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1 Introduction

1.1 Purpose

This Sea Turtle Management Plan (STMP) focuses on managing potential impacts to sea turtles and marine mammals associated with the Pluto LNG Project. Specifically, this management plan:

- Focuses on management actions and strategies associated with onshore, nearshore and offshore activities for the Pluto operation phase and associated maintenance activities.
- Outlines management strategies to be adopted to mitigate risks associated with each project phase.

Commissioning of the Pluto LNG plant progressed through 2012, with performance testing undertaken during the first half of 2013, which permitted commissioning closeout reporting and an application for an operating licence to be submitted to Department of Water and Environment Regulation (DWER) (formerly DEC). Commencement of stable operations begun on 1 August 2013 in accordance with DWER approved (EP Act Part V) Licence L8752/2013/1.

The plan supersedes the previous STMPs including: the construction and commissioning STMP (Rev 10) approved in 2008 as part of the Pluto LNG Project's (i.e. Trains 1 and 2) ministerial requirements (WA Statement No. 757), and Australian Govt EPBC 2006/2968. Revision 0 of this Pluto - Sea Turtle Management Plan was approved by Western Australian Office of the Environmental Protection Authority on 30 March 2012 addressing MS757 Condition 9-1. The OEPA letter of approval is attached as Appendix F.

Revisions 1-6 of this Plan include minor updates as part of annual review cycles.

1.2 Scope

State and Commonwealth environmental approvals for the Pluto LNG Project were finalised in late 2007 (Ministerial Statements 733 and 757, and EPBC Approvals 2005/2391 and 2006/2968) and provided approval for the following key project components:

- an offshore platform, associated subsea infrastructure and a gas trunkline;
- an onshore LNG plant and storage facilities; and
- A jetty and associated navigation channel and berthing pocket.

The onshore and nearshore components of the Pluto LNG Project are shown within Figure 1.

A variety of activities associated with the Pluto LNG Plant may have an impact upon sea turtles. Activities included in the scope of this plan are:

- Routine operation and maintenance activities
- potential maintenance dredging works;
- dredge spoil disposal both within and outside of Mermaid Sound;
- operation of LNG and condensate storage and export facilities on Site A (predominantly from lighting); and
- vessel movement from operations and maintenance

Further information on all environmental aspects of the Pluto LNG Project is contained within the Public Environment Report/ Public Environmental Review (Woodside 2006).

Opportunities for future expansion, requiring additional LNG trains and further capital marine dredging works are not included in the scope of this plan. Any additional risks to those outlined in this plan, including those resulting from expansion activities, would be implemented in consultation with DWER.
1.3 Description of Operator

Woodside Burrup Pty Ltd, a wholly owned subsidiary of Woodside Energy Ltd, is the operator of the Pluto LNG Project and associated infrastructure for the Pluto LNG Joint Venture Participants, being Woodside Burrup Pty Ltd, Tokyo Gas Pluto Pty Ltd and Kansai Electric Power Australia Pty Ltd.

Woodside Petroleum Ltd (Woodside) is Australia’s largest independent oil and gas company, with a history of safe and reliable operations spanning decades. As the largest operator of oil and gas in Australia, Woodside produces around 900,000 barrels of oil equivalent each day from a portfolio of facilities which are operated on behalf of some of the world’s major oil and gas companies. Woodside has been operating the North West Shelf Project for 28 years, and with the successful start-up of the Pluto LNG Plant in 2012, now operates six of the seven LNG processing trains in Australia.

Woodside strives for excellence in safety and environmental performance and continues to strengthen relationships with customers, co-venturers, governments and communities to ensure they are a partner of choice. Further information about Woodside can be found at http://www.woodside.com.au.
Figure 1- Pluto LNG Project Site A and B on the Burrup Peninsula
1.4 Management Plan Requirements and Objectives

The minimum requirements for this plan are summarised in the framework STMP, contained within the Project’s Public Environment Report/Public Environmental Review (Woodside 2006 - Appendix Table G-1). The plan also fulfils the requirements, as approved under the provisions of the Environmental Protection Act 1986 (WA) (Ministerial Statement No. 757).

The objectives of this plan are to:

- provide a management framework to enable Woodside and its contractors to detect and mitigate as necessary any impact upon marine turtles or marine mammals from the project; and
- identify darkness strategies to reduce as far as practicable lights or light glow interfering with nesting female turtles and hatchlings.

The specific outputs required as part of this plan are to:

- identify project-related stressors (causes of environmental impacts) and potential consequences for marine turtles or marine mammals (including impacts of noise, vibration, light overspill and glow, vessel strike, and changes to coastal processes); and
- identify and demonstrate the effectiveness of the proposed management measures to mitigate project-related impacts and consequences for marine turtles and marine mammals.

It should also be acknowledged that advice from the EPA during the Project’s ministerial appeals determination stated that it is unlikely the project will result in significant impacts on sea turtles, which are highly mobile creatures able to avoid operational activities and areas of turbidity and are capable of temporarily relocating to less disturbed areas for foraging and breeding (Office of the Appeals Convenor 2007b).

The contents of the STMP shall be reviewed on an annual basis and revised where necessary. This includes instance of significant changes in project scope, where sea turtle impacts have not already been accounted for.

1.5 Relevant Legislation

Sea Turtles are protected under both Western Australian and Commonwealth environmental legislation. Under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The loggerhead turtle (Caretta caretta) and olive ridley turtle (Lepidochelys olivacea) are listed as endangered, whilst the leatherback turtle (Dermochelys coriacea), green turtle (Chelonia mydas), hawksbill turtle (Eretmochelys imbricata) and flatback turtle (Natator depressus) are all listed as vulnerable species. Under the Western Australian Wildlife Conservation Act 1950 (WC Act), the green turtle, leatherback turtle, hawksbill turtle, and flatback turtle are listed under Schedule 3 — Fauna that is rare or is likely to become extinct as vulnerable fauna. The loggerhead turtle and olive ridley turtle are listed under Schedule 2 — Fauna that is rare or is likely to become extinct as endangered fauna.

Marine turtles are also recognised internationally as species of conservation concern. Six of the species found in Australia are listed in the 2000 IUCN Red List (World Conservation Union), whilst all are a ‘Priority for Conservation’ under the Bonn Convention (for migratory species).

It should be noted that other EPBC listed marine mammal species frequent the Dampier Archipelago and mitigation measured adopted for protecting sea turtles shall also apply to them. A search was conducted using the Protected Matters Search Tool (available from: http://www.environment.gov.au/epbc/protected-matters-search-tool) on 21 August 2018 to identify relevant marine mammal species that are known to or may occur within the Dampier Archipelago.
Archipelago (Table 1). This plan is not applicable to impacts or management measures pertaining to EPBC listed birds or fish.

### Table 1 Marine Mammal Species of Conservation Significance (EPBC Act)

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Status</th>
<th>Type of Presence</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Balaenoptera musculus</em></td>
<td>Blue Whale</td>
<td>Endangered, Migratory, Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Megaptera novaeangliae</em></td>
<td>Humpback Whale</td>
<td>Vulnerable, Migratory, Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Balaenoptera bonaerensis</em></td>
<td>Antarctic Minke Whale, Dark-shoulder Minke Whale</td>
<td>Migratory, Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Balaenoptera edeni</em></td>
<td>Bryde’s Whale</td>
<td>Migratory, Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Orcinus orca</em></td>
<td>Killer Whale, Orca</td>
<td>Migratory, Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Physeter macrocephalus</em></td>
<td>Sperm Whale</td>
<td>Migratory, Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Sousa chinensis</em></td>
<td>Indo-Pacific Humpback Dolphin</td>
<td>Migratory, Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Tursiops aduncus</em> (Arafura/Timor Sea populations)</td>
<td>Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)</td>
<td>Migratory, Cetacean</td>
<td>Species or species habitat likely to occur within area</td>
</tr>
<tr>
<td><em>Balaenoptera acutorostrata</em></td>
<td>Minke Whale</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Delphinus delphis</em></td>
<td>Common Dolphin</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Feresa attenuata</em></td>
<td>Pygmy Killer Whale</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Globicephala macrocephalus</em></td>
<td>Short-finned Pilot Whale</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Grampus griseus</em></td>
<td>Risso’s Dolphin, Grampus</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Kogia breviceps</em></td>
<td>Pygmy Sperm Whale</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Kogia simus</em></td>
<td>Dwarf Sperm Whale</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td>Species</td>
<td>Common Name</td>
<td>Status</td>
<td>Type of Presence</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------------------------------------</td>
<td>-----------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td><em>Lagenodelphis hosei</em></td>
<td>Fraser’s Dolphin, Sarawak Dolphin</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Mesoplodon densirostris</em></td>
<td>Blainville’s Beaked Whale, Dense-beaked Whale</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Pepinocephala electra</em></td>
<td>Melon-headed Whale</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Pseudorca crassidens</em></td>
<td>False Killer Whale</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Stenella attenuata</em></td>
<td>Spotted Dolphin, Pantropical Spotted Dolphin</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Stenella coeruleoalba</em></td>
<td>Striped Dolphin, Euphrosyne Dolphin</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Stenella longirostris</em></td>
<td>Long-snouted Spinner Dolphin</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Steno bredanensis</em></td>
<td>Rough-toothed Dolphin</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Tursiops aduncus</em></td>
<td>Spotted Bottlenose Dolphin</td>
<td>Cetacean</td>
<td>Species or species habitat likely to occur within area</td>
</tr>
<tr>
<td><em>Tursiops truncates s. str.</em></td>
<td>Bottlenose Dolphin</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Ziphius cavirostris</em></td>
<td>Cuvier’s Beaked Whale, Goose-beaked Whale</td>
<td>Cetacean</td>
<td>Species or species habitat may occur within area</td>
</tr>
<tr>
<td><em>Dugong dugon</em></td>
<td>Dugong</td>
<td>Migratory, Listed Marine Species</td>
<td>Species or species habitat likely to occur within area</td>
</tr>
</tbody>
</table>

### 1.6 Structure of the Plan

This plan provides the following information:

- an overview of turtle species and ecology within Dampier Archipelago;
- an overview of turtle activity at Holden Beach (immediately adjacent to Site A);
- existing lighting at Holden Beach;
- identification of the key stressors, potential impacts and environmental risk assessment;
- an outline of strategies to minimise the impact associated with operations;
- an outline of monitoring procedures and programmes; and
- a list of project personnel responsible for implementation of this plan.
The plan will be made publicly available on the Woodside public website.
2 Sea Turtle Ecology in the Dampier Archipelago

Of the seven marine turtle species found globally, six are known to occur in the waters within the Dampier Archipelago (EA 1998). These include the:

- green turtle *(Chelonia mydas)*;
- hawksbill turtle *(Eretmochelys imbricata)*;
- leatherback turtle *(Dermochelys coriacea)*;
- flatback turtle *(Natator depressus)*;
- loggerhead turtle *(Caretta caretta)*; and
- olive ridley turtle *(Lepidochelys olivacea)*.

