10. Draft EIS Section 7 Existing Marine Environment

10.1 Section 7.2 Physical Environment

10.1.1 Section 7.2.3 Bathymetry and Seabed Features

OEH 5: The detailed path of the pipeline is still unknown but undulations are known to occur along the seabed. Given this, evaluation of pipe construction requirements and the effect these may have on the seabed should be presented.

Include discussion of the area of seabed likely to be impacted by works and the measures that will be employed to minimise this disturbance.

OEH 5: Evaluation of pipeline construction requirements and the effect these may have on the seabed should be presented.

The detailed design of the pipeline which will commence upon or just after project sanction will look to further optimise the pipeline route to further reduce adverse pipeline interaction with significant seabed undulations. Adverse pipeline interactions with significant seabed undulations typically result in the pipeline free spanning in these areas. Route optimisation involves localised adjustments to the route to reduce the amount of free spanning. In some areas it will not be possible to reduce free span lengths to below acceptable and allowable operating values and in these areas, it will be necessary to correct or support these free spans. The fact that the pipeline will be trenched along the majority of the route is a natural method of correcting for these free spans. The area of the seabed likely to be affected by the works is very minor. Only the seabed directly under the pipeline where the pipeline is not trenched will be affected (0.5 m width). In areas where the pipeline is trenched then only the seabed immediately adjacent to pipeline will be affected. The total width is dependent on the final trenching methodology selected but will typically be in the order of 10–50 m.

10.1.2 Section 7.2.4 Oceanography and Water Quality

NTG 51: Information on water quality nearshore is available from the work undertaken by LeProvost Dames and Moore for Teikoku Oil (Bonaparte Gulf) Co Ltd in 1994. This information includes turbidity, water temperature and salinity. Records of current speed and direction have relevance to modelling of discharges in the nearshore environment.

NTG 51: Information on water quality nearshore is available from the work undertaken by LeProvost Dames and Moore for Teikoku Oil (Bonaparte Gulf) Co Ltd in 1994.

The Proponent conducted an extensive current measurement programme in 2004 with the deployment of seven current meters along the pipeline route and at the platform location. These were deployed for approximately six weeks and the data was analysed and a detailed metocean report (Metocean Engineers 2004) was prepared. The site-specific results of that report are being used as the basis for environmental loading for the platform and pipeline design. This data is far

more relevant to the Blacktip Project than the data presented in LDM (1994). However, in most cases the LDM (1994) data is consistent with that recorded by the Proponent in 2004.

LDM (1994) provide some water temperature, secchi depth and salinity records, collected in November 1993 mostly around the lower Joseph Bonaparte Gulf. Water temperature ranged from 29.5–30.9°C, marginally higher than that recorded in May 2004 (28–29°C) during the marine environmental survey. Salinity in November 1993 ranged from 36 to 36.9 ppt, compared to 33 to nearly 35 ppt in May 2004. This minor difference is probably attributable to some limited freshwater input still occurring in May 2004 following an extended wet season. The secchi depth records recorded by LDM (1994) are not directly comparable to the turbidity measures collected in May 2004 during the marine environmental survey. However, both confirm that waters of the Joseph Bonaparte Gulf are very turbid.

Environmental Parameters Governing Design Criteria - Internal waves

NTG 118: The Western Australian branch of the Global Ocean Observing System published a draft paper entitled 'Timor Sea Focus Area and PIT' in 28 August 2002. The focus of the paper was a 'so called high frequency current phenomena' (pp 1 WAGOOS 2002). The interest for the offshore hydrocarbon industry was the impact that these currents may have on engineering design. Has the proponent considered the presence of high frequency currents as a criterion for detailed design engineering studies to be undertaken for the offshore component of the Blacktip Project?

In consideration of the strong tidal influence on the current regime within Joseph Bonaparte Gulf, what further environmental investigations will the proponent conduct in relation to the presence of high frequency currents at the proposed location? It is indicated in that Figure 2 of the WAGOOS 2002 draft paper that the Blacktip Project area is within or adjacent the southern boundary of the focus area for the Timor Sea.

NTG 118a: Have the presence of high frequency currents been considered as a criterion for detailed design engineering studies?

NTG 118b: What further investigations will be conducted in relation to high frequency currents at the proposed location?

The paper referred to was co-authored by a Woodside employee, Mr S Stroud, who was also involved in the development of the metocean criteria that has been and will continue to be adopted for the Blacktip Project. Mr Stroud has confirmed that the draft paper has no relevance to the Blacktip Project, and internal waves are not a problem for this project. With the current measurements the Proponent performed, we specifically looked for internal waves out at the platform end of the pipeline and did not identify any.

The Proponent conducted an extensive current measurement campaign in 2004 with the deployment of seven current meters along the pipeline route and at the platform location. These gathered data for around six weeks and the data was analysed and a detailed metocean report (Metocean Engineers 2004) was developed. The site-specific results of that report are being used as the basis for environmental loading for the wellhead platform and pipeline design.

No further environmental investigations are currently planned as the campaign conducted in 2004 gathered sufficient data to allow the Proponent to progress with a pipeline and platform design that will comply with the applicable codes and standards. Currently the Proponent is conducting further work in refining the storm wave model to better define storm wave conditions in the nearshore area. These refinements will then be used in detailed design of the pipeline.

10.2 Section 7.3 Ecological Environment

Biota – Condensate Mooring

OEH 73a: Further, the Supplement should detail the type of biota present at the condensate mooring (Section 11.3 [S7.3?]).

OEH 73a: The Supplement should detail the type of biota present at the condensate mooring

The biota at the mooring location is typical of the nearshore soft sedimentary habitats described in **Section 7.3.2**, with species distributions as described in **Section 7.3.4–7.3.7**, **Volume 1** of the Draft EIS. As part of the Blacktip offshore environmental survey (**Appendix B**, **Volume 2** of the Draft EIS), water quality parameters were measured and benthic grab samples were collected at the condensate export mooring location (three samples) and in and around the nearby PW discharge location (12 samples).

Water turbidity was extremely high even in the dry season, peaking near 40 NTU and generally above 20 NTU, indicating that benthic light levels will be very low and very unlikely to support photosynthetic flora. It is difficult to make specific statements on light requirements, turbidity levels and the distribution of seagrass and corals as this seems to be species and location specific. However, turbidity levels in the Joseph Bonaparte Gulf are extremely high in comparison to other Australian locations. For example, turbidity data collected from Weipa, Queensland in the Gulf of Carpentaria observed dry season turbidity levels typically between 5–12 NTU and wet season levels typically between 30–40 NTU (WBM 2003). Seagrass in Weipa is limited to shallow water (< 6 m) and stony corals do not occur. The Blacktip condensate export mooring, by comparison, is located in 17 m of water and subjected to considerably higher turbidity levels. Given the depth of water at the Blacktip condensate export mooring (17 m) and high turbidity levels, the condensate export mooring area is unlikely to support photosynthetic flora such as seagrass and macroalgae.

The grab samples collected at the Blacktip condensate export mooring site revealed that the sediments comprised very coarse sands that supported a higher abundance and species richness of infauna than sites sampled further offshore and further inshore:

> *The composition of the infaunal community is unusual as continental shelf infauna is generally dominated by polychaete worms. However, nearly three times as many crustaceans were collected as polychaetes; bryozoans and hydroids were the next most abundant group after the crustaceans; and, nearly as many molluscs and echinoderms were collected as polychaetes* (**Volume 2**, **Appendix B** of the Draft EIS).

No corals, macroalgae or seagrasses were collected in the grab samples. A list of the infauna found in and around the condensate export mooring is provided in **Appendix B**, **Volume 2** and summarised in **Table 9**.

- **Table 9 Biota Found in and around the Condensate Export Mooring**

Taxa	Abundance (as a % of total)
Crustaceans Decapods Amphipods	36 24 6
Bryozoans	19
Echinoderms Ophiroids	14 12
Hydrozoans	12
Annelids	10
Molluscs	3
Average abundance per 90 x 100 mm core	24 individuals
Average number of species per 90 x 100 mm core	10 species

10.2.1 Section 7.3.1 Regional Setting

NTG 52: The statement 'high turbidity and river flows appear to limit epibenthic development' does not hold true in Darwin Harbour, which in parts has a very diverse epibenthic assemblages and it is also likely to be untrue for the Joseph Bonaparte Gulf. In fact high turbidity/tidal flow is likely to be primary reason for the diverse communities of sponges and soft corals in Darwin Harbour. On Page 183 it is stated that Figure 7-4 shows the extent of mangroves in the Joseph Bonaparte Gulf and surrounding area.' In fact Fig 7-4 only shows the distribution of mangroves in the area where the proposed pipeline will cross the shore.

NTG 52a: The statement 'high turbidity and river flows appear to limit epibenthic development' is unlikely to be true for the Joseph Bonaparte Gulf.

It is acknowledged that it is premature to state that high turbidity and river flows appear to limit epibenthic development in Joseph Bonaparte Gulf, particularly in light of data collected in Darwin Harbour (Smit 2003). Both Darwin Harbour and the Joseph Bonaparte Gulf are characterised by high tidal flows, high turbidity and significant seasonal freshwater inputs. Darwin Harbour sediment and water dynamics are discussed in Williams and Wolanski (2003) and Padovan (2003).

The information that is available suggests that the Joseph Bonaparte Gulf has limited epibenthic development:

- Hooper et al. (2002) conducted research into the biodiversity of sponges across tropical Australia. This study, which utilised museum voucher specimens, investigated diversity of sponges from the Abrolhos Island in Western Australia, across the top end and around as far south as Sydney. The results of this study indicate that the area around Darwin Harbour was

diverse with in excess of 250 sponge species. By comparison, the species richness of sponges in the Joseph Bonaparte Gulf was very low, with only 19 species recorded.

- Evidence from the NT Trepang Fishery suggests that trepang (epibenthic sea cucumbers) abundance is lower in the Joseph Bonaparte Gulf than other areas of the NT (**Section 9.7.4**, **Volume 1** of the Draft EIS).
- Walker et al. (1996) observed that:
  - The mollusc fauna of the eastern coast of the Joseph Bonaparte Gulf was depauperate in terms of species richness due to the restricted number of habitats available and the silty conditions.
  - The diversity and abundance of algae of the eastern coast of the Joseph Bonaparte Gulf was low.
  - Intertidal reef flats on the eastern coast of the Joseph Bonaparte Gulf contained a poor xanthid and pilumnid crab fauna attributed to tidal scour restricting the crab's habitat.
- Only one soft coral species was collected during the Blacktip offshore marine survey and only 11 records of soft corals occur in the Museum and Art Gallery of the Northern Territory (MAGNT) database for the Joseph Bonaparte Gulf. By comparison, Russell and Hewitt (2000) cited in Smit (2003) suggest that there is likely to be 50–65 species of soft coral and seawhips in Darwin Harbour. The Blacktip offshore marine survey used a benthic grab, which is not the optimal method to collect epibenthic species. The grab failed to collect any epibenthos from six grab samples collected on a nearshore reef. While it is acknowledged that a grab is not the ideal hard bottom sampling device, a grab is still likely to collect faunal fragments from a hard substrate if the epibenthos is abundant.

NTG 52b: Fig 7-4 shows the distribution of mangroves where the proposed pipeline will cross the shore, not the extent of mangroves in the Joseph Bonaparte Gulf and surrounding area, as stated in the text.

With regards to the distribution of mangroves in the vicinity of the Blacktip Project area, it is acknowledged that the reference to Figure 7-4 is not correct. Figure 7-4 identifies the distribution of mangroves in the immediate vicinity of the Blacktip Project area, not the whole of the Joseph Bonaparte Gulf. The regional distribution of mangroves is discussed further in **Section 7.3.1**, **Volume 1** of the Draft EIS.

OEH 6: The Supplement should recognise that habitat diversity is different to habitat scarcity and that each is important. For example, seagrass is not a diverse habitat, yet its scarcity may make any patch of seagrass extremely valuable. The Supplement should also recognise the significance of mangroves as a regional habitat (Section 7.3.1).

Description of the coastline habitat at the particular point where the pipeline is proposed to cross should be provided rather than a generic beach description.

OEH 6a: Recognise that habitat diversity is different to habitat scarcity and the significance of mangroves as a regional habitat.

It is acknowledged that habitat 'diversity' is different from habitat 'scarcity' and that each is important. These distinctions are made throughout the Draft EIS although they are not directly referred to in this manner. For example, **Section 7.3.2** of the Draft EIS identifies seagrass communities between Point Pearce and Cape Hay as exhibiting a 'patchy' distribution, which implies a relatively scarce local distribution. Seagrasses are considered sensitive receptors based on their limited distribution in the study area and also their ecological importance to a range of significant fauna. Potential impacts to seagrasses have been assessed based on oil spill fate and trajectory modelling (**Section 11.19.2**, **Volume 1** of the Draft EIS). The potential effects on seagrasses and other sensitive coastal habitat features have been assessed and mitigation and management measures developed. It is acknowledged that the Draft EIS does not describe in detail the distinguishing factors and features between a habitat considered to be diverse or a habitat considered scarce. The EIA process has however identified the key sensitive and significant environmental receptors of the project location based on site visits, literature reviews and field studies and assessed the environmental risks of the Blacktip Project.

Significance of Mangroves as a Regional Habitat: **Section 7.3.1**, **Volume 1** of the Draft EIS provides a summary of the regional baseline environmental conditions prevailing in the project study area. **Sections 7.3.3–7.3.8**, **Volume 1** of the Draft EIS provides discussion on the significance of mangrove habitats in the project area and the inter-relationships that exist between mangroves and various species and communities. It is considered that the level of information relating to mangrove distribution, abundance, diversity and habitat significance is sufficient to enable an accurate assessment of potential impacts. However, the following additional baseline information is presented to support the Draft EIS.

Within a regional context, Galloway (1982) has estimated that mangrove communities in the Northern Territory encompass an area of approximately 4,120 km^2 representing around 35% of the 11,617 km^2 of mangroves in Australia (DIPE 2004).

Mangrove Species Richness and Densities: Results from field studies (**Appendix B**, **Volume 2** of the Draft EIS) indicate that a total of eight species of mangroves are present within the project area. Eight species recorded in the project area were listed under the EPBC Act (DEH 2004 <www.deh.gov.au>) or under the IUCN *Red List of Threatened Species* (IUCN 2005). The risk assessment process described in **Section 10**, **Volume 1** of the Draft EIS has taken into consideration the regional importance of mangrove species when assessing the level of potential impacts associated with the Blacktip Project. Most importantly, it should be noted that the Blacktip Project footprint will not result in the direct loss of any mangrove habitats in the project vicinity. Proposed management measures, which the Proponent will put in place, are outlined in the response to **NTG 106a** (**Section 14.9.2**).

OEH 6b: Describe the coastline habitat at the particular point where the pipeline is proposed rather than a generic beach description.

Section 7 and **8** of the Draft EIS provides an overview of the baseline environment at the pipeline shore crossing location. A general description of Northern Yelcher Beach, including areas not

directly affected by the footprint of the project activities, has been provided and is relevant for the following reasons:

- Beach habitats and species located in the intertidal zone at the shore crossing location are characteristic of habitats distributed across the intertidal zone of Yelcher Beach (**Appendix B, Volume 2** of the Draft EIS).
- A general description of beach features allows the reader to identify any environmental features outside of the direct project footprint.

Notwithstanding, a detailed description of the ecological environment at the shore crossing location is provided in **Appendix B**, **Volume 2** of the Draft EIS. The environmental features identified during the intertidal survey were taken into consideration during the assessment of potential impacts.

The reader is also directed to the response to **OEH 9**.

10.2.2 Section 7.3.2 Seabed Habitat & Communities

Offshore Reef

NLC 15: Section 7.3.2 in relation to Seabed Habitats and Communities provides no information on the ecology of the rocky ridge 1-1.5 ks from shore, or Walpinhthi Reef.

NLC 15: Section 7.3.2 provides no information on the ecology of the rocky ridge 1-1.5 km from shore, or Walpinhthi Reef.

All information available prior to the commencement of the offshore environmental survey in May 2004 indicated that only soft sedimentary habitats were present. Therefore, a benthic grab was selected as the most appropriate sampling device. The narrow band of hard substrate, located 1–1.5 km from the coast, was first encountered during the nearshore geotechnical investigation and Blacktip Project Offshore Environmental Survey in May 2004. However, the presence of the reef was not confirmed until the results of the geotechnical and geophysical investigations were completed late in 2004 (Fugro 2004). In addition, the Walpinhthi Reef is designated as a sacred site and access is not available (refer to response to **NTG 66b**, **Section 12.4**). Consequently no baseline environmental data exists for this location, nor has any been obtained to date.

Benthic grabs operate using two metal jaws that take a *bite* out of the seafloor sediments and enclose the sample which is then winched back to the boat for processing. While a grab is an inadequate hard bottom-sampling device because the jaws can not penetrate hard substrates, a benthic grab would remove fragments of epibenthos from a hard substrate where the benthos is abundant. Six grab samples collected on the rocky ridge encountered 1–1.5 km from shore failed to collect any epibenthos suggesting that the biota of the ridge is not abundant.

Examination of the limited literature on the ecology of reefs in the Joseph Bonaparte Gulf also suggests that reefs in the Gulf support a limited biota. Walker et al. (1996) surveyed various habitats on the eastern side of the Joseph Bonaparte Gulf and observed the following:

- The crustacean fringing reef fauna was dominated by wide spread Indo-Pacific or Indian Ocean species. It was also noted that lack of coral development also limited that diversity of Xanthid crabs (Davie and Short 1996)
- The shallow reef fish fauna was dominated by species able to tolerate waters of high turbidity. The most abundant species observed underwater belong to the families Labridae and Pomacentridae (Hutchins 1996). Reefs on the western side of the Joseph Bonaparte Gulf will probably include the apogonid *Pseudamia nigra*, the chaetodontid *Chelmon mueleri*, the gobiid *Acentrogobius gracilis* and the tetradontid *Chelonodon patoca*.
- The mollusc fauna was depauperate in terms of species richness due to the restricted number of habitats available and the silty conditions (Wells and Bryce 1996).
- The diversity and abundance of algae was low. This was attributed to extreme tidal exposure for intertidal species and high water turbidity, which limits light penetration and results in smothering with fine sediments (Walker 1996).

Hooper et al. (2002) conducted research into the biodiversity of sponges across tropical Australia and observed that unlike the area around Darwin Harbour which contained a very diverse sponge fauna with in excess of 250 sponge species, species richness of sponges in the Joseph Bonaparte Gulf was very low, with only 19 species recorded.

Only one soft coral species was collected during the Blacktip offshore marine survey and only 11 records of soft corals occur in the MAGNT database for the Joseph Bonaparte Gulf. By comparison, Russell and Hewitt (2000) in Smit (2003) suggest that there is likely to be 50–65 species of soft coral and seawhips in Darwin Harbour.

The potential impacts of dredging and trenching activities on these reefs are described in **NTG 9a** and **NTG 9b** (**Section 7.3.2**).

NLC 45: Page 184. Macroalgae is an important food source for many organisms and is not given appropriate consideration. Furthermore, many rely on the habitat based on macroalgae, not just for a food source (such as dugongs and turtles), but as a normal habitat (such as signathids, which are extremely poorly researched for N Aust) and also as a nursery habitat.

The EIS baseline surveys (limited at best) not finding any is not sufficient, particularly in view of the advice on page 212 that "there has been no comprehensive mapping of marine macroalgae distribution in the vicinity of the shore crossing or pipeline route". The obvious conclusion is that the survey should be done prior to construction approval.

The seagrass survey methodology is questionable. Grab samples are not the best for this type of survey as seagrass distribution is often patchy. It is also difficult to assess, without knowing the details of the sample technique, whether the grab sampling data has any value. Traditional Owners have reported the presence of seagrass growing off Yelcherr beach at very low tides, yet the EIS, to the contrary, does not recognise such local advice.

OEH 69: Several areas require further study before an environmental assessment can be made. For instance, failure to find macroalgae during an abbreviated study does not permit the conclusion that marcoalgae is insignificant (Section 7.3.2). The suggestion that conditions are not suitable for macroalgae growth needs to be qualified with some quantitative measures of limiting conditions.

In the absence of survey work, inferences were made, for example, that seagrasses in the area would be similar to elsewhere in the Top End. Further investigation of seagrass presence is required as significant areas of seagrass may exist in small extents. Rigorous investigations and details of sampling methodologies should be presented in the Supplement.

NLC 45a: The EIS baseline surveys not finding any macroalgae is not sufficient, particularly since "there has been no comprehensive mapping of marine macroalgae…" (page 212).

OEH 69a: The suggestion that conditions are not suitable for macroalgae growth needs to be qualified with some quantitative measures of limiting conditions.

OEH 69b: Further investigation of seagrass presence is required as significant areas of seagrass may exist in small extents.

Sufficient environmental information has been collected to enable the environmental risks associated with the Blacktip Project to be assessed and managed appropriately. Furthermore, it is considered that the marine ecological data presented in **Section 7**, **Volume 1** of the Draft EIS, which incorporates the results of all field and desktop studies undertaken by the Proponent, is sufficiently detailed to enable an accurate assessment of the potential impacts on the marine environment of the Blacktip Project. The footprint of the Blacktip Project is well defined and this area has been sufficiently studied to enable assessment of the likely impacts as presented in **Section 11**, **Volume 1** of the Draft EIS. The reader is also directed to the response to **NTG 107a** (**Section 20.3**).

Macroalgae and seagrass are important benthic habitats (refer to **Section 7.3.2, Volume 1** of the Draft EIS and the response to **NTG 106h**, **Section 20.2**). Tropical macroalgal beds can generate high primary and secondary production rates (Schaffelke et al. 1996). However, the weight of evidence indicates that neither macroalgae and seagrass are abundant in the Blacktip Project area and so any impact on these habitats will be minor or negligible.

The conclusion that seagrass and macroalgae is limited in the Blacktip Project area is based on the following:

- No algae or seagrass was found washed up on Northern Yelcher or Yelcher Beach, though other flotsam and jetsam such as mangrove leaves were recorded (**Appendix B**, **Volume 2** of Draft EIS). *Sargassum* is a dominant algae in Tropical Australia. *Sargassum* achieves its greatest biomass in late Summer/Autumn in the southern hemisphere (Cribb 1990, Vuki and Price 1994). During April–June on the North West Shelf where *Sargassum* is abundant (e.g. around Barrow Island), rafts of detached *Sargassum* are observed floating on the ocean surface and seen washed up on

beaches. Similarly, where seagrass is abundant, seagrass racks, or at least remnants of decaying seagrass, are also found washed up on beaches.

- No algae were observed growing on the rocky headlands either end of Northern Yelcher Beach (**Appendix B**, **Volume 2** of Draft EIS).
- No algae or seagrass were collected subtidally, '*The offshore survey collected approximately 40 grabs along the proposed pipeline route, of which 24 grabs were collected within 4 km of the coast. No seagrass* (or macroalgae) *was observed in any of the grab samples*' (**Section 7.3.2**, **Volume 1** of the Draft EIS).

NLC 45b: The seagrass survey methodology is difficult to assess without knowing the details of the sample technique. The EIS does not recognise the advice of traditional Aboriginal owners.

As stated in detail in the Draft EIS (**Appendix C**, **Volume 2**) three methods were employed in the survey of the sea turtles, dugongs and seagrasses of the proposed project area. These methods are summarised below:

- A regional or large scale survey involved the use of an aerial survey at low altitude in the IMCRA bioregion of Anson and Beagle (No 18). The aerial survey was conducted in the morning of 4 June 2004. The aerial survey in the Port Keats region was conducted during the period of low tide. This enabled maximum viewing of the intertidal region for seagrasses.
- Discussions were held with traditional Aboriginal owners of the coastal regions likely to incur an impact by the proposed pipeline.
- Beach surveys by foot and vehicle were used in areas where sea turtles had been reported nesting. All foot and vehicle surveys were conducted in the presence of the traditional Aboriginal owners.

The information on the presence of dugongs and seagrasses in the area came primarily from the anecdotal reports of the traditional Aboriginal owners who had lived in the area all of their lives and who had shared stories with others who had passed on observations and locations to the presence of dugongs.

The Draft EIS openly presented the advice of traditional Aboriginal owners on seagrass:

> Discussions with Wadeye Aboriginals also indicated that during the lowest tides of the year, seagrass is exposed at the proposed pipeline crossing beach (Northern Yelcher Beach) and the southern end of the beach immediately to the north (Injin Beach). The seagrass is probably *Enhalus acoroides* and the Wadeye Aboriginals reported dugong-feeding trails amongst the seagrass (Guinea, M., Charles Darwin University, pers. comm., 2004). However, the environmental surveys conducted in May 2004 failed to detect any signs of seagrass indicating that the distribution of seagrass is, at best, patchy and limited (**Section 7.3.2**, **Volume 1** of the Draft EIS).
>
> Seagrasses were reported from the western side of Dorcherty Island. In addition, in the region seaward of Yelcher Beach, I was told that during the lowest tides of the year the locals have walked to the low tide mark and found long seagrasses about the width of a belt (Cf. Enhalus

acorides). In amongst these seagrasses are dugong feeding trails (**Appendix C**, **Volume 2** of the Draft EIS).

Corals

NTG 54: Page 187. The gorgonian corals mentioned on Page 142, collected during the survey of the proposed pipeline route, are not mentioned in the section on Corals. They should be. The proposed path of the pipeline goes through a coral patch and the extent of this should be further analysed by appropriate sampling methods. This would be far more pertinent than the discussion of the corals from the Ashmore Cartier Group, which lie well offshore in the Timor Sea.

NTG 54: The gorgonian corals collected during the survey of the proposed pipeline route, are not mentioned in the section on Corals.

It is acknowledged that the gorgonian coral collected during the marine environmental surveys should have been mentioned in **Section 7.3.2**. As discussed in the response to **NTG 41a** (**Section 8.3**), gorgonian corals are not reef building corals and these corals do not indicate the presence of a coral reef or a large coral patch. The small gorgonians collected along the pipeline route (site Pipeline 11), approximately 4 km from the shore crossing location, were found on a coarse sandy substrate attached to small rocks. The distribution of gorgonians in the nearshore waters of the Blacktip Project area will, in part, be determined by the distribution of suitable substrate in an area largely devoid of hard substrate. The lack of hard substrate is also likely to limit the development of large gorgonian specimens, as gorgonians attached to rocks are likely to become unstable as they grow in the strong currents the predominate in the area.

The use of epibenthic sampling equipment, such as a dredge, may have encountered more isolated gorgonians. However, 17 grab samples were collected in the nearshore environment, 2 to 4 km from the beach crossing location, and only two small gorgonian corals were collected from a single grab (site Pipeline 11). This indicates that the abundance of gorgonians is low.

10.2.3 Section 7.3.3 Intertidal Habitats and Communities

NTG 55: Page 188. Lower intertidal habitats and communities of the sand beach/sandflat are not discussed, and a comparison is made between the upper intertidal of Northern Yelcher Beach with the mid-tidal zone at Southern Yelcher Beach. This is not a valid comparison given the degree of zonation expected on these beaches (esp. Northern Yelcher, which has relatively steep relief).

NTG 55a: Lower intertidal habitats and communities of the sand beach/sandflat are not discussed.

NTG 55b: The comparison between the upper intertidal of Northern Yelcher Beach with the mid-tidal zone at Southern Yelcher Beach is not a valid comparison given the degree of zonation expected on these beaches.

It is acknowledged that lower intertidal habitats and communities should have been discussed in **Section 7.3.3** of the Draft EIS. Lower intertidal communities were discussed in **Appendix B**,

Volume 2 of the Draft EIS, which was the source of data for **Section 7.3.3** of the Draft EIS and referenced in **Section 7.3.3** of the Draft EIS. The following is an extract from the Draft EIS:

> The mid- and lower intertidal zones on the northern transect at Yelcher Beach, closest to Yulow Point had dark coloured sediments at approximately 5 cm depth and a notably higher invertebrate species richness and abundance. In contrast, 200 m further south, on the second Yelcher Beach transect, the invertebrate fauna was similar to that occurring on Northern Yelcher Beach (**Section 4.3, Appendix B**, **Volume 2**).

The comparison between the upper intertidal of Northern Yelcher Beach with the mid-tidal zone at Yelcher Beach was specifically made to highlight how different the two zones where:

> The upper intertidal zone slopes relatively steeply to the flatter mid tidal zone. The sand in the upper intertidal zone is typically coarse and comprises mainly shell grit with abundant quartz pebbles. The invertebrate infauna was abundant, though species richness was low and dominated by molluscs. In contrast, the mid-tidal zone at Yelcher Beach to the south is more variable, both in terms of topography and invertebrate fauna. Northern Yelcher Beach has a relatively steep gradient and the width of the intertidal zone is not particularly broad. The intertidal zone at Yelcher Beach is much wider and this beach has a more complex topography with rocky areas and intertidal sand spits. Large numbers of Soldier Crabs (Mictyris sp.) were common in sections of Yelcher Beach but uncommon on Northern Yelcher Beach (**Section 7.3.3**, **Volume 1** of the Draft EIS).

10.2.4 Section 7.3.4 Invertebrates

NTG 53: On Page 192 the prawn species are discussed, but the text is very general and poorly referenced, so that the reader does not know where the information comes from or if it is relevant to the area. It appears that the proponent has not contacted NT Fisheries for information on prawn species diversity, by-catch etc. In 1993 the NT Department of Infrastructure Planning and Environment and MAGNT conducted a joint marine fauna survey from Anson Bay to the Beagle Gulf – a region directly comparable to that described in the EIS. The material from this work is held at MAGNT. This survey is not even mentioned in the EIS, despite this survey being the only biological survey ever carried out close to the EIS region.

NTG 56: This section refers to a WA survey of the Kimberley region and to an unpublished 1994 Dames and Moore report on Darwin Harbour. The publication by Larson and Williams (1997) is more up to date and accurate on Darwin Harbour fishes. It would be relevant here to discuss the Anson Bay/Beagle Gulf survey (which obtained many fishes). This section does not deal adequately with presence of endangered or threatened elasmobranchs or other fishes in the EIS region as is required.

NTG 53: Prawn species are discussed, but the text is very general and poorly referenced.

NTG 56: This section does not deal adequately with presence of endangered or threatened elasmobranchs or other fish in the region.

Northern Territory Fisheries was contacted for information on all NT commercial fisheries and provided the information on catch and effort, which is presented in **Section 9.7, Volume 1** of the Draft EIS. This information was supplied by Leonie Cooper, Senior Fisheries Manager, Northern Territory Fisheries in June, 2004. There is no Northern Territory administered prawn fishery. The

Northern Prawn Fishery is a Commonwealth administered fishery, administered by the Australia Fisheries Management Authority. Both CSIRO (N Loneragan, [CSIRO Division of Marine Research], *pers comm*, February 2004) and the Australian Fisheries Management Authority (AFMA) (J Adams, [AFMA Fisheries Branch] *pers comm*, 2004) were contacted in 2004 concerning the Northern Prawn Fishery, as detailed in **Section 7.3.4** and **9.7.2**, **Volume 1** of the Draft EIS. AFMA was contacted again in February 2005 (A Bain [AFMA Fisheries Branch], *pers comm*, 2005). These discussions indicated that several reports had been compiled on bycatch and epibenthic communities of the Northern Prawn Fishery area. However, nearly all work on Northern Prawn Fishery bycatch and impacted epifaunal communities has been conducted in the Gulf of Carpentaria. No work has been done in the Joseph Bonaparte Gulf.

Bycatch in the Northern Prawn Fishery in the Gulf of Carpentaria was very diverse and comprised 390 species of fish, 47 species of elasmobranchs and 234 invertebrate taxa. Fish species comprised 73% of the bycatch weight with three families comprising the bulk (41% of the weight), Bathysauridae (lizard fish or grinners), Leiognathidae (pony fishes) and Nemipteridae (monacled bream) (Stobutzki et al. 1996). Studies of the epibenthic community of the Gulf of Carpentaria indicate that echinoderms dominate, accounting for over 50 % of the biomass, and sponges account for 25 % of the fauna (Hill et al. 2002 summarised in **Table 10**). The remaining epifaunal classes accounted for a minor proportion of the community. The relevance of information from the Gulf of Carpentaria to the Joseph Bonaparte Gulf is difficult to gauge. The MAGNT fish database was subsequently searched for records specifically in the Joseph Bonaparte Gulf including most of Anson Bay in February 2005. There were almost three hundred records in the MAGNT database of marine species recorded in the Joseph Bonaparte Gulf, mostly collected during two surveys conducted in 1990 and 1996. Results of this search are presented in **Table 17** in response to **NTG 49b**.

The Larson and Williams (1997) report and elasmobranchs and other fish species are discussed in response to **ECNT 12b** (**Section 10.2.5**).

- **Table 10 Catch Rates (weight kg/h) and Percentage Composition (by weight) for the Various Broad Classes of Benthos Collected by a Dredge in the Gulf of Carpentaria**

Class	Weight (kg/h of dredging)	% (by weight)
Echinodermata	5168.5	57.79
Porifera	2302.3	25.74
Anthozoa	356.4	3.99
Coelenterata	326.6	3.65
Malacostraca	217.6	2.43
Bivalvia	200.4	2.24
Bryozoa	119.4	1.34
Urochordata	115.1	1.29
Gastropoda	45.1	0.50
Annelida	34.9	0.39
Cephalopoda	26.5	0.30
Chordata	17.5	0.20

Class	Weight (kg/h of dredging)	% (by weight)
Mollusca	8.7	0.10
Echiura	2.6	0.03
Sipuncula	0.4	0.004
Gorgonacea	0.3	0.003
Crustacea (non-Malacostraca)	0.2	0.002
Nemertea	0.1	0.001
Platyhelminthes	0.1	0.001
Cirrepedia	0.1	0.001
Ctenophora	<<0.1	0.001

Source: Modified from Table 5.2.8 from Hill et al. 2002

OEH 70: Discussions relating to invertebrates and fish populations rely again on inferential logic that populations are similar to elsewhere in the Top End (Sections 7.3.4 and 7.3.5). As such, these comments cannot be the basis of informed environmental assessment; more baseline studies are needed.

OEH 70: Discussions on invertebrate and fish populations assume that populations are similar to elsewhere in the Top End.

Further information on fish communities of the Joseph Bonaparte Gulf is presented in the responses to **ECNT 12b, NLC 46** (**Section 10.2.5**) and **NTG 56** above.

Nearly all of the information presented in **Section 7.3.4**, **Volume 1** of the Draft EIS concerning marine invertebrates is based on work conducted inside the Joseph Bonaparte Gulf, therefore, it is directly relevant to making an informed environmental assessment of the Blacktip Project. The citations used in **Section 7.3.4**, **Volume 1** of the Draft EIS are presented at the end of this response in sequential order. The studies undertaken by BBG (2000), Halse et al. (1996), Walker et al. (1996) and Loneragan *pers comm* (2004) were specifically conducted in the Joseph Bonaparte Gulf.

The BBG (2000) study investigated the offshore benthic biota of the Gulf. Halse et al. (1996) investigated aquatic invertebrates and insects of the mudflats at the southern end of the Gulf. Walker et al. (1996) investigated the intertidal and shallow subtidal biota of the western coastline of the Gulf, and Loneragan *pers comm* (2004) provided information specifically discussing prawn migration in the Joseph Bonaparte Gulf.

Furthermore, the Proponent conducted an Offshore Marine and Intertidal Environmental Survey (**Appendix B, Volume 2** of the Draft EIS). These surveys, along with the information presented in **Section 7**, **Volume 1** of the Draft EIS, were used to assess the environmental risks of the offshore components of the Blacktip Project, which is presented in **Section 11**, **Volume 1** of the Draft EIS.

BBG, 2000, *Environmental baseline surveys in Joseph Bonaparte Gulf in June 2000*. Unpublished report for Woodside Energy Limited.

Halse, SA, Shiel, RJ and Pearson, GB 1996, *Waterbirds and aquatic invertebrates of swamps on the Victoria-Bonaparte mudflat, northern Western Australia*. *Journal of the Royal Society of Western Australia,* 79: 217-224

Walker, D, Wells, F & Hanley, RJ 1996, *Marine biological survey of the eastern Kimberley, Western Australia*, unpublished report by UWA, WAM and MARNT

Jones, D and Morgan, G 1994, *A Field Guide to Crustaceans of Australian Waters*, Reed Books, Australia

Loneragan, N 2004, CSIRO Division of Marine Research, *Personal Communication*, February 2004

Tranter, D 1962, *Zooplankton abundance in Australasian Waters,* Australian Journal of Marine and Freshwater Research, 13 (2), pp. 106-142

10.2.5 Section 7.3.5 Fish

NLC 46: Page 193. Re fish. Darwin harbour species information is only partly relevant as it is stated that the project area is in a different habitat to Darwin. It is questionable whether the desktop information provided is sufficient on its own on which to make confident statements on impacts in the project area.

ECNT 12b: No fish surveys were completed in offshore areas it appears, as the only information provided is from outside the Joseph Bonaparte Gulf (7.3.5. Fish, p193). With such limited information it is impossible to adequately assess the impacts on wildlife, including protected species.

ECNT 12b: It appears that no fish surveys were completed in offshore areas, as information provided is from outside the Joseph Bonaparte Gulf.

NLC 46: It is questionable whether the desktop information provided is sufficient to make confident statements on impacts to fish in the project area.

No fish surveys were completed as part of the Blacktip environmental surveys. However, it is incorrect to state that the only information provided on fish is from outside the Joseph Bonaparte Gulf. Commercial and traditional fisheries data from the Joseph Bonaparte Gulf are present in **Section 9.7** of the Draft EIS and the results of a survey of the eastern Kimberley coast, located in the Joseph Bonaparte Gulf (Walker et al. 1994) are presented in **Section 7.3.5**. Because of their commercial and recreational value of fish, more is known about the distribution of fish in Australian waters than almost all other marine taxa.

Larson and Williams (1997) report 415 species of fish in Darwin Harbour, seven more than reported by LDM (1994) (**Section 7.3.5, Volume 1** of Draft EIS). The most species rich groups were gobies (about 70 species), cardinalfish (20 species) and syngnathids (19 species) respectively, including four species listed under Convention on International Trade in Endangered Species (Larson and Williams 1997). Many of the fish species that occur in Darwin Harbour are expected to occur in the Joseph Bonaparte Gulf. However, as discussed in **Section 7.3.5**, **Volume 1** of Draft

EIS, many (44 %) of the fish in Darwin Harbour are associated with coral reefs, a habitat that is poorly represented in the Joseph Bonaparte Gulf, therefore they are less likely to occur.

The MAGNT fish database was subsequently searched in February 2005. Results of this search are presented in response to **NTG 49b** (**Table 17**, **Section 20.2**).

EPBC Listed Species: It is acknowledged that of the 31 listed and vulnerable species under the *Environmental Protection and Biodiversity Conservation Act,* only the vulnerable Freshwater Sawfish was discussed in the Draft EIS. The full list of listed and vulnerable species under the *Environmental Protection and Biodiversity Conservation Act* is presented in **Table 11**. Of these 31 species (three elasmobranchs (sharks, rays, and skates) and 28 sygnathids (seahorse and sea dragon species), the freshwater sawfish is the only species that is considered likely to occur in the Joseph Bonaparte Gulf. However, as outlined in **Section 7.3.5**, **Volume 1** of the Draft EIS, this species appears to be confined to freshwater drainages and the upper reaches of estuaries in northern Australian waters so is unlikely to occur in the Blacktip Project area. Of the other species, a few sygnathids may occur in the Joseph Bonaparte Gulf. However, very little is known of the habitat requirements and distribution of many of the listed sygnathids. Some species, such as the Great White Shark, could potentially occur in the area but, in reality, are most unlikely to occur in the Joseph Bonaparte Gulf.

The reader is also directed to the response to **OEH 70**, **Section 10.2.4**, and **OEH 20**, **Section 15.4.1**.

- **Table 11 Listed and Vulnerable Species under the Environmental Protection and Biodiversity Conservation Act which may occur in the Joseph Bonaparte Gulf.**

Sharks		
Pristis microdon Freshwater Sawfish	Vulnerable	Species or species habitat likely to occur within area
Rhincodon typus Whale Shark	Vulnerable	Species or species habitat may occur within area
Carcharodon carcharias Great White Shark	Vulnerable	Species or species habitat may occur within area
Fish		
Campichthys tricarinatus Three-keel Pipefish	Listed	Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish,	Listed	Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish	Listed	Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish	Listed	Species or species habitat may occur within area
Corythoichthys flavofasciatus Yellow-banded Pipefish	Listed	Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish	Listed	Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish	Listed	Species or species habitat may occur within area
Doryrhamphus excisus Indian Blue-stripe Pipefish	Listed	Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish	Listed	Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish	Listed	Species or species habitat may occur within area

Halicampus brocki Brock's Pipefish	Listed	Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish	Listed	Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish	Listed	Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Seadragon	Listed	Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish	Listed	Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keeled Pipefish	Listed	Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish	Listed	Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse	Listed	Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse	Listed	Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse	Listed	Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse	Listed	Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish	Listed	Species or species habitat may occur within area
Solegnathus hardwickii Pipehorse	Listed	Species or species habitat may occur within area
Solegnathus lettiensis Indonesian Pipehorse	Listed	Species or species habitat may occur within area
Solenostomus cyanopterus Blue-finned Ghost Pipefish	Listed	Species or species habitat may occur within area
Syngnathoides biaculeatus Double-ended Pipehorse	Listed	Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bend Stick Pipefish	Listed	Species or species habitat may occur within area
Trachyrhamphus longirostris Long-nosed Pipefish	Listed	Species or species habitat may occur within area

10.2.6 Section 7.3.6 Dugongs

OEH 71: The Draft EIS states that no dugong surveys have been conducted in the Joseph Bonaparte Gulf. Investigations should be undertaken. Given that there is no information regarding the susceptibility of dugongs to oil spills, the statement they are "likely to be able to detect a surface slick" cannot be justified. The Draft EIS assumes that a lack of seagrass will translate into an absence of dugongs, however this is speculation. Further confusion is added when the Draft EIS states that dugongs are known to occur both to the north and to the south of the proposed pipeline and yet saying that in the region of the proposed pipeline dugong activity is "very limited" (Section 7.3.6).

OEH 71a: Dugong surveys should be undertaken.

In relation to the Statement in **Section 7.3.6**, **Volume 1** of the Draft EIS which states, 'No surveys have been undertaken in the Joseph Bonaparte Gulf', it should have been made apparent that this was the case up until the time that the Blacktip Project was initiated. Hence, little is known of the numbers of dugongs and their habitat preferences in the southern regions of the Joseph Bonaparte Gulf. In recognition of the absence of data the Proponent commissioned Dr Michael Guinea (Charles Darwin University) to undertake 'A turtle, dugong and seagrass survey' in May 2004.

The complete findings from this survey, which included discussions with the Wadeye community on the occurrence of turtles and dugongs near the proposed pipeline crossing location, is presented in **Appendix C**, **Volume 2** of the Draft EIS. With regard to the presence of dugongs Dr Guinea documented the following in his report based on the Blacktip site visit and survey:

> Dugongs were reported by the traditional owners to frequent the rock flats at Cape Hay on Dorcherty Island, the mouth of the Moyle River and the southern regions of Joseph Bonaparte Gulf. In the region of the pipeline a dugong was shot from a boat some years ago.
>
> Seagrasses were reported from the western side of Dorcherty Island. In addition, in the region seaward of Yelcher Beach, I was told that during the lowest tides of the year the locals have walked to the low tide mark and found long seagrasses about the width of a belt (cf. Enhalus acoroides). In amongst these seagrasses are dugong feeding trails.

In short, dugongs are present in the area. They will move through the project area but are not known to feed in the vicinity of the pipeline. An intertidal feeding area is known near Dorcherty Island. The number of animals using this feeding site at any time of the year is unknown.

During the aerial survey there was no evidence of seagrass in the intertidal zone and no dugongs were seen. The abundance of dugongs in the nearshore region adjacent to the shore crossing location has been determined to be low and the proposed activities associated with the Blacktip Project, such as the installation of the pipeline, are unlikely to have any direct or indirect impact on dugongs. The Proponent has committed to conduct turtle and dugong monitoring, as detailed in **Appendix P**, **Volume 2** of the Draft EIS, during the construction phase of the Blacktip Project.

Based on the information gathered during the Blacktip site visit and survey it is therefore concluded that sufficient information has been gathered on the distribution and abundance of dugongs in the region between Cape Hay and Point Pearce to enable the risks associated with the Blacktip Project to be assessed. Further investigations are therefore not necessary at this stage.

OEH 71b: Information is required on the susceptibility of Dugongs to oil spills.

The statement in the Draft EIS that '*No information* is available regarding the susceptibility or sensitivity of dugongs to oil spills' should more accurately have stated, '*No research* is known to have been conducted into the susceptibility or sensitivity of dugongs to oil spills'.

However, and as stated on p.372 of the Draft EIS, based on the behavioural responses of other marine mammals, such as whales and dolphins, it is highly likely that dugongs are able to detect a surface slick. Therefore in the event of a hydrocarbon spill dugongs would vacate the area to other feeding grounds. Hydrocarbons on the surface of the water could cause respiratory problems. Individuals so affected would require veterinary care if their health was compromised. Dugongs are visual feeders and can discern between edible and inedible algae and seagrass, and once again would move away if this occurred (Dr M Guinea [Charles Darwin University] pers. comm., 14 January 05). The reader is also directed to **Section 20.3**.

OEH 71c: An absence of seagrass does not necessarily mean there will be an absence of dugongs.

Dugongs are primarily seagrass eaters, and are also known to eat only certain species of seagrass; they are also known to feed on macro algae but to a much lesser extent. The Draft EIS does not assume that a lack of seagrass will translate into an absence of dugongs. The Draft EIS (**Section 7.3.6**, **Volume 1**) infers that since large seagrass beds were not found in the vicinity of the Blacktip Project area, it is unlikely that large numbers of dugongs will be encountered. This conclusion has been supported by the results of the survey undertaken by Dr M Guinea (**Appendix C**, **Volume 2**). In summary, he found that dugongs will move through the project area but are not known to feed in the vicinity of the pipeline. An intertidal feeding area is known near Dorcherty Island.

OEH 71d: The text is not clear on the level of dugong activity in the area.

The statements on dugong distribution presented in **Section 7.3.6**, **Volume 1** of the Draft EIS are correct. **Section 7.3.6** states that dugongs have been, '*Reported to occur along the coastline from Cape Hay to Point Pearce*' i.e north and south of and including the Blacktip Project Area. However, further information on dugongs was gained from the 2004 survey by Dr M Guinea (**Appendix C**, **Volume 2** of the Draft EIS). The study indicated that dugongs are concentrated to the north in particular, around Cape Hay on Dorcherty Island (16 km away), and to a lesser extent to the south of the Blacktip Project area around Point Pearce (20 km away). The results of the 2004 study also indicated that dugongs are not common adjacent to Northern Yelcher Beach. During the site visit discussions with local Aboriginals (May 2004) indicated that a single dugong was shot from a boat some years ago in the region of the pipeline. During the aerial survey no dugongs were seen.

10.2.7 Section 7.3.9 Sea Turtles

OEH 72: The Draft EIS states that the abundance and distribution of sea turtles is unknown. The sea turtle section is speculative and it is regrettable that no investigation has been performed. The argument that an animal is rare does not support the conclusion that a section of its habitat may knowingly be damaged (Section 7.3.9). Management strategies need to be addressed and presented for evaluation.

OEH 72: Management strategies for sea turtles need to be addressed and presented for evaluation.

It is agreed that the abundance and distribution of sea turtles is unknown. This is true for most of the Australian coastline with the exception of limited areas at Bundaberg and Heron Island in Queensland where more than thirty years of research provides an adequate database for predicting population trends. Even on Bare Sand Island within the same bioregion as the site of the proposed pipeline crossing, ten years of nesting data indicate that there is a slight decrease in nesting populations of Flatback Sea Turtle of about 3% per year. It should be pointed out that the error associated with this estimate is unacceptably large and more precise monitoring of nesting numbers at the start and end of the season is required before a final estimate can be made. The beach being

impacted by the pipeline landfall is approximately 700 m in length in a bioregion of approximately 2000 km of suitable nesting beach. The actual length of beach where the pipe will be laid is in the order of tens of metres during the construction phase and having been filled with indigenous sediment will be indistinguishable from the rest of the beach profile. The management options put in place to exclude nesting sea turtles from the construction site and to remove all clutches to a hatchery in the vicinity of the nesting beach comply with the Sea Turtle Recovery Plan by reducing anthropogenic impacts, increasing hatching and hatchling success and capacity building of community groups. At the present time sea turtle nests in the area are opened by goannas and the entire clutch either consumed or killed by exposure to lethal temperatures.

11. Draft EIS Section 8 Existing Terrestrial Environment

11.1 Section 8.2 Physical Environment

General

NTG 57: This section lacks detail on small, cryptic fauna that can only be obtained through comprehensive, multi-seasonal surveys.

NTG 57: This section lacks detail on small, cryptic fauna that can only be obtained through comprehensive, multi-seasonal surveys.

The fauna survey that was conducted for the Draft EIS was reviewed and given approval in principle by the Biodiversity Unit of DIPE and utilised procedures which are standard for fauna survey in the Top End region of the NT and which are systematic, repeatable and intensive (Woinarski et al. 2004). A fauna survey study of Litchfield National Park, conducted by Woinarski et al. (2004) which spanned a six-year period, highlighted the fact that the effort required for 'adequate' fauna monitoring must be very substantial with the results from this study indicating that a sampling programme with enough sensitivity to detect a 20% change in abundance in an ecosystem would require several thousand sampling points. This intensity of sampling was not called for and would be considered unreasonable for a single project.

Further field surveys would provide more data for the region but extensive surveys (i.e. 1000's) would be required in order to establish a fauna assemblage which would be adequate to base fauna monitoring programmes. In a study by Thompson et al. (2003) new species of small reptiles were recorded at a site even after 14 000 pit trap days.

Surveys were originally planned for April 2004, however due to an inability to access the area until early June (the Daly River could not be crossed until late May) fauna surveys were not conducted until June. The need for further fauna trapping has been discussed with Woinarski and Price (14 February 2005) and agreed that further trapping is not warranted at this stage to determine impacts.

It is anticipated that the fauna trench clearing activities that have been proposed for the Blacktip Project will result in the accumulation of a highly significant faunal database for the area as demonstrated on similar trench clearing projects such as the Moranbah to Townsville project (current), Moomba to Sydney (Ayers and Wallace 1997) and the McArthur River Mine expansion (Woinarski et al. 2000). Mitigation measures will be implemented to ensure that mortality rates are minimised.

11.1.1 Section 8.2.2 Meteorology

Rainfall, Storms & Floods

OEH 54: Rainfall and storms will have an impact on the proposed project site (Section 8.2.2). Storm surge mitigation details are sought.

OEH 57: The Supplement should include a flood frequency analysis of the proposed site to enable assessment of the risk of flooding.

OEH 81: Detailed results should be presented for the flood studies (Section 8.2.2).

OEH 54: Rainfall and storms will have an impact on the proposed project site. Storm surge mitigation details are sought.

OEH 57: The Supplement should include a flood frequency analysis of the proposed site to enable assessment of the risk of flooding.

OEH 81: Detailed results should be presented for the flood studies.

The site location has been chosen such that it is not at risk from storm surge and to mitigate the risk of flooding. The plant and accommodation areas have been elevated approx 700 mm on an earth pad to keep the plant site above the standing water generated by peak rainfall.

The access road has been designed for a 1 in 10 year rainfall event with overtopping at floodways.

An aerial survey is planned to verify the topography of the catchment areas and watercourses.

11.1.2 Section 8.2.6 Surface and Groundwater Hydrology

OEH 55: The Supplement should definitively indicate the location of groundwater bores, both existing and proposed, and discuss the availability of groundwater for drinking and for hydrotesting of pipes. A full water balance should be presented detailing use, source and sink of all water sources for the duration of the proposed project.

OEH 55a: Indicate the location of groundwater bores and discuss the availability of groundwater for drinking and for hydrotesting of pipes.

OEH 55b: A full water balance should be presented detailing use, source and sink of all water sources for the duration of the proposed project.

The aquifer under the gas plant site is known to be a widespread shallow aquifer in sandstone (Haig and Matsuyama 2003). It is a high yielding aquifer with good chance of drilling a bore with a 5 L/s yield (or higher in bores located near fracturing or a local source of recharge) (Haig and Matsuyama 2003). It is recognised that this aquifer supplies water to numerous local communities and therefore the objectives of the Proponent (as stated in **Table 15-10**, **Volume 1** of the Draft EIS) are to:

- maintain the quality of groundwater;
- minimise the potential for groundwater contamination.

It is stated in the Draft EIS that groundwater bores will be installed within the gas plant footprint. It is anticipated that two bores will be drilled. One will provide the primary supply of groundwater with the second bore being used during peak demand periods and also acting as a back-up. The exact location of these bores is not yet known. However, under the Framework for the Groundwater Protection EMP (**Table 15-10**) the proponent commits to undertaking a baseline groundwater monitoring programme to characterise the groundwater at the site.

Treated water will be required for:

- drinking;
- washing (clothes and personal hygiene);
- toilets;
- wash-down;
- safety showers.

Untreated water will be required for:

- concrete mixing;
- dust suppression (some of this water will be from treated sewage effluent);
- to obtain optimum moisture content for soil compaction;
- service water;
- fire water.

The existing bores in the region are shown on Map 1 (Blacktip Hydrological Impacts), **Appendix E**, **Volume 2** of the Draft EIS.

The Water Resources Report for the Wadeye region (Haig and Mastuyama 2003) states:

> It is recommended that a hydrogeologist be consulted in future when the placement of any facility on or near the present borefields (where contamination of the aquifer from surface pollution is an issue) is considered.

As required under the Water Act, all bores that are drilled will be registered (and approved) by the DIPE. All bore data obtain from drilling reports and monitoring data will be supplied to the Water Resources Section of the Natural Systems Division, DIPE, to be entered and maintained on their hydrographic database.

During construction and operation, it has been estimated that water use per person will be approximately 700 l/day. Currently manning levels have been estimated to be approximately 75 people on site during the dry season of 2005, 150 people on site during the dry season of 2006 and 2007, two people on site continuously throughout the duration of the plant life with an annual

maintenance crew of 32 people for a period of a few weeks. It has been estimated that an average of 400 m^3 of water will be required daily in 2005 with approximately 430 m^3 daily in 2006 and 405 m^3 in 2007. Operational water requirements will be around 30 m^3 daily.

The hydrotest water for the plant will be obtained from a bore located within the plant site, the exact location of which is yet to be decided. The export pipeline will be hydrotested using seawater. This water will be discharged to sea after use.

OEH 56: There appears to be little information with regard to ground and surface water resources in the gas plant area and there is definite intent to use these resources for the project during construction (Section 8.2.6). To adequately assess the environmental impact of this proposal, further discussion is required on the potential of ground and surface water systems to be affected by water bores, access routes, borrow pits and quarries and establishment of laydown areas (Section 8.3.3). The Supplement should include, and assess the impacts of, various management options associated with potential impacts on surface and groundwater resources. The environmental effects of the proposed onshore structures on the hydrological system should also be discussed.

OEH 82: Detailed results should be presented for the groundwater studies (Section 8.2.6).

OEH 56a: Discuss the potential of ground and surface water systems to be affected by water bores, access routes, borrow pits and quarries and establishment of laydown areas.

OEH 56b: Discuss the environmental effects of the proposed onshore structures on the hydrological system.

OEH 82: Detailed results should be presented for the groundwater studies.

A description of existing ground and surface waters within the Blacktip gas plant region is provided in **Appendix E**, **Volume 2** of the Draft EIS. Potential impacts on surface and groundwater were discussed in **Section 12**, **Volume 1** of the Draft EIS. To summarise below:

Surface water: The project area is located within the southern sub-catchment of the Moyle River basin. There is no well-defined surface drainage in the project area and coastal inlets and associated mangroves with seasonally inundated inland swamps occur 2–3 kms to the north of the project area and around the inlet on Yelcher beach to the south. Many of the creeks and streams have small flows at the end of the dry season with most creeks drying up each year. There is no perennial stream network in the vicinity of the proposed development. Ephemeral runoff in or adjacent to the proposed gas plant site would appear to support near coastal wetland ecosystems.

Groundwater: A high yielding, widespread shallow aquifer system underlies the Blacktip Project area with water table depths at 10 to 15 m within the vicinity of the gas plant site. This is a significant resource with potential to supply industrial or residential development in the future. The NT Government has designated this aquifer system as a community resource that requires a high level of protection. The Wadeye community has an established designated bore field for domestic water supply. There are also groundwater dependent ecosystems north and south of the project area.

Potential Impacts

The Draft EIS states that 'The potential impacts of the project on flora and fauna biodiversity, and threatened species, have been minimised in the design phase by avoidance of monsoon vine forest, riparian and wetland communities, which are known to typically contain distinct flora and fauna species assemblages. Additional project infrastructure such as laydown areas, shore anchors, borrow pits, washdown bays etc. will not be located in areas of environmental sensitivity' (**Section 12.3.2**). Further commitments are made in **Section 15**, **Table 15-2**, where it states that, 'Environmental and heritage values of routes chosen for access roads, laydown areas, borrow pits will be comprehensively assessed prior to disturbance'.

Water bores: The area selected for the gas plant has no existing surface water features and is remote from wetland ecosystems. The groundwater aquifer below the site does provide water to numerous communities and outstations and is important in maintaining freshwater springs throughout the dry season (Haig and Matsuyama 2003). It is important that groundwater-dependant ecosystems are identified and monitored throughout the life of the project to ensure that the use of water at the Blacktip Project is not impacting on the surrounding ecosystem requirements.

It is anticipated that two groundwater bores will be established within the Blacktip gas plant footprint. One will be the primary water source while the second will be used during periods of peak demand and as a back-up supply. A Groundwater Protection Management Plan will be developed which will include monitoring of groundwater levels and quality (framework is provided at **Table 15-10, Volume 1** of the Draft EIS). The objectives for the plan include:

- to maintain the quality of ground water resources;
- to minimise the potential for groundwater contamination.

The proponent has committed to conducting a baseline groundwater monitoring programme, to characterise the groundwater at the site. Additionally all fuel and chemical storage will be designed and constructed in accordance with the relevant Australian Standards (i.e. AS1940:2004, note the inclusion of AS3740 was an error).

A hydrologist will be required to make an assessment of the impacts associated with extracting the estimated volumes of groundwater especially any temporary impacts on natural ecosystems during the periods of construction where the water table will be lowered.

The exact location of bores will be determined during detailed design.

Access routes and laydown areas: The proposed all-weather construction road will be 13 km long, 4 m wide and will require a construction corridor 50 m wide to accommodate laydown areas at various intervals along the corridor. Not all of the 50 m corridor will be cleared of vegetation. Laydown areas that will be required during the construction of the 13 km access road will be located within the proposed 50 m corridor (**Section 4.5.10**, **Volume 1** of the Draft EIS).

The location of the two expected laydown areas required near the shore crossing have not yet been confirmed. Both will be approximately 100 m by 100 m. There will also be a permanent laydown

area located within the 64 ha gas plant site boundary. During construction, this area will be used to house the construction camp as well as for storage of material, vehicles and equipment (**Section 12.5.4**, **Volume 1** of the Draft EIS).

Potential impacts include:

- Increased sediment load from upgrading of the unsealed access road to the project area into surrounding surface water systems during the wet seasons following dry-season construction.
- Groundwater contamination if fuels or chemicals are spilt.

Proposed mitigation measures include:

- Construction of laydown areas to be prioritised to as early as possible in the dry season.
- An Erosion and Sediment Control Plan is to be developed and implemented for all stages of the project and will ensure that all drainage onto and leaving disturbed areas will minimise the potential for elevated turbidity in surface waters surrounding the project area.
- All fuel storage will comply with AS1940: Storage and Handling of Flammable and Combustible Liquids, 2004. Spill kits will be available where fuels and hazardous materials are used and stored and personnel will be trained and competent in the correct handling procedures and spill management.

Borrow Pits and Quarries: The main potential impact from borrow pits and quarries on groundwater or surface water resources would be similar to the access track and laydown areas. Primarily there will be a risk of increased sediment loads, from cleared and disturbed areas, entering freshwater systems during the wet seasons following construction.

The commitment that borrow pits will not be located near areas of environmental sensitivity is repeated throughout the Draft EIS. The environmental and heritage values of borrow pits will be comprehensively assessed prior to disturbance (**Table 15-2**, **Volume 1**, item 29).

It is unknown at this stage if quarries will be required in the vicinity of the project area. **Section 4.5.11.4**, **Volume 1** of the Draft EIS states that potential aggregate exists in the vicinity of the Moyle River crossing. However, the feasibility of quarrying this aggregate has not been conducted. Other potential sources may be existing quarries near Darwin or leftover spoil from the Alice to Darwin railway.

OEH 58: If groundwater is to be used for hydrotesting of pipes, a complete groundwater survey of the region should be undertaken for assessment of the available resource both for the life of the project and for ongoing concerns of the local community following decommissioning of the project.

OEH 58: A groundwater survey of the region should be undertaken to assess the available resource both for the life of the project and for ongoing concerns of the local community.

Two groundwater bores are planned to be established within the gas plant footprint. The exact location of these bores is not known. Under the Framework for the Groundwater Protection EMP

(**Table 15-10**) the proponent commits to undertaking a baseline groundwater monitoring programme to characterise the groundwater at the site.

Currently it is estimated that 6 m^3 of groundwater will be stored on the processing plant site to be used for hydrotesting of tanks and some piping infrastructure around the plant. Seawater will be used for hydrotesting of the export pipeline.

A study of the groundwater systems of the area was conducted by the NT Government and the report published (Haig and Matsuyama 2003). The aquifer under the gas plant site is known to be a widespread shallow aquifer in sandstone (Haig and Matsuyama 2003). It is a high yielding aquifer with good chance of drilling a bore with a 5 l/s yield (or higher in bores located near fracturing or a local source of recharge) (Haig and Matsuyama 2003). It supplies water for numerous communities and outstations within the region.

During the construction phase of the project, it has been estimated that 405–430 m^3 of water will be required daily including both treated and untreated water. This volume represents approximately 33% of the daily water requirements for the Wadeye Community, which was calculated to be 1295 m^3/day (1999–2001). This excludes water used for irrigation of market gardens or industrial use (Haig and Matsuyama 2003). Given the extent of the groundwater aquifer within the region, which is described to be widespread with a large supply, it is likely that water extraction during the construction phase of the project will result in a temporary depression of the groundwater table in the immediate area, but will have no impact on the water availability for the communities and outstations that also source their water from other areas of the aquifer. Haig and Mastuyama (2003) state that:

> 'Presently the volume of use from the municipal bore fields has not caused any noticeable impact on areas of environmental significance. It would be prudent, in the future, to address this issue in expanding or establishing new municipal bore fields (Haig and Matsuyama 2003)'.

11.1.3 Section 8.2.5 Geology and Soils

NTG 58: The EIS states that an on-site study was to be completed by the end of 2004 to determine the extent of acid sulfate soils along the pipeline route, landfall site and proposed plant site. This follows from the desktop study presented in Appendix D of Volume 2. This study has not been presented and the actual extent of ASS is therefore unknown. The report generated by the on-site shall be submitted.

NTG 58: The report generated by the on-site study to determine the extent of acid sulphate soils should be submitted.

The acid sulfate soils report was completed in February 2005 and is attached as **Appendix D** at the end of this report, the findings are summarised below.

As reported in the Draft EIS Sinclair Knight Merz (SKM) completed a desktop assessment in January 2004 identifying the possible presence of Acid Sulphate Soils (ASS) or Potential Acid Sulphate Soils (PASS) in areas of the proposed Blacktip Project. In recognition of the potential impact, exposure of ASS or PASS soils could have on the environment and site infrastructure, the

Proponent commissioned SKM to investigate the presence or absence of ASS and PASS soils in the Blacktip Project area.

Prior to completion of the investigation activities a sampling and analysis plan (SAP) was developed based on the level of risk posed by ASS in the proposed development areas. Where risks were identified as high, the sampling programme was in accordance with regulatory guidelines. Where risks of ASS conditions were identified as low to moderate, a reduced sampling programme was undertaken.

A field programme based on the SAP was completed, including field tests and collection of samples for analysis. Samples were collected across three areas, selected during a desktop investigation and based on the anticipated level of risk posed by ASS. The selected areas included:

- Area A: Landfall and beach-crossing portion of proposed pipeline route.
- Area B: Proposed plant site and portions of the pipeline route.
- Area C: Nearshore zone of proposed pipeline route, from lowest astronomical tide to approximately 10 m water depth.

Samples were selected for analysis based on field observations and were analysed for the Suspended Peroxide Oxidation Combined Acidity and Sulphate (SPOCAS) suite of analytes.

The results of this investigation concluded the following:

- Based on the findings of the 'acid trail' and 'sulphur trail' lines of evidence for all samples selected for laboratory analysis, ASS or PASS are *not* expected to be encountered during construction activities in Areas A, B or C (where maximum depth of disturbance is understood to be 2 mbg).
- Based on field data and laboratory data, the shallow sandy soils encountered in Area A have a high buffering capacity. All other soils encountered have a low to nil buffering capacity. Buffering capacity refers to the intrinsic nature of a soil to resist changes in pH, where a high buffering capacity indicates a good resistance to change.
- The clays encountered at depth within Area A are acidic in nature. Disturbance of these acidic clays may have a negative impact on the environment by introducing an acidic medium to the naturally alkaline marine environment, although the potential risk is considered to be Nil to Very Low due to the small exposure time and rapid tidal changes in the area. Disturbance of the acidic clays in Area A may also have a negative impact on infrastructure exposed to those clays, therefore consideration should be given to the materials used during construction, in accordance with recommendations in Woodside (2004).
- Due to the alternative sample handling methods undertaken in Area C as a result of access and timing constraints, field tests and laboratory results may be biased, although still broadly indicative of the presence or absence of ASS or PASS.
- A detailed ASS management plan to remove, remediate or manage the presence of ASS or PASS is *not* required.

Although ASS and PASS were not identified in the areas of investigation, naturally acidic soils which may have pipeline integrity issues were noted. Due to the presence of these acidic soils consideration should be given to the design and materials of any infrastructure that may be exposed to acidic soils across Areas A, B and C.

Impacts on Turtles: For these reasons acid sulfate soils are highly unlikely to have any effect on sea turtles, their eggs and hatchlings. The eggs are deposited above the water table that is likely to show the greatest impact by changes in pH. The moisture available to sea turtle eggs comes from precipitation during the wet season. The sands are rich in calcium carbonate from mollusc shells and other invertebrates. These provide a natural pH buffer to acid contaminated precipitation. Most of the turtle nesting occurs in the dry season of the bioregion. Eggs absorb moisture from that contained wither within the porous calcium carbonate particles or from between the silicious sand grains. During the dry season with its cool nights, dew formation within the surface layers of the sand provides moisture to the developing eggs.

11.2 Section 8.3 Ecological Environment

11.2.1 Section 8.3.1 Regional Ecological Setting

NTG 59: How has the design of Flora and Fauna surveys ensured adequate and appropriate information is obtained in relation to this setting. The lack of information regarding the presence of threatened fauna in the proposal location should be investigated along with the other identified areas where there is a paucity of information.

NTG 59: How has the design of flora and fauna surveys ensured adequate and appropriate information is obtained in relation to this setting?

The area of study was assessed during several vegetation surveys during 2002 and 2003 and a fauna habitat map was developed (refer to **Figure 1**, **Appendix H**, **Volume 2**) by combining this information with high resolution satellite imagery. This map stratified the project area into four habitat types. The fauna survey methodology followed the accepted Bioregional Assessment Unit methods developed by the PWCNT and the methods were reviewed and sanctioned by PWCNT. Survey sites were established at sites representative of the most dominant habitat types as well as in monsoon vine forest located near the project area (these were considered to be habitat most likely to support species of conservation significance).

Flora surveys were conducted on three occasions spanning two years and were conducted at times considered to be early-dry, mid-dry and early-wet seasons (whilst the area was still accessible). These surveys involved botanical assessment of the pipeline shore crossing, along the on-shore pipeline route and at the proposed gas plant site. Flora surveys were also conducted at each of the fauna survey sites.

In regards to the degree of consideration that was applied to threatened fauna, an assessment of species of conservation significance that would potentially occur in, and surrounding, the project area was made following a desktop review of:

- Threatened species listed under the *Territory Parks and Wildlife Conservation Act 2000* and the EPBC Act.
- Migratory species listed under the EPBC Act.
- Habitats of listed threatened species of those recognised as possessing outstanding biodiversity values identified from published literature and assessment of the habitat.
- Discussions with PWCNT on potential threatened species that may be present in the region.
- Species that are classified as Near-Threatened or have a regionally restricted distribution in the NT.

A discussion of listed threatened species that have the potential to occur in the project area is provided at **Section 4.1**, **Appendix H**, **Volume 2**. Table 2 discusses the conservation status and range of these species and the likelihood that the species would occur in habitats in or near the project area. The fauna survey included spotlighting and active searches at night in an attempt to locate *Phascogale tapoatafa pirata* and *Conilurus penicillatus*, and specific searches in habitat suitable for *Xeromys myoides* were conducted by an expert in this field during the survey.

ECNT 12a: There are habitats where threatened species could be found i.e. false water-rat, Northern Brush-tailed phascogale, Red Goshawk, Brush-tailed tree-rat - but none were recorded during the fauna surveys. Field surveys in the region have been extremely limited (8.3.1. Regional Ecological Setting, p230). With such limited information it is impossible to adequately assess the impacts on wildlife, including protected species.

ECNT 12a: With limited field surveys of the region it is impossible to adequately assess the impacts on wildlife, including protected species.

When developing the fauna surveys for the Blacktip Project, a great degree of consideration was applied to threatened fauna including an assessment of species of conservation significance that would potentially occur in, and surrounding, the project area. This included discussions with experts from the PWCNT and a desktop review of:

- Threatened species listed under the *Territory Parks and Wildlife Conservation Act 2000* and the *Environment Protection and Biodiversity Conservation Act 1999*.
- Migratory species listed under the EPBC Act.
- Habitats of listed threatened species of those recognised as possessing outstanding biodiversity values identified from published literature and assessment of the habitat.
- Species that are classified as Near-Threatened or have a regionally restricted distribution in the NT.

A discussion of listed threatened species that have the potential to occur in the project area is provided at **Section 4.1, Appendix H, Volume 2.** Table 2 discusses the conservation status and

range of these species and the likelihood that the species would occur in habitats in or near the project area. As noted above, specific attention was given to identifying threatened species during surveys.

11.2.2 Section 8.3.2 Vegetation and Flora

OEH 44: Description of the management of green waste disposal from areas proposed to be cleared is required.

OEH 44: Please discuss the management and disposal of green waste from areas that are proposed to be cleared.

Section 12.3.5, Volume 1 of the Draft EIS states that vegetation cleared from the plant site will probably have to be burned to avoid large stockpiles remaining on or adjacent to the plant site. The details of such burns will be discussed with the NT Bushfires Council and will be incorporated into the Fire Management Plans.

Vegetation cleared along the trench route will be stockpiled and pulled back over the trench following pipe laying to enable grass roots on either side of the trench to start to grow back and will provide viable seed in the surface soil and natural vegetation.

11.2.3 Section 8.3.4 Weeds

OEH 74: The Supplement should specify that it is the proponents' responsibility to ensure that new weed species are not introduced and that existing weeds do not accelerate their colonisation (Section 8.3.4).

OEH 74: Recognise the proponents' responsibility to ensure that new weed species are not introduced and that existing weeds do not accelerate their colonisation.

Section 8, **Volume 1** of the Draft EIS provides a description of the existing environment and hence, **Section 8.3.4** describes the existing weed species that are known to occur, or are likely to occur, in the project area and the surrounding region. Commitments to weed management have been made in **Section 12.3.4** and these are reiterated under **Section 15, Volume 1** of the Draft EIS.

Under the *Weeds Management Act 2001*, it can be an offence to introduce or spread weeds. The Proponent has committed in the Draft EIS to developing an exotic species and weed management plan prior to construction that will include the following:

- Identifying and treating existing weed infestations.
- Requiring suppliers of plant, vehicles and equipment to certify materials as weed free and to undergo random inspections.
- Developing weed eradication programme in consultation with DIPE.
- Constructing a washdown bay to the specifications required by DIPE along the access route to the site.
- Implementing a weed monitoring and control programme.

Plant, vehicles and equipment will undergo an inspection for weeds or weed carrying material by a representative from Weeds Branch in Darwin prior to dispatch to the site. Notice must be provided to the Weeds Branch in advance and a meeting point agreed.

In addition to this, it may still be a requirement for all vehicles and machinery to be washed in the washdown bay prior to entry onto the Blacktip Project area.

11.2.4 Section 8.3.5 Fauna Habitat & Species

NTG 60: Examination of the Fauna habitats and species (8.3.5) indicates that the fauna species lists were compiled from a single brief 5 day (dry season) survey and a search of the NT Fauna Atlas database. Due to this poor survey effort, the compiled list is a considerable underestimate of the terrestrial vertebrate species liable to be present. Additionally, further doubt on the veracity of the given species list is given by the inclusion of some taxa, admittedly taken from the Fauna Atlas database, whose distributions do not include the project area. These are the scincid lizards *Carlia longipes* and *Glaphyromorphus nigricaudis* (Appendix 3 of Appendix H), both only known from north-east Arnhem Land in the NT, and the freshwater turtle *Emydura worrelli* (Table 3 of Appendix H) known only from the Roper River drainage system in the NT. Although, the areal extent of the project is relatively small, and is contained within a much greater area of similar surrounding environment, the terrestrial fauna species list provided does not satisfy the requirement that significant species (including the few mentioned) do not occur on the project's site.

NTG 60: The terrestrial fauna species list provided does not satisfy the requirement that significant species do not occur on the project's site.

