Puffin Field Subsea Equipment (Non-production Phase) Environment Plan Summary

March 2014

(EP-0505-ZP-050)

This Environment Plan summary has been prepared to comply with Regulations 11(3) and 11(4) of the Offshore Petroleum & Greenhouse Gas (Environment) Regulations 2009.

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Revision History

Rev.	Date	Description	By	Checked	Approved
0	07/03/14	Issued to NOPSEMA	Giulio Pinzone	Phil Harrick, James Chu, Ian Cashion	Ian Cashion
A	28/02/14	Issued for internal review	Giulio Pinzone	Phil Harrick	-

1. Introduction

Sinopec Oil and Gas Australia (Puffin) Pty Ltd (SOGA), a wholly-owned subsidiary of China Petrochemical Corporation (Sinopec), as Titleholder of Petroleum Production Licence AC/L6 in the Ashmore and Cartier Area of the Bonaparte Basin, operates the Puffin Development (Figure 1).

Oil from the Puffin Field was produced through a Floating Production, Storage and Offloading (FPSO) vessel from two wells (Puffin-7 and -8), with the previously drilled wells Puffin-5, -9, 10, -11 and -12 wells being temporarily suspended after drilling.

Production from Puffin North East commenced in October 2007 through the use of a Floating Production, Storage and Offtake (FPSO) vessel, the *Front Puffin*, tied to the Puffin-7 and -8 subsea wells (Figure 2). These wells required gas lift to produce oil. This vessel departed the field in July 2009 after having produced 2.2 MMbbls of crude oil (and cessation production in May 2009).

Since July 2009, the Puffin Field Subsea Equipment infrastructure has been managed under a care and maintenance regime by Oceaneering Services Australia Pty Ltd (OSA).

OSA is the registered Operator of the Puffin Field Subsea Equipment under the Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009. SOGA is the registered Operator under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E)).

In March 2013, NOPSEMA wrote to SOGA requesting that the Puffin Development Operations (Non-production phase) EP, which was accepted by the then Designated Authority, the Northern Territory Department of Resources (DoR), be revised in response to NOPSEMA's review of all EPs transitioned from Designated Authorities. The Environment Plan (EP) for the non-production phase of the Puffin Field Subsea Equipment was accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in February 2014.

2. Proponent

China Petrochemical Corporation (Sinopec Group) is a large petroleum and petrochemical enterprise group established in July 1998 on the basis of the former China Petrochemical Corporation. Headquartered in Beijing, Sinopec Group has a registered capital of RMB 182 billion (~$AUD32 billion).

Sinopec Group's key business activities include industrial investment and investment management, the exploration, production, storage and transportation, and marketing of oil and natural gas, oil refining, the wholesale of gasoline, kerosene and diesel, the production, marketing, storage, transportation of petrochemicals and other chemical products, the design, construction and installation of petroleum and petrochemical engineering projects and other associated activities.

Additional information about the Sinopec Group can be obtained from its website at: http//english.sinopec.com.

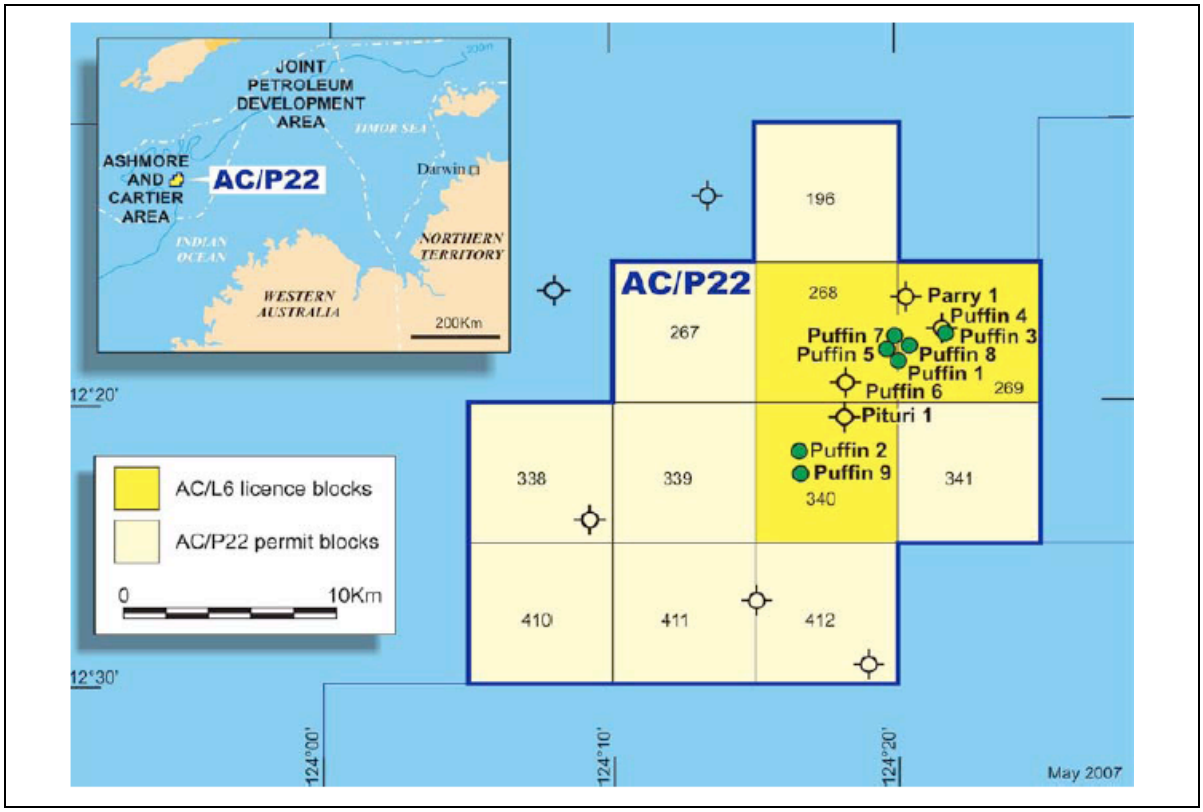

Figure 1. Location of the Puffin subsea equipment

3. Location

The Puffin Field Subsea Equipment is located in AC/L6 and covers an area of approximately 900 km^2 in the Vulcan sub-basin in water depths ranging from 75 to 104 m. The Puffin Development is remote from environmental sensitivities and coastal populations, as listed in Table 1.

