IPB

IPB Petroleum Limited

3D Marine Seismic Survey
(WA-471-P & WA-485-P)

ENVIRONMENT PLAN SUMMARY

September 2014

(PGA-84.02-02-02)

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 and NOPSEMA's Guidance Note for Environment Plan Summaries (N-04750-GN1448, Rev 0, June 2014).

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Revision History

Rev.	Date	Description	Author	Checked	Approved
1	25/09/14	Re-issued to NOPSEMA	Giulio Pinzone	Phil Harrick	Phil Smith
0	12/09/14	Issued to NOPSEMA	Giulio Pinzone	Phil Harrick	Phil Smith

1. Introduction

IPB Operations Pty Ltd (IPB) proposes to undertake a three-dimensional (3D) marine seismic survey (referred to hereafter as the 'survey') in offshore Commonwealth waters, northwest of Western Australia (WA) (Figure 1).

The survey will take place in exploration permits WA-471-P and WA-485-P in Commonwealth waters. The survey is situated within the offshore waters of the Browse Basin of northwest WA, covering a total area of approximately 2,780 square kilometres (km^2) in water depths ranging from approximately 70 metres (m) to 100 m.

The proposed survey is scheduled to commence no earlier than November 2014, with exact timing contingent on the confirmation of contractor resources, vessel availability and fair sea state conditions suitable for marine seismic acquisition. The survey may be conducted at any time between November 2014 to June 2016 to avoid peak whale migration seasons in the region. The duration of the survey is expected to be approximately 30 to 50 days subject to weather conditions and prevailing currents.

2. Proponent

IPB Operations Pty Ltd is the appointed operator of the survey. IPB Browse Pty Ltd (WA-471-P), IPB West Pty Ltd (WA-485-P) and IPB Operations Pty Ltd are wholly-owned subsidiaries of IPB Petroleum Limited.

IPB Petroleum Ltd is an Australian oil and gas exploration company founded in May 2009 and was listed on the Australian Stock Exchange (ASX) in 2013. IPB Petroleum Ltd has three petroleum exploration permits in the Browse Basin including WA-424-P in which it has a 75% interest.

Additional information about IPB Petroleum Ltd can be found at its website: http//www.ipbpet.com.au.

3. Location

The proposed survey is located entirely within Commonwealth waters of the Browse Basin (see Figure 1).

The area defined as the 'survey area' is the polygon of full fold coverage. The area defined as the 'operational area' is the physical area used for conducting operations ancillary to achieving coverage within the survey area. Activities conducted in the operational area include vessel approach, vessel turns at the end of each sail line, and miscellaneous maintenance operations.

Coordinates of the survey and operational areas are provided in Table 1 and the distances to key environmental and other features are provided in Table 2.

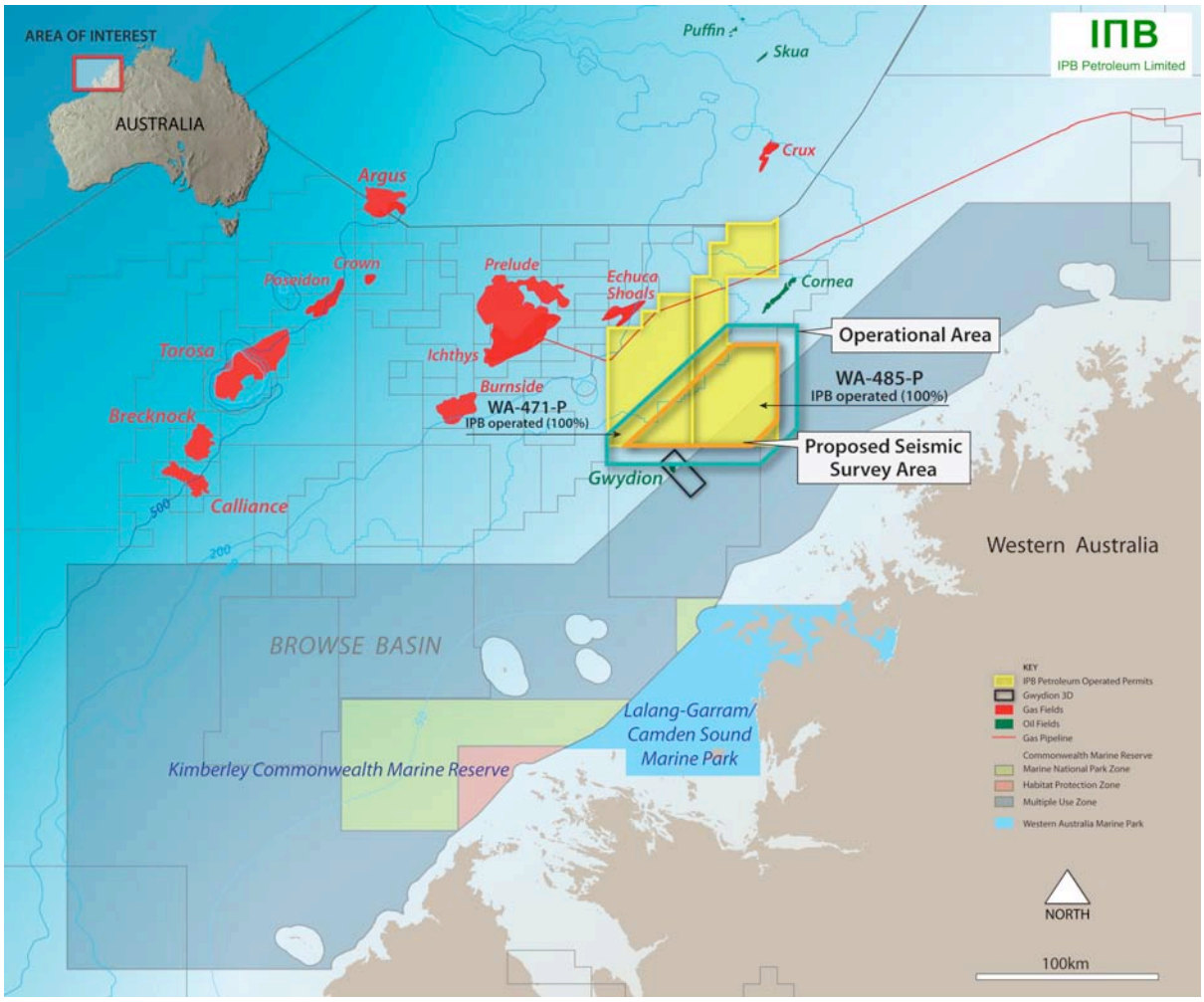

Figure 1. Location of IPB's proposed 3D seismic survey

Table 1. Coordinates of the proposed survey and operational areas

Location Point ID	Latitude (Northing)			Longitude (Easting)		
	Degrees	**Minutes**	**Seconds**	**Degrees**	**Minutes**	**Seconds**
Survey Area						
1	-13	54	57.06	124	30	05.68
2	-14	17	20.68	124	30	09.54
3	-14	25	00.08	124	22	07.76
4	-14	24	55.36	123	45	09.13
5	-13	54	56.64	124	17	16.53
Operational Area						
1	-13	49	19.91	124	35	52.29
2	-14	20	06.89	124	35	55.15
3	-14	30	32.83	124	25	00.92
4	-14	30	31.54	123	39	30.65
5	-14	22	06.29	123	39	27.84
6	-13	49	21.03	124	15	14.79

Table 2. Distances to key features in the region

Locality	Distance to survey area*
Environmental features	
Echuca Shoal (submