels at least 1.5 km from turtle nesting beaches. The EPA does not consider the application of guidelines for recreational vessels to be applicable to construction vessels or offshore accommodation vessels. EAG 5 refers to a darkness zone of 1.5 km for significant rookeries and is not a distance from turtle nesting beaches for vessel or offshore accommodation vessel with lights of unknown intensity, directivity and wavelength.

The EPA is of the opinion that further consideration and management of light impacts to turtles is required and recommends condition 10-10 for the preparation and implementation of a Conservation Significant Marine Fauna Interaction Management Plan. This plan should be prepared in consultation with the DEC and would require a description, causes of environmental impacts and potential consequences for turtles of light spill and sky glow, a description of effective design features and management measures for appropriately avoiding or mitigating impacts of light spill and sky glow and darkness strategies that reduce, as far as possible, lights or light glow interfering with female turtles and hatchlings from operations, construction and moored accommodation.

Impacts to sawfish

The EPA considers that an assessment of impacts to sawfish species cannot be made due to lack of information on its occurrence and habitat. Juvenile sawfish are known to occur in the Ashburton Delta and Hooley Creek. Similar habitat, in the form of lagoons and creeks, is found east and west of the proposal area and may also be sawfish habitat. Adults are known to frequent coastal waters in the Pilbara. Sawfish also return to inshore coastal waters to breed and pup on a seasonal basis.

To protect the sawfish the EPA recommends that its breeding and nursery habitat be protected. Condition 14-2 for a Mangrove, Algal Mat and Tidal Creek Protection Management Plan, with an objective of protecting sawfish habitat is recommended.

Impacts to other species

The EPA is satisfied with the proposed management for the other species considered.

Introduced marine pests

While the proponent may consider that the risk of the introduction of marine pest is low, the impact of marine pests to the environment may be devastating. On advice of the DoF, the EPA recommends condition 12 to protect against the introduction of marine pests.

The recreational impact to marine fauna is considered in section 3-7, Recreation and Aesthetics.

Summary

As some information was not available and uncertainties remain, the EPA's recommended conditions (including the residual impacts and risk management measures) reflect these gaps in knowledge and uncertainties. The EPA considers that with the implementation of the recommended conditions impacts to marine fauna would be minimised and, while noting that there may be a temporary reduction in abundance and geographic distribution at a local scale, the EPA's objective would be met. The recommended conditions are:

- condition 7 relating to state of the marine environment surveys;
- condition 11 relating to marine drilling and blasting activities;
- condition 12 relating to non-indigenous marine species;
- condition 13 relating to marine outfalls; and
- condition 14 relating to mangrove, algal mat and tidal creek protection, and
- condition 22 relating to the proponent's residual impacts and risk management measures.

3.4 Flora and vegetation

Description

Flora and vegetation

The proposal would require approximately 3300 ha of terrestrial native vegetation to be cleared for construction. This is a conservative estimate assuming all vegetation within the proposal area would be cleared ("maximum clearance scenario"). The management target for vegetation to be cleared is 2930 ha. Approximately 265 ha would be cleared from within the DEC's proposed extension to the Cane River Conservation Park.

In addition to clearing of vegetation there would be the potential for coastal dune habitats to be affected directly by changed coastal processes as a result of the proposal, with potential loss of coastal dune habitat between the proposal site and Beadon Creak due to coastal erosion.

A large volume of fill, estimated at 8.5Mm^3, would be required to build up the site and infrastructure corridor above storm and flood levels. This would be sourced from four "hills", containing 20 Mm^3, situated on the

adjacent Onslow Salt land. Issues associated with the fill removal that are relevant to flora and vegetation are:

- management of acid sulphate soils;
- management of weeds;
- changes to surface water flows; and
- rehabilitation.

The proponent considered that the residual risk to flora and vegetation is medium based on the local long term reduction of abundance of a Commonwealth or WA Listed Flora species.

Listed flora

Three Priority flora species (*Eremophila forrestii* subsp. *viridis* [Priority 3], *Atriplex flabelliformis* [Priority 3] and *Triumfetta echinata* [Priority 3] as listed by the DEC) were identified within the proposal area. There was also one Threatened Flora species, *Eleocharis papillosa* (Dwarf Desert Spike-rush), listed as Vulnerable under the EPBC Act and as a Priority 3 flora species, and an additional Priority flora species (*Abutilon uncinatum* ms. [Priority 1]) found in the survey area, but not in the proposal area (Attachment 2). Although some priority flora may be cleared, all of these flora have also been recorded outside of the proposal area.

Table 5 provides a summary of impacts and other known populations.

Table 5: Listed Flora

Species	Conservation Level	Number of species within the TAA	Number of species within the ANSIA (outside of the TAA)	Regional Distribution outside the ANSIA
Abutilon uncinatum ms	Priority 1 (EP Act [WA])	This species has not been found within the proposal area.	This species was not identified within the ANSIA outside of the TAA	Although not common this species is relatively widespread within the Onslow locality (Biota 2009a). Seven locations of this species have been recorded within a 120 km radius of Onslow.
Eremophila forrestii subsp. *viridis*	Priority 3 (EP Act [WA])	This species may be impacted at 69 locations in the LNG plant area, and SIC and Accommodation Village areas.	This species was not recorded within the ANSIA outside of the TAA.	*E. forrestii* subsp. *viridis* has been recorded from two additional locations approximately three km north of the Minderoo Station turnoff (Biota unpublished data). According to the Department of Environment and Conservation there have been 10 other recordings of the species in Western Australia, South Australia and the Northern Territory, however the subspecies from the Onslow locality shows some dissimularities from those recorded in SA and the NT.
Atriplex flabellifor mis	Priority 3 (EP Act [WA])	This species may be impacted at one location in the SIC.	This species was also identified at four other locations. Three populations were recorded south of the LNG plant area and one population was located near the SIC.	This species has been recorded at six locations within a 1474 km radius of the Site.

Species	Conservation Level	Number of species within the TAA	Number of species within the ANSIA (outside of the TAA)	Regional Distribution outside the ANSIA
Triumfetta echinata	Priority 3 (EP Act [WA])	This species may be impacted at 12 locations in the LNG plant area, within the Domgas pipeline and in the SIC.	This species was recorded at 18 locations with a total record of 52 plants. Forty-eight of these plants were located south of the Accommodation Village in 13 locations. The remaining five locations were located south of the LNG plant area and south of the SIC.	Eleven sites have been recorded within a 130km radius of the town of Onslow. This species is relatively widespread throughout the Onslow locality; however, it is not common and is restricted to red sand dunes (Biota 2009a).
Eleocharis papillosa	Vulnerable (EPBC Act [Cth]) Priority 3 (EP Act [WA])	This species has not been found within the TAA.	This species has not been found within the ANSIA	The most current records indicate that this species has a considerably broader distribution than previously thought. Extending from the Site, there are 44 records of this species within a 2500 km radius. It is likely that this species has been poorly collected in the past due to its small size and ephemeral nature (Biota 2009a).

TAA – terrestrial assessment area
ANSIA – Ashburton North Strategic Industrial Area

Conservation significant flora
In addition to the listed species numerous species of interest were found, being undescribed or potentially new species (Attachment 2).

- The undescribed pea *Aenictophyton* aff. *reconditum* appears to be restricted to sand dune habitats in the Onslow locality.
- There is a "complex" of *Tecticornia spp.* which has not been identified. As many as nine different taxa may be represented within the sterile material collected, although some may be referrable to existing named taxa or to each other. This includes two specimens of undescribed taxa, which unfortunately lacked sufficient material to allow them to be circumscribed and allocated a phrase name.
- Numerous plant groups in the Pilbara are poorly resolved and urgently require revision; these include the genera *Abutilon, Bonamia, Eriachne, Euphorbia, Polygala, Sida* and *Triumfetta*. Most of the undescribed taxa recorded during the Wheatstone study have been recorded more widely in the Pilbara except for a potentially new taxa in the genera *Abutilon*. This could only be matched to one other indeterminate specimen at the WA Herbarium (also from near Onslow). This species has been found in the plant site and also along Onslow Road.

Some 39 other flora are of interests as they are range extensions. This may be due to specimens not having been vouchered previously.

Table 6 provides a summary of conservation significant flora that would be impacted and their distribution.

Table 6: Conservation significant flora

Species	Conservation Level	Number of species within the TAA	Number of species within the ANSIA (outside of the TAA)	Regional Distribution outside the ANSIA
Aenictophyton aff. *reconditum* (Onslow)	Undescribed	This species may be impacted at one location (<1per cent density) in the SIC.	This species has been identified at six other locations. Populations were recorded north of the SIC. It was also recorded south of the LNG plant.	This undescribed pea appears to be restricted to sand dune habitats in the Onslow locality. This taxon has also been recorded at nine other locations within a 100km radius of Onslow, though is not common in the area.
Tecticornia spp. (samphires).	Undescribed	Undescribed taxa were recorded from 12 locations; within the plant site and Borrow site 2 in the proposal area.	The undescribed taxa have not been recorded within the ANSIA.	*Tecticornia* sp shrublands habitat occurs from the tip of the Exmouth Peninsular to east of Port Hedland. This comprises over 39 000 ha mapped as "samphire shrubland" along with over 301 000 ha mapped as "mudflats" by Beard (1975). The undescribed taxa appear within the species complex designated as *T. halocnemoides* sens. lat. "large seed aggregate". This complex was also identified within the Gorgon Project area approximately 125 km north east of the site and for the Macedon Project to the South west of the proposal site.
Abutilon sp.	Undescribed	This species may be impacted at five locations in the SIC and Domgas pipeline.	Abutilon sp. was recorded from an additional two locations, north of the SIC and south of the Accommodation Village. These populations occur at <1 per cent cover.	This taxa was matched to an indeterminate specimen at the WA Herbarium, also previously recorded near Onslow. Twelve populations are known to occur within a 26 km radius of the ANSIA.

Vegetation units

Vegetation surveys have been undertaken within the Wheatstone footprint, within the Ashburton North Industrial Area and, to a limited extent, outside of the Industrial Area. Vegetation within Industrial Area is considered to be under threat.

The proposal would require the clearing of approximately 49% of locally significant vegetation unit C3 (low *Tecticornia* shrubland in saline claypans) and 41% of locally significant vegetation unit ID1 (an inland sand dune community of *Grevillea stenobotrya* tall open shrubland over

Crotalaria cunninghamii, *Trichodesma zeylanicum var. grandiflorum* open shrubland over *Triodia epactia* open hummock grassland) in a "maximum clearance scenario". The proponent expects the actual proportional clearing of vegetation unit C3 to be less than 45 per cent.

Onshore Environmental Consultants conducted a targeted Tecticornia survey across the site in 2009. This survey identified seven Tecticornia taxa from samples collected. Six of these subspecies are not conservation significant; other samples found were grouped by the WA Herbarium into the *Tecticornia halocnemoides* 'complex'. Although the Herbarium was unable to provide any guidance on the conservation significance of this "complex", Chevron has taken a conservative approach and classified them as "undescribed".

The proponent has provided information that the unidentified *Tecticornia halocnemoides* 'complex' has been found within the Gorgon project area and in the Macedon area. As there is a widespread distribution of samphire shrubland from Exmouth to Port Hedland, the proponent concludes that it is very likely that the "complex" occurs in other areas as well.

Although some vegetation communities are classified as locally significant, none are declared matters of national environmental significance under the EPBC Act 1999 or Threatened Ecological Communities.

Table 7: Changes to Locally Significant Vegetation Units

Vegetation Code	Extent Within Survey Area (ha)[1]	Extent Within Proposal Footprint (ha)	Percentage of VU to be Cleared Within the Survey Area	Local Conservation Significance
ID1	247.53	101.90	41.17	**High**
ID2	221.58	24.38	11.00	**High**
ID4	12.48	0	0	**High**
C3	1089.38	536.34	49.23	**High**
C3 / CP1	58.42	1.80	3.08	**High/Moderate**
C3 / C2	17.18	0.00	0.00	**High/Low**
CP1	802.74	88.24	10.99	**Moderate**
CS1 / CP1	138.50	36.27	26.19	**Low/Moderate**
CS4 / CP1	29.12	4.26	14.62	**Low/Moderate**

[1] Updated Survey Area encompasses approximately 13 000 ha.
An additional 20.12 ha of already cleared land (tracks and roads) exists in the proposal footprint, of a total of 165.22 ha of cleared land in the survey area.

Management of vegetation clearing
The proponent would prepare a management plan which includes the following issues:

- reduction of the physical footprint of the operations as far as practicable;
- establishment of buffer zones between the proposal area and the mature mangrove habitat in the Ashburton Delta;
- prevention of unauthorised clearing;
- employment of experienced and trained Site Environmental Officers to inspect construction areas prior to any site clearing;
- marking of sensitive vegetation communities and habitats in proximity to working areas and prevention of access to these areas, unless approved;
- prevention of burning of vegetation during site clearing, unless otherwise approved;
- inclusion of quarantine requirements in contracts for relevant suppliers and contractors;
- induction of relevant personnel regarding quarantine management requirements;
- development and implementation of vehicle hygiene procedures;
- weed management procedures; and
- vegetation monitoring, including threatened species.

Weeds
Some vegetation units (in particular CD2, CS2 and CS4) have been found to be heavily infested with the weed species buffel grass (Cenchrus ciliaris) and/or mesquite. Eleven weed species were recorded from the Wheatstone study area, including two declared plants, mesquite and parkinsonia. The infestation of mesquite in the west Pilbara is the largest in Australia.

Weed management
The proponent has committed that the Terrestrial Flora and Vegetation Management Plan would include provisions for the control of introduced species. This plan would be part of the construction management plan. The proponent has committed to consulting with the DEC, EPA and The Pilbara Mesquite Management Committee during the formulation of the flora and vegetation management plan. However, this plan has not yet been prepared.

Rehabilitation
The proponent has made the following commitments:

- Disturbed areas not required for future activities would be progressively rehabilitated upon completion of activities where practicable (e.g. following construction of the Domgas pipeline), with rehabilitation procedures identified as part of the CEMP to facilitate this process. It is estimated that approximately 935 ha, consisting of the borrow sites and a 15 m width along the

approximately 75 km long domestic gas pipeline corridor, could be rehabilitated following the initial construction phase;

- Rehabilitation strategies would aim to ensure disturbed land is returned to a condition which is equivalent to the area's baseline status where practicable. Rehabilitation strategies would be implemented which introduce works and land use practices appropriate for areas of disturbed ASS and which mitigate acid drainage; and
- Native plant species shall be used to maintain biodiversity, reduce opportunity for weed establishment, and maintain wildlife habitat. Rehabilitation measures shall actively promote the regeneration of native groundcover and shrubs.

Submissions

The **DEC** recommended that:

- impacts to *Abutilon uncinatum* and *Eleocharis papillosa* be avoided,
- the number, distribution and habitat extent of *Tecticornia spp* be clarified,
- impacts to individual *Tecticornia spp* from footprint, dredge material and water changes be considered and, if impacts within surveyed area are significant, further survey should demonstrate that the complex extends beyond proposal area;
- an Outcome Based Condition that there is no weed increase in the former Mount Minnie pastoral lease; and
- weed hygiene and management plan, and weed management plans be developed.
- The **DPA** recommended that more detailed assessment of acid sulphate soil (ASS) in accordance with DEC guidelines, more appropriate screening and management of ASS is required.

Assessment

The EPA's environmental objective for this factor is to maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

The EPA recognises that the implementation of the proposal would lead to the residual impact of a loss of a large area of vegetation. However, this is unavoidable.

The proponent has established since the publication of the ERMP that the *Tecticornia halocnemoides* 'complex' is present at other locations, as raised by the DEC. The EPA considers that it is unlikely that any species would suffer extinction or vegetation unit be lost as a result of implementation of the proposal. However, the impact to the C3 and ID1 vegetation units is large. These units do occur outside of the site. Should there be extensive future developments along the Pilbara coastline cumulative impacts to nearshore vegetation such as dune vegetation, samphire shrublands and algal mats, would need to be considered.

The Construction Management Plan has not been provided with the assessment. The proponent should prepare and implement this plan and ensure adequate management for vegetation clearing.

The EPA considers that the management of weeds is an important issue. The DEC has provided advice that it considers the mesquite infestation to pose a major threat to biodiversity values. Of particular concern is that construction activities may increase the risk of spreading declared plants and environmental weeds, particularly into the proposed addition to Cane River Conservation Park. The EPA recommends condition 16 to ensure that the incidence of weeds in the proposed conservation park does not increase due to the proposal implementation and condition 17-1 (7) to ensure that weed cover does not increase in rehabilitated areas.

The loss of vegetation can be mitigated by the implementation of progressive rehabilitation of temporarily disturbed areas. The EPA recommends condition 17 applying to rehabilitation

Acid sulphate soils are likely to occur in the coastal region of the terrestrial footprint. To manage the potential impacts of acid sulphate soil disturbance and dewatering the EPA recommends that this be included in condition 14 requiring a management plan for Mangrove, Algal Mat and Tidal Creek areas.

At the end of the project's life decommissioning, final rehabilitation and remediation or management of contaminated area would be required. The EPA recommends condition 21 for decommissioning.

As additional residual impacts and risk management measures the proponent would fund the DEC to manage impacts and risks associated with additional visitation to island nature reserves and mainland coastal areas and for the management of visitors and recreational impacts to the Cane River Conservation Park. This would assist with the protection of vegetation in these areas. The proponent would also provide a contingency fund for the remediation of impacts to offshore islands and/or nearshore environments attributed to the Wheatstone development.

Summary

The EPA considers that with the implementation of the recommended conditions impacts to flora and vegetation would be minimised and, while noting that there would be a reduction in abundance, productivity and geographic distribution at a local scale, the EPA's objectives would be met. The recommended conditions are:

- condition 14 relating to mangrove, algal mats and tidal creek protection;
- condition 16 relating to weeds;
- condition 17 relating to rehabilitation;
- condition 21 relating to decommissioning,

- condition 22 relating to residual impacts and risk management measures.

3.5 Greenhouse gas

Description

The total predicted emissions from the proposal is 9 878 000 tonnes $CO_{2\,e}$ per year. Sources of emissions, anticipated amounts and $CO_{2\,e}$ efficiency/tonne LNG are shown in the table below (Chevron, 2010):

Table 8: Predicted Annual GHG Emissions from the Onshore Component of the Proposal

Emissions Source	Onshore LNG Processing (TPA $CO_{2\,e}$)	Onshore Domgas Production (TPA $CO_{2\,e}$)	Supporting Infrastructure (TPA $CO_{2\,e}$)	Total
Gas turbines (direct process drive)	4 800 000			4 800 000
Gas turbines (electrical power generation)	900 000	150 000	140 000	1 190 00
Venting of reservoir carbon dioxide	2 350 000	250 000		2 600 000
Fired heaters/boilers	7 000			7 000
Flare – pilots	45 000			45 000
Flare – events	220 000			220 000
Fugitive emissions	5 000			5 000
Methane from N_2 vent	920 000	50 000		970 000
Diesel engines (stand-by pumps)	1 000			1 000
Marine tugs	40 000			40 000
Total	9 288 000	450 000	140 000	9 878 000
Tonne $CO_{2\text{-}e}$ /tonne LNG	0.372			0.395

Emissions from the offshore component of the proposal would be an additional 450 000 t/a of $CO_{2\,e.}$

The emission from the proposal would increase Australia's GHG emissions by 1.7% and Western Australia's GHG emissions by 13.5% on 2006/7 emission levels.

The proponent considers that the configuration of gas turbines and electrical drives, choice of turbines and waste heat recovery on compression turbines are best practice measures and would lead to reductions in greenhouse gas emissions as shown in the table below (Chevron, 2011b):

Table 9: Predicted Annual GHG Savings through Best Practice

Technology selection of major equipment	Saving in GHG with selected option compared with other realistic options
Gas Turbine Drivers	65 000 TPA
Gas Turbine Power Generators	47 000 to 118 000 TPA
Waste Heat Recovery Units	1 800 000 TPA
TOTAL	Approximately 1 983 000 TPA

Management

The following actions have been taken to manage the Project's GHG emissions:

- selection of high efficiency aero derivative models for gas turbines;
- selection of LNG process train technology and size so as to enable the consideration of aero derivative gas turbines for refrigeration compressor drivers;
- the use of inlet air humidification (cooling) on the LNG process gas turbine drivers and gas turbine generators in order to operate the gas turbines at near optimum energy efficiency over a wide range of ambient temperatures;
- waste heat recovery from the LNG compressor gas turbine exhausts to meet routine process heat requirements in the onshore gas processing facility;
- waste heat recovery from the gas turbine exhausts of the main generators on the offshore platform to meet specific heating requirements;
- the use of sophisticated process control systems to ensure continuous optimisation and integration between various components of the gas processing system; and
- the capture and use of energy recovered from the pressure let down in the liquefaction section of the onshore gas processing facility.

The following opportunities to further reduce the Project's GHG emissions have been identified by the proponent and would be evaluated further during ongoing Project design and engineering:

- alternatives to the use of hydrocarbon purge gas to ensure the safe and effective operation of the flare, such as using nitrogen would be examined;
- further consideration may be given to opportunities such as adding a liquid expander, or propane sub-coolers to improve the overall process efficiency of the plant; and
- opportunities to further reduce the potential release of methane in the Nitrogen Vent.

Submissions

The **Conservation Council of Western Australia** and the **Wilderness Society** considered the lack of greenhouse gas mitigation measures unacceptable and that there was a cursory approach to abatement measures, no evidence presented for claims that LNG would reduce

carbon emission by replacing dirtier sources and recommended that the proposal should have at least the same abatement conditions as the Gorgon and Pluto projects.

The **CCG** questioned whether CO_2 reuse had been investigated.

Four submissions from the public considered the greenhouse gas emissions unacceptable.

Assessment

The EPA's environmental objective for this factor is to minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions.

The EPA requires all large emitters of greenhouse gases to develop and implement a Greenhouse Gas Abatement Program which includes measures to minimise net greenhouse gas emissions and reduce emissions per unit of production as much as practicable. The EPA encourages proponents to consider offsetting the remaining greenhouse gas emissions throughout the life of their projects.

The EPA expects that, as a minimum, the proponent should offset the reservoir CO_2 gas released during the life of the project (condition 19-7). This is consistent with the Gorgon project, in which the proponent intends to sequester much of its reservoir CO2; the Pluto LNG development (EPA 2007); and more recently, the Commonwealth approved Shell Prelude Floating LNG project.

The EPA notes that the proponent has supplied comparisons of its proposed $CO_{2\,e}$ emission intensity from the LNG processing plant with other plants from around the world (Chevron 2011b). The proposed emission intensity for the proposal is approximately 0.28 tonne $CO_{2\,e}$/tonne LNG. The EPA notes that emission intensity from the Pluto project is expected to be 0.26 and that other plants around the world have predicted emission intensity as low as 0.22 tonne $CO_{2\,e}$/tonne LNG. The EPA understands that there are many influences on emission intensity for each individual project, e.g. process selection, gas source, and operational environment. However, the EPA is of the opinion that the proponent should implement best practice in design and operation of the plant to minimise $CO_{2\,e}$ emissions and recommends an initial target of 0.26 tonne $CO_{2\,e}$/tonne LNG and further improvements to be made over time (condition 19-2).

The EPA considers that the proponent should undertake further investigation of reducing the discharge of methane from the nitrogen vent as a priority. This source adds approximately 1 Mt of $CO_{2\,e}$/annum to the emissions and due to methane having a CO_2 equivalence of 25, small reductions in methane emissions equate to larger reductions in $CO_{2\,e}$.

In recognition that a national policy or regulatory framework addressing greenhouse gas emissions may be introduced in future, the EPA recommends condition 19-8 exempting the proponent from the requirements to implement an offset package if national requirements cover the emissions from the proposal. This is consistent with the conditions applied by the Commonwealth on the Shell FLNG project.

However, the EPA is of the view that the remainder of the conditions (19-1 to 19-6) requiring a Greenhouse Gas Abatement Program should remain in place to encourage best practice in the design and operation of the facility and to ensure public transparency. Further, the EPA considers that the appointment of an independent specialist to audit the performance of the proponent against the objectives of the Greenhouse Gas Abatement Program, on a biennial basis, would provide a higher degree of public accountability in the face of growing community concern about the environmental impact of greenhouse gas emissions. The appointment of an independent specialist is consistent with the approach taken on the Bluewaters power station expansion which was granted Ministerial approval in September 2010.

Summary

The EPA considers the key environmental factor of Greenhouse Gas has been addressed and the EPA's objectives for this factor can be achieved provided that condition 19 is implemented requiring the proponent to prepare and implement a Greenhouse Gas Abatement Program and offsets package.

3.6 Air emissions

Description

Emissions to air may impact on human health and vegetation. The proponent has determined the environmental risk from air emissions from construction and operation of the proposal to be medium.

Nitrogen Oxides (NOx)

During operations, NOx emissions are estimated to be approximately 5000 tonnes per year from onshore sources. The proponent has modelled these emissions and also emissions for non-routine operations. The maximum on grid groundlevel concentrations and those at Onslow have been found to comply with National Environment Protection Measure (NEPM) standards (maximum 32% of the standard). The modelling is based on gas turbines with 25 ppm NO_X emission using dry low NOx burners.

The proponent has committed to selecting turbines with dry low NOx burners with a potential NOx generation capacity of 15 ppm NOx or less (30 mg/Nm^3) at 15% oxygen and would endeavour to run the equipment to the manufacture's specifications to minimise emissions. The turbines are, therefore, expected to produce less than 25 ppm during normal operations. The proponent would also undertake periodic monitoring of

emissions from the turbines in order to determine their efficiency and emissions profile. If these emissions are determined to be significantly above 15 ppm a review of turbine efficiencies would be undertaken (Response to comments, 2011a).

Volatile Organic Compounds (VOC)
The predicted ground level concentrations of Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) under normal operating conditions are very low with benzene having the highest predicted impact on the model grid at 8.4% of the NEPM investigation level.

Fugitive emissions of 360 tonnes per year are possible.

Point source emissions of VOCs are included in the modelling as photochemical precursors.

Ozone
During operations ozone is predicted to be a maximum of 50% of the NEPM standard anywhere on the modelled grid. The maximum predicted at Onslow is 43% of the NEPM standard.

Sulphur compounds
Sulphur dioxide emissions are predicted to be very low.

Sulphur compounds, such as hydrogen sulphide (H_2S), mercaptans and carbonyl sulphide may cause odours. Gas from the currently identified offshore fields would generally be low in inorganic and organic sulphur compounds. Gas supplied for processing from third party gas field operators in trains 3,4 and 5, however, may have a different composition. The proponent considers that most sulphur compounds would be removed from the gas stream in the Acid Gas Removal Unit (AGRU) of both the LNG and Domgas processing lines and sent to thermal oxidisers for conversion to sulphur dioxide. Emissions of odorous sulphur compounds would normally only occur during incomplete combustion in thermal oxidisers, venting and from fugitive emissions.

In summary, the following are considered to ameliorate the odour potential from hydrogen sulphide:

- the feed gas stream to Wheatstone LNG Plant is expected to be low in H_2S content;
- Wheatstone facilities would be designed to avoid any continuous venting or flaring of feed gas or other hydrocarbon streams which may contain H_2S;
- the fuel gas to be used in the plant would be primarily obtained from process gas which has been treated in the AGRU. The AGRU would remove the majority of H_2S. The resulting fuel gas sulphur content would be similar to pipeline or domestic quality natural gas, which has minimal H_2S or oxides of sulphur emissions when combusted;

- H_2S removed from the feed gas stream in the AGRU would be sent to the Acid Gas Incinerator Unit where it would be incinerated;
- in the event of plant upset, gas streams containing H_2S would be routed to an enclosed relief system and sent to an elevated flare stack. Any gas containing H_2S would be burned in a high efficiency flare burner tip; and
- the plant facilities would be designed, operated and maintained to industry standards which minimise any fugitive emissions that could contain small levels of H_2S.

Dust

PM_{10} particulate levels from dust emissions might exceed NEPM standards during times of high background dust. PM_{10} emissions from the proposal are predicted to reach a maximum of 53% of the NEPM standard on the modelled grid and 50% of the NEPM standard at Onslow. Under upset conditions PM_{10} emissions might reach 87% of the NEPM standard on the modelled grid and 50% of the NEPM standard at Onslow.

The proponent has committed to developing a subsidiary management plan as part of the CEMP with the key objective to manage the generation of dust. A range of management controls and monitoring procedures would be applied as part of this management plan during key activities at the onshore development area. Specific dust control measures would also be implemented as part of the standard operation of the concrete batching plant.

Cumulative impacts

The proponent undertook modelling for the potential cumulative air quality impacts assuming normal operating conditions and incorporating the emissions from the Chevron Wheatstone Development and two additional gas processing facilities located on an adjacent site, immediately to the south of the Chevron Wheatstone facility. The potential additional emissions were assumed to be those of an LNG plant similar to that of the fifth train at the proposed Wheatstone facility and those from a Domgas facility assumed to be similar to that of Apache Energy Domgas facility at Devil Creek). The pollutants taken into consideration included NO_2, SO_2, PM_{10} and O_3. The maximum ground-level concentration of each of these pollutants was assessed against the NEPM criteria.

A comparison between the criteria and the maximum predicted ground-level concentrations showed that all the predicted concentrations for modelled pollutants were below the NEPM criterion. The highest predicted PM_{10} on the modelling grid was 54% of the NEPM and the highest predicted $O_{3,}$ 51% of the NEPM (SKM, 2010).

Submissions

The **DEC** advised that there was insufficient information provided for mitigation measures with regard to emissions, monitoring, and cumulative impacts modelling for works approvals/licensing.
The **DEC** further advised

- results of baseline monitoring should be compared with model assumptions and reported to the DEC;
- H_2S emission from acid gas removal needs to be addressed as a potential odour issue;
- Chevron should refer to and consider the DEC guidelines, NSW dust deposition guidelines and NEPMs.

The **DoH** advised that the components of dust should be analysed for particulates of health concern.

Assessment

The EPA's environmental objective for this factor is to ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards.

The EPA notes that ground level concentrations of emissions would not exceed NEPM standards, expect for dust in times of high background dust. As Ashburton North is designated as a Strategic Industrial Area, the proponent has modelled cumulative emissions under normal operations from its proposal and one further LNG train and Domgas plant. However, more and larger developments than those modelled may occur in the future. Therefore, the proponent should minimise its emissions by implementing best practice in order to allow room in the air shed for other developments. As the predicted cumulative ground level concentrations of ozone may exceed 50% of the NEPM standard, the proponent should in particular seek to minimise emissions of volatile organic compounds and oxides of nitrogen as recommended in condition 18-1.

Dust generation is expected during construction activities and would need management. The EPA notes the proponent's commitment to a dust management plan and expects that management would be implemented to prevent impacts to human health and vegetation. Health impacts from the project may occur if NEPM standards for PM_{10} are exceeded at Onslow from project-attributable dust, which is unlikely. If this should occur the proponent would need to seek advice from the Health Department. Impacts of dust to workers on the site is regulated by WorkSafe.

Particulate emissions from operations are not likely to impact on the public if adequately managed. However, particulate emissions from flaring should be minimised and the EPA recommends condition 18-1 requiring the optimisation of the smokeless capacity of flares.

Dust from prescribed premises, such as the concrete batching plant and the LNG plant, would be managed by the DEC.

Summary

The EPA considers the key environmental factor of Air Emissions has been addressed and the EPA's objective for this factor can be achieved

provided that condition 18 is implemented requiring the proponent to install equipment and manage ongoing operations such that best practice for a liquefied natural gas/domestic gas facility is achieved with respect to:

1. minimising emissions of volatile organic compounds and oxides of nitrogen emissions;
2. optimising the smokeless capacity of flares; and
3. minimising non-emergency flaring of gas.

3.7 Recreation and aesthetics

Description

There are potential impacts to recreation from the proposal as well as impacts from recreation to conservation areas from the influx of people to the area.

Impacts to recreation during construction and operation include the restriction of access to areas used for dog walking, fishing, 4 wheel driving and camping. Access may be restricted by exclusion zones or by cutting off approaches to areas. There is likely to be an impact on recreational values as a result of changed access arrangements, in particular, land access to Hooley Creek. The proponent is consulting with the local community about these changes.

Recreation may also be impacted by the erosion of recreational beaches due to changes in coastal processes caused by the construction of the MOF and PLF. This impact has been described in section 3-2, Intertidal BPPH.

Recreation may also be impacted by marine discharges that would cause a loss of social environmental quality objectives. As there would already be an exclusion zone around the port loss of water quality around the nearshore outfalls is unlikely to cause further impacts to recreational fishing or primary and secondary recreation. However, impacts from the produced water outfall may cause some loss of social objectives in this area.

Increased recreation from the increased population may impact on conservation areas, in particular the island reserves, threatened marine fauna habitats and regionally significant coral communities. The nearby islands are bird breeding sites and are used by turtles for nesting. Increased recreational fishing may threaten fish stocks and protected species. These impacts could be due to the Wheatstone workforce but could also be due to factors beyond the proponent's control such as offshore work vessels and bulk carriers.

The proponent would reduce environmental impacts from recreational activities of its workforce by:

- not permitting boats and recreational vehicles within the workforce accommodation village or the access road from the Onslow Road;

- instituting a Recreation Code of Conduct for workers;
- having a community complaints system;
- working with the Department of Fisheries;
- working with the DEC to reduce potential risks from excessive recreational use of the islands within a 25km radius of Onslow.

There would be an aesthetic impact to the marine environment due to the turbidity plume generated during dredging. Modelling indicates that suspended sediment plumes would travel greater distances in nearshore waters due to wind driven nearshore currents and resuspension by waves in the shallower waters. During summer, nearshore turbidity plume excursions to the east are likely to extend upwards of 50 km from the dredge area. Similarly, plumes created during winter are expected to travel up to 70 km to the west of the dredge area.

Submissions

The **DEC** raised concerns about direct impacts to marine fauna, impacts to island nature reserves, marine fauna and fauna habitats from recreation and offsets for residual impacts. The DEC recommended a recreation management plan to include education, management and monitoring, and provision of resources.

The **DoF** raised the concerns that:

- studies are needed on current recreational fishing and potential fishing trends;
- if increased fishing results from the project, how the added risk to fish resources would be managed; and
- recreational fishing was important and reduction for even one year could have social consequences.

Assessment

The EPA's environmental objectives for this factor are:

- to ensure that existing and planned recreational uses are not compromised; and
- to maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

The EPA notes that the proponent has committed to working with the community to address their concerns and is setting up a Fisheries and Tourism Working Group Panel with recreational fishing representatives and the DoF to address impacts to recreational fishing. The EPA recommends that this Group continues to work through outstanding issues with the objective of concluding satisfactory outcomes with the participants before the commencement of dredging.

To address the impacts of changes to coastal processes, the EPA recommends condition 9 which requires the proponent to manage littoral transport to prevent:

- an erosion trend under non-cyclonic conditions in the position of the mean sea level shoreline and dune vegetation line between the proposal site and Beadon Creek;
- reduction in the recreational value of beaches between the proposal site and Beadon Creek;
- reduction in the integrity and performance of the Onslow seawall; and
- reduction in the integrity and values of heritage sites between the Ashburton Delta and Beadon Creek.

There are also heritage sites near to the proposal site which are recreational/tourism sites. Condition 9 affords protection to these sites from coastal erosion. It is understood that these sites would be managed under a Development Impact Mitigation Plan and a Heritage Agreement with the Heritage Council.

The EPA notes that the proponent intends to manage any recreational impacts from its workforce as best it can. The EPA considers there is still a residual risk of indirect impacts to island nature reserves. In recognition of this risk, the proponent would provide funding during the construction of the initial phase of the proposal to the DEC to manage the impacts and risks associated with additional visitation to island nature reserves and mainland coastal areas and also for the management of visitors to the Cane River Conservation Park within the vicinity of the proposal. The proponent would also provide a contingency fund for the remediation of offshore islands and nearshore environments where impacts can be reasonably attributed to the proposal. This commitment is formalised in conditions 22 – 6, 22 - 8 and 22 - 9.

To mitigate the impact of increased recreational fishing the proponent would fund the DoF to assist in ensuring that recreational fishers comply with bags limits and size limits in the coastal and estuarine environment within the vicinity of the proposal. This commitment is formalised in condition 22 – 7.

The EPA has recommended conditions for the protection of BPPH. These conditions would require limiting the turbidity and sedimentation impact of the dredge plume. The EPA recognises that it is likely that the turbidity plume would still extend over a very large area under certain conditions and that an aesthetic impact would occur.

Summary

The EPA considers the key environmental factor of Recreation and Aesthetics has been addressed and the EPA's objectives for this factor can be achieved provided that the proponent continues to work with the community and DoF and implements the recommended condition 22.

3.8 Tourism and fishing related industries

Description

The proposal would have some impact to the dive resort with facilities on Thevenard and Direction Islands. The dredging would impact some coral reefs in the area and the turbidity from the four year dredge campaign would affect the visibility for diving on reefs. The location of the turbidity impact could alter with the time of year and currents. Different reefs may be unimpacted at different times of the year, depending on the dredging schedule.

The proposal would have some impacts on commercial fishing activities. The proponent considers that pearl farming operations, wild oyster collection, blue swimmer crab fishing and trap fishing would be unlikely to be significantly impacted.

The proposal intersects the Pilbara Line Fishery, however, the proponent considers that this small fishery can work around Project operations without significant impact. The proponent considers it possible that the dredging program may have a minor impact on the Mackerel Managed Fishery but that commercial activity would be temporarily displaced within the fishery rather than prevented. The proponent considers that the Specimen Shell Managed Fishery and the Marine Aquarium Managed Fishery may be affected by dredging activities. The proposal footprint intersects the Pilbara Fish Trawl (Interim) Managed Fishery. The fishery consists of two zones, and Zone 1 in the south west of Fishery has had zero effort allocated for more than 10 years. The Project pipeline intersects Zone 2 of the fishery but no impacts are expected on trawling operations.

The fishery likely to be most affected would be the Onslow Prawn Fishery. The proponent has determined that 4% of the nursery area would be directly impacted. There may, however, be additional impacts such as the intake of larvae through seawater intakes, loss of habitat, noise and changes to water quality. The proposal footprint, including exclusion areas, would occupy less than one per cent of the area trawled between 2004 and 2006. However, the jetty and shipping lanes may on occasion affect a trawler's ability to operate in the most productive part of a mobile prawn fishery.

To manage potential impacts to commercial fishing in the local area, the proponent would appoint a staff member whose role includes liaising between the proponent and holders of commercial fishing licences. The liaison officer would provide information on key project activities such as dredging, pipelaying and vessel traffic.

Submissions

The **DoF** raised the following issues:

- more details on the desalination plant are needed and the impact of the intake on larval fish and prawn populations;

- no reference to commercial finfish fisheries and target species has been made;
- studies of marine fauna do not include fish,
- more details are required on the summer fish survey;
- the proponent is referred to Kangas et al 2007 for fish and invertebrate species composition of prawn trawls;
- structured habitats for tiger and endeavour prawns are important. Tiger prawns are the most commercially valuable species in Area 1 and the major species caught. Their habitat requirements should be highlighted,
- finfish fishing is only briefly mentioned and no value of production stated;
- if localised impact occurs in a nursery area or area of high abundance, it could have major impact to the fishery;
- reduction of fish for even one season can cause large loss to commercial fishers;
- it is unclear how the cause of consequences will be identified as being due to the project;
- effect on offshore fish populations was not considered and there is too much focus on protected species and not enough on fish resources;
- a high risk to fish stock sustainability is indicated and management of the risk should be developed in conjunction with the DoF;
- the management controls and mitigation measures proposed are too vague;
- the percent area impacted may underestimate production impact for fisheries,
- long term exclusion of fishers is not covered and the risk to commercial fisheries from exclusion zones and reduced access should be medium,
- cumulative risk should be high as other projects are also planned for the area,
- the Pilbara Trawl industry and the effects of increased vessel traffic are not considered;
- impact of cyclone mooring buoys is not considered;
- the impact to Onslow Prawn Managed Fishery is considered to be high as the project will have impacts to tiger and banana prawn industry when species abundance is high and dredging in Area 1 will affect all species; and
- incorrect licence information, incorrect definitions of “bycatch”, inaccurate fishery areas and other errors.

The **Nickol Bay Professional Fishermens Association**: had issues with:

- new and existing cyclone moorings,
- seawater intake and impacts to longshore water movement and salinity and impacts to prawns, larvae, etc,
- changes to water flow from shipping channel, PLF and MOF and impact to prawns,
- removal of prawn nursery habitat,

- impacts of dredging and spoil placement on prawn habitat (including seagrass) and trawl grounds,
- wrongly identified prawn species and habitat as the main industry species.

A **Public submission** had concerns about the pipeline and spoil disposal area covering some of the main mackerel fishing area, safety, loss of fishing grounds, water clarity and changes to fish migration patterns
.
The **Pearl Producers Association** had concerns about marine water and sediment quality (Monte Bello Is and Exmouth Gulf), possible impacts at 80 Mile beach, invasive marine pests, increased traffic, dredging disruption, suspended solids, shift in species mix at pipelines and exclusion zones/access limitations.

The **WA Fishing Industry Council** raised concerns about:
- having significant impact to managed fisheries, the highest impact would be to Onslow Prawn Fishery, 2nd highest to Pilbara Wetline Fishery and lesser extent Mackerel Fishery, Marine Aquarium Fishery, Specimen Shell Fishery, Exmouth Gulf Fishery, Plibara Trap Fishery, Pearling Industry and the Developmental Blue Swimmer Crab Fishery;
- safety,
- marine pests and cumulative impacts of regional developments;
- the pipeline travelling through middle of Wetline Fishery area for Goldband Snapper and Saddletail which are not found in concentrations elsewhere and pipeline intercepting key areas of mackerel spawning aggregation;
- recreational fishing from resource vessels in the commercial area;
- impacts to key fishing grounds and prawn nurseries not being manageable;
- management proposed for recreational fishing not being sufficient; and
- more information being needed on exclusion zones.

A review undertaken by Peter Hick for the WA Fishing Industry Council raised:
- more information was needed on the extent of dredging, depths, and impacts to prawn fishing area 1,
- infrastructure will impact habitats for tiger prawn breeding, growth and maturity cycles;
- interruption of shoreline processes could result in productivity reduction;
- more information on baseline environment and processes for tiger prawns is required, post Tropical Cyclone Vance prawns took several years to recover, and
- baseline and continuing study and monitoring of turbidity in the prawning area is needed.

Mackerel Islands Pty Ltd expressed concerns about the impacts of dredging turbidity and spoil dumps to the commercial accommodation

and diving business on Thevenard and Direction Islands and to the environment, about the lack of consultation with the submitter and that the area was of high diversity with environmental importance.

Assessment

The EPA's environmental objective for this factor is to ensure that changes to the environment do not unacceptably impact upon the social surroundings of man, where the social surroundings of man are his aesthetic, cultural, economic and social surroundings to the extent that those surroundings directly affect or are affected by his physical or biological surroundings.

While acknowledging that some adverse economic impacts may occur as a result of the environmental impacts, the EPA does not see its role as that of an advisor or mediator on matters that may be resolved by a commercial agreement between stakeholders. The EPA notes that the proponent has committed to working with the community to address their concerns and is setting up a Fisheries and Tourism Working Group Panel with commercial fishing and tourism operators and the DoF to address impacts from the proposal. The EPA recommends that this Group continues to work through outstanding issues with the objective of concluding satisfactory outcomes with the participants before the commencement of dredging.

Summary

The EPA considers that the EPA's objective for the key environmental factor of tourism and fishing related industries can be achieved through co-operative processes between the proponent and the affected parties or legal avenues.

3.9 Environmental principles

In preparing this report and recommendations, the EPA has had regard for the object and principles contained in s4A of the *Environmental Protection Act (1986)*. Appendix 3 contains a summary of the EPA's consideration of the principles.

4. Conditions

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for Environment on the key environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

4.1 Recommended conditions

Having considered the information provided by the proponent and in this report, the EPA has developed a set of conditions that the EPA recommends be implemented if the proposal by Chevron Australia Pty

Ltd to construct and operate a 25 Mtpa LNG plant, a domestic gas plant and to construct marine facilities to support the proposal, is approved for implementation.

These conditions are presented in Appendix 4. Matters addressed in the conditions include the following:

a) condition 5 ‘Final Marine Infrastructure Plan’ to show the location and design of the marine components of the proposal;

b) condition 6 ‘Construction of Marine Facilities’ to define the required and target Environmental Protection Outcomes from dredging and spoil disposal and to require a Dredging and Dredge Spoil Placement Environmental Monitoring and Management Plan;

c) condition 7 ‘State of the Marine Environment Surveys’ to determine the pre-development Baseline state, the mid-term of marine works state and post-development state(s) of the marine environment;

d) condition 8 ‘Trunkline Installation’ to define the actual trunkline route, require a Trunkline Route and Infrastructure Plan detailing the environmental impact of the chosen route, set the impact footprint and zones of impact of the trunkline and require a Trunkline Installation Environmental Monitoring and Management Plan;

e) condition 9 ‘Coastal Processes’ to require implementation of the proposal in a manner that minimises changes to littoral transport and the development and implementation of an approved Coastal Processes Monitoring and Management Plan;

f) condition 10 ‘Marine Fauna Interaction – Pile Driving, Dredging and Marine Construction Vessels and Offshore Accommodation Vessel and Onshore Facility Light Sources’ to require dedicated Marine Fauna Observers and trained crew members for dredging and piling operations, lodge cetacean records with the National Cetacean Sighting and Strandings Database, limit work vessel speeds, set conditions for the commencement and suspension of piling operations and require a Conservation Significant Marine Fauna Interaction Management Plan and an Underwater Noise Monitoring and Review Program;

g) condition 11 ‘Marine Drilling and Blasting Activities’ to require that these operations are managed to minimise adverse impacts to marine fauna;

h) condition 12 ‘Introduced Marine Pests’ to prevent, detect and control marine pests;

i) condition 13 ‘Marine Outfalls’ to define the location of outfalls from onshore facilities and the Offshore Accommodation Vessel, the quality of waste water discharges and the environmental quality objectives to be met;

j) condition 14 ‘Mangrove, Algal Mat and Tidal Creek Protection’ to set the limits of mangrove and algal mat loss and require the

development and implementation of an approved Mangrove and Algal Mat and Tidal Creek Protection Management Plan, which includes consideration of sawfish;

k) condition 15 ‘Terrestrial Fauna’ to manage the impact of pipeline trenches on terrestrial fauna;

l) condition 16 ‘Weeds’ to prevent the introduction of new weeds into the proposed extension to the Cane River conservation park and to undertake weed control and rehabilitation, where necessary;

m) condition 17 ‘Rehabilitation’ to require progressive rehabilitation and the development of completion criteria for rehabilitation;

n) condition 18 ‘Emissions to Air’ to require best practice for minimising emissions of volatile organic compounds and oxides of nitrogen emissions, optimising the smokeless capacity of flares and minimising non emergency flaring of gas;

o) condition 19 ‘Greenhouse Gas Abatement’ to require the development and implementation of an approved Greenhouse Gas Abatement Program and the offsetting of the emission of reservoir carbon dioxide to the atmosphere;

p) condition 20 ‘Public Availability of Data’ to require all validated environmental data to be made publicly available, except where it can be demonstrated it is confidential commercially sensitive information;

q) condition 21 ’Decommissioning’ to set decommissioning criteria prior to closure; and

r) condition 22 ‘Residual Impacts and Risk Management Measures’ to be implemented to address the residual environmental impacts and risks of the proposal to seagrass, coral, mangroves, marine and estuarine fauna, algal mats, vegetation and conservation areas.

It should be noted that other regulatory approvals and mechanisms relevant to the proposal are:

- Works approval and licensing by the DEC;
- Development approval from the DPA;
- Major hazard facility licensing from the DMP;
- Oil spill management plan requirement by the DoT and the DMP,
- Sea dumping permit from the DSEWCP;
- Rezoning/development approval from the Shire of Ashburton;
- Water abstraction licences from the DOW;
- Disturbance of Aboriginal sites permission from the Minister for Indigenous Affairs;
- Commonwealth government approvals relating to offshore operations.

4.2 Consultation

In developing these conditions, the EPA consulted with the proponent, the Department of Environment and Conservation, the Department of Fisheries, the Dampier Port Authority, the Department of State Development, the Department of Mines and Petroleum and the Department of Transport in respect of matters of fact and matters of technical or implementation significance.

5. Other Advice

Operational port management

The operational management of the port has not been assessed for this proposal. It is anticipated that the DPA would ultimately take over control of the port and its operation. An appropriate level of environmental management and monitoring for the operational port would need to be put in place to achieve good environmental stewardship.

The EPA recommends that a port operations environmental management plan would need to be prepared by Chevron in consultation with the DPA for the initial stages of the development prior to the DPA assuming control of the port.

Once the port is vested in the DPA, the *Port Authorities Act 1999* requires a strategic development plan which must set out an environmental management plan for the port. The EPA recommends that the management plan considers such environmental issues as the impact on benthic habitat of maintenance dredging, planning of water quality management, especially for additional outfalls, vessel impacts to marine fauna, oil spill management and introduced pest management.

The EPA recommends to the Minister for Environment that upon issuing the statement for the implementation of the proposal, if the Minister so decides, the Minister writes to the proponent and the Minister for Transport (as the Minister with responsibility for the DPA) reiterating the EPA advice above.

Ashburton North Strategic Industrial Area (SIA)

While this assessment is the assessment of a proposal put forward by the proponent, Chevron Australia Pty Ltd, it is not the assessment of a strategic proposal, i.e. the Ashburton North SIA.

It is the EPA's opinion that there is considerable merit in it undertaking a strategic assessment of a proposed industrial area before considering individual proposals. This would allow cumulative impacts to be considered and provide information for planning of the industrial area and requirements for individual proposals.

The EPA is aware that Chevron has undertaken some cumulative impact studies for the future SIA for its rezoning application and for the draft structure plan. These are:

- Cumulative Air Quality Modelling;
- Cumulative Noise Impact Assessment; and
- Ashburton North Strategic Industrial Area – Surface Water Studies.

Cumulative impacts

The proponent considered cumulative impacts from foreseeable future projects within the SIA, existing impacts, and associated development. These included:

- the BHP Billiton / Apache Macedon Gas Development;
- the Exxon Mobil / BHP Billiton Scarborough (North West Shelf) Pilbara Liquefied Natural Gas (LNG) Processing Plant;
- the town of Onslow;
- Onslow Salt;
- pastoral leases;
- commercial and recreational fishing;
- access roads and road upgrades;
- airport expansion;
- landfill;
- quarry and borrow pits; and
- associated traffic.

The proponent considered the following factors:

a) Marine Water and Sediment Quality;
b) Benthic Primary Producer Habitat;
c) Marine Fauna;
d) Coastal Processes;
e) Terrestrial Factors (Soils and Landforms, Groundwater, Surface Water, Terrestrial Flora and Vegetation, Terrestrial Fauna, Subterranean Fauna, Air Quality); and
f) Social Factors (European and Aboriginal Cultural Heritage, Local Fishing and Pearling, Disturbance to Other Recreational Use, Public Amenity, Health and Well-Being).

The proponent concluded that the cumulative impacts arising from the proposal and other actions included in the cumulative assessment were considered to be either not significant or manageable through the incorporation of appropriate mitigation measures.