Table 1. Distances to key features in the region*

Locality	Distance from Puffin Field
Environmental features	
Barracouta Shoal (submerged feature)	42 km (23 nm) to the southwest
Vulcan Shoal (submerged feature)	57 km (31 nm) to the south
Goeree Shoal (submerged feature)	65 km (35 nm) to the south
Cartier Island	88 km (47 nm) to the west
Eugene McDermott Shoal (submerged feature)	90 km (49 nm) to the southeast
Hibernia Reef	110 km (59 nm) to the northwest
Ashmore islands and reef	129 km (69 nm) to the west
Heywood Shoal (submerged feature)	134 km (72 nm) to the south
Echuca Shoal (submerged feature)	185 km (100 nm) to the southwest
Gale Bank (submerged feature)	194 km (104 nm) to the east

Baldwin Bank (submerged feature)	208 km (112 nm) to the east-southeast
Bassett-Smith Shoal (submerged feature)	190 km (102 nm) to the east-southeast
Penguin Shoal (submerged feature)	199 km (107 nm) to the east-southeast
Browse Island	220 km (119 nm) to the east
Nearest Australian mainland	255 km (137 nm) to the southeast
Commonwealth Marine Reserves	
Cartier Island	81 km (44 nm) to the southwest
Ashmore Reef	116 km (63 nm) to the west
Kimberley	~212 km (115 nm) to the south
Coastal towns	
Darwin	706 km (380 nm) to the east
Broome	670 km (361 nm) to the southeast
Other oil and gas infrastructure	
Montara unmanned wellhead platform	48 km (26 nm) to the south
Crux FPSO (proposed only)	74 km (40 nm) to the south-southeast
Prelude Floating LNG (under construction)	197 km (96 nm) to the south-southeast
Ichthys wellhead platform (in development)	217 km (117 nm) to the south-southeast

* Using Puffin-7 as the point of measurement.

4. Activity Description

Production from the Puffin Field ceased when the Front Puffin FPSO departed the field in July 2009. Since that time, the field has been in a non-production care and maintenance mode.

During its operational period to July 2009, the field produced approximately 2.2 MMBbls of crude oil (a Group II, light persistent crude with an API of 43.5°). Prior to disconnection, all subsea production infrastructure (production and gas-lift flowlines) was purged of hydrocarbons, flushed five times with freshwater, tested and left in-situ (attached to STP Buoy) preserved with inhibited water.

Subsequent modification works were carried out in late 2010 to remove the STP Buoy and mooring system and lay down the dynamic flowlines and umbilicals on the seabed secured with clump weights

A surface buoy (with functional navigational light) is situated above the subsea infrastructure to mark its presence. The remaining infrastructure on the seabed consists of:

- Disconnected flexible risers (x3);
- Riser bases in place (x3);
- Flowline jumpers (containing inhibited water) for oil and gas lift and hydraulic umbilicals between the PLEM and riser bases and between the PLEM and the well subsea trees (SSTs);
- PLEM (containing inhibited water);
- Anchors (x 6) (with anchor lines disconnected and laying on the seabed); and

- The Puffin-7 and -8 SSTs. Tree isolations are in place, valves are closed and marine growth covers are in place on the tree and production pod.

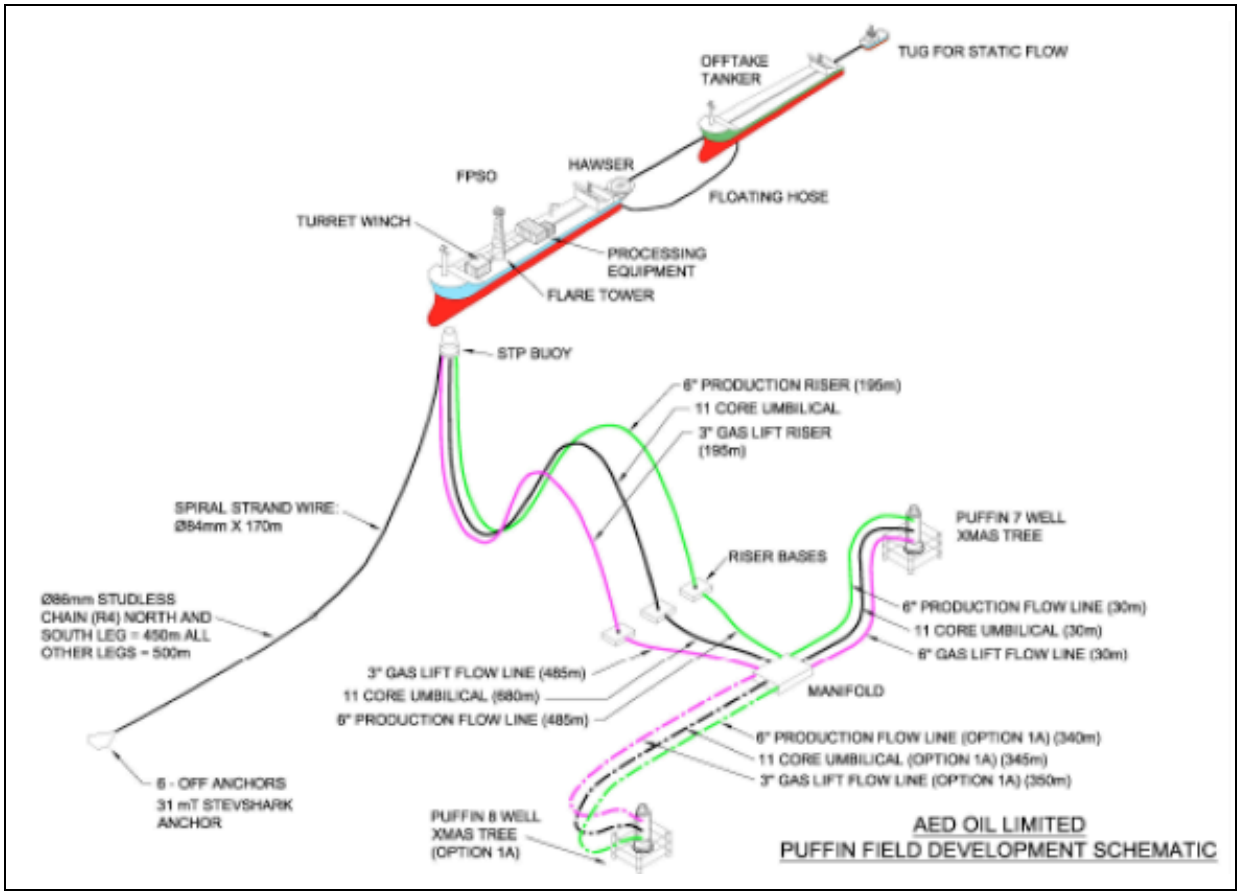

Figure 2. The original layout of the Puffin Field Development

The Puffin-7 and -8 production wells are in a suspended state with all control/safety valving closed. In the event that the subsea trees are catastrophically damaged by third-party interference (e.g., vessel anchor drag), the sub-surface safety valve (SSSV) will limit the loss of reservoir fluids to the sea to a maximum of 790 litres (volume of fluids in production tubing above SSSV and below production swab valve, PSV). Marine growth on the wellheads is dense.

An abandonment program for Puffin-7 and -8 is planned for mid-2014. A separate EP has been submitted for this activity.

The Puffin-5, -9, -10, -11 and -12 wells were temporarily suspended with wellheads in place but no subsea xmas tree or completion string. The wells were suspended in accordance with the Designated Authority-accepted Well Operations Management Plans (WOMP) submitted at the time.

Puffin-1, -2, -3, and -4 were permanently abandoned in accordance with good oilfield practices of the time (June 1972, July 1974, February 1975 and June 1988 respectively). They have no infrastructure remaining above the seabed. As abandoned wells, they are not considered part of the scope of the EP.

The PLEM, flowlines and jumpers are filled and capped with inhibited water, which comprises fresh water and 'Multitreat 650' dosed at 1,000 ppm. This is a corrosion inhibitor

that acts to maintain the structural integrity of the infrastructure by preventing corrosion. Multitreat 650 is a 'Silver' rated CHARM product. The hydraulic umbilical lines are filled and capped with Transaqua HT hydraulic fluid, which is a 'D' rated non-CHARM product.

Since the FPSO departed the location in July 2009, activities at the Puffin field are restricted to annual remotely-operated vehicle (ROV) inspections of the Puffin-5, -7, -8, -9, -10, -11 and -12 wells and associated subsea infrastructure.

A Petroleum Safety Zone (PSZ) is gazetted around the Puffin subsea infrastructure under Chapter 6, Part 6.6 of the OPGGS Act 2006. The purpose of the PSZ is to prohibit vessels from entering or being present in specified areas surrounding petroleum wells, structures or equipment that may be damaged by their presence. The PSZ extends in a 500-m radius from each of the Puffin-7 and -8 wells, production, umbilical and Gas Lift (GL) PLEMs, and marker buoy.

5. Stakeholder Consultation

Consultation between SOGA and relevant persons has been ongoing since initial field production planning, including the following phases:

- Puffin Development planning - June to September 2005;
- Puffin Development pre-installation – February to March 2007;
- Additional drilling and geotechnical work – March 2008;
- Additional drilling – 2009;
- Cessation of production – 2010; and
- Proposed well abandonment program – August 2013.

The latest round of consultation commenced in December 2013 with over 25 government, commercial and recreational fishing, environment and industry organisations for the non-production phase of the Puffin Field. This consultation yielded no material concerns. Consultation with agencies involved in oil spill response have been engaged to ensure that the Oil Spill Contingency Plan (OSCP) reflects current agency arrangements.

6. Receiving Environment

6.1 Physical Environment

Climate. The region has a tropical climate with hot and humid summers and warm winters. There are two distinct seasons: the 'wet' usually from October to March and the 'dry' for the remainder of the year. The median annual rainfall is 1,209 mm. Over 75% of the average annual rainfall events from January to March are associated with thunderstorms and tropical lows or cyclones. From October to April maximum ambient air temperatures average over 35°C while overnight minima are typically 24°C. Winters are milder, with July average maximum and minimum temperatures being 32°C and 14.0°C respectively. Mean sea temperature ranges are reported to range between 22-27°C in winter and 26-30°C during summer.

Winds. The two main broad scale influences are the band of high pressure known as the sub-tropical ridge well to the south, and the monsoon that delivers moist air from the warm tropical waters to the north. During the warmer months, a heat-trough forms over the inland Kimberley. These combine to produce a general south-easterly wind regime for much of the year. Tropical cyclones capable of strong winds, high seas and heavy rain can be experienced during the months from November to April, but are most common in January and February.

Ocean currents. Ocean currents in the Timor Province bioregion are dominated by the southward-flowing warm surface Indonesian Throughflow that flows from the tropics to the waters of southwest Western Australia and dominates most of the water column. The Indonesian Flowthrough generally flows westwards and its strength varies seasonally in conjunction with the Northwest Monsoon. During the wet season (December–March), monsoon winds push some of the waters of the current eastwards, extending as far as the Gulf of Carpentaria. At the end of the Northwest monsoon (March–April), the pressure gradient is released, which releases a south-westerly flow of water across the shelf during autumn and winter, known as the Holloway Current.

Bathymetry. The Puffin Development is located on the outer slope of the Australian continental shelf in water depths of 60-100 m. Scattered along the outer shelf are sea mounds, shoals and occasional islands. Bathymetric data for the licence area indicates that the topography is predominantly flat and featureless.

Seabed. There is no distinct shelf break within the Timor Province. Instead, there is a smooth transition from the outer shelf to the upper continental slope. The seabed sediments of the region comprise bio-clastic, calcareous and organogenic sediments that were deposited by relatively slow and uniform sedimentation rates. Within the Timor Province, carbonate sands dominate the sediments of the outer shelf and slope of this bioregion and mud content typically increases with water depth. The seabed of the permit area is characterised by fine to coarse sand with small zones of gravel/coral fragments.

6.2 Biological Environment

Benthic Invertebrates. Most of the benthic systems of the Timor Province are detritus-based and reliant upon deposit feeding infauna and epifauna (animals that live on the seafloor or burrow into its sediments, such as nematodes, polychaete worms, shelled molluscs and a variety of crustaceans).

Site surveys performed along the subsea flowline route and at the STP anchoring sites indicate that the seabed is a soft-substratum habitat, characterised by fine-coarse sand with numerous zones of coarse sediment interpreted as gravel and coral fragments. At these water depths, light is limiting near the seafloor and inhibits plant growth.

While no benthic surveys have been performed at the Puffin Development site, benthic survey data available from the Challis site (located 80 km northeast of Puffin in similar soft-sediment types) is considered to be indicative of the benthic habitat at the Puffin development site (i.e., clayey silts to sand-sized marine carbonate sediments). At Challis, while abundances of most taxa were low, there was high variability in species. Polychaetes and crustaceans were the most abundant taxa. Empty trochid shells and ostracod carapaces were abundant in the samples. Polychaetes in this deep water, soft sediment habitat are likely to have planktonic larvae and wide geographic ranges.

Plankton. Big Bank Shoals plankton surveys have found that zooplankton assemblages in the top 20 m of water column to be diverse and abundant at most sites in the region. Planktonic crustaceans that feed on phytoplankton were the most common taxa found. Previous studies undertaken found that zooplankton abundance increased during July-August and was related to the coastal upwellings caused by the southeast monsoonal winds. These studies indicate that zooplankton biomass was in the range 65-155 mg/m^3 which, although high for Australian continental shelf waters, is still relatively low in a world context.

Fish. The Timor Province bioregion has 408 fish species, 64 (15%) of which are endemic, and 198 of which occur in water depths greater than 200 m. Most fish have tropical distributions and are well distributed throughout the Indo-West Pacific region. Key fish species targeted in the region by commercial fisheries include goldband snapper (*Pristipomoides multidens*), Spanish mackerel (*Scomberomorus commerson*), rankin cod (*Epinephelus multinotatus*), red emperor (*Lutjanus sebae*), pink snapper (*Pagrus auratus*),

blacktip shark (*Carcharhinus melanopterus*) and sandbar shark (*C. plumbeus*). The whale shark (*Rhincodon typus*), shortfin mako shark (*Isurus oxyrinchus*) and longfin mako shark (*I. paucus*) are EPBC Act-listed migratory species that are likely to pass through the waters of the development area.

Marine Mammals. Dolphins are relatively common in the region. Species known to occur in the region are the bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*) and Indo-pacific humpback dolphins (*Sousa chinensis*). A number of whale species, including the short-finned pilot whale (*Globicephala macrorhynchus*), Bryde's whale (*Balaenoptera edeni*) and humpback whale (*Megaptera novaeangliae*) also occur in the region, the most commonly sighted of these being the humpback whale. This species migrates between the Antarctic waters (feeding) and the Kimberly region of Western Australia (breeding and calving).

The peak of their northerly migration to the Camden Sound region occurs around mid- to late July to early August, while the southerly return migration peaks from late August to early September. Humpback whales use the Kimberley coast (Camden Sound and King Sound in particular) as calving grounds between June and mid-November (200 km southwest of the proposed drill site). The highest numbers of cows/calf pairs are present from mid-August to mid-September.

Reptiles. Six species of marine turtles are listed as threatened and migratory under the EPBC Act and may traverse the licence area. Four of these species, the green, flatback, loggerhead, and hawksbill turtles, nest on sandy shore sites south of the region around the Dampier Archipelago, Montebello Islands, Lowendal Islands, Murion Islands, Barrow Island, Airlie Island, Thevenard Island, other nearby coastal islands and the Exmouth region. All species except the green turtle have mid-shelf or deep water habitats, with the green turtle (*Chelonia mydas*) generally found in water depths less than 20 m. Green turtles are known to nest at Ashmore, Cartier and Browse islands.