Of the above noted species, the leatherback, loggerhead and olive ridley turtles are found to a lesser extent within the Dampier Archipelago. A summary of the general sea turtle ecology (i.e. habitat and foraging behaviour, diet, nesting activity) for Australia and the Dampier Archipelago is provided within Table 2.
### Table 2 Sea Turtle Ecology in the Dampier Archipelago

<table>
<thead>
<tr>
<th>Name</th>
<th>Habitat</th>
<th>Diet</th>
<th>Nesting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leatherback turtle</td>
<td>Leatherback turtles occur in tropical and temperate waters of Australia. Large numbers of leatherback turtles feed off the south Queensland and New South Wales coasts and off Western Australia’s coast, south of Geraldton. They are less abundant in the tropical waters of the northern Australian continental shelf. Most leatherback turtles living in Australian waters migrate to breed in neighbouring countries, particularly in Java and along the northern coast of West Papua, Papua New Guinea and the Solomon Islands. There are no defined Biologically Important Areas (BIAs*) for leatherback turtles in the Dampier Archipelago, or across WA (DoEE, 2017a and 2017b).</td>
<td>The leatherback turtle is planktivorous throughout their life, feeding mainly in the open ocean on jellyfish and other soft-bodied invertebrates (Limpus, 2009).</td>
<td>Genetic linkages between populations of leatherback turtles in Australia are not well understood, however, evidence available indicates there are potentially three stocks within the broad area of the Indo-Pacific (DoEE, 2017b). No significant rookeries have been recorded in Australia and there are no confirmed records of nesting with WA (DoEE, 2017b). Scattered nesting occurs along the south Queensland coast from Cobourg Peninsula to Cape Arnhem (including Danger Point) and adjacent islands (including Wessel Islands and Elcho Island). Nesting in this region occurs between December and January (DoEE, 2017b).</td>
</tr>
<tr>
<td>(Dermochelys coriacea)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green turtle</td>
<td>Green turtles occur in seaweed-rich coral reefs and inshore seagrass pastures in tropical and subtropical areas of the Indo-Pacific region. In the Dampier Archipelago, there are a number of defined BIAs for green turtles. The nearest foraging BIA occurs at Dixon Island approximately 27 km to the east of the Pluto LNG project. Other foraging BIAs include the islands between Cape Preston and Onslow, and Barrow Island (approximately</td>
<td>The green turtle is mainly herbivorous. Adult green turtles feed on algae, seagrass and mangroves, however, juveniles feed on algae as well as crustaceans and molluscs in their pelagic phase (Boyle and Limpus, 2008).</td>
<td>In Australia, there are genetically distinct breeding populations of green turtle (DoEE, 2017b). The North West Shelf population, which overlaps the Dampier Archipelago, has a number of widely spread, rookeries including Adele Island, Maret Island, Cassini Island, Lacepede Islands, Barrow Island, Montebello Islands (all with sandy beaches), Serrurier Island, Dampier Archipelago, Thevenard Island, Northwest Cape, and the Ningaloo coast (DoEE, 2017b). In the Dampier Archipelago there are a number of nesting BIAs for green turtles, including the islands to the west of the Burrup Peninsula, Legendre and Huay Islands and Delambre Island (3, 27 and 33 km from the Pluto LNG project, respectively). There is also a 20 km year round internesting buffer BIA that covers the Dampier Archipelago and overlaps Holden Beach and the shoreline of the</td>
</tr>
<tr>
<td>(Chelonia mydas)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Habitat</td>
<td>Diet</td>
<td>Nesting</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Flatback turtle</td>
<td>All known breeding sites of the Flatback turtle occur in Australia.</td>
<td>The flatback turtle is carnivorous, feeding mostly on soft bodied</td>
<td>Currently, there are at least five known stocks of flatback turtles in Australia (DoEE, 2017b), with the population nesting in the Dampier</td>
</tr>
<tr>
<td></td>
<td>Flatback turtles feed in the northern coastal regions of Australia,</td>
<td>invertebrates such as gastropod molluscs, squid, sea cucumbers, soft</td>
<td>Archipelago part of the Pilbara stock. Flatback turtles from this stock nest on inshore islands and the mainland across the region, with</td>
</tr>
<tr>
<td></td>
<td>extending as far south as the Tropic of Capricorn. Their feeding grounds</td>
<td>corals and jellyfish (Zangerl et al, 1988).</td>
<td>significant nesting locations on the Montebello Islands, Mundabullangana Beach, Barrow Island, Cemetery Beach, Dampier Archipelago,</td>
</tr>
<tr>
<td></td>
<td>also extend to the Indonesian archipelago and the Papua New Guinea</td>
<td></td>
<td>coastal islands from Cape Preston to Locker Island (DoEE, 2017b). In the Dampier Peninsula there are a number of established nesting</td>
</tr>
<tr>
<td></td>
<td>coast. Flatbacks have a preference for shallow, soft-bottomed sea bed</td>
<td></td>
<td>BIAs for flatback turtles. The nearest is a nesting BIA on Intercourse</td>
</tr>
<tr>
<td></td>
<td>habitats away from reefs.</td>
<td></td>
<td>Island (approximately 15 km west of the Pluto LNG project). Use level at</td>
</tr>
<tr>
<td></td>
<td>In the Dampier Archipelago, there are a number of defined BIAs for</td>
<td></td>
<td>this BIA is defined as low. Other nesting BIAs in close proximity to the</td>
</tr>
<tr>
<td></td>
<td>flatback turtles. The nearest foraging BIA occurs along a string of</td>
<td></td>
<td>Pluto LNG project include Legendre and Huay Islands, Delambre Island,</td>
</tr>
<tr>
<td></td>
<td>islands between Cape Preston and Onslow, inshore of Barrow Island (70</td>
<td></td>
<td>Dixon Islands and west of Cape Lambert (all &gt;25 km from the Pluto LNG</td>
</tr>
<tr>
<td></td>
<td>km from the Pluto LNG project). A mating BIA occurs around the islands</td>
<td></td>
<td>project). There is also an 80 km year round internesting buffer BIA that</td>
</tr>
<tr>
<td></td>
<td>to the west of the Burrup Peninsula (approximately 3 km from the Pluto</td>
<td></td>
<td>covers the Dampier Archipelago and overlaps Holden Beach and the shoreline</td>
</tr>
<tr>
<td></td>
<td>LNG project).</td>
<td></td>
<td>of the Pluto LNG project. Use level for this BIA has been defined as very</td>
</tr>
<tr>
<td></td>
<td>(DoEE, 2017a)</td>
<td></td>
<td>low. (DoEE, 2017a) Nesting activity occurs during summer, between October</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and March (DoEE, 2017b).</td>
</tr>
<tr>
<td>Loggerhead turtles</td>
<td>Loggerheads occur in coral reefs, bays and estuaries in tropical and</td>
<td>Loggerheads are carnivorous, feeding mostly on benthic invertebrates</td>
<td>In Australia, loggerhead turtles occur as two genetically distinct stocks,</td>
</tr>
<tr>
<td></td>
<td>warm temperate waters, foraging in all coastal states and the NT and</td>
<td></td>
<td>nesting in the southern Great Barrier Reef (south-west Pacific stock), and</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>in Western Australia. Low numbers of loggerhead turtles nest in the</td>
</tr>
<tr>
<td>(Caretta caretta)</td>
<td></td>
<td></td>
<td>Dampier Archipelago (on Rosemary and Cohen Islands),</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Name</th>
<th>Habitat</th>
<th>Diet</th>
<th>Nesting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travelling as far as South America (Boyle et al., 2009). In the Dampier Archipelago, there are no defined foraging BIAs for loggerhead turtles, however, an interesting BIA has been defined for the area (inclusive of two 20 km buffers around Rosemary and Cohen Islands). There is a low level of use associated with these BIAs (DoEE, 2017a).</td>
<td>Including shellfish, crabs, sea urchins and jellyfish. The loggerhead turtle feeds mainly from nearshore to 55 m water depth (Limpus, 2009).</td>
<td>and the main nesting sites for this population occur on Dirk Hartog Island, Muiron Islands, Gnaraloo Bay, and the Ningaloo coast (DoEE, 2017b). No nesting BIAs have been defined in the Dampier Archipelago, however, a 20 km internesting buffer BIA does overlap the region and the shoreline along the Pluto LNG project. Loggerheads tagged in Western Australia have been recaptured in the Northern Territory, Western Australia and Indonesia. In WA, loggerhead turtles nest from November to May (DoEE, 2017b).</td>
<td></td>
</tr>
<tr>
<td>Hawksbill turtle (Eretmochelys imbricata)</td>
<td>Hawksbills typically occur in tidal and sub-tidal coral and rocky reef habitats throughout tropical waters, extending into warm temperate areas as far south as northern New South Wales. In Australia the main feeding area extends along the east coast, including the Great Barrier Reef. Other feeding areas include Torres Strait and the archipelagos of the Northern Territory and Western Australia, possibly as far south as Shark Bay or beyond. In the Dampier Archipelago, there are a number of defined BIAs for flatback turtles. The nearest foraging BIA occurs at Dixon Island approximately 27 km to the east of the Pluto LNG project. Other foraging BIAs include the islands between Cape Preston and Onslow, and Barrow Island (approximately 70 km and 160 km from the Pluto LNG project, respectively). (DoEE, 2017a)</td>
<td>Hawksbill turtles are omnivorous. Sponges make up a major part of the diet of hawksbills, although they also feed on seagrasses, algae, soft corals and shellfish. (Bell, 2012; Whiting and Whiting, 2014)</td>
<td>There are three major hawksbill turtle breeding stocks in Australia including the north Queensland stock, the north-east Arnhem Land stock and the north west shelf of WA stock (DoEE, 2017b). The most significant rookeries in the north west shelf include Dampier Archipelago (including Rosemary Island and Delambre Island), Montebello Islands (including Ah Chong Island, South East Island and Trimouille Island), Lowendal Islands (including Varanus Island, Beacon Island and Bridled Island), and Sholl Island (DoEE, 2017b). In the Dampier Archipelago there are a number of established nesting BIAs for hawksbill turtles. The nearest is a nesting BIA on Delambre and surrounding islands (approximately 3 km of the Pluto LNG project). Use level at this BIA is defined as high. There is also a 20 km year round internesting buffer BIA that covers the Dampier Archipelago and overlaps Holden Beach and the shoreline of the Pluto LNG project. Other nesting BIAs in proximity to the Pluto LNG project include Barrow and the Montebello Islands (&gt;100 km west of the Pluto LNG project). (DoEE, 2017a) Nesting in Western Australia occurs between October and February (DoEE, 2017b).</td>
</tr>
</tbody>
</table>
Olive ridley turtle
(*Lepidochelys olivacea*)

The olive ridley turtle has a worldwide tropical and subtropical distribution, including northern Australia. Olive ridley turtles occur in shallow, protected waters, especially in soft-bottomed habitats. In Australia, they occur along the coast from southern Queensland and the Great Barrier Reef, northwards to Torres Strait, the Gulf of Papua, Gulf of Carpentaria, Arafura Sea and Joseph Bonaparte Gulf in Western Australia.

In the Dampier Archipelago, there are no defined foraging BIAs for loggerhead turtles, however, there are a number of nesting BIAs (DoEE, 2017a).

The olive ridley turtle is primarily carnivorous, feeding mostly on soft-bodied invertebrates, including sea pens, soft corals, sea cucumbers and jellyfish. The feed in water depths between 15 – 200 m. (Limpus, 2009)

There are at least two genetic stocks of olive ridley turtles in Australia, including a nesting population in the NT and a nesting population in western Cape York, Qld. There is also nesting in low numbers along the Kimberley coast, however, the genetic relationship between these turtles and populations in NT and Qld is unknown (DoEE, 2017b). It is suggested olive ridley turtles in the Kimberley and WA may migrate from international waters.

A number of BIAs have been recently established in WA to protect nesting olive ridley turtles in the Kimberley. All four of these nesting BIAs occur north east of Broome in the Dampier Peninsula (>770 km from the Pluto LNG project). Nesting at these locations occurs between May and July (Prince et al, 2010).

* BIAs include habitat critical to the survival of a species, as defined in the Recovery Plan for Marine Turtles in Australia and the National Conservation Values Atlas (NCVA) (DoEE, 2017a and 2017b). Where BIAs closely relate to spatially defined habitats critical to the survival of a marine turtle species, areas have been merged and described only as one.
2.1.1 Nesting and Internesting

Significant nesting and interesting aggregation areas for sea turtles occur within the Dampier Archipelago, as reported in the (NCVA and the Recovery Plan for Marine Turtles in Australia (DoEE, 2017a and 2017b), and are shown in Figure 2 (as well as summarised in Table 2). Figure 2 highlights that marine turtles, predominantly flatback, green and hawksbill turtles, nest across the Dampier Archipelago, with most nesting occurring on offshore islands (e.g. Rosemary, Legendre, Delambre, West Intercourse and Dixon Islands). Habitat data, as determined using multi-beam hyper-spectral analysis and towed video data, is provided within Figure 3 and provides an indication of the distribution and diversity of sea turtle habitat within the Dampier Archipelago.

An internesting period denotes the time between each successful nesting period during a nesting season (all species of marine turtles lay several clutches of eggs during a nesting season). Many adult turtles are known to remain in relatively close proximity to their nesting beaches during interesting periods. Whittock et al. (2014) tracked flatback turtles from beaches on the east coast of Barrow Island, finding the mean displacement of internesting females was 25.7 and 27.2 km from Thevenard Island and Barrow Island, respectively. These results indicate that internesting turtles remain in continental shelf waters, which is consistent with the distribution of preferred foraging habitat of soft-bottomed shallow continental shelf waters (Limpus, 2007).

As turtles leave their nesting beaches they typically spread out and consequently, density decreases rapidly with increasing distance from a nesting beach (Waayers et al., 2011; Whittock et al., 2014). It is likely that marine turtles remain in general proximity of nesting beaches during interesting periods to forage in shallow waters along the mainland coastline, as well as around offshore islands and shoals in the Dampier Archipelago.

Based on monitoring conducted at Holden Beach during the construction phase of the Pluto LNG Foundation Project, the key breeding and nesting periods at Holden Beach are the similar to other locations in the Pilbara and Dampier Archipelago. A breakdown of typical Pilbara sea turtle nesting activity is provided within Table 3.

Table 3 Pilbara Sea Turtle Breeding Timing across Species (taken from Pendoley 2007)

<table>
<thead>
<tr>
<th>Breeding Activity</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aug</td>
</tr>
<tr>
<td>Adults Mating</td>
<td></td>
</tr>
<tr>
<td>Adults, nesting and   inter-nesting</td>
<td></td>
</tr>
<tr>
<td>Egg development (6-8 weeks)</td>
<td></td>
</tr>
<tr>
<td>Hatchlings Emerge</td>
<td></td>
</tr>
</tbody>
</table>

2.1.2 Migratory and Foraging Patterns

Tracking data indicates the three main turtle species recorded in the Dampier Archipelago travel and forage in coastal waters that are relatively shallow (Chevron Australia Pty Ltd, 2015), as follows:

- hawksbill turtles – less than 10 m deep;
- green turtles – less than 25 m deep; and
- flatback turtles – less than 70 m deep.

Post-nesting migratory routes for green, hawksbill and flatback turtles were recorded for the Northwest Marine Region (from Barrow Island and mainland sites) (Chevron Australia Pty Ltd, 2015). Green, flatback and hawksbill turtles travelling from nesting sites to foraging grounds generally travelled east or south of Barrow Island and around or through the Dampier Archipelago and along the coast towards foraging grounds to the north (north of Broome). The hawksbill turtle was an exception as it tended to travel south to the coastal island chain south of Barrow Island (Chevron Australia Pty Ltd, 2015).
Figure 2 BIAs for Sea Turtle Species within the Dampier Archipelago (DoEE 2017a)
Figure 3 Local Marine Habitat Map of Mermaid Sound based on Multi-beam, Hyper-spectral and Towed Video Data (SKM 2009)
2.2 Sea Turtle Activity at Holden Beach

2.2.1 Pre-construction Monitoring Results

Holden Beach is a north-west facing beach, approximately 590m in length, situated immediately south of the existing Pluto LNG jetty, on the western coast of the Burrup Peninsula. The beach is split into two beaches by a rocky outcrop, which extends into the intertidal zone (Figure 4).

Two periods of baseline sea turtle surveys of Holden Beach were conducted prior to commencing construction of the Pluto LNG Project. The first was conducted during the 22nd of December 2005 and the 3 - 4th of January 2006 by Pendoley Environmental (Pendoley 2005b and 2006) (Appendix A). The surveys noted:

- No evidence of sea turtle nesting activity was present on the northern half of Holden Beach.
- Turtle activity was observed between the creek bed and the rocks located halfway along the beach. The supratidal sand in this area was less compact than elsewhere on the two (north and south) beach areas.
- The southern portion of Holden Beach was primarily being used by low numbers of flatback turtles during early January 2006.
- There was no evidence of marine turtle tracks or nests occurring overnight.
- One set of relatively unweathered flatback turtle tracks were identified. There was no nest associated with these tracks.
- Thirteen body pits characteristic of green and/or flatback turtle nesting attempts were observed, however weathering of the tracks and nests prevented accurate identification of species and quantification of nesting success rate. Three of these pits were associated with visible nests, with the relatively shallow nature of the body exit pits suggesting these were likely made by flatback turtles. A single nest had emerged the night before the survey. While the exact location of the nest could not be found the size of the tracks indicate that the nest was from a flatback turtle (track width on dry flat sand was 11.5 cm wide; Pendoley 2005b). The estimated location of the nest was half way along the southern beach, immediately in front of the rocky outcrop backing the beach.
- There was evidence of numerous vehicle tracks through the nesting area. Continual use of the beach by vehicles may compact sand over time and reduce the chance of nests developing or emerging successfully.

The results of the first surveys provided an initial baseline of sea turtle usage of Holden Beach prior to construction of the approved Pluto LNG Project. It was noted that these results represented a snapshot of Holden Beach sea turtle nesting populations based on limited data collected over a small portion of nesting seasons. In addition, hawksbill turtles are known to begin nesting in October/November, which is earlier than other species in the region such as green and flatback turtles. The surveys are therefore likely to have missed the opportunity to detect the presence of hawksbill turtles at Holden Beach.

Subsequently, a second period of surveying was conducted. Woodside staff commenced daily visual inspections of Holden Beach from 1st January 2007 to 8th June 2007 as part of the site preparation environmental monitoring programme (FWW 2007a). The aim of this program was to record evidence of adult sea turtles using Holden Beach. There was no evidence of adult sea turtles on Holden Beach during this monitoring period.
2.2.2 Construction Monitoring Results

During the construction phase of the Pluto LNG Foundation Project, Holden Beach was monitored for nesting sea turtles. Trained personnel conducted daily track surveys at Holden Beach between 30 September and 1 May each year for the 2007/2008, 2008/2009 and 2009/2010 nesting seasons. These periods coincided with the nesting seasons of the flatback, green and hawksbill turtles.

Marine turtle tracks were used to identify species. The results of the track surveys from Holden Beach are summarised within Table 4.

Table 4 Sea Turtle Track Counts from the 2007-2010 Nesting Seasons at Holden Beach

<table>
<thead>
<tr>
<th>Nesting Season</th>
<th>Number of Tracks</th>
<th>Number of Recorded Emerged Nests</th>
<th>Average Number of Tracks Per Night</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007 – 2008</td>
<td>14</td>
<td>6</td>
<td>0.03</td>
</tr>
<tr>
<td>2008 – 2009</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2009 – 2010</td>
<td>24</td>
<td>4</td>
<td>0.06</td>
</tr>
</tbody>
</table>

In addition to track counts, nest fan measurements of all hatched turtle nests on Holden Beach were recorded during the surveys. Nest fan measurements were recorded to identify the behaviour of hatchlings in response to light during the sea-finding behaviour and to confirm the actual nesting activity on the beach. Five nest fan measurements were recorded during the 2007/2008 nesting season. Of these, one nest indicated hatching disorientation with a wide angle spread of emergent tracks. It is unclear whether the source of light causing the disorientation was natural or anthropogenic in origin.
While the results in Table 4 suggest Holden Beach does not support a major sea turtle rookery (Pendoley 2010), Woodside acknowledges that all suitable nesting locations for sea turtle species are important given their conservation status (see Section 2). There are limited alternative nesting beaches nearby along the shoreline between the King Bay Supply Base and the Karratha Gas Plant LNG Facility, with the only other potential nesting beach, near No Name Bay, located ~500 m north of Holden Beach. Key sea turtle nesting locations are located towards the outer Dampier Archipelago on Rosemary and Legendre Islands.

It is Woodside’s view that any beach that provides, or potentially provides, habitat for nesting sea turtles shall be appropriately managed.

### 2.2.3 Operations Monitoring Results

Results gathered from sea turtle monitoring on Holden Beach during the operations phase of Pluto Gas Plant to date are presented in Section 6.

### 2.3 Lighting at Holden Beach

A number of existing and external sources of light are located within close proximity to Holden Beach (Table 5 and Figure 5).

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Distance/ Direction from Holden Beach</th>
<th>Lighting observed from Holden Beach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pluto LNG Project Jetty</td>
<td>Adjacent to Holden Beach</td>
<td>Direct line of sight</td>
</tr>
<tr>
<td>Pluto LNG Site A infrastructure</td>
<td>Adjacent to Holden Beach</td>
<td>Light overspill/ glow</td>
</tr>
<tr>
<td>Dampier Cargo Wharf</td>
<td>1.1 km south</td>
<td>Direct line of sight</td>
</tr>
<tr>
<td>Bulk Liquids Berth</td>
<td>1.7 km south</td>
<td>Direct line of sight</td>
</tr>
<tr>
<td>NWSV LNG Facility</td>
<td>1.6 km north</td>
<td>Direct line of sight</td>
</tr>
<tr>
<td>Dampier Port Authority- Cargo Wharf Administration Building</td>
<td>1 km south</td>
<td>Light overspill/ glow</td>
</tr>
<tr>
<td>King Bay Supply Base</td>
<td>1.8 km south</td>
<td>Light overspill/ glow</td>
</tr>
<tr>
<td>LNG Tankers/ Vessels (Transient)</td>
<td>Not applicable</td>
<td>Light overspill/ glow</td>
</tr>
</tbody>
</table>

While nearby infrastructure continues to emit light, the likelihood of natural darkness periods occurring at Holden Beach are limited. There is still a need, however, to consider cumulative impacts of lighting (both direct light and glow) on sea turtles that utilise land and water in close proximity to Site A. Therefore, a sensible and strategic management approach to minimise the impact of lighting is an essential component of this Sea Turtle Management Plan (refer to Section 4). Woodside shall minimise lighting emissions whilst at the same time complying with health, safety and security requirements. An Operational Environmental Lighting Specification (OELS) has been prepared and approved by the DEC as part of approvals for the Pluto LNG Project (Trains 1 and 2). A copy of the OELS is provided within Appendix C.
Figure 5 Existing Lighting Sources within Close Proximity to Holden Beach
3 Management Issues

3.1 Environmental Risk Assessment

An assessment of environmental risk to sea turtles has been undertaken using Woodside’s environmental risk matrix (refer to Appendix B). This assessment methodology is consistent with standard risk management process and practice as outlined in the Australian risk management standard (AS/NZS 4360). The risk assessment presented in Appendix B has been tailored to be specific to Holden Beach sea turtle nesting populations.

The criteria that have been applied to determine ‘likelihood’ and ‘consequence’ of each potential impact/project activity are presented within Appendix B. The risk level is derived from the consequence and likelihood levels determined above in accordance with the risk matrix are shown in Figure 6.

![Figure 6 Woodside risk matrix – risk level](image)

Table presents the results of the risk assessment process and identifies the inherent risk (unmitigated risk) and residual risks (mitigated risks) to sea turtle populations associated with the project. The risk assessment is based on the following assumptions:

- The likelihood rating (remote – highly likely) is based on the likelihood of an impact occurring to Holden Beach sea turtle populations as opposed to the likelihood of an event occurring.
- The consequence rating (no lasting effect – catastrophic) is based on the most probable consequence resulting from the likelihood of an impact occurring to sea turtle populations, taking into consideration external factors such as existing light at Holden Point from surrounding sources.

Should any additional impacts to sea turtles and their habitats be identified during operations and associated maintenance, the plan shall be revised and additional management measures developed and implemented. This would be undertaken in consultation with DWER and the Commonwealth Department of Environment and Energy (DoEE).
### Table 6 Summary of Key Potential Environmental Risks to Sea Turtle Populations

<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Aspect</th>
<th>Activity</th>
<th>Potential Impact(s) and Consequences to Sea Turtle</th>
<th>Consequences (population)</th>
<th>Likelihood (Population)</th>
<th>Inherent Risk</th>
<th>Mitigation and Management</th>
<th>Consequences</th>
<th>Likelihood</th>
<th>Residual Risk</th>
</tr>
</thead>
</table>
| **Light Spill**   | Operation | **Site A – LNG and Condensate Storage Facility** | Potential impacts may include:  
- disruption of turtle nesting activity (i.e. deter females from emerging onto the beach) on Holden Beach;  
- light overspill or glow from the operation of infrastructure at Site A may lead to disorientation of turtle hatchlings;  
- hatchling sea turtles may be attracted to lights on boats/barges moored offshore at night;  
- hatchling sea turtles may be attracted to temporary lighting and permanent lights required for operation of facilities within Site A; and  
- the potential consequences of disruption to sea turtle nesting activity may be i) reduced nesting attempts ii) disorientation due to artificial lighting, resulting in increased mortality of emerging hatchlings due to increased dehydration, predation, and exhaustion. Additionally, hatchlings trapped by light spill from jetty and vessel lights may be concentrated within a small area exposing them to predation.  

Table 7, OS1. | E 3 | M | Table 77, OS1. | E 1 | L |
| **Human Presence** | Operation | **Site A** | The potential impact is disruption of adult nesting. The potential consequences of disruption to nesting activity is sea turtles abandoning nesting attempts and returning to the water.  

Table 7, OS4. | E 3 | M | Table 7, OS4. | E 0 | L |
| **Water Quality** | Operation | **Jetty adjacent to Site A** | Potential impacts would be limited to maintenance activities. This may include:  
- increased total suspended solids in water column in vicinity of dredge/disposal activities;  
- altered sea turtle behaviour (i.e. avoidance) during dredging operations from plumes of suspended sediments; and  
- Plumes associated with LNG and condensate tanker propeller wash during berthing and departure operations may deter turtles from entering the immediate area.  
Potential consequence include:  
- sea turtles being deterred from entering areas important for foraging and breeding or from accessing beaches used for nesting.  

Table 7, OS3. F 2 | E 2 | M | Table 7, OS3. | F 2 | L |
| **Physical Presence** | Operation | **Jetty adjacent to Site A** | Potential impacts may include:  
- direct striking caused by the physical presence of marine infrastructure installation vessel(s); and  
- LNG tanker, condensate tankers and support vessel movement in Mermaid Sound may result in increased propeller and/or vessel strike.  
The potential consequence is increased sea turtle injury and/or mortality from vessel strike.  

Table 7, OS5 | E 3 | M | Table 7, OS5 | E 2 | M |
| **Light Spill** | Operation | **Jetty adjacent to Site A** | Potential impacts may include:  
- sea turtle hatchlings being attracted to permanent light sources located on the jetty;  
- hatchling sea turtles being attracted to lights onboard LNG and condensate tankers loading from the jetty at night;  
- hatchling sea turtles being attracted to lights onboard vessels moored or operating in Mermaid Sound at night.  
Potential consequences include:  

Table 7, OS1. Section 4.2 of this plan. (Dredging and Spoil Disposal Procedure) | E 3 | M | Table 7, OS1. Section 4.2 of this plan. (Dredging and Spoil Disposal Procedure) | F 2 | L |
<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Aspect</th>
<th>Activity</th>
<th>Potential Impact(s) and Consequences to Sea Turtle</th>
<th>Consequences (population)</th>
<th>Likelihood (Population)</th>
<th>Inherent Risk</th>
<th>Mitigation and Management</th>
<th>Residual Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>• hatchlings trapped by the light spill from jetty and vessel lights being concentrated within a small area exposing them to predation; and • physical exhaustion of hatchlings from maintaining position under infrastructure lighting, after entering the water.</td>
<td>E</td>
<td>5</td>
<td>H</td>
<td>Table 7, OS6. Section 4.2 of this plan (Dredging and Spoil Disposal Procedure)</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Potential impacts may include: • direct striking/impact from physical presence of dredge vessel and support vessels; and • sea turtles coming in contact with the dredge head (i.e. Trailer Suction Hopper Dredge (TSHD) or the Cutter Suction Dredge (CSD))</td>
<td>E</td>
<td>3</td>
<td>M</td>
<td>Table 7 OS1. Section 4.2 of this plan (Dredging and Spoil Disposal Procedure)</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Potential impacts may include: • sea turtle hatchings being attracted to lights onboard dredge vessel(s); • adult sea turtle being deterred from nesting/foraging activities; • physical exhaustion of hatchlings from maintaining position under dredge lighting, after entering the water; and • nesting and foraging activity by adult sea turtle being reduced leading to a loss of available habitat.</td>
<td>E</td>
<td>3</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Potential impacts may include: • plumes of suspended solids deterring turtles from entering the immediate area, during dredging operations; and • suspended solid plumes reducing visibility in sea turtle foraging habitat. The potential consequence is that sea turtles may be deterred from using Holden Beach for nesting and/or utilising foraging areas.</td>
<td>E</td>
<td>3</td>
<td>M</td>
<td>Table 7, OS3. Dredge Spoil Disposal and Management Plan.</td>
<td>L</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Potential impacts may include: • loss of habitat as a result of inappropriately managed activities (e.g. dredging) in the marine environment; and • habitat loss may be direct (i.e. direct removal from dredging), or indirect (i.e. loss of habitat due to changes in water quality/turbidity during construction). Potential consequence is habitat loss that may result in reduced area for sea turtle foraging and mating.</td>
<td>E</td>
<td>1</td>
<td>L</td>
<td>Table 7, OS5 Section 4.2 of this plan (Dredging and Spoil Disposal Procedure)</td>
<td>L</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Potential consequences are increased injury and/or mortality to sea turtles.</td>
<td>E</td>
<td>3</td>
<td>M</td>
<td>Table 7, OS5 Section 4.2 of this plan (Dredging and Spoil Disposal Procedure)</td>
<td>L</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Potential impacts include sea turtle burial/strike during dredge spoil disposal activities. Potential consequences include increased sea turtle injury and/or mortality from vessel strike or burial by dredge spoil.</td>
<td>E</td>
<td>2</td>
<td>M</td>
<td>Table 7, OS5 Section 4.2 of this plan (Dredging and Spoil Disposal Procedure)</td>
<td>L</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Aspect</th>
<th>Activity</th>
<th>Potential Impact(s) and Consequences to Sea Turtle</th>
<th>Consequences (population)</th>
<th>Likelihood (Population)</th>
<th>Inherent Risk</th>
<th>Mitigation and Management</th>
<th>Consequences</th>
<th>Likelihood</th>
<th>Residual Risk</th>
</tr>
</thead>
</table>
|                   | Water Quality | Spoil disposal | Potential impacts upon sea turtles from elevated suspended solids in the water column include:  
  - turtles being deterred from entering the immediate area; and  
  - temporary disruption to feeding and foraging areas. A potential consequence is that habitat loss may result in a reduced area for sea turtle foraging and mating. Sea turtles may be deterred from entering areas important for foraging and breeding. | E                          | 3                      | M              | Table 7, OS5 Section 4.2 of this plan (Dredging and Spoil disposal Procedure)                | F            | 2          | L             |
4 Management Actions and Strategies

4.1 Overview

Management measures to be implemented during the operation and future construction phases of the Pluto LNG Project are outlined in Table 7. The management measures addressing the operational activities have been reviewed and updated considering turtle monitoring data collected during the Pluto LNG Project Train 1 construction phase (2007-2010).

Management actions and strategies have been developed in accordance with the Draft PER mitigation and control measures (Woodside 2006), as well as recommended actions from specific sea turtle studies (i.e. Pendoley 2010) and the EPA Environmental Assessment Guideline No.5 for protecting marine turtles from light impacts (EPA 2010). The minimum standard outlined in the APPEA guidelines for the Code of Environmental Practice have also been adopted, and in many cases proposed management strategies exceed these guidelines (APPEA 1996).

In addition, the plan has been prepared in accordance with the EPBC Regulations 2000, Regulation Part 8 – Interaction with Cetaceans and Whale Watching. Section 4.2 (Dredging and Spoil Disposal) of this plan, specifically detail the avoidance actions to be implemented in the event of potential disturbance or interaction with sea turtles or marine mammals. For dredge vessel activity undertaken outside of dredging and spoil disposal that is, when the vessel is in transit), the vessels will comply with the following:

- If a dolphin (other than a calf) approaches the vessel or comes within the avoidance area (50 m for dolphins and 100 m for a whale), the vessel will not change course or speed suddenly.
- If a calf appears within 300 m of the vessel, the vessel will take the appropriate action to withdraw from this distance at a constant slow speed.