Section 8.3.5, Volume 1 of the Draft EIS states that the fauna species list was compiled using data obtained from field surveys with reference to existing reports and databases. **Appendix H**, **Volume 2, Section 2.1** provides a list of the main data sources utilised in the desktop review which includes but is not limited to the NT Fauna Atlas. Review of key scientific papers and reports as well as searches of the EPBC protected matters search tool were conducted for the Draft EIS. Information was also obtained through consultation with regional fauna experts from the NT Parks and Wildlife Commission (NTPWC) and the NTPWC Threatened Species on-line records, especially when evaluating potential threatened and significant species.

Original survey plans for 2004 were to conduct the Blacktip fauna survey in April 2004. However, due to access issues (the Daly River could not be crossed until late May 2004) the surveys were delayed until early June 2004.

The fauna survey methodology that was conducted for the Draft EIS was submitted to and sanctioned by the Biodiversity Unit of DIPE and utilised procedures which are standard for fauna survey in the Top End region of the NT that are systematic, repeatable and intensive (Woinarski et al. 2004). A fauna survey study of Litchfield National Park, conducted by Woinarski et al. (2004) which spanned a six-year period, highlighted the fact that the effort required for 'adequate' fauna monitoring must be very substantial with the results from this study indicating that a sampling programme with enough sensitivity to detect a 20% change in abundance in an ecosystem would require several thousand sampling points.

It is a common, and expected, practice in Environmental Impact Assessment to conduct a desktop study of available databases and literature, as was conducted for the Draft EIS. These databases consist of historical records and prove to be useful inventories for species that both exist, and have existed, in a given area (Fraser et al. 2003). As is noted above, the project area is surrounded by a 'much greater area of similar surrounding environment'. Hence the search radius of the fauna atlas records of terrestrial species was within a 20 km radius of the project area.

All historical records of species that were identified from the area in the NT Fauna Atlas were included. Dismissing historical records of species distributions, especially throughout a region where some faunal assemblages are poorly known, is both poor practice and could potentially limit the EIA process through omission of data. It was acknowledged that some species records did not match the contemporary expected distributions of the species. It was a positive decision to maintain the species list obtained from the NT Fauna Atlas, as removal of records was believed to represent a manipulation and omission of data.

It was acknowledged in **Table 3**, **Appendix H**, **Volume 2** of the Draft EIS that *Emydura subglobosa worrelli* was unlikely to be present in the project area as suitable habitats do not extend in or near the project area. It should be noted that although brief, the terrestrial and aquatic fauna surveys that have been conducted for the Blacktip and Trans Territory Pipeline Projects, have significantly added to the NT Fauna Atlas database for the areas surveyed and have resulted in numerous range extensions for species. The surveys conducted for the Blacktip Project produced 28 new species records for the region and that this data has been supplied to the NT Fauna Atlas Database. This further emphasises the fact that the Top End faunal assemblages are poorly known and that records should not be discarded even when it may contradict existing known distributions.

It should also be noted the actual trapping results produced numbers and richness of species at these sites which were equivalent to other studies conducted by fauna researchers across tropical Northern Territory. The field surveys recorded 60 fauna species, including one mammal species, 46 bird species, 11 reptile and two frog species. The methods utilised for this survey were not in any way deficient, even though they were limited to one period.

It is anticipated that the fauna identification work that will be conducted during construction of the Blacktip Project will result in the accumulation of a faunal database and will result in the extensions of known ranges for many species.

11.2.5 Section 8.3.6 Biting Insects

NTG 61: For the management strategy proposed floristic composition and diversity may be impacted. What is the rational associated with the burning of Swamp 1 to minimise mosquito habit? What alternative mechanisms have been explored?

NTG 61: What is the rational associated with the burning of Swamp 1 to minimise mosquito habit? What alternative mechanisms have been explored?

Appendix I, **Volume 2** of the Draft EIS states that it is recommended that mosquito breeding at Swamp 1 be controlled at least during the construction period. This recommendation has been provided by the Territory Medical Entomology Branch as a means of minimising mosquito numbers. Burning the swamp is recognised as a means to reduce mosquito breeding habitat in the late dry season and early to mid wet season. This removes dead reeds which would result in fewer breeding sites, allow ease of predator access to mosquito larvae when the swamp is flooded, and enable disruptive wave action to prevent larval development.

Chemical control methods have also been discussed in the Draft EIS. These are recognised as costly alternatives (although they may be used in conjunction with burning during construction) and may be implemented if:

1) Burning is not deemed a sufficient control (especially during the construction phase); or
2) Burning is not a desirable option for the Traditional Aboriginal Owners of the area.

OEH 83: Detailed results should be presented for mosquito breeding sites (Section 8.3.6).

OEH 83: Detailed results should be presented for mosquito breeding sites.

The technical report; Biting Insect Survey and Assessment Blacktip Project June 2004, prepared by NT Medical Entomology, is included at **Appendix G**, **Volume 2** of the Draft EIS. The report details the species of biting insects and mosquitoes that were identified along with where they were found and densities.

This Supplement includes the data and report (**Appendix E**) from the surveys conducted by the Medical Entomology Branch in September 2004. The surveys that were proposed for November 2004 were not conducted due to access issues into the area.

NLC 47: Page 255 The field survey missed the late dry season major migratory visits from Asia to the shores of the NT, (eg Waders-March/April & Sept/October) so the current data has a strong seasonal bias. Eg The EIS advises on page 285 [page 255] that "no migratory species have been recorded in the onshore project area in field surveys, but 8 species are likely to occur". The non-recording of migratory birds is not surprising in view of the above migratory dates. The data is inadequate. Additional survey work in the appropriate migratory seasons would determine the level to which the beach area is used as a first landfall and a staging post for bird species migrating from Asia. Such surveys during the appropriate season would most likely add to 8 migratory species predicted in the EIS eg Ruff have been noted in Darwin this year and the Asian Dowitcher, Phalarope and SE Asian Passerines could turn up in the project shore area.

There are few places along any coastline where sea birds would be prepared to roost, be it for breeding or an evening roost. The shore area affected by the project needs to be assessed by field survey for its use as a landing area for migratory birds, and use as a roosting and foraging area by seabirds, waders and water birds. There is little sense in compiling an incomplete bird list and then attempt to analyse how proposed activities might affect key habitats or assess impacts that may vary depending on seasonal or diurnal utilisation of the project area. (See also comment 31 below).

Any potential spills and subsequent remediation plans in the Oil Spill Management Plan must take into account the role that the local area, including the project area, has in hosting bird species and populations. It does not help prepare management plans if the EIS has dismissed local water and shore birds as insignificant in the project area. Any spill plan must not rely upon key equipment having to be flown in during an emergency.

NLC 47a: The data on migratory birds is inadequate.

The seven species of migratory birds (the eighth species was the saltwater crocodile *Crocodylus porosus*) listed in the Draft EIS as 'likely to be present' were the result of a search conducted using the EPBC Protected Matters Search Tool. The only species from this list that has been identified in the area as a result of survey was the Oriental Plover *Charadrius veredus* (Chatto 2003).

In regards to further potentially migrating species that may visit the beach, the New Atlas of Australian Birds (Barrett et al. 2003) which details the records of the largest continent-wide survey of birds from 1998–2002, have recorded Ruff *Philomachus pugnax* in Darwin, Central Australia, north-east Western Australia and along the east coast of Australia. The atlas also shows only incidental sightings of the Asian Dowitcher *Limnodromus semipalmatus* in the Darwin area. There are three species of Phalarope listed in the Atlas; two have been recorded in SA, VIC and WA and one was not recorded in the new Atlas. It is possible that other migratory birds could visit the project area from time to time. However, in order to capture such rare visitations, a survey would need to be conducted on a near daily basis, spanning many years.

Extensive surveys of the NT coastline and coastal wetlands have been conducted by the PWCNT for seabirds, shorebirds and waterbirds (Chatto 2000, 2001, 2003). This work has demonstrated that extensive areas of the NT coastline are utilised by breeding colonies of numerous seabird, shorebird and waterbird species (Chatto 2000, 2001, 2003). As a result of the extensive survey work conducted by PWCNT, Yelcher beach was recognised as a site that is used from time to time for resting terns but in relatively low numbers. It was therefore identified as an insignificant site for roosting or breeding colonies of shorebirds, seabirds or waterbirds (Chatto 2000, 2001, 2003, and pers. comm. 2004).

NLC 47b: The Oil Spill Management Plan must take into account the role that the local area, including the project area, has in hosting bird species and populations.

A Draft Outline OSCP is provided in **Appendix C**. This is a high level plan which provides a good example of how the detailed OSCP will be executed. The detailed OSCP will be prepared at later date prior to drilling commencing. The OSCP will address the matters noted.

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12. Draft EIS Section 9 Regional Economics and Land Use

12.1 Section 9.5 Military Zones

NTG 62: Defence areas are impacted on in the offshore and onshore component of the project. Whilst the EIS indicates that further consultation with Defence is to occur it implies that the tacit approval of the Department of Defence to the infringement in its naval training and RAAF exercise areas. A definitive statement to that effect from the Department of Defence should be a prerequisite to an EIS approval.

NTG 62: Approval of the Department of Defence to the infringement in its naval training and RAAF exercise areas should be a prerequisite to an EIS approval.

It is recognised that the wording employed in **Section 9.5, Volume 1** of the Draft EIS may have resulted in some confusion or misinterpretation to the reader of the document. During the design of the Blacktip Project, the Proponent has been proactive in undertaking ongoing consultation with the Department of Defence to discuss potential conflicts, issues and concerns associated with the onshore and offshore project components. Regular meetings with the Department of Defence have been held to discuss project progress and this has been well received.

Potential issues raised during these ongoing consultations have been identified and documented in the Draft EIS and potential impacts appropriately assessed. Discussions to date indicate that the Blacktip Project is not expected to result in any significant impacts on existing military exercise areas. Furthermore, the Proponent will continue to liase with the Department of Defence during detailed project design, construction and operation to ensure that any issues identified by the Department are addressed in an appropriate manner.

12.1.1 Section 9.5.2 Offshore Military Exercise Zone

OEH 78: The Draft EIS states that the "offshore components of the Blacktip Project are located within the R202G offshore military exercise zone," in which "a wide range of military exercises including live firing" occurs (Section 9.5.2). Quantification of the risk of stray firing incidents is sought in the Supplement, along with any arrangements made with the military to mitigate any accidents.

OEH 78: Quantification of the risk of stray firing incidents is sought in the Supplement, along with any arrangements made with the military to mitigate any accidents.

The Blacktip Project has maintained close liaison with the Australian Defence Force (ADF) over the potential impact of military exercises with R202G. The ADF has advised that they do not have concerns over the location of the Blacktip offshore facilities. The gas export pipeline skirts along the extreme southern boundary of the exercise area. The offshore platform is outside the exercise area. The ADF does not believe the facilities will impact on their exercises. There is therefore no requirement to quantify the risk of stray firing incidents.

NTG 63: Have appropriate procedures and processes been established regarding identification of any unexploded ordinance in the construction area. What agreements or relationships are in place in regard to the shared use of this area particularly in relation to risks associated stray firing impacting on the project.

NTG 63a: Have appropriate procedures and processes been established regarding identification of any unexploded ordinance in the construction area.

NTG 63b: What agreements or relationships are in place in regard to the shared use of this area particularly in relation to risks associated stray firing impacting on the project.

In discussions with the ADF, the Royal Australian Navy (RAN) has advised the Blacktip Project of the possibility of live ordnance being encountered during the installation of the offshore export gas pipeline. The Blacktip Project has taken this into account in the pipeline surveys already conducted. To date there has been no ordnance encountered. During the installation of the pipeline in 2007, the Blacktip Project will work closely with the ADF in the event that any ordnance is detected.

The reader is also directed to the response to **OEH 78**.

12.2 Section 9.7 Fisheries

NTG 64a: The EIS discusses fisheries of all kinds, but just their presence and number of licences, and almost nothing as to what is caught in these fisheries or their bycatch, which could provide faunal community information.

NTG 64b Very little of the information provided is adequately referenced. It is presumed that it must have come from NT Fisheries reports – so why not say so? In particular, the text on traditional fisheries must have come from Coleman (2003) or Henry and Lyle (2003), and it should also be referenced.

NTG 64a: The EIS discusses the presence and number of licences of fisheries of all kinds, however there is almost no discussion as to what is caught in these fisheries, or their bycatch.

Section 9.7, Volume 1 of the Draft EIS provides a detailed description of fishing activities undertaken within the Joseph Bonaparte Gulf including commercial fisheries (**Section 9.7.2**) recreational fisheries (**Section 9.7.6**) and traditional fisheries (**Section 9.7.6**). The Draft EIS provides a description of the types of species typically targeted in each of the fisheries operating in the area, as well as the geographical distribution of each fishery.

During the baseline data collection exercise, the absence of publicly available data relating to fisheries in the Joseph Bonaparte Gulf region was identified as a significant data gap. Subsequently, direct communication was made with both the Commonwealth (CSIRO and Australian Fisheries Management Authority), State (Fisheries Western Australia) and Northern Territory (Northern Territory Department of Primary Industries Fisheries) governments to identify recent and relevant baseline fisheries data. The results of this exercise are summarised in the Draft EIS. It is considered that the fisheries data presented in the Draft EIS is sufficiently detailed to be able to make an accurate assessment of the potential impacts resulting from the Blacktip Project on fisheries in the project vicinity.

It is acknowledged that the presentation of by-catch data in relation to the individual fisheries may provide additional useful information on the faunal community of the area, particularly for demersal, bottom-trawl fisheries. However, such information is not publicly available for most of the fisheries operating in the Joseph Bonaparte Gulf. Additionally, considering that a number of the fisheries which are active in the vicinity of the Blacktip Project area have a wide geographical coverage, it may be misleading to present data which may not be characteristic of the benthic assemblage in the vicinity of the Blacktip Project area. For example, the Western Australian Demersal Scalefish Fishery operates off the north coast of Western Australia, with a limited coverage in the Joseph Bonaparte Gulf (Fisheries Western Australia 2000). This fishery is concentrated offshore Broome, Western Australia (Fisheries Western Australia 2000). Similarly, extensive research has been conducted on the bycatch of the Northern Prawn Fishery; however, none of this work has been conducted in the Joseph Bonaparte Gulf (refer to response to **NTG 53 Section 10.2.2**) for further details).

NTG 64b: The information provided in the section on fisheries is poorly referenced.

Unless otherwise indicated, the data on NT Fisheries were sourced from the Fishery Status Report 2002, which was accessed online on 24 August 2004 and cited in the reference list (**Section 18**) as DBIRD (2002). However, APM Coleman is the actual author of the 2002 Fishery Status Report. Therefore, the reference to DBIRD (2002) should be amended as follows:

> Coleman, APM (2003). Fishery Status Report 2002. Fishery report No. 69. Department of Business, Industry and Resource Development, Northern Territory Government, Darwin, Australia.

Henry and Lyle (2003) conducted a very thorough investigation of recreational and indigenous fishing throughout Australia, and APM Coleman was heavily involved in the survey of indigenous fishing. Coleman, (2003) utilises the data specific to indigenous fishing in the Northern Territory, which was collected as part of the wider Henry and Lyle (2003) study, in the Fishery Status Report 2002.

12.3 Section 9.9 Archaeology

12.3.1 Section 9.9.2 Terrestrial Archaeology

NTG 65: There is a possibility that archaeological sites are also sacred sites. The *NTASSA* defines a sacred site as: " A site that is sacred to Aboriginals or otherwise of significance according to Aboriginal tradition, and includes any land that, under law of the Northern Territory, is declared to be sacred to Aboriginals or of significance according to Aboriginal tradition".

NTG 65: Clarify the definition of a sacred site and consider the possibility that archaeological sites are also sacred sites.

The site has been surveyed in relation to sacred sites by the NLC in consultation with the traditional Aboriginal owners of the area. Authority certificates were issued by the AAPA under the Northern Territory *Aboriginal Sacred Sites Act 1989* for all on-ground work that has been carried out to date for the Blacktip Project. As shown in **Figure 9-10**, **Volume 1** of the Draft EIS, it

is expected that none of the sacred sites that were identified from the survey and a search of AAPA records will be impacted by the project.

OEH 66: The recommendations within the archaeological survey report by Begnaze represent a comprehensive approach to managing any potential impact on prescribed archaeological places and objects located within the Black Tip onshore pipeline and gas plant footprint. Recommendations provided for linear midden site are appropriate to minimise impact, regardless of where the pipeline cuts through the dune. Any decision concerning the exact location of the pipeline and permit to disturb that section of the site should be in consultation with the appropriate parties (Aboriginal Traditional Owners/NLC/AAPA).

Should the location differ from those inspected by Begnaze it is recommended that the exact section of the midden is inspected prior to final design and onset of construction to minimise the potential for impacting upon sensitive or highly significant archaeological remains (eg human burials, hearths) through selection of a site.

Prior to trenching and disturbance of the site for pipe laying, it is suggested that the opportunity for further research on the midden be pursued, given that "the site has a high potential for further research" (Section 9.9.2).

It is also recommended that Woodside comply with recommendations developed by Begnaze for the Design (8.1), Construction (8.2) and Operational phase (8.3) including, but not limited to:

- placement of additional infrastructure and auxiliary areas in accordance with the archaeological predictive model developed.
- undertaking of additional surveys, as recommended by Begnaze, during the design phase of the project for all Onshore-Related Components as specified in Table 4.2 (Vol1, pg 48) not within the gas plant footprint or not previously subject to archaeological survey, including, but not limited to, the proposed haul road between Wadeye and the proposed gas plant.
- lodgement of permit applications for consent from the Minister for the Environment and Heritage to disturb/destroy archaeological materials protected under the Heritage Conservation Act prior to the onset of construction (see attachment). The proponent should note that consent may be subject to certain archaeological mitigative works.

Lastly the proponent should note that recommendations made by Begnaze for the construction and operational phases are considered preliminary and may be revised pending further archaeological surveys.

OEH 66: To what extent will the recommendations within the archaeological survey report by Begnaze be implemented in the final design plans?

The Proponent has committed to ensuring that the Shell Midden 1 site will be thoroughly recorded and collected in accordance with requirements set out by the Heritage Conservation Branch. The sections of the midden that are not to be disturbed will be fenced to prohibit any vehicle or pedestrian access. The Proponent has committed to undertaking additional site surveys and to implementing a Cultural Heritage Management Plan (**Section 13.8**, **Volume 1**). Prior to construction taking place, an application to disturb or destroy the section of the archaeological site will be required from the Heritage Conservation Branch as directed by the NT *Heritage*

Conservation Act 1991 (**Section 13.8**, **Volume 1** of the Draft EIS). Construction work will not commence until the appropriate permit is obtained.

12.4 Section 9.10 Aboriginal Heritage

NTG 66: A more defined usage of the term "sacred site" is required. The *Northern Territory Aboriginal Sacred Sites Act 1989 (NTASSA)* defines a sacred site as:

"… a site that is sacred to Aboriginals or otherwise of significance according to Aboriginal tradition, and includes any land that, under law of the Northern Territory, is declared to be sacred to Aboriginals or of significance according to Aboriginal tradition". The EIS uses numerous terms to describe sacred sites. For instance, the following are used:

- Aboriginal sensitive cultural site
- Cultural site
- Aboriginal cultural site
- Aboriginal sites
- Aboriginal heritage sites
- Sites and sensitive areas
- Aboriginal sites of significance.

A section that clearly illustrates the *NTASSA*'s definition of a sacred site and the penalties for illegal entry, illegal work and desecration of a sacred site is required. Following this, consistent usage of the term 'sacred site' is required throughout the EIS. All 'sacred sites' are protected. A proponent requires an Authority Certificate and must work in accordance with the conditions of the Certificate.

A clear explanation of the Authority Certificate process under the *NTASSA* is needed. Also, a clear statement that the Northern Territory Government's requires Authority Certificates for all project development is essential. In such a section the proponent's commitment to obtaining Authority Certificates also requires re-statement.

The particular process of obtaining these Authority Certificates for this development requires explanation in the EIS. As the report clearly indicates, the Northern Land Council (NLC) was funded by the proponents to perform sacred site protection surveys. The AAPA was not involved in these surveys. Arrangements have been made between the NLC and the AAPA for the issue of Authority Certificates on the basis of NLC reports, assuming such reports meet minimum AAPA requirements which the NLC are aware of.

A preliminary report has been received from the NLC, however further reports are required before an assessment can be made as to whether Authority Certificates can be issued. The EIS suggests that the sacred site WALPINHTHI REEF may be interfered with by offshore developments. The report should discuss such a possibility in more detail and the efforts made to minimise damage, for example, rerouting the off-shore pipeline and mooring facility. If the off-shore pipeline and mooring facility cannot be shifted, the reasons for this inability should be clearly stated.

NTG 66a: A section that clearly illustrates the Northern Territory Aboriginal Sacred Sites Act 1989 (NTASSA's) definition of a sacred site and the penalties for illegal entry, illegal work and desecration of a sacred site is required.

The AAPA is correct in highlighting the inconsistent usage of the terms for sacred sites or sites of importance to Aboriginal people in the Draft EIS and that the treatment of the sacred site section is deficient. The following is additional information to the Supplement **Section 9.10.1**, **Volume 1** in the Draft EIS.

Aboriginal Sacred Sites and Species with Indigenous Conservation Values

Aboriginal Sacred Sites Legislation: The *NTASSA* exists to provide protection to Aboriginal sacred sites in the Northern Territory. More specifically the Act exists to:

> "… effect a practical balance between the recognised need to preserve and enhance an Aboriginal cultural tradition in relation to certain land in the Territory and the aspirations of the Aboriginal and all other peoples of the Territory for their economic, cultural and social advancement, by establishing a procedure for the protection and registration of sacred sites, providing for entry on to sacred sites and the conditions to which such entry is subject, establishing a procedure for the avoidance of sacred sites in the development and use of land and establishing an Authority for the purposes of the Act and a procedure for the review of the decisions of the Authority by the Minister, and for related purposes."

In the Act a sacred site is defined as "… a sacred site within the meaning of the Land Rights Act. The *Aboriginal Land Rights (Northern Territory) Act 1976* (ALRA), defines a sacred site as:

> "… a site that is sacred to Aboriginals or otherwise of significance to Aboriginal tradition, and includes any land that, under law of the Northern Territory, is declared to be sacred to Aboriginals or of significance according to Aboriginal tradition."

All sacred sites are protected, whether they are registered with the AAPA or not and the Act contains certain penalties for their unlawful disturbance.

Under the Act, it is an offence to enter or remain, work on, use or desecrate a sacred site and penalties for carrying out such an offence for bodies corporate can be up to 2000 penalty units. The Act provides a process, (under section 19) for obtaining approval to work on a sacred site through the provision of an Authority Certificate. The AAPA may issue a certificate (under section 22) where it is satisfied that:

- the work or use of the land could proceed or be made without there being a substantive risk of damage to or interference with a sacred site on or in the vicinity of the land; or
- an agreement has been reached between the custodians and the applicant…

Note that it is also an offence not to comply with the conditions of an Authority Certificate if that non-compliance causes damage to a sacred site or causes distress to a custodian.

The proponent is required to make an application to the AAPA for an Authority Certificate using the prescribed form and after making arrangements with the applicant about fees and / or costs, the AAPA must, within 60 days, consult with the custodians of sacred sites on or in the vicinity of land to which the application relates that are likely to be affected by the proposed use or work.

The applicant may request a conference with the custodians and the Act provides processes for this to occur. If the AAPA decides to grant an Authority Certificate, subject to the conditions, if any of the Certificate, the holder may:

- "enter and remain on that part and remain on those parts of land the subject of [the] Authority Certificate on which, under the Certificate, work or a use proposed in the application for the Certificate may be carried out or made;
- do such things as are reasonably necessary for carrying out that work or making use of that land."

The development of the Blacktip Project will require an Authority Certificate and will be required to work within any conditions on the certificate. The Northern Territory Government requires Authority Certificates for all project development and consequently the Proponent has made applications for relevant Authority Certificates.

The Proponent has undertaken a range of studies on the land for the preparation of the Draft EIS and for engineering purposes. These have been undertaken within the conditions of an Authority Certificate for defined scopes of work that were submitted to the AAPA with an application in 2003. The Authority Certificate was then extended in 2004 to cover the completion of the existing work scopes and additional works that needed to be undertaken.

The AAPA issued an Authority Certificate for these works on the basis that an agreement had been reached with the custodians, in this case, represented by the NLC. The AAPA did not consult directly with the custodians, to the knowledge of the proponent.

As the land associated with the Blacktip Project is solely Aboriginal land and because the proponent had entered into negotiations with the NLC for both short and long term access to the land, in accordance with the ALRA, it was agreed between the AAPA and the NLC that the NLC would carry out sacred site avoidance surveys for the Blacktip Project. The NLC agreed with the proponent that it would report to the AAPA the results of its consultations with the traditional Aboriginal owners, site custodians and other relevant Aboriginals. The purpose of the surveys, in the case of the Blacktip Project, was to advise areas that were not subject to any access limitations due to the existence of any Sacred Sites or Sacred Objects.

The work undertaken by the NLC in relation to sacred sites formed part of much broader consultation by them with traditional Aboriginal owners and custodians about the Blacktip Project. The NLC's activities were funded by the proponent under a Funding Agreement made with them.

At the end of 2004, the proponent lodged a further application with the AAPA for an Authority Certificate for the avoidance and protection of sacred sites in the vicinity of the land and consequently, for the construction of the Blacktip Project.

The NLC has provided its report to the AAPA in relation to sacred sites and the Proponent, the NLC and the AAPA have entered into tripartite discussions regarding these sites. **Table 12** sets out the instances where corrections to the terminology related to sacred sites should be noted.

- **Table 12 Corrections to the Terminology Related to Sacred Sites**

Draft EIS Section	Existing Terminology and / or page reference	Correction
Executive Summary	Cultural Heritage	The paragraph should read headed "Aboriginal Sacred Sites" and all references to "Aboriginal cultural sites" should read "sacred sites".
	Aboriginal Cultural Sites (**Table ES-3**)	All references to "Aboriginal cultural sites" should read "sacred sites".
Table of Contents	9.10 Aboriginal Heritage, Table of Contents, pV.	Should read "Aboriginal Sacred Sites and Species with Indigenous Conservation Values".
	9.10.1 Aboriginal Sites of Significance, Table of Contents, pV.	Should read "Aboriginal Sacred Sites.
	13.9 Aboriginal Heritage, Table of Contents, pVII.	Should read "Aboriginal Sacred Sites.
	13.10. Species with Indigenous Cultural Values", Table of Contents, pVII.	Should read "Species with Indigenous Conservation Values".
Draft EIS Volume 1	Section 9.10.1 First sentence, last para, "… Aboriginal sacred and significant sites…"	Should read "sacred sites".
	Figure 9.10, Drawing No. 400 -20398, p295.	Title should read "Aboriginal Sacred Sites" and legend should read "AAPA Registered Sites" and "Recently identified Sacred Sites".
	9.10.2, Title, p29.	Should read "Species with Indigenous Conservation Values".
	13.9, "Aboriginal Heritage", p458.	Should read "Aboriginal Sacred Sites".
	13.9, p458, Impacts, first sentence, reads "… sensitive cultural sites …".	Should read "sacred sites".
	13.9, p459, Impacts, last para, first sentence, reads "… Aboriginal cultural sites…".	Should read "sacred sites".
	13.9, p459, Impacts, last para, last sentence, reads, "… sensitive areas …".	Should read "sacred sites".
	13.9, p459, Preventative and Management Measures, first sentence, reads, "… Aboriginal cultural sites …".	Should read "sacred sites".
	13.9, p459, Preventative and Management Measures, first dot points, reads, "… Aboriginal site issues …".	Should read "sacred site issues".
	13.9, p459, Preventative and Management Measures, last para, reads, "… Aboriginal heritage sites …".	Should read "sacred sites".

The reader is also directed to the response to **OEH 67** (**Section 12.4.1**).

NTG 66b: The report should discuss the possibility of Walpinhthi Reef being interfered with by offshore developments in more detail and the efforts made to minimise damage.

Walpinhthi Reef was originally identified by the traditional Aboriginal owners and custodians of the site, in consultation with the NLC anthropologist. The agreement in relation to reporting between the Blacktip Project and the NLC was that only the AAPA would receive the anthropologist's report. Consequently, a detailed discussion of the site characteristics of the site is not possible here. However, the following attempts to answer the matters raised in the comment above.

The Draft EIS states that there exists potential disturbance to Walpinhthi Reef during nearshore pipelaying and shore pull and that consultation will be undertaken with traditional Aboriginal owners regarding appropriate mitigation measures. Earlier statements indicate that no sites will be disturbed. The inconsistency reflects the uncertainty regarding the scope of Walpinhthi Reef.

The original survey of Walpinhthi Reef identified an exclusion zone that applied to the near shore survey work and was determined largely in relation to the proximity within which the vessel used could safely approach the reef. Consequently there was some technical uncertainty in relation to the actual high point of the reef and the reef's edge and so an appropriate exclusion zone.

The proposal for the pipe laybarge and shore crossing activities shows a typical anchor pattern and two of the anchor sites in this configuration lie within the exclusion zone initially identified. Currently discussions are taking place between the Proponent, the AAPA and the NLC to reach an agreed position on the extent of the exclusion zone around the reef.

The laybarge anchors need to be laid in the sandy bottom and reef structures are strictly avoided, so there is a mutual need to avoid reefs. The final identification of the anchor configuration will not be known; however, until the laybarge contract is finalised and the laybarge Captain has examined the work at the time of construction. Final identification will also be subject to the prevailing environmental conditions. It is the Proponent's view however, that the work will be able to be carried out with no impact on Walpinhthi Reef.

The reader is also directed to the response to **NTG 42**, **Section 8.4**.

12.4.1 Section 9.10.1 Aboriginal Sites of Significance

NTG 67: Under "sacred sites" (page 285), the report states that sacred site surveys were undertaken by the NLC in conjunction with traditional owners. It also states that it has been a high priority of Woodside not to damage or impact on sacred sites. It is indicated that, "None of these sites will be impacted on by the proposed development". However, the EIS strongly suggests that the WALPINHTHI REEF sacred site will be impacted. If this is the case, then the above statement should be altered.

Two Aboriginal groups are identified as having responsibility for various sacred sites. These are variously spelt as: YAK MANNING, YAK MANINH, YAK DIMINHIN and YAK DIYMINH. Consistent spelling is required.

NTG 67a: Clarify the impact on Walpinhthi Reef by the proposed development.

NTG 67b: Consistent spelling of the names of the two Aboriginal groups identified as having responsibility for various sacred sites is required.

The reader is directed to the response to **NTG 66b** (**Section 12.4**).

The correct spelling should be as follows:

- Yek Maninh
- Yek Dimininh
- Injin (sometimes Injun).

OEH 67: The Supplement should include further consideration of the planned disturbance to Walpinhthi Reef (Section 4.5.4). The Draft EIS states that anchoring for pipelaying and the shore pull operation will occur in this sacred site but does not provide justification for the disturbance or the alternatives that may have been considered in determining the need for disturbance. Discuss the options for managing the impacts to this site. Explain the strategy to be adopted should the Traditional Owners not give consent for the disturbance of Walpinhthi Reef.

OEH 67: The Supplement should include further consideration of the planned disturbance to Walpinhthi Reef.

A difficulty has been the lack of accessibility to define the exact location and extent of Walpinhthi Reef for the Proponent to adequately plan the proposed activities around. The Proponent was restricted from conducting a survey over the suspected area in 2004 when the opportunity was there to properly identify the reef. Notwithstanding this, the Proponent has been able to obtain Australian Navy soundings that were collected in 1983 over this area and has been able to correlate the position of a localised high spot on the seabed with the approximate position given for the reef by the NLC. The centre of that localised high spot is approximately 740 m south of the proposed pipeline route. The laybarge breasting anchors have to be placed approximately 500 m from the barge to provide sufficient holding force for the laybarge in the high tidal currents experienced in this area. This leaves approximately 240 m between the maximum extent of the anchors and the centre of the 'reef'. Discussions are ongoing within the tripartite meetings between the NLC, the AAPA and Woodside to determine mutually acceptable arrangements for the protection of the site and the construction and operation of the pipeline

It should be noted that the laybarge anchoring system has a very accurate positioning system for the placement of anchors and the positioning of the anchors by anchor handling tugs is directly controlled from the laybarge. The positioning system can actually input into it the reef position via a graphical display and barge operators can see where the anchors are in relation to the reef. This is the most effective management tool to be used to ensure there is no impact to this site.

NLC 48: Page 295 Figure 9.10 should show the location of the PW outlet in relation to Walpinhthi Reef.

NLC 48: Figure 9.10 should show the location of the PW outlet in relation to Walpinhthi Reef.

Arising from the tripartite meeting process it is planned to conduct a visit to the reef in April 05 with traditional Aboriginal owners, the NLC, the AAPA and Woodside representatives, to determine mutually acceptable arrangements for the protection of the site and the construction and operation of the pipeline. The PW outfall can be considered to be at the same location as the condensate export mooring.

12.5 Section 9.12 Existing Economic Environment

12.5.1 Section 9.12.1 Wadeye Township

NLC 50: Page 321- In relation to Northern Territory Local Businesses and services, there is no discussion of the relevant local businesses and services that exist at Wadeye.

NLC 50: There is no discussion of the relevant local businesses and services that exist at Wadeye.

Matters associated with business opportunities for local business will be addressed in detail in the draft SIMP. The reader is also directed to the response to **OEH 60a** (**Section 5.2.1**).

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13. Draft EIS Section 10 Risk Assessment Approach

NLC 55: Page 393 Vol 1 lists 5 impacts requiring a higher level of assessment. This list should include:

(a) marine contamination from the PW outfall;

(b) road use impacts (highest impact on residents expected from the project)

(c) EMP assessment processes

(d) Oil spill frequency and management

(e) Provision of further baseline EIS data

NLC 55: The list of impacts requiring a higher level of assessment should be extended.

A formal environmental risk assessment was undertaken as outlined in **Section 10**, **Volume 1** of the Draft EIS. The findings from this risk assessment are those outlined in **Section 10.3**.

The impacts identified through the assessment process as having a higher level of potential impact, in accordance with this risk assessment are:

- beach disturbance, due to potential for impacting on a small number of nesting and hatchling turtles;
- small hydrocarbon spills (onshore and offshore);
- fauna death and capture from pipeline trenching;
- introduction of feral and pest animals;
- vegetation clearing;
- biting insects resulting in mosquito borne disease.

NLC 51: Page 364 Would an additional risk of a hydrocarbon spill come from a rupture of the subsea export pipeline or condensate pipeline through such causes as anchor strike?

NLC 66: P. 456- is there any risk of anchor strike with the pipeline?

OEH 2: The Supplement should consider and describe the consequences of damage to the pipe by accidental anchor strike.

NTG 68: Has the proponent given consideration to risk assessment of terrorist activity for an unmanned wellhead platform? The EIS has not discussed the risk assessment of environmental impacts of export pipeline rupture for the following events:

- strike by sinking vessel; and
- dropped objects.

Consideration may be given to:

- Has the pipeline design incorporated subsea and onshore isolation valves?
- The use of plume discharge modelling for the near shore and offshore marine environments

In addition, social impact assessment indicates that consultation with the community of Wadeye has been undertaken. It is assumed that the risk to the community associated with catastrophic failure has been discussed however, have these risks been understood by the community? It is requested that Woodside demonstrate that the community of Wadeye has understood the risks inherent with the project (pers comm Matthew Stephen 2005).

NTG 68a: Has the proponent given consideration to risk assessment of terrorist activity for an unmanned wellhead platform?

CCTV coverage will be provided for monitoring any unauthorised approach or access to the wellhead platform. The system will be designed such that any movement in specified zones will trigger an alarm at the onshore gas plant Central Control Room (CCR). The Blacktip Emergency Response Plan will detail the procedures to be followed in the event of unauthorised approaches to the wellhead platform which will include notification of Coastwatch.

To prevent unauthorised access to the wellhead platform, the single access way at the boat landing will be secured by means of a security gate. This gate will be secured by an electronic lock operated either by keypad or swipe card. The gate will be monitored from the onshore gas plant CCR, and will have the facility for remote activation / deactivation of the lock.

A 'Threat and Vulnerability Assessment' will be carried out, by a specialist consultant, during the detailed design phase of the project to ensure that the security risk is adequately managed.

The Proponent will liase with NT Government and federal agencies as required.

NTG 68b: The EIS has not discussed the risk assessment, and environmental impacts, of export pipeline rupture for events such as a strike by a sinking vessel or dropped objects.

NLC 51: Would an additional risk of a hydrocarbon spill come from a rupture of the subsea export pipeline or condensate pipeline through such causes as anchor strike?

NLC 66: Is there any risk of anchor strike with the pipeline?

OEH 2: Consider and describe the consequences of damage to the pipe by accidental anchor strike.

Risk Assessment: The following risk assessment work has been done so far in relation to threats to the pipelines:

1) A risk assessment was undertaken to review the potential threats to the subsea pipeline integrity in the exclusion zone surrounding the Blacktip wellhead platform

The primary focus of the assessment was the threats to the pipeline integrity in the zone extending out to 500 m from the wellhead platform.

The Blacktip platform will normally be unmanned and consequently will have no operations related vessels in its vicinity under normal operations. Such vessels will only be present for planned maintenance visits and wireline operations as well as potentially during unscheduled visits following platform trips.

The platform is located in 52 m of water that is designated as a prawn fishing area but it is understood that prawn fishing in the area is not common. Very little other commercial fishing activity takes place in the region. No private fishing takes place as the location is too far from land for the majority of individuals.

The prime source of threat to the pipeline was concluded from this assessment to be the operations support vessels visiting the platforms.

The principal hazards associated with vessel movement are:

- dropped objects;
- dragging anchors;
- vessel sinking

DNV OS F101 Section 2 - C301 requires that where the boundary between Location Classes 1 and 2 (as defined by DNV OS F101) is closer to the platform than 500 m, this should be supported by a risk assessment. The result of the risk assessment is that the likelihood of events occurring that might threaten the integrity of the pipeline is so low as to be considered negligible. Furthermore, the normally unmanned nature of the platform makes the risks associated with any release from the subsea pipeline very low. This allowed the project to adopt an appropriate Location Class regime which was carried forward into the design.

2) A risk assessment was also conducted to evaluate the frequency and consequence of a helicopter crash in the vicinity of the export pipeline near the wellhead platform. It also estimated the risk to the pipeline due to helicopter impact.

The assessment of the risk to the gas export pipeline due to helicopter impact included the following steps:

- Estimation of the number of helicopter visits to the wellhead platform.
- Estimation of the distribution of visits with respect to the seasons of the year.
- Review of meteorological data to assess the percentage of times the helicopter approaches the platform over the pipeline.
- Review of historical accident frequency data for helicopters.
- Evaluation of the risk to the pipeline.

The result of the assessment was that the risk to the pipeline due to helicopter impact is considered to be negligible.

3) Studies conducted by the project during the development of the Draft EIS identified marine traffic and navigation in the area of the offshore pipelines. This was input into the pipeline mechanical protection philosophy and preliminary QRA that was performed during Front End Engineering Design (FEED) to identify any pipeline protection issues along the pipeline routes in addition to the scope of the more formal studies conducted as described above.

   The Draft EIS studies identified the following:

   - Offshore Military Exercise Zones: The pipelines are located within the R202G offshore military exercise zone. Discussions with the Department of Defence indicated that the offshore components of the Blacktip Project (i.e. pipelines) would have minimal effect on their training facilities and their activities would pose minimal risk to the integrity of the pipelines.
   - Marine Traffic: There is very little shipping traffic in the vicinity of the pipelines with the nearest existing shipping route approximately 100 km away to the north of the wellhead platform.
   - Fisheries: A range of fisheries are located within or adjacent to the Blacktip offshore area. However it was found that most commercial prawn fishing activity in the Joseph Bonaparte Gulf is carried out in areas 40 km or more west of the Blacktip wellhead platform. There was very little commercial barramundi, shark, mackerel and demersal fishery operations conducted in the Joseph Bonaparte Gulf in the vicinity of the Blacktip wellhead platform and pipeline route.

   Based on the results of the Draft EIS studies and the fact that it is intended to lower the pipelines below natural seabed level along the routes, it is believed that the risk of mechanical damage to the pipelines was low. This risk assessment will be formalised during the detailed design phase.

Requirement for Valves: The pipeline design has not incorporated subsea and onshore isolation valves. Risk assessments were conducted to evaluate the requirement for these valves. The gas export pipeline is some 110 km in length and under normal operations will be pressurised to approximately 90–100 barg. This large inventory is therefore available to feed any accidental release at the platform that occurs outside the riser Emergency Shut Down Valve (ESDV). A very long duration event is therefore possible and so it was necessary to consider the potential benefits of providing a subsea isolation valve (SSIV) in the pipeline to limit the impact of any such accidental release. However the main mitigating factor was the general lack of personnel normally located on the wellhead platform.

The investigation of the benefits of a SSIV was done along two separate lines:

- qualitatively, reviewing typical practice;

- quantitatively, using a cost benefit analysis approach.

The quantitative review took the form of an assessment of the anticipated risks due to riser events at the platform under normal operations. This was done by:

- developing a simple event tree describing the potential outcomes of riser events;
- estimating the consequences for the various outcomes;
- performing a cost benefit analysis calculation on the derived results;
- testing the various assumptions within the model for their sensitivities.

The result of the review was to recommend that the gas export pipeline be installed without a SSIV and that the Safety Case for the wellhead platform be written to include the risk management actions to be taken in the event of a jack-up rig approach.

The requirement or otherwise for the incorporation of beach valves with the pipeline systems shall form part of a formal risk assessment to be conducted in accordance with AS2885 during the detailed design phase, post project sanction, and prior to the application made for a Pipeline License.

However, a preliminary assessment has been conducted on this requirement and it has been concluded that a beach valve will not be required. The reasons for this are outlined below using an approach consistent with the guidance given by Section 2.2 of AS2885.1:

- Location Analysis: The location of the pipeline is remote with low human activity in the area. Hence both the risk and consequence of a pipeline rupture are low. As per Appendix E2 of AS2885.1, the area is not farmed at all with no mechanical plant activity current or anticipated. Hence, it is logical to conclude that there are no design events requiring external interference protection.
- Threat Analysis: Threats which could cause loss of containment are considered minimal i.e human activities that could result in pipeline rupture are considered low.
- Pipeline corrosion will be controlled with anti-corrosion coatings, sacrificial anodes, corrosion inhibitor and corrosion monitoring.
- All operations and maintenance activities shall be controlled by procedures.
- Natural events are not anticipated to cause loads sufficient to rupture the pipeline.
- Length of onshore pipeline is relatively small.

In addition, a beach valve increases risk due to the following:

- A section of the pipeline system would be exposed that would otherwise be buried. This would create a pipeline component that could potentially be vandalised and pose risk to local users of the beach.
- There would be more potential product leak paths.
- More complex cathodic protection required.

- External Interference Protection Design: The onshore pipeline between the beach and the onshore plant will be buried to at least 900 mm to top of pipe and it is anticipated that the pipeline will have a wall thickness that resists penetration from potential external interference. (The required wall thickness for external interference protection design shall be confirmed in detailed design).

NTG 68c: It is requested that Woodside demonstrate that the community of Wadeye has understood the risks inherent with the project.

Phase 1 of the Social Impact Assessment involved undertaking consultations with the Wadeye community about the project as discussed elsewhere in the Supplement document. However, the second phase of consultations has been proposed and is yet to be undertaken (refer to response to **NLC 11** (**Section 6.1**).

It is proposed that further communication with the general population of the town of Wadeye and Daly River Region will be undertaken during the second phase of the SIMP development. This will include information relating to the key risks associated with the Blacktip Project.

Demonstrating that the community has understood the risks inherent with the project is an impractical request. However, the Proponent will make its best endeavours to ensure that the broader population understands the Blacktip Project and its key risks prior to and during construction and during the operation phase.

14. Draft EIS Section 11 Marine Impacts, Preventative & Management Measures

14.1 Section 11.2 Physical Presence

NLC 56: Page 396 Refers to support vessels to the trading tankers. Would these support vessels assist with all moorings at the condensate mooring?

NLC 56: Would the support vessels to the trading tankers assist with all moorings at the condensate mooring?

Yes the support vessels to the trading tankers will assist with all moorings at the condensate mooring.

14.2 Section 11.3 Seabed Disturbance

OEH 3: The Supplement should quantify the potential impact of pipeline construction on the seabed rather than reporting it as "slight".

OEH 4: Quantification of sediment disturbance for each of the two options for post-lay trenching (plough vs. jetting sled) is required in the Supplement to facilitate informed comparison of the potential impacts of both options.

OEH 5: The detailed path of the pipeline is still unknown but undulations are known to occur along the seabed. Given this, evaluation of pipe construction requirements and the effect these may have on the seabed should be presented.

OEH 3: The Supplement should quantify the potential impact of pipeline construction on the seabed rather than reporting it as "slight".

OEH 4: Quantify sediment disturbance for each of the two options for post-lay trenching (plough vs. jetting sled).

OEH 5: Evaluation of pipe construction requirements and the effect these may have on the seabed should be presented.

The pipeline will be trenched for the majority of its length. Where the pipeline is not trenched, only the seabed directly under the pipeline will be affected (0.5 m width). Two different trenching methods are being considered for the offshore sections of the pipeline.

Option 1: Involves the use of a plough, which is towed along the pipeline by a vessel and digs a trench under the pipe.

Option 2: Use of a jetting sled, which is mounted with high-pressure water jets and pulled along the seafloor either behind the laybarge or some other support vessel. The sled straddles the pipe and jets water beneath it to dig a trench.

The two different trenching options would disturb a similar area of seabed and have very similar environmental impacts including temporary increased sedimentation of the water column and smothering of the seabed and associated benthic community. The area of the seabed likely to be affected is considered very minor compared to the area of seabed that will not be affected by construction works. In areas where the pipeline is trenched, only the seabed immediately adjacent to pipeline will be affected. For a 1 m deep trench, the plough will directly cut approximately 5 m width of seabed. The bulk of the sediment from within the trench is deposited approximately 5 m either side of the central trench, thus affecting a total area approximately 15 m wide, centred on the pipeline. A jet sled also disturbs an approximate 5 m central area directly below the pipeline, with light sedimentation spread over a wide area to minimise the formation of unnatural mounds on the seabed, to increase dilution of sediment and decrease benthic smothering. The total width is dependent on the final trenching methodology selected but will typically be 10–50 m. The precise amount of sediment disturbance cannot be quantified without knowledge of the detailed design of the pipeline and its route, as factors such as the length of pipeline to be trenched will impact the amount of sediment disturbed.

Some fauna may be able to survive this disturbance, though percentage mortality is expected to be high within the central 5 m area along the pipeline route, regardless of which method is used. Strong tidal currents can re-suspend sediments and spread sediment further afield. However, sedimentation is expected to be light outside the immediate zone of disturbance and any impact is expected to be minimal, particularly in an environment like the Joseph Bonaparte Gulf where turbidity and sedimentation rates are naturally high.

Adverse pipeline interactions with significant seabed undulations typically result in the pipeline free spanning in these areas. Route optimisation involves localised adjustments to the route to reduce the amount of free spanning. In some areas it will not be possible to reduce free span lengths to below acceptable and allowable operating values, and in these areas it will be necessary to correct or support these free spans. The main method used in the petroleum industry for correcting free spans is pipeline trenching. The detailed design of the pipeline, which will commence upon or just after project sanction, will look to further optimise the pipeline route in order to further reduce adverse pipeline interaction with significant seabed undulations.

The consequence of seabed disturbance caused by the installation of the pipeline is considered to be *slight* because:

- The narrow area of disturbance along the pipeline route, relative to the area of similar habitat (even if the whole pipeline route is trenched).
- The known rapid recovery rate of infaunal communities.
- The lack of sensitive receptors along the pipeline route e.g. installation will occur outside prawn migration times and over 200 m from Walpinhthi Reef.

However, the Proponent will attempt to minimise the length of pipeline that needs trenching during detailed design as this reduces the geotechnical risk to the Project, thus reducing the impact of the pipeline installation process on the benthic environment of the Joseph Bonaparte Gulf.

NTG 71: What will be the expected location of the cargo vessel anchors forward or to the rear of the swamp mooring?

Page 335. 'There are no known coral reefs, seagrass beds or other areas of sensitive bottom habitat along the pipeline route (Fugro 2004) (repeated 2 times on this page; see also ES: 8). Fugro appears to be a geotechnical report and it is doubtful if much attention was paid to the biota. Besides, this statement directly conflicts with the finding of gorgonians at site Pipeline 11 (Section 7: 177; Appendix B: 37). The proponents state the WALPINHTHI REEF is a sensitive Aboriginal cultural site. The term "sacred site" should be used rather than "sensitive Aboriginal cultural site". They also indicate there is potential for its disturbance by near-shore pipeline laying and shore pull activities. This contravenes previous statements which indicate that no sacred site will be damaged. This section should indicate any possible alternatives for the location of the pipeline and mooring facilities.

NTG 71a: What will be the expected location of the cargo vessel anchors forward or to the rear of the export mooring?

The cargo vessels anchors will be north of the condensate export mooring.

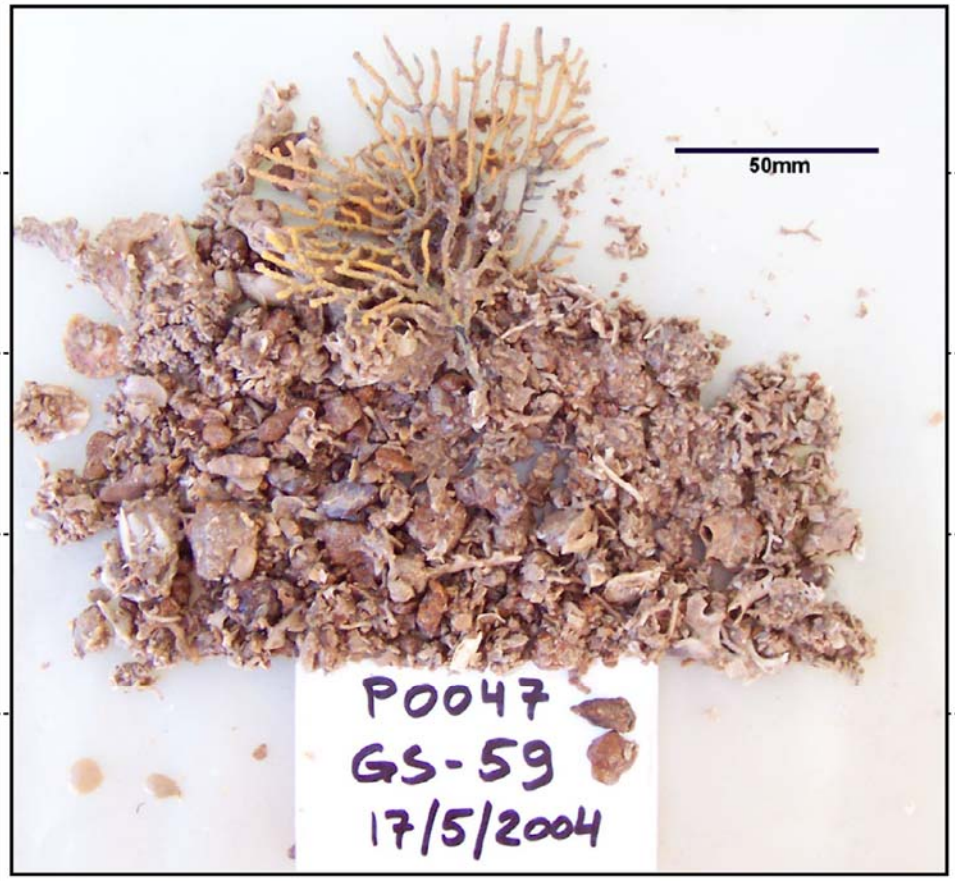
NTG 71b: Discuss the validity of the Fugro geotechnical report's findings on the biota of the area.

The geotechnical and geophysical studies use remote sensing techniques and bottom sampling devices to provide detailed information on substrate type. This information includes assessment of the sediments and hardness of the substrate and can be used to determine if reefs are present or if sediments support seagrass beds.

The geotechnical study (Fugro 2004) used multibeam soundings, single beam soundings, side scan sonar, chirp, boomer, sparker, refraction, magnetometer and geotechnical samples to interpret the bathymetry seabed features and shallow geology within the Blacktip Project area. The information collected by this study maps the occurrence of hard substrates or reefs within the Blacktip Project area. In addition, a total of 63 grab and drop core samples were collected as part of the geotechnical study, in addition to the 38 grab samples collected as part of the environmental survey. These geotechnical samples were logged and described and included information on sediment type and macrobiota. A number of the nearshore samples were also photographed and presented in Fugro (2004). An example is presented **Figure 12**.

Fugro Marine Division
FSHY41-1
SEABED SAMPLE LOG

CLIENT:	Woodside Energy Ltd	SAMPLE NO:	GS_59
JOB NO:	P0047	DATE:	17/05/2004
PROJECT:	Blacktip Inshore Geophysical	EQUIPMENT:	VAN VEEN GRAB (20l)
NAVIGATION:	StarfixHP	TIME ON BOTTOM:	9:58
LOCATION:	Route-1 : KP103.826,Offset -7m	WATER DEPTH:	19.3m (uncorrected)
EASTING:	540 888.6m		
NORTHING:	8 425 873.5m		
LATITUDE:		RECOVERY:	0.1 litre total
LONGITUDE:			

Depth(m)	DESCRIPTION
00	

Light brown to grey, fine to medium, well sorted quartz (silica) SAND and fine to coarse GRAVEL composed of skeletal fragments including shells, coral and sponges, and rounded ferruginous gravel. This gravel supports living marine biota including coral.

- **Figure 12 Seabed Sample Log (Fugro)**

NTG 71c: The term "sacred site" should be used rather than "sensitive Aboriginal cultural site" when referring to Walpinhthi reef. Discuss impacts on the reef.

The reader is directed to the responses to **NTG 66a, NTG 66b** (**Section 12.4**) and **OEH 67** (**Section 12.4.1**).

NTG 71d: This section should indicate any possible alternatives for the location of the pipeline and mooring facilities.

Alternative pipeline corridors are presented in the Draft EIS. The condensate mooring location is determined by the minimal depth of water required to enable tankers to approach and suitable seabed characteristics to support anchor fixing.

14.3 Section 11.4 Beach Disturbance

Turtles: Acid Sulphate Soils

Discuss impacts on NES matters.

Discuss impacts on NES matters.

The reader is directed to the response to **NTG 58** (**Section 11.1.3**).

Acid sulphate soils although highly unlikely to occur in the project area are unlikely to have any effect on sea turtles, their eggs and hatchlings. The eggs are deposited above the water table that is likely to show the greatest impact by changes in pH. The moisture available to sea turtle eggs comes from precipitation during the wet season. The sands are rich in calcium carbonate from mollusc shells and other invertebrates. These provide a natural pH buffer to acid contaminated precipitation. Most of the turtle nesting occurs in the dry season of the bioregion. Eggs absorb moisture from that contained either within the porous calcium carbonate particles or from between the silicious sand grains. During the dry season with its cool nights, dew formation within the surface layers of the sand provides moisture to the developing eggs.

NTG 73: The Flatback turtle is listed as vulnerable under the Commonwealth *Environmental Protection Biodiversity and Conservation Act 1999*. Though it is stated that the area is not critical for the survival of the species this does not mean that importance of the nesting area should be discounted. The contribution of the project to increased mortality amongst hatchlings in an already vulnerable species needs to be put in context. The following is taken from the Commonwealth Department of the Environment and Heritage (DEH) Marine Turtles website:

"When breeding, nesting females return to the same area, thought to be in the region of their birth. As hatchlings, they become imprinted to the earth's magnetic field and, possibly, the smell of the waters adjacent to the nesting beach which allow them to successfully complete their migration." (DEH, 2005)

"Between nesting efforts, female turtles gather adjacent to the nesting beaches. They return to the same beach to lay consecutive clutches." (DEH, 2005)

The occurrence of nesting sites in eastern portion of the gulf coastline is less frequent than areas further to the south. The rarity and presence of the nesting sites in the vicinity of the proposal site makes these important on the regional level. This issue requires further consideration.

NTG 73: The contribution of the project to increased mortality amongst hatchlings in an already vulnerable species needs to be put in context.

Relocating Sea Turtle Eggs: Throughout the Draft EIS (**Appendix C**, **Volume 2**) it has been stressed that the aims of clutch relocation is to increase hatchling survival. This is placed in the context that presently the eggs are either eaten by goannas or collected by the traditional Aboriginal owners or other persons. There was no evidence of hatchling tracks to indicate that eggs hatched naturally in the vicinity of the pipeline landfall. Measures such as relocating eggs to a hatchery for safe development and supervised release of hatchlings will increase the numbers of hatchlings entering the water from Yelcher Beach.

With regards to the precision with which hatchlings return to the beach of their birth, in 1974 and 1975, as a research assistant of Dr Colin Limpus of Queensland EPA, Dr M Guinea was involved in scale clipping in excess of 200,000 hatchlings that were released from Mon Repos Beach at Bundaberg. In the summers of recent years, those uniquely identified hatchlings are returning to nest as adults. Few have returned to Mon Repos Beach. Most have nested on the beaches to the north and south of Mon Repos.

Regarding the suggestion that females remain close to the nesting beach during their inter-nesting intervals, on Bare Sand Island, in 2001, four female Flatback Sea Turtles were fitted with satellite transmitters as they left the nesting beach after laying. In addition three were fitted with time depth recorders. Each turtle moved between 20 and 40 km from the nesting beach and remained relatively motionless in 30 to 40 m of water on the seabed for the next 10 days before swimming back to the island to lay their next clutch of eggs. Flatback sea turtles do not remain in the vicinity of the beach during the inter-nesting period. There is similar evidence for Green, Olive Ridley and Loggerhead sea turtles.

Regarding the significance of the nesting sites in the region of the pipeline landfall. Extensive surveys by Ray Chatto and Colin Limpus of the Northern Territory coastline reveal that sea turtles either nest or attempt to nest on just about every beach in the Northern Territory. There are even about 20 turtle nests laid each year on Casuarina Beach in Darwin City. The species involved, in order of abundance, are Flatback, Olive Ridley and Green. In 1990 a coastal development project at Dundee Beach, 150 km to the west of Darwin, constructed a concrete boat ramp across an area of sea cliffs. This obstruction to the long shore drift resulted in a sand beach forming on the northern side of the boat ramp. In 1995 the first Flatback Sea Turtle was recorded nesting on this stretch of new beach that did not exist prior to 1990. This indicates how Flatback Sea Turtles explore new beaches as suitable nesting sites. Having nested successfully at a site, female Flatback Sea Turtles will remain faithful to that site. In ten years of monitoring sea turtle nesting at Dundee Beach, Bare Sand Island and Quail Island, Dr Guinea has found no Flatback Sea Turtle changing locations even though Bare Sand and Quail Islands are only 1 km apart on the same reef.

Training: Relocating sea turtle eggs will only be carried out by trained personnel and that a detailed Turtle Management Plan should be prepared for this process. The Proponent has committed to preparing such a plan once the full construction details are known for the pipelay operations including timing and duration. These details will be known at the end of the tendering process for this activity which is anticipated to be in July 2005. The plan will be finalised (in partnership with the offshore installation contractor) and submitted to government for approval in the 1st Quarter 2007 prior to construction. Pipeline construction is not proposed to commence until the 2nd Quarter of 2007. A key component of this plan will be the inclusion of appropriate guidelines for the protection of turtle during pipe lay operations.

Literature on Relocation of Eggs: There is a large and diverse literature on the successful relocation of sea turtle nests. Those relocation activities that have been unsuccessful lack quality control of either the age of the eggs or the procedures involved in egg handling and transportation. Enterprises such as Reefseekers Dive Centre on Gili Air in Lombok Indonesia, purchase the sea turtle eggs from the village market and handle them carefully during transportation and burial to get an acceptable hatching success for Green Sea Turtle eggs from usually an unknown source. Eggs are unaffected by the translocation if shifted within two hours of laying (Limpus et al. 1979). Chilling the eggs to 10–14ºC increases their resilience to rough handling and the time over which they can be transported (Limpus and Miller 1983).

Turtle Management Plan: The Blacktip Project detailed Turtle Management Plan will be based on the *'Guidelines on Natural and Artificial Incubation of Marine Turtle Eggs'* (Limpus 1993) developed Dr Colin Limpus of the Queensland Department of Environment, Australia, for sea turtle recovery plans of ASEAN countries. These provide a valuable resource for organisations or agencies embarking on sea turtle restoration programmes involving artificial incubation of egg.

Dr Colin Limpus's recommendations for hatchery construction and maintenance are detailed below.

Essential Environmental Conditions for Incubation of Marine Turtle Eggs:

- Several essential environmental conditions are required to achieve the most successful incubation of marine turtle eggs under natural conditions.
- Marine turtle eggs require well ventilated, low-salinity, high-humidity, sand/soil surrounding the nest.
- Marine turtles usually lay their eggs above the level of tidal inundation and at least 30 cm below the beach, surface (depth varies among the species). Sand that is regularly washed over by seawater (high tides) can be too salty and cause reduced incubation success of the eggs.
- Flooding with either salt water or fresh water kills marine turtle eggs.
- Flooding by either seawater or fresh water for a few hours will usually drown the eggs. It is important that the air spaces between the sand grains do not become filled with water. Nests need to be above the water table and above normal high tide and/or storm surge level.

- Marine turtle eggs can be expected to have approximately 80% incubation success when nest temperatures are in the range of 25–31°C.
- When nest temperatures exceed 31.5°C, incubation success decreases. At nest temperatures above 33°C, all eggs are killed.
- It is highly probable that some fungi and bacteria, when present in the sand, can reduce the incubation success of some species of turtle eggs.

Movement Induced Mortality of Marine Turtle Eggs:

- When a marine turtle comes ashore to lay eggs, each egg contains a very small embryo (gastrula) that has temporarily ceased development. At this stage of development a marine turtle egg can survive the bumping and rolling associated with being laid. However, within approximately two hours of being laid the embryo recommences development. From this time onwards, rotation of the egg may cause its death. The eggs continue to be very, susceptible to movement induced mortality for the next few week of incubation.
- Marine turtle eggs should not be moved after they are laid. Wherever possible, marine turtle eggs should be left to incubate where they are laid. If the circumstances are such that the eggs have to be moved to ensure that incubation can occur, then it is best to complete the movement of the eggs within two hours of them being laid and with no rotation of the eggs.

Temperature Dependent Sex Determination:

- Marine turtles, like many other turtle species and crocodilians, possess temperature dependent sex determination. The sex of the hatchling is determined during the middle third of the incubation period by the temperature of the nest.
- The pivotal temperature is the theoretical constant incubation temperature that would produce an equal proportion of male and female hatchlings. The pivotal temperature is not a constant for all marine turtle species but varies among the species and can vary among populations within a single species.
- For all species, warm temperatures (nest temperatures above the pivotal temperature) produce mostly female hatchlings while cool nests (below the pivotal temperature) produce mostly male hatchlings. At very low nest temperatures (approaching 26°C) all species produce 100% males and at very high nest temperatures (approaching 32°C) all species produce 100% females.
- Incubation temperature for marine turtle eggs is a highly variable parameter, being a function of the latitude of the beach, sand colour, orientation to the sun, degree of shading, nest depth, time of year and rainfall. However, on any one beach it is usually fairly predictable once detailed temperature profiles have been quantified. The temperature regime of nests and hence hatchling sex ratios can be easily altered by transferring eggs from natural nests to artificial nests or altering the vegetation of the nesting habitat and hence altering the extent to which nests are exposed to the sun or shade.

- Quantifying hatchling sex ratio requires that large numbers of hatchlings be killed for histological examination of the gonads. This is unsuitable as an on-going management task. Therefore, as a general principle, management of turtle egg incubation and hence sex ratios is simplest when the majority of the eggs are incubating in natural nests.
- In artificial nest environments, especially hatcheries, there is great potential for gross alteration of sex ratio unless active management of the temperature environment occurs.

Natural Sex Ratio:

Because hatchling sex ratio can vary greatly from beach to beach, the sex ratio of an entire population will be difficult to estimate. In recent years, the sex ratio of wild populations of immature marine turtles in their feeding areas have been measured. The measured sex ratios are strongly biased to female at most sites and for most species. For example, *Chelonia mydas*, 54% to 84% are female at different habitats in central and southern Queensland, Australia. For *Eretmochelys imbricata*, 72% to 80% are female in the southern and northern Great Barrier Reef.

On the basis of these limited data, where a hatchling sex ratio has to be managed, a sex ratio of 70±10% females is recommended.

Management of Egg Harvests:

To maintain population stability, ensure that, at the district level, a minimum of 70% of the clutches of marine turtle eggs successfully produce hatchlings into the sea.

If the management intent is to increase the size of a depleted population, the goal will be to have greater than 70%, perhaps as high as 100%, of clutches successfully producing hatchlings.

Where there is an excessive harvest or mortality of turtle eggs, establish a beach management project to increase hatchling production to the desired level for each species using *in situ* clutches.

Where excessive egg harvest or mortality can not be effectively reduced by leaving eggs in the natural state on the beach, use a hatchery programme to increase hatchling production from eggs relocated from the natural nesting sites to protected areas.

Management of Marine Turtle Egg Incubation:

Four goals to strive for when managing the incubation of turtle eggs:

- High emergence success from individual clutches (>80% average emergence success can be expected).
- Sex ratio slightly biased to female (recommended 70% ±10% female).
- Correctly imprinted hatchlings. Maintain the incubation and emergence system as close to natural as possible: natural sands, no wire cages, no rapid contact with natural seawater.
- Healthy vigorous hatchlings entering the sea.

Situations that may justify use of artificial nest sites or hatcheries:

- Clutches laid below the high tide level or below the storm surge / erosion line.

- Clutches laid in areas with an extremely high probability of being dug into by another nesting turtle.
- Clutches laid in areas with a high probability of being collected by people or being preyed upon by dogs, pigs, varanid lizards or similar predators.
- Clutches laid in sand/soil with a high microbial content.

Movement of Eggs:

- When the turtle egg is laid, it contains an embryo that has already developed to a pin-head sized collection of cells (gastrula). Most failure of eggs to hatch in hatcheries is the result of disruption of subsequent embryonic development (i.e.. early embryonic death), not infertility. Microscopic examination of the embryo in turtle eggs as they are laid shows that infertile eggs are usually extremely rare at most rookeries.
- In some localities infertility may be a problem.
- The longer the interval from when the eggs were laid to when the eggs are moved, the greater the probability that the movement will kill some or all of the eggs.

If a clutch of eggs is to be purchased from an egg collector, then adopt the following guidelines:

- Each year educate the egg collectors in the safe handling of turtle eggs.
- Acquire only those eggs that have been transported in the proper manner to the hatchery.
- Enter into a contract with the egg collectors so that they receive the market price for each egg on delivery, plus a bonus of each of their eggs that hatch successfully. This ensures the collectors have an interest in the number of hatchlings produced by the hatchery.
- If a clutch of eggs is to be relocated to an artificial nest site or hatchery, then the following guidelines should be followed closely:
- Complete the movement within 2 hours of the eggs being laid.
- Avoid rotation of the eggs, especially vertical rotation.
- Use a stiff-sided container to carry the eggs.
- Do not wash the eggs, especially not in seawater.
- Where possible, relocate the eggs to a similar habitat with respect to depth, shade, sand temperature and sand texture.
- Avoid the use of probing rods when finding the eggs.
- The contents of broken eggs smeared on the other eggs can attract crabs and other predators to the relocated eggs.

Management of Artificial Nests:

- Select artificial nest sites to replicate natural nesting habitat.
- Construct the artificial nest with replicate depth and width to that of natural nests for the species.

- Remove all vegetation (grass and vines) growing within 0.5 m radius (minimum) of the artificial nest site.
- Use plastic or other non-metal fences/cages to protect nests. (Metal cages/fences around the nest sites have the potential for altering the earth's magnetic field around the nest and hence altering hatchling imprinting).
- Wherever possible allow the natural emergence of the hatchlings from the nest.
- Wherever possible allow the immediate release of the hatchlings from the nest to run across the beach to the sea.
- Avoid holding hatchlings captive in cages. Holding hatchlings in pools for one or more days disrupts their natural dispersal processes for them, almost certainly substantially increasing mortality while at sea.
- Change the location of hatcheries at approximately yearly intervals to minimise the accumulation of microbial organisms (bacteria, fungi) in the sand.
- After the hatchlings have emerged, remove broken shells and unhatched eggs from the hatchery (bury these in the beach below the high tide level).

Management of Sex Ratio:

- It is recommended that when averaged across all the rookeries for the region, the hatchling sex ratio should be approximately 70% female (±10%).
- Measure sand temperatures at all major rookeries for, the genetically distinct stock.
- When the pivotal temperature for the population is known:
  - Identify the warm (female producing) and cool (male producing) rookeries.
  - Ensure that good hatchling production is occurring at both the male and the female producing beaches.
- When the pivotal temperature is not known, ensure that eggs are incubating from a full range of natural habitats, especially with regard to natural shading.
- At rookeries with natural beach vegetation, maintain the same ratio of shaded and unshaded clutches as occurs naturally.
- Hatcheries provide very artificial nest sites with respect, to the range of sand temperatures available to the eggs.
- Endeavour to provide the same range of sand temperature as occurs at natural nest sites.
- Use more than one hatchery, if necessary.

Use shading of different intensities to create sections of the hatchery so that one section produces all males (26–27°C) and another produces all females (30–31°C). (Sand temperatures measured at nest depth).

Partition eggs into the two sections so as to produce the desired sex ratio. Adjustment of shade intensity throughout the breeding season may be necessary to maintain these temperatures.

Low cost shading can be provided with palm fronds. Shade cloth sheeting may be more suitable for altering intensity of shade in response to changing sand temperature.

Incubation in styrofoam boxes and incubators.

Eggs can be incubated in styrofoam boxes filled with sand from above the high tide level of the nesting beach. If the eggs are handled carefully, incubation in styrofoam boxes usually has the following results:

- high hatching success;
- the hatchlings produced are usually all males;
- the hatchlings are weak and lack the normal vigour of naturally produced hatchlings.

Incubating in styrofoam boxes is not recommended because it produces weakened hatchlings. There may also be significant problems with regard to sex ratio and to imprinting depending on the structure used for housing the boxes during incubation.

However, styrofoam boxes may be able to make a significant contribution to improving incubation success of clutches that require protection but are laid at beaches that are remote from the hatcheries.

Collect eggs laid at remote beaches directly from the nests into styrofoam incubation boxes, preferably collecting the eggs within 2hr of them being laid. Minimise rotation of the eggs.

Immediately transfer and store the styrofoam incubation boxes to a nearby site with a minimum of transportation, especially avoiding boats.

Although these guidelines were developed for conservation orientated hatcheries to counteract the impacts of long-term egg harvests by the local people, the same principles have been utilised in Dr Guinea's (Charles Darwin University) studies but with the requirement of extra protection from goannas, as Roger Vanderlely describes in his masters thesis:

Hatchery Construction and Use: Over the two year period of the study, three hatcheries were constructed in order to protect clutches from goanna and other predation. Two of these were built on Middle Beach, one in 1993 and one in 1994, and one on Field Island (1994). A description of each is provided below.

A central area of Middle Beach was selected for the construction of the 1993 and 1994 mainland hatcheries. Both the 1993 and 1994 hatcheries were placed on the first dune, some 20 m behind the crest. An area of bare sand away from shade trees was chosen. This area received direct sunlight from dawn to dusk and was easy to access. The 1994 hatchery was located 10 m east of the 1993 hatchery site but in similar conditions.

The hatchery on the East Beach of Field Island was placed 10 m behind the crest of the dune. The hatchery was only 5 m from the base of the second dune and received late afternoon shade typical of the beach.

For the Middle Beach hatchery in 1993, eight 2.5 m star pickets and a roll of light-gauge, large-mesh wire mesh were used to construct a 3 m^2 cage in the sand. Trenches were dug around the perimeter of the hatchery to a depth of 80 cm and a layer of large mesh wire was placed in each before it was refilled. This was done to prevent goannas digging under the side walls and gaining access to the nests within. A roof of wire mesh was also placed over the hatchery.

Observations of goannas chewing through the wire instigated fortification of the structure. Chain mesh was wrapped around the hatchery to a height of 1 m. The same mesh was laid out around the hatchery and buried at a depth of 15 cm. The horizontal and vertical sections of chain mesh on each side of the structure were tied together with wire.

In 1994 on Middle Beach, twelve 2.5 m and several smaller star pickets were used in the construction of the 1994 mainland hatchery. The star pickets were placed in a 10 m x 10 m square with one of the corners facing the ocean. Heavy-gauge large-mesh wire and chain mesh were attached to the star pickets to a height of 1.7 m. As with the 1993 hatchery, chain mesh was laid down in front of each side of the hatchery and buried at a depth of 15 cm. These pieces of mesh were overlapped to prevent goannas digging into the hatchery from the corners. A fringe of light-gauge, small-mesh wire placed on top of each side excluded goannas access to the hatchery by climbing the walls.

On Field Island in 1994, ten 2.5 m star pickets were placed in a circle. Light-gauge, small-mesh wire was wrapped around the star pickets to a height of 2 m. Chain mesh was attached to the star pickets to a height of 1 m and was laid out in front of the hatchery and buried at a depth of 15 cm. The bottom 15 cm of chicken wire was removed to facilitate the release of hatchlings through the chain mesh after completion of the study.

Relocation of Clutches to the Hatcheries: Clutches were relocated to a hatchery as soon as they were found. Care was taken not to rotate the eggs during handling (Limpus et al. 1979, Limpus and Miller 1980). Eggs were removed from the nest and placed in a bucket containing sand from the nest.

Relocated clutches were placed in artificial nest holes dug to 50 cm depth. These nest holes replicated of the original shape and depth of the egg chamber, with a shaft of approximately 15 cm diameter. The bowl of each nest was of approximately 25 cm diameter. These dimensions are similar to those of the natural nests (Guinea *pers comm*, Limpus *pers comm*).

Placement of Clutches within the Hatchery: Initially clutches were placed in the corner of the hatchery furthest from the sea. Successive clutches were placed progressively closer to the water as the hatchery filled. Clutches were placed at least 30 cm from the hatchery wall and 35 cm apart from each other. This was in order to maximise the number of clutches that could be placed in the

hatchery. Each clutch received with a plastic nest tag stating date, species, tag numbers of the female and clutch size. This tag was placed at the bottom of the hole. The location of each clutch was marked with a stick which carried a second tag bearing the same information as that inserted with the eggs.

Hatchling Emergence and Hatched Clutches: Nests within the hatchery were monitored for signs of hatching. When a clutch was due to emerge, a constant night-time vigil was kept at the hatchery. Times of clutch emergence were recorded. Upon completion of clutch emergence the nest was opened and examined for dead eggs and hatchlings. Numbers of dead hatchlings, live hatchlings trapped in the nest, part developed embryos and undeveloped eggs remaining in the nest were recorded. Any hatchlings found live in the nest were released if healthy, or taken for sex determination if weak or moribund.

'Emerged' hatchlings (Table 16) were defined as those that were able to emerge from the nest under their own power within two days of the first hatchling emerging from that clutch." (Vanderlely, R. 1997. Nesting ecology of flatback sea turtles (*Natator depressus*) at West Alligator Head and Field Island, Kakadu National Park. Master of Science Thesis Northern Territory University.).

Impacts from Blasting: The nearshore geotechnical survey (Woodside 2004) conducted in mid 2004 identified discrete ridges of ferruginous caprock running in a north–south direction located out to 2 km from the shoreline. Testing indicated a medium rock strength for this material (UCS value could be greater than 20 MPa). However, the report did note that laboratory strength testing was difficult. This was due to the number of joints (natural and drilling breaks) in the cores which could have biased the UCS test results towards higher strength values consistent with the more competent nature of the test specimens between breaks. The use of an excavator dredge fitted with a rock breaker may work in this environment and that this is a preferable alternative over the use of explosives. However, the Proponent is currently tendering for this work and wishes to evaluate the various installation tenderer's proposed methodologies for excavation of the trench in this area before adopting the final methodology. Award of this contract is currently scheduled for July 2005, subject to project sanction.

Ground Vibration Levels: Typically the ground vibration levels would not exceed a peak particle velocity of 200 mm/s depending to an extent on the method for drilling and charging the holes. The typical nominal maximum level of airblast overpressure would be around 135 dB (Lin Peak) over a very short time scale (<1 s).

Impacts: A significant potential impact associated with underwater blasting is the potential noise effects on fauna. Underwater explosions are the strongest point source of explosions in the sea (Richardson et al. 1995). Furthermore, potentially damaging sound pressures can propagate greater distances along hard substrate as opposed to soft substrate. The following information presents typical behavioural and physiological responses to noise disturbance from the effects of blasting.

Impacts on Marine Mammals: Few specific data are available relating to disturbance or blast injury effects of underwater explosions on marine mammals. Richardson et al. (1995) notes that certain pinnipeds and toothed whales exhibit short-term avoidance reactions. Furthermore, various marine mammals show considerable tolerance of noise pulses from explosions. Nearby blasts can result in injury and death, but exact threshold levels for these physiological characteristics are not well-established (Richardson et al. 1995).

Impacts on Sea Turtles: If the procedures of nest relocation to a hatchery on Kentjiptharra Beach are adopted then drilling and blasting can go ahead as required with little impact on marine turtles. In 2003 and 2004 the RAAF disposal team detonated World War II bombs on Bare Sand Island and on nearby Quail Island. The 2003 detonation involved a 200 lb Japanese bomb plus an unknown amount of modern day explosive. The bomb was discovered and detonated where it lay in the intertidal zone. It was detonated in the peak of the nesting season and at a time when Dr Guinea's research team lead by Ms Koch was camping on the island. In the immediate reef area the team had tagged more than 500 subadult Green and Hawksbill sea turtles that feed on the intertidal reef. Following the detonation there was no evidence of sea turtles being adversely affected by the explosion. Female Flatbacks nested that night as usual. There was no hiatus in hatchling production and feeding turtles were present on the reef in their usual numbers. The crater left by the explosion was more than 5 m in diameter. It is unlikely that explosions associated with blasting the path for the pipeline will be of that size. The impacts on sea turtles of blasting in the intertidal zone are likely to be insignificant, short-lived and undetectable.

Mitigation and Management Measures: In the event that blasting is necessary to assist in the nearshore installation of the pipeline, authorisation will be sought from the *NT WorkSafe* under the *Dangerous Goods Regulations (1985) (*NT) and Australian Standard AS2187.2 - 1993 - Explosives Storage, Transport and Use, Part 2, in advance of blasting activities commencing. Mitigation measures associated with marine blasting will be incorporated into the Blasting Management Plan which will be prepared in advance of construction and approved by the relevant regulatory authorities (**Section 15**, **Volume 1** of the Draft EIS).

If drilling and blasting is definitely required, a watch will be maintained prior to and during offshore blasting operations for the presence of marine mammals and turtles in the vicinity of the blasting work areas.

Installation of a temporary groyne: The construction of a temporary groyne will have no impact on sea turtle nesting. As the turtles approach the beach they swim parallel to the shore and just beyond the surf. They judge and choose the location on the beach where they will emerge. When they come ashore they encounter rocks, logs, debris and even boats on some beaches. Female sea turtles avoid these obstacles and move along the beach some metres until the object is of no concern. The turtles simply nest further along the beach. In the coastal states of Malaysia and on Bare Sand Island, sea turtles avoided objects on the beach until they became familiar with the presence of these objects. As the temporary groyne will cover only a small section of the beach, the remainder of the beach will be available for nesting (Hendrickson 1958).

Movement of Nests: Moving nests is possible with the right training. It is successful in producing healthy hatchlings. With careful attention hatch rates can equal or exceed that of nests left in the wild.

Relocation of sea turtle nests have become a routine procedure for sea turtle conservation measures in Sabah, Sarawak and in rookeries on Peninsular Malaysia where every nest is relocated to the protective security of a hatchery. This procedure has been in place for up to 20 years in Sabah where armed guards protect the hatchery from egg poachers (Pilcher and Ismail 2000).

At Mon Repos Beach at Bundaberg, Queensland, sea turtle nests in danger of being lost to beach erosion are relocated to a safe hatchery environment on the top of the sand dunes (Kay 1995).

The procedures of collecting eggs as they are laid or digging into the nest shortly after the female has finished nesting and removing the eggs has become standard practice in many sea turtle conservation programmes. Care should be taken to retain the correct orientation of the egg by marking the upper surface with a pencil. Movement induced shock is further reduced by packing the eggs in either indigenous sand from the nest or a packing material such as moistened vermiculite. Transport is by the smoothest method possible in a firm sided container. The eggs should be protected from direct sunlight and drying wind during reburial. The nest location should be marked and the date of relocation should be recorded.

The results of the hatching process should be recorded in an ordered manner and reports on the hatching rate and ambient environment should be provided to the relevant offices of the Northern Territory Government and to DEH.

Monitoring of Turtles: During construction activities on the beach the proponent will be responsible for and will undertake monitoring of these activities in relation to their potential impact on turtle populations. Monitoring teams will comprise trained personnel in turtle management who will be led by a senior experienced team leader responsible for monitoring reporting and the implementation of turtle management measures presented in the Turtle Management Plan. Monitoring reports will be prepared and will be issued to the internal team as part of the routine monitoring and report procedures to be implemented through the Project Assurance Process. These reports will be issued to government departments in the Northern Territory and to DEH for review. The information contained in these reports will also be made available to other organisations interested in maintaining data on turtle numbers and species in northern Australia.

Temporary Groyne

OEH 16*:* The Draft EIS indicates the "potential installation of a temporary groyne". OEH understands the purpose of a shoreline groyne is to mitigate near-shore currents, particularly long-shore drift that occurs parallel to the beach. Groynes are typically constructed to limit beach erosion by long-shore drift, and certainly do "affect sediment transfer along the beach and interrupt beach nourishment". More discussion is required regarding the intended use of the groyne impacts of the groyne, and measures to mitigate them. A timeline of groyne presence is also required.

OEH 16: More discussion is required regarding the intended use of the groyne, impacts of the groyne and a timeline of groyne presence.

The groyne is only required to facilitate the excavation and subsequent backfill off the pipeline trench just seaward of the high water mark where this area of the trench would be worked on by land based excavators. The groyne acts as a support for the land based equipment above the water level. It will only be formed just prior to the section of the pipeline route around the high water mark being trenched and will remain there until after the pipelines have been pulled ashore and the trench backfilled. The groyne will then be completely removed at that time. At this stage it is envisaged that the groyne will only need to consist of *in situ* material with no requirement to import material; however, this will be confirmed once installation contracts have been awarded. Due to the short time scale that the groyne will be present, it is anticipated that the presence of the groyne will not provide any long term effects on the area.

Contrary to the statement made in **Section 11.4, Volume 1** of the Draft EIS about 'beach erosion by long-shore drift', a more recent coastal erosion assessment study concluded that there is no evidence of any significant long shore drift at the shore crossing location (Worley Parsons 2004). The report indicates that the presence of the two rocky headlands either side of the shore crossing (Maning Point and Yulow Point) limits longshore transport to minor seasonal adjustment of the orientation of the shoreline. Furthermore, the report concluded that the location of the dune at the shore crossing and the overall position of the beach has been stable over the period 1986–2001.

14.4 Section 11.6 Marine Pest Species

OEH 7: The likelihood of exotic species being introduced through fouling should be clarified as the Draft EIS suggests that the fouling community is expected to consist of local species "although some [vessels] may come from international waters". Proposed mitigation measures should be described.

NTG 74: Page 341 does not adequately address aquatic pests, in particular the translocation of non-indigenous fouling species on rigs etc. This section and later (Table 15-3, Page 491) largely ignore introductions of marine pests through hull and structure fouling.

Further the Australian Quarantine and Inspection Service (AQIS) Australian Ballast Water Management Requirements Section 4 states that "*Ballast exchanges must be conducted outside the Australian 12 nautical mile limit. It is also recommended that ballast exchanges be conducted as far as possible away from shore and in water at least 200m deep.*" (pp 5 AQIS, 2001) The EIS identifies that the wellhead platform as a suitable location for international shipping to conduct ballast water exchange. It is suggested that Woodside reconsider conducting ballast water exchange at the wellhead platform given the water depth recommendation described in the AQIS Ballast Water Management Requirements.

OEH 7: The likelihood of exotic species being introduced through fouling should be clarified. Proposed mitigation measures should be described.

NTG 74: The Draft EIS does not adequately address aquatic pests, in particular the translocation of non-indigenous fouling species on rigs etc.

The international efforts and focus for controlling invasive species has shifted from hull fouling management measures to ballast water management. The introduction of marine invasive species by hull fouling was probably the main mechanism for the introduction of marine invasive species during the 1800s and early 1900s, when wooden vessel were in operation for transportation of cargo. However, with the need for increased efficiency in international shipping and advent of more effective antifouling techniques, this problem has decreased and the problem of ballast water has increased (CSIRO 2005).

The availability of effective mitigation and management measures to prevent the introduction of marine pests by means of hull fouling are extremely limited. There are no barrier techniques any where in the world that meet the requirements for being cost effective, technically feasible, safe and environmentally sound (CSIRO 2005). Similarly, international and national efforts through the auspices of the International Maritime Organisation (IMO) and the Commonwealth Department of Agriculture, Fisheries and Forestry, respectively are concentrated on reducing the introduction of invasive species in ballast water. The IMO guidelines for ballast water transport (*Guidelines for the Control and Management of Ships' Ballast Water to Minimise the Transfer of Harmful Aquatic Organisms and pathogens, 1997*) do not currently give any consideration to hull fouling as a possible introduction vector (CSIRO 2005).

The environmental risk assessment (**Section 10**, **Volume 1** of the Draft EIS) and **Section 11.6 Volume 1** of the Draft EIS assessed the risk associated with the introduction of marine pests by means of fouling as low. This assessment is based on the following:

- Relatively low frequency of marine traffic during construction, operation (single tanker visit to the condensate export mooring every four months) and decommissioning.
- Anti-fouling paints used to coat the hull of vessels will reduce the potential for transportation of introduced marine pests.
- Isolation of seabed project infrastructure from other suitable substrate for colonisation by introduced species. The offshore wellhead platform is located approximately 90 km from the coast and the condensate mooring is located approximately 3 km from the coast. This is likely to limit the colonisation of hull fouling species beyond these two project components.
- Oceanographic characteristics associated with the project area. The project area is located within a high-energy marine environment with associated high levels of turbidity, particularly in the inshore waters. These conditions are not suitable for likely hull fouling, sheltered coastal species.
- Relatively few ecological studies have been undertaken to provide guidance about the likely impacts of introduced species on native fouling communities, though it is commonly accepted that many fouling species do not appear to have spread widely beyond sheltered ports and harbours or to have colonised natural reefs extensively (Keough and Ross 1999).

The likelihood of introduction of introduced species to the wellhead platform is extremely remote. Once installed, '*Maintenance for the wellhead platform will be minimal, with an estimated ten trips per year required. Personnel undertaking inspection and maintenance operations will access the*

platform by helicopter or by service vessel for longer operations (*Section 4.7.2, Volume 1 of the Draft EIS*)'. Service vessels will most likely be based in Darwin and will not need to exchange ballast. Construction vessels (jack-up, laybarge and support vessels) and service ships with an international last port of call are required to comply with the Commonwealth *Quarantine Act 2000* and the AQIS ballast water management requirements, as will all international shipping. In addition, as it states in **Section 11.6 Volume 1** of the Draft EIS, '*The jack-up, laybarge and support vessels will exchange ballast prior to arrival at the Blacktip Project area where it is safe and feasible for vessels to do so.'*

14.5 Section 11.8 Drilling Waste and Discharges

NTG 75: 'Benthic organisms are widely distributed in the area of the proposed development and the environmental impact associated with drill cutting disposal in predicted to be minor due to the relatively small area protected and the [presumably] wide distribution of similar community types throughout the region'. Add 'presumably', as there is little or no data available to characterise the benthic communities in these areas. What is the cumulative impact associated with drilling a number of wells at the location? The proposal indicates that the number of wells may be between two and six. The cumulative impacts of batch drilling programmes should be discussed. What are the volumes of drill cuttings expected to be discharged? Given the jurisdiction in which drilling is to be undertaken consideration needs to be given to this issue in light of the Western Australian Department of Industry and Resources policy regarding cumulative impacts of discharges from batch drilling.

Changes in reduction oxidation potential: The next logical step is to consider chemical changes that result from oxygen depletion i.e. from aerobic to anaerobic decomposition. Changes to the oxidation reduction potential of the benthos may lead to the preferential release of heavy metals or other elements from the sediments. Decomposition of drilling fluids in an anoxic environment would preferentially use sulphur as the next oxidising element if available. One of the products of anaerobic decomposition is methane gas. The following information related to gas impacts including methane homologues is provided in Patin 1999.

"The concentrations of bottled gas that caused the death of 50% of the fish during 48 hours (LC50) equaled 1-3 mg/l [Umorin et al., 1991]. For zooplankton, this concentration during a 96-hour exposition was 5.5 mg/l without air pumping and 1.75 mg/l with it. These results suggest that fish are more vulnerable to the effects of methane homologues than zooplankton. They also indicate that acute toxic gas effects in fish start under minimum concentration of about 1 mg/l, which approximately match the results from field observations as previously described. Some other studies give similar values of LC50 (96 hour) of natural gas for zooplankton, zoobenthos, and fry of marine fish (0.6-1.8 mg/l) [Borisov et al., 1994; Kosheleva et al., 1997]." (Patin, 1999)

Information is required for the primary secondary and tertiary breakdown products of non-water based drilling fluids, including persistence. Non water based drilling fluids are proposed for use in the lower sections of the production wells if conditions require. The above reference is also relevant to subsea releases of raw wellstream fluids from the export pipeline.

NTG 75a: What is the cumulative impact associated with drilling a number of wells at the location? What are the volumes of drill cuttings expected to be discharged?

NTG 75b: Consider chemical changes that result from oxygen depletion i.e. from aerobic to anaerobic decomposition and the potential impacts on the benthic environment.

WA Department of Industry and Resources (DOIR) Requirements: WA DoIR does not currently have a formal policy regarding cumulative impacts of discharges from batch drilling programmes (P. Achour, [Environmental Assessor, Petroleum Division WA DOIR] *Pers. Comm.* February 05). WA DoIR policy on drilling fluid management indicates that the assessment of drilling fluid will take into account the technical justification for the proposed fluids, the environmental sensitivities of the drill location, the method of cuttings disposal and the drill fluid environmental performance. As outlined in **Section 11.8**, **Volume 1** of the Draft EIS:

- WBMs will be used wherever possible and technically feasible.
- Only regulator-approved NWBMs will be used.
- NWBMs will only be used where WBMs are inappropriate.
- Whole NWBMs will not be discharged.
- Drilling will be undertaken according to a regulator approved Production Drilling EP to the requirements of PSLAMER.

Multiple Wells: The impacts of drilling discharges are discussed in **Section 11.8**, **Volume 1** of the Draft EIS, with additional information presented in response to **OEH 28** (**Section 7.2.1**). In simple terms, multiple wells drilled back to back at the same location will result in a doubling of the drill cuttings and muds discharged to the ocean, depending on the precise length of the wells. **Table 4-5** (**Volume 1**) in the Draft EIS indicates that approximately 263–426 m^3 of cuttings and 2632–3132 m^3 of muds will be used for the initial two Blacktip wells. There are environmental benefits or savings for drilling multiple wells at the same location, compared to drilling multiple wells at different locations. The drill rig does not relocate between wells; rather the drill table is offset, so only one set of drilling depressions will be generated. Some minor reductions in drilling fluid discharges will result as the drill fluids can be reused on the subsequent well and some reductions in drill cuttings discharge can be achieved if the wells use the same surface location. Most importantly, the environmental impact is confined to one location and not spread across multiple sites. The spatial extent of impacts of multiple wells drilled at the same location is broadly similar to a single well as any discharge is confined to the same area.

The impact of drilling single wells with WBM and SBM, and multiple wells with WBM are discussed in response to **OEH 28** (**Section 7.2.1**). If NWBMs are used for a multiple well drilling programme, a greater volume of NWBMs on cuttings will be discharge to sea, which may increase the sediment hydrocarbon levels and increase the likelihood that the sediments surrounding the platform become anoxic. This will slow the NWBM degradation process, as discussed below, and increase the time taken for the benthic environment to recover, compared to a single well drilling campaign.

An extensive monitoring programme was conducted around the Fortescue Field in the Bass Straits by Terrens et al. (1998). Twenty one wells were drilled with WBMs between 1983 and 1985. An

additional 18 wells were drilled between 1994 and 1996, most with WBM but seven wells had sections drilled using an ester-based NWBM. A total of 2000 m^3 of NWBM were used in these seven wells. Highest hydrocarbon levels of 12,000 mg/kg were collected 100 m from the platform soon after drilling. However, six months later the hydrocarbon level had decreased to 200 mg/kg. Impacts on benthic communities were limited to within 100 m of the platform. Infaunal abundance showed little variation but diversity decreased as discussed below. The degradation of an SBM made from internal olefins can take longer than ester-based NWBM, as discussed in response to **OEH 28** (**Section 7.2.1**) and below.

Degradation of NWBM: Neff et al. (2000) conducted a thorough review of the environmental impacts of NWBMs, including discussions on the degradation of NWBM, which is summarised below.

The main mechanism of degradation of NWBMs is through microbial metabolism to harmless products. Hydrocarbons degrade mainly by oxidation so degradation is much more rapid in the presence of oxygen (aerobic conditions) than when oxygen lacking (anaerobic conditions). Hydrocarbons vary in their susceptibility to biodegradation:

- Lower weight hydrocarbons are more readily biodegraded than higher weight hydrocarbons.
- Linear hydrocarbons are more easily biodegraded than branched or aromatic hydrocarbons.

It is expected that a NWBM such as 'Synteq' may be used for the lower hole sections. Most NWBMs, including ‘Synteq’, are constructed using alkenes (linear alpha olefins, poly alpha olefins or internal olefins), which are oxidised by microbes to an alcohol in the presence of oxygen and further oxidised to a fatty acid which is used as an energy source. The oxidation of alkenes can reduce oxygen levels in sediments and make the sediment anaerobic.

In the absence of oxygen, alkenes are dehydrogenated to alcohols, then a ketone or aldehyde intermediates and onto fatty acids. However, under anaerobic conditions, these reactions are less efficient and the process takes considerably longer. In addition, under anaerobic conditions, the degradation of alkenes produces by-products, such as hydrogen sulfide, ammonia and methane, that are toxic to some fauna.

NTG 75c: Information is required for the primary secondary and tertiary breakdown products of non-water based drilling fluids, including persistence.

Platforms in northern Australia act as an artificial reef or fish attracting device and can support a very abundant and diverse fish community. Gases released from the sediments around production platforms have been observed bubbling to the ocean surface without causing any fish kills. These gases result from the anaerobic decomposition of drilling wastes as outlined above. These gases are believed to be hydrogen sulfide gas, not methane. As Neff et al. (2002) states:

> Sulfate is abundant in seawater (~29 mM) and marine sediments; therefore, it is the dominant terminal electron receptor for microbial oxidation of SBF [synthetic based fluid] based

> chemicals in anoxia marine sediments…Methanogenesis (reduction of CO_2 to CH_4) occurs only when most of the available sulfur has been reduced to sulfide.

Benthic impacts caused by drilling discharges can largely be attributed to organic enrichment and its by products (anaerobic conditions and the production of H_2S gas) (Peterson et al. 1996). The response of infaunal communities to organic enrichment and anaerobic environments has been well documented. Organic enrichment typically causes the selective increase in the abundance of deposit feeding polychaetes and decrease in the abundance of most other taxa (Gee et al. 1985, Spies et al. 1988 and Peterson et al. 1996). The recovery rate of infaunal communities is discussed in response to **OEH 28** (**Section 7.2.1**).

Drilling Waste Discharge Plume

OEH 29: Potential impacts to phytoplankton and zooplankton from the drilling waste discharge plume should be discussed, particularly as many invertebrates (including commercial crustacean species) and fish have a planktonic stage in their lifecycle. Consideration also needs to be given to interruptions to the safe passage of prawns along their seasonal travel route by these plumes.

OEH 29: Discuss the potential impacts to phytoplankton and zooplankton from the drilling waste discharge plume.

The impact of the drilling waste discharge plume on the biota living in the water column will be negligible for the following reasons:

- The limited spatial and temporal extent of the plume.
  - The discharges from the drilling rig are not continuous during the drilling programme. The drilling of two wells typically takes in the vicinity of two months. However, during the drilling of the upper sections of each well (first 700–900 m), discharges from the rig are limited as the cuttings are deposited directly on the seafloor. It is only after the well has been 'closed in' that cuttings are returned to the rig for processing and discharged overboard. Even then, the discharge of cuttings from the rig is not continuous.
  - The plume is typically visible as a long narrow band that extends for about 1 km (**Section 11.8, Volume 1** of the Draft EIS). Any impact on the water column community is minor due to the relatively small area of disturbance and the wide distribution of similar habitat throughout the region. In addition, the strong currents in the Joseph Bonaparte Gulf will ensure that any biota that becomes entrained in the plume will be exposed for relatively short periods and the plume will be subjected to rapid dilution and dispersion.
- The toxicity of drilling muds (both WBM and NWBM) is tightly regulated. Using the drilling fluid toxicity rating system adopted by WA DoIR, WBMs are rated as non-toxic and NWBMs are rated as almost non-toxic or non-toxic (**Section 11.8, Volume 1** of the Draft EIS) and so will have a negligible effect on water column biota.

Drilling is planned to commence in the 3rd Quarter of 2007 and may overlap with the prawn migration, which is understood to occur between October and December, as well as February to

April (**Section 7.3.4, Volume 1** of the Draft EIS). However, as outlined above, the discharge of drill cuttings and fluids affects a very limited area of open ocean seabed and will have a negligible impact on the prawn migration.

14.6 Section 11.14 Scale

Scale; NORMS, Scale Inhibitor

NLC 49: Page 354. What is the chemical composition of scale formation inhibitor? If this inhibitor is to end up in PW water, then its potential impact on the receiving environment needs to be known.

NTG 31: Details on NORMS disposal were requested.

OEH 31: The Supplement should explain the composition, expected loads and concentration of scale material. It is not satisfactory to delay the preparation of a management plan for the disposal of Naturally Occurring Radioactive Materials until they become an issue.

NTG 77: Precipitation of naturally occurring radioactive materials (NORMS) within production equipment needs consideration in more detail. The discussion should include:

-any ecological impacts of radioisotopes entrained in PW discharged on the near shore environment specifically bioaccumulation in lower trophic species; and

-disposal options for norm generated as result of onshore/offshore operations.

There are currently no onshore facilities in the Northern Territory, which accept low specific activity wastes. The preventative measures outlined in Section 11.20.3 of the EIS will not be sufficient if NORMS disposal becomes an issue during the project lifecycle. It is suggested that Woodside discuss available disposal options with the custodians of the Northern Territory *Radiation (Safety Control) Act*, the Department of Health and Community Services, Environmental Health Section. Should scale containing NORMs be recovered from the production process, then DHCS' Radiation Protection requests a detailed plan to provide advice on the assessment of disposal options.

OEH 24: Explain the constituents, toxicity, sink details, amount required and the likely impact on the environment of corrosion inhibitor.

NLC 49: What is the chemical composition of scale formation inhibitor and its impacts?

NTG 31: Details on NORMS disposal were requested.

OEH 31: The Supplement should explain the composition, expected loads and concentration of scale material.

NTG 77: Consider in more detail the precipitation of naturally occurring radioactive materials (NORMS) within production equipment.

OEH 24: Explain the constituents, toxicity, sink details, amount required and the likely impact on the environment of corrosion inhibitor.

Scale Assessment: An 'informal' assessment was undertaken of the risk from NORMS and hence there is no corresponding reference.

Scale Formation: As stated in the EIS scale tends to form at places in the process where there is a large pressure drop or change in temperature. For the Blacktip systems these locations will be offshore at the wellhead platform choke, downstream of the slugcatcher and in the LP separator at the onshore gas plant (**Figure 4.13**, **Volume 1** of the Draft EIS). All analyses undertaken to date indicate that scale should not form at these points. If it is found that scale forms in quantities that affect operations then the injection of scale inhibitors may be required. Based on the relatively low levels of salinity in the reservoir formation water and the relatively low pressure and temperature drops expected at well perforations, significant downhole scale accumulation is therefore unlikely.

Corrosion Inhibitor: Corrosion inhibitor is a substance used to reduce internal corrosion of pipelines to such a level that pipeline integrity is maintained. The active ingredients in corrosion inhibitors are chemicals with surface acting properties (surfactants). This class of chemical has a lipophilic/hydrophilic structure that gives them a tendency to collect at aqueous/organic boundaries. Surfactants used in pipelines coat the inner pipeline wall to form a film over the metal surface, thus reducing the surface area of metal exposed to the liquids passing through the pipeline which in turn limits corrosion. Because a coating is formed, not all corrosion inhibitor used in the pipeline is discharged. Surfactants are believed to be susceptible to both aerobic and anaerobic biodegradation and no evidence has been found to support concern with respect to biomagnification (McWilliams and Payne 2001). Details on recommended corrosion inhibitors and their impacts are given in the response to **NTG 40b** (**Section 8.2.1**).

Scale Inhibitors: Scale inhibitors are generally low pH solutions that prevent the precipitation of carbonate salts. Scale inhibitors are injected at parts per million (ppm) levels and alter the water chemistry to prevent scale formation. If scale inhibitor is injected then it will be discharged with the PW. Examples of scale inhibitors are phosphate esters, phosphoric acid and solutions of low molecular weight polyacrylic acid. They are not toxic and are highly diluted in the PW prior to discharge. Changes in pH can impact marine organisms; however seawater is a natural buffer to acidity so there is unlikely to be an impact from the discharge of water with slightly reduced pH.

The chemical composition and quantities of the corrosion and scale inhibitors are not known at this time as composition depends on the exact products selected. The type of scale inhibitor used will also be specific to the type of scale formed. The initial dosage concentration of scale and corrosion inhibitors is specified by the chemical supplier and then fine-tuned by the operator to achieve optimal performance of the chemical in combination with other process chemicals and the process liquids. As a guide, scale inhibitor used in Timor Sea oil fields is about 25 l/day and corrosion inhibitor use is about 75 l/day.

However, based on work from the UK sector of the North Sea it is not envisaged that the inhibitor will have a detrimental effect on the environment. Under the direction of the Department of Trade and Industry (DTI), CEFAS has undertaken an assessment of the various chemicals used in the UK sector of the North Sea and assessed and ranked their environmental impact in the North Sea

environment. The document ranks each chemical in one of six categories depending on their environmental impact and lists them by function. Under scale inhibitors 63 individual products are listed, of which 60 are reported as being in the lowest impact category.

Impacts from Process Chemicals: Though not explicitly stated, the toxicity and impact on the marine environment from corrosion and scale inhibitors and other process chemicals are covered in **Section 11.18**, **Volume 1** of the Draft EIS which primarily deals with PW through discussion of Whole of Effluent Toxicity Testing. Chemicals added to the production process, including corrosion inhibitors, scale inhibitors and other process chemicals such as oxygen scavenger and biocides, which are hydrophilic (end up in the water fraction of reservoir fluids as opposed to the oil fraction) will be discharged into the marine environment in the PW stream. Therefore by assessing the toxicity and impact of the PW stream at the point of discharge, the cumulative effect of the above chemicals added to the PW is also assessed. Ecotoxicological assessment of Whole Effluent Toxicity provided better information than the assessment of individual components such as corrosion or scale inhibitors because it includes the results of chemical reactions and synergies occurring in the process and measures the toxicity of the actual waste discharged into the marine environment.

The modelling of the PW discharge and the calculation of the Predicted No Effects Concentrations (PNEC) in **Section 11.18 Volume 1** of the Draft EIS used real, worst case data collected from across all Woodside's facilities in northern Australia. The modelling also used worst case weather conditions to model the worst possible scenario over the lifetime of the Blacktip Project. The ecotoxicological tests were conducted on whole PW collected immediately prior to discharge, which includes residual corrosion inhibitor and other process chemicals. The modelling of whole effluent PW, which includes added process chemicals, indicates that the toxicity thresholds (PEC:PNEC >1, **Section 11.18**, **Volume 1** of the Draft EIS) are only likely to be exceeded under lifetime worst case conditions (maximum PW discharge rates, neap tides and inshore winds) for a period of less than 1 hour at slack water and extending for a distance of 400 m.

The ratio of the Predicted Environmental Concentration (PEC) to the Predicted No Effect Concentration (PNEC) (PEC:PNEC ratio) is an established technique to screen chemicals in offshore discharges (**Section 2.5.3**, **Appendix J**, **Volume 2** of the Draft EIS). The PNEC value is derived from ecotoxicity data and is the concentration below which it is believed that there will be no detrimental effect on the environment. A PEC:PNEC ratio of one will generally correspond to a 5% probability that biota will be affected.

At all other times, toxicity thresholds were not exceeded (**Section 11.18**, **Volume 1** of the Draft EIS) indicating that the discharge should not have a toxic affect. Even under maximum discharge rates, exceedence of toxicity thresholds occurs for less than one hour and is unlikely to affect the biota, even if the biota is entrained in the discharge plume. As outlined in **Volume 2**, **Appendix J**, toxicity thresholds are calculated from the results of toxicity tests that have a minimum duration of 1 hour, though most tests are conducted over periods of 24–96 hours.

Furthermore, Woodside has completed a study investigating the environmental acceptability of four corrosion inhibitors under consideration (de Reus 2004). Results of this study indicated that all four chemicals are deemed environmentally acceptable (refer to response to **NTG 40b** and **Section 2.4.6**, **Volume 2**, **Appendix J** of the Draft EIS).

Impacts from NORMS: The APPEA (2002) guidelines indicate that environmental effects of NORMs disposal to sea are negligible because of the low radioactivity of scale; the high dispersion of ground scale in the open ocean; and the dissolution of the scale in warm water. NORMS scale discharged to sea with radioactivity of 500,000 Bq/kg can easily be dispersed and spread to ensure resulting radioactivity on the seabed will be below threshold values.

As a further demonstration of the low risk associated with NORMS disposal to sea, the following example is included from the APPEA guidelines (APPEA 2002). The public dose limit of 1 mSV requires 4.2g of barium sulfate scale to be ingested if the scale has a radiation level of 550,000 Bq/kg. Assuming the concentration in fish is 2 Bq/g, which has only been found in fish living close to a nuclear reactor, an individual would have to consume about a tonne of contaminated fish in a year to receive the public dose limit of 1 mSV.

There are no recommended radiation protection dose limits for flora and fauna. Instead the International Commission of Radiological Protection (IRCP) recommends that if man is protected by means of a public dose limit then flora and fauna are also in effect protected. The public dose limit for human protection is 1 mSv per annum which is the level stipulated by the National Health and Medical Research Council (NHMRC). Therefore provided public exposure to radiation caused by NORM discharges or by NORMs waste disposal is below the 1 mSv/y public dose limit, then the radiation doses received by flora and fauna would also be acceptable. APPEA (2002, p.20) provides the following supporting research pertaining to the low risk to flora and fauna through bioaccumulation:

> The public dose limit of 1 mSv would be received after ingestion of the activity of radium-226 and radium-228 of 3,600 Bq and 1,500 Bq respectively (IAEA, 1996). As the combined radium-226 and radium-228 activity concentration in barium sulfate scale is about 550 Bq/g ...some 4.2 g of scale would have to be ingested to receive the dose of 1 mSv. Even if it was assumed that the radium concentration in the flesh of bottom feeding fish is the same as those living close to a nuclear reactor (about 2 Bq/kg according to S. St-Pierre et al., 1999), an individual would have to consume about a tonne of fish meat in a year to receive the dose of 1 mSv. This is of course a highly conservative assessment where the radium concentration in river sediment and water near to a nuclear reactor is far higher than would be found near an oil or gas facility in the sea.

PW discharged to sea can also contain radioisotopes. However, as these have not been concentrated, their radioactivity is very low. Upon discharge, any NORMs will be rapidly co-precipitated with barium sulphate. Radium concentrations in ambient water near PW discharges are rarely higher than background levels (Neff 2002). Toxic concentrations for radium are well above the saturation concentrations of radium in sulphate-rich seawater. Radium, because of its low concentration in solution in seawater, has a low bioavailability to marine organisms. Marine

animals are highly tolerant to low-level radiation and there is also no evidence that radium accumulates in sediments or marine animals (molluscs, crabs and fish) living in the vicinity of offshore PW discharges (Neff 2002). The Brookhaven National Laboratory performed a human health risk assessment for radium in PW discharged to the northwestern Gulf of Mexico and concluded that radium in PW represents a minimal risk to even the most sensitive workers (platform crew and recreational fishermen) who consume fish from the vicinity of PW discharges (Brookhaven National Laboratory (1992) cited in Neff (2002)).

Radiation exposures and the radiological impact on marine life due to discharges of small volumes of NORMs are likely to be negligible.

Management of Process Chemicals: As discussed in **Section 11.18, Volume 1** of the Draft EIS selection of process chemicals, including corrosion and scale inhibitors, will consider only environmentally acceptable chemicals.

Scale Disposal Options and Management: Scale produced by the petroleum industry is typically Barium Sulphate ($BaSO_4$) scale. There is no uniform view in State, Territory or Commonwealth regulations on the radium specific threshold activity of NORMs, below which materials would be classified as not radioactive (APPEA 2002). APPEA (2002) suggests that scale should be considered to be Naturally Occurring Radioactive Material (NORMs) if radioactivity is above 2400 Bq/kg (APPEA 2002). The disposal options for scale will depend on the location of the scale deposit within the process and the radioactivity of scale. If scale becomes an issue offshore, for example at the wellhead platform, Commonwealth legislation is activated but if it is formed at the onshore gas plant then Northern Territory legislation applies.

NORMS, predominantly radium (226Ra and 228Ra) which can occur in hydrocarbon deposits at very low levels, are concentrated in the scale and in some case increase the radioactivity of the scale to a level above the appropriate radioactivity threshold. NORMs scale (i.e. scale with elevated radioactivity) in petroleum facilities in northern Australia, typically has radioactivity in the vicinity of 500,000 Bq/kg, although there has been one recorded instance of NORMs scale with radioactivity of 1,600,000 Bq/kg.

Onshore in the Northern Territory, disposal of scale is administered under the Northern Territory *Guidelines for application for approval to dispose of Natural Occurring Radioactive Materials* (NORM) (EG 506) and the Northern Territory *Radiation (Safety Control) Act*. NORMs scale would be removed from the gas plant to an appropriate licensed disposal facility.

Offshore at the wellhead platform, disposal of scale would be administered under the Commonwealth's *Petroleum (Submerged Lands) Act* and associated legislation, and administered by the WA DOIR.

Offshore disposal options include:

- Entombing the scale in situ – if the scale is located in tubing inside the wells and below the level of tubing which needs to be removed during well decommissioning.