The main turtle nesting and hatching period occurs from November to March with a peak in December. Hatchlings emerge 6 to 8 weeks after females have nested. There are no biologically important areas in or around AC/L6 for any of these turtle species.

Twenty-five species of sea snakes are recorded in WA waters (12 of these potentially occurring in and around AC/L6), however little is known of the distribution of individual species, population sizes or aspects of their ecology. Sea snakes are widespread through tropical waters in offshore and near-shore habitats.

Coral. Coral reef habitat occurs to the southwest (Scott, Seringapatam, Cartier), west (Ashmore Reef) and the southeast and east (various shoals) of AC/L6, but not within it. These reef systems are regionally important for their high biodiversity, and support a high biomass of fish species, including tropical reef fish, small pelagic fish such parrotfish and groupers, and larger species such as trevally, coral trout, emperors, snappers, dolphinfish, marlin and sailfish, as well as crustaceans.

Avifauna. Seabirds may transit the area on occasion, but the deep waters and distance to emergent land make it unlikely that the area comprises important habitat to birds.

Birds that occur year round or as seasonal visitors in the region, such as petrels and shearwaters, are likely to be common in and around the project area. Surveys of pelagic seabird populations in the northeast Indian Ocean reveal that foraging seabirds were typically clumped in areas adjacent to islands. This may be because islands provide shelter, while anomalies in surface water concentrate food seasonally. Foraging groups typically comprise sooty terns (Sterna fuscata), wedge-tailed shearwaters (*Puffinus pacificus*) and the occasional frigatebird (*Fregata* spp.). The most commonly encountered seabirds that were not foraging were wedge-tailed shearwaters and Bulwer's petrels (*Bulweria bulweria*); however, these two species were only recorded in low densities.

Ashmore Reef and Cartier Island are important breeding areas for the brown booby (*Sula leucogaster*), which breeds from February to October, and the red-footed booby (*S. sula*), which breeds year round with most egg laying between April and June. The great frigatebird (*Fregatea minor*) is reported to be a widespread pelagic seabird, with breeding take place on numerous tropical islands, including in small numbers on Ashmore Reef. The lesser frigatebird (*F. ariel*) is also known to breed on Ashmore Reef and Cartier Island (from March to September).

EPBC Act-listed avifauna that may occur in and around AC/L6 includes the streaked shearwater (*Puffinus leucomelas*), which occurs all along the Australian northwest, northern and eastern coasts, though is scarcer in northern and eastern waters. The Australian lesser noddy (*Anous tenuirostris melanops*) usually occupies coral-limestone islands densely fringed with white mangrove (*Avicennia marina*) in which it roosts at night.

6.3 Socio-economic Environment

Settlements. The AC/L6 licence area is located approximately 550 km north of the township of Derby. Derby has a population of 4,500 people, about 50% of which area Aboriginal. A high proportion of the population is employed in State and Commonwealth departments (e.g., Main Roads, health eservices and the water authority). Derby is also the main base for the Royal Flying Doctor Services (RFDS) in the Kimberley.

Shipping. The ports of northwest Australia (Onslow, Dampier, Cape Lambert, Port Hedland and Broome) handle large tonnages of iron ore and petroleum exports, resulting in very busy shipping routes through the area. The closest port to AC/L6 is Broome, which is the largest deep-water port in the Kimberley region. It supports livestock export, offshore oil and gas exploration supply vessels, pearling, cruise liners, fishing charters and general cargo. In 2006-07, 80% of the imported tonnage to the port related to the servicing the petroleum exploration and development industry. Consultation with the Australian Maritime Safety Authority (AMSA) indicates that there will be local vessel traffic encountered south of the Puffin subsea equipment, with most traffic travelling in an east-west direction along the Osborn Passage located 50 km to the south.

Petroleum Exploration and Production. The Timor Sea is a highly prospective petroleum region and includes world-scale project such as the Bayu-Undan Gas Project and the Evans Shoals and Sunrise gas fields.

Within the Bonaparte Basin, 68 petroleum accumulations have been identified and commercial production has occurred from 11 of these discoveries. The estimated gas reserves measure in excess of 566 billion cubic meters (bcm^3) in the Bonaparte Basin and 538 bcm^3 in the Browse Basin off Western Australia.

Estimated oil reserves remaining within the Timor Sea are at least 167.73 million cubic metres of oil, condensate and liquid petroleum gas (LPG). While there is currently no petroleum production from the offshore Browse Basin, several projects are in development (Ichthys and Browse LNG).

Commercial Fisheries. Several WA- and Commonwealth-managed fisheries have jurisdiction to fish in the licence area. Western Australian-managed fisheries that may fish the area include the North Coast Demersal Scalefish Fishery (Area 2, Zone C), the North Coast Prawn Fishery (Kimberley Prawn) and Northern Prawn Fishery (Broome), though little to no fishing actually occurs in the licence area. Commonwealth-managed fisheries that may fish the area include the Western Tuna and Billfish fishery and Northwest Slope Trawl fisheries, though there has been little to no fishing recorded around the licence area between 2005 and 2011.

Traditional Fisheries. The Puffin subsea equipment lies to the east of the 'MoU Box' (the Memorandum of Understanding between Australia and the Republic of Indonesia in 1974), which allow traditional Indonesian fishing within Australian waters. This access was granted

in recognition of the long history of traditional Indonesian fishing in the area. The MoU allows fishing within the reefs of Cartier Island, Scott Reef, Seringapatam Reef and Browse Island. The MoU defines traditional fisherman as fishers who have traditionally taken fish and sedentary organisms in Australian waters using traditional fishing methods and non-motorised sailing vessels. Target species include trochus, sea cucumber, abalone, green snail, sponges, molluscs and finfish, including sharks. While the amount of fish taken is unknown, it is thought to be substantial.