These measures will be implemented where it is safe and practicable to do so, relative to vessel manoeuvrability, vessel draft considerations and other vessel activity within the port.
Table 7 Management Measures for Operations

<table>
<thead>
<tr>
<th>Reference</th>
<th>Project Activity</th>
<th>Management Objective</th>
<th>Key Management Measures</th>
<th>Performance Measures/ Targets</th>
<th>Proceeding actions if/when an impact is detected</th>
<th>Related Management Measures / Plans</th>
<th>Responsibility</th>
</tr>
</thead>
</table>
| OS1       | Onshore Lighting (LNG Storage Area Site A and Jetty) | To minimise the impact of lighting on sea turtles, including nesting and hatching activity. | - Implementation of the existing Pluto OELS (Appendix C). The plan contains:  
  - Detail on personnel roles and responsibilities.  
  - Detail on light management strategies, including lamp design, controlling light levels, positioning and shielding and procedural controls.  
  - Minimising light intensity to as low as reasonably practicable (ALARP) within Site A, while maintaining Health, Safety, and Security (HSS) conditions.  
  - Avoidance, wherever practicable, on the use of short wave-length lighting (considered highly disruptive to turtles) including metal halide, halogen and florescent light.  
  - A preference towards the use of lighting in the 590-625 nm wavelength (shown to be less disruptive to sea turtles) including colour filtered lamps, filtered high pressure sodium (HPS) lamps and low pressure sodium lamps.  
  - Reducing light spill falling on Holden Beach through shielding, directional alignment, window covering and other techniques (where no alternatives are available to halide, halogen and fluorescent light).  
  - Reducing horizon glow through the use of downward-facing luminaries, attention to reflecting surfaces and minimisation of external visibility of indoor lighting.  
  - Detail on monitoring of light levels on Holden Beach and reporting requirements.  
  - Development of the OELS was undertaken following consultation with turtle specialists (i.e. Pendoley Environmental) and the DEC. The finalised plan was submitted to DEC on 4 April 2008 and was approved on 7 November 2008. This plan will be implemented for operations.  
  - Audits of lighting during operations against the OELS shall be conducted during the first turtle nesting season of operations. Additional audits shall be conducted every 5 years during the operational life of the Pluto Offshore Facility. | No incidents of adult or hatching sea turtles being disoriented by light associated with the Pluto LNG project. | - In the event that evidence of turtle disorientation resulting from the Pluto LNG project is recorded, investigation will be undertaken to determine the source(s) of light responsible for the incident and to identify and consider potential additional controls/mitigation measures that should be implemented. | APPEA Code of Environmental Practice (APPEA 1996)  
Pluto OELS (Appendix C)                                                                                   | Woodside                                      |
| OS2       | Offshore / Nearshore Hydrocarbon Spills      | To minimise the impact of offshore / nearshore hydrocarbon spills on sea turtles and marine mammals. | In the event of a hydrocarbon spill, management measures contained within the Nearshore Pipelines Oil Pollution Response Plan and Pluto Facilities Oil Spill Response Plan shall be implemented. The plans:  
  - ensure the effective and timely management of hydrocarbon spills;  
  - describe the procedure for management of hydrocarbon spills; and  
  - provide for prompt notification of regulatory agencies in the event of a spill. | No incidents of adult or marine mammal injury/deaths associated with oil spill from the Pluto LNG project. | - In the event that a turtle or marine mammal injury/death associated with oil spill is recorded, it will be reported to the Woodside HSE advisor who will report the incident to DBCA and DoEE (Section 7.10.6.2). An investigation will be initiated to determine the cause of the incident and to identify and consider potential additional controls/mitigation measures that should be implemented. | Pluto LNG Development Draft Public Environmental Report/Public Environmental Review (Woodside 2006):  
Section 7.10.6.2.  
Woodside Oil Pollution Emergency Arrangements (Australas) | Woodside / Vessel Captains |
<table>
<thead>
<tr>
<th>Reference</th>
<th>Project Activity</th>
<th>Management Objective</th>
<th>Key Management Measures</th>
<th>Performance Measures/ Targets</th>
<th>Proceeding actions if/when an impact is detected</th>
<th>Related Management Measures / Plans</th>
<th>Responsibility</th>
</tr>
</thead>
</table>
| OS3 | Waste Discharge | To minimise the impact of waste discharge on sea turtles and marine mammals. | • Water quality to meet ANZECC/ ARMCANZ (2000) 99% species protection level.  
• Wastewater reuse, and discharge residual wastewater. | No turtle or marine mammal injury/death resulting from wastewater discharge from the Pluto LNG project. | • In the event that a turtle or marine mammal injury/death associated with wastewater discharge is recorded at the Pluto LNG project, it will be reported to the Woodside HSE advisor who will report the incident to DBCA and DoEE (Section 7.1). An investigation will be initiated to determine the cause of the incident and to identify and consider potential additional controls/mitigation measures that should be implemented. | Waste Management Plan and Waste Water Management Plan | Woodside |
| OS4 | Operational Personnel | To minimise the impact of human presence on sea turtle activity on Holden Beach | • Access to Holden Beach is restricted to key personnel, including staff involved in monitoring programs, security, health and safety, environmental and cultural heritage staff.  
• No vehicle access is permitted on the beach. | No unauthorised access to Holden Beach by Woodside personnel and contractors. | • In the event that unauthorized access by Woodside personnel and contractors is identified on Holden Beach, an investigation will be initiated to assess any resulting impacts and to identify and consider potential additional controls/mitigation measures that should be implemented. | Pluto LNG Cultural Heritage Management Plan | Woodside |
| OS5 | Maintenance Dredging and Spoil disposal | To minimise the impact of maintenance dredging activities on sea turtle and marine mammals | Habitat Loss  
• Any future dredging activities would be undertaken in accordance with a pre-prepared Dredging and Spoil Disposal Management Plan (DSDMP). All requirements listed within the DSDMP would be strictly followed to ensure dredging activities have ALARP impact to areas of sea turtle habitat.  
Dredging  
• Evaluate future timeframes of maintenance dredging to avoid coinciding with turtle nesting and breeding season.  
• Vessel crews shall undertake a site induction by the Woodside Environment Advisor.  
• Turtle deflectors or a jetting device system shall be installed on dredge equipment to reduce the likelihood of sea turtle contact with the dredge drag head.  
• An assessment of sea turtle presence shall be made prior to dredging. If a sea turtle is sighted within 300 m, the dredge vessel will relocate to >300 away from the turtle to commence dredging.  
• Any incidents relating to sea turtle injury / mortality shall be documented.  
• Sightings and locations of sea turtles shall be recorded in the vessel’s daily log book.  
Spoil Disposal (Physical Smothering and Foraging Area Impacts) | No turtle or marine mammal injury/death resulting from maintenance dredging or spoil disposal activities associated with the Pluto LNG project. | • In the event that a turtle or marine mammal injury/death associated with dredging or spoil disposal is recorded, it will be reported to the Woodside HSE advisor who will report the incident to DBCA and DoEE (Section 7.1). An investigation will be initiated to determine the cause of the incident and to identify and consider potential additional controls/mitigation measures that should be implemented. | Refer to Section 4.2 of this plan (Dredging and Spoil Disposal Procedure) | Woodside  
Fauna Spotter |
<table>
<thead>
<tr>
<th>Reference</th>
<th>Project Activity</th>
<th>Management Objective</th>
<th>Key Management Measures</th>
<th>Performance Measures/ Targets</th>
<th>Proceeding actions if/when an impact is detected</th>
<th>Related Management Measures / Plans</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>• An assessment of sea turtle presence shall be made prior to spoil disposal. If a sea turtle(s) is observed within 300 m, the vessel shall dump in an adjacent area &gt;300 m away from sea turtle activity.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Any incidents relating to sea turtle injury / mortality shall be documented.</td>
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<tr>
<td></td>
<td></td>
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<td>• Sightings and locations of sea turtles shall be maintained in the vessel’s daily log book.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• All spoil grounds are located away from documented nesting areas.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• The dredging method shall include disposal of spoil into spoil grounds within Mermaid Sound for the shortest period, wherever practicable.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Disposal of spoil shall be restricted to defined areas within the overall spoil ground, thus minimising the potential for suspended solids drift.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.2 Stressor CS3 – Dredging and Spoil Disposal Procedure

In advance of future dredging activities, the dredge vessel crew will receive training from a qualified marine fauna observer (MFO). In the absence of a MFO, the vessel captain will be responsible for logging sighting and sea turtle injury/death reporting by the crew. These procedures must be followed as part of any dredging (Figure 7) and spoil disposal (Figure 8) procedure.

A turtle/marine mammal watch will be maintained at all times from all dredging and dredge support vessels. Should any marine fauna (turtle, dolphins, dugongs, whales) be sighted, all vessels operating in the area shall be notified. Fauna presence, including direction and behaviour will be monitored and dredging equipment kept well clear. Sighting of sick or injured turtles will be reported to the regional Department of Biodiversity, Conservation and Attractions office. These incidences will be recorded using the sea turtle incident form contained in Appendix D.

It is noted that the dredging procedure (Figure 7) identifies a 20 m exclusion zone to be maintained for sea turtles and marine mammals in the event that animals are identified within 50 m of the vessel. Application of the 20 m exclusion zone with respect to dolphins in not considered feasible. Dolphins are unique in that they:

- are relatively common in the work area;
- are known to be attracted to dredging activities due to foraging potential created by disturbance of the seabed;
- frequently “bow ride” on small and large vessel when moving at speeds greater than 4 knots;
- are intelligent;
- are extremely manoeuvrable and are capable of outpacing a working CSD or TSHD; and
- have excellent navigational abilities (echolocation).

As such, the response to a dolphin within 20 m of any dredging vessel will be gauged on the behaviour of that individual. This will include an assessment of whether the animal is showing a tendency or persistence to enter and remain in high risk areas (such as in close proximity to drag and cutter heads). An animal that is tracking across the 20 m radius at speed, or bow riding will not trigger a stop dredge response (bow riding animals will be managed in accordance with the Australia National Guidelines for Whale and Dolphin Watching). This procedure will be evaluated on an ongoing basis by the MFO.

In addition to the procedures described above, turtle exclusion devices and methods will be implemented, the application of which, being dependent on the particular dredging situation. The following exclusion devices would be used for the TSHD in the appropriate situations:

- In areas where an under keel clearance for a loaded dredge is in excess of 4 m, sea turtle deflection devices constructed of chains will be fitted to the trailing pipe forward of the draghead on the TSHD. These deflectors will be similar to those used on previous dredging projects within Western Australia.

- In areas where the TSHD are operating with less than 4 m under keel clearance (loaded vessel), the use of deflector devices would affect the steering and propulsion of the vessel, thereby presenting an unacceptable safety risk. In addition, the deflector devices would drag along the seabed rendering them ineffective. When dredging in these areas, the dredge will move slowly through the area before commencing dredging to allow time for the pressure pulse, noise and vibration to encourage any sea turtles to leave the vicinity. This will be done on the first few passes when dredging in virgin material and not on every pass once a work area has been established, with the under keel clearance...
measurement based on the level at lowest astronomical tide (LA). This is based on a number of factors:

- In Mermaid Sound, turtles are not known to concentrate in substantial numbers through depressions and channels like as in other parts of the world (i.e. United States of America, USA).
- In these shallow areas (less than 4 m under keel loaded clearance at Lowest Astronomical Tide (LAT), when fully loaded) the dragheads are typically positioned some 70-100 m behind the bow of the dredge. At the typical dredging speed of 1.5 to 2.5 knots, the hull provides a significant “pressure pulse wave” over an area where turtles may have settled well in advance of the passing dragheads. In addition the general noise generated by the dredge pumps running, the bow will also pass over such an area well before the dragheads do, thereby adding further warning to any turtles in the area.