- Where technically feasible re-injection of the scale into a well.
- Collection of the scale and removal to an acceptable onshore storage facility.
- Disposal of the scale to sea depending on the volume of scale and its radioactivity level.

If a significant amount of scale was found to be present, and if there was the potential for production to be impacted as a result of the scale, all equipment would be removed onshore to a contractor in Darwin who has a licence to accept LSA scale.

Recent (2003) legislative changes to the *Nuclear Waste Storage Prohibition Act 1999* (WA) also enables low specific activity waste to be stored in Western Australia.

Disposal of NORMs scale to the seabed at the Blacktip platform would require regulatory approval under the Petroleum (Submerged Lands) Management of Environment 1999 regulations, in the form of an approved Environment Plan. Disposal to sea is undertaken routinely overseas. The Northern Territory *Radiation (Safety Control) Act* provides for a discharge of water that contains less than 1.5 Bq/L of radium. Over 60% of cases of NORMs disposal reported in the Oil Industry Exploration and Production Report (1988) were discharged to sea at the platform location. Disposal of NORMs scale to sea has occurred at least twice in northern Australian waters (Chalis and Buffalo Fields).

If scale containing NORMS becomes an issue that has to be dealt with either during operation or decommissioning it will be managed in accordance with a detailed NORMS Management Plan which will be approved by the relevant regulatory authorities. At this time, the various disposal options described previously will be assessed as well as any other alternatives.

The objectives of the plan will be to:

- Ensure that all waste is disposed of in a controlled and appropriate manner consistent with Woodside Policy.
- Avoid undesirable safety and environmental effects through inappropriate handling, storage, transportation or disposal of waste.
- Ensure that a 'Radiation monitoring and personal assessment summary' is prepared and submitted with the operational review to the NT DBIRD and Territory Health Service if required.

14.7 Section 11.15 Cooling Water

OEH 32: The Supplement should quantify the "rapid dispersion of the biocide by the surrounding ocean at the discharge point" in both space and time.

OEH 32: Quantify the "rapid dispersion of the biocide by the surrounding ocean at the discharge point" in both space and time.

Modelling of the cooling water discharge from the drill rig and the associated dispersion of biocides is not warranted because of the short term nature and very low volume of the discharge,

the rapid dilution rates achieved in the open ocean and the lack of sensitive receptors at the Blacktip platform location. Biocides are discussed further in the response to **OEH 25a** (**Section 7.4.2**).

14.8 Section 11.18 Produced Water

NLC 53: Page 362. The EIS advises that Oysters can be tainted at concentrations as low as 10 ppb. The EIS advises that tainting can not occur as the maximum modelled discharge rate in the nearshore environment indicates that hydrocarbon concentrations will be below 5 ppb. This is a very poor factor of safety to base assurances and is not acceptable.

The EIS on the next page explains how ocean disposal of PW is a common practice throughout the industry. The EIS fails to explain that nearshore ocean disposal is not a common practice and is prevented in southern states at operating gas plants. This a crude and misleading means of defending nearshore disposal and should be addressed through Government requiring the proponent to carry out a detailed study of an onshore biological PW disposal system.

NLC 53a: Maximum modelled hydrocarbon concentrations below 5 ppb is a poor factor of safety on which to base assurances that no tainting of marine life (eg oysters) will occur.

Numerous safety factors have been included in the assessment regarding the potential for tainting to occur. Most importantly, modelling of the PW discharge was undertaken for the worst case conditions anticipated during the lifetime of the Blacktip Project. These conditions include:

- Use of the maximum PW production rate of 7,000 bwpd, which is anticipated only to occur only on a number of occasions over field life.
- Using a discharge release coinciding with a neap tide and onshore winds.
- Using the maximum allowable peak hydrocarbon level in PW of 50 mg/l, rather than the 24 hr average of 30 mg/l.
- Using a dilution factor of 10,000 based on the upper limit (highest) concentration of PW contacting the coast according to the modelling results (0.01–0.005% PW).

Modelling indicated that even under these worst case conditions, concentrations of hydrocarbon in water that reach the coast are below 5 ppb, which is half the level required to cause tainting in oysters which is the fauna most likely to suffer from tainting.

For the majority of the life of the Blacktip Project; however, lower PW discharge volumes and more favourable tidal conditions will ensure greater dilution of the PW, reducing the oil concentration in PW which contacts the coast to levels well below 5 ppb.

Additionally, as outlined in response to **OEH 33** below, onshore processing means there is greater scope for treatment than can be achieved in space limited offshore facilities and it is likely that the oil level in Blacktip PW will be considerably less than the 30 mg/l average requirement, proportionally reducing the limit concentration of PW contacting the coast.

NLC 53b: The EIS fails to explain that nearshore ocean disposal is not a common practice and is prevented in southern states at operating gas plants.

Four oil and gas processing facilities have been built on islands on the North West Shelf of Western Australia (none on the mainland), three facilities discharge PW into the nearshore marine environment:

- Barrow Island: PW is injected into a deep ground water reservoir.
- Thevenard Island: PW is reinjected into a depleted reservoir but was previously discharged in the vicinity of the nearshore environment, just off the coast of Thevenard Island.
- Varanus Island: PW from a number of wells is injected into deep groundwater reservoir below the island. PW from the nearby Harriet Field is discharged at an offshore platform located about 6 km from the nearest islands of the Lowendal Island group.
- Airlie Island: The facility is currently mothballed. However, when operational, PW was discharged in the nearshore environment, just off the coast of Airlie Island.

The remaining facilities in northern Australia are located further offshore and discharge PW directly to sea.

Recently, three similar onshore gas plants have been developed or are in the process of being developed in Victoria. Under Victorian legislation, the discharge of PW in coastal waters is controlled by the *State Environment Protection Policies (Waters of Victoria) 1988* which applies within 3 nm of the coast. The discharge of PW in coastal waters is not prevented in coastal Victorian waters; however, the level of treatment required varies according to distance from the coast.

Of the new facilities in Victoria:

- Otway Gas is a Woodside development off the Otway coast. PW rates from this development will peak at 320 m^3 per day, compared to over 7000 bwpd for the Blacktip Project. Nearshore disposal was considered during the early phase of the project but, given the small volumes of PW, recharge of the deep Waarre aquifer was selected as the preferred option.
- The Casino gas field is a Santos development. This development will utilise the existing TXU-owned Iona gas facility which has an onshore PW treatment to process the small quantities of PW generated.
- The Minerva development is operated by BHP. It uses thermal oxidation (burning) to dispose of its small quantities of PW.

The Blacktip gas field generates significantly greater quantities of PW than the three recent gas developments in Victoria. The only technically viable solution for the disposal of the quantities of PW from the Blacktip Field is offshore disposal.

The reader is also directed to the response to **NLC 26** later in this section.

NTG 78: It is stated that 'biological communities are unlikely to experience prolonged exposure to the PW plume' and that the produced water is treated and discharged 3 km offshore via a pipeline. What mitigation measures will be taken to ensure that the produced water, particularly on incoming tides, does not affect the fish and shellfish sourced by the Wadeye Community and commercial harvesters from the project area? Will the proponent conduct ongoing testing measuring toxic effects on marine fauna & flora in the project area to verify their claims? The Wadeye Community does not have the capacity to do such testing and will likely expect answers from the proponent confirming that the fish and crabs are safe to eat.

NTG 78a: What measures will be taken to ensure that the PW, particularly on incoming tides, does not affect fish and shellfish from the project area?

Refer to response to **NLC 5a** and **NLC 53** later in this section.

NTG 78b: Will the proponent conduct ongoing testing measuring toxic effects on marine fauna & flora in the project area to verify their claims?

Proposed PW Studies: The quality of Blacktip PW will be assessed once it becomes available. This will include chemical characterisation, ecotoxicology, bioaccumulation and biodegradation tests. Should the PW be found to be toxic or show the potential for bioaccumulation or persistence in the marine environment, then treatment can be put in place before volumes increase to their peak values.

Impacts on Turtles and Dugongs: As stated in **Section 11.18** (p.362) under the worst case conditions a PEC:PNEC exceedence of greater than one (refer to response to **OEH 31** (**Section 14.6**) will extend 400 m from the pipeline discharge point at the turn of the tide at slack water. Turtles and dugongs may potentially travel through this area and could be exposed to the PEC:PNEC exceedence. However, the modelling output indicates that this exceedence occurs for less than 1 hour duration and only during times of maximum PW discharge. The maximum discharge rate occurs for only a short period (**Figure 4.1**, **Appendix J**, **Volume 2** of the Draft EIS). At all other times the discharge rate of PW will be lower due to low rates of PW discharge, low contaminant concentration of PW and high rates of dilution at the point of discharge when an exceedence of the PEC:PNEC ratio will be highly unlikely.

As stated in Section 11.18, '*The PEC:PNEC approach is generally considered to be highly conservative, as it assumes an ecological response immediately on contact with PW that exceeds the PNEC. In reality PNECs are derived from ecotoxicology studies in which organisms are exposed for durations of at least one hour'* and often up to 96 hours. PW is generally not acutely toxic (Neff 2002) so such short term exposure to PEC:PNEC values <1 will have negligible impact on all biota. Additionally, the ecological tests on which the PEC values were derived were conducted on sensitive invertebrate taxa and life stages amenable to toxicity testing. The exposure of larger vertebrates, such as dugongs and turtles, to PW at concentrations where PEC:PNEC values are greater than one will have no deleterious effect on vertebrates, particularly as these organisms have the ability to swim away from the plume.

It is not possible to obtain exact data on the toxicity of Blacktip PW until well production commences, therefore the derivation of the PEC:PNEC ratio was based on the worst case PW ecotoxicity data from five ecotoxicity tests conducted on samples from all five of Woodside's northern Australian facilities (**Appendix J, Volume 2**). The ecotoxicity of Blacktip PW will be determined once well production commences. If, as expected, Blacktip PW is less toxic than that used in the Draft EIS modelling exercise, the area exposed to the PEC:PNEC exceedence will be reduced and possibly eliminated, even under times of maximum PW discharge.

OEH 30: The volume of hydrocarbon (Section 11.8) proposed to be discharged to sea should be quantified and discussed.

NLC 5: Plant Water

Fossil water from the Blacktip gas field will be included in the gas stream bought on shore to Yek Maninh country for treatment and disposal. The amount of this produced water (PW) will oscillate with the maturity of the stacked gas horizons from which gas will be extracted with increases up to 1119m3 a day from mature reservoirs with annual totals up to 136,382m3 based on annually derived averages of 373M3 per day. The EIS does not advise on the predicted hydrocarbon content of the contained discharge water. If Government discharge regulations can not be met on commissioning and operation of the current proposed disposal system, it is unlikely that Woodside would turn around and put in a land based bio-degradation system-the environment and the regulations would be asked to adjust. Hence it is important to resolve best practice for PW disposal at this early stage of plant design.

The EIS advises that the PSLA specifies that the oil concentration must be below 50mg/L (assume per litre of water), with a 24 hour average below 30mg/L. If it were assumed that these would be the discharge rates and hydrocarbon content, there would be a discharge of 1,119,000 litres of water per day x 30mg= 33,570,000 mg of oil per day. This is about 33.57 kg per day on high discharge days or 4090 kg per year (4 tonne) based on the averaged annual discharge of 136,382m3. This submission questions that up to 4 tonne of hydrocarbons slow released over a year at an nearshore discharge point will not have a level of environmental impact on marine biota in the nearshore environment even if no impact can be demonstrated when such releases take place 100 kilometre or more offshore at existing fields.

The Executive Summary on page ES9, advises PW will be treated onshore to meet legislative standards, piped 3km offshore and that discharge location and the design of the PW plant have been selected to ensure no adverse impacts occur from this discharge. The NLC in earlier comments to Woodside raised the issues of oil sheens, food tainting and onshore disposal. There has been no evaluation of the environmental advantages and disadvantages of onshore disposal in the EIS. Nor has there been any consideration of alternative locations for offshore disposal, particularly in relation to Walpinhthi Reef. The EIS advice on tainting and oil sheens is that they are both possible under certain conditions.

The baseline hydrocarbon survey in the mangroves at Maninh Point turned up total recoverable hydrocarbon values in the 2 to 27 mg/kg range for C10 to C36 hydrocarbons . The EIS advises it is likely the hydrocarbons originated from Petrel and Tern wells, which are known to leak hydrocarbons. Tern is 150k from Maninh Point. It is difficult to rely on the detailed dilution and current modelling in the EIS justifying offshore hydrocarbon disposal within 3 or 5 kilometres of the shore when the same EIS advises that a low level hydrocarbon source 150k away is likely to be contaminating mangrove sediments at Maninh Point.

p. 117 refers to the preferred offshore discharge location to be 3-5 km offshore. However, Walpinhthi Reef is closer to the discharge location than this and the potential impacts on this reef need to be considered.

One of the basic problems with offshore disposal is that once disposal has occurred and where adverse impacts follow, the contaminants cannot be bought back from the marine environment as they would be no longer under Woodside's control. The Blacktip PW composition is unknown until actual operation commences. Woodside, among other things, is relying on the assumption that the quality of the PW will equate to other PW effluent from current offshore hydrocarbon production sites.

The NLC considers that the assessment of hydrocarbon impacts should consider the cumulative impacts of the PW, Hydrocarbon Spills and background hydrocarbon from Tern and Petrel rather than considering these matters separately. It is also noted that as winds are typically onshore during the wet season, the risks are greater at that time of the year.

The NLC also notes that despite the request that the EIS show clearly the location of the PW outfall in relation to the Walpinhthi Reef sacred site, this has not occurred.

There are areas within the EIS where prevention and management arrangements are left to the regulations. For example on page 363 there is a statement in relation to Produced Water that "the PSLA specifies that the oil concentration must be below 50mg/L etc". The EIS must make clear what regulations would apply if the offshore disposal option were to apply.

Yek Maninh traditional owners and adjacent landowners, Yek Nangu and Yek Kinmore, have all expressed concern to the NLC about the proposed discharge of Plant Water in seas adjacent or near to their lands. Traditional owners see no reason why the project should be presented to them encumbered, as it currently is, with worry about potential future impact upon their marine based food resources.

The NLC considers:

1. Woodside should be required by Government to address, to same level detail it has for the offshore disposal, the option of onshore treatment and disposal as practiced in southern Australian states at current operating gas plants;

2. There is a need to define adverse impacts from the TOs perspective and assess whether the detailed design can meet their criteria. Oil sheens (p 359 Vol 1) are possible and their visual impact and movement to shore in hunting areas may be unacceptable to TOs. Non- tainting of traditional marine animals in the mangroves can not be guaranteed (mangrove worms, oysters, other shell fish and crabs);

3. The specific details of the onshore treatment process supporting an offshore PW disposal system should be subject to engineering assessment by Government and the NLC.

4. If offshore disposal is eventually put in place, commitments should also be in place from Woodside to revert to land disposal where, in the view of the TOs, adverse impacts from offshore disposal occur during the project life. Monitoring of traditional marine foods for tainting would be essential to validate, or otherwise, the claims of the EIS, monitoring must include the ecotoxicological studies recommended by Woodside's consultant on page 8 Appendix J, Vol2 of the EIS;

5. If an offshore disposal system is eventually put in place, a more distant offshore disposal point should be implemented as a part of that best practice given there is still a risk that a 3 kilometre discharge point may not in some circumstances achieve no impact in the shore zone;

6. A Produced Water Management Plan (as noted in the EIS) for either offshore or land disposal of PW should be agreed by key stakeholders before approvals are given by Government for the project to proceed.

OEH 33: The Draft EIS forecasts that produced water (PW) "may produce an oily sheen which has a visual impact" (Section 11.18). This is undesirable as there is a high potential for marine food resources to become tainted. Modelling results further suggest that pollution may initially move away from the coast but return on the following tide; the Supplement should therefore investigate scenarios in which the discharge point is further out to sea (Figure 11.3, Section 11.19.1). Dispersion has perhaps been overstated as a mechanism throughout the report given the pulsing currents in this tidal area.

NLC 5a: Advise on the predicted hydrocarbon content of the contained discharge water.

OEH 30: Quantify and discuss the proposed volume of hydrocarbon to be discharged to sea.

NLC 5c: Discuss the impact that 4 tonne of hydrocarbons, slow released over a year, will have on marine biota in the nearshore environment.

Figure 13 shows the average annual mass of oil discharged over the lifetime of the field. This was calculated from the projected discharge rate assuming an average oil concentration of 30 m/l. As can be seen, in the first year approximately 360 kg will be released. This increases to approximately 4700 kg in 2012.

Whilst these masses appear large the following points should be considered when assessing the environmental impact.

Onshore processing means there is greater scope for treatment. It is envisaged that the average oil content will be well below the 30 mg/l limit. Hence the amount released will be proportionally less.

- **Table 13 Biodegradation Rates for PW Compound Groups**

Group	Main Group	Biodegradation rate ½ life (days)
1	BTEX	0.5
2	Naphthalenes	1.5
3	PAH 2-3 ring	17
4	PAH 4-ring +	350
5	Alkyl phenols C0 – C3	1.2
6	Alkyl phenols C4+	10
7	Aliphatic hydrocarbons	60
8	Metals	None
10	Organic acids	Not included
11-n	Process Chemicals	Specific data

Source: Johnsen et al. 2000

Oil is made up of numerous hydrocarbon compounds all with unique properties and characteristics. The oil that makes up the 30 mg/l in PW will most likely be made up of low molecular weight hydrocarbons, phenols and organic acids that are soluble enough to partition into the water phase. The hydrocarbon component would include:

- aliphatic hydrocarbons;
- BTEX compounds;
- low molecular weight PAHs.

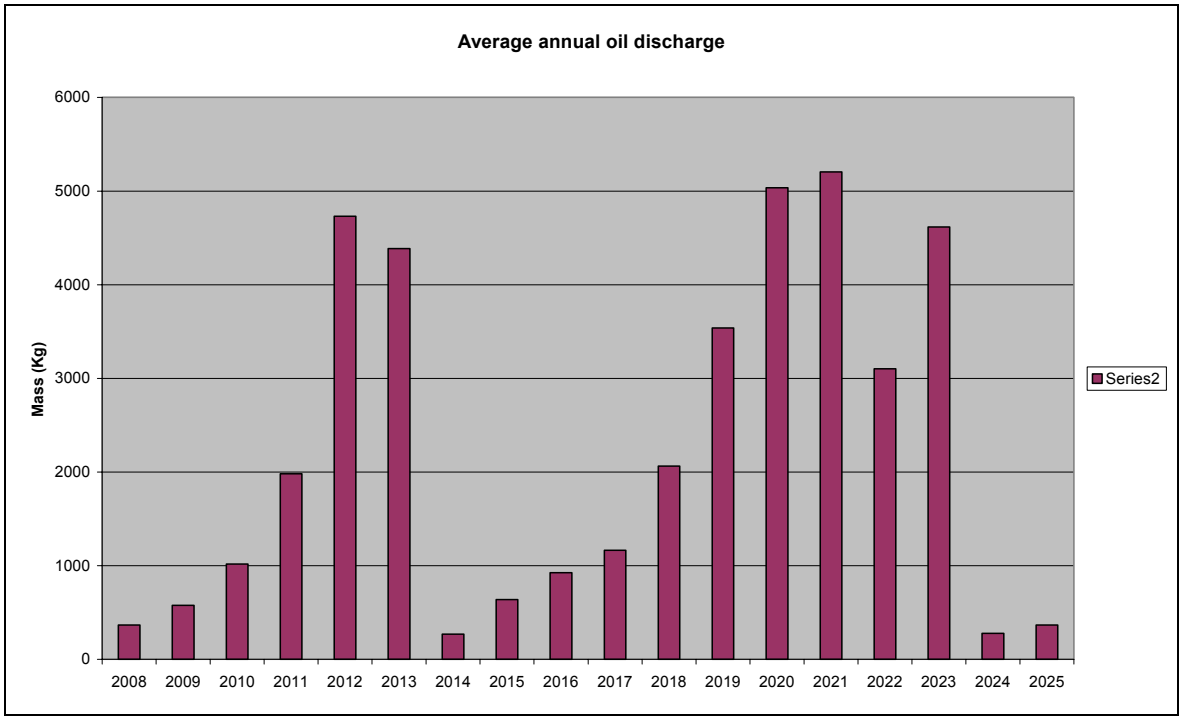
As described in IRCE (2004) and reiterated in **OEH 33** below, all of these compounds dilute rapidly into the receiving water, are volatile and biodegrade readily.

Biodegradation will be important in the long term to prevent build up of chemicals in the environment. Due to the differential rate of biodegradation the relative concentrations of the different hydrocarbons remaining in seawater after discharge will vary over time. Experiments by Flynn et al. (1996) showed that after eight days, over 99% of phenols and PAHs were degraded, and BTEX was reduced to below detection limits. Toxicity, as measured by Microtox®, was also reduced from 8.6% PW to 100% PW, suggesting that the components responsible for the initial toxicity are readily biodegradable. **Table 13** provides conservative biodegradation rates for individual components in PW (from Johnsen et al. 2000).

PAH compounds are the most likely to bioaccumulate, however, only low molecular weight compounds are found in PW which have less propensity for bioaccumulation. Moreover, the combination of high dilution rates, evaporation and biodegradation means that concentration could never reach sufficient levels for marine organisms to bioaccumulate.

The quality of the PW will be assessed once it becomes available. This will include chemical characterisation, ecotoxicology, bioaccumulation and biodegradation tests. Should the PW be found to be toxic or show the potential for bioaccumulation or persistence in the marine environment, then treatment can be put in place before volumes increase to their peak values.

- **Figure 13 Projected Average Annual Mass Of Hydrocarbon Discharge over the Lifetime of the Field (Assuming 30mg/l)**



NLC 5b: Discuss best practice for PW disposal including onshore disposal.

NLC 5d: Discuss the environmental advantages and disadvantages of onshore disposal of PW.

The reader is directed to responses to **NLC 26** and **NLC 53b** also in this section.

NLC 5e: The EIS advises that both tainting and oil sheens are possible under certain conditions. Monitoring and ecotoxicological studies must be undertaken.

OEH 33: PW may result in an oily sheen. Dispersion has perhaps been overstated as a mechanism throughout the report given the pulsing currents in this tidal area.

Sheening: The onshore processing of Blacktip PW provides greater scope for the treatment and removal of contaminants than can be achieved in the limited space available on an offshore facility. Preliminary investigations indicate that the use of a gas flotation unit during PW treatment will reduce the concentration free oil (the oil that is free to float on the surface of the sea water) discharged to less than 30 mg/l. Upon discharge the free oil component will undergo dispersion, bio-degradation and evaporation thus further reducing the concentration of free oil so that the discharge is unlikely to produce a sheen.

Dispersion: Following discharge, several mechanisms will act to dilute the PW within the ambient seawater. Initially, dispersion will be the most important process for reducing concentrations in the ambient seawater. In the longer term other degradation processes such as bio- and photo-

degradation will act to break down the compounds or completely demineralise them to carbon dioxide.

The strong tidal currents of Joseph Bonaparte Gulf, provide optimal dispersion conditions. Modelling has demonstrated that even at slack tides, which occur for less than 1 hour between each tide, the natural turbulence in the water column will be sufficient to achieve an initial dilution of approximately 1000 dilutions under maximum flow conditions. Therefore, the concentration of the PW within the sea water will have been diluted to 1 part PW to 1000 parts sea water at a distance of 25 m from the discharge point. For the vast majority of the life of the Blacktip Project, the volumes of PW discharged into the Joseph Bonaparte Gulf will be less than the maximum volume, on which the results of the modelling are based. Dilution will increase as the volume of discharged PW decreases.

Tainting: **Table 14** presents estimated concentrations of the contaminants of most concern in the PW and their predicted environmental concentration (PEC) following initial nearfield dilution, achieved within 25 m of discharge, and in the PW plume when it reaches the coast. Nearfield dilution will result in a minimum of a 1000 fold dilution of PW within 25 m of the discharge. The PW plume will receive a minimum of 10,000 dilutions before reaching the coast. As the actual concentrations in the PW of the various contaminants are currently not known, typical values for Woodside's North West Shelf and Timor Sea facilities have been assumed. To ensure conservatism, the highest measured concentration across all facilities has been used. These concentrations are compared with the concentrations that can lead to tainting of fish and other aquatic organisms (Connell and Miller 1981) and ANZECC water quality guideline values (ANZECC 2000).

Due to their solubility in water, BTEX concentrations in PW can be high. However, BTEX compounds are extremely volatile, evaporating readily once in contact with the atmosphere and their concentration will be reduced even more rapidly than suggested by dilution alone. Most BTEX chemicals are below tait concentrations and ANZECC guideline values within 25 m of the discharge point, based on dilution alone, and all are below these thresholds by the time the plume reaches the coast

Of the chemicals likely to be present in PW, PAHs are the compounds of greatest concern in the environment because of their persistence and potential for bioaccumulation. Fortunately only the lower molecular weight PAH compounds are soluble enough to be found in PW. The highest molecular weight compounds remain in the oil phase. All PAHs and phenols are below taint and ANZECC guideline values, indicating that they are unlikely to cause tainting even close to the discharge.

The results demonstrate that tainting of coastal resources is highly unlikely.

Table 14 Comparison between the Predicted Environmental Concentration (PEC) of Individual Chemical Components found in PW and Concentration Likely to Cause Taint

Chemical Group	Chemical	Estimated Concentration in PW[1] mg/L	Concentration in PW at 25m from discharge[2] mg/L	Concentration in PW at coast[3] mg/L	ANZECC water quality guidelines[4]	Taint concentration[5] mg/L
Hydrocarbons		30 average or 50 peak	0.03 or 0.05	0.003 or 0.005	N/a	Na
BTEX	Benzene	5.6	0.0056	0.00056	0.00059	Na
	Ethyl Benzene	0.8	0.0008	0.00008	0.59	0.25
	toluene	13	0.013	0.0013	8.5	0.25
	Xylene	8.3	0.0083	0.00083	0.0032	Na
PAH	Naphthalene	3	0.003	0.0003	50	1
	Phenanthrene	1	0.001	0.0001	2	Na
	PAH C4 - C6	0.1	0.0001	0.00001	0.001	Na
Phenols	phenol	17	0.017	0.0017	270	1
	Cresol	3.4	0.0034	0.00034	200	0.07

Notes: [1] estimated from previous Woodside studies; [2] calculated by applying a worst case dilution rate of 1000 to concentration in PW; [3] calculated by applying a worst case dilution rate of 10000 to concentration in PW, [4] from ANZECC water quality guidelines (ANZECC, 2000); [5] from Connell and Miller, 1981

The reader is also directed to the response to **NLC 53a** (**Section 14.8**).

The role of the EIS is to identify all potential impacts which may occur as a result of the project. However, with the implementation of appropriate management measures, the risk of these impacts actually occurring is significantly reduced.

The selection of the discharge location, and the investigation of alternative locations is discussed in response to **NTG 27a** (**Section 7.4.2**).

NLC 5f: Woodside is relying on the assumption that the quality of the PW equates to PW effluent from current offshore production sites.

Refer to the response to **NTG 40b**, **Section 8.2.1**.

NLC 5g: It is difficult to rely on modelling in the EIS justifying offshore hydrocarbon disposal within 3 or 5 kilometres of the shore when it is also advised that a low level hydrocarbon source 150 km away is likely to be contaminating mangrove sediments. Consider the cumulative impacts of the PW, hydrocarbon spills and background hydrocarbon from Tern and Petrel. Consider increased risk with seasonality also.

Hydrocarbons in the Mangroves: Petrel and Tern are gas fields. Leaking hydrocarbons from the Petrel and Tern fields are likely to comprise mostly gas, which will dissolve into the water or evaporate when hitting the ocean surface, and small quantities of condensate, which will also

dissolve into the water or float to the ocean surface or absorb on to where they would mostly evaporate. As only low molecular PAH are soluble in water, the higher molecular weight PAH found in the mangrove sediments would have been transported to the coast as a hydrocarbon floating on the ocean surface, not dissolved in the water column.

The PW discharge modelling (**Section 11.18**, **Volume 1** of the Draft EIS) considers dissolved substances, while the hydrocarbon spill modelling (**Section 11.19**, **Volume 1** of the Draft EIS) considers hydrocarbons on the ocean surface. Spilt hydrocarbons behave very differently to the dissolved hydrocarbon found in PW. For hydrocarbons floating on the ocean surface, the prevailing wind and surface currents will be the most important factors transporting the oil. For dissolved hydrocarbons, dilution is the most important processes for reducing contaminant concentrations. The modelled PW dilution rates are consistent with measured dilution rates for similar discharges and can be used confidently for the purpose of predicting the fate of PW.

While it was suggested that the hydrocarbon contamination found in the mangrove sediments originated from the Tern and Petrel gas fields, this is not known with any certainty. It could equally have originated from other anthropogenic sources such as a passing vessel much closer to Northern Yelcher Beach. It may have also be the result of natural seepage in the area.

The hydrocarbon concentration in the mangrove sediments are all below the ocean disposal sediment guidelines for PAH (EA 2002) (maximum level for PAH is 45 mg/kg), which indicates that the low level contamination measured in the mangrove sediments is unlikely to have any significant effect on mangrove fauna. In addition, mangrove sediments are typically high in organic content, which binds organic compounds including hydrocarbons, and renders them less biologically available (EA 2002), further reducing any possible impact by organic compounds on mangroves fauna.

PW: PW contains low molecular weight PAH which are soluble, volatile and are easily biodegraded, particularly when compared to the high molecular weight PAHs found in the mangrove sediments. The maximum concentration of total hydrocarbons in PW when it reaches the coast is below 5 ppb and the duration of exposure is minimal (2 hours), even under maximum discharge rates and onshore wind conditions. For the vast majority of the life of the Blacktip Project, lower PW discharge volumes will ensure even greater dilution and concentrations considerably less than 5 ppb. Any hydrocarbon in PW that are absorbed by coastal sediments will evaporate or biodegrade quickly, ensuring that there will be no build up of hydrocarbons in coastal sediments or impacts on coastal biota.

Hydrocarbon Spills: The Proponent will endeavour to prevent any oil spills during the life of the Blacktip Project. The probability of spills is discussed in detail in response to **OEH 73b** (**Section 14.9.2**), which demonstrates that a likelihood of any spill contacting the coast is extremely remote, even during the wet season when onshore winds dominate. If an oil spill occurs and contacts the coast, remediation programmes will be implemented to minimise any impact and monitoring programmes will be expanded to accurately determine the scale of any impact. The

typical consequences of oil spills are discussed in **Section 11.19, Volume 1** of the Draft EIS and in response to **NTG 79** (**Section 14.9.2**).

Cumulative Impacts: It is important to consider cumulative impacts from any proposal, such as the discussion of multiple well drilling programmes presented in response to **NTG 75b** (**Section 14.5**), rather than just individual scenarios in isolation. However, in this case such an assessment requires more information than is currently or will be available in the future. Detailed information is only available on the likely PW impacts. The occurrence, timing and quantity of spilt oil can not be known in advance, nor is sufficient known about the source of hydrocarbons in the mangrove sediments to determine cumulative impacts. It is also not known if an oil spill will occur and impact the same area subjected to PW discharge.

NLC 5h: The location of the PW outfall relative to the sacred site should be illustrated.

Arising from the tripartite meeting process it is planned to conduct a visit to the reef in April 05 with traditional Aboriginal owners, the NLC, the AAPA and Woodside representatives, to determine mutually acceptable arrangements for the protection of the site and the construction and operation of the pipeline.

NLC 5i. A more distant offshore disposal point should be implemented as a part of best practice given there is still a risk that a 3 km discharge point may not in some circumstances achieve 'no impact' in the shore zone.

The results of the dispersion and toxicity modelling undertaken for the PW discharge, support the view that the PW location as presented in the Draft EIS is appropriate from an environmental management perspective. The characteristics of the final effluent will be agreed with the regulatory bodies and appropriate treatment installed to ensure that the final effluent meets these agreed characteristics under all discharge conditions.

NLC 5j: The EIS must make clear what regulations would apply if the offshore disposal option were to apply.

The proposed PW discharge location is located in Northern Territory territorial waters. Therefore, the Northern Territory *Petroleum (Submerged Lands) Act 1982* and associated legislation apply. The Northern Territory *Petroleum (Submerged Lands) Act Schedule Of Specific Requirements As To Offshore Petroleum Exploration And Production 1995* specifies that:

> The concentration of petroleum in any formation water discharged into the sea shall not be greater than 50 mg/L at any one time and the average content over each 24 hours shall be less than 30 mg/L unless otherwise approved.

The same requirement is stipulated in the Commonwealth and State/Territory Petroleum (Submerged Lands) Act.

NLC 5k: The specific details of the onshore treatment process supporting an offshore PW disposal system should be subject to engineering assessment by Government and the NLC.

It is the Proponent's responsibility to make proposals to government regarding its preferred development option and it is the government's responsibility to assess and approve or disapprove such proposals on their merits. The Proponent does not believe that it is the NLC's responsibility to undertake engineering assessments of aspects of the project, but to make representations, as it sees fit, during the Draft EIS public comment period and through further consultation with the Proponent. The Proponent believes that it is the responsibility of government to request further information regarding aspects of the project, should it see fit to do so, during its assessment and ongoing control and monitoring of the project pursuant to the relevant legislation.

The issue regarding onshore disposal of PW is discussed in response to

NTG 72: Comment on the effect oil and hydrocarbon spillage may have on the WALPINHTHI REEF sacred site is needed.

NTG 72: Comment on the effect oil and hydrocarbon spillage may have on the Walpinhthi Reef sacred site.

Impacts of PW discharge and oil spills are expected to be minimal on Walpinhthi Reef as the reef is subtidal, approximately 3 to 11 m below LAT. Both oil spills and the PW plume are buoyant and will float over the reef. The PW plume reaches the ocean surface within 20 m of the discharge location and PW concentrations are greatest in the surface 2 m of the water column (**Appendix P**, **Volume 2** of the Draft EIS). PW concentrations in the 2–4 m, 4–6 m and 6–10 m, even under maximum PW discharge rates and worst case dilution scenarios, never cause the PEC:PNEC ratio to exceed one, as occurs in the surface layer (refer to **Section 14.8**), which means that no impact is expected.

The reader is also directed to the response to **NTG 66b** (**Section 12.4**) for information on the location of the reef.

The Proponent believes that it is the responsibility of Governments to apply conditions to the project's licence to operate and that the traditional Aboriginal owners and the NLC and any other stakeholders should be able to rely on the Government in this regard.

NLC 54: Even though there is a low abundance of dugong in the project area, the presence of these animals is still significant given their conservation status. The EIS advises on page 372 that "in the absence of any data to the contrary, dugong must be considered to be potentially sensitive to oil with the predicted environmental consequence the same as for dolphins and whales". The EIS does not evaluate how dugong would respond to effluent from a plant water outfall, as well as the impact that the outfall could have on seagrasses that are available in the project area (TOs have observed seagrasses at very low tides offshore from Yelcherr. This evaluation should be carried out. TOs and other decision makers such as Government should be aware if the project is likely to create an avoidance area for dugong in making their assessment of the cost – benefit of the project.

NLC 54: Evaluate how dugongs would respond to effluent from a plant water outfall, as well as the impact that the outfall could have on seagrasses that are available in the project area.

The potential impact of discharged Blacktip PW on dugongs is discussed in **Section 14.8**. It is expected that dugongs or other fauna will not be able to detect the PW discharge outside of the immediate discharge point and will not actively avoid the area. Within 5 m of discharge, the PW receives 100 dilutions and by the time the discharge reaches the sea surface it has received 700 dilutions (**Appendix J**, **Volume 2** of the Draft EIS). The reader is also directed to **OEH 33** (earlier in this section) for further details on nearfield and farfield PW dilution. Marine vertebrates including large fish and sharks, turtles and whales have been observed residing around and/or migrating past production platforms with PW discharges, including platforms on the North West Shelf and Timor Sea off northern Australia. These animals do not avoid the PW discharge plume and there is not reason to believe that dugongs will behave differently to any other marine vertebrate.

O'Sullivan and Jacques (2001) indicate that hydrocarbon concentrations above 100 ppm are required to kill marine flora. As demonstrated in response to **OEH 33** (earlier in this section), the concentration of hydrocarbons in PW when it contacts the coast will be below 5 ppb, even under worst case maximum discharge rates, there will be no impact on seagrass. In addition, as the seagrass beds are located low in the intertidal zone, near the lowest astronomic tide level, and only exposed during the lowest tides of the year (**Section 7.3.2**, **Volume 1** of Draft EIS), they will rarely be exposed to the PW discharge plume.

NLC 26: Page 31: Woodside claim to apply the ALARP principle to its decision making processes in relation to environmental standards. It has failed to do this in relation to PW disposal by not giving consideration to best practice disposal in southern states of PW to onshore hydrocarbon contaminant systems.

NLC 26: Consider best practice disposal of PW.

The idea that injection of PW into underground aquifers is best practice in all cases is a misconception, it is certainly a practice adopted by some developments but this is by no means universal. The decision to inject PW depends on a number of interrelated factors such as, area geology, PW composition, flowrates and contaminants, reservoir support requirements, and local water uses among others. The decision by the Blacktip Project to dispose of PW offshore rather than injection has been driven by the technical evaluation of the alternatives. The construction of a shallow bore and disposal to an aquifer as per 'best practice in the southern states' would also be a cheaper option than the proposed treatment system.