Conservation Values and Sensitivities. The conservation of natural and anthropological heritage in Commonwealth marine areas is grouped into the categories outlined in Table 2, with the nearest sites to AC/L6 listed and briefly described.

Table 2. Conservation areas in the vicinity of the Puffin Field

Heritage Place	Commonwealth Marine Reserve (CMR)	World Heritage List	Commonwealth Heritage List	National Heritage List	Ramsar Wetland site
Ashmore Reef	Yes	No	Yes	No	Yes
Cartier Island	Yes	No	No	No	No
Hibernia Reef	No	No	No	No	No

The Ashmore Reef CMR is located approximately 115 km west of the Puffin Field at its nearest boundary and includes two extensive lagoons, shifting sand flats and cays, seagrass meadows and a large reef flat covering 239 km^2. The reserve was originally proclaimed in 1983.

Ashmore Reef consists of an atoll-like structure with three low, vegetated islands, numerous banks of shifting sand and two large lagoon areas. The three islands located within the lagoon — West Island (32 ha), East Island (16 ha), and Middle Island (13 ha) — are mostly flat, being composed of coarse sand with a few areas of exposed beach rock and limestone outcrops. All of the islands are vegetated with shrubs and herbs. Ashmore Reef is as an important breeding site for seabirds such as the common noddy (*Anous stolidus*), sooty tern (*Sterna fuscata*), bridled tern (*S. anaethetus*) and crested tern (*S. bergii*). In all, 20 species are known to breed on the islands. The reef also provides habitat to a diverse marine fauna that includes dugong (*Dugong dugon*), loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*), and an important and unique population of sea snake species — three of which are endemic to the area.

The Cartier Island CMR covers an area of 172 km² and was originally proclaimed as the Cartier Island Marine Reserve in June 2000. The CMR covers an area within a 4 nm radius of the centre of the island. The island is an un-vegetated sand cay surrounded by mature reef flats; it sits at the centre of a reef platform that rises steeply from the seabed. The island supports large populations of nesting turtles.

The conservation values of the CMR include its international significance for its abundance and diversity of sea snakes, a large and significant feeding population of green, hawksbill and loggerhead turtles, and it supports some of the most important seabird rookeries on the North West Shelf.

Although part of the same group as Ashmore Reef and Cartier Island, Hibernia Reef does not form part of the Ashmore Reef & Cartier Island External Territory of Australia. Situated 42 km northeast of Ashmore Reef and 62 km northwest of Cartier Island, Hibernia Reef consists of an approximately oval-shaped reef that tapers to a point on the western side. The reef has no permanent land, but large areas of the reef can become exposed at low tide. The reef covers an area of 11.5 km².

Ecologically rich shoals are found around the Puffin Field, mostly within a 250 km radius to the south and east. These are mostly poorly described but are known to support light-dependent species such as macroalgae and coral, in turn supporting diverse fish populations.

Maritime Archaeological Heritage. The Australian National Shipwreck Database lists 4 shipwrecks registered within the vicinity of Browse Island, but none in the WA-425-P permit area. There are no historic shipwreck protected zones in the permit area. The Western Australian Shipwrecks Database indicates there are no shipwrecks in or near the permit area, with the nearest wreck being the *Yarra* at Scott Reef.

7. Environmental Impact Assessment

The known and potential environmental impacts resulting from the non-operations phase of the Puffin Subsea Equipment are outlined in detail in the EP. Table 3 provides a summary of the environmental impact assessment (EIA) and mitigation measures that are in place, which have been assessed to be As Low As Reasonably Practicable (ALARP).

For this EP, the EIA has been applied to *planned* events – events that will occur and will impact the environment and are therefore not subject to an assessment of likelihood of occurrence.

On the other hand, environmental risk assessment (ERA) refers to a process where hazards associated with an activity are assessed for their likelihood of occurrence and their consequence in terms of their potential impact on the environment (physical, biological, and socio-economic) at a defined location and specified period of time. For this EP, the ERA has been applied to *unplanned* events – events that may or may not occur and may or may not impact the environment, and are therefore subject to an assessment of likelihood of occurrence.

Table 3. Summary environmental impact assessment for the non-operations phase of the Puffin subsea equipment

Potential risk	Potential consequences	Key avoidance, mitigation & management measures	Residual risk ranking
ROUTINE ACTIVITIES			
Physical presence of infrastructure			
Seabed habitat alteration	Increase in localised biodiversity due to the presence of hard substrate in an otherwise soft sediment environment.	• None identified.	Insignificant
Vessel presence during annual ROV survey			
Underwater noise	Temporary physiological impacts on sensitive fauna, such as cetaceans.	• Vessel engines maintained in accordance with planned maintenance systems.	Insignificant
Artificial	Attractant to fauna, temporary increase	• Lighting managed in accordance with	Insignificant

lighting	in predation rates on fauna attracted to lights.	maritime safety standards.	
Atmospheric emissions	Temporary and localised reduction in air quality.	• Marine-grade (low sulphur) diesel used. • Vessel engines and machinery maintained in accordance with planned maintenance systems. • No waste incineration will take place.	Insignificant
Cooling and brine water discharge	Localised elevation in surface water temperature and salinity.	• Cooling water and reverse osmosis systems maintained in accordance with the planned maintenance system.	Insignificant
Sewage, grey water and putrescible waste discharge	Temporary and localised reduction in water quality. Modification of fauna feeding patterns.	• MARPOL-approved sewage treatment plant fitted to vessel. • Sewage treatment plant is maintained in accordance with the planned maintenance system. • No discharge of sewage and putrescible waste within 12 nm of land. • Putrescible waste macerated to < 25 mm in size prior to discharge. • Non-food galley wastes will be bagged and returned to shore for disposal.	Insignificant
Deck and bilge water drainage	Temporary and localised reduction in water quality.	• Oil-in-water (OIW) treatment systems in place on the bilge water tank, with no discharge over 15 ppm oil-in-water. • Oil captured from the OIW treatment system will be transferred to shore for disposal. • Chemical storage and fuel transfer areas are bunded. • Vessel has valid International Oil Pollution Prevention Certificate. • Spills to decks cleaned immediately. • Shipboard Oil Pollution Equipment Plan (SOPEP) kits available on board for rapid clean-up response.	Insignificant

Hazardous and non-hazardous solid waste discharges	Temporary and localised reduction in water quality.	• Vessel Waste Management Plan in place:
		  ○ Crew inducted into procedures.
		  ○ Material Safety Data Sheet (MSDS) register maintained.
		  ○ Solid wastes bagged and sent ashore for disposal.
		  ○ All bins secured to deck and covered with lids.
		  ○ Only small volumes of chemicals kept on board.
		  ○ Waste streams will be sorted on board according to shore-based recycling
			Insignificant

		capabilities. ○ Garbage Record Book will be maintained. • Large, bulky items are secured to main deck in accordance with the Sea Fastening Procedure. • ROV is deployed to search for (and retrieve, where possible) any large non-buoyant dropped objects. • Use of licensed shore-based waste contractors.	
UNPLANNED ACTIVITIES			
Physical presence of infrastructure			
Interactions with other marine users	Temporary loss of fishing grounds. Snagging risk.	• The location of the subsea infrastructure is communicated to other marine users by: ○ The gazettal of the 500-m radius petroleum safety zone (PSZ). ○ Markings on post-2007 navigation charts. ○ The presence of a surface marker buoy with internal radar reflection and flashing beacon.	Inconse-quential
Release of inhibited water, hydraulic fluid, gas lift gas or crude oil from subsea infrastructure	Temporary decrease in water quality. Acute toxicity to exposed marine fauna.	• Subsea infrastructure is designed to resist corrosion and third-party damage. • The Production Swab Valve (PSV), Production Master Valve (PMV) and the SSSV are closed on the Puffin-7 and -8 subsea trees and are of a 'fail-close' design. • Annual subsea infrastructure integrity inspection is performed to check for leaks.	Inconse-quential
Vessel presence during annual ROV survey			
Seabed disturbance (from anchoring and dropped objects)	Temporary displacement of a small area of benthic habitat. Localised and temporary seabed turbidity.	• No anchoring will take place if a dynamically-positioned vessel is used. • If an anchored vessel is used, anchors will be deployed to meet the seabed conditions outlined in the mooring analysis. • Large, bulky items are secured to main deck in accordance with the Sea Fastening Procedure. • ROV is deployed to search for (and retrieve, where possible) any large non-buoyant dropped objects.	
Introduction of invasive marine species	Establishment of foreign species to open ocean and/or seabed, competing with and displacing native species.	• Vessel will have anti-fouling paint applied to its hulls and internal niches. • Vessel will be cleared to enter Australian waters (if previously mobilised from outside Australian waters) in accordance with the Australian Ballast Water Management	Inconse-quential

		Requirements.	
Interference with third-party vessels	Damage to and/or loss of fishing equipment. Loss of commercial fish catches. Disruption to commercial shipping activities.	• Stakeholder consultation indicates very low fishing effort around the permit area. • No shipping lanes located in close proximity to the Puffin Field. • Vessel will employ standard maritime safety measures (e.g., lighting, 24-hr visual, radio and radar watch). • Vessel location will be communicated to other users via the Notice to Mariners and AusCoast warnings. • Vessel Master will maintain constant communications with any third-party vessels tracked by radar to ensure they remain outside of the 500-m radius PSZ.	Inconse-quential
Diesel spill (vessel-to-vessel collision)	Injury or death to marine fauna through ingestion or contact. Temporary decrease in water quality. Habitat damage in the case of shoreline contact.	• As per row above. • Oil Spill Contingency Plan (OSCP) and Emergency Response Plan (ERP) in place and ready for implementation. • Diesel spill will be promptly reported internally and externally. • Operational monitoring will take place in accordance with the OSCP to support the spill response and characterise environmental impacts.	Inconse-quential

Hierarchy of consequence and risk

Consequence (planned events)	Risk (unplanned events)
Catastrophic	Critical
Major	Significant
Moderate	Tolerable
Minor	Inconsequential
Insignificant	

8. Hydrocarbon Spill Preparedness and Response

The Puffin Field Subsea Equipment OSCP is the primary reference document to be used in the event of a diesel spill or crude oil release. The OSCP contains information on the proposed response strategies.

In the case of a diesel spill or crude oil release, SOGA has determined that the most appropriate strategy for responding to the spill is to allow it to naturally disperse and biodegrade, while monitoring and evaluating the situation. This is primarily because there are no shorelines, reefs or other environmental sensitivities that are likely to be contacted (as determined by spill modelling), due to the very small release volumes. This is supported by a Net Environmental Benefit Analysis (NEBA) that assesses the strengths and weaknesses or each response strategy for both hydrocarbon types. The Australian Marine Oil Spill Centre (AMOSC) has endorsed this response strategy.

The first priorities in the event of a diesel spill from the vessel are to:

- Ensure the safety of all personnel; and
- Contain and where possible stop the source of the spill.