- In areas where the under keel clearance is in excess of 4 m (i.e. the pressure pulse will be ineffective) and the material to be dredged consists of compacted sand or gravel, the draghead jets will be used to deter turtles from the draghead. The jets will be operated by a pass over of the areas prior to dredging. This method is not feasible during the dredging of low density / high moisture content material as the jets will increase sedimentation, increasing the intensity and duration of impact caused by the dredge plume.

- Within the requirements of the dredging operations, the dredge pumps will be turned off as soon as practically possible after the draghead clears the bottom on completion of the dredging cycle.

As CSDs and BHDs occupy a much smaller “static” work area (relative to a TSHD), different management measures would be utilised, should these vessels be required. Should operations with a BHD be required, operations would stop if a sea turtle or marine mammal entered the 20 m radius as per above. However, it is not possible to stop a CSD abruptly due to the mass and momentum of the dredge. Such a sudden stoppage may results in damage to the ladder and cutter head. For a CSD, the same establishment procedures as described above (300 m radius) would be implemented when starting / restarting works and the 50 m watch will be maintained (50 m from cutter head). Should a sea turtle be observed within a 20 m radius of the dredge, the dredge would stop swinging and the ladder would be lifted so the cutter is clear of the sea bed and the cutter blade disengaged. The dredge pumps will continue to prevent blockages of the dredge pumps and pipelines. Should the animal(s) remain within close proximity of the cutter head (i.e. within 20 m) the pumps will be slowly shut down once the dredge pumps and pipelines are cleared of dredge material.
Pluto LNG Project Sea Turtle Management Plan

Figure 7 Dredging Procedure

Pre-Dredge Commencement

Action: Vessel crew will be given the training on sea turtle and marine mammal observations from IFO.

On arrival at the site, commence marine fauna lookout within 300 m of the vessel for 30 min.
Available crew will be located around the vessel, each with good visibility in all directions using binoculars. Is a sea turtle or marine mammal sighted by anyone?

Yes

Action: Dredge vessel will relocate to an adjacent area >900 m away from the site if a sea turtle or marine mammal activity.

No

Action: Start dredging

Action: Constant watch to be maintained during dredging

Is a sea turtle or marine mammal sighted within 50 m of vessel?

Yes

Action: Dedicated watch will be established.

No

Action: Stop dredge and ‘piles on deck’.
The delay shall be maintained until the sea turtle(s) or marine mammal(s) have been seen to move away from the vessel (i.e., >50 m) or have not been seen for 10 min. If the animal shows signs of being disturbed, immediately withdraw the vessel away from the animal(s) at a constant slow speed.

Action: If the sea turtle(s) or marine mammal(s) are within 20 m of the dredge vessel.

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Uncontrolled when printed. Refer to electronic version for most up to date information.
### Figure 8 Dredge Spoil Disposal Procedure

#### 4.3 Contingency Actions

Woodside recognises that contingency measures and adjustments to management strategies may be required in the event a detrimental impact is recorded, and/or performance measures or targets are not met. Any new mitigation measures would be discussed with the DWER prior to implementation.
5 Monitoring

5.1 Previous Monitoring

In accordance with the commitment made in the original STMP (Rev 0), a sea turtle monitoring program for Holden Beach was undertaken for five years from Pluto Foundation Project start-up (i.e. until 2016).

The goals of the first phase of monitoring were:

- detection of trends over time relating to turtle nesting (i.e. frequency); and
- investigation on whether potential light-related impacts are affecting nesting and hatchling behaviour.

Results of this monitoring are presented in Section 6. This program has now concluded, and following consultation with the Department of Biodiversity, Conservation and Attractions (DBCA) an ongoing monitoring program (described in Section 5.2) has been developed.

As with the monitoring undertaken during construction of the initial site infrastructure within Site A (as part of the approved Pluto LNG Project), operational monitoring involved the recording of sea turtle tracks. This occurred (until 2016) from September to May, thereby coinciding with the flatback, green and hawksbill nesting period. Track photographs were taken, to assist in the identification of sea turtle species', and records taken of any nesting attempts (as represented by a body pit). GPS locations were also be taken of both turtle tracks and body pits.

Monitoring was planned to best consider factors such as number of nests, incubation duration, and forecast wind and rain events. During likely hatching periods, monitoring for weather events optimised the ability to observe and record hatchling tracks.

Nest fan measurements assisted in identifying the movements of hatchlings from light during their sea-finding behaviour, as well as confirming actual nesting activity on Holden Beach. Measurements, including hatchling emergence date, GPS location, fan heading, fan spread and fan offset were taken.

Monitoring was undertaken by a suitably trained person, coordinated by the Environmental Adviser.

5.2 Ongoing Monitoring Plan

Ongoing monitoring of turtle activity on Holden Beach will be undertaken to detect potential impacts on marine turtles from the project, in accordance with Condition 9 of MS757. The ongoing monitoring plan has been developed in consultation with DBCA.

5.2.1 Monitoring Method

5.2.1.1 ‘Morning After’ Beach Surveys


Suitably trained personnel (see Section 5.2.3) will walk the extent of Holden Beach using a handheld GPS, camera, tape measure, compass and clipboard or the DBCA Marine Science Program turtle field data collection application on a tablet to record:

- the total number of nests per species and a GPS location for each one;
• the number of successful nests per species and a GPS location for each one;
• the number of false crawls per species;
• the number and location of disturbed nests;
• potential causes of nest disturbance;
• presence of predators; and
• the number of hatched nests.

Record keeping of data obtained during beach surveys is aligned with chapter 4 of the Ningaloo Turtle Program Monitoring Field Guide, treating Holden Beach as a continuous beach subsection (Note: equivalent information is not provided in the North West Shelf Flatback Turtle Conservation Program – Turtle Monitoring Field Guide – 2nd Edition).

5.2.1.2 Hatching Emergence Fan Survey
When a hatched nest is identified during beach surveys, data on hatchling emergence fans are also collected as part of ongoing monitoring. The method for collecting and analysing this data was adapted from Pendoley (2005) and Salmon and Witherington (1995).

The two parameters used to determine hatchling disorientation are fan spread and offset angles. The compass bearings collected during surveys to determine these parameters include (see Figure 9):

• compass bearings on either side of the furthest right and left hatchling tracks, taken from the nest to the Census Line (A and B Bearings in Figure 9);
• compass bearing for the most direct route to the ocean, taken from the nest to the Census Line (X Bearing in Figure 9); and
• compass bearings from the nest to anthropogenic light sources (Flare and Jetty Bearings in Figure 9).

This data is used to calculate the following:
• Fan spread, which is the angle between A-B Bearings.
• Fan angle midpoint, which is the midpoint between A-B Bearings.
• Offset Angles, which are the angles between the fan angle midpoint and
  1. the X Bearing (X offset angle);
  2. the Jetty Bearing (Jetty offset angle); and
  3. the Flare Bearing (Flare offset angle).

![Figure 9 Illustration of fan spread and offset angle parameters for hatchling emergence fan survey](image-url)
To determine hatchling orientation, the smallest offset angle can be used to infer the most influential navigation aid used by the hatchlings. If the smallest angle is the X offset angle then it can be concluded that there was no significant influence from the identified anthropogenic light sources (as shown in Figure 10(A) and 10(B)). Alternatively, if the smallest angle is either the jetty or the flare offset angles, there is evidence that these light sources are significantly influencing the hatchling's navigation (as shown in Figure 10(C) and 10(D)).

**Figure 10** outlines the main scenarios that may occur from the described hatchling emergence fan surveys: the top-left illustrates a scenario where there is no evidence of disorientation or influence from anthropogenic sources; the bottom-left figure illustrates evidence or disorientation, however, with no apparent influence from the identified anthropogenic light sources; the top and bottom figures on the right show influence from the jetty anthropogenic light source, with both small and large fan spread angles. In both these cases, it would be considered that there was an incident or hatching turtles being disoriented by light associated with the Pluto LNG project and proceeding actions would be triggered (refer to Performance Management Targets in Error! Reference source not found.).

The fan spread can also be used to qualitatively assess disorientation. Pendeley (2005) found that mean fan spread was the largest when turtles were exposed to both offshore and onshore anthropogenic light sources (65°), and second largest when they were exposed to only onshore light (60°); the smallest mean fan spread was when there was no anthropogenic light source (39°). External factors, such as moon phase and beach topography were also found to influence fan spread (Pendeley, 2005). Given this, a threshold of 60° could be used to determine if there is evidence of disorientation for each hatched nest, independent to calculated offset angles which assess influencers of disorientation.
Figure 10 Hatchling emergence fan survey decision criteria (top-left: no disorientation or anthropogenic influence; bottom-left: evidence of disorientation, but no anthropogenic influence; top and bottom right: evidence of disorientation caused by anthropogenic influence).
5.2.1.3 Annual Lighting Survey

In addition to the five yearly audits against the OELS undertaken by a specialist consultant, at the beginning of each season (prior to hatching season) the Pluto Environment Adviser conducts a check of anthropogenic light sources to Holden Beach at night, to identify any deviations from the OELS. The check will involve:

- Verification that turtle lighting minimisation measures as per the OELS have been activated by 1st September each season
- A survey to identify any additional sources of light within the light management zones and if present, ensure compliance with OELS

5.2.2 Frequency

Beach surveys are undertaken fortnightly from 1 September, until the first turtle activity is recorded. Following this, beach surveys are undertaken once per week. Weekly monitoring will continue until the last potential nest has hatched, or 1 May. Additional surveys will be undertaken where practicable before predicted adverse weather events such as periods of cyclones and tropical lows to ensure that evidence of nesting or hatchling emergence is not eroded prior to scheduled monitoring event.

Evidence from the first phase of turtle monitoring on Holden Beach suggests that turtle tracks remain clear for an extended period and weekly monitoring is adequate to identify all tracks, including hatchling emergence fans. Table 8 shows the degradation of a set of tracks over time, indicating that deterioration is limited over 14 days (note the following reference points (1) census cut line crossing the tracks and (2) vegetation in the top right-hand corner of the photographs). The third photograph in the table highlights that even after over 25 days, the same tracks are still easily identifiable as turtle tracks. This is due to the sheltered nature of the beach and access to the beach being prohibited apart from specially authorised personnel.

<table>
<thead>
<tr>
<th>Photograph 1: taken 29/12/17</th>
<th>Photograph 2: +14 days</th>
<th>Photograph 3: +25 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(2)</td>
</tr>
</tbody>
</table>

Table 8: Degradation of turtle tracks on Holden Beach over one time

5.2.3 Training and Competency

Monitoring will be undertaken (or led) by personnel with appropriate training under the North West Shelf Flatback Turtle Conservation Program – Turtle Monitoring Field Guide – 2nd Edition.
5.2.4 Future Monitoring
Additional requirements for monitoring relating to future expansion related construction activities, shall be determined in consultation with the DWER and as part of further Environmental Impact Assessment approvals.

5.3 Offshore / Nearshore
As part of any future dredging and spoil disposal, sea turtle observations will be recorded in a daily log book. The vessel captain will be ultimately responsibility for ensuring these observations are made and recorded in the vessel log.

Prior to commencement of these activities, fauna spotters will be identified and briefed by the Woodside Environmental Adviser to ensure observational and reporting requirements are understood. It would be expected that individual turtle sightings be recorded; however, species identification will not be required. In instances where the MFO is on board, the responsibility for recording observations will default to the MFO.