If an injection scheme is adopted then the primary consideration is the identification of a suitable aquifer. For an aquifer to be suitable it must be demonstrated that the water injected into it will not migrate to other water bearing strata that could then be used for bore water by the local populace, either now or in the future. This is particularly relevant in Australia were bore water is used extensively as drinking water. The most conclusive demonstration that a particular geological formation has formed a trap, i.e. is not in communication with aquifers above it, is the presence of hydrocarbons. When injection is adopted it is almost always into the aquifer associated with the hydrocarbon accumulation that the facility is actually producing from, and in a lot of cases the driver for this is increased recovery rather than environmental considerations. An alternative to

injecting into the producing reservoir would be to inject into depleted or partially depleted reservoir local to the facility. This approach has been adopted by Woodside's Otway development where PW is injected into the aquifer associated with the depleted Iona reservoir that is currently used for gas storage.

If a suitable hydrocarbon trap is not available, and there is no indication of this near the Blacktip facility, then water would be injected into a local aquifer. Without the presence of hydrocarbon it is difficult to prove that the selected aquifer will contain the PW, prior to the commencement of injection. One way to monitor the effectiveness of the trap would be to sink monitoring bores into the surrounding area. However, if these bores show that injected water is leaking into the monitored aquifer there is no recourse; all that has been demonstrated is that the monitored aquifer has been contaminated nothing can be done to rectify the problem. Furthermore, the use of monitoring bores is not conclusive, they can demonstrate that there is a leak but they do not demonstrate that there is not a leak.

The reader is also directed to the response to **NLC 53b**, **Section 14.8**.

14.9 Section 11.19 Hydrocarbon Spills

14.9.1 Section 11.19.1 Oil Spill Fate and Trajectory Modelling

ECNT 13: A spill of 100,000 cubic metres of condensate (complete rupture of tanker) 'will not be allowed to happen' says Woodside (11.19. Hydrocarbon Spills, p366). Therefore it does not even bother to provide an assessment of this worst-case scenario. This is not good enough. Accidents do happen and the risks must be properly assessed and considered. Furthermore, a contingency plan must be developed.

ECNT 13: Assess the risks associated with a worst case scenario spill of 100,000 cubic metres and develop a contingency plan.

The risks of various oil spills have been appropriately assessed during the preparation of the Draft EIS. The assessment considered various spill scenarios ranging from a small spill (8 m^3) occurring during cargo loading operations, to a medium spill (500 m^3) of fuel oil to a large spill (100,000 m^3) resulting from a complete loss of condensate from a fully laden tanker. According to industry averages for well-managed operations, spills of the magnitude of 100 m^3 or more are extremely unlikely and have a frequency of one in 100–1000 years or greater. Large spills (>1000 m^3) are extremely unlikely with a likelihood as low as one in one million years. In order for a spill of this magnitude to eventuate the following would need to occur:

- The vessel would need to run aground or collide violently due to navigation error or engine failure.
- The support vessel(s) would fail to respond and provide assistance.
- The cargo or fuel tanks would need to rupture and spill their loads into the sea.

It is not a case that the above 'will not be allowed to happen', but rather management measures such as those outlined below will ensure that the likelihood of such an occurrence is so low that it is not a reasonable scenario to analyse further.

- Only four tankers will be loaded per year.
- Tankers will be moored and loaded by experienced pilots, under suitable weather conditions;
- Vessels supporting the trading tankers during condensate loading will carry spill response equipment to combat spills immediately.
- Aframax trading tankers which carry up to 100,000 m^3 of condensate are double hulled.

However, this does not mean that contingency plans will not be developed. The Proponent has committed to prepare a Blacktip-specific OSCP prior to the commencement of production. This document will include:

- Oil spill trajectory modelling capability based on site specific metocean conditions and knowledge of oil weathering rates.
- Identification of oil-sensitive marine and coastal resources and priority protection areas, including the identification of fauna that may be attracted to affected areas.
- Spill response and clean up strategies for offshore and shoreline, including the use of dispersants, booms, skimmers and sorbents and the restrictions of weather and oil type on the various response strategies. Vessels supporting the trading tankers during condensate loading will carry spill response equipment to combat spills immediately.
- Identification of internal and external emergency organisations, responsibilities and resources (human and equipment and materials) for oil spill response, and call out details.
- Identification of local capacity to maintain and implement rapid response equipment and assist with habitat and wildlife rehabilitation.

A Framework Draft OSCP is provided in **Appendix C**. This plan has been provided to help the reader understand the format and contents of OSCP. This OSCP will be developed further and submitted to the NT Government for approval.

ECNT 14: Instead in the main report only an 8 cubic metre spill is modelled as this is 'likely to occur'. Under this scenario 900 kg of condensate became stranded on shorelines affecting about 1 km of beach, but is expected to evaporate and disperse within 3 days. What, however, are the likely impacts within that 3 day period? The EIS also states that the modelling indicates that even for large spills, oil does not extend to the important turtle nesting sites around Cape Hay and Point Pearce (11.19.2. Effects on Biota, p372). But what about the effects on Yelcherr beach nesting sites?

ECNT 14: What are the likely impacts of the 8 cubic metre spill scenario within the 3 day period before the condensate is expected to evaporate and disperse?

Oil spill modelling of an 8 m^3 spill indicates that by the time a spill of this size has impacted the coast, 86% of the spill has evaporated and the concentration of oil coming ashore would be 0.005 kg/m^2 (**Appendix K**, **Volume 2** of the Draft EIS). This is equivalent to about 7 ml/m^2 which is unlikely to cause either a toxic or physical impact (**Appendix K**, **Volume 2** of the Draft EIS). Therefore, impacts of an 8 m^3 spill are expected to be minimal. Spilt oil that contacts the coast is expected to continue to evaporate.

A Blacktip-Specific OSCP will be developed, as outlined in response to **ECNT 13** (earlier in this section), which will document oil spill response strategies to further reduce the likelihood and severity of a spill contacting the coast, and response strategies to mitigate against potential impacts. Measures to mitigate against impacts on turtle nesting will be incorporated into this plan.

Refer also to **Section 7.3.1**.

ECNT 15: Modelling of a 500 cubic metres spill of heavy fuel oil is not discussed in the Main Report. Appendix K notes, 'adverse effects from a heavy fuel spill are more likely to be related to coating of wildlife dwelling on the water surface, smothering of intertidal organisms, and long-term sediment contamination'. 400,000kg of oil were predicted to be washed ashore and would impact 50km of beach. This is a significant risk which requires serious consideration. Instead the EIS glosses over this risk.

ECNT 15: Consider the scenario of a 500 cubic metres spill of heavy fuel oil in the body of the report.

Modelling of a 500 m^3 heavy fuel oil spill (**Appendix K**, **Volume 2** of the Draft EIS) indicates the following:

- Approximately 50 km of coastline is at risk during the wet season and 40 km during the dry season, based on the 5% probability contour. However, the shore contact of an individual spill depends on the spill specific weather and metocean conditions in place at the time of the spill. As an example, deterministic modelling of a single spill indicates that the spill made contact with 6 km of the coastline.
- A total of 400,000 kg of oil was predicted to be washed onto the shoreline, under a worst case scenario. This is likely to be persistent and, if left unattended, is likely to cause a significant localised environmental impact which is discussed in **Section 11.19, Volume 1** of the Draft EIS.
- There is a 25% probability of oil impacting the shoreline during the wet season within one day after a spill has occurred and a 5 to 10% probability in the dry season.
- The overall probability of a 500 m^3 oil spill occurring and the spill contacting the coast is one in 4000 years during the wet season and one in 10,000 years during the dry season.

Environmental risk is determined on the likelihood or probability of an event occurring and the consequences of the event occurring (refer to **Section 10**, **Volume 1** of the Draft EIS). Undoubtedly, the consequences of a 500 m^3 spill of heavy fuel, as outlined above, is greater than the consequences of an 8 m^3 spill of condensate. However, the likelihood of this large spill is an order of magnitude less than the likelihood of the small spill (**Table 11-2**, **Volume 1** of the Draft EIS) and the probability of the spill contacting the coast is two orders of magnitude less likely (refer to response to **OEH 73b**, **Section 14.9.2**). The overall risk of a large spill is low compared to the risk of a small spill which is medium, as demonstrated in **Table 11-4**, **Volume 1** of the Draft EIS). The highest risk was presented and discussed in Volume 1 of the Draft EIS. A large spill was discussed in further detail in **Appendix K**, **Volume 2** of the Draft EIS.

14.9.2 Section 11.19.2 Effects on Biota

NLC 6: Oil Spills

P. 363, Section 11.1 deals with QRAs for oil spill scenarios. Spill modelling of a small $8m^3$ condensate spill would bring 136 kg oil max to each 100m of beach and no more than 1kilometre impacted overall- eg on a conservative basis of 1 in 3 years, less than ~10 times during a 30 year project. The model demonstrates hydrocarbon deposition on Yelcherr beach. Woodside still advise on page 374 that the chance of a small spill is remote as there will be only 4 condensate tanker loads a year. The EIS needs to link the mathematics of their spill model with the number of tanker loads.

The EIS should make it clear what spill containment and clean up equipment Woodside would have stored at Wadeye or the proposed gas plant to manage small local spills.

The EIS gives a commitment to produce a Blacktip onshore OSCP before commencement of construction. The NLC needs such a plan now to discuss with TOs to explain risk and remediation actions.

Yek Maninh, Yek Ngangu and Yek Kinmore traditional owners have all expressed concern to the NLC about the potential for the project to impact on their lands and food resources through insufficient attention to ensuring that oil spills cannot occur and, should they occur, insufficient attention to arrangements to ensure effective and immediate containment and management of such spills such that their resources are not impacted.

OEH 73b: Further, the Supplement should quantify the risk of [condensate] spills reaching a "sensitive resource" (Section 11.8).

NLC 6a: Clarify the estimate of the chance of a small spill.

NLC 6c: Traditional Aboriginal owners have expressed concern about the potential for the project to impact on their lands and food resources through insufficient attention to oil spills.

OEH 73b: Quantify the risk of [condensate] spills reaching a "sensitive resource".

The Proponent expects the frequency of spills associated with the Blacktip Project to be substantially less than for most existing offshore facilities for the following reasons:

- Facility design is continually evolving to reduce the risk of a spill reaching the environment. That is, new platforms and facilities are better designed to reduce and contain spills than older facilities.
- The offshore Blacktip facilities are unmanned which greatly reduces the likelihood of human error resulting in a spill.
- The level of offshore activity, including tanker loading, for the Blacktip Project is very low, compared to larger, manned operations, again reducing the likelihood of human error resulting in a spill.

Table 11-2, **Volume 1** of the Draft EIS presents the probability or likelihood of different sized spills for Woodside's most recent projects, based on historic data of oil spills worldwide and is considered a suitable guide for the Blacktip Project.

Based on the data presented in **Table 11-2**, a spill of 8 m^3 of hydrocarbon is expected every 1 in 3 years or 0.33 probability. As demonstrated by the oil spill modelling, a spill of 8 m^3 of condensate at the export mooring has a 1 in 20 or 0.05 probability of oil impacting the shoreline during the dry season when onshore winds predominate. To determine the overall probability of an 8 m^3 oil spill at the condensate export mooring occurring and the oil reaching shore, the two probabilities are multiples as in **Table 15** below. It should also be remembered that all modelled scenarios assume that no oil spill response measures are undertaken. In reality, any spill heading ashore would be managed using appropriate equipment which may include dispersants, booms, skimmers or sorbents. This should further reduce the probability of spilt oil reaching the shoreline.

Table 15 Probability of an 8 m^3 Condensate Spill at the Condensate Export Mooring Reaching the Coastline

Season	Probability of 8 m^3 spill at mooring	Probability of oil reaching coast	Overall Probability
Wet	0.33	0.05	0.0165 or 1 in every 60 years
Dry	0.33	0.02	0.0066 or 1 in every 150 years

An 8 m^3 spill places up to 20 km of coastline at risk. Sensitive resources within the 20 km stretch of coastline at risk include mangroves, turtle nesting beaches and rocky intertidal areas. However, the shore contact of an individual spill depends on the spill specific weather and metocean conditions in place at the time of the spill. As demonstrated in **Section 11.19**, **Volume 1** of the Draft EIS, each individual spill would affect a far smaller area. In the 8 m^3 spill example presented **Figure 11-3**, **Volume 1** of the Draft EIS, less than one kilometre of coastline was impacted.

As demonstrated in **Table 15**, the probability of spilt oil reaching the coastline or sensitive resources is very small and the area impacted by an individual 8 m^3 spill, which contacts the coast, should be limited. A Blacktip-specific OSCP will be prepared (refer to response to **ECNT 13**, **Section 14.9.1**). A Framework Draft OSCP is provided in **Appendix C**.

NLC 6b: Clarify what spill containment and clean up equipment Woodside would have stored at Wadeye or the proposed gas plant to manage small local spills.

It is unlikely that extensive oil spill clean up kit required for large spills will be stored at the gas plant. This equipment requires regular maintenance and trained operators. This type of equipment will be brought in from other supply bases as will the trained operators in the highly unlikely event of a large spill occurring.

NLC 44: The first draft of the EIS provided to the NLC EIS on page 219 7.3.3 stated that an epiphytic mangrove Littorinid endemic to the Joseph Bonaparte Gulf should not be affected by impacts resulting from the Blacktip Project. It was requested that this statement should be qualified. What are the potential impacts-presumably oil? Would the Littorinid avoid impact from an oil spill or from low level oil in diluted PW water because it suspends itself above the watermark? Other invertebrates would not avoid oil impacts. The above questions were answered by removal of the statement from the public EIS. It must be now assumed that it could be impacted.

NTG 106a: What processes should be put in place to protect the environmentally sensitive mangroves and associated fauna from possible sediment overloads, oil spillages and other deleterious impacts, both during and after the construction phase? [SKM, Brian]

NTG 106c: Why is there no mention of the rare, narrow-range endemic mollusc Littoraria ianthostoma in the Executive Summary? Surely this extra-special, rare species ought to be monitored very carefully and perhaps be monitored especially during, and after, the construction phase. This species is mentioned on Page 32, but its importance and the necessity for conservation are ignored. [SKM, Brian]

NLC 44: Qualify the statement that an epiphytic mangrove Littorinid, endemic to the Joseph Bonaparte Gulf, should not be affected by impacts resulting from the Blacktip Project.

NTG 106c: Discuss the importance and the necessity for conservation of the rare, narrow-range endemic mollusc Littoraria ianthostoma.

NTG 106a: Discuss strategies to protect the environmentally sensitive mangroves and associated fauna from possible sediment overloads, oil spillages and other deleterious impacts.

The purpose of the Executive Summary is to serve as a summary of the Draft EIS and particularly to identify the key findings of the environmental assessment. *Littoraria ianthostoma* was not mentioned specifically in the Executive Summary because the Blacktip Project is not expected to have any effect on this mollusc, for the reasons outlined below.

Littoraria ianthostoma lives on the trunks of mangrove trees only in the Joseph Bonaparte Gulf (R Wallin [Curator of Molluscs MAGNT], *pers. comm.* February 2004). Its restricted range makes it vulnerable if its habitat is disturbed. However, the Blacktip Project should not have an impact on mangroves. Mangroves are a significant habitat because they support a wide diversity of fauna, are highly productive and play an important role in stabilising the coastal system. Mangroves can be easily disturbed by changes to local water movement, sedimentation migration or littoral drift patterns, which can cause sediment scour and erosion of the mangrove habitat or rapid accretion of sediments causing smothering and loss of mangroves. No mangroves will be disturbed during the construction, operation and decommissioning phases of the Blacktip Project so there should be no loss of mangrove habitat. Shore crossing construction activities are located towards the centre of Northern Yelcher Beach, 300 m or more from the mangroves at each end of the beach and these activities should have no effect on the mangroves.

A Vegetation Clearing Construction EMP (**Table 15-11**, **Volume 1** of the Draft EIS) will be prepared which will ensure that no vegetation is cleared outside of the approved working areas. This management plan aims to protect against impacts on vegetation and flora adjacent to work areas, prevent impacts on vegetation communities of conservation significance and prevent the introduction and spread of weeds.

A Sediment & Erosion Control Construction EMP (**Table 15-9, Volume 1** of the Draft EIS) will also be prepared which will aim to minimise soil disturbance, degradation and erosion and to minimise turbidity impacts on marine, surface and ground waters.

The proponent will undertake further intertidal baseline monitoring prior to construction (**Table 15-1**, **Volume 1** of the Draft EIS). Routine intertidal monitoring will be undertaken during the operational phase of the project at intervals to be agreed with the appropriate Northern Territory Government departments.

The only risk to mangroves and associated fauna is from an accidental oil spill. Management of oil spills is discussed in detail in **Section 11.19**, **Volume 1** of the Draft EIS. A Blacktip-specific OSCP will be prepared prior to the commencement of production (refer to response to **ECNT 13** (**Section 14.9.1**). A Framework Draft OSCP is provided in **Appendix C**.

Littoraria ianthostoma may escape the direct impact of an oil spill, as this species lives above the high tide mark on the trunks of mangroves. However, given the limited distribution of this species, it is vulnerable to habitat loss. Oil can cause significant mortality of mangroves and mangrove seedlings and significant leave loss on surviving mangroves. Recovery of disturbed areas can take decades (Duke and Burns 1999). Importantly, the use of dispersants has been shown to significantly reduce the impact of an oil spill on mangroves (Duke and Burns 1999). In the event of an oil spill, *Littoraria ianthostoma* may be able to be collected and translocated to unaffected mangroves in the Joseph Bonaparte Gulf. The use of dispersants and the ability to collect and translocate *Littoraria ianthostoma* in affected areas will be investigated further during the preparation of the Blacktip OSCP.

Responses to **NTG 106** are further addressed in **Section 20.2**.

OEH 35: Model results suggest 20km of coastline is at risk after 5 days of elapsed time, but more temporal information is needed. Modelling suggests that biota may be coated and smothered in oil in shallow waters. Recovery of the system following an oil spill is forecast to be "relatively quick, unless the oil enters the tidal inlets". What happens if the oil enters tidal inlets? How likely is this to occur? Sensitivity analyses for various model parameters should be performed and outlined in the Supplement and more certainty needs to be provided for the potential booming off of the mangrove area.

OEH 35: Provide more temporal information on model results and sensitivity analyses for various model parameters.

The oil spill scenarios are discussed in detail in **Appendix K**, **Volume 2** of the Draft EIS. An 8 m^3 spill scenario was run which indicated that the spill contacted the coast within six hours. A 500 m slick was formed and 86% of the slick evaporated by the time the slick reached the shore, stranding 800 kg of oil over a 700 m area. By the time the spill had impacted the coast, the concentration of oil was 0.005 kg/m^2, which is unlikely to cause a toxic or physical impact. Stochastic modelling was also undertaken to allow for the many possible wind and tide conditions that could be experienced in the nearshore waters of the Blacktip Project. The stochastic modelling after five days was very similar to the results achieved after 24 hours indicating that most of the condensate evaporates within 24 hours and there is little need to model beyond this period.

The impact of oil on tidal mangrove inlets is discussed in response to **NLC 44** (earlier in this section) and further information on the likelihood of a spill reaching the coastline is presented in response to **OEH 73b** (**Section 14.9.2**).

Verification of the model is discussed in response to **NTG 26** (**Section 7.4.2**). The potential for booming the mangrove tidal inlets will be fully investigated during the development of the Blacktip OSCP. There are several issues which need detailed consideration. Strong tidal currents in the project area may make the use of booms impractical. Furthermore, there are significant HSE issues associated with people deploying booms in this area due to the presence of crocodiles.

NTG 79: The following impacts associated with discharge of hydrocarbons into the nearshore marine environment require consideration:

- oil spill beaching on 20 km of coastline on subsistence fisheries; and
- remedial treatments for rocky platforms oil subsequent to a spill.

NTG 79: Consider the impacts on subsistence fisheries of an oil spill beaching on 20 km of coastline and subsequent remedial treatments for rocky platforms.

It should be noted that if an 8 m^3 spill was to occur, this would not impact 20 km of coastline. Rather an 8 m^3 spill places up to 20 km of coastline at risk. However, the shore contact of an individual spill depends on the spill specific weather and metocean conditions at the time. As demonstrated in **Section 11.19**, **Volume 1** of the Draft EIS, each individual spill would affect a far smaller area. In the example presented in **Figure 11-3** and **11-4**, **Volume 1** of the Draft EIS, less than one kilometre of coastline was impacted. The impact on subsistence fisheries would depend on the precise location of the spill contacting the coast and the time of year of the spill. The dominant habitat within the 20 km of coastline at risk is sandy beaches and therefore a spill occurring in the wet season would have little impact on subsistence fisheries as there would be little marine life of interest in the area. However, a spill during the dry season may limit nesting activity or access to turtle nests if it occurred on a turtle nesting beach. If the oil was to beach on rocky platforms or mangroves, the impact on subsistence fisheries would potentially be greater.

A Blacktip-specific OSCP will be prepared prior to the commencement of production which will include:

- Identification of oil-sensitive marine and coastal resources and priority protection areas.
- Spill response and clean up strategies for offshore and shoreline, including the use of dispersants, booms, skimmers and sorbents and the restrictions of weather and oil type on the various response strategies. Vessels supporting the trading tankers during condensate loading will carry spill response equipment to combat spills immediately.

Remedial treatments for sandy beaches, rocky platforms and mangroves will be developed as part of the Blacktip-specific OSCP. A Framework Draft OSCP is provided in **Appendix C**. The

International Tanker Owners Pollution Federation Limited <http://www.itopf.com/shoreline.html> has prepared several remediation response strategies which are outlined below.

Sand Beaches: Bulk oil can usually be removed without difficulty from hard-packed sand beaches, using a combination of well-organised teams of manual labourers assisted by front-end loaders and other mechanical equipment to transport recovered wastes. Care needs to be taken not to remove excessive quantities of sand or to mix the oil deeply into the beach substrate, and in this respect manual collection of the oil is far preferable to attempts at mechanical removal with machinery. Final cleaning options can include manual removal of tarballs or oil fragments or the use of specialist beach cleaning machinery, such as tractor drawn units which are usually employed to collect rubbish and debris from beaches during the tourist season. In some circumstances techniques such as flushing with sea water to remove buried oil or harrowing to encourage the breakdown or degradation of final traces may be appropriate.

Rocky Shores: Cleaning of rocky shores close to amenity beaches or sea walls and slipways is normally straightforward. Bulk oil can be recovered manually or by using vacuum units or other skimmers on pooled oil. Low pressure flushing with sea water may also be employed to wash oil residues to collection points. Final cleaning usually requires high pressure flushing, the pressure needed depending on how firmly the oil is adhering to the rock. If the residual oil is stuck very firmly to the rock, or if a very high degree of cleanliness is required, then it may be necessary to resort to high pressure hot water washing or even sand blasting. Such 'aggressive' techniques will cause damage to the natural fauna and flora living on the rocks, and so they should be used with caution. In many cases it will be most appropriate and least damaging to leave natural processes, such as wave action and scouring, to deal with any residual oil over time.

Greater problems are caused where oil penetrates deeply into boulders, cobbles or gravel since it is rarely practical to do more than remove surface accumulations. If amenity or wildlife concerns dictate a more thorough clean-up, the most effective technique is likely to be sea water flushing, with the containment and collection of any oil that is released using booms and skimmers. On cobble or gravel beaches it may be appropriate to bulldoze the contaminated beach material into the surf zone to take benefit of natural cleaning processes. In circumstances where residual oil on shorelines might pose a threat to breeding colonies of marine mammals or birds and where other techniques might cause damage through greater disturbance, it may be appropriate to cloak oily haul out areas and access routes with some form of natural sorbent, such as peat.

Saltmarsh and Mangrove: Leaving residual oil to weather and degrade naturally is usually recommended for sensitive shoreline types such as salt marshes and mangroves, because they have been shown to be more easily damaged by the physical disturbance caused by clean-up teams and vehicles than by the oil itself. If any cleaning is attempted, it should be carried out with specialist guidance and advice.

14.10 Section 11.20 Waste

14.10.1 Section 11.20.3 Hazardous Waste Stream & Chemicals

NTG 80: DHCS Environmental Health Darwin Rural requests to see a copy of the Waste Management Plan. The International convention for the Prevention of Pollution from Ships 1973 Annex 3 Regulation 8 Discharge of Sewerage (1) (a) states that *"the ship is discharged comminuted and disinfected sewerage using a system approved by the administration in accordance with regulation 3(1) (a) at a distance of more than four nautical miles from the nearest land, or sewage which is not comminuted or disinfected at a distance of more than 12 nautical miles from the nearest land,…*' Information provided in the EIS should to be amended to reflect this requirement.

NTG 80: Consider the requirements of the 'International Convention for the Prevention of Pollution from Ships 1973' for the discharge of sewerage.

Requirements of the *International Convention for the Prevention of Pollution from Ships 1973* are discussed in **Section 11.20.2**, **Volume 1** of the Draft EIS. This convention is also known as MARPOL. As stated in the **Section 11.20.2,** sewage, greywater, drainage water and other putrescible waste such as food scraps will be disposed of in accordance with PSLA and MARPOL 73/78 Annex IV.

Once finalised the detailed Waste Management Plan will be made available to all relevant regulatory authorities. Refer also to the response to **OEH 38** (**Section 9.1**) and **ECNT 5b** (**Section 9.1.1**).

14.11 Section 11.22 Noise and Vibration

NLC 57: Page 382 refers to impacts from noise and vibration. Will there in future be any likelihood of compression being placed on the offshore platform and therefore increasing the noise levels?

NLC 57: Is there any likelihood of compression being placed on the offshore platform and therefore increasing the noise levels?

There is no plan to install compression offshore.

15. Draft EIS Section 12 Terrestrial Impacts, Preventative & Management Measures

15.1 Section 12.1 Introduction

Sacred Sites

NTG 81: There should be some discussion about possible effects on sacred sites.

NTG 81: There should be some discussion about possible effects on sacred sites.

Impacts on sacred sites are not discussed in **Section 12** but **Section 13**, **Volume 1** of the Draft EIS. The reader is directed to the responses to **NTG 66a, NTG 66b** (**Section 12.4**) and **OEH 67** (**Section 12.4.1**) for further detail.

15.2 Section 12.2 Physical Environment

15.2.1 Section 12.2.1 Topography and Soils

Preventative & Management Measures for Acid Sulfate Soils

NTG 82: It is stated that 'acid generation from soils can affect human health'. There is potential for a moderate to high risk of acid sulfate soils around the shore crossing. What mechanisms will be put in place to monitor the prevalence of acid sulfate soils? DHCS Environmental Health Darwin Rural requests a copy of the ASS site investigation report.

NTG 82: What mechanisms will be put in place to monitor the prevalence of acid sulfate soils?

Refer to response to **NTG 58** (**Section 11.1.3**), and the attached **Appendix D** for more detailed information.

15.2.2 Section 12.2.2 Hydrology & Water Quality

NTG 83: DHCS Environmental Health Darwin Rural requests a copy of the Groundwater Protection Management Plan. The plan needs to demonstrate that there will be no detrimental impact on the groundwater sourced by the Wadeye Community. How will small systemic leaks over long periods of time be captured? To this end, will analysis of groundwater beneath the onshore processing be undertaken at scheduled intervals as part of the proposed monitoring programme? It is noted that groundwater monitoring is not established in Table 15.1 of the EIS. Suggested contaminants of concern are hydrocarbons and faecal coliforms. It is acknowledged that Table 15-10 outlines proposed groundwater monitoring.

The hydrological risk assessment indicates a high primary risk of contamination of ground water. There is reference to a Ground Water Protection Management Plan, however there is insufficient detail provided.

NTG 83: Further information on the Groundwater Protection Management Plan and monitoring is requested.

The EMP will be made available to the relevant government bodies.

It is noted that a commitment to monitoring groundwater is absent in **Table 15-1, Volume 1** of the Draft EIS. However, **Table 15-10** (Framework Groundwater Protection EMP) commits to undertaking both baseline groundwater monitoring to characterise the groundwater at the site, and groundwater monitoring to provide information about environmental performance and impacts. It will also be necessary to conduct routine health monitoring on groundwater sources that are utilised for potable water.

The Groundwater Protection EMP will be produced as part of the overall EMP that will be issued to, and approved by, the relevant government bodies prior to construction beginning.

Groundwater bores will be located within the gas plant footprint, however, exact locations have not been decided.

15.3 Section 12.3 Ecological Environment

15.3.1 Section 12.3.1 Vegetation Clearing and Habitat Loss

ECNT 17: 2ha of sand dune habitat will be disturbed and 74 ha of tropical savanna woodland will be cleared. These figures do not include disturbance arising from borrow pits or the upgrade of access tracks to the project area (12.3.1. Vegetation Clearing and Habitat Loss, p400-401). What will this entail? There are no details provided in the EIS. Cycads, a protected species, also occur in the savanna woodland to be cleared.

ECNT 17: Discuss the disturbance arising from borrow pits or the upgrade of access tracks to the project area.

All *Cycas spp*. that are listed as threatened wildlife in the NT are "protected" plants under section 3(A) of the Territory Wildlife Regulations. *Cycas maconochiei ssp. maconochiei,* which is present on the project site, is currently listed as 'least concern' and so is technically not protected.

It is recognised that this species is endemic to the NT and the project will work under the Management Plan for Cycads in the NT 2003–2008 in order to 'provide for the wise use of cycads that will otherwise be destroyed through land use permitted under relevant legislation', especially as this species is not found on parks or reserves in the NT. The Blacktip Project will encourage the harvesting of specimens of *C. maconochiei* prior to clearing activities taking place. Harvesting will only occur once a permit is sourced from the NTPWC and will take place in consultation with the traditional Aboriginal owners of the region. The traditional Aboriginal owners will be given first selection of the harvested plants, prior to consulting other land care groups. Where land clearing has been approved by the NT Government, it is understood that no permit to take cycads on the area designated to be cleared will be required, although individual plants will require to be tagged.

NLC 58: Page 395 & 402. Revegetation: On these pages there are references to "quick revegetation". Eg clayey sands landward of the beach. It is possible to work out from the EIS that quick revegetation consists of returning of overburden and removed soils seed store and dead vegetation. This may not be sufficient and a more active means of surface erosion control may be needed for certain areas in preparation for the following wet season eg surface binding methods such as hydro mulching.

NLC 58: Discuss the efficacy of "quick revegetation", particularly with regards to erosion control.

The revegetation methods detailed in the Draft EIS have been deemed sufficient due to the following factors as detailed in **Sections 12.2.1** and **12.2.2**, **Volume 1** of the Draft EIS:

- There are no watercourses in close proximity to the plant or pipeline that could be affected by increased run-off or erosion.
- The topography of the area is relatively flat which reduces the risk of erosion.
- Only one watercourse (Sandfly Creek) will be crossed by the proposed access road to the project area and increased turbidity loads will be managed by the development of guidelines for the selection, establishment and rehabilitation of vehicle crossings over watercourses as part of the Erosion and Sediment Control Plan.
- Construction activities and rehabilitation will occur in the dry season prior to the onset of the rains.
- Construction of areas considered to pose a higher risk of sediment-laden run-off entering surface waters will be prioritised and conducted as early as possible during the dry season construction programme. This will allow for adequate time for rehabilitation and erosion control to stabilise sediments prior to the onset of the wet season. This includes the area landward of the beach with near surface clayey sands that may be highly erodible.

Hydromulching typically consists of applying grass seed mixed with mulch material (generally a mix of wood or recycled paper) that has been processed to a very specific fibre texture. Its purpose is to prevent moisture loss from the soil in order to assist the grass seed mix to germinate and grow. It is marketed as achieving a high level of erosion resistance and can be easily applied with hydro-mulching machine. A tackifier (glue) is often used to tie the mulch to the soil. Site soil must be suitable for hydromulching to be successful, otherwise additional topsoil will need to be introduced. Generally, irrigation of the mulch material is required on a regular basis to keep seeds alive and to encourage germination.

Hydromulching is not viewed as the most useful methodology to use for this location as it may increase the probability of the introduction of weed species. It has been found to be a suitable methodology for the creation of smooth, manicured surfaces such as new home lawns and golf greens.

The proposed rehabilitation practices would see the soil layers reapplied in the appropriate order with the top layer of soil that contains vegetation material and the natural seed bank of the area reapplied.

Where surface stabilisation is required, such as on the re-formed dune, then a suitable surfacing material such as a wood shaving filled netting (e.g. Enviromat) would be used. Plantings of spinifex (*Spinifex longifolius*) seeds and runners may also be utilised. These techniques will be

developed and described in the Erosion and Sediment Control Plan and Rehabilitation Management Plans.

15.3.2 Section 12.3.2 Significant Vegetation, Habitats & Individual Species of Flora & Fauna

Habitat

OEH 18: Habitat fragmentation and its implications should be discussed in the Supplement, as should the clearing of protected cycad and orchid plants.

OEH 18: Discuss habitat fragmentation and its implications and the clearing of protected cycad and orchid plants.

Habitat Fragmentation: The Blacktip Project will result in the creation of a narrow gap in continuous forest habitat. However, it will not create small islands of habitat that are separated from each other, as is typically described in fragmented systems. These small fragments often adequately address the needs of species that inhabit the edge regions of habitat but are largely unable to support specialised species that require an adequate 'interior' habitat. This interior habitat often has a different climate and supports different species from those towards the edge; therefore, where fragmentation is occurring, species in the interior are increasingly exposed to unsuitable edge habitat and become vulnerable to localised extinction (Jellinek et al. 2004; Major 2003). As the Blacktip Project is not causing fragmentation in this sense, it is expected that the effects will be as described in the fauna report and the Draft EIS, discussed next.

As discussed in **Section 12.3.1**, **Volume 1** of the Draft EIS, the magnitude of barrier effects that will result from the clearing of the pipeline corridor and gas plant footprint will largely depend on species behaviour and mobility (Goosem et al. 2001). The majority of species are likely to continue to use the temporarily disturbed woodland in and around the project area, although it is likely that some sensitive species will move away from the area (PWCNT 2001). Given the widespread regional availability of eucalyptus woodland and sand dune habitats, it is considered unlikely that faunal populations and assemblages will undergo any more than minor change in the region.

Cycads and Orchid Plants: Although cycads and orchids are typically recognised as being regionally restricted in distribution, none of the cycad or orchid species that are present on the site are listed as 'threatened' and are therefore not considered to be 'protected' under the legislation. *Cycas maconochiei ssp. maconochiei,* which is present on the project site, is currently listed as 'least concern', as are the orchids *Cymbidium canaliculatum* and *Dendrobium affine*.

It is recognised that these species are endemic to the NT and will encourage the harvesting of specimens prior to clearing activities taking place. Where land clearing has been approved by the NT Government, it is understood that no permit is required to take non-protected plants from an area that has been designated to be cleared. Harvesting will only occur following consultation with the PWCNT and following permission being granted from the Traditional Aboriginal Owners of the region.

Page 404 Seabird Roosts

NLC 59: Information is needed from Woodside on seabird roosting sites recorded in proximity to the proposed pipeline landfall site that are said to be of low significance. This evaluation of significance is disputed. On Page 285 of the initial Draft EIS it advised that there are some sea bird breeding roosts (i.e. terns) recorded in proximity to the proposed pipeline landfall site with numbers in the low hundreds. Roosting terns in such numbers are not insignificant. Additional information is needed on what "proximity" means on the ground. Eg on the dune area behind the beach or elsewhere? Location information will help resolve this issue. The NLC would not wish to unknowingly be party to impacts on seabird roosting sites without there being an agreed management plan in place acceptable to major stakeholders.

NLC 59: Justify the evaluation that seabird roosting sites recorded in proximity to the proposed pipeline landfall site are of low significance.

Seabird roosting information came from personal communication with Ray Chatto (2004), and from the report *Distribution and Status of Colonial Breeding Seabirds in the Northern Territory* (Chatto 2001) which did not indicate any seabird breeding sites within the vicinity of the landfall area. To put the description of 'low significance' in context, as part of the 2001 report, *breeding* colonies were allocated a level of significance as either nationally significant, regionally high or regionally low. National significance was defined according to Ramsar Convention criteria as 'regularly supporting 1% or more of the individuals in a population of fauna and/or regularly supporting more than 20 000 birds'. The two regional levels of significance were used to 'separate small colonies of minor significance and larger, more significant colonies which did not have numbers high enough to rate a nationally significant allocation' (Chatto 2001).

The Tern species that roost within 1–2 km from the landfall area are known to form non-breeding roosts along the majority of the NT coastline and do not form breeding colonies anywhere near Yelcher Beach (Chatto 2001). As the roosting sites present around the Yelcher beach site do not represent breeding sites for these species, and numbers are present only in the low 100s, then the significance of these roosts was considered to be low.

The area is not known to be a breeding site for any seabirds, waterbirds or shorebirds (Chatto *pers comm*. 2004).