Recommendations to the DEC

The Ministerial Conditions for this proposal set out the environmental quality management framework that the proponent and regulators need to use for establishing management objectives for any waste water discharges associated with this proposal. The EPA recognises that regulation and on-going management of the discharge would be through the Department of Environment and Conservation discharge licensing process under Part V of the Environmental Protection Act 1986. The EPA

therefore provides the following recommendations to help guide on-going regulation and management of wastewater discharges to achieve the environmental quality objectives and levels of ecological protection it has established for the proposal. The EPA recommends that:

1 The proponent should demonstrate implementation of the waste management hierarchy and that best practice waste water treatment and management procedures are being applied at all times to minimise the discharge of brine and other contaminants into the marine environment.

2 Any discharge licences issued for the Wheatstone Development by the Department of Environment and Conservation under Part V of the Environmental Protection Act 1986 include conditions that ensure that the environmental quality objectives and levels of ecological protection outlined in Schedule 2 of the recommended Ministerial Conditions are achieved.

3 If the results of the Effluent or Discharge Quality Validation and Reporting Plan indicate that the environmental quality objectives or levels of ecological protection outlined in Schedule 2 of the recommended Ministerial Conditions, for the areas identified in condition 13, are not being achieved then the CEO of the Department of Environment and Conservation should require measures to be taken, including revision of the discharge licence, to ensure that the requirements of Schedule 2 are met.

4 Prior to application for any licence to discharge the proponent should prepare a Effluent / Discharge and Environmental Quality Monitoring and Management Program to the satisfaction of the CEO of the Department of Environment and Conservation to ensure that the environmental quality objectives and levels of ecological protection outlined in Schedule 2 of the recommended Ministerial Conditions are achieved on an on-going basis for the Low, Moderate and High Ecological Protection Areas identified in recommended condition 13.

5 The Department of Environment and Conservation should ensure that any licence requirements for discharges from the Wheatstone Development require the proponent to implement the Effluent / Discharge and Environmental Quality Monitoring and Management Program. The results of the Effluent / Discharge and Environmental Monitoring and Management Program should be reported to the CEO of the Department of Environment and Conservation within 18 months of commissioning, and annually thereafter. If monitoring results indicate that the environmental quality objectives and levels of ecological protection outlined in Schedule 2 of the recommended Ministerial Conditions may not be met for the areas identified in condition 13 then the report should include discussion of the management strategies necessary to

achieve, and ensure ongoing compliance with, the environmental quality objectives and levels of ecological protection.

6 The Department of Environment and Conservation should require the proponent to verify the performance of any outfall diffuser under the conditions of the discharge licence and to report the results within 12 months of commissioning of that outfall. The objective of diffuser performance monitoring is to determine whether the required number of dilutions is being achieved to meet the requirements of Schedule 2 of the Ministerial Conditions, under a range of flow rates, meteorological and sea state conditions. The report should include any management strategies necessary to ensure ongoing compliance with environmental quality objectives and levels of ecological protection outlined in Schedule 2.

7 If the results from any monitoring program indicate that the environmental quality objectives or levels of ecological protection outlined in Schedule 2 of the recommended Ministerial Conditions for the areas identified in condition 13 are not being achieved then the CEO of the Department of Environment and Conservation should revise the licence conditions accordingly to ensure the requirements of Schedule 2 are met.

8 The EPA recommends that the proponent should incorporate the procedures contained in the *Manual of Operating Procedures for Environmental Monitoring Against the Cockburn Sound Environmental Quality Criteria* (EPA Report 21, 2005) when preparing and implementing the Effluent and Environmental Quality Monitoring and Management Program.

9 In the absence of any quality assured baseline data on the background concentrations of seawater constituents in local marine waters, analysed to ultra-trace levels, the proponent should refer to the results in the North West Shelf Joint Environmental Management Study Technical Report *Background Quality of Coastal Marine Waters of the North West Shelf, Western Australia*, 2006.

The EPA recommends the following requirements in works approvals and licensing for marine outfalls:

- continuous monitoring of flow, pH, temperature and turbidity with targets and limits set by the DEC;
- contaminant discharge to environment to be managed by setting both concentration (to manage acute and chronic effects) and load (to manage long term impacts due to bioaccumulation and biomagnification) limits and targets; and
- to ensure Best Practice, operation of WWTP targets to be set for wastewater quality for Biological Oxygen Demand (20 parts per million (ppm) flow weighted monthly average); Chemical Oxygen

Demand (100 ppm flow weighted monthly average) and Total Suspended Solids (25 ppm flow weighted monthly average).

To prevent soil, marine, surface and groundwater pollution during construction and operation the EPA recommends to the DEC that works approval and licensing address the following:

- environmentally hazardous substances should have secondary containment;
- groundwater should be monitored on an annual basis around facility pad and other potentially contaminating infrastructure;
- spills should be reported to the DEC, with the DEC to define the reporting limits for spills;
- a fire fighting foam management plan to the satisfaction of the CEO of the Office of the EPA should be submitted prior to commissioning and should cover fire fighting training, emergency response and foam storage;
- stormwater facilities should allow segregation of uncontaminated and contaminated stormwater;
- uncontaminated stormwater should be routed through detention basins to allow monitoring of quality and flow. Contaminant limits and targets for uncontaminated stormwater should be set by the DEC, noting the EPA's recommendation that the concentration of Total Petroleum Hydrocarbons in stormwater should be less than 1ppm for discharge to the creek system or the marine environment; and
- contaminated stormwater should be routed to the WWTP for treatment prior to discharge to the marine environment.

The EPA recommends to the DEC that works approvals and licensing for air emissions address the following:

- a licence condition to require the proponent to periodically carry out ambient air quality monitoring (combustion emissions and relevant air toxics) to verify modelling predictions. Monitoring over one year every five or ten years, depending on the rate at which industrial activity at the SIA increases, is suggested;

- for flares, a condition to cover installation of flow meters and flare gas sampling points to allow estimation of emissions. It is recommended that flaring targets be conditioned based on assumptions in the ERMP used for modelling. It is suggested that one target be set for mass or volume of gas flared per year; or mass/volume of gas flared per tonne of LNG produced per year. Another target should be the number of hours per year of black smoke emitted from the flare, again based on assumptions used in the ERMP modelling for particulate emissions from flares. It is recommended that an annual flaring report is submitted to the DEC covering metrics above. The works approval should also consider noise from flares;

- for greenhouse gases, a condition to require flow metering and gas sampling of all significant emission sources of greenhouse gases to allow accurate estimation of emissions. The initial $CO_{2\,e}$ target should be based on 0.26 t $CO_{2\,e}$/tonne LNG (excludes offshore emissions, Domgas emissions and reservoir CO_2);

- for air toxics, a condition to apply targets for BTEX and mercury based on assumptions in the ERMP;

- for fugitive emissions, a condition to require a Leak Detection and Repair program covering all potential leak points consistent with USEPA Method 21 protocol to be carried out every 2 years. The definition of a leak should be a concentration of 1000 ppm or greater. Repair times for leaks are recommended as follows:
    - Leak concentration > 100,000 ppm, 2 weeks;
    - Leak concentration >10,000 but < 100,000, 6 weeks; and
    - Leak concentration >1000ppm but < 10,000ppm 12 weeks.

  If a shutdown is required to repair a leak, the repair should be carried out at next available shutdown.

  It is recommended that the leak detection and repair program is carried out by conventional means using a Flame Ionization Detector or Photo Ionization Detector. Chevron has proposed leak surveys using an infrared camera, however, these will only detect leaks greater than 10,000ppm when used by very experienced operators and under ideal atmospheric conditions.

6. Conclusion

The EPA has assessed the proposal for the Wheatstone Development and believes that the proposal can be implemented with appropriate management to limit environmental impacts to an acceptable level.

Sub-tidal Benthic Habitat

Implementation of the proposal would result in unavoidable impacts to sub-tidal Benthic Primary Producer Habitat and other benthic communities, some of which would be permanent but the majority of which are predicted to recover within five years. Impacts are predicted based on modelling results for which there is always some degree of uncertainty. Impact predictions have been based on results from dredging in Singapore and scientific literature about turbidity and sedimentation relationships to benthic habitat impact. This may be the best information that the proponent can obtain, but there is still uncertainty as to how this information relates to local conditions. The frequency of cyclones in the Onslow area also creates the risk of unpredictable and additional impact.

The uncertainty generated in modelling is compounded by the lack of information about the final design and plant/equipment to be selected. This is a common issue in large industrial proposals where, for financial decision making purposes, environmental approval precedes front-end engineering and detailed design. In addition, the future expansion of the plant using feed gas from unknown sources adds to the uncertainty.

In view of these uncertainties, the EPA has recommended detailed conditions (conditions 6, 8 and 13) with the aim of limiting loss of sub-tidal benthic habitat to as low as reasonably practicable and to ensure as high a standard of monitoring and management as practicable. Condition 7 requiring State of the Marine Environment Surveys is also recommended to confirm that predicted losses are not exceeded and predicted recoveries of benthic habitat occur.

Turbidity and sedimentation generated by the proposal can impact coral spawning and larvae survival rates. The EPA believes that turbidity-generating activities should be suspended three days prior to the predicted commencement of mass coral spawning, or as soon as mass coral spawning is detected if prior to the predicted time, and remain suspended for 7 days from the commencement of mass coral spawning. This is included in recommended conditions 6 and 8.

As some information was not available and uncertainties remain, the EPA's recommended conditions (including the residual impacts and risk management measures) reflect these gaps in knowledge and uncertainties. The EPA considers that with the implementation of the recommended conditions, impacts to benthic habitat would be minimised and, while noting that there would be a reduction in abundance, productivity and geographic distribution at a local scale, the EPA's objectives would be met.

Intertidal Benthic Primary Producer Habitat (BPPH)

Implementation of the proposal would result in unavoidable, and mostly permanent, impacts to intertidal BPPH. The EPA notes that the proposal has been sited to avoid impacts to the regionally significant mangrove community at the Ashburton River Delta and that, to a certain extent, the proposal is constrained by the location of the Materials Offloading Facility (MOF) and the extent of the Strategic Industrial Area.

The EPA acknowledges that there would be losses of intertidal BPPH in excess of its guidelines and that there is lack of knowledge and uncertainty in the impact these losses may cause to the Hooley Creek mangrove system.

The EPA is also aware that the location of the MOF is likely to cause coastal impacts and the extensive filling of the site to avoid flooding is likely to change surface water flows, both from flooding and tidal inundation. These impacts require management and monitoring to ensure that there is no unpredicted loss of BPPH. The EPA therefore has

recommended conditions to manage and monitor impacts to intertidal BPPH (conditions 9 and 14).

As some information was not available and uncertainties remain, the EPA's recommended conditions (including the residual impacts and risk management measures) reflect these gaps in knowledge and uncertainties. The EPA considers that with the implementation of the recommended conditions, impacts to intertidal benthic primary producer habitat would be minimised and, while noting that there would be a reduction in abundance, productivity and geographic distribution at a local scale, the EPA's objective would be met.

Marine fauna

There are a number of protected species that utilise the proposal area and surrounds. Although the proponent considers that the residual risk of impact to protected marine fauna is low, the EPA is of the opinion that insufficient weight has been given the to the status of the species as protected species. Species are listed under the Environment *Protection and Biodiversity Conservation Act 1999* and the Western Australian *Wildlife Conservation Act 1950* because there is already, or could be in the medium term future, a high risk of extinction of the species.

The recording of significant numbers of resting or milling pods suggests that whales may be resting offshore of the Onslow area during their southern migration. Mothers and calves are of particular concern as humpback whales use complex vocalisations and it is possible that communication between mothers and their calves helps to keep them close together. Noise from piling activities may cause disruption of mother and calf communications and stress to the animals. As a precaution, the EPA recommends condition 10-9 that marine pile driving be suspended at night during the peak southern migration of mother and calf humpback whale pods.

The EPA is of the view that further consideration should be given to the management of impacts to protected species, in particular, light impacts to turtles and hatchlings and, therefore, recommends conditions 10 and 11. There is no evidence that any planning for the minimisation of lighting for the facility or in the placement of flares has been undertaken.

Risks that would impact all species are hydrocarbon spills in the marine environment and increased recreational impacts to species and habitats. A Marine Oil Pollution Plan would be required by other legislation and recreational impacts are considered under the factor for Recreation and Aesthetics.

The EPA notes that there is a lack of knowledge on critical habitats for humpback whales, dugongs and snubfin dolphins in the Pilbara region.

As some information was not available and uncertainties remain, the EPA's recommended conditions (including the residual impacts and risk

management measures) reflect these gaps in knowledge and uncertainties. The EPA considers that with the implementation of the recommended conditions, impacts to marine fauna would be minimised and, while noting that there may be a temporary reduction in abundance and geographic distribution at a local scale, the EPA's objective would be met.

Flora and vegetation

Approximately 3300 ha of terrestrial vegetation would be cleared and this is unavoidable for the implementation of the proposal. There is opportunity for the early rehabilitation of 935 ha, consisting of the borrow sites and a 15 m width along the approximately 75 km long domestic gas pipeline corridor. Other rehabilitation would not be possible until facilities are decommissioned.

While there are some species of conservation significance that may be impacted, the EPA considers that it is unlikely that any species would suffer extinction or a vegetation unit would be lost as a result of implementation of the proposal. The EPA notes that there is a lack of taxonomic knowledge for the genera *Abutilon, Bonamia, Eriachne, Euphorbia, Polygala, Sida* and *Triumfetta* in the Pilbara. The EPA considers that the management of weeds is important, particularly in the proposed addition to the Cane River Conservation Park. The EPA recommends conditions 16 for weed management and 17 for progressive rehabilitation.

As some information was not available, the EPA's conditions (including the residual impacts and risk management measures) reflect these gaps in knowledge. The EPA considers that with the implementation of the recommended conditions impacts to flora and vegetation would be minimised and, while noting that there would be a reduction in abundance, productivity and geographic distribution at a local scale, the EPA's objectives would be met.

Greenhouse gases

Emissions of greenhouse gases from the proposal would be approximately 10 Mt/a. This would increase Western Australia's greenhouse gas emissions substantially. The EPA considers that best practice design and operation should be implemented to minimise greenhouse gas emissions and considers that the current best practice for an equivalent location is represented by the emission intensity from the Pluto project which is expected to be 0.26 tonne $CO_{2\,e}$/tonne LNG. The EPA recommends an initial target of 0.26 tonne $CO_{2\,e}$/tonne LNG with further improvements to be made over time (condition 19).

In the absence of Commonwealth legislation for greenhouse gas emissions the EPA expects that as a minimum, the proponent should offset the reservoir CO_2 released. Should Commonwealth legislation come into force, this requirement would be extinguished if it is non-

complementary to the Commonwealth's greenhouse gas reduction legislation applicable to the proposal (condition 19).

The EPA considers that, with the implementation of the recommended condition, greenhouse gas impacts would be reduced and the EPA's objective to minimise emissions to levels as low as practicable on an on-going basis and consider offsets to further reduce cumulative emissions, would be met.

Air emissions

Air emissions from the proposal are predicted to meet National Environment Protection Measure (NEPM) standards, except for dust when high levels of background dust are experienced.

Nevertheless, the EPA expects the proponent to implement best practice for a liquefied natural gas/domestic gas facility. The EPA notes that further development in the Ashburton North Strategic Industrial Estate is expected. To ensure that best practice is implemented and that future cumulative emissions do not exceed NEPM standards, the EPA recommends condition 18.

The EPA considers that, with the implementation of the recommended condition, the EPA's objective to ensure that emissions do not adversely affect environment values or the health, welfare and amenity of people and land uses by meeting statutory requirements and acceptable standards would be met.

Recreation and aesthetics

The EPA acknowledges that there would be both impacts to recreational pursuits and impacts from recreation to the environment from the proposal. Aesthetic amenity would be impacted by a large visible plume in the nearshore region during dredging which may take up to four years. This impact is largely unavoidable.

The EPA understands that the proponent is setting up a Fisheries and Tourism Working Group Panel with recreational fishing representatives and the Department of Fisheries (DoF) to address impacts to recreational fishing and encourages the proponent to continue working with the community.

To reduce the impact to recreational sites, the EPA recommends condition 9 which requires the proponent to manage littoral transport to prevent reduction in the recreational value of beaches, reduction in the integrity and performance of the Onslow seawall and reduction in the integrity and values of heritage sites.

The EPA notes that the proponent would provide funding during the construction of the initial phase of the proposal to the Department of Environment and Conservation (DEC) to manage the impacts and risks associated with additional visitation to island nature reserves and

mainland coastal areas and also for the management of visitors to the Cane River Conservation Park within the vicinity of the proposal. The proponent would also fund the DoF to assist in ensuring that recreational fishers comply with bags limits and size limits in the coastal and estuarine environment within the vicinity of the proposal (condition 22).

The EPA considers that with the implementation of these actions and conditions, the EPA's objectives to ensure that existing and planned recreational uses are not compromised and to maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge would be met.

Tourism and fishing related industry

The EPA acknowledges that there may be impacts to the tourism and fishing related industries from the proposal, particularly the Onslow Managed Prawn Fishery and the Mackerel Island Dive Resort.

However, the EPA does not see its role as that of an advisor or mediator on matters that may be resolved by a commercial agreement between stakeholders. The EPA notes that the proponent has committed to working with the community to address their concerns and is setting up a Fisheries and Tourism Working Group Panel with commercial fishing and tourism operators and the DoF to address impacts from the proposal. The EPA recommends that this Group continues to work through outstanding issues with the objective of concluding satisfactory outcomes with the participants before the commencement of dredging.

Environmental Management Plans

In this assessment the EPA has had to recommend a number of conditions requiring management plans. This is because the proponent has not completed its management plans. This is not the EPA's preference and nor is it normal practice. The level of assessment of Environmental Review and Management Program requires management plans for the key environmental factors to be included in the ERMP, so that comment may be made on proposed management during the public review. These management plans could be further refined as a result of submissions and the EPA's assessment. It is the EPA's expectation that by the end of the assessment, agreed management plans would have been prepared by the proponent and that there would not be the requirement to recommend conditions for the preparation of key management plans. The recommendation that this proposal could be implemented is conditional upon environmental management plans being finalised to the Office of the EPA's Chief Executive Officer's satisfaction.

Proposed residual impacts and risk management measures

While the proponent has endeavoured to minimise the impacts of the proposal, the EPA recognises that the following significant residual marine and terrestrial environmental impacts and risks remain, including:

Marine

Habitat/species	Potential permanent/direct loss (ha)	Potential temporary/indirect loss (ha)
Seagrass	10	2963
Coral	37	22.4
Macroalgae	250	4018
Filter feeders	2272	904

In addition, there are residual risks of impact to marine habitat for dugong, dolphins, turtles and sawfish, and further risk of impacts to those species and megafauna (including whales) from noise and vessel strike.

Near shore / Wetland

Habitat/species	Potential permanent loss (ha)
High tidal mud flats	108
Mangroves/Hooley Creek	4
Algal mats/Hooley Creek & Four Mile Creek system	52

Further, significant risks have been identified as a result of additional recreational fishing pressure, particularly during the construction phase of the proposal.

Terrestrial

Habitat	Potential permanent loss (ha)
Native vegetation	3300
Cane River Conservation Park and proposed extensions	265
Locally significant native vegetation	3

In addition, there are residual risks associated with the increased visitation to offshore island nature reserves and the Cane River Conservation Park and its proposed extensions.

To manage these residual environmental impacts and risks, the proponent has proposed the following additional measures:

Research projects to:

- improve the understanding and management of the impacts of dredging on tropical marine communities;
- improve the understanding of west Pilbara marine habitats, connectivity and recovery potential following natural and human induced disturbance;
- identify and improve management of critical habitat for threatened marine species including humpback whales, dugongs and snubfin dolphins in Pilbara waters; and

Management projects for addressing:

- the impacts and risks associated with increased visitation to island nature reserves managed under the *Conservation and Land Management Act 1984* within the vicinity of the Project;
- additional recreational fishing pressure within the vicinity of the Project; and
- impacts and risks associated with increased visitation to the Cane River Conservation Park and proposed extensions.

In addition, the proponent would maintain a contingency fund for the purposes of remediating impacts to offshore islands and the Cane River Conservation Park and proposed extensions where impacts can be reasonably attributed to the Wheatstone project.

The EPA has concluded that the proposed residual impacts and risk management measures sufficiently address the residual environmental impacts and risks of the proposal on the State's biodiversity assets.

In order to ensure these additional measures are transparent and auditable, the EPA has recommended that they be included in the recommended conditions (refer condition 22).

7. Recommendations

The EPA submits the following recommendations to the Minister for Environment:

1. That the Minister notes that the proposal being assessed is for the construction and operation of a 25 million tonne per annum liquefied natural gas plant, a domestic gas plant and marine and terrestrial infrastructure to support the proposal;
2. That the Minister considers the report on the key environmental factors and principles as set out in Section 3;
3. That the Minister notes that the EPA has concluded that it is likely that the EPA's objectives would be achieved provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 4 (and summarised in Section 4) and of the EPA's recommendations to the Department of Conservation and Environment;
4. That the Minister notes that the EPA has made a number of recommendations to the Department of Environment and Conservation regarding works approvals and licensing in Section 5 of this Report; and
5. That the Minister imposes the conditions and procedures recommended in Appendix 4 of this report.

Appendix 1

List of submitters

Organisations:
Department of Mines and Petroleum
Main Roads
Department of Environment and Conservation
Department of Transport, Coastal Infrastructure
Department of Indigenous Affairs
Department of Health
Radiological Council
Department of State Development
Heritage Council
Department of Fisheries
Department of Water
Dampier Port Authority
Shire of Ashburton
Woodside Energy Ltd
Nickol Bay Professional Fishermens Association
Pearl Producers Association
WA Fishing Industry Council
Mackerel Islands Pty Ltd
Cape Conservation Group Inc
Conservation Council and Wilderness Society
CARE Group

Individuals:
Leah Hair
Fiona Bishop
R & L Mitchell
Sharon Mcarthur
Glenn Osboldstone

Appendix 2

References

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Appendix 3

Summary of identification of key environmental factors and principles

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
BIOPHYSICAL			
Marine benthic primary producer habitat	Impacts due to dredging, pipeline installation, changes to water quality from discharges and spills	**Department of Environment and Conservation (DEC)** recommended that: • a plan is provided to show dredge scenarios are practicable and predictions are conservative, • there are no water quality changes or sedimentation outside ZoI, to ensure dredge plume does not reach marine reserves, • mitigation or offsets are needed for BPPH where guideline values are exceeded, • zones of impact should be high and moderate impact zones, • impacts in zone of moderate impact should be refined (graduated) to give more accurate loss estimate, • extent of mortality of coral shoals in high impact zone be specified, • in the ZoI the net live cover of benthic habitats does not fall below 100%, • in ZoMI impacts are zero for filter feeders and zero for regionally significant coral communities around offshore islands, • a benthic health monitoring programme be required prior to completion of assessment, • in the ZoMI monitoring of seagrass to prove recovery within 5 years and if not, active rehabilitation or contingency offset measures, • conditions based on specific amounts of habitat to remain based on predicted losses, • the DSDMP be a complete plan, including validation of modelling; • during maintenance dredging no mortality of BPPH outside of dredged areas and monitoring; and • there was insufficient information provided for mitigation measures with regard to discharges, effluent toxicity testing of discharges, monitoring, and cumulative impacts modelling for works approvals / licensing. **Department of Transport (DoT)** had concerns that: • disposal site A was unlikely to be suitable for slurry dumped directly for a CSD; • disposal sites B and C were unlikely to be stable, • dredge plume modelling had not calibrated and validated against field water quality data, • conditions requiring collection of plume data and review of model and management, and the use of adaptive management with forecasting a week in advance and modification of dredge activities were needed; • the proponent should be required to contribute to scientific research by data collection (data to be publicly available); • inter-annual variability in conditions needs consideration; • the statement that local habitats are adapted to dredge related sedimentation and turbidity is incorrect as natural turbidity duration is not comparable with dredging; • there was low confidence in boundaries of 100% mortality zone; • there was no proper consideration of natural turbidity and sedimentation and compounding dredging impacts;	Marine BPPH is considered to be a relevant environmental factor.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
		• that the channel backfilling model was oversimplified and not capable of providing engineering predictions; • there was insufficient information on the non-cohesive sediment transport model; and • trunkline stability analysis should be required if it passes sand-wave fields. **Dampier Port Authority (DPA)** made the following submission regarding marine infrastructure, common user infrastructure and corridors and dredging: • there is limited information of how the MOF/breakwaters would be constructed; • details on the MOF diesel storage and transport are needed; • hydrodynamic modelling results showing optimisation of MOF and channel configuration to minimise maintenance dredging; • information is required about the temporary access channel, • DPA is concerned about the location of spoil dumps A & B and spoil mobilisation and channel blockage, • information is required on the design characteristics of main shipping channel, • more information is required about pipeline stabilisation, shore crossing method and location. • DPA requires outfall in port area to be sized for all future users; • more information is required about the offshore outfall; • more information required about the location and capacity of intake which should be sized for all future users;. • more information is required about onshore spoil disposal; • spoil dumping permit request does not include maintenance dredging; • more information required on maintenance dredging; • impacts of dredge spoil disposal sites; and • Dredge Plume Management – concerns raised about modelling, material sizes, overflow rates, duration of scenarios, weather conditions and light deprivation. **Department of Fisheries (DoF)** commented that • literature indicated seagrass recovery time in Qld of about 10 years and seagrass/macroalgal recovery in Exmouth Gulf of 2-3 years. Projected recovery time is unrealistic, • dredging impacts not the same as a cyclone, cannot extrapolate recovery between the two, **Conservation Council and Wilderness Society (CCWA & WS)** submitted that Studies, Modelling, Management and Mitigation Measures and Environmental Conditions should be industry best practice. **Cape Conservation Group Inc (CCG)** had concerns about: • measures to prevent condensate leaks and the management of oil spills; • whether vessels would be prevented from entering sensitive areas; • the management of waiting ships; • comparing volumes dredged for Dampier Salt channel and Wheatstone in making assumptions about impacts based on Dampier Salt channel.	
Intertidal benthic primary producer	Impacts due to land clearing,	**DPA** made the following submission: • DPA is concerned about accuracy of coastal geomorphology and impacts modelling,	Intertidal benthic primary producer habitat is considered to be a relevant

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
habitat	changes to coastal processes and surface water flows and quality	especially longshore sand transport; • A better understanding of accretion and erosion and impact of cyclones is needed, • The preliminary design of MOF would not survive wave attack from rear and the modelling needs to be reviewed;' • a commitment to bypass sand from west to east on regular basis is needed. In the Coastal Processes Management Plan; and • the Domgas corridor should be able to accommodate other users. **DEC** recommended • a monitoring program for impacts from LNG plant and construction road to show predicted losses of benthic habitat not exceeded; • a management plan for mangroves, algal mat and samphires; and • offsets for a significant impact to Hooley and 4 Mile Creek. **CCG** had concerns that cumulative impacts from project to the Ashburton River mouth mangrove system need to be assessed.	environmental factor.