Any incident that involves the injury or mortality of a turtle will be recorded and the Fauna Spotter/ MFO shall ensure it is reported (Appendix D) to the HSE representative or Woodside Environmental Adviser immediately.
6 Monitoring Results

6.1.1 Construction Monitoring Results

During the construction phase of the Pluto LNG Foundation Project, Holden Beach was monitored for nesting sea turtles. Trained personnel conducted daily track surveys at Holden Beach between 30 September and 1 May each year for the 2007/2008, 2008/2009 and 2009/2010 nesting seasons. These periods coincided with the nesting seasons of the flatback, green and hawksbill turtles.

The results of the track surveys from Holden Beach are summarised within Table 9. One “track” is counted as one up and one down movement, i.e. one land excursion for an individual turtle. The number of “craters” includes the number of body pits, nest attempts and confirmed nests. Confirmed nests were only counted after evidence of hatchling emergence was observed.

Table 9: Sea Turtle Track Counts from the 2007-2010 Nesting Seasons at Holden Beach

<table>
<thead>
<tr>
<th>Nesting Season</th>
<th>Number of Tracks</th>
<th>Number of craters</th>
<th>Number of confirmed nests</th>
<th>Number of hatchling tracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007 – 2008</td>
<td>7</td>
<td>12</td>
<td>7</td>
<td>118</td>
</tr>
<tr>
<td>2008 – 2009</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2009 – 2010</td>
<td>12</td>
<td>13</td>
<td>11</td>
<td>101</td>
</tr>
</tbody>
</table>

In addition to track counts, nest fan measurements of all hatched turtle nests on Holden Beach were recorded during the surveys. Nest fan measurements were recorded to identify the behaviour of hatchlings in response to light during the sea-finding behaviour and to confirm the actual nesting activity on the beach. Five nest fan measurements were recorded during the 2007/2008 nesting season. Of these, one nest indicated hatchling disorientation with a wide angle spread of emergent tracks. It is unclear whether the source of light causing the disorientation was natural or anthropogenic in origin.

While the results in Table 9 suggest Holden Beach does not support a major sea turtle rookery (Pendoley 2010), it is acknowledged that all suitable nesting locations for sea turtle species are important given their conservation status (see Section 2). Other nesting locations nearby include No Name Bay, located ~500 m north of Holden Beach, and nesting locations are located towards the outer Dampier Archipelago on Rosemary and Legendre Islands.

6.1.2 Operations Monitoring Results

Results gathered from sea turtle monitoring on Holden Beach during the operations phase of Pluto Gas Plant to date are presented in Table 6.

Table 6: Turtle monitoring results during PGP operational phase

<table>
<thead>
<tr>
<th>Nesting Season</th>
<th>Number of Tracks</th>
<th>Number of craters/body pits</th>
<th>Number of confirmed nests</th>
<th>Hatching Tracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 - 2011</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2011 - 2012</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>27</td>
</tr>
<tr>
<td>2012 - 2013</td>
<td>7</td>
<td>10</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>2013 - 2014</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>26</td>
</tr>
</tbody>
</table>
Similar to results from prior to and during construction, nesting activity on Holden Beach appears to be highly variable with no clear trend apparent.

6.1.3 Monitoring Summary

During the nine years monitoring over the 2007-2015 nesting periods, 33 emergences have been observed, with incubation periods averaging 46 days, with a minimum recorded incubation period of 32 days, and maximum 61 days. The evidence of continued nesting effort and successful emergence suggests that there has been no observable negative impact from Pluto construction and operations.

*Sea Turtle Monitoring Results Associated with Pluto LNG* (Box et al 2014), presented at the Second Western Australian Marine Turtle Symposium discussed monitoring results to date and concluded that although frequency of turtle nesting was highly variable on an annual basis, Holden Beach does not support major sea turtle rookeries.
7 Reporting

7.1 Operations

Monitoring of the Sea Turtle Management Plan will be achieved through the compilation of monitoring records, yearly reports and environmental reports. Any incident that results in a sea turtle injury or fatality will be recorded on Accident, Injury and Incident Reports (Appendix D).

Turtle observation data will be compiled by the Woodside Environmental Adviser and reports sent on a yearly basis, within 1 month of the end of the turtle nesting season to the DBCA and DOEE.

Reports shall be provided in an electronic format.

Any incident that involves the injury or mortality of a sea turtle or marine mammal during operations and maintenance will be reported. Details of the incident, including time and date of incident, cause of injury/mortality and the species (if known) will be recorded and reported to the DBCA and DoEE as soon as possible, but within 24 hours of its occurrence. Any recovered remains will be used by a turtle biologist for species identification.

Turtle injury and fatality reporting details are as follows:

<table>
<thead>
<tr>
<th>DBCA</th>
<th>DOEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBCA Karratha office general contact for the reporting of fauna injury and mortalities:</td>
<td>Janine Warren</td>
</tr>
<tr>
<td>Department of Parks and Wildlife (DBCA) Pilbara Region PO Box 835, KARRATHA WA 6714</td>
<td>Assistant Director - Approvals Monitoring South Section Environmental Assessment and Compliance Division GPO Box 787, CANBERRA ACT 2601</td>
</tr>
<tr>
<td>Phone: 08 9182 2000 (within business hours); 08 9182 2088 (after hours)</td>
<td>Phone: 02 6274 2942</td>
</tr>
<tr>
<td>Fax: 08 9144 1118</td>
<td>Fax: 02 6274 1878</td>
</tr>
<tr>
<td>Email: <a href="mailto:Karratha.admin@dbca.wa.gov.au">Karratha.admin@dbca.wa.gov.au</a> and <a href="mailto:fauna@dbca.wa.gov.au">fauna@dbca.wa.gov.au</a></td>
<td>Email: <a href="mailto:PostApproval@environment.gov.au">PostApproval@environment.gov.au</a></td>
</tr>
</tbody>
</table>

DWER will be notified when any maintenance dredging programs are being scheduled.

7.2 Organisation

Responsibility for implementation of the Sea Turtle Management Plan resides with Woodside as Operator of the Pluto LNG Project. Responsibility for meeting any reporting requirements to the statutory organisations will remain with Woodside. A typical organisation structure showing the interrelationship between the various personnel involved in sea turtle and marine mammal management is presented in Figure 11.
7.3 Roles and Responsibilities

The Woodside representative and vessel captain are ultimately responsible for ensuring the accurate reporting of any observations or incidences involving turtles. However, there will also be an MFO on dredge vessels, where maintenance necessitates further dredging works, responsible for training, logging and reporting turtle observations and incidents. The MFO will be independent of the day to day dredging operations ensuring that an objective review process is undertaken. The MFO may be a Woodside staff member, who is not directly affiliated with required dredging activities.

Figure 11 Recommended Reporting Line for Outcomes of the Turtle Monitoring Program.

Nb. The MFO is a temporary position and would only be required based on the requirements outlined in Section 4.2.
An outline of roles and accountabilities for personnel are detailed in Table 7.

### Table 7 Responsibility Matrix for Personnel in the Implementation Phase

<table>
<thead>
<tr>
<th>Role</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance and Operations Managers</td>
<td>• Ensures the project complies with legal conditions and commitments.</td>
</tr>
<tr>
<td></td>
<td>• Notification to regulators of regulatory reportable incidents.</td>
</tr>
<tr>
<td>Woodside Dredging (site) representatives</td>
<td>• Ensures implementation of Dredge Spoil Disposal and Sea Turtle management plans.</td>
</tr>
<tr>
<td></td>
<td>• Ensure implementation of dredging commitments.</td>
</tr>
<tr>
<td>Site Environmental Adviser - Dredging</td>
<td>• Co-ordinates environmental aspects of dredging and disposal.</td>
</tr>
<tr>
<td></td>
<td>• Assists with fauna training and observations.</td>
</tr>
<tr>
<td></td>
<td>• Provides input into inductions on fauna observations.</td>
</tr>
<tr>
<td>Site Environmental Adviser - Onshore works</td>
<td>• Co-ordinates environmental aspects of onshore works (i.e. nearshore turtle monitoring at Holden Beach/ nearshore).</td>
</tr>
<tr>
<td></td>
<td>• Assists with fauna training and observations.</td>
</tr>
<tr>
<td></td>
<td>• Provides input into inductions on fauna observations.</td>
</tr>
<tr>
<td>Vessel Captain(s)</td>
<td>• Responsible for ensuring accurate reporting of marine fauna observations and incidents.</td>
</tr>
<tr>
<td>Fauna Spotters</td>
<td>• Operations crew trained in fauna observations by the environmental adviser, responsible for conducting and reporting Holden Beach monitoring during operations.</td>
</tr>
<tr>
<td></td>
<td>• Maintenance crew trained in fauna observations by the MFO, responsible for conducting and reporting fauna observations during dredging</td>
</tr>
<tr>
<td>Marine Fauna Observer (MFO)</td>
<td>• Provide training to allocated fauna spotters in fauna observations.</td>
</tr>
<tr>
<td></td>
<td>• Provides input into inductions on fauna observations.</td>
</tr>
<tr>
<td></td>
<td>• Provides independent review of fauna observations during peak nesting period.</td>
</tr>
<tr>
<td></td>
<td>• Provides independent review of Holden Beach turtle monitoring program.</td>
</tr>
</tbody>
</table>

### 7.4 Annual Review

This Management Plan will be reviewed on an annual basis to ensure conditions and objectives outlined in Section 1.4 of this Management Plan are being met. An immediate review process will be initiated if a sea turtle/marine mammal incident occurs and Woodside, in consultation with DBCA/DOEE, consider that additional mitigation measures are required.
8 References


CALM - see Department of Conservation and Land Management.


DoE - see Department of Environment.

DSEWPC - see Department of Sustainability, Environment, Water, Population and Communities.

EA - see Environment Australia.


Environmental Protection Authority 2010. *Environmental Assessment Guideline No. 5 for Protecting Marine Turtles from Light Impacts*. Environmental Protection Authority, Perth, Australia, pp. 27.

EPA - see Environmental Protection Authority.


FWW - see Foster Wheeler WorleyParson.


Pendoley K 2006. *Pluto LNG Development: Holden Beach and West Intercourse Island Beach Sea Turtle Habitat Use Survey*. Perth, Western Australia: Pendoley Environmental Pty Ltd


Shigenaka G 2003. Oil and sea turtle. Biology, planning and response, NOAA.


SKM - see Sinclair Knight Merz.


Waayers, D., Smith, L., Malseed, B. 2011. Inter-nesting distribution of green turtles (Chelonia mydas) and flatback turtles (Natator depressus) at the Laceyede Islands, Western Australia. Journal of the Royal Society of Western Australia 94, 359–364.