15.3.3 Section 12.3.3 Fauna Capture in Open Trench

NTG 84: A major impact on the local terrestrial fauna will be the 2.5 kilometre trench, open for several weeks (Table 12.2). Although preventative measures, such as escape ramps at regular intervals along the trench, are proposed, many of the smaller animals likely to be trapped in the trench (eg small lizards) may not locate a ramp. As a further management measure, placement of numerous sheltering sites (eg flattened cardboard boxes) on the trench floor would provide shade and protection from predators. While the EIS addresses potential impacts on terrestrial fauna and gives commitment to mitigation measures, it does not supply enough information on species likely to be present and, therefore, does not adequately address their management.

NTG 84: Address the management of local terrestrial fauna with regards to the proposed 2.5 kilometre trench.

In addition to conducting fauna surveys of the project area, a thorough desktop study was undertaken in order to compile the most accurate species list possible. The fauna surveys conducted in June 2004 added an extra 28 species to the NT Fauna Atlas records for the region. Further surveys were planned for the access tracks and drainage lines, however, due to access issues beyond the control of the proponent, these surveys did not occur.

Woinarski et al. (2000) compared the results for quadrat trapping surveys of habitats surrounding an open trench with fauna captured in the open trench. The study found that species capture in the open trench resulted in the capture of numerous species (snakes, pygopodids and frogs) that were not recorded using conventional quadrat sampling. A significant amount of data will be obtained through the animal collection and identification work that will occur during the period that the trench is open.

Potentially placing wet hessian bags along the bottom of the trench could provide shelter places for small reptiles and mammal species that are prone to dying as a result of stress during capture and handling, such as *Pseudomys delicatulus* (Strahan 1995). This method is being used on the Moranbah to Townsville pipeline.

OEH 19: The comment that reptile activity is lower in the dry season than in the wet (Section 12.3.3) should be referenced and the timing for the excavated "trench [being] open for minimised periods" should be specified. Fauna mortality through falling directly into the trench should be acknowledged, especially for macrofauna such as wallabies, and plans to minimise it should be presented.

OEH 19: The comment that reptile activity is lower in the dry season than in the wet should be referenced and the timing for the excavated trench should be specified.

It is well known that reptiles are sensitive to external temperatures and to varying degrees regulate their body temperatures by thermoregulating (for a detailed discussion, see Heatwole and Taylor 1985). Reptiles are ectothermic animals and therefore rely on the external environment to reach and maintain an 'active' body temperature (Cogger and Zweifel 1998). A number of studies of tropical reptiles in northern Australia demonstrate that at least some reptiles are affected by seasonal climate, generally showing that during the dry season when temperatures are generally cooler, activity can be reduced. Brown and Shine (2002) conducted a study on the influence of weather conditions on activity of tropical snakes at Fogg Dam in the Northern Territory. Much of the variation in the number of snakes, that were encountered during the year-long study, was related to long-term (seasonal) factors, with at least a 10-fold difference in mean encounter rates among months. Water Pythons *Liasis fuscus* were encountered most frequently during September-November and Keelbacks *Tropidonopohis mairii* between April-June. Activity patterns of adult male and juvenile Keelbacks appeared to be related to diurnal temperature, and adult females by dry, rapidly cooling nights. The Frillneck Lizard *Chlamydosaurus kingii* is a species that shows a marked reduction in energy expenditure during the dry season during periods of low food and

water availability (Griffiths and Christian 1996). These examples do not indicate that reptiles cease activity during the dry season, but do suggest that their activity levels are lowered. The lower wildlife activity during the dry season (the most benign season) was specifically mentioned in the key paper on open trench fauna captures, deaths and mitigation (Woinarski et al. 2000), and the recommendation made in this paper was to 'undertake operations in the most benign season' on the premises that:

- wildlife mortality is likely to be highest in hot (or very cold) weather;
- wildlife activity may also be higher in warm weather than cool weather, so capture rates then would be greater' (Woinarski et al. 2000).

The trench will be open for the shortest time possible. The trench will remain open until hydrotesting is complete. The trench is likely to be open for a maximum of six weeks; however, this could be significantly reduced once the pipe lay and testing schedule are confirmed. Whilst the trench is open, it will be inspected at least twice daily in order to remove any trapped fauna and escape ramps will be placed along the length of open trench.

It is acknowledged that fauna may be injured as a result of the impact of landing in the trench. Fauna handlers will need to undergo a degree of training which will include euthanasia for seriously injured animals. The study of fauna capture in an open trench conducted on the Moomba to Sydney pipeline (1997) found one western grey kangaroo with a broken leg, which was euthanased. Others were observed frequently licking their forearms and foaming slightly at the mouth indicating stress and overheating. The overall mortality rate for this study was 41.8% however, it was not a routine, daily investigation. Observations suggested that death in the trench was, in the large majority of cases, related to stress, dehydration, exposure and predation. Some dead animals appeared to have been crushed, presumably by other animals moving along the trench trying to escape. Emu feathers were found on nine occasions in the trench but no emu was sighted.

The study conducted by Woinarski et al. (2000) of fauna capture in an open trench at MacArthur River in the Northern Territory, recorded relatively high mortality rates for three mammalian species, *Leggadina lakedownensis, Pseudomys delicatulus* and *P. nanus*. These small mammal species are known to be easily stressed, with *P. delicatulus* often dying when handled (Strahan 1995). This study recorded a much lower mortality rate of 11%, which was substantially less than the previous study in NSW and from the results obtained from previous pipeline works at MacArthur River in 1994. The Proponent has adopted many of the recommended mitigation measures detailed in the Woinarski et al. (2000) report.

OEH 75: The treatment of weed infestation (Section 12.3.4) as a serious issue should be formally addressed. Include in the discussion: -

-the definition of "weed free;"

-a specification that the washdown bay include a hoist or inspection pit;

-the likelihood that fill material from borrow pits will contain weed seed;

-the urgent need for all materials and fill to be quarantined before being transferred to the proposed construction site.

OEH 75: Formally address the issue of weed infestation.

Weed Treatment: The treatment of weed infestations is being treated as a serious issue with the proponent making numerous commitments under **Section 12.3.4**. Included in these is the development of a weed monitoring and control programme that will be implemented for the duration of construction and operation of the Blacktip Project. This commitment is further repeated under **Section 15**, **Volume 1** of the Draft EIS, Environmental Management.

Weed Free: Contractors and suppliers of plant, vehicles and equipment will be required to certify that the plant, vehicles or equipment that have been supplied for the Blacktip Project to be 'weed free'. This means that the equipment has been thoroughly washed and inspected prior to leaving its point of origin and is free of visible soil and plant material. Provided adequate notice is provided, a representative from NT Weeds Branch will be available to conduct inspections in Darwin, prior to equipment moving out to the Blacktip site.

A washdown bay will be constructed along the access route to the project where plant, vehicles and equipment can be washed down if they have not been deemed weed free by the supplier or if they are found to be carrying soil or plant material during a random inspection.

The washdown pad will be constructed to the specifications of the DIPE Weeds Branch. If these specifications include the requirement for a hoist or inspection pit, then the proponent will meet these specifications.

Prior to plant, vehicles and equipment being dispatched from Darwin to the Blacktip Project area, they will be inspected by a representative from Weeds Branch. Where plant, vehicles and equipment meet the specifications of being 'weed free', Weeds Branch will provide appropriate documentation.

Quarry material will be sourced where suitable material is found. When quarry sites area determined, they will be inspected for weeds and treated if necessary to eradicate weed infestations. Weeds Branch has offered to assist with inspections and advice on treatment.

15.3.4 Section 12.3.5 Fire

OEH 64: Alternative mosquito control measures are also sought as the burning of swamps raises unnecessary greenhouse and ecological issues (Section 12.3.5).

OEH 64: Provide alternative mosquito control measures as the burning of swamps raises unnecessary greenhouse and ecological issues.

Burning of the swamp has been a recommendation made by Territory Medical Entomology to reduce mosquito numbers and therefore reducing the potential mosquito nuisance problem as well as the risk of personnel contracting mosquito borne diseases such as Ross River Fever and Murray Valley Encephalitis. Considering fires were so extensive across the Top End in 2004 that an area the size of Tasmania and Victoria combined was burnt (Savanna Links, Issue 30, 2004), the annual burning of the swamp areas which total approximately 5–10 ha is not going to contribute substantially to greenhouse gases. The swamps are annually inundated, and are probably burnt under current fire regimes every second or third year. It is not envisaged that these management burns will result in any unusual or significant ecological issues. Although the frequency and scale of fires in the Wadeye area appear to be less than other areas across the Top End region, it is still an area which experiences fire on a frequent basis (Russell-Smith 2001).

Public health should also be given a high priority and burning is recommended at least during the construction phase and perhaps to a lesser extent, on alternate years for example, during operation of the plant.

15.4 Section 12.4 Biting Insects and Mosquito Borne Disease

15.4.1 Section 12.4.1 Biting Insects

OEH 20: Consideration also needs to be made in the Supplement for the natural predators of mosquitoes. If mosquito numbers are minimised, this may have a deleterious effect on threatened species of fish. This should be investigated.

OEH 20: Consider the impacts of proposed control measures on the natural predators of mosquitoes.

Mosquito control may include burning the swamps in the dry season. Burning of the swamp areas would be conducted to minimise the amount of dead vegetation material which reduces the amount of shelter for mosquito larvae. This in turn allows natural fish predators easier access to the larvae. Burning would result in less prolific salt marsh mosquito numbers and may reduce mid-wet season numbers of *Culex* and *Anopheles* species.

For health and safety purposes, additional mosquito larval control may also be required during the construction phase of the project, if it is to take place between September and January, when the salt marsh mosquito will be at very high numbers. This species is likely to cause a severe pest problem in the Blacktip Project area with high risk of transmission of Ross River virus and Barmah forest virus.

Potential ‘threatened’ fish species that were identified as being present in the area included the Speartooth Shark *Glyphis sp. A* and the Freshwater Sawfish *Pristis microdon*. Given that the known range of both species does not extend to the project area and that there are no permanent freshwater bodies surrounding the proposed plant site, it is highly unlikely that any ‘threatened’ fish species

occur in the area. Therefore, controlling mosquito numbers is not going to have a deleterious effect on threatened species of fish.

Biting Insects – proposed annual burning of swamps

NLC 20: The Draft EIS advises, at section 12.3.5 Fire, that:

". Burning of the swamps north and south of the pipeline and plant (Swamp 1 at 1.5km north and Swamp 2 at 3km south) will be required in the dry season when the grasses and other vegetation have dried sufficiently, in order to reduce and mosquito breeding habitat (Section 12.4)"

Further, the Draft EIS advises, at section 12.4.1 Biting Insects – Impacts, that:

"Biting insects pose two types of problems. They cause a nuisance because of their bites, and they can cause a health risk to workers involved with the Blacktip Project and the Wadeye community…"

And, at 12.4.1. Biting Insects – Preventative and Management Measures, that:

"Elimination of natural mosquito breeding sites in the area surrounding the onshore gas plant is not feasible, however mosquito larval reduction measures will be implemented to assist with the control of mosquito populations. These include:

-The annual burning of Swamps 1 and 2 (Figure 8-9) as soon as possible after the swamps dry out. Burning reduces shelter for mosquito larvae, which allows predator access to larvae.

-A mosquito larval control programme will also be established during the construction phase using the larvicide methoprene 30 day residual pellet formulation. This larvicide will be applied before the October monthly high tide and reapplied after every 30 days of water inundation in the breeding site until the end of January. This control programme will be continued during the production phase of the Blacktip Project if warranted.

The NLC notes that no previous advice, prior to the release of the Draft EIS, was provided to traditional owners to suggest that the proponents may wish to burn their swamp country. As a consequence some traditional owners have questioned the need, suggesting that: "They never asked us that..what for they want to burn…mosquito belong to that country, he was here before them…no matter they burn there will still be mosquitos…leave him alone…they don't need to burn".

Similarly, some traditional owners have expressed affront and responded with comments such as: "Nobody has spoken to us about this…what do they know about burning and who do they think they are assuming that they are going to burn our country… we've been burning country for thousands of years…if country needs burning we will burn".

The NLC would suggest that some substantive work will need to be done in relation to the development of an agreed EMP for biting insects.

NLC 20: It is suggested that EMP for biting insects is developed in consultation with traditional Aboriginal owners.

Planned burning of swamp 1 was recommended by the Medical Entomology branch of the Department of Health and Community Services as a means of reducing mosquito breeding habitat. Although not stated under **Section 12.4** (Biting insects and mosquito borne diseases) of **Volume 1** of the Draft EIS, it is stated in **Section 12.3.5** (Fire) that Fire Management Plans will be developed and implemented in consultation with the NT Bushfires Council and Traditional Aboriginal Owners, for both the construction and operational phases of the project. The planned burning of the swamps will be incorporated into this EMP.

If burning of the swamp areas once they have dried out is not acceptable to the traditional Aboriginal owners of the region, then it will not occur.

As with all EMPs that are to be developed for the Blacktip Project, draft versions will be made available to all relevant government bodies for review and comment. EMPs will be issued to government for approval. The traditional Aboriginal owners will be consulted on the contents of the EMPs.

15.5 Section 12.5 Waste

15.5.1 Section 12.5.1 Non-Hazardous Waste Stream

Wadeye Landfill Feasibility Study

OEH 39: Detailed feasibility study results are required for the suitability of Wadeye Landfill for the disposal of waste from the project site. Issues include:

- identifying the relevant authorities;
- nominating the auditor of compliance with regard to waste disposal;
- a plan for recycling;
- alternatives to the disposal of sewage sludge at a municipal landfill;
- nominating the auditor of disposal approval;
- specifying the plan for wastes deemed unsuitable for landfill;
- estimated quantification of waste loads and their distribution through time;
- detailed analysis of the option to transport all waste to Darwin and to a specific location.

NLC 61: Page 416 Re Wadeye landfill. In a number of places in the EIS the Wadeye landfill is proposed as a possible receptacle for various wastes. The capacity of the landfill facility at Wadeye needs to be assessed for its suitability for waste disposal from the project. There is potential business opportunity here for the council if planned appropriately but also a problem issue if the landfill is unsuitable for coping with development of the Blacktip Project.

Section 4.5.11.3 Construction Waste Materials

NTG 21: The proponent states that "…materials are compacted via disposal at the Wadeye Council Landfill Facility, subject to capacity and approval." What other options are available if the Wadeye Landfill does not have the capacity and compatibility or if approval is not given to dispose of project wastes?

NTG 21: What options are available if the Wadeye Landfill does not have the capacity or if approval is not given to dispose of project wastes?

OEH 39: Detailed feasibility study results are required for the suitability of Wadeye Landfill for the disposal of waste from the project site.

NLC 61: The capacity & suitability of the landfill facility at Wadeye for waste disposal from the project needs to be assessed.

Waste will only be deposited at the Wadeye facility (which the project understands the Thamarrurr Regional Council is keen to utilise), only if it has the capacity to do so. All waste will be backloaded to Darwin should the use of the Wadeye facility be undesirable. A detailed Waste Management Plan will be issued to the appropriate Northern Territory Government departments for review and approval before the first waste is generated. Refer also to the response to **OEH 38** (**Section 9.1**) and **ECNT 5b** (**Section 9.1.1**).

NLC 60: Page 415- States that waste management procedures will be in accordance with Woodside's Waste Minimisation Policy and Guidelines and the Environmental Standards and Aspirations document. Copies of these documents should be provided in the appendix to the EIS.

OEH 45: Specification is required for the handling of onshore packaging waste (Section 6.2.1.1).

NLC 60: Provide copies of Woodside's 'Waste Minimisation Policy and Guidelines' and the 'Environmental Standards and Aspirations' document in the appendix to the EIS.

OEH 45: Specification is required for the handling of onshore packaging waste.

Details of the Woodside Policy, Waste Guidelines and Woodside's Environmental Standards and Aspirations will be reflected in the Waste Management Plan which is being prepared for the project. The reader is also directed to response to **NLC 61** above and **OEH 38** (**Section 9.1**) and **ECNT 5b** (**Section 9.1.1**).

15.5.2 Section 12.5.2 Liquid Waste Stream

Wadeye Sewage Treatment Facilities

NTG 86: It is not recommended that the Wadeye Sewage Treatment Facilities be used as a backup for the disposal of sewage sludge from the project. There has been a history of sewage pond failures across the NT when they are shock loaded with sludge and so it is unlikely that Power and Water Corporation will approve any application for this activity. DHCS would not support this proposal. It is noted that DHCS Environmental Health Darwin Rural must approve the onsite wastewater disposal systems. Decommissioning of system may require capping of pipes, pumping out and filling of septic tanks.

OEH 37: In the Draft EIS it is proposed that sewage sludge be dumped at Wadeye municipal landfill. This cannot occur. Alternatives are required in the Supplement.

NTG 86: It is not recommended that the Wadeye Sewage Treatment Facilities be used as a backup for the disposal of sewage sludge from the project.

OEH 37: Alternatives to the proposal that sewage sludge be disposed of at Wadeye municipal landfill are required.

There will be minimal sludge from the wastewater treatment plant. If the Wadeye facility is not capable of receiving effluent from the plant due to a malfunction of the wastewater treatment plant then the waste will be backloaded to Darwin. The contractors' Waste Management Plan will address all of these requirements. Refer also to the response to **OEH 38** (**Section 9.1**) and **ECNT 5b** (**Section 9.1.1**).

Stormwater Management

OEH 42: Stormwater management could be a significant issue. Detailed plans for contaminated stormwater should be provided, including the method by which contaminated water would be detected. Currently the Draft EIS suggests it will be "stored and tankered off site for disposal at an approved location" (Section 12.5.2). Indicate the intended approved location of the hazardous waste disposal.

OEH 42a: Provide detailed plans for contaminated stormwater, including methods for detecting contaminated water.

OEH 42b: Indicate the intended approved location of the hazardous waste disposal.

Oily contaminated water will be trapped locally in bunds, from where it will be piped to first flush interceptors and corrugated plate interceptors to remove oils from the stormwater. A sampling system will test if the water is suitable to discharge. Water which does not meet the discharge criteria will be treated in the processed water system for further separation or removed off site for treatment and disposal.

15.5.3 Section 12.5.3 Hazardous Waste Stream

OEH 46: The "negligible to slight incremental increase in the environmental impacts" of hazardous waste disposal needs to be quantified and all outputs specified (Section 12.5.3). Issues associated with transport of hazardous waste should also be addressed.

OEH 46: Quantify the environmental impacts of all outputs specified and address issues associated with transport of hazardous waste.

Refer to the response to **OEH 38** (**Section 9.1**) and **ECNT 5b** (**Section 9.1.1**).

NTG 87: What security will be afforded to ensure that the hazardous waste is secure?

NTG 87: What security will be afforded to ensure that the hazardous waste is secure?

All hazardous waste will be segregated and contained. The reader is also directed to the response to **NLC 40** (**Section 7.5.3**) and **OEH 47** (**Section 7.6.1**).

15.5.4 Section 12.5.4 Chemical & Hydrocarbon Spills

OEH 21: Details of the gas processing plant area regarding measures to prevent contamination of groundwater in the event of a spill, should be described and standards cited. Leak protection is stated as being mainly via appropriate design of the tanks. The design of tanks and primary and secondary bunding should meet relevant Australian standards and these standards should be cited in the Supplement.

OEH 21: Detail measures to prevent contamination of groundwater in the event of a spill, citing Australian Standards.

Section 12.5.4 (**Volume 1** of the Draft EIS) states that:

> Fuel will be stored within the plant area and shore crossing laydown area in accordance with AS1940:1993, *The Storage and Handling of Combustible and Flammable Liquids*. This standard includes a requirement of a bunding capacity of 110% of the stored volume.

However, it is recognised that this standard was updated late in 2004 and so fuel will be stored in accordance with *AS1940:2004, The Storage and Handling of Combustible and Flammable Liquids*.

The following commitments are also stated under **Section 12.5.4**, **Volume 1** of the Draft EIS regarding containment of hazardous goods and spill response:

> All hazardous materials will be handled and stored in accordance with the Materials Safety Data Sheet (MSDS) and Australian Standards as a minimum. Where possible, all hazardous materials will be handled and stored in bunded areas within the plant site.
>
> Appropriate spill kits will be stored where fuels and hazardous materials are used and stored.
>
> All personnel handling fuel and other hazardous materials will be trained and competent in the correct handling procedures and management of spills of applicable materials.

The storage and handling of hazardous materials including fuels, oils and condensate will be in accordance with AS1940:2004 *The Storage and Handling of Combustible and Flammable Liquids,* and AS1692: 1989 *Tanks for flammable and combustible liquids*. All proposed works relating to the development will be undertaken in accordance with the NT Dangerous Goods Act and Regulations.

Table 15-10 provides a summary of the management and monitoring strategies that will be implemented under the Groundwater Protection EMP which will be developed further prior to construction commencing. These include:

- Undertake baseline groundwater monitoring to characterise groundwater at the site.
- Construct bunds around condensate tanks and other chemical storage or handling equipment according to appropriate legislative requirements and Australian Standards 1940.
- Establish and maintain a Hazardous Materials Register detailing the location and quantities of hazardous substances including their storage, use and disposal.

- Design site drainage systems to separate potentially contaminated stormwater for treatment and disposal.
- Maintain ancillary infrastructure to identify any corrosion or leaks.
- Undertake groundwater monitoring to provide information about environmental performance and hydrological impacts.
- Train operators in implementation of safe work practices to minimise risks of spillage.
- Implement contingency plans if a spill or overflow incident occurs.

15.6 Section 12.6 Atmospheric Emissions

NTG 89: The report states that the proponent will minimise atmospheric emissions including dust and odours. A monitoring programme will also be conducted. What involvement will the Wadeye Community have with the monitoring programme and what are their options to voice concerns about possible atmospheric emissions from the project? Dust contributes to diseases such as trachoma and may cause complications for asthma sufferers. Therefore, DHCS Environmental Health Darwin Rural requests a copy of the Dust Management Plan.

In the above section atmospheric monitoring of non-greenhouse emission is not proposed. Will non-greenhouse gas emissions be incorporated into any atmospheric monitoring planning to confirm and routinely assess the non-significance of these emissions?

Woodside has obligations to report annually emissions for an established suite of air contaminants under the National Pollution Inventory. If measurement is not undertaken how will Woodside demonstrate quantitative reporting, best practice technology and continuous improvement?

NTG 89a: What involvement will the Wadeye Community have with the monitoring programme and what are their options to voice concerns about possible atmospheric emissions from the project?

Refer to response to **NTG 47a**, **b** and **c**.

NTG 89b: Will non-greenhouse gas emissions be incorporated into any atmospheric monitoring to confirm the non-significance of these emissions?

The review of the expected air emissions data (NOx, SOx, VOC, CO_2-e), concluded that the monitoring of atmospheric emissions is not warranted. This is based on many factors including: the low level of emissions predicted and the distance from any sensitive receptors such as Wadeye.

Furthermore, a high volume air sampler would only measure particulates which will only be emitted in minute volumes at such a small gas plant.

NTG 89c: How will Woodside demonstrate quantitative reporting, best practice technology and continuous improvement?

Woodside through its Opportunity and Project Realisation Process ensure they achieve best practice and continually look for improvements through peer reviews, benchmarking and

challenging the way they work. The Opportunity and Project Realisation Process includes specific assurance checks and value improving practices which are derived from 'best in class' project performances and leveraged across all Woodside opportunities.

The following Assurance Checks and Value Improving Practices have or are planned to be carried out on the Blacktip Project:

- Assurance check 7 - Benchmarking Reviews.
- Assurance check 8 - HSE Reviews.
- Assurance Check 13 - Peer Reviews.
- Value Improvement Practices M2 - Lessons Learned and Best Practice.
- Value Improvement Practices M4 – Improvement.

15.6.1 Section 12.6.1 Greenhouse Gas Emissions

OEH 51: The Blacktip proposal is expected to emit 90 000t CO2-e per year during the operation phase. This would represent a six per cent increase in NT greenhouse gas emissions (based on 2000 Northern Territory inventory data), and an increase of 1.6 per cent in Australia's national emissions (based on 2002 national inventory data). Emissions from the construction phase are estimated to be 15 000t CO2 (Section 12.6.1).

To expedite the assessment process, comments on the Draft EIS were provided by Paul Purdon (Senior Policy Officer, Greenhouse Unit) to the proponent at a meeting on 10 December 2004 and in a follow-up email to Ceri Morgan (cc Rod Johnson) on 13 December 2004. This correspondence requested additional information on emissions from the commissioning and early production stages of the project, and greater detail on product life-cycle emissions. Comments also suggested the revision of emissions calculations (Table 6-5). It is expected that the proponent will address these comments in the Supplement to the EIS.

OEH 51: Address comments on the product life-cycle emissions and the revision of greenhouse emissions calculations.

The comments are noted on the slight differences between the OEH calculations and those included in the draft EIS. However, the differences are not considered significant.

The figure of 4.5 MT is based on converting 1.5 MT of hydrocarbon production mentioned in **Section 12.6.1**, **Volume 1** of the Draft EIS to CO_2 when burnt. Typical conversion factors for gas combustion to CO_2 is 2.75 tonnes CO_2/tonne gas burnt, and for liquid hydrocarbons this conversion factor is in the order of 3.2 tonnes CO_2/tonne liquid product burnt. An average of three has been used in the estimate to obtain the 4.5 MT figure from the 1.5 MT.

Refer to response to **ECNT 4a** (**Section 9.2.1**) with regard to commissioning.

OEH 52: The Draft EIS discusses ongoing action by Woodside in relation to sustainable and renewable energy investment and technology. The proponent has not identified options to offset emissions specifically from the Blacktip proposal. As raised with the proponent, it is recommended that Woodside investigate options to offset greenhouse gas emissions specifically from the Blacktip development, in consultation with the Office of Environment and Heritage (OEH). This recommendation should be listed **as a commitment** by the proponent in the Supplement to the EIS. OEH is particularly interested in identifying offsets options in the Northern Territory. It is noted that Woodside is currently a member of the Australian Government's Greenhouse Challenge programme. It is recommended that ongoing membership of the programme be listed as a commitment in the Supplement.

OEH 52: Discuss options to offset greenhouse gas emissions specifically from the Blacktip development.

Woodside addresses offsets from its facilities at a corporate level as stated in **Section 12.6.1**, **Volume 1** of the Draft EIS. Development of the Blacktip reserves enables the product consumers in the Northern Territory to offset their greenhouse gas emissions by using natural gas instead of more carbon intensive fuels. This is a significant offset to 'business as usual' emissions in the Northern Territory.

The Proponent does not currently offset any part of its emissions inventory, although it has made significant investments in renewable energy technology companies through its wholly owned subsidiary Metasource Pty Ltd, which have the potential to generate offsets in the future. The Proponent's focus is on managing its emissions intensity of production (measured in tonnes of CO_2-equivalent per tonne of hydrocarbon produced) which is the key performance indicator under its Greenhouse Challenge Agreement with the Commonwealth Government. Since becoming the 100th member of the Greenhouse Challenge Programme in 1997, the Proponent's operated venture emissions intensity has decreased by approximately 50% to 0.2 tonnes CO_2e per tonne hydrocarbon produced, this compares to an estimated emissions intensity for the Blacktip Project of 0.06 tonnes of CO_2e per tonne hydrocarbon produced. However, the Proponent would be pleased to discuss the generation of offsets in the Northern Territory with the Greenhouse Unit as well as recognition of such offsets by the Northern Territory Government.

15.6.2 Section 12.6.2 Other Combustion Products

OEH 49: The management summary list for combustion gases needs to be improved, as no consideration is given to a worst-case scenario (Section 12.6.2). Discussion of the implications of atmospheric pollution moving over terrestrial lands outside the project area is required. For example, there may be implications for species that were considered too distant in earlier analyses, but whose habitat may be affected by atmospheric pollution. Low NOx emissions are expected, but specification of the steps to be followed if NOx levels are found to be high is desirable (Section 12.6.2). Low background levels of SOx and NOx indicate the status of the natural system (before impact). This project proposal should seek to minimise its impact and so should aim to affect NOx and SOx levels as little as possible.

OEH 49: Include consideration of the worst-case scenario in the management summary list and the implications of atmospheric pollution moving over lands outside the project area.

The same gases are released during worst case scenarios as during normal operations but at a different rate. The worst case scenario will be during emergency flaring when the plant could potentially be vented of all gas through the flare. The vast majority of flaring will occur within 15 minutes. As this flaring will only occur during emergency conditions it is not possible to state its exact frequency. This type of event is rare and it is possible that it may never occur. Maintenance flaring will occur quarterly for 1–24 hours but this should not be as significant as emergency flaring. The flaring schedule is detailed in **Table 4-12**, **Volume 1** of the Draft EIS. The impact of atmospheric pollutants moving across land is expected to be minimal due to the low levels of NOx and SOx from the facility. Any potential impact will decrease with distance due to the dispersion of the pollutants and depletion. As stated in the Draft EIS (**Section 12.6.2**), management measures will be applied to maximise the plant efficiency and minimise fuel use which will effectively reduce SOx emissions.

The reader is also directed to the response to **OEH 53**, **Section 15.7**.

NLC 62: P. 427 in relation to other combustion products, further information on the nitrogen levels of the gas and combustion products should be provided.

NLC 62: Further information on the nitrogen levels of the gas and combustion products should be provided.

As discussed in response to **NLC 12** (**Section 7.5.2**), nitrogen constitutes 80% of the atmosphere, it is not a greenhouse gas and is inert. As combustion occurs in air the level of nitrogen in the gas is not relevant to the type and quantity of combustion products formed. Nitrogen present during the combustion process will form NOx and this process would occur to the same extent even with nitrogen free fuel gas. Impacts from NOx are dealt with in **Section 6.3.3** and **12.6.2**, **Volume 1** of the Draft EIS.

15.6.3 Section 12.6.5 Dust Emissions

OEH 50: Use of a chemical binder (MgCl2) to suppress dust needs to be further explained (Section 12.6.5). Its volume, persistence, application, and impact on waterways should be fully detailed.

OEH 50: Explain the use of a chemical binder ($MgCl_2$) to suppress dust including details of volume, persistence, application, and impact on waterways.

Liquid magnesium chloride ($MgCl_2$), a chemical binder known as 'bittern', is used as a dust suppressant on unpaved roads, construction sites, unpaved parking lots, quarries, and for stockpile containment and stabilisation of surface and underground roads for mines and quarries (Aral et al. 2004). $MgCl_2$ bittern is hygroscopic (absorbs moisture), so compacts a dusty surface by slowing the rate of roadway evaporation. The bittern forms a surface coating on the roadway by binding the soil particles thereby improving the road surface. A humid environment is required for $MgCl_2$ bittern to be effective (Vorobieff 2004).

Details of the application of the bittern depend on the manufacturer's recommendations, the product used, the contractor and the road surface. In Australia where the road surfaces are typically very dry, larger quantities of water will be required to properly apply the bittern, however if too much water is used the bittern can leach into soils. A current practice is to test for leaching using the Australian Standard AS4439.3 *Wastes, sediments and contaminated soils - Preparation of leachates - Bottle leaching procedures* (Vorobieff 2004).

DustMag is a product based on $MgCl_2$ and a study carried out in WA in 1995 by Astron Engineering concluded that the product did not significantly reduce the germination of the seeds studied in the Pilbara region. Details are available from the 'Rainstorm' web site <www.rainstorm.com.au>. DustMag has been used internationally, and was used on the Dampier to Port Hedland and Goldfields Gas Transmission Pipeline Projects, alumina and ore mines, quarries and public unsealed roads.

The DustMag website states that dust suppression will last longer on roads with medium to heavy traffic than on areas that receive little or no traffic, and that the majority of users will only require treatment once a year. However, it is also stated that mines and quarries will sometimes require low-rate top ups on an 'as needed' basis, due to the high levels of ambient dust in the area. The DustMag website claims that on the Goldfields Gas Transmission Pipeline Project the choice of DustMag for the project followed 'the carrying out of a special environmental study to ensure that there would be no deleterious effect on the regrowth of vegetation in the fragile environment'.

15.7 Section 12.7 Noise

OEH 53: Noise levels at Tchindi Aboriginal Camping ground appear to be between 54 and 50 dBA (Figure 12.2) rather than <47 dBA as is quoted in the text (Section 12.7); however, the Draft EIS suggests that the Tchindi Aboriginal Camping ground and Wadeye local community would be notified at least 24 hours prior to the commencement of planned flaring. Include in the Supplement an indication of the flexibility of the flaring schedule according to cultural requirements, such as postponing the flaring should it be unsuitable for people at Tchindi. Design of the flare needs to account for nearby sensitive receptors even in emergency situations.

OEH 53: Indicate the flexibility of the flaring schedule according to cultural requirements.

The calculated noise level at 2.5 km (Tchindi Camping Ground) is based on a source noise of 110 dB(A), while the contours use a worst case of 115 dB(A) as the assumed noise source; hence the discrepancy noted.

The flare is designed to allow depressurisation of the plant in an emergency situation. In this type of event the plant will be depressurised in 15 minutes, during this time the noise from the flare will fall progressively from 115 db to normal operating levels. This type of event is rare, potentially varying from quarterly to once every five years, and the duration less than 15 minutes. While it is recognised that nearby sensitive receptors need to be accounted for in the design, it must also be recognised that the emergency depressurisation of the facilities is safety critical and the noise associated with high gas rate burning is difficult to mitigate.

The rate and therefore the noise associated with maintenance depressurisation (flaring) can be controlled. As such it is envisaged that during maintenance flaring the noise levels will not exceed the normal operational levels. And so the effect on the local community is expected to be minimal, if indeed noticeable. The flexibility to move maintenance flaring will depend on the urgency and criticality of the maintenance required.

Ongoing consultation with the community in relation to the interaction of maintenance flaring events and the community cultural calendar will be undertaken.

NLC 63: P434; Noise standards are for indoors-TOs do not quite live indoors at the beach camping areas.

NLC 63: Discuss noise standards in relation to both indoor and outdoor impacts.

External noise standards were referenced in the technical report on noise (**Appendix A, Volume 2** of the Draft EIS), except for the commentary on the camp accommodation.

With regard to onsite accommodation, predicted external noise levels are 30 dB(A). Based on the revised source noise data presented in ERM (2004), plant noise levels are expected to be 15 dB(A) lower at the site boundary, hence predicted external noise levels at the accommodation camp are estimated at around 15 dB(A). This would be inaudible.

15.8 Section 12.8 Vibration

Blasting

OEH 17: Blasting, described in the Draft EIS as being similar to a "quiet thud", requires quantification. Clarification is sought regarding the necessity of blasting and strategies that will be taken to minimise adverse impacts, including impacts on fauna in the are.

OEH 17: Clarify the necessity of blasting and strategies that will be taken to minimise adverse impacts, including impacts on fauna in the area.

Blasting: Typically the ground vibration levels would not exceed a peak particle velocity of 200 mm/s depending to an extent on the method for drilling and charging the holes. The typical nominal maximum level of airblast overpressure would be around 135 dB (Lin Peak) over a very short time scale (<1 s). The reader is directed to the response to **NTG 11** (**Section 7.3.5**) for a discussion on the possibilities of drilling and blasting.

Noise, such as that from blasting, can affect the behaviour and physiology of animals in a number of ways: reproduction and survival can be affected if animals are forced to vacate favourable habitat; energy can be reduced due to disrupted feeding combined with avoidance movement (Larkin 1996; Radle n.d.); communication interference, including masking the sounds of predators and prey; sleep deprivation; and in extreme cases, temporary or permanent hearing loss (Environment Australia 1998). In some cases, animals could be forced from scarce habitat (Radle n.d.).

The reaction of animals to noise varies widely between species and individual animals (Radle n.d.; Larkin 1996; Environment Australia 1998). Some individuals may be seriously affected while others show no response. Noise can also interact with other factors. In some cases, the reaction to noise may increase when accompanied by visual stimulation. A new noise may frighten an animal, 'but if other sensory systems are not stimulated (for instance optical or smell), the animal learns quite quickly to ignore the noise source, particularly when it exists in the presence of man' (Environment Australia 1998). Habituation to noise is a common trait in many species (Larkin 1996; Environment Australia 1998). The noise from possible blasting will be short term and instantaneous, and is unlikely to affect fauna more than momentarily.

Nevertheless, impacts from blasting noise and vibration will be minimised in the following ways:

- Scarce habitat such as monsoon vine forest will be avoided and remain buffered by surrounding vegetation communities.
- Cues prior to blasts will be used to alert animals, resulting in reduced stress associated with sudden noise and encouraging animals to vacate the area.
- Visual stimulation causing increased animal stress will be minimised by restricting worker-movement beyond the construction corridor.
- Blasts will be acoustically screened with blast mats.
- Shotfirers will follow Best Practice Environmental Management as described in Section 3.3.3 'Control Measures for Vibration,' and Section 3.3.4 'Control Measure for Airblast,' of the 'Noise, Vibration and Airblast Control' module on Best Practice Environmental Management in Mining (Environment Australia 1998).

If drilling and blasting is definitely required, a watch will be maintained prior to and during offshore blasting operations for the presence of marine mammals and turtles in the vicinity of the blasting work areas. Should marine mammals and turtles be sighted, offshore blasting will be delayed until marine mammals and turtles have moved to a safe distance from the blast site. The safe distance will be confirmed as part of the development of the detonation procedure and a risk assessment will be conducted.