Marine fauna	Impacts due to collision, habitat loss, noise, light, dredge entrainment and introduction of exotic species	**DEC** expressed concerns about :
		• the loss and mortality of BPPH supporting dugongs and turtles,
		• direct impacts to marine fauna,
		• impacts to island nature reserves, marine fauna and fauna habitats from recreation and
		• offsets for residual impacts.
		DEC recommended
		• further surveys for presence and significance of population and habitat of the green sawfish;
		• improved dredge management measures to prevent impact to marine turtles;
		• Full season of in-water turtle studies be undertaken
		• for dugongs recommends marine observers on all vessels during construction and funding of further studies of dugong occurrence and movements.
		• for seawater intakes recommends double screens and that the intake velocity does not exceed turtle swimming speeds.
		• a fauna management plan for vessel movements including specified measures,
		• a recreation management plan to include education, management and monitoring, and provision of resources for increased recreational pressure on conservation values.
		• underwater acoustical modelling be done for pile driving and determination of zones of physical injury to fauna, management procedures and OBC.
		  • underwater blasting be excluded from assessment.
		  • light management plan including baseline data, zero light horizon, hatchling orientation studies, contingency measures, no light spill on turtle nesting beaches for trunkline.
		DoF raised concerns about:
		• the survey of Hooley Creek and north-eastern lagoon of Ashburton delta which was done in daylight only therefore not accurate, DoF would like to discuss methodology of studies;
		• potential noise effects on fish from drilling rigs, rig tenders and fishing vessels,
		• the impact of noise to demersal fish was not assessed;
			Marine fauna is considered to be a relevant environmental factor.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
		• the risk of introducing marine pest species to be high, • all vessels for the project should be risk assessed for biosecurity. **CCG** had concerns about dugongs, especially: • the distribution of seagrass as it is critical habitat for dugong fecundity, • recovery times for seagrasses; • cumulative impact assessment to seagrass from all sources and also accidental sources; • the limited surveying for dugongs and that the survey was within 3 years of cyclonic event which may have affected seagrasses and caused dugong migration away from the site; • limited knowledge of use of the proposal area by dugongs, especially whether Ashburton delta and Hooley Creek are calving areas and if there are any leks in the project area, • risk of impacts from vessels and acoustic impacts; • cumulative impacts of regional dugong displacement; • cumulative impacts to dugongs from project CCG had concerns about • more research being needed on impacts to whale sharks, • further studies on the use of the mouth of the Ashburton by flatback turtles being undertaken, • cumulative risk to flatback hatchlings, • sky glow and impact to hatchlings • that further information was needed on fauna observers and • that the proposal does not address planning of activities with respect to migration patterns for marine species. CCG also recommended: • having a system to safeguard against marine pests, bacteria, viruses and parasites; • extra measures should be taken for bio-fouling; • AQIS requirements should be complied with.	
Flora and vegetation	Impacts due to vegetation clearing, changes to surface water flows and quality	**DEC** recommended that: • impacts to *Abutilon uncinatum* and *Eleocharis papillosa* be avoided, • the number, distribution and habitat extent of *Tecticornia spp* be clarified, • impacts to individual *Tecticornia spp* from footprint, dredge material and water changes be considered and if impacts within surveyed area are significant further survey should demonstrate that the complex extends beyond project area; • an OBC that there is no weed increase in the former Mount Minnie pastoral lease, • weed hygiene and management plan, and weed management plans be developed. • that the Wheatstone Domgas pipeline be located in or near Macedon pipeline corridor. **DPA** recommended that more detailed assessment of acid sulphate soil in accordance with DEC guidelines, more appropriate screening and management of ASS is required.	Flora and vegetation is considered to be a relevant environmental factor.
Terrestrial fauna	Impacts due to collision, habitat loss and trenching	**DEC** recommends a fauna management plan for trenching for pipelines.	This condition has been recommended (condition15). However, as this is considered to be

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
			the main impact to terrestrial fauna a full assessment of this factor has not been provided.
Surface water	Impacts due to changes in flows and volumes	**DOW** advised that floodplain modelling was satisfactory, and the proposal would have minimal impact to 100 ARI flood levels, advised of the need for 8m AHD for accommodation village not 6m, that flood protection levees not considered best practice and that the proponent should consider the accommodation village being isolated from Onslow Rd during flood events. **Shire of Ashburton** was concerned that there was no adequate assessment of the build up of flood waters due to infrastructure corridor. **CCG** requested information on precautions to prevent Ashburton River changing course to Hooley Creek and the response to such an event.	Secondary effects of impacts to surface water quality are considered in intertidal benthic BPPH
Groundwater		**DoH** advised that "sharing" of Onslow water facilities is a concern as Onslow supplies are fully allocated and Chevron bores are not proven or may not be operational when required, and that a Drinking Water Quality Management Plan is required for desalinated water. **DoW** advised that it supports a RO plant and that the proponent should consider the option of a single water provider for all projects in the SIA, and that any further allocations from local aquifer would need further technical justification from Chevron.	The use of groundwater for the proposal has been put forward as an option. Should groundwater supplies be required, these would be subject to DoW approval.
POLLUTION			
Marine water quality	Impacts due to dredging, spoil dumping, discharges and spills	See sub-tidal and intertidal BPPH, marine fauna and recreational and visual amenity for turbidity impacts and waste discharge impacts	There are no uses of marine water in the area other than those proposed by this proposal. All impacts due to water quality changes are secondary impacts to BPPH, marine fauna and social amenity. Water quality is therefore not considered as an environmental factor in this report, but the secondary impacts to BPPH, marine fauna and social amenity are considered.
Surface water quality	Potential impacts due to turbidity and contamination	**Department of Health** advised that recycled water use needs approval and the quality should meet guidelines and that the application of pesticides and fumigants must comply with health regulations and the project should have a pest management plan. **DOW** advised that proposed hydrocarbon management was satisfactory and that DOW guidelines for spill contingencies and response should be referenced.	Secondary effects of impacts to surface water quality are considered in the factor intertidal benthic BPPH
Greenhouse gases	Emission of approximately 10Mt/a of greenhouse gases	**CCWA & WS** considered the lack of greenhouse gas mitigation measures unacceptable and that there was a cursory approach to abatement measures, no evidence presented for claims that LNG would reduce carbon emission by replacing dirtier sources and recommended that the proposal should have at least the same abatement conditions as the Gorgon and Pluto projects. **CCG** questioned whether CO_2 reuse had been investigated. **Public**:4 submitters considered the emissions unacceptable.	Greenhouse gases are considered to be a relevant environmental factor.
Air emissions	Impacts due to emission of dust	**DEC** advised that there was insufficient information provided for mitigation measures with regard to emissions, monitoring, and cumulative impacts modelling for works	Air emissions are considered to be a relevant environmental factor.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
	and other air contaminants from land clearing, turbines and gas processing	approvals/licensing. **DEC** further advised • results of baseline monitoring should be compared with model assumptions and reported to DEC; • H_2S emission from acid gas removal needs to be addressed as a potential odour issue; • Chevron should refer to and consider DEC guidelines, NSW dust deposition guidelines and NEPMs. **DoH** advised that the components of dust should be analysed for particulates of health concern.	
Noise	Noise from construction and operations	**DEC** advised that noise could be managed to comply with Noise Regulations for both construction and operation.	Noise can be managed under the Environmental Protection (Noise) Regulations 1997
Waste management	Solid waste produced during the construction and operation of the project	**DEC** advised that the waste management hierarchy should be applied, remoteness may be a factor and any application for an incinerator would need to meet DEC licensing conditions. **DoH** advised that the regulatory requirements for the transport and disposal of controlled wastes need to be met. **Radiological Council** advised that the Council must be consulted regarding radiation issues and that a Radiation Management Plan would be required for removal and disposal of waste containing NORM. **CARE** was concerned about roadside litter and its management.	The proponent has removed the option of an incinerator from the proposal. All waste would be disposed of to 3rd party facilities. Controlled and Radioactive waste disposal can be managed under existing legislation.
SOCIAL SURROUNDINGS			
Recreation and aesthetics		**DEC** raised concerns about direct impacts to marine fauna, impacts to island nature reserves, marine fauna and fauna habitats from recreation and offsets for residual impacts. **DoF** raised the concerns that: • studies are needed on current recreational fishing and potential fishing trends, • if increased fishing results from the project, how will the proponent address added risk to fish resources? • recreational fishing was important and reduction for even one year could have social consequences, • there was no discussion of indigenous fishing	Recreation and aesthetics are considered to be relevant environmental factors.
Aboriginal heritage	Impacts to Aboriginal archaeological sites due to land clearing	**DIA** had commented that there were areas still to be surveyed for heritage sites, noted that a Cultural Heritage Management Plan would be produced, and raised questions on particulate levels and monitoring and health impacts to Aboriginals.	No submissions have been received from the Thalanyji group and no concerns have been raised about any site. Chevron has provided information that Cultural Heritage Management Plan is being developed with this Group and DIA. Aboriginal heritage can be managed under the Aboriginal Heritage Act.
European heritage and	Impacts to European heritage	**The Heritage Council** has provided advice to the proponent regarding a development application, Development Impact Mitigation Plan, Conservation Plan and a required Heritage	European heritage can be managed by the Heritage Council under the

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
geoheritage	sites and possibly geoheritage sites from land clearing and coastal erosion.	Agreement with the Heritage Council and guidelines for visitors to be developed by the proponent.	Heritage Act. It is understood that these sites would be managed under a Development Impact Mitigation Plan and a Heritage Agreement with the Heritage Council. Advice from the Department of Mines and Petroleum indicates that the geoheritage sites found on the proposal site are not unique or rare and are not on the WA Register of Geoheritage Sites. The site on Big Island is not likely to be of National significance
Fishing and tourist industry		**DoF** raised the following issues: • more details on desalination plant are needed and the impact of the intake on larval fish and prawn populations, • no reference to commercial finfish fisheries and target species has been made although the project has potential impact to demersal scale fishery and mackerel fishery, • studies of marine fauna do not include fish, • more details are required on the summer fish survey, • the proponent is referred to Kangas et al 2007 for fish and invertebrate species composition of prawn trawls, • structured habitats for tiger and endeavour prawns are important, • finfish fishing only briefly mentioned and no value of production stated, • if localised impact occurs in a nursery area or area of high abundance, it could have major impact to fishery, consequence definitions in Table 7.5 not adequate, • reduction of fish for even one season can cause large loss to commercial fishers, • Table 7.2 aspects do not cover long term exclusion of fishers; • it is unclear how the cause of consequences will be identified as due to the project, • effect on offshore fish populations was not considered, • S84.5.5 indicates a high risk to fish stock sustainability and management of the risk should be developed in conjunction with DoF, • Ch 8 focuses too much on protected species and not enough on fish resources, • More details of recreational fishing survey method required, • The management controls and mitigation measures in Table 10.10 are too vague, • % area impacted may underestimate production impact for fisheries, DoF consider risk to commercial fisheries from exclusion zones and reduced access to be medium, • Cumulative risk should be high, other projects also planned for the area, • S10.4 does not consider Pilbara Trawl, (State's biggest finfish fishery), effects of increased vessel traffic not considered, • Table 10.9 some fisheries and fishery areas inaccurate,	Environmental impact causing a social impact can give rise to an environmental factor. Fishing and tourist industry is considered to be a relevant environmental factor. The proposal may have some impact to unofficial camping areas in the vicinity of the proposal. However, as these areas have no formal recognition, the impacts have not been assessed.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
		• Impact of cyclone mooring buoys not considered, • the impact to Onslow Prawn Managed Fishery considered to be high, • S2.7.1 has inaccurate trawl net information, • tiger prawns are the most commercially valuable species in Area 1 and the major species caught. Their habitat requirements should be highlighted, • Incorrect licence information, incorrect definitions of bycatch and other errors, • Project will have impacts to tiger and banana prawn industry when species abundance is high, dredging in Area 1 will affect all species, • Survey of Hooley Creek and north-eastern lagoon of Ashburton delta done in daylight only therefore not accurate, DoF would like to discuss methodology of studies. **Nickol Bay Professional Fishermens Association**: had issues with: new and existing cyclone moorings, seawater intake and impacts to longshore water movement and salinity and impacts to prawns, larvae, etc, changes to water flow from shipping channel and impact to prawns, changes to water flow from MOF, removal of prawn nursery habitat, further changes to water flows from PLF, impacts of dredging and spoil placement on prawn habitat (including seagrass) and trawl grounds, wrongly identified prawn species and habitat (tiger and western king are main industry species). **Public submission** had concerns about the pipeline and spoil disposal area covering some of main mackerel fishing area, safety, loss of fishing grounds, water clarity and changes to fish migration patterns. **Pearl Producers' Association** concerns about marine water and sediment quality (Monte Bello Is and Exmouth Gulf), possible impacts at 80 Mile beach, invasive marine pests, increased traffic, dredging disruption, suspended solids, shift in species mix at pipelines, exclusion zones/access limitations. **WA Fishing Industry Council** raised concerns about: • It sought assistance from Chevron for submission but no reply received, • the proposal having significant impact to managed fisheries in State and Commonwealth waters, • the highest impact would be to Onslow Prawn Fishery, 2nd highest to Pilbara Wetline Fishery and lesser extent Mackerel Fishery, Marine Aquarium Fishery, Specimen Shell Fishery, Exmouth Gulf Fishery, Plibara Trap Fishery, Pearling Industry and the Developmental Blue Swimmer Crab Fishery; • safety, • marine pests and cumulative impacts of regional developments; • the moorings constructed in Mangrove Passage without consultation with prawn fishers; • the pipeline travelling through middle of Wetline Fishery area for Goldband Snapper and Saddletail which are not found in concentrations elsewhere, • pipeline intercepting key areas of mackerel spawning aggregation, • recreational fishing from resource vessels in commercial area, • impacts to key fishing grounds and prawn nurseries not being manageable, • management proposed for recreational fishing not being sufficient: and • more information being needed on exclusion zones.	

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
		A review undertaken by Peter Hick raised: • more information was needed on extent of dredging, depths, and impacts to prawn fishing area 1, • infrastructure will impact habitats for tiger prawn breeding, growth and maturity cycles, • interruption of shoreline processes could result in productivity reduction, • more information on baseline environment and processes for tiger prawns required, post TC Vance prawns took several years to recover, • baseline and continuing study and monitoring of turbidity in prawning area needed. **Mackerel Islands Pty Ltd** expressed concerns about the impacts of dredging turbidity and spoil dumps to the commercial accommodation and diving business on Thevenard and Direction Is and to the environment, about the lack of consultation with submitter and that the area was of high diversity with environmental importance.	
Risk		Department of Mines and Petroleum: queried the separation between terrestrial gas pipeline and accommodation. **DPA** commented that the ERMP has not provided individual buffer zones and risk profile criteria and impact to surrounding areas.	Risk would be managed under Department of Mines and Petroleum legislation.
Transport		Main Roads: raised questions about Onslow road and flood management, quarry sites for road building, traffic impact assessment and management.	Road issues would be managed under Main Roads requirements.
Cumulative impacts and Strategic assessment		**DSD** advised that the proponent should minimise impacts outside of their project area and identify cumulative impacts from their project, existing and proposed projects and minimise and manage their contributions to these. **CCG** was concerned about the lack information about the cumulative impact of the project and impact in a regional context. DPA commented that the ERMP does not mention the SIA. **Conservation Council and Wilderness Society** considered that there was a need for strategic assessment of industrial development in region (Exmouth Sub-basin, Ningaloo Marine Park, Muiron Is Marine Management Area, the waters and lands of Exmouth Gulf and the Onslow coastline and the project should not be approved without strategic assessment.	The proponent has addressed cumulative air emissions from other proposals in the area and carried out a qualitative cumulative assessment for other factors. Only the proponent's proposal is being assessed as no strategic plan for the SIA has been referred to the EPA.
Rezoning and social impact		**Shire of Ashburton** commented that Chevron had lodged an application for rezoning of their site and infrastructure corridor which contains inconsistencies with the ERMP. It has concerns that the social impact assessment had been omitted from the ERMP. The Shire does not support "two town" approach and different documents give different numbers of permanent workforce at SIA and Onslow.	Rezoning and social impacts beyond those directly caused by the proposal are not being assessed.
Other		**Woodside Energy Ltd** stated that it does not agree with comments that 3rd party production facilities on Burrup have limited potential for project development in a timely manner and considers that any additional environmental studies required for expansion on Burrup are prudent and responsible. **CCG** was concerned about the lack of some EMPs, about site selection, the use of other sites by 3rd parties and community consultation. CCG asked for information about the capability of Wheatstone infrastructure to accept and process 3rd party gas, details of pipelines Wheatstone will cross and capability of using other processing facilities, domestic gas plant supply from Macedon or others, whether other Pilbara or Onslow salt facilities be shared, what provisions were made for shared infrastructure, why Macedon needed a separate pipeline corridor, and	No environmental issues or beyond the scope of the assessment.

Preliminary Environmental Factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Key Environmental Factors
		about the Griffin pipeline. **Conservation Council and Wilderness Society** had concerns that there was no assistance to conservation groups to provide comments, that there appear to be contradicting, misleading, unsubstantiated or false statements in ERMP, there is a potential lack of opportunity for public to comment on OBCs, EMPs and for public reporting of results and impacts.	
Impacts to Exmouth		**CCG** had concerns that there may be impacts to Exmouth Gulf from vessels, social impacts to Exmouth and that limestone may be sourced from Cape Range.	The proponent has replied that "The current Project description does not involve: supplies being sourced from North West Cape, supplies being loaded at Exmouth, or personnel being based in Exmouth. The majority of Project vessels are not likely to use Exmouth Gulf waters. A limited number of small vessels may use Exmouth Port and will therefore travel through Exmouth Gulf waters. These vessels will most likely be used for environmental survey work and hydrographic survey work. It is also possible that vessels may use Exmouth Gulf waters for safety reasons during cyclonic activity." The proposal would use only licensed quarries.

PRINCIPLES		
Principle	**Relevant Yes/No**	**If yes, Consideration**
The precautionary principle *Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.* *In application of this precautionary principle, decisions should be guided by –* *(a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and* *(b) an assessment of the risk-weighted consequences of various options.*		
	Yes	There is uncertainty over the level of impact to the marine environment. Impacts to BPPH and marine fauna are considered in the assessment and a precautionary approach adopted.

PRINCIPLES		
Principle	**Relevant Yes/No**	**If yes, Consideration**
2. The principle of intergenerational equity *The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.*		
	Yes	The proposal has the potential to impact on island nature reserves and historical sites. The assessment has considered the management of these impacts. The proposal would emit a large quantity of greenhouse gases that has the potential to impact on future generations. Greenhouse gases are considered in the assessment.
3. The principle of the conservation of biological diversity and ecological integrity *Conservation of biological diversity and ecological integrity should be a fundamental consideration.*		
	Yes	The proposal has the potential to impact upon already threatened species of marine fauna. Marine fauna impacts have been considered in the assessment. The proposal also has the potential to impact on the ecological integrity of BPPH. Sub-tidal and intertidal BPPH have been considered in the assessment.
4. Principles relating to improved valuation, pricing and incentive mechanisms *(1) Environmental factors should be included in the valuation of assets and services.* *(2) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.* *(3) The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.* *(4) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximize benefits and/or minimize costs to develop their own solution and responses to environmental problems.*		
	Yes	The proponent should bear the cost of avoiding or abating pollution. Where environmental assets are lost, the proponent should bear the cost of offsetting those losses.
5. The principle of waste minimisation *All reasonable and practicable measures should be taken to minimize the generation of waste and its discharge into the environment.*		
	Yes	Emissions of greenhouse gas and pollutants to the air and marine environment should be avoided or minimised.

Appendix 4

Recommended Environmental Conditions and nominated Decision-Making Authorities

Identified Decision-making Authorities

Section 44(2) of the *Environmental Protection Act 1986* (EP Act) specifies that the EPA's report must set out (if it recommends that implementation be allowed) the conditions and procedures, if any, to which implementation should be subject. This Appendix contains the EPA's recommended conditions and procedures.

Section 45(1) requires the Minister for Environment to consult with decision-making authorities, and if possible, agree on whether or not the proposal may be implemented, and if so, to what conditions and procedures, if any, that implementation should be subject.

The following decision-making authorities have been identified for this consultation:

Decision-making Authority	Act
Minister for State Development	*Agreement Acts*
Minister for Environment	*Wildlife Conservation Act 1950*
Minister for Planning	*Planning & Development Act 2005*
Minister for Water	*Rights in Water and Irrigation Act 1914*
Minister for Mines & Petroleum	*Petroleum Pipelines Act 1969*
Minister for Transport	*Marine & Harbours Act 1981;* *Harbours & Jetties Act 1928;* *Jetties Act 1926;* *Port Authorities Act 1999*
Minister for Lands	*Land Administration Act 1997*
Minister for Indigenous Affairs	*Aboriginal Heritage Act 1972*
Department of Environment and Conservation	Works Approval and Licence under *Environmental Protection Act 1986*
Department of Mines and Petroleum	*Dangerous Goods Safety Act 2004*
Shire of Ashburton	s162 *Planning and Development Act* 2005 planning approval

RECOMMENDED ENVIRONMENTAL CONDITIONS

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED
(PURSUANT TO THE PROVISIONS OF THE
ENVIRONMENTAL PROTECTION ACT 1986)

WHEATSTONE DEVELOPMENT – GAS PROCESSING, EXPORT FACILITIES AND INFRASTRUCTURE.
SHIRE OF ASHBURTON AND ROEBOURNE.

Proposal: The proposal is to construct and operate a 25 million tonne per annum Liquefied Natural Gas (LNG) facility and associated Domestic Gas (Domgas) facility in the proposed Ashburton North Strategic Industrial Area (ANSIA) 12 kilometres south west of the town of Onslow.

The proposal includes a:

- subsea gas trunkline to bring produced hydrocarbons onshore to the LNG and Domgas plants;
- Product loading facility (PLF);
- Materials offloading facility (MOF);
- LNG and Domgas plants;
- Accommodation facilities; and
- Domgas pipeline to transport natural gas to the Dampier to Bunbury Natural Gas Pipeline;

The key component of the proposal is further documented in schedule 1 of this statement.

Proponent: Chevron Australia Pty Ltd

Proponent Address: 250 St George's Terrace,
PERTH WA 6000

Assessment Number: 1754

Report of the Environmental Protection Authority: Report 1404

1 Proposal Implementation

1-1 The Proponent shall implement the proposal as documented and described in Schedule 1 of this statement subject to the conditions and procedures of this statement.

Note: Unless otherwise indicated, terms and acronyms are defined in Schedule 4.

2 Proponent Nomination and Contact Details

2-1 The Proponent for the time being nominated by the Minister for Environment under sections 38(6) or 38(7) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal.

2-2 The Proponent shall notify the CEO of any change of the name and address of the Proponent for the serving of notices or other correspondence within 30 days of such change.

3 Time Limit of Authorisation

3-1 The authorisation to implement the proposal provided for in this statement shall lapse and be void five years after the date of this statement if the proposal to which this statement relates is not substantially commenced.

3-2 The Proponent shall provide the CEO with written evidence which demonstrates that the proposal has substantially commenced on or before the expiration of five years from the date of this statement.

4 Compliance Reporting

4-1 The Proponent shall prepare and maintain a Compliance Assessment Plan to the satisfaction of the CEO.

4-2 The Proponent shall submit to the CEO the Compliance Assessment Plan required by condition 4-1 at least six months prior to the first compliance report required by condition 4-6, or prior to construction, whichever is sooner.

The Compliance Assessment Plan shall indicate:

i. the frequency of compliance reporting;

ii. the approach and timing of compliance assessments;

iii. the retention of compliance assessments;

iv. the method of reporting of potential non-compliances and corrective actions taken;

v. the table of contents of compliance assessment reports; and

vi. public availability of compliance assessment reports.

4-3 The Proponent shall assess compliance with conditions in accordance with the Compliance Assessment Plan required by condition 4-1.

4-4 The Proponent shall retain reports of all compliance assessments described in the Compliance Assessment Plan required by condition 4-1 and shall make those reports available when requested by the CEO.

4-5 The Proponent shall advise the CEO of any potential non-compliance within seven days of that non-compliance being known.

4-6 The Proponent shall submit to the CEO the first compliance assessment report fifteen months from the date of issue of this Statement addressing the twelve month period from the date of issue of this Statement and then annually from the date of submission of the first compliance assessment report.

The compliance assessment report shall:

i. be endorsed by the Proponent's Managing Director or a person delegated to sign on the Managing Director's behalf;

ii. include a statement as to whether the Proponent has complied with the conditions;

iii. identify all potential non-compliances and describe corrective and preventative actions taken;

iv. be made publicly available in accordance with the approved compliance assessment plan; and

v. indicate any proposed changes to the compliance assessment plan required by condition 4-1.