9 Appendices
Appendix A  Pendoley Environmental Holden Beach Sea Turtle Survey Report
# Woodside Risk Matrix

## Consequence

<table>
<thead>
<tr>
<th>Health &amp; Safety</th>
<th>Environment</th>
<th>Financial</th>
<th>Regulatory &amp; Brand</th>
<th>Legal &amp; Compliance</th>
<th>Social &amp; Cultural</th>
</tr>
</thead>
<tbody>
<tr>
<td>A &gt; 30 fatalities and/or permanent total disabilities</td>
<td>Catastrophic, long-term impact (10 years) on highly valued ecosystems, species, habitat or physical or biological attributes</td>
<td>&gt; $100M</td>
<td>&gt; $100M</td>
<td>&gt; $10M</td>
<td>Catastrophic, long-term impact (30 years) on community, social infrastructure or highly valued social, cultural or environmental significance</td>
</tr>
<tr>
<td>B Multiple fatality and/or permanent total disabilities</td>
<td>Major long-term impact (10 years) on highly valued ecosystems, species, habitat or physical or biological attributes</td>
<td>&gt; $10M</td>
<td>&gt; $10M</td>
<td>&gt; $1M</td>
<td>Major long-term impact (10 years) on community, social infrastructure or highly valued social, cultural or environmental significance</td>
</tr>
<tr>
<td>C Single fatality and/or permanent total disability</td>
<td>Moderate, medium-term impact (3-5 years) on ecosystems, species, habitat or physical or biological attributes</td>
<td>&gt; $1M</td>
<td>&gt; $1M</td>
<td>&gt; $100,000</td>
<td>Moderate, medium-term impact (3-5 years) on community, social infrastructure or highly valued social, cultural or environmental significance</td>
</tr>
<tr>
<td>D Major injury or permanent partial disability</td>
<td>Minor, short-term impact (1-2 weeks) and/or limited ecological or biological impacts</td>
<td>&gt; $100,000</td>
<td>&gt; $100,000</td>
<td>&gt; $10,000</td>
<td>Minor, short-term impact (1-2 weeks) and/or limited ecological or biological impacts</td>
</tr>
<tr>
<td>E Minor injury or permanent partial disability</td>
<td>Slight, short-term impact on species, habitat and non-production activities</td>
<td>&gt; $10,000</td>
<td>&gt; $10,000</td>
<td>&gt; $1,000</td>
<td>Slight, short-term impact on species, habitat and non-production activities</td>
</tr>
<tr>
<td>F Minor injury or partial disability</td>
<td>No lasting effect (1 month)</td>
<td>No lasting effect (1 month)</td>
<td>No lasting effect (1 month)</td>
<td>No lasting effect (1 month)</td>
<td>No lasting effect (1 month)</td>
</tr>
</tbody>
</table>

## Likelihood

<table>
<thead>
<tr>
<th>Remote</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>&gt; 10%</td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>&gt; 10%</td>
</tr>
<tr>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>&gt; 10%</td>
</tr>
<tr>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>&gt; 10%</td>
</tr>
<tr>
<td>E</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>&gt; 10%</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>&gt; 10%</td>
</tr>
</tbody>
</table>

## Risk endorsement table

- **SEVERE**: Risk at this level requires immediate (i.e. more than 12 hours communication to the CEO or Designated DCP / EVP) with incident communication to HSE Risk & Compliance
- **HIGH**: Risk at this level requires notification to DCP / EVP / Business unit or Executive
- **MODERATE**: Risk at this level requires notification to the relevant Asset Project Manager
- **LOW**: Risk at this level requires notification to the relevant line manager

---

Note: All currency stated is in $AUS. The consequence and likelihood categories are not necessarily equal to each other. For example, the financial column is not equal to the remediation costs or consequence described in other columns.
Appendix C  Approved Pluto Operational Environmental Lighting Specification (OELS)

(DRIMS# 8019892)
Appendix D  Turtle Accident, Injury and Incident Reporting Forms
Use this form to report any accident likely to impact on a sea turtle, any injury sustained by any means to a sea turtle or any report of illness involving a sea turtle. The report will be filled out by the person finding the sea turtle. Return the completed form to the Environmental Manager.

**Marine Turtle Incident Report Form**

<table>
<thead>
<tr>
<th>CODE NO:</th>
<th>TIME</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>FOUND BY</th>
<th>PHONE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SPECIES:</th>
<th>SEX:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Female</td>
</tr>
<tr>
<td>Hawksbill</td>
<td>Male</td>
</tr>
<tr>
<td>Loggerhead</td>
<td>Unknown</td>
</tr>
<tr>
<td>Leatherback</td>
<td>Immature</td>
</tr>
<tr>
<td>Flatback</td>
<td>Adult</td>
</tr>
<tr>
<td>Unidentified</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOCATION (place)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LOCATION (Lat and Long)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALIVE:</td>
</tr>
<tr>
<td>Alert</td>
</tr>
<tr>
<td>Weakly responsive</td>
</tr>
<tr>
<td>Non responsive</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INJURIES/CONDITION (mark on drawing)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>TAGS OR TAG SCARS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left flipper</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MEASUREMENTS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curved carapace length (CCL) cm,</td>
</tr>
<tr>
<td>Curved carapace width (CCW) cm,</td>
</tr>
<tr>
<td>Tail length cm,</td>
</tr>
<tr>
<td>Head width cm,</td>
</tr>
</tbody>
</table>

RESULT (swam away, died, location of carcass/skeleton etc)__________________________

<table>
<thead>
<tr>
<th>PHOTOGRAPHs: YES</th>
<th>location__________________________ NO</th>
</tr>
</thead>
</table>

FORM COMPLETED BY__________________________ PHONE:__________________________

DNA SAMPLE TAKEN? YES NO

Please use the back of this sheet for any additional notes or details on the stranding ____________________________
<table>
<thead>
<tr>
<th>SPECIES/ANIMAL NAME:</th>
<th>NUMBER SEEN:</th>
</tr>
</thead>
<tbody>
<tr>
<td>OBSERVATION DATE:</td>
<td>TIME: am/pm</td>
</tr>
<tr>
<td>OBSERVER NAME/S:</td>
<td></td>
</tr>
<tr>
<td>Organisation and Role OR member of public:</td>
<td></td>
</tr>
<tr>
<td>EMAIL:</td>
<td>PHONE:</td>
</tr>
</tbody>
</table>

**OBSERVATION LOCATION:** (e.g. property address, street and suburb, distance to nearest intersection, coordinates etc.)

**HABITAT INFORMATION:** (Was the animal seen in a garden, forest, wetland, farmland etc? Was it sitting in or eating a particular plant?)

**CERTAINTY OF ANIMAL IDENTIFICATION:**
- Certain
- Moderately certain
- Not sure
- Photo

**DESCRIPTION OF ANIMAL:** (required to confirm identification OR attach photo) (include information about size, colour, number of animals, age (adult/juvenile) and sex (male/female) of animal etc.)

**OBSERVATION:** (what was the animal doing? Select any of the boxes below that apply)

**METHOD:**
- Opportunistic Sighting
- Survey
- Historical (Written)
- Historical (Oral)

**TYPE:**
- Dawn sighting
- Day sighting
- Dead (fresh)
- Dead (degenerated)
- Dusk sighting
- Spotted
- Night sighting
- Released
- Remote camera
- Caught/Trapped
- Other:

**OTHER SIGNS:**
- Feathers/Hair/Fur/Skin
- Benes
- Eggs/eggshell
- Natural Hollow
- Artificial Hollow
- Nest/Mound
- Burrow
- Tracks
- Diggings
- Other:

**IF DEAD, CAUSE OF DEATH:**
- Roadkill
- Stranded on beach
- Found drowned
- Predation by native animal
- Poisoning by cat/dog
- Starvation/malnutrition
- Other:

**OTHER COMMENTS:**

Submitter of record:  
Organisation and Role:  
Contact Details:  
Date Submitted:  

Please return form to: fauna@dboa.wa.gov.au
or Species and Communities Branch, DBCA, Locked Bag 104, Bentley Delivery Centre WA 6983
Appendix E  Sea Turtle Identification Kit
Great Barrier Reef Marine Turtles

**Loggerhead Turtle** *(Caretta caretta)*

Did you know . . . Loggerhead turtles get their name because of their large square heads and strong jaws.

**Olive Ridley Turtle** *(Lepidochelys olivacea)*

Did you know . . . Olive Ridley turtles are the smallest of all the marine turtles and their shell is shaped like a heart.

**Leatherback Turtle** *(Dermochelys coriacea)*

Did you know . . . Leatherback turtles are the largest of all the marine turtles with a leather-like shell up to 2.5m in length.

**Hawksbill Turtle** *(Eretmochelys imbricata)*

Did you know . . . Hawksbill turtles have thick overlapping scales and a distinctive beak. Their shell was once used to make ‘tortoiseshell’ jewellery.

**Flatback Turtle** *(Natator depressus)*

Did you know . . . Flatback turtles have a very flat shell with upturned edges. The species is only found on the Australian continental shelf.

**Green Turtle** *(Chelonia mydas)*

Did you know . . . Green turtles get their name because their fat is coloured green. They mainly eat algae and other marine plants.

---

**Egg Facts**

Marine turtles lay between 50 and 200 eggs per clutch. Eggs take about 60 days to hatch.
The identification key below will help you identify the marine turtles of the Great Barrier Reef. Follow the flow chart and match the carapace (shell) and/or the pre-frontal scales on the head to the turtle in question.

**Leatherback**
- 5 pair costal scales
- Colour red-brown to brown

**Loggerhead**
- 6 pair costal scales
- Colour grey-green

**Olive Ridley**
- Carapace scales
- Colour light to dark green with dark mottling

**Flatback**
- Carapace low domed with upturned edges
- Colour olive grey

**Green**
- Carapace high domed
- Colour light to dark green with dark mottling

**Hawksbill**
- 4 pair costal scales
- 2 pair pre-frontal scales
- Thick overlapping carapace scales

- 1 pair pre-frontal scales
- No thick overlapping carapace scales

**Please report sick, injured, stranded or dead turtles to the EPA Hotline 1300 130 372.**
Mr Tom Brennan
Onshore Project Manager
Pluto LNG project
GPO Box (188)
PERTH WA 6840

Attn: Marc Steele

Dear Mr Brennan

PLUTO LIQUIFIED NATURAL GAS DEVELOPMENT (SITE B OPTION) (MINISTERIAL STATEMENT 757) – SEA TURTLE MANAGEMENT PLAN

Thank you for your letter of 27 July 2011 and the Sea Turtle Management Plan prepared to address Condition 9-1 of Ministerial Statement 757 which states that:

"Prior to the commencement of works and in consultation with the Department of Environment and Conservation, the proponent shall prepare a Turtle Management Plan to the requirements of the Minister for the Environment.

The objectives of this Plan are:

- to provide a management framework to enable the proponent to manage the project so as to detect and mitigate as necessary "mitigate" as defined in Environmental Protection Authority Guidance Statement 9) any impact upon marine turtles from the project; and

- to identify darkness strategies to reduce as far as possible lights or light glow interfering with nesting female turtles and hatchlings.

This Plan shall:

1. Identify project-related stresses, causes of environmental impacts and potential consequences for marine turtles (including impact of noise, vibration, light overspill and glow, vessel strikes, and changes to coastal processes); and

2. Identify and demonstrate the effectiveness of proposed management measures to mitigate as defined in Environmental Protection Authority Guidance Statement 9) project-related impacts and consequences for marine turtles."

The Sea Turtle Management Plan (July, 2011) is considered to satisfy the required protocol required by Condition 9-1 of Ministerial Statement 757.

If there are any changes to the Sea Turtle Management Plan that would substantially affect the management actions or targets, then please note that the amended plan would require submittal to the Office of the EPA.

Yours sincerely

[Signature]
Kim Taylor
GENERAL MANAGER

30 March 2012