9. Implementation Strategy

SOGA retains full and ultimate responsibility as the operator of the AC/L6 licence area and is responsible for ensuring that the activities associated with the Puffin Field Subsea Equipment are implemented in accordance with the performance objectives outlined in this EP. As the operator of the licence, SOGA has entered into an agreement with OSA to provide the following ongoing services throughout this phase:

- Integrated Management System (IMS) (i.e., health, safety and environment) and support (resource) services; and
- Oil Spill Response and overall emergency response capabilities.

9.1 Environmental Management System

OSA's IMS is certified to ISO 14001 and is supported by a set of Management System Standards (MSS) that provide a framework for the management of quality, health, safety and environment throughout OSA's operations and associated activities.

9.2 Key Roles and Responsibilities

The vessel contractor, through the Vessel Master, will have the day-to-day control and management of the vessel and reports via the OSA On-board Representative to the OSA Operations Manager and ultimately to the SOGA Head of Upstream Assets on the execution of the inspection activities. The Vessel Master has over-riding authority and responsibility to make decisions with respect to environment protection and pollution prevention and to request assistance in an emergency as required.

A detailed list of the environmental roles and responsibilities of personnel are outlined in the EP.

9.3 Training and Awareness

In order to ensure that operations meet all business and statutory requirements, the correct selection, placement, training and ongoing assessment of employees is managed, and sufficient resources are provided.

The OSA recruitment and selection process is contained in the Recruitment & Selection Procedure, basis of which is a position description which details the necessary qualifications, experience and skill levels required to undertake the defined role. Position Descriptions also define the Health, Safety, Environmental and Quality (HSEQ) responsibilities.

The OSA Training and Development Procedure provides a process to identify the training needs of an individual to competently perform current roles and career development and emerging driver need for further development. Personnel working on the Puffin Field subsea equipment are required to have a SOGA (Puffin)/OSA Facility Induction.

The vessel contractor has training needs identified for all positions on board, requiring all personnel undertaking activities that may create a significant impact on the environment to receive appropriate training. If the personnel do not have appropriate skills to undertake the identified responsibilities, training will be provided or they will be replaced with competent personnel.

All sub-contractors engaged for activity on the Puffin Facility will have equivalent resource management systems and associated documentation to ensure equivalent levels of

personnel competency and training. This is determined as part of OSA's Contractor HSE Evaluation Procedure.

All vessel-base personnel will attend a campaign-specific induction prior to the commencement of duties (either shore-based or on board the vessel). The induction will include EP awareness and compliance aspects, including:

- Environmental regulatory requirements;
- Environmental sensitivities and key risks;
- Key environmental management actions, including but not limited to:
  - Waste segregation, containment and disposal.
  - Housekeeping and spill prevention.
  - Spill preparedness and response.
  - Environmental incident reporting.

The OSA On-board Representative is responsible for ensuring personnel receive this induction prior to the commencement of annual inspection activities.

9.4 Emergency Response and Preparedness

All activities undertaken at the Puffin field operate under an ERP and OSCP to ensure timely response and effective management of any emergency.

To ensure readiness, SOGA and OSA conduct an annual desktop emergency response exercise, the findings of which are recorded and communicated to all involved in the exercise in the form of a post-exercise debrief by the facilitator and a production of a detailed report. Any opportunities for improvement identified as a result of conducting the exercise are used to update the ERP and OSCP where necessary to ensure a well organised response to any emergencies during offshore activities.

During ROV inspection activities, general vessel emergencies are handled under the contract vessel's ERP supported by the contractor vessel's shore-side Emergency Management System. The OSA Emergency Response Group (ERG) and SOGA Emergency Management Team (EMT) provides shore-side support to the contract vessel's Shore-side Emergency Management System, the Vessel Master and the Shipboard Team as necessary in the event of an emergency.

The vessel's SOPEP will be implemented to ensure timely response and effective management of any hydrocarbon spills. The SOPEP is routinely tested and exercise drills are conducted regularly.

OSA personnel that have responsibility for responding to hydrocarbon spills have undertaken training by AMOSC to IMO Level 1 or 2.

9.5 Incident Recording and Reporting

SOGA and OSA have internal requirements for the recording and reporting of incidents. There are legal obligations under the OPGGS(E) to report incidents to NOPSEMA within a specified time period. These requirements are outlined in detail in the EP.

All breaches of the EP are considered non-compliances. Non-compliances may be identified during an audit, inspection, crew observation or as a consequence of an incident. These will be investigated in accordance with the the OSA MSS. Following an investigation, remedial actions will be developed to prevent recurrence and tracked to completion.

9.6 Environmental Monitoring

SOGA will maintain a quantitative record of emissions and discharges as required under Regulation 14(7) of the OPGGS(E). This record will include all emissions and discharges to the air and water and can be monitored and audited against the environmental performance standards. Results will be reported in the Annual EP performance report submitted to NOPSEMA.

9.7 Audit and Review

OSA assesses operating performance to ensure that the processes and systems adopted are effective in meeting OSA policies and objectives, and statutory HSEQ Performance requirements. OSA's HSE Audits and Management Review Procedure details how audits are scheduled and executed to ensure that Puffin Field Operations meets the requirements of the OSA MSS.

Inspections will be made by the OSA On-board Representative on the contract vessel to ensure that vessel standards and equipment reflect the requirements of the EP and that performance standards are met. Any departures from the performance standard will be documented as a non-compliance (see Section 9.5) with follow-up actions recorded, communicated to affected parties and remedial actions implemented and tracked to closure.

A review of the environmental records at the end of each annual ROV inspection will be undertaken to determine whether environmental performance objectives have been met and whether the EP requires further refinements. These results will be included with the Annual EP Performance Report submitted to NOPSEMA.

10. Further Information

For further information about the non-production phase of the Puffin Field, please contact:

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