5 Final Marine Infrastructure Plan

5-1 Prior to the construction of the nearshore and offshore marine facilities listed in Schedule 1 for this Proposal the Proponent must prepare a final Marine Infrastructure Plan which is to be approved by the CEO, on advice of the Dampier Port Authority, which details the nearshore and offshore marine facilities. The plan must also show the proposed location(s) for anchoring the Offshore Accommodation Vessel (floatel).

5-2 The Proponent shall provide the CEO with the approved Marine Infrastructure Plan described in Condition 5-1 and spatial data locating the nearshore and offshore marine facilities, in a GIS compatible format specified by the CEO.

5-3 The Proponent shall construct the nearshore and offshore marine facilities listed in Schedule 1 consistent with the approved Marine Infrastructure Plan.

5-4 The Proponent must locate the Offshore Accommodation Vessel greater than 500 metres from any sessile benthic filter feeder communities or benthic primary producer habitat (other than soft bottom microphytobenthos), in greater than 10 metres water depth from lowest astronomical tide at a location(s) approved by the CEO.

5-5 The Offshore Accommodation Vessel (if any) shall be anchored for this Proposal using an appropriate mooring system approved by the CEO that prevents anchor chains from scouring the adjacent seafloor and associated habitats.

5-6 The Proponent shall locate the Offshore Accommodation Vessel (if any) consistent with the principles and suggested measures contained in the EPA Environmental Assessment Guideline No. 5 unless otherwise approved by the CEO.

6 Construction of Marine Facilities

Note: Definitions pertaining to condition 6 are contained in Schedule 4.

6-1 The Proponent shall ensure the construction of nearshore and offshore marine facilities achieves the following Environmental Protection Outcomes:

i. no irreversible loss of, or serious damage to, coral habitats outside of the Zone of High Impact shown in Figure 3;

ii. no irreversible loss of, or serious damage to, filter feeder habitats outside of the Zone of High Impact shown in Figure 3;

iii. no irreversible loss of, or serious damage to, seagrass, macroalgal and other benthic habitats outside of the Zone of High Impact shown in Figure 4;

iv. protection of at least 70% of baseline live coral cover on each designated reef formation (see Figure 2) within the Zone of Moderate Impact shown in Figure 3;

v. no detectable reduction of net live coral cover within the Zone of Influence shown in Figure 5; and

vi. no detectible negative change from the baseline state of filter feeder, seagrass, macroalgal and other benthic habitats determined by implementing condition 7, outside of the Zones of High and Moderate Impact, shown in Figures 3 and 4, whichever figure is relevant to the habitats above,

unless and until, at a specified site(s) outside the Zones of Moderate Impact or specified designated reef formation(s) or site(s) in the Zones of Moderate Impact, a revised environmental protection outcome has been approved by the Minister in accordance with condition 6-10 to have effect for that specified site(s) or designated reef formation(s), in which case the approved revised environmental protection outcome for the specified site(s) or designated reef formation(s) shall be achieved in the construction of the nearshore and offshore marine facilities.

6-2 Notwithstanding the Environment Protection Outcomes specified in condition 6-1 which the Proponent must achieve, the Proponent shall design and execute turbidity-generating activities which are part of the construction of the nearshore and offshore marine facilities with the aim of meeting the following management objectives:

i. Within the Zone of High Impact shown in Figure 3: protection of at least 50% of baseline live coral cover on each of the following two reef formations: a) End of Channel Shoal and b) Saladin Shoal, which are shown in Figure 2;

ii. Within the Zone of Moderate Impact shown in Figure 3: no detectible reduction of live coral cover at any designated reef formation in this zone; and

iii. Within the Zone of Influence shown in Figure 5: no detectable reduction of net live coral cover within this zone.

6-3 Prior to the commencement of turbidity-generating activities which are part of the construction of the nearshore and offshore marine facilities, the Proponent shall prepare a Dredging and Dredge Spoil Placement Environmental Monitoring and Management Plan that meets the objectives set out in condition 6-4 to be approved by the CEO.

6-4 The objectives of the Dredging and Dredge Spoil Placement Environmental Monitoring and Management Plan are to ensure that turbidity-generating activities which are part of the construction of the nearshore and offshore marine facilities:

i. achieve the environmental protection outcomes set in condition 6-1; and

ii. are managed with the aim of meeting the management objectives set out in condition 6-2.

6-5 The Dredging and Dredge Spoil Placement Environmental Monitoring and Management Plan shall include:

i. descriptions of monitoring sites, including key physical attributes, geographic locations and measures of the baseline condition of benthic communities to be monitored;

ii. descriptions of the environmental variables to be monitored for determining achievement of the environmental protection outcomes set in condition 6-1 (i), (iv) and (v) and the management objectives in condition 6-2;

iii. the monitoring and data evaluation procedures to be applied so as to assess achievement of the environmental protection outcomes set in condition 6-1 (i), (iv) and (v) and the management objectives in condition 6-2;

iv. the monitoring methodologies to be applied to:

a. measure relevant physical indicators (e.g. water currents, water quality conditions including turbidity, photosynthetic radiation and light attenuation coefficient, and sediment production and deposition rates) at a frequency to allow near-real time dredge and dredge

overflow management and the validation and calibration of numerical models that may be used to assist in the management of dredging activities; and

b. measure biological indicators with intervals between monitoring occasions of approximately 14 days (depending on weather conditions) to inform adaptive environmental management (e.g. measures of live coral cover/coral mortality).

v. management trigger indicators and values for relevant physical and biological indicators to be applied in a risk-based tiered approach for the management of the environmental impacts of turbidity generating activities which are part of the construction of nearshore and offshore marine facilities;

vi. evidence demonstrating that the monitoring required to assess achievement of environmental protection outcomes set in Condition 6-1 and management objectives in condition 6-2, is based on tests using appropriate effect size(s) and has statistical power values of at least 0.8 (or alternative value(s) as approved by the CEO);

vii. management actions that will be implemented in the event that the management triggers values set in condition 6-5 (v) are not met;

viii. methods and procedures that will be implemented to regularly characterise, spatially-define and report the realised Zone of Influence caused by turbidity-generating activities which are part of the nearshore and offshore marine facilities;

ix. procedures for coral reproductive status monitoring to assist with predicting the timing and duration of coral spawning events;

x. the following with respect to dredge spoil placement site C:

a. calculations of predicted incremental loss of dredge spoil under metocean conditions typical of the location (i.e. inter-cyclone periods taking account of seasonal variations) following completion of marine works; and

b. predictions of fate and environmental impact of dredge spoil calculated to be lost following completion of marine works;

xi. the following, with respect to dredge spoil placement sites in State waters, having regard to condition 6-5 (x):

a. management measures to be undertaken during dredge spoil placement activities to minimise the environmental impact of those activities and any material incremental losses of dredge spoil which may occur following completion of dredge spoil placement at sites in State waters;

b. monitoring to be undertaken of retention, stability and fate of dredge spoil placed at dredge spoil placement sites during and following the completion of dredge spoil placement at sites in State waters to verify the efficacy of the measures referred to in (a) above;

c. contingency measures to be implemented should monitoring required by condition 6-5 (xi)(b) indicate management measures referred to in (xi)(a) are not effective; and

xii. requirements for timely reporting of monitoring data, management responses and contingency measures.

6-6 The Proponent shall implement the approved Dredging and Dredge Spoil Placement Environmental Monitoring and Management Plan and make that plan publically available in a manner approved by the CEO.

6-7 In the event that monitoring carried out under the approved Dredging and Dredge Spoil Placement Environmental Monitoring and Management Plan or the survey required by condition 7-5 determines that any of the environmental protection outcomes set in condition 6-1 (or any approved revised environmental protection outcome) are not being achieved by construction of the nearshore and/or offshore marine facilities, the Proponent shall:

i. immediately suspend all turbidity-generating activities which are part of the construction of the nearshore and offshore marine facilities;

ii. within 24 hours of that suspension, report the non-achievement to the Minister and that it has suspended all turbidity-generating activities which are part of the construction of the nearshore and offshore marine facilities; and

iii. within 48 hours of that suspension, report to the Minister:

a. the results of the monitoring that led to that suspension;

b. the findings of investigations into the status of relevant environmental measures against achievement of the environmental protection outcomes set in condition 6-1 (i), (iv) and (v) (or condition 6-1 (ii),(iii) and (vi) if suspension is due to findings of the survey required under condition 7-5), or any approved revised environmental protection outcomes;

c. the turbidity-generating activities and metocean conditions occurring at the time of the non achievement of environmental protection outcomes set in condition 6-1 (or any approved revised environmental protection outcome); and

d. the results of the most recent water quality and sediment deposition monitoring.

6-8 If, after suspending any turbidity-generating activities under condition 6-7, in the report required by condition 6-7(iii), the Proponent:

i. determines that environmental protection outcomes set in condition 6-1 (or any approved revised environmental protection outcome) are being achieved; or

ii. provides strong evidence that a particular turbidity generating activity did not cause the non-achievement,

and the Minister concurs with the findings of the Proponent's report, then the Proponent may recommence turbidity-generating activities which are part of:

iii. the construction of nearshore and/or offshore marine facilities if 6-8 (i) applies; or

iv. the construction of which-ever particular marine facilities that are determined not to have caused the non-achievement if 6-8 (ii) applies, consistent with relevant management plans.

6-9 If condition 6-8 (iii) and (iv) do not apply, and the Proponent wishes to recommence the turbidity-generating activities which are suspended under condition 6-7, the Proponent:

i. shall submit to the Minister a report detailing the following:

a. the results of the most recent environmental monitoring for all monitoring and reference sites, including identifying where an environmental protection outcome (or any approved revised environmental protection outcome) is not being achieved, and those sites where there is strong evidence that non-achievement of an environmental protection outcome (or any approved revised environmental protection outcome) is reasonably expected to be recorded as part of the same event;

b. the turbidity-generating activities which were being undertaken in the monitoring period prior to the environmental protection outcome (or an approved revised environmental protection outcome) not being achieved and until the time of suspension;

c. the metocean conditions as monitored in the most recent monitoring period prior to the environmental protection outcome (or an approved revised environmental protection outcome) not being achieved and until the time of suspension;

d. the results of the most recent water quality and sediment deposition monitoring;

e. proposed revised environmental protection outcome(s) for the site(s) outside the Zones of Moderate Impact where an environmental protection outcome (or an approved revised environmental protection outcome) is not being achieved, and those sites where there is strong evidence that contravention of an environmental protection

outcome (or an approved revised environmental protection outcome) is expected to be recorded as part of the same event, and or for the designated reef formation(s) or site(s) inside the Zones of Moderate Impact where an environmental protection outcome (or an approved revised environmental protection outcome) is not being achieved; and

f. any other information considered relevant by the Proponent in support of its proposal to recommence all turbidity-generating activities that remain suspended after implementing condition 6-8.

ii. shall, if an environmental protection outcome (or any approved revised environmental protection outcome) is not being achieved inside a Zone of Moderate Impact, include in the report required by 6-9 (i), additional management measures proposed to be implemented so that the recommencement of turbidity-generating activities which are part of the construction of that particular nearshore or offshore marine facility:

a. will not contribute to non-achievement of a revised environmental protection outcome proposed by the Proponent in condition 6-9 (i)(e) for that zone where an environmental protection outcome has not been achieved, having regard to the matters provided for in condition 6-9 (i); and

b. will ensure environmental protection outcomes set in condition 6-1 (or any approved revised environmental protection outcome) continue to be achieved outside the Zones of Moderate Impact.

iii. shall, if an environmental protection outcome (or any approved revised environmental protection outcome) is not being achieved outside the Zones of Moderate Impact (not including the zone of high impact), include in the report required by condition 6-9 (i), additional management measures proposed to be implemented so that the recommencement of turbidity-generating activities which are part of the construction of that particular nearshore or offshore marine facility:

a. will not contribute to further non-achievement of environmental protection outcomes set in condition 6-1(i), (iv) and (v) (or environmental protection outcomes set in condition 6-1 (ii), (iii) and (vi) if the suspension is due to findings of the survey required under condition 7-5), or any approved revised environmental protection outcome; or

b. will not cause non-achievement of a revised environmental protection outcome proposed by the Proponent in condition 6-9 (i) to apply at those sites where an environmental protection outcome (or any approved revised environmental protection outcome) has not been achieved or there is strong evidence that non-achievement of an environmental protection outcome (or any approved revised environmental protection outcome) is expected as part of the same event; and

c. will ensure the environmental protection outcomes set in condition 6-1 (or any approved revised environmental protection outcome) continue to be achieved at all other sites and designated reef formations.

6-10 The Minister may, having regard to the report submitted by the Proponent under condition 6-9 and on the advice of the Chairman of the EPA, approve revised environmental protection outcome(s) to have effect for the purpose of conditions 6-1 in which case the Proponent may then recommence turbidity-generating activities which are part of construction of the particular nearshore or offshore marine facility(s) subject to the approved revised environmental protection outcome(s). The Minister may also, having regard to the report submitted by the Proponent under condition 6-9, require the Proponent to implement the additional management measures proposed in 6-9 (ii) and (iii) above, or other additional practicable management measures, as part of the approved Dredging and Dredge Spoil Placement Environmental Monitoring and Management Plan (condition 6-3).

6-11 The Proponent shall not conduct turbidity-generating activities which are part of the construction of nearshore and offshore marine facilities during the period 3 days prior to the predicted commencement of mass coral spawning, or as soon as mass coral spawning is detected if prior to the predicted time, and dredging and dredge spoil placement activities are to remain suspended for 7 days from the commencement of mass coral spawning.

6-12 The Proponent shall undertake turbidity-generating activities which are part of the maintenance of nearshore and offshore marine facilities listed in Schedule 1 to ensure that each of the environmental protection outcomes set in condition 6-1 (including any approved Revised Environmental Protection Outcomes) are achieved.

6-13 If under condition 6-10 any revised environmental protection outcomes for conditions 6-1 (i), (iv) and (v) are approved, and/or additional management measures are required to be implemented, those approved revised environmental protection outcomes and additional management measures required by the Minister under condition 6-10 shall have effect as if they were part of the approved Dredging and Dredge Spoil Placement Environmental Monitoring and Management Plan.

Control of turbid water overflow from dredging equipment

6-14 If the Proponent proposes to allow turbid water overflow from dredging equipment in overflow control zones as defined in Schedule 4 in such a manner that designated reef formations in the Zone of Moderate Impact may reasonably be expected to be exposed to some turbidity associated with the turbid water overflow from dredging equipment, the Proponent shall prepare a Turbid Water Overflow Adaptive Monitoring and Management Strategy which is to be implemented once approved by the CEO. The Turbid Water Overflow Adaptive Monitoring and Management Strategy shall include the following basic elements:

i. environmental baseline data covering the range of seasonal conditions expected during turbid water overflow from dredging equipment in overflow control zones, focusing on relevant key water quality and coral health indicators;

ii. proposal-specific tolerance limits for relevant key water quality and coral health indicators;

iii. a sediment spill budget and spill budget limits relevant to the proposal-specific tolerance limits referred to in ii above that aims to meet the management objectives on condition 6-2 and ensures that the environmental protection outcomes set in condition 6-1 are achieved;

iv. work plans that specify the time, location and geographical coordinates of dredging that is likely to cause turbid water overflow from dredging equipment in overflow control zones, and includes relevant procedures and equipment;

v. compliance monitoring of relevant environmental indicators and assessment of monitoring data against sediment spill budget limits, at a frequency of at least daily;

vi. near real time control monitoring of relevant environmental indicators and evaluation against proposal-specific environmental tolerance limits for those indicators with the objective of on-going verification of the spill budget and performance of the validated and calibrated plume hindcast model;

vii. daily spill hindcast simulations using a plume hindcast model which as been validated and calibrated for implementation at the site, with input data including actual dredging rates and schedules, empirical data on the composition of dredged material and actual metocean conditions over the hindcast period, to assess the extent, intensity and duration of sediment plumes generated by turbid water overflow from dredging equipment in overflow control zones over hindcast periods not exceeding 3 days in arrears;

viii. fortnightly monitoring of coral health at each designated reef formation in the Zone of Moderate Impact and at appropriate reference sites;

ix. a program to inform routine verification and update (as necessary) of the proposal-specific tolerance limits and the spill budget;

x. measures for timely, proactive management of dredging, or turbid water overflow from dredging equipment, in overflow control zones to prevent detectible reduction of live coral cover at any designated reef formation in the Zone of Moderate Impact and achieve the environmental protection outcomes referred to in condition 6-1; and

xi. procedures for timely reporting of monitoring results and management actions.

6-15 If coral health monitoring required by condition 6-14 (viii) indicates the lowest detectible reduction of live coral cover at any designated reef formation in the Zone of Moderate Impact, then the Proponent shall report that monitoring result to the CEO within 24 hours of the detection and immediately, and then for the remainder of marine works required for construction of marine facilities, implement management of turbid water overflow from dredging equipment in overflow control zones in accordance with condition 6-16.

6-16 If condition 6-15 is brought into effect or if the Proponent exercises discretion at any time not to implement condition 6-14, then the turbid water overflow from dredging equipment in overflow control zones shall only be allowed when and where it can be demonstrated, by undertaking monitoring to the satisfaction of the CEO, that designated reef formations would not be exposed to turbidity associated with the turbid water overflow from dredging equipment.

7 State of the Marine Environment Surveys

Note: Definitions pertaining to condition 7 are contained in Schedule 4.

7-1 The Proponent shall, within six months following the date of this Statement, or at least three months prior to the commencement of any marine works that may impact the marine environment, whichever is sooner, prepare a Scope of Works for surveys of the marine environment referred to in condition 7-2 for the approval of the CEO.

7-2 The surveys of the marine environment are to be conducted in accordance with the approved Scope of Works at the times as indicated below, so as to establish the following:

i. the baseline state of the marine environment prior to the commencement of any marine works;

ii. the state of the marine environment at the mid-term of the marine works period associated with:

   a. the construction of the nearshore and offshore marine facilities; and

   b. the trunkline installation;

iii. the first post-development state of the marine environment associated with:

   a. the construction nearshore and offshore marine facilities; and

   b. the trunkline installation;

iv. a second post-development state of the marine environment having regard to the findings of previous surveys.

7-3 The Scope of Works for surveys of the marine environment required in condition 7-2 shall include the following where relevant having regard to when the survey is conducted:

i. Procedures and methods for the collection of quantitative environmental data for:

a. water quality,

b. hydrodynamic conditions including direction and velocity of water currents,

c. the physical characteristics of native sediments and development-influenced sediments suspended in the water column and deposited on the benthos,

d. the natural and development-influenced rates, and spatial and temporal patterns of sediment deposition, and

e. the spatial extent, distribution, community composition (at a suitable taxonomic resolution to differentiate different communities), natural variability including seasonality and condition of benthic habitats; and

f. the preparation of benthic habitat maps.

ii. timing for the implementation and completion of the surveys having regard to the types and sequence of surveys referred to in condition 7-2;

iii. procedures for the use of survey data to assess compliance with relevant environmental protection outcomes in conditions 6-1 and 8-7; and

iv. timing and frequency of reporting.

Notes:

In the case of the hard coral components of benthic habitats referred to in condition 7-3, a measure of condition shall include live coral cover at each of the designated reef formations in the Zones of Moderate Impact shown in Figure 2.

7-4 Within a timeframe not longer than three months prior to the commencement of marine works and in accordance with the approved Scope of Works, the Proponent shall undertake the baseline state of the marine environment survey.

7-5 At the time specified in the approved Scope of Works and in accordance with the approved Scope of Works, the Proponent shall undertake the surveys for the state of the marine environment at the mid-term of the marine works.

7-6 At the time specified by the approved Scope of Works and in accordance with the approved Scope of Works, the Proponent shall undertake the surveys for

the state of the marine environment at the post development of the marine works.

7-7 No longer than 5 years following completion of marine works required for the construction of marine facilities or the trunkline and in accordance with the approved Scope of Works, the Proponent shall undertake a second post-development state of the marine environment survey to determine compliance with the environmental protection outcomes set in conditions 6-1 and 8-7 (or any approved revised environmental protection outcome).

7-8 The Proponent shall report the findings of the baseline state of the marine environment survey required by condition 7-4 to the CEO within three months of having completed that survey.

7-9 The Proponent shall report the findings of subsequent state of the marine environment surveys required by conditions 7-5, 7-6 and 7-7 and include in each report an appraisal of compliance with environmental protection outcomes set in condition 6-1 and condition 8-7 having regard to any relevant approved Revised Environmental Protection Outcome, to the CEO within four months of having completed each survey.

8 Trunkline Installation

Note: Definitions pertaining to condition 8 are contained in Schedule 4.

8-1 The Proponent shall, prior to the commencement of trunkline installation activities, prepare a Trunkline Route and Infrastructure Plan, to be approved by the CEO, on the advice of the Dampier Port Authority.

8-2 The objective of Trunkline Route and Infrastructure Plan is to accurately describe, including with the use of spatial data, the actual trunkline route to be used, trunkline installation methods, and activities that will be associated with trunkline installation activities following that route.

8-3 The actual trunkline route to be used shall be contained wholly within the corridor and investigative area shown on Figure 7 and described by coordinates provided in Table 3.

8-4 Trunkline Route and Infrastructure Plan shall include:

i. a sufficient number of scale, spatially-rectified maps and/or technical drawings to show the configuration and location of all components of the trunkline to be installed within Western Australian coastal waters;

ii. geo-spatial information describing the actual trunkline route to be used and the associated centre-line of trunkline for its full length in Western Australian coastal waters;

iii. geo-spatial information describing the Trunkline Direct Disturbance Footprint , Zone of High Impact, Zones of Moderate Impact about the actual trunkline route to be used, as defined in condition 8-5;

iv. geo-spatial information describing the Zone of Influence for the actual trunkline route and construction methods to be used, based on modelling outputs;

v. benthic habitat maps showing the extent and distribution of different benthic habitats coincident with the Zone of High Impact and Zones of Moderate Impact and at representative sites in the Zones of Influence as defined in condition 8-5;

vi. a table setting out the areas, in hectares, of the different benthic habitats within the Trunkline Direct Disturbance Footprint, Zone of High Impact and the Zones of Moderate Impact; and

vii. descriptions of key trunkline installation activities and the measures taken to design the trunkline route and execute trunkline installation activities to minimise, so far as is reasonably practicable, the impacts to benthic habitats.

8-5 For the purpose of condition 8, the Trunkline Direct Disturbance Footprint and Zones of impact and influence applying to trunkline installation and associated activities are defined as follows:

i. the Trunkline Direct Disturbance Footprint, which lies within the Zone of High Impact defined in (ii) below, is not to extend beyond 25 metres of the centre-line of trunkline for the length of the trunkline in State waters;

ii. the Zone of High Impact about the trunkline is not to extend beyond 100 metres either side of the centre-line of trunkline for the length of the trunkline in State waters;

iii. Zones of Moderate Impact about the trunkline are those areas beyond the Zone of High Impact, but are not to extend more than 500 metres either side of the centre-line of trunkline for the length of the trunkline in State waters; and

iv. Zones of Influence are areas beyond the Zones of Moderate Impact defined in (iii), predicted in accordance with the requirements of condition 8-4,

unless the Proponent justifies, to the requirements of the CEO on the advice of the Dampier Port Authority, that having exercised all practicable means to minimise the impacts of trunkline installation activities, an alternative Zone of High Impact and/or Zones of Moderate Impact are warranted. In which case, for those sections of the trunkline route to which alternative Zones are considered to be warranted, conditions 8-5 i and iv shall continue to apply and conditions 8-5 ii and iii shall be substituted with the following for the purpose of defining any alternative Zone of High Impact and/or Zones of Moderate Impact:

v. the Zone of High Impact about the trunkline is not to extend beyond 525 metres of the centre-line of trunkline for the length of the trunkline in State waters; and

vi. Zones of Moderate Impact about the trunkline are those areas beyond the Zone of High Impact defined in (v) above, but are not to extend more than 1525 metres from the centre-line of trunkline for the length of the trunkline in State waters; and

vii. for those sections of the trunkline route for which any alternative Zone of High Impact and/or Zones of Moderate Impact are not warranted, conditions 8-5 i–iv shall continue to apply.

8-6 Reef formations at Ashburton Island and Brewis Reef shown in Figure 2 shall not be contained within either the Zone of High Impact or the Zones of Moderate Impact defined in condition 8-5.

8-7 The Proponent shall undertake trunkline installation activities in State waters consistent with the approved Trunkline Route and Infrastructure Plan and ensure that each of the following environmental protection outcomes are achieved:

i. no irreversible loss of, or serious damage to macroalgal habitats due to the installation of the trunkline;

ii. no irreversible loss of, or serious damage to, seagrass habitat outside of the Trunkline Direct Disturbance Footprint;

iii. no irreversible loss of, or serious damage to, coral and/or filter feeder habitats outside of the Zone of High Impact;

iv. no detectible negative change from the baseline state of seagrass habitats determined by implementing condition 7, outside of the Zone of High Impact;

v. no detectible negative change from the baseline state of filter feeder and macroalgal habitats determined by implementing condition 7, outside the Zone of High Impact and the Zones of Moderate Impact; and

vi. no detectable reduction of net live coral cover within the Zones of Influence, including reef formations at Ashburton Island and Brewis Reef,

unless and until, at a specified site(s), outside the Zones of Moderate Impact or reef formations at Ashburton Island or Brewis Reef or site(s) in the Zones of Moderate Impact, a revised environmental protection outcome has been approved to have effect for that specified site(s) or reef formation(s) by the Minister in accordance with condition 8-16, in which case the approved revised environmental protection outcome for the specified site(s) or designated reef formation(s) shall not be exceeded due to trunkline installation activities.

8-8 Notwithstanding the Environment Protection Outcomes specified in condition 8-7 which the Proponent must achieve, the Proponent shall design and execute trunkline installation activities in State waters with the aim of meeting the following management objectives:

i. irreversible loss of, and serious damage to, benthic habitats is restricted to the area within the Trunkline Direct Disturbance Footprint (excluding macroalgal habitats to which there shall be no irreversible loss or serious damage);

ii. impacts to the marine environment within the Zones of Moderate Impact are minimised to the greatest extent practicable; and

iii. cumulative impacts from dredging associated with trunkline installation activities undertaken simultaneously with dredging associated with marine facilities construction are managed so as to achieve the environmental protection outcomes set in condition 8-7 and condition 6-1 (or any approved revised environmental protection outcomes).

8-9 Prior to the commencement of trunkline installation activities and consistent with the Trunkline Route and Infrastructure Plan required by condition 8-1, the Proponent shall submit a Trunkline Installation Environmental Monitoring and Management Plan that meets the objectives set out in condition 8-10 to be approved by the CEO.

8-10 The objectives of the Trunkline Installation Environmental Monitoring and Management Plan are to ensure that trunkline installation activities, including turbidity-generating activities associated with the construction of the trunkline, in State waters:

i. achieve the environmental protection outcomes set in condition 8-7; and

ii. are managed with the aim of meeting the management objectives set out in condition 8-8.

8-11 The Trunkline Installation Environmental Monitoring and Management Plan shall include:

i. information describing the actual trunkline route to be used consistent with the approved Trunkline Route and Infrastructure Plan;

ii. descriptions of key trunkline installation activities, including information about where and when each activity will occur consistent with the approved Trunkline Route and Infrastructure Plan;

iii. descriptions of monitoring sites, including key physical attributes, geographic locations and measures of the baseline condition of benthic communities to be monitored;

iv. the monitoring methodologies to be applied to:

a. measure relevant physical indicators (e.g. water currents, water quality conditions including turbidity, photosynthetic radiation and light attenuation coefficient, and sediment production and deposition rates) at a frequency to allow near-real time dredge management and the validation and calibration of numerical models that may be used to assist in the management of dredging activities; and

b. measure biological indicators for environmental management (e.g. live coral cover, coral mortality) at a frequency of approximately not less than each 14 days (weather permitting);

v. the measures, procedures and monitoring strategy to be applied for monitoring achievement of the environmental protection outcomes set in condition 8-7 (or any approved revised environmental protection outcome that may apply);

vi. evidence demonstrating that the design of the monitoring strategy applied to determine achievement of environmental protection outcomes set in condition 8-7 (or any approved revised environmental protection outcome that may apply) is based on tests using appropriate effect size(s) and has statistical power value of at least 0.8 or an alternative value as determined by the CEO;

vii. the trigger indicators, values and circumstances that shall be applied to determine whether the management objectives detailed in condition 8-8 are being met;

viii. a risk-based tiered approach to management of the environmental impacts of trunkline installation activities;

ix. management measures that will be implemented in the event that tiered management trigger levels for the various indicators being monitored are not being achieved;

x. methods and procedures that will be implemented to regularly characterise, spatially-define and report the realised Zone of Influence caused by trunkline installation activities;

xi. procedures to be implemented to minimise the environmental impact of trunkline installation vessel operations, including vessel anchoring;

xii. coral reproductive status monitoring to assist with predicting the timing and duration of coral spawning events; and

xiii. reporting requirements.

8-12 The Proponent shall implement the approved Trunkline Installation Environmental Monitoring and Management Plan and make that plan publically available in a manner approved by the CEO.

8-13 In the event that monitoring carried out under the approved Trunkline Installation Environmental Monitoring and Management Plan or the survey required by condition 7-5 determines that the environmental protection outcomes set in condition 8-7 (including any approved revised environmental protection outcomes that may apply at the time) are not being achieved, the Proponent shall:

i. immediately suspend all turbidity-generating activities associated with construction of the trunkline;

ii. within 24 hours of that suspension, report the non-achievement and suspension of turbidity-generating activities consistent with relevant management plans to the Minister; and

iii. within 48 hours of that suspension, report to the Minister:

a. the results of the monitoring that led to that suspension;

b. the findings of investigations into the status of relevant environmental measures against the achievement of the environmental protection outcomes set in condition 8-7;

c. the turbidity generating activities, and metocean conditions which resulted in the non-achievement of the environmental protection outcomes set in condition 8-7 (or approved Revised Environmental Protection Outcomes); and

d. the results of the most recent water quality and sediment deposition monitoring.

8-14 If, after suspending turbidity-generating activities associated with construction of the trunkline under condition 8-13, the Proponent:

i determines that the environmental protection outcomes set in condition 8-7 are being achieved; or

ii provides strong evidence that trunkline installation activities did not cause the non-achievement,

and the Minister concurs with the findings of the report, then the Proponent may recommence turbidity-generating activities consistent with relevant management plans.

8-15 If, after suspending turbidity-generating activities associated with construction of the trunkline under condition 8-13, and if condition 8-14 does not apply, and the Proponent wishes to recommence turbidity-generating activities associated with construction of the trunkline, the Proponent:

i. shall submit a report to the Minister detailing the following:

a. the results of the most recent biological indicators monitoring, for all monitoring and reference sites, including identifying where an environmental protection outcome is not being achieved, and those sites where there is strong evidence that non-achievement of an environmental protection outcome is reasonably expected to be recorded as part of the same event;

b. the turbidity-generating activities which were being undertaken in the monitoring period prior to the environmental protection outcome being contravened and until the time of suspension;

c. the metocean conditions as monitored in the monitoring period prior to the environmental protection outcome not being contravened achieved and until the time of suspension;

d. the results of the most recent water quality and sediment deposition monitoring;

e. proposed revised Environmental Protection Outcome(s) for the site(s) outside the Zones of Moderate Impact where an environmental protection outcome is not being achieved, and those sites where there is strong evidence that contravention of an environmental protection outcome is expected to be recorded as part of the same event, and or for the designated reef formations at Ashburton Island and Brewis Reef or site(s) inside the Zones of Moderate Impact where an environmental protection outcome is not being achieved; and

f. any other information considered relevant by the Proponent in support of its proposal to recommence turbidity-generating activities associated with construction of the trunkline.

ii. shall, if an environmental protection outcome (or an approved revised environmental protection outcome) is not being achieved inside a Zone of Moderate Impact, include in the report required by 8-15(1) additional management measures proposed so that the recommencement of turbidity-generating activities associated with construction of the trunkline:

a. will not contribute to non-achievement of a revised environmental protection outcome proposed by the Proponent in condition 8-15 (i)(e), for that zone where failure to achieve an environmental protection outcome has been recorded having regard to the matters provided for in condition 8-15 (i); and

b. will ensure environmental protection outcomes set in condition 8-7 continue to be achieved outside the Zones of Moderate Impact (unless a revised environmental protection outcome for a specified site(s) has been approved).

iii. shall, if an environmental protection outcome (or any approved revised environmental protection outcome) is not being achieved outside the

Zones of Moderate Impact (not including the Zone of High Impact), include in the report required by 8-15(i) additional management measures proposed to be implemented so that the recommencement of turbidity-generating activities associated with construction of the trunkline:

a. will not contribute to further non-achievement of environmental protection outcomes set in condition 8-7 (or any approved Revised Environmental Protection Outcome); or

b. will not cause non-achievement of a revised environmental protection outcome proposed by the Proponent in condition 8-15 (i)(e), at those sites where failure to achieve an environmental protection outcome (or any approved revised environmental protection outcome) has been recorded or there is strong evidence that non-achievement of an environmental protection outcome (or any approved revised environmental protection outcome) is expected to be recorded as part of the same event; and

c. will ensure the environmental protection outcomes set in condition 8-7 (or any approved revised environmental protection outcome) continue to be achieved at all other sites and reef formations.

8-16 The Minister may, having regard to the report submitted by the Proponent under condition 8-15 and on the advice of the Chairman of the EPA, approve revised environmental protection outcome(s) to have effect for the purpose of conditions 8-7 in which case the Proponent may then recommence turbidity-generating activities associated with construction of the Trunkline subject to the revised environmental protection outcome(s). The Minister may also, having regard to the report submitted by the Proponent under condition 8-15, require the Proponent to implement additional management measures in 8-15 (ii) and (iii) or other additional practicable management measures, as part of the approved Trunkline Dredging and Dredge Spoil Placement Environmental Monitoring and Management Plan (condition 8-9).

8-17 The Proponent shall not conduct turbidity-generating activities associated with construction of the trunkline during the period 3 days prior to the predicted commencement of mass coral spawning, or as soon as mass coral spawning is detected if prior to the predicted time, and dredging and dredge spoil placement activities are to remain suspended for 7 days from the commencement of mass coral spawning.

9 Coastal Processes

9-1 The Proponent shall ensure that construction and operation of the nearshore marine facilities (as defined in Schedule 1) achieve the following outcomes as far as is practicable as measured under the Coastal Processes Monitoring and Management Plan:

i. minimise change to littoral sediment transport;

ii. minimise an erosion trend under non-cyclonic conditions in the position of the mean sea level shoreline and dune vegetation line between the nearshore marine facilities and Beadon Creek;

iii. maintain the functionality of Hooley Creek;

iv. maintain the functionality of the Ashburton delta and avoid destabilisation of the chenier that impounds the coastal lagoon east of Entrance Point;

v. maintain the recreational value of beaches between the nearshore marine facilities and Beadon Creek;

vi. avoid reduction in the integrity and performance of the Onslow seawall; and

vii. avoid reduction in the integrity and values of heritage sites between the Ashburton Delta and Beadon Creek.

9-2 Prior to construction of the Marine Offloading Facility and Product Loading Facility the Proponent shall develop a Coastal Processes Monitoring and Management Plan to be approved by the CEO. The plan shall include:

i. site inspection of beach, entrance bar and seawall condition between the Ashburton Delta and Beadon Creek;

ii. beach, chenier and spit/entrance bar width using a combination of topographic surveys and aerial photography/satellite imagery;

iii. beach profile using on-ground photography;

iv. mangrove habitat monitoring;

v. hydrographic survey of the near-shore area;

vi. community liaison strategy to obtain feedback on impacts on recreational values; and

vii. site inspection of heritage locations to assess the condition and potential threats to European heritage locations;

viii. a table showing the type of monitoring and monitoring frequency for each of the coastal features to be protected under condition 9-1;

ix. management triggers relevant to achieving the outcomes specified in condition 9-1;

x. management measures that will be implemented in the event that management triggers are likely to be exceeded.

9-3 The Proponent shall implement the approved Coastal Processes Monitoring and Management Plan referred to in condition 9-2.

9-4 The Proponent shall report any non achievement of the management trigger referred to in condition 9-2, along with measures taken and/or proposed to be taken, and strategies to be implemented in response to the non achievement, to the CEO within 21 days of the non achievement being identified.

9-5 The Proponent shall make the Plan required under condition 9-2 publicly available in a manner approved by the CEO.

10 Marine Fauna Interaction – Marine Pile Driving, Dredging and Marine Construction Vessels, Offshore Accommodation Vessel and Onshore Facility light sources

10-1 The Proponent shall engage dedicated Marine Fauna Observers who must:

i. demonstrate a knowledge of marine wildlife species in the Pilbara region, including Threatened and Migratory Species listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), and their behaviours;

ii. be on duty on vessels actively engaged in pile-driving barges and/or dredging during all daylight hours when pile-driving operations and/or dredging are conducted; and

iii. maintain a log of:

a. their observations of cetaceans in a format consistent with the National Cetacean Sightings and Strandings Database;

b. their observations of other marine fauna, including injured or dead fauna within 500m of the vessels referred to in 2 above;

c. their observations of fauna behaviours, in particular any behaviours that could be in interpreted as a display of disturbance or distress;

d. management responses by the Proponent in relation to observation of disturbed or distressed fauna, and injured or dead fauna; and

e. observation hours and in relation to the duration of the pile driving and dredge activity.

10-2 The Proponent shall within six months of completing pile driving operations, lodge cetacean records with the National Cetacean Sighting and Strandings Database at the Australian Antarctic Division and with DEC and OEPA.

10-3 At least one member of the crew on each vessel undertaking construction activities will be trained in marine fauna observations and mitigation measures, including the requirements of the *Wildlife Conservation (Closed*

Season for Marine Mammals) Notice 1998, as amended or replaced from time to time, and maintain a log of fauna observed during transit and construction activity consisting of: GPS coordinates; species (if known); and behaviour. Logs are to be submitted to the Department of Conservation and Environment on an annual basis at the same time as submitting the compliance assessment report required by condition 4-6 to the CEO.

10-4 Vessel speeds of vessels while engaged in construction of the nearshore or offshore marine facilities or trunkline shall not exceed 14 knots or a speed designated by the Department of Transport or relevant Port Authority.

10-5 Subject to condition 10-9, no marine pile driving operations shall commence until the Marine Fauna Observer (or observers) required by condition 10-1 have verified that no cetaceans or dugong have been observed within a radius of 1500 metres or marine turtles within a radius of 300 meters from the planned piling operation during the 30 minute period immediately prior to commencement of piling operations.

10-6 Prior to commencement of full power marine pile driving, the Proponent shall implement soft start-up procedures that slowly increase the intensity of noise emissions over a period of no less than 15 minutes.

10-7 If the Marine Fauna Observer(s) required by condition 10-1, or any other person, observes a marine turtle enter within 100 metres of a piling operation, or cetacean or dugong within 500 metres of each piling operation, the piling operation within 100 metres of a marine turtle or 500 metres of the cetacean or dugong is to be suspended.

10-8 Marine pile driving that has been suspended in accordance with condition 10-7 shall not recommence until the cetacean or dugong has moved beyond 1500 metres from the suspended piling operation or the marine turtle beyond 300 metres or the cetacean, dugong or marine turtle has not been observed within the exclusion zone for a period of 30 minutes. Marine pile driving that has been suspended for more than 15 minutes shall recommence with soft start-up procedures as required by condition 10-6.

10-9 No marine pile-driving operations shall occur between the hours of sunset and sunrise during the peak southern migration of mother and calf humpback whale pods defined as 10 August to 10 October in any year.

Conservation Significant Marine Fauna Interaction Management Plan

10-10 Prior to the commencement of construction and operation of nearshore and offshore marine facilities, trunkline and Onshore Facilities, in consultation with DEC and Commonwealth Department of Sustainability, Environment, Water, Population and Communities, the Proponent shall prepare a Conservation Significant Marine Fauna Interaction Management Plan which is to be approved of the CEO.

The objective of this Conservation Significant Marine Fauna Interaction Management Plan is to ensure that the Proponent constructs and operates the nearshore and offshore marine facilities, trunkline and Onshore Facility so as to:

1. detect and
2. avoid, or where this is not practicable, mitigate,

impacts upon conservation significant marine fauna, from construction and operation of nearshore and offshore marine facilities, trunkline and Onshore Facilities.

Note: For the purposes of this condition the term ‘conservation significant marine fauna’ includes marine mammals, marine turtles, whale sharks and sawfish.

10-11 The Proponent shall include the following in the Conservation Significant Marine Fauna Interaction Management Plan.

i. a description of the environmental stressors relating to the construction and operation of nearshore and offshore marine facilities, trunkline and Onshore Facility which are likely to impact on marine fauna. (environmental stressors may include, but are not limited to, noise, vibration, light spill and glow, vessel strike, dredge entrainment, and changes to coastal processes with the potential to impact on important marine fauna habitats);

ii. a description of design features and management measures which the Proponent will implement to avoid, or where this is not practicable, mitigate impacts of the environmental stressors relating to the construction and operation of nearshore and offshore marine facilities, trunkline and Onshore Facility on conservation significant marine fauna (for example, darkness strategies that avoid, or where this is not practicable, the impact of lights or light glow from the construction and operations of the Proposal, vessels and offshore accommodation vessel, interfering with female turtles and hatchlings).

iii. environmental performance standards to determine whether the design features and management measures are achieving the plan objectives referred to in condition 10-10; and

iv. a process (including a monitoring programme) to determine that the environmental performance standards are being met.

10-12 The Proponent shall implement the approved Conservation Significant Marine Fauna Interaction Management Plan.

10-13 The Proponent shall make the approved Conservation Significant Marine Fauna Interaction Management Plan publicly available in a manner approved by the CEO.

10-14 The Proponent shall review annually the approved Conservation Significant Marine Fauna Interaction Management Plan.

10-15 The Proponent shall report to:

i. the CEO any non-achievement of the environmental performance standards referred to in condition 10-11 (iii) within 21 days of it having determined non-achievement and its recommendations as to how the plan should be amended.

ii. DEC whether any natural or Proposal attributable injury or mortality of conservation significant marine fauna is observed within 24 hours of the observation.

Underwater Noise Monitoring and Review Program

10-16 Prior to commencement of marine pile driving activities, the Proponent shall prepare, with the advice of an expert(s) in the field of noise propagation modelling in the marine environment, an Underwater Noise Monitoring and Review Program for the marine pile driving activities, to be approved by the CEO, which:

i. measures underwater noise from pile driving operations to establish a library of sound signals:

a. at varying distances from the noise source;

b. when driving piles of different sizes and types;

c. during the concurrent piling of different numbers of piles;

d. in conditions of different water depths; and

e. in different driving conditions (substrate types).

ii. reviews the predictive capacity of the noise propagation model used for the pile driving and make recommendations for improving the accuracy of underwater noise modelling in the future.

10-17 The Proponent shall implement the approved Underwater Noise Monitoring and Review Program.

10-18 The results of the approved Underwater Noise Monitoring and Review Program are to be published within one year after the completion of the pile driving operations in a manner approved by the CEO.

11 Marine Drilling and Blasting Activities

11-1 Prior to commencing marine drilling and blasting activities which are part of the construction of the nearshore or offshore marine facilities and trunkline,

the Proponent shall prepare a Drilling and Blasting Management Plan to be approved by the CEO in consultation with:

i. DEC;

ii. Department of Transport (Maritime Division);

iii. Department of Fisheries; and;

iv. Commonwealth Department of Sustainability, Environment, Water, Population and Communities.

11-2 The objectives of the Drilling and Blasting Management Plan are to ensure that drilling and blasting activities which are part of the construction of the nearshore or offshore marine facilities and trunkline are managed to minimise adverse impacts on all marine fauna. The Drilling and Blasting Management Plan shall include:

i. a description of geographical location and duration of drilling and blasting required;

ii. a description of likely blast pressures and potential environmental impacts of these pressures;

iii. management measures to minimise environmental impacts, including the disposal of drilling muds and avoidance of marine blasting and drilling activities during seasonally sensitive periods for marine fauna (for example, there shall be no marine drilling and blasting operations occurring between the hours of sunset and sunrise during the peak southern migration of mother and calf humpback whale pods defined as 10 August to 10 October in any year);

iv. management measures for dead and injured wildlife;

v. stakeholder communication; and

vi. reporting procedures and time frames.

11-3 In the event that marine drilling and blasting is required, the Proponent shall implement the approved Drilling and Blasting Management Plan required under conditions 11-1 and 11-2.

11-4 The Proponent shall make the approved Drilling and Blasting Management Plan publicly available in a manner approved by the CEO.

12 Introduced Marine Pests

12-1 The Proponent shall manage construction and operation non-trading vessel activities and immersible equipment activities so as to:

i. to prevent the Introduction of Marine Pests;

ii. to detect Introduced Marine Pests;

iii. to control or eradicate detected Introduced Marine Pests; and

iv. mitigate adverse impacts of any control or eradication actions taken against detected Introduced Marine Pests.

12-2 The Proponent shall ensure that all non-trading vessels and associated immersible equipment, that are either owned by the Proponent, or contracted for construction, maintenance, port operations or decommissioning of the Wheatstone Development proposal, (including dredges and pile driving barges) are appropriately cleaned and maintained prior to being inspected by a Department of Fisheries Officer or a suitably qualified marine pest expert approved by the Department of Fisheries, and provide evidence to the CEO, on advice from the Department of Fisheries, certifying that:

i. there is no sediment on or within the non-trading vessel and immersible equipment;

ii. ballast water (if any) has been, or will be, managed according to the Australian Quarantine Inspection Service ballast water requirements as amended or replaced from time to time;

iii. no Introduced Marine Pests (as listed within the Revised Consultative Committee on Introduced Marine Pest Emergencies (CCIMPE) Trigger List or any other species demonstrating invasive characteristics, have been identified on or within any vessel or immersible equipment inspected;

iv. any cleaning or treatment activities undertaken to address Introduced Marine Pests risk, has been undertaken to an extent that the non-trading vessel or associated immersible equipment is considered to represent a low risk to the West Australian marine environment; and

v. vessel and immersible equipment inspections have been conducted either:

a. no more than 48 hours prior to vessel or immersible equipment departure for Ashburton North (unless an extension to up to 7 days has been agreed with the Department of Fisheries after consideration of the assessed risk); or

b. within 48 hours following arrival of vessel or immersible equipment within Port of Onslow; and

c. vessels that have spent more than seven days in coastal waters (less than 50 meters depth) between inspection and their arrival at Port of Onslow shall also be inspected during the sixth week after arrival in Port of Onslow.

Note: Arrangements for inspection within Port of Onslow shall be carried out in consultation with the Harbour Master.

12-3 Specified vessels and immersible equipment and vessels used to undertake single or multiple bunkering or other routine operational activities at a neighbouring port such as Exmouth, Dampier and Port Hedland will be exempt from the Introduced Marine Pests risk mitigation measures referred to in condition 12-2 if, prior to arriving or departing from Port of Onslow, the Department of Fisheries, has issued a written exemption for that specified vessel and immersible equipment to enter Port of Onslow prior to an identified date, based on comprehensive information submitted by the Proponent that includes a risk assessment supported by documentation demonstrating biofouling management measures and a vessel activity profile since the most recent dry-dock cleaning.

12-4 If, non-trading vessels and associated immersible equipment are to be transferred without exemption (condition 12-3) from Ashburton North to other locations within Western Australia's territorial waters, the Proponent shall, at least 14 days prior to departure from Port of Onslow undertake an inspection or submit a demobilisation risk assessment report to the Department of Fisheries that is informed by the Introduced Marine Pests monitoring of Ashburton North. Introduced Marine Pests monitoring shall:

i. be consistent with monitoring design, implementation and reporting standards set out as part of the National Monitoring Network for the Prevention and Management of Marine Pest Incursions, as approved by the Monitoring Design Assessment Panel of the Marine Pest Sectoral Committee (MPSC).

ii. include a review of target priority species prior to each monitoring survey;

iii. include a range of sample sites focusing on habitats considered most capable of facilitating the establishment of priority target species throughout all areas of port activities including anchorages, wharves, jetties, slipways, harbours and natural substrates;

iv. be undertaken a minimum of each year for the life of the Proposal; and

v. include opportunistic sampling and analysis of specimens removed during port and vessel maintenance activities.

12-5 The Proponent shall, throughout the life of the Proposal notify the Department of Fisheries, the Port of Onslow Harbour Master and the CEO of any known or suspected the Introduced Marine Pests detected in the waters within the marine leases held by the Proponent at or adjacent to Ashburton North within 24 hours following detection or following subsequent sample analysis undertaken as part of inspection or monitoring activities.

12-6 In the event that any the Introduced Marine Pests are detected during either the inspection of non-trading vessels and immersible equipment, or during monitoring surveys, the Proponent shall, in consultation with the Department of Fisheries and the CEO to develop and implement an Introduced Marine Pests Management Strategy to prevent wherever practicable, the establishment and proliferation of that organism, aiming to control and potentially eradicating that organism, and to minimise the risk of that the organism being transferred to other locations within Western Australia.

12-7 The Proponent is to submit a report detailing the outcomes of the implementation of the Introduced Marine Pests Management Strategy to the Department of Fisheries and the CEO within a month of the commencement of the implementation of the Introduced Marine Pests Management Strategy and thereafter as required by the CEO.

13 Marine Outfalls

Environmental Quality Management Framework and location of waste water discharges

13-1 Prior to construction of any infrastructure for this Proposal related to waste water discharge, and prior to application for any works approval from DEC for any discharge, the Proponent must prepare a map to be approved by the CEO that spatially defines the areas where each environmental quality objective and level of ecological protection is to be met in the marine environment surrounding this proposal. The map shall be provided in a GIS compatible format specified by the CEO.

13-2 The Proponent must locate the co-mingled on-shore brine and waste water outfalls so that the associated Low Ecological Protection Area is entirely contained within the Moderate Ecological Protection Area of the port.

13-3 The Moderate Ecological Protection Area for the port is defined as the area contained within 250 metres of the shipping berths and ship turning basin, and the area enclosed by the Marine Offloading Facility breakwaters. Outside of the Moderate Ecological Protection Area a high level of ecological protection shall be maintained.

13-4 The Low Ecological Protection Area for the co-mingled on-shore brine and waste water outfalls must not extend beyond 70 metres from all points of the diffuser structure.

13-5 The Proponent must locate the produced water outfall beyond the 20 metre isobath at a location approved by the CEO.

13-6 The Proponent shall incorporate waste treatment strategies and design the produced water outfall to minimise the size of any associated Low Ecological Protection Area and to ensure it does not extend beyond 70 metres from all points of the diffuser. Outside the Low Ecological Protection Area a high level of ecological protection shall be maintained.

13-7 The Proponent shall ensure that all waste and produced water discharges are managed to achieve the environmental quality objectives and levels of ecological protection as identified through condition 13-1 and described in Schedule 2.

Offshore Accommodation Vessel Marine Discharge Infrastructure

13-8 The Proponent shall not combine the brine discharge from the onboard desalination plant with the treated waste water discharge.

13-9 The Proponent shall incorporate waste treatment strategies and design the discharge outlets for treated waste water, brine and generator cooling water so that the size of any associated Low Ecological Protection Area is minimised and does not extend beyond 70 metres from the vessel. Outside the Low Ecological Protection Area a high level of ecological protection shall be maintained.

13-10 The Proponent shall ensure that all discharges from the Offshore Accommodation Vessel are managed to achieve the environmental quality objectives and levels of ecological protection as described in Schedule 2.

Quality of all Waste Water Discharges from the On-shore Facilities

13-11 Prior to application for a works approval from DEC for any discharge from the on-shore facilities, the Proponent shall submit a report to DEC that:

i. spatially maps the areas where each environmental quality objective and level of ecological protection is to be met;

ii. identifies the environmental quality criteria, for constituents of the discharge considered relevant by DEC, that should be met to maintain the environmental quality objectives and levels of ecological protection established through condition 13-1;

iii. predicts the toxicity of the final discharge under typical conditions;

iv. predicts the number of dilutions necessary to meet the required environmental quality objectives and level of ecological protection. For example, a moderate level of protection at the boundary of a Low and Moderate Ecological Protection Area and a high level of protection at the boundary of a Moderate and High Ecological Protection Area, or to meet

a high level of protection at the boundary of a Low and High Ecological Protection Area (predictions are based on achieving environmental quality criteria and effluent toxicity); and

v. presents contingency options for additional treatment or extending the diffuser to achieve greater dilutions if required.

13-12 Prior to application for a works approval from DEC for any discharge from the on-shore facilities, the Proponent shall develop an Effluent Quality Validation and Reporting Plan in consultation with DEC that addresses the following issues:

i. Whole Effluent Toxicity Testing program for determining:

   a. the actual toxicity of any discharge post commissioning and post operation of the outfall and following any significant change in effluent composition;

   b. the number of dilutions required to meet each relevant level of ecological protection.

   Testing is to be undertaken on a minimum of five locally relevant species from four different taxonomic groups using the recommended protocols from ANZECC and ARMCANZ (2000)[1];

ii. Characterisation of any waste water discharge under typical operational conditions and after any significant changes in effluent composition;

iii. A revised set of environmental quality criteria based on the contaminants of concern identified from (ii) above;

iv. Given the results from (i) (ii) and (iii) above, the number of dilutions required to achieve the environmental quality objectives and levels of ecological protection identified in condition 13-1 and described in Schedule 2; and

v. Reporting to DEC within 6 months of commissioning of a discharge or within 6 months of any significant change in composition of a discharge, including any management strategies necessary to ensure ongoing compliance with the environmental quality objectives and levels of ecological protection established through condition 13-1 and described in Schedule 2.

[1] Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000), Report 4, National Water Quality Management Strategy.

Quality of any Offshore Accommodation Vessel Discharges

13-13 Prior to application for a works approval from DEC for any discharges from the Offshore Accommodation Vessel, the Proponent shall submit a report to DEC that:

i. for those water quality indicators considered relevant to the discharges, identifies the environmental quality criteria that should be met to maintain the environmental quality objectives and levels of ecological protection established through conditions 13-1 and 13-9 and described in Schedule 2;

ii. models the behaviour of the different discharges from the offshore accommodation vessel and confirms that the environmental quality objectives will be met and that a high level of ecological protection will be achieved at the edge of the low ecological protection area;

iii. predicts the likely impact of the discharges under typical conditions;

iv. predicts the volumes and rates of the different discharges;

v. predicts the number of dilutions required to meet all of the environmental quality objectives, including a high level of ecological protection at the boundary of the Low and High Ecological Protection Areas (based on achieving the environmental quality criteria); and

vi. presents contingency options for additional management or treatment to achieve the required levels of ecological protection if required.

13-14 Prior to application for a works approval from DEC for the discharges from any Offshore Accommodation Vessels, the Proponent shall develop a Discharge Quality Validation and Reporting Plan to the satisfaction DEC that addresses the following issues:

i. Characterisation of the different discharge streams under typical operational conditions;

ii. A revised set of environmental quality criteria based on the contaminants of concern identified from (i) above;

iii. Given the results from (i) and (ii) above, confirmation that the environmental quality objectives and levels of ecological protection identified in conditions 13-1 and 13-9, and as outlined in Schedule 2, will be achieved; and

iv. Reporting to DEC within 6 months of commissioning, including any additional treatment or management strategies necessary to ensure ongoing compliance with the environmental quality objectives and levels of ecological protection established through conditions 13-1 and 13-9 and described in Schedule 2.

Reporting

13-15 In the event that the monitoring required by 13-12 and 13-14 or through the discharge licences issued under Part V of the Environmental Protection Act 1986 indicates that the environmental quality objectives and levels of ecological protection established through condition 13-1 and 13-9, and described in Schedule 2, are not being met, or are not likely to be met, the Proponent shall report the findings to the CEO and DEC as soon as practicable, but within five working days, along with a description of the management actions to be taken to meet the required level of environmental quality.

Discharge of hydrostatic test water

13-16 Prior to the discharge of hydrostatic test fluids to marine waters the Proponent is to develop, to the approval of the CEO, a Hydrostatic Test Fluids Discharge Management Plan that includes ecotoxicity testing of the hydrostatic test fluid, an assessment of likely impacts of the potential discharge against the environmental quality management framework outlined in schedule 2 and management measures that will be implemented to ensure that the environmental quality objectives and levels of ecological protection are maintained, including monitoring and reporting frameworks.

13-17 The Proponent must implement the Hydrostatic Test Fluids Discharge Management Plan once approved by the CEO.

14 Mangrove, Algal Mat and Tidal Creek Protection

14-1 The Proponent shall manage construction and operation activities to ensure that there is:

i. not more than 5% long-term (greater than 5 years) loss of mangrove habitat in the Hooley Creek – Four Mile Creek mangrove system

ii. no long-term (greater than 5 years) net detectable loss of mangrove habitat in the Ashburton Delta mangrove system.

iii. no long-term (greater than 5 years) net detectable loss of algal mat habitat outside the proposal footprint.

14-2 Prior to construction of the MOF or ground disturbing activities that could potentially impact upon mangroves and algal mat habitats, the Proponent shall prepare a Mangrove Algal Mat and Tidal Creek Protection Management Plan to be approved by the CEO on advice from the Department of Fisheries and DEC.

The objective of the Mangrove Algal Mat and Tidal Creek Protection Management Plan is to minimise the impacts of construction and operation of

the Proposal on mangroves, algal mats and saw fish nursery habitat (tidal creeks and lagoon) between and including the Ashburton River Delta and Four Mile Creek. The Plan shall include the results of the additional saw fish survey referred to in the Wheatstone Environmental Review and Management Program (July 2010), and details of management, monitoring, triggers, contingencies and reporting in relation to:

i. human impacts;

ii. contaminated surface water runoff;

iii. contaminated groundwater impacts;

iv. changes in turbidity;

v. changes in hydrological regime;

vi. generation of acidity from potential acid sulphate soil disturbance; and

vii. chemical and hydrocarbon spills and leaks.

14-3 The Proponent shall implement the approved Mangrove Algal Mat and Tidal Creek Protection Management Plan.

14-4 The Proponent shall make the Mangrove Algal Mat and Tidal Creek Protection Management Plan required under conditions 14-2 publicly available in a manner approved by the CEO.

15 Terrestrial Fauna

15-1 The Proponent shall ensure that any section of Open Trenches which are part of construction of the underground Domgas pipeline(s) and onshore portion of the trunkline(s) are cleared of trapped vertebrate fauna by Fauna-Rescue Personnel at least twice daily. Details of all fauna recovered shall be recorded, consistent with condition 15-5. The first daily clearing shall be conducted within three hours after sunrise and the second clearing shall be conducted between the hours of 3:00 pm and 6:00 pm.

The Proponent shall ensure that the Open Trenches which are part of construction of the Domgas pipeline and onshore portion of the trunkline(s) are also be cleared of vertebrate fauna, and fauna details recorded, by Fauna-Rescue Personnel within one hour prior to backfilling the Open Trenches for the construction of the Domgas pipeline(s) and onshore portion of the trunkline(s) being backfilled.

15-2 The fauna-rescue personnel shall obtain the appropriate licenses as required for fauna rescue under the *Wildlife Conservation Act 1950* and be trained in the following:

i. fauna identification, capture and handling (including specially protected fauna and venomous snakes likely to occur in the area);

ii. identification of tracks, scats, burrows and nests of all vertebrate fauna likely to occur in the area;

iii. fauna vouchering (of deceased animals);

iv. assessing injured fauna for suitability for release, rehabilitation or euthanasia;

v. familiarity with the ecology of the species which may be encountered in order to be able to appropriately translocate fauna encountered; and

vi. performing euthanasia on fauna.

15-3 Open trench lengths for construction of the underground pipelines shall be of a length capable of being inspected and cleared by the fauna-clearing personnel within the required times as set out in condition 15-1.

15-4 Egress points and/or fauna refuges providing suitable reasonable shelter from the sun and predators, for trapped fauna are to be placed in the open trenches (as per 15-1) at intervals not exceeding 50 metres.

15-5 The Proponent shall produce a report on fauna management within the pipeline trench or trenches at the completion of construction of both the Domgas pipeline and onshore portion of the trunkline(s). The report shall include the following:

i. details of fauna inspections;

ii. the number and type of fauna cleared from trenches and actions taken; and

iii. vertebrate fauna mortalities;

15-6 The report required under condition 15-5 shall be provided to the CEO and DEC no later than 21 days after completion of construction of both the Domgas pipeline and onshore portion of the trunkline(s), and shall be made publicly available in a manner approved by the CEO.

16 Weeds

16-1 The Proponent shall ensure that:

i. No new species of declared weeds and environmental weeds are introduced into the proposed extension to the Cane River conservation park that can be attributed to the Proposal.

ii. Prior to ground disturbing activities the Proponent shall undertake a baseline weed survey to determine the species and extent of declared weeds and environmental weeds present at weed monitoring sites within 50 metres of the onshore facilities including the pipeline disturbance corridor and at least three reference sites on nearby undisturbed land beyond 200 metres from the Onshore Facilities disturbance footprint in consultation with DEC.

iii. Baseline and reference weed monitoring sites surveyed as required by condition 16-1(ii) are to be monitored every 2 years for the life of the proposal to determine whether changes in weed cover and type within 50 metres of the onshore facilities including the pipeline corridor disturbance footprint have occurred and are likely to have resulted from implementation of the proposal or broader regional changes.

iv. If the results of monitoring under condition 16-1(iii) indicate that adverse changes in weed cover and type within 50 metres of the onshore facilities footprint are Proposal attributable, the Proponent shall report the monitoring findings to DEC within 3 months of completion of the monitoring and shall immediately undertake weed control and rehabilitation in the affected areas, where Proposal attributable weed cover has adversely changed, using native flora species of local provenance.

17 Rehabilitation

17-1 The Proponent shall undertake progressive rehabilitation of areas temporarily disturbed by construction and operation of onshore facilities for the duration of the construction and operation of onshore facilities, in a manner specified as follows:

i. Within 12 months of the date of this statement the Proponent shall conduct surveys of each of the vegetation communities that are likely to be impacted by construction and operation of onshore facilities to collect adequate information to assist setting completion criteria for rehabilitation.

ii. The methodology of the survey required in condition 17-1(i) shall be prepared and submitted for the approval of the CEO, on advice from DEC.

iii. Within 18 months of initial disturbance of vegetation in an area temporarily disturbed by construction and operation of onshore facilities commencing, the Proponent will develop completion criteria for rehabilitation for that area to be approved by the CEO on advice from DEC.

iv. Rehabilitation of areas temporarily disturbed by construction and operation of onshore facilities shall be initiated within 6 months of the completion of the temporary disturbance.

v. After 5 years of the completion of rehabilitation of those areas temporarily disturbed, the percentage cover and species diversity of living self sustaining native vegetation in rehabilitation areas shall be comparable to that of undisturbed natural analogue sites.

vi. No new species of declared weeds and environmental weeds shall be introduced into the rehabilitated areas which are likely to be attributable to the Proposal.

vii. The cover of declared weeds and environmental weeds in rehabilitated areas shall not exceed the lesser of:

a. that identified in the baseline weed survey condition 16-1(ii);

b. that existing on comparable nearby land which has not been disturbed during implementation of the Proposal.

17-2 The Proponent shall progressively monitor the rehabilitation for a range of sites against the criteria developed pursuant to condition 17-1(iii) with appropriately timed surveys as agreed with DEC, until the completion criteria are met. The monitoring shall be conducted annually unless otherwise agreed by the CEO, on advice from DEC.

17-3 The Proponent shall include the results of the rehabilitation monitoring required pursuant to condition 17-2 in the compliance assessment report referred to in condition 4-6. The report shall address the following:

i. The progress made towards meeting the completion criteria developed pursuant to condition 17-1(iii); and

ii. Contingency management measures if the monitoring required by condition 17-2 indicates that the completion criteria required by condition 17-1(iii) are unlikely to be met.

18 Emissions to Air

18-1 The Proponent shall install equipment in the LNG plants and Domgas plants and manage ongoing operations such that best practice for a liquefied natural gas/domestic gas facility is achieved in respect of:

i. minimising emissions of volatile organic compounds and oxides of nitrogen emissions;

ii. optimising the smokeless capacity of flares so as to minimise the frequency and duration of visible smoke; and

iii. minimising non emergency flaring of gas.

18-2 As part of its Works Approval application under Part V of the EP Act for the Foundation Project and also for Works Approval applications for subsequent LNG trains, the Proponent shall provide reports to DEC showing:

i. specific design features that have been used to minimise and monitor emissions to air, pursuant to condition 18-1;

ii. how the design features compare with current European and American best practice and associated emissions requirements for similar operations;

iii. a peer review report as required by condition 18-3.

18-3 The Proponent shall commission peer reviewer(s), approved by the CEO to undertake the following, in accordance with terms of reference also approved by the CEO:

i. a review of the reports referred to in condition 18-2;

ii. provide comment on the basis and validity of the conclusions in the reports; and

iii. provide comment on the relevance of the described international standards for the Ashburton North Strategic Industrial Area.

18-4 The Proponent shall replace plant and equipment with that which meets the best practice standards as at the time of replacement.

19 Greenhouse Gas Abatement

19-1 Prior to commencement of construction of the LNG plant, the Proponent shall prepare and submit to the CEO a Greenhouse Gas Abatement Program for the Proposal, which has the objectives of minimising net greenhouse gas emissions from the Proposal and reducing emissions per tonne of product as far as practicable.

19-2 The Greenhouse Gas Abatement Program shall:

i. demonstrate that the Proposal is designed and operated in a manner which minimises greenhouse gas emissions as far as practicable;

ii. demonstrate that maximising energy efficiency and opportunities for future energy recovery have been given due consideration in the design and operation of the Proposal;

iii. include measures aimed at meeting an initial target for “greenhouse gas” emissions of 0.26 tonnes carbon dioxide equivalent per tonne of product, excluding consideration of reservoir carbon dioxide, and thereafter achieving as low as practicable a greenhouse gas emission.

iv. include a management objective on “greenhouse gas” intensity [i.e. quantity of carbon dioxide equivalents (CO_2-e) generated per tonne of product produced] that is equivalent to, or better than published benchmarked best practice for equivalent plants; and

v. achieve continuous improvement in net greenhouse gas emissions and emission intensity through the periodic review, and adoption of advances in technology and process management.

19-3 The Proponent shall review the Greenhouse Gas Abatement Program each calendar year and submit a review assessment report to the CEO on the performance of the proposal against the requirements of condition 19-2 by 31 March of each year.

19-4 The Proponent shall implement the Greenhouse Gas Abatement Program referred to in conditions 19-1 to 19-3.

19-5 In addition to condition 19-3, the Proponent shall commission an Independent Specialist to assess the Proponent’s performance against the requirements of condition 19-2 at intervals of no greater than two years, with the Independent Specialist’s assessment report being provided to the CEO within 20 business days of it being received by the Proponent.

19-6 The Proponent shall make the Greenhouse Gas Abatement Program required by condition 19-1 and the reviews under conditions 19-3 and 19-5 publicly available in a manner approved by the CEO.

19-7 Subject to condition 19-8, for the life of the Proposal, the Proponent shall implement a greenhouse gas offset package approved by the Minister which, as a minimum, offsets the reservoir carbon dioxide released to the atmosphere from the Proposal.

19-8 Condition 19-7 continues to have effect and conditions the implementation of the proposal until such time as it is determined by the Minister for Environment that it is non-complementary to the Commonwealth Government’s greenhouse gas reduction legislation applicable to the proposal.

20 Public Availability of Data

20-1 Subject to condition 20-2, within a reasonable time period approved by the CEO of the issue of this Statement and for the remainder of the life of the proposal the Proponent shall make publicly available, in a manner approved by the CEO, all validated environmental data (including sampling design, sampling methodologies, empirical data and derived information products (e.g. maps)) relevant to the assessment of this proposal and implementation of this Statement.

20-2 If any of the data referred to in condition 20-1 contains particulars of:

i. a secret formula or process; or

ii. confidential commercially sensitive information

the Proponent may submit a request for approval from the CEO to not make this data publically available. In making such a request the Proponent shall provide the CEO with an explanation and reasons why that data should not be made publically available.

21 Decommissioning

21-1 At least six months prior to the anticipated cessation of the Facilities, the Proponent shall meet the following decommissioning criteria.

i. removal or, if agreed in writing by the CEO on advice from the appropriate regulatory authority in consultation with relevant stakeholders, retention of (that is, leave in-situ) plant and infrastructure;

ii. rehabilitation of all disturbed areas to a standard suitable for the new land use(s) as agreed pursuant to the consultation referred to in condition 21-1(i); and

iii. identification of contaminated areas, including provision of evidence of notification and proposed management measures to relevant statutory authorities.

22. Residual Impacts and Risk Management Measures

22.1 Given the residual impacts and risks (permanent and temporary) of the Proposal to seagrass, coral, mangroves, marine and estuarine fauna, algal mats, vegetation, and conservation areas, the Proponent shall undertake the following residual impacts and risk management measures, consistent with financial, governance and accountability arrangements described in Schedule 3 (Proponent residual impacts and risk management measures – Wheatstone Proposal), unless otherwise agreed by the CEO.

22.2 The Proponent will contribute to a relevant scientific initiative, on the basis as described in Schedule 3 (**Project A**), which has the aim of adding to the understanding and management of the impacts of dredging on tropical marine communities in Western Australia. The Proponent will develop a process, approved by the CEO on advice from DEC, to select and fund research project/s by 30 January 2012, unless otherwise agreed by the CEO.

22.3 The Proponent will contribute to a research program, on the basis as described in Schedule 3 (**Project B**), which has the aim of adding to the understanding of west Pilbara marine habitats (including coral and seagrass communities), their level of connectivity and recovery potential following natural and human induced disturbance. The Proponent will develop a process, approved by the CEO on advice from DEC, to select and fund

research project/s by 30 January 2012, unless otherwise agreed with the CEO.

22.4 The Proponent will contribute to a research program, on the basis described in Schedule 3 (**Project C**), which has the aim of adding to the understanding and improved management of regionally critical habitat for humpback whales, dugongs and snubfin dolphins in Pilbara waters. The Proponent will develop a process, approved by the CEO, on advice from DEC, to select and fund research projects by 30 January 2012, unless otherwise agreed by the CEO.

22.5 Where practicable, the Proponent will take account of the findings of research Projects A, B and C in the management of the Proposal.

22.6 The Proponent will provide funding to DEC, on the basis as described in Schedule 3 (**Project D**). The aim of the funding will be to assist DEC in the management of potential impacts and risks associated with increased visitation to island nature reserves managed under the *Conservation and Land Management Act 1984* within the vicinity of the Proposal.

22.7 The Proponent will fund the Department of Fisheries, on the basis described in Schedule 3 (**Project E**). The aim of the funding will be to assist the Department of Fisheries enforce compliance with bag limits and size limits in the coastal and estuarine environment within the vicinity of the Proposal.

22.8 The Proponent will fund DEC, on the basis described in Schedule 3 (**Project F**). The aim of the funding will be to assist DEC in the management of potential impacts and risks to the Cane River Conservation Park and proposed extensions associated with increased visitation from the Proposal.

22.9 The Proponent will maintain a contingency fund, on the basis described in Schedule 3 (**Project G**), for the purposes of remediating potential impacts to offshore islands and the Cane River Conservation Park and proposed extensions to be released on an as-needs basis to DEC, where impacts can be reasonably attributed to the Proposal, as determined by the CEO, on advice from the DEC and the Proponent. The contingency funding will continue to be available until one year after the date of first shipment of product from the LNG plant.

22.10 The real value of funding for Projects D, E and G will be maintained through indexation to the Perth consumer price index (CPI), with the first adjustment occurring on 30 January 2013.

23 Staging of plans

23-1 Where a plan, program, report or strategy is required by these conditions to be approved prior to commencement of construction or operation of a facility or activity, it will be sufficient for the plan, program, report or strategy to be approved for the component or stage of the facility or activity before commencing construction or operation.

24 Review of plans

24-1 If the Proponent amends any plan, program, report or strategy required by these conditions, the Proponent must implement the amended plan from the date of the amendment.

24-2 If any plan, program, report or strategy is required to be approved under these conditions, the Proponent may only make a significant amendment to the plan, program, report or strategy if the amendment is also approved. Significant amendments are those amendments which alter the obligations of the Proponent, that is, are not minor or administrative.

Notes

1. Where a condition states “on advice of the Office of the Environmental Protection Authority”, the Office of the Environmental Protection Authority will provide that advice to the Proponent.

2. The Office of the Environmental Protection Authority may seek advice from other agencies or organisations, as required, in order to provide its advice to DEC.

3. The Minister for Environment will determine any dispute between the Proponent and the Office of the Environmental Protection Authority over the fulfilment of the requirements of the conditions.

4. The Proponent is required to apply for a Works Approval and Licence for this Proposal under the provisions of Part V of the *Environmental Protection Act 1986*.

Schedule 1

The Proposal (Assessment No. 1754)

The proposal is to construct and operate a 25 million tonne per annum Liquefied Natural Gas (LNG) facility and associated Domestic Gas (Domgas) facility in the proposed Ashburton North Strategic Industrial Area (ANSIA) 12 kilometres south west of the town of Onslow.

The proposal includes a:

- subsea gas trunkline to bring produced gas onshore to the LNG and Domgas plants;
- product loading facility (PLF);
- Materials offloading facility (MOF);
- LNG and Domgas plants;
- Accommodation facilities; and
- Domgas pipeline to transport natural gas to the Dampier to Bunbury Natural Gas Pipeline

The location of the various Proposal components is shown in Figures 1 to 7.

The main characteristics of the proposal are summarised in Table 1 below. A detailed description of the proposal is provided in section 2.0 of the Environmental Review and Management Programme document, *Draft Environmental Impact Statement/Environmental Review and Management Programme for the Proposed Wheatstone Proposal*, Chevron Australia Pty Ltd, (July 2010) and section 2.3 of *Final Environmental Impact Statement/Response to Submissions on the Environmental Review and Management Programme for the Proposed Wheatstone Proposal,* Chevron Australia Pty Ltd, (February 2011).

Table 1: Summary of Key Proposal Characteristics

Element	**Description**
Nearshore facilities	(Figure 6)
Shipping channel	Up to 18 km long navigation channel and turning basin for access to the PLF (nearshore component of the shipping channel shown in Figure 6).
Product loading facility (PLF)	Up to 2.5 km long, with export facilities for up to 3 LNG tankers or up to 2 LNG tankers and 1 condensate tanker. Includes jetty and mooring dolphins.
Materials Offloading Facility (MOF)	Includes the associated breakwater, access channel, turning circle and basin, roll on, roll off facilities and tug berths.
Dredge Spoil disposal site A	Up to 1.5 Mm^3 in 4 km^2
Discharge lines	Up to 2 x wastewater lines from the onshore facilities to the PLF or within the area designated as Moderate Level of Environmental Protection.
Offshore facilities	
Shipping Channel	Up to 18 km long navigation channel and turning basin

Element	Description
	for access to the PLF (offshore component of the shipping channel not shown in Figure 6).
Dredge Spoil disposal sites B C D E	 Up to 3 Mm^3 in 5 km^2 Up to 40 Mm^3 in 24 km^2 Up to 40 Mm^3 in 9 km^2 Contingency only **Note:** Although the combined available capacity of the approved Dredge Spoil disposal sites exceed 48 Mm^3, the maximum of dredge spoil authorised for disposal by this Statement shall not exceed 48Mm^3.
Produced Water Outfall	1 x produced water line up to 50 km long from onshore facilities to 20 m depth contour.
Other marine facilities	
Dredging	Up to 18 km long navigation channel, turning basin and MOF and tanker berths with up to 45 Mm^3 of dredge spoil. Up to 3 Mm^3 dredge spoil for the trunkline.
Trunkline	One subsea partially buried pipeline to the shore crossing
Trunkline shore crossing	Up to 6 tunnels installed by micro-tunnelling technique up to 1400 m long.
Offshore Accommodation Vessel	Vessel for accommodation for marine construction workers.
Onshore Facilities	
LNG plant	Located in Ashburton North Strategic Industrial Area (ANSIA)
Throughput	Up to 25 MTPA (foundation plant up to 9 MTPA)
Components	Up to 6 LNG trains
No. of storage tanks	Up to 4 x 180,000 m^3 LNG tanks
	Up to 4 x 120,000 m^3 condensate tanks
No. of flares	Up to 8 elevated flare structures: • 3 x high pressure (minimum height 125 m); • 3 x low pressure (minimum height 45 m); and • 2 marine flares (minimum height 45 m)
Footprint	Total disturbance onshore – approximately 3,300 ha comprised of: • LNG plant approximately 1010 ha; • Shared Infrastructure Corridor (including construction village area) approximately 1,000 ha;

Element	Description
	• Roads and fill sources approximately 980 ha; and • Domgas line approximately 320 ha.
Utilities	Construction power generation – 15 MW from on site diesel generators. Operations power generation – approximately 400 MW. Construction water usage – approximately 6,134,000 m^3 (excluding hydro test water) Operations water usage – approximately 150 m^3/hr potable water.
Discharges	Produced Water (PW) offshore outfall approximately 13,200 m^3/day (starting from commissioning of LNG trains 3 to 6). Storm water – approximately 9,600 kL/day. Cooling water – none (air cooled). Flaring – no routine flaring other than pilot. Construction sewage – approximately 78 m^3/hr. Operations sewage – approximately 18 m^3/hr. Construction RO Brine – approximately 433 m^3/hr. Operations RO Brine – approximately 234 m^3/hr. Construction waste – up to 11,800 tonnes/year disposed of to a licensed 3rd party waste facility (no onsite incineration). Operations waste – up to 1,600 tonnes/year disposed of to a licensed 3rd party waste facility (no onsite incineration).
Domgas plants	Up to four
Capacity	Approximately 15% of heating value of LNG produced
Domgas pipeline	Up to 2 pipelines in a 60 m wide corridor approximately 75 km long connecting to the existing Dampier to Bunbury Natural Gas Pipeline (DBNGP)
Accommodation Village	
Location	Approximately 5 km inland from LNG facility in the ANSIA
Capacity	Construction - approximately 5000 people. Operations – approximately 400 people
Utilities	Construction power generation - approximately 10 MW from onsite diesel generators Operations power generation – electrical power delivered from LNG facility. Construction and operations water usage – included LNG facility figures.
Discharges	Construction sewage - approximately 76 m^3/hr recycled where possible for dust suppression

Element	Description
	Operations sewage – approximately 18 m^3/hr to waste water outfall Construction waste disposal – approximately 5,500 tonnes/year disposed of to a licensed 3rd party waste facility (no onsite incineration). Operations waste – approximately 175 tonnes/year disposed of to a licensed 3rd party waste facility (no onsite incineration

Abbreviations

ha	hectares	m	metres
hr	hour	m^3	cubic metres
kg	kilograms	Mm^3	million cubic metres
km	kilometres	MW	megawatts (10^6 watts)
km^2	square kilometres		

Figures

Figure 1 Location of all Proposal components (Figure 1 in report above)
Figure 2 Islands, coral habitats, including designated reef formations, and Wheatstone marine facilities (attached below)
Figure 3 Zones of High Impact and Zones of Moderate Impact for corals and filter feeders, associated with dredging for construction of marine facilities (Figure 4 in report above)
Figure 4 Zones of High Impact and Zones of Moderate Impact for seagrass and macroalgae, associated with dredging for construction of marine facilities (Figure 5 in report above)
Figure 5 Zones of Influence associated with dredging for construction of marine facilities excluding trunkline (Figure 6 in report above)
Figure 6 Nearshore marine facilities (attached below)
Figure 7 Trunkine corridor (Figure 2 in report above)

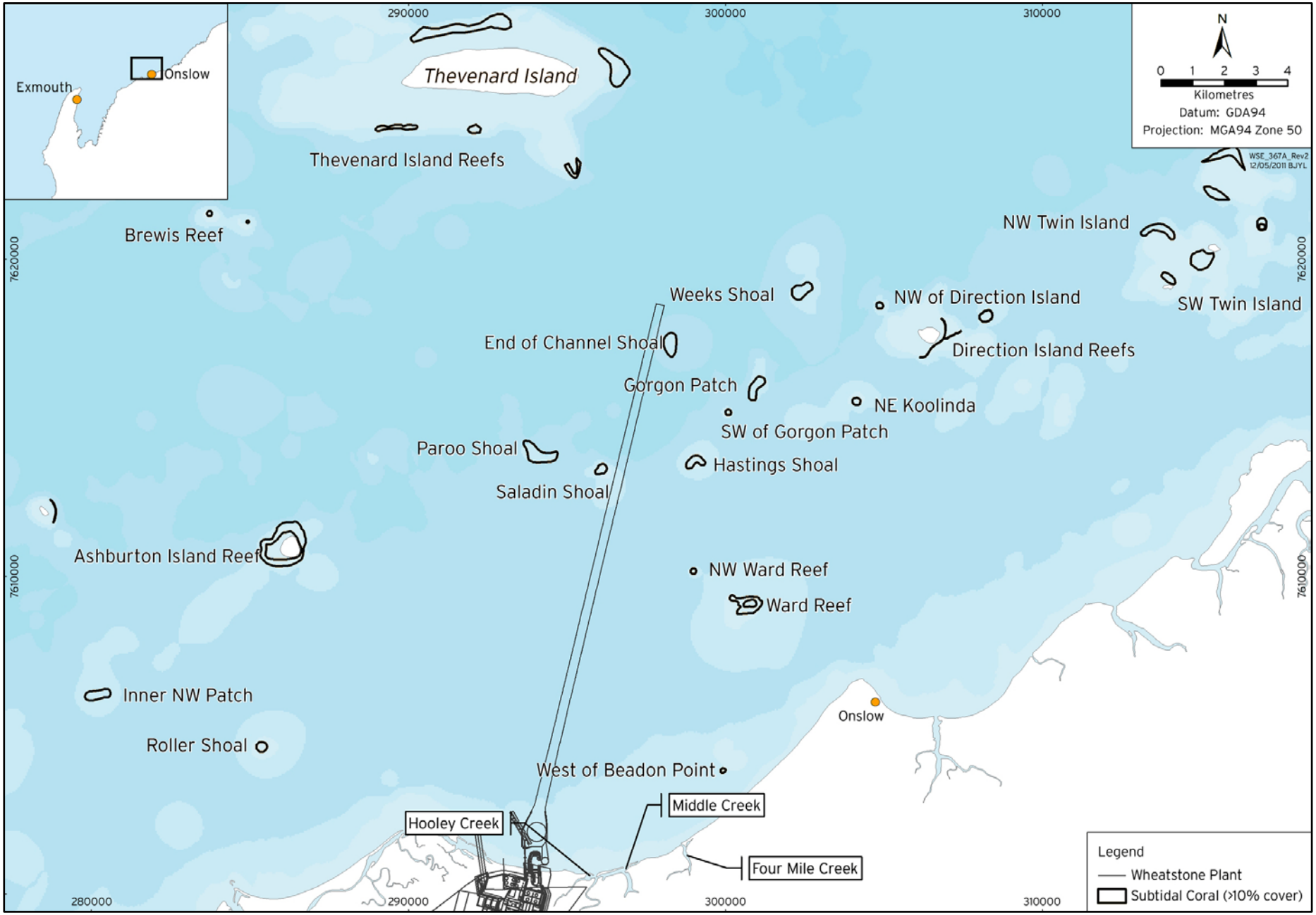

Figure 2: Islands, coral habitats, including designated reef formations, and Wheatstone marine facilities.

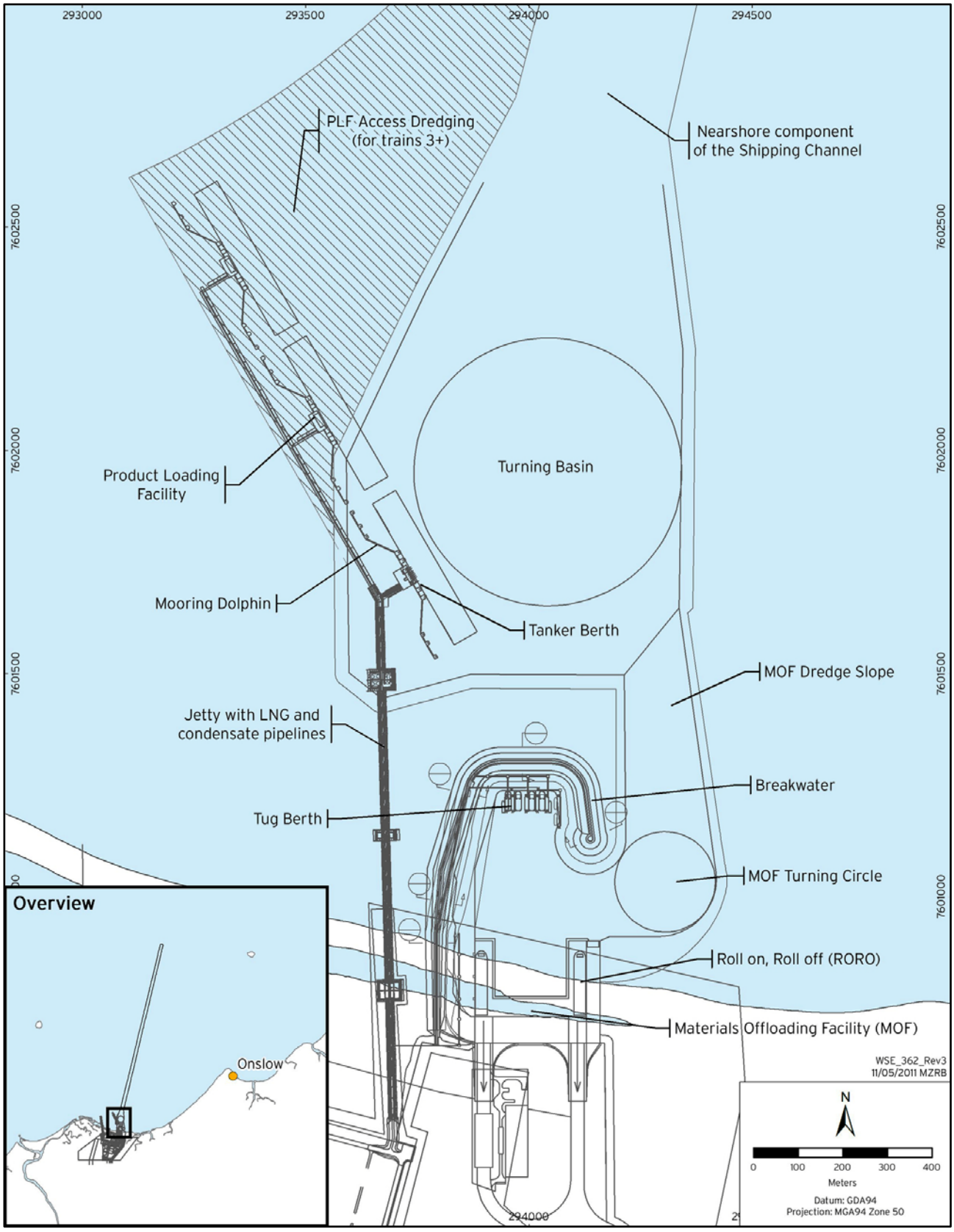

Figure 6 Nearshore marine facilities

Table 2 Overflow Control Zones (Datum GDA94, Projection MGA94 Zone 50)

Id	Overflow Zone	Easting	Northing
1	Zone 1	295343	7608380
2	Zone 1	295626	7608316
3	Zone 1	295174	7606420
4	Zone 1	294885	7606485
5	Zone 2	297003	7615260
6	Zone 2	297269	7615198
7	Zone 2	296576	7612289
8	Zone 2	296299	7612353

Table 3 Trunkline corridor boundary coordinates

Point	Easting	Northing
1	288364	7612137
2	291845	7606067
3	291994	7605591
4	291455	7605677
5	291255	7606134
6	288017	7611769
7	283425	7617048
8	282999	7617309
9	282527	7617470
10	282040	7617583
11	281553	7617697
12	281066	7617810
13	280579	7617923
14	280092	7618036
15	279605	7618150
16	279118	7618263
17	278631	7618376
18	278144	7618489
19	277657	7618603
20	277170	7618716
21	276685	7618836
22	276224	7619027
23	275805	7619299
24	275441	7619641
25	275146	7620044
26	274929	7620493
27	274796	7620975
28	273962	7631557
29	283628	7617646
30	283749	7616737
31	288510	7611941
32	273798	7632841
33	273353	7632357
34	288616	7611773
35	288434	7612048
36	288565	7611858
37	288071	7611696
38	288127	7611614
39	291514	7605444
40	291929	7605837
41	291373	7605899
42	292216	7600403
43	292711	7600471

Schedule 2 The Environmental Quality Objectives and Levels of Ecological Protection to be achieved in marine waters for the Wheatstone Proposal. (Condition 13)

Area	Environmental Quality Objectives	Level of Ecological Protection for Maintenance of Ecosystem Integrity
Zone of initial dilution – maximum 70 m radius around diffuser or discharge.	• Maintenance of ecosystem integrity. • Maintenance of seafood for human consumption. Maintenance of aquaculture. • Maintenance of primary contact recreation. • Maintenance of secondary contact recreation. • Maintenance of aesthetic values. Maintenance of cultural and spiritual values. Maintenance of industrial water supply.	**Low** - To allow for large changes in the quality of water, sediment and biota (eg. Large changes in contaminant concentrations causing large changes beyond natural variation in the natural variation in the natural diversity of species and biological communities, rates of ecosystem processes and abundance/biomass of marine life, but which do not result in bioaccumulation/biomagnification in nearby high ecological protection areas). For this protection level only the 80% species protection guideline trigger values* for potentially bio-accumulating toxicants in water apply. There should be no bioaccumulation in adjacent high ecological protection areas.
Marine waters within 250 m from ship turning basin and berthing areas and the area enclosed by the Marine Offloading Facility breakwaters.	• Maintenance of ecosystem integrity. • Maintenance of seafood for human consumption. Maintenance of aquaculture. • Maintenance of primary contact recreation. • Maintenance of secondary contact recreation. • Maintenance of aesthetic values. Maintenance of cultural and spiritual values. Maintenance of industrial water supply.	**Moderate** - To allow moderate changes in the quality of water, sediment and biota (eg moderate changes in contaminant concentrations that cause small changes, beyond natural variation, in ecosystem processes and abundance/biomass of marine life, but no detectable changes from the natural diversity of species and biological communities). For this protection level the 90% species protection guideline trigger values* for toxicants in water apply and for discharges that contain a mixture of toxicants, the sum of the concentrations of the primary toxicants (up to 5 toxicants) should not exceed the sum of the relevant trigger values. For other physical and chemical parameters the trigger values are based on the 95th percentile of natural background measurements. Trigger values should be derived in accordance with the recommended approaches in ANZECC & ARMCANZ (2000). For sediments the ISQG-low* apply. For dissolved oxygen the outfalls should preferably be managed so that they do not cause the median dissolved oxygen concentration in waters ≤0.5 metres from the seafloor, calculated over a period of up to 6 weeks, to fall below 80% saturation at any site, but they should never cause dissolved oxygen concentrations to fall below 60% saturation.
Marine waters beyond the areas of Moderate and Low Ecological Protection.	• Maintenance of ecosystem integrity. • Maintenance of seafood for human consumption. Maintenance of aquaculture. • Maintenance of primary contact recreation. • Maintenance of secondary contact recreation. • Maintenance of aesthetic values. Maintenance of cultural and spiritual values. Maintenance of industrial water supply.	**High** – To allow small changes in the quality of water, sediment and biota (eg. small changes in contaminant concentrations with no resultant detectable changes beyond natural variation in the diversity of species and biological communities, ecosystem processes and abundance/biomass of marine life). For this protection level the 99% species protection guideline trigger values* for toxicants in water apply (except for cobalt for which the 95% species protection guideline should apply) and for discharges that contain a mixture of toxicants, the sum of the concentrations of the primary toxicants (up to 5 toxicants) should not exceed the sum of the relevant trigger values. For other physical and chemical parameters the trigger values are based on the 80th percentile of natural background measurements. Trigger values should be derived in accordance with the recommended approaches in

		ANZECC & ARMCANZ (2000). For sediments the ISQG-low* apply. For dissolved oxygen the outfalls should preferably be managed so that they do not cause the median dissolved oxygen concentration in waters ≤0.5 metres from the seafloor, calculated over a period of up to 6 weeks, to fall below 90% saturation at any site, but they should never cause dissolved oxygen concentrations to fall below 60% saturation.
Marine waters adjacent to the Ashburton River mouth identified for maximum ecological protection in map 5 of DoE Marine Report 1 (2006).	• Maintenance of ecosystem integrity. • Maintenance of seafood for human consumption. Maintenance of aquaculture. • Maintenance of primary contact recreation. • Maintenance of secondary contact recreation. • Maintenance of aesthetic values. Maintenance of cultural and spiritual values. Maintenance of industrial water supply.	**Maximum** – No detectable changes beyond natural variation in ecosystem processes, the quality of water, sediment and biota, the diversity of species and biological communities or in the abundance/biomass of marine life.

* From National Water Quality Management Strategy Report 4, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (2000) or its updates.

Schedule 3: Proponent Residual Impacts and Risk Management Measures - Wheatstone Proposal (Condition 22)

Project	Value & Timeframe	Responsibility to implement	Governance	Cost
RESEARCH				
Project A Improving the understanding and management of the impacts of dredging on tropical marine communities.	$1.6 million by 30 January 2012; $1.6 million by 30 Jan 2013.	Chevron / WAMSI	Chevron, WAMSI, OEPA	$3.2 million over 2 years
Project B Improving the understanding of west Pilbara marine habitats, connectivity and recovery potential following natural and human induced disturbance.	$300,000 by 30 Jan 2012; $300,000 by 30 Jan 2013; $300,000 by 30 Jan 2014; $300,000 by 30 Jan 2015.	DEC	Chevron, DEC, OEPA	$1.2 million over 4 years
Project C Identification and improved management of critical habitat for the following threatened marine species: 1) humpback whales; 2) dugongs; and 3) snubfin dolphins in Pilbara waters.	$875,000 by 30 Jan 2012; $875,000 by 30 Jan 2013; $875,000 by 30 Jan 2014; $875,000 by 30 Jan 2015.	DEC	Chevron, DEC, OEPA	$3.5 million over four years
MANAGEMENT				
Project D Managing the impacts and risks associated with potential increased visitation to island nature reserves managed under the *Conservation and Land Management Act 1984* within vicinity of the Proposal.	$770,000 by 30 Jan 2012; $770,000* by 30 Jan 2013; $770,000* by 30 Jan 2014; $770,000* by 30 Jan 2015; $770,000* by 30 Jan 2016; (* indexed to CPI)	DEC	Chevron, DEC	$3.85 million over 5 years (*indexed to CPI) Note: if the construction of the Foundation Project extends beyond 5 years, the Proponent will continue to provide resources to DEC on a pro-rata basis until the date of first

				shipment of product from the LNG plant.
Project E Management of potential additional recreational fishing pressure within vicinity of the Proposal.	$220,000 by 30 Jan 2012; $220,000* by 30 Jan 2013; $220,000* by 30 Jan 2014; $220,000* by 30 Jan 2015; $220,000* by 30 Jan 2016 (* indexed to CPI)	DoF	Chevron, DoF	$1.1 million over 5 years (*indexed to CPI) Note: if the construction of the Foundation Project extends beyond 5 years, the Proponent will continue to provide resources to DoF on a pro-rata basis until the date of first shipment of product from the LNG plant.
Project F Managing the impacts and risks associated with potential increased visitation to the Cane River Conservation Park and proposed extensions.	$300,000 by 30 Jan 2012	DEC	Chevron, DEC	$300,000
CONTINGENCY				
Project G Contingency fund for the purposes of remediating potential impacts to offshore islands and the Cane River Conservation Park and proposed extensions where impacts can be reasonably attributed to the Proposal.	$250,000*, to be maintained by the Proponent until one year after the date of first shipment of product from the LNG plant. (*Indexed to CPI)	Chevron to maintain and administer fund; DEC to implement remediation.	Chevron, DEC, OEPA	$250,000

Schedule 4 Definition of terms and acronyms used in this Statement

General

"**approximately**" for the purposes of Schedule 1 only of this Statement means plus or minus 10 percent.

"**best practice**" has the meaning outlined in the Environmental Protection Authority's Guidance 55 *Implementing Best Practice in proposals submitted to the Environmental Impact Assessment process (2003).*

"**CEO**" – means the Chief Executive Office of the Office of the Environmental Protection Authority.

"**Construction**" – means construction and commissioning of a Facility excluding temporary, minor, preliminary and investigatory works, geotechnical, geophysical, biological and cultural heritage surveys, staging works, baseline surveys, monitoring, technology trials, and works consented to by OEPA.

"**DEC**" – means the Department of Environment and Conservation.

"**Environmental weeds**" means are plants that establish themselves in natural ecosystems (marine, aquatic and terrestrial) and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade. Impacts of environmental weeds on ecosystem function include:

- resource competition,
- prevention of seedling recruitment,
- alteration to geomorphological processes,
- alteration of hydrological cycle,
- changes to soil nutrient status,
- alteration of fire regime,
- changes to the abundance of indigenous fauna, and
- genetic changes.

(Carr et al., 1992; Humphries et al., 1993, Csurhes and Edwards, 1998).

"**Facilities**" means the elements of the Proposal listed in Schedule 1 of this statement, but excluding the Port Facilities.

"**Fauna-Rescue Personnel**" means employees of the Proponent whose responsibility it is to walk the open trench to recover and record fauna found within the trench.

"**Foundation Project**" means the initial 2 Trains of a Liquefied Natural Gas (LNG) facility and associated Domestic Gas (Domgas) facility. The proposal is described in detail in the Draft Environmental Impact Statement/Environmental Review and Management Program and the Final Environmental Impact Statement/Response to Submissions on the Environmental Review and Management Program for the

Proposed Wheatstone Proposal. Key components of the proposal are summarised within Schedule 1 of this statement.

These include a:

- subsea gas trunkline to bring produced gas onshore to the LNG facility;
- Product loading facility (PLF);
- Materials offloading facility (MOF);
- LNG processing facility Located in the Ashburton North Strategic Industrial Area (ANSIA);
- Accommodation facility and;
- Domgas pipeline to transport natural gas to the Dampier to Bunbury Natural Gas Pipeline.

"**Independent Specialist**" means an external auditor commissioned by the Proponent and approved by the CEO.

"**non-trading vessel**" – for the purposes of condition 12 the term 'non-trading vessel' refers to those vessels included in the definition of non-trading vessels outlined in the *National System for the Prevention and Management of Marine Pest Incursions, National Biofouling Management Guidance for Non-Trading Vessels*; and known invasive marine species are considered to be those species listed by the Consultative Committee on Introduced Marine Pest Emergencies (CCIMPE) within the Revised CCIMPE Trigger List.

"**Port Facilities**" means any facilities under the operational; control of the Dampier Port Authority.

Definitions for terms used in condition 6, 7 and 8

For a monitoring occasion, the "**change in live coral cover**" is determined by subtracting the baseline live coral cover from the 'live coral cover' measured on that monitoring occasion.

The term "**live coral cover**" means, for a given total area of sea bed, the area of the sea bed occupied by live tissues of species of scleractinian corals expressed as a percentage of the given total area of sea bed.

The term "**baseline live coral cover**" means the live coral cover at the time of the last survey before the commencement of marine works.

The term "**net live coral cover**" is the result of subtracting the change in live coral cover at the assigned reference site(s) from the live coral cover at the monitoring site.

For each designated reef formation, the term "**protection of at least 70% of baseline live coral cover**" means net live coral cover is at least 70% of the baseline live coral cover for that designated reef formation.

For the purpose of condition 6-2, the term "**protection of at least 50% of baseline live coral cover**" means net live coral cover is at least 50% of the baseline live coral cover for that designated reef formation.

The term "**benthic habitats**" means all functional ecological communities that inhabit the seabed, including benthic primary producer habitats as defined in the Environmental Protection Authority's Environmental Assessment Guideline Number 3 (2009). Benthic communities covered by this definition include but are not restricted to those with predominant components being hard corals, filter feeders including soft corals, sponges and other non-coral benthic macro-invertebrates, seagrass, macroalgae and mangroves.

In respect of Benthic Primary Producer Habitats the terms "**irreversible loss**" and "**serious damage**", are defined in the Environmental Protection Authority's Environmental Assessment Guideline Number 3 (2009).

Paroo Shoal, Gorgon Patch, SW of Gorgon Patch and Hastings Shoal shown in Figure 2 are each referred to as a "**designated reef formation**".

The term "**detectable**" refers to the smallest statistically discernable effect size that can be achieved with a monitoring strategy designed to achieve a statistical power value of at least 0.8 or an alternative value as determined by the CEO.

The term "**turbid water overflow from dredging equipment**" means the intentional discharge to the ambient marine environment of sediment-laden excess sea water during the act of loading for the purposes of dumping.

The term "**loading for the purposes of dumping**" means where material or substances of any kind are loaded on any vessel, platform or aircraft for the purpose of being dumped into the sea (Australian Government, 2009).

The term "**turbidity-generating activities which are part of the construction of the nearshore and offshore marine facilities**" means any activity, including but not limited to capital dredging and loading, rock dumping, dredge spoil placement activities and pipeline installation required for the construction of nearshore or offshore marine facilities listed in Schedule 1, which generate and/or release sediment into marine waters.

The term "**turbidity-generating activities which are part of the maintenance of nearshore and offshore marine facilities**" means any activity, including but not limited to maintenance dredging and loading, rock dumping and dredge spoil placement activities required to maintain operability of nearshore or offshore marine facilities listed in Schedule 1, which generate and/or release sediment into marine waters.

The term "**nearshore and offshore marine facilities**" means the marine facilities listed in Schedule 1 under the headings Nearshore facilities and Offshore facilities.

The "**overflow control zones"** referred to in conditions 6-13, 6-14 and 6-15 are described by the geographic co-ordinates set out in Table 2.

The term “**trunkline installation activities**” means any activity undertaken in the marine environment required for the installation of the trunkline in WA State Waters, including but not limited to trench dredging, dredge spoil placement, rock dumping, pipe lay operations and micro-tunnel marine exit.

The term “**trunkline infrastructure**” means the key components of the actual trunkline pipe to be installed.

The term “**turbidity-generating activities associated with construction of the trunkline**” is a subset of trunkline installation activities means any activity, including but not limited to dredging and loading for trunkline installation, rock dumping, micro-tunnel marine exit and dredge spoil placement which generates and/or releases sediment into marine waters.

The term “**marine works**” means all activities undertaken to construct the Nearshore, Offshore and Other marine facilities referred to in Schedule 1, including but not limited to turbidity-generating activities associated with construction of those facilities.

The term “**near-real time dredge and dredge overflow management**” refers to the practice of acquiring monitoring data *in situ* and interpreting those data where the time lag between acquiring data and responding to those data in a management sense is sufficiently short to be considered as immediate as practicable.

The term “**realised Zone of Influence**” is the maximum detectable extent of turbidity associated with the turbidity generating activities which are part of marine works, measured at any point in time.

Appendix 5

Summary of submissions and proponent's response to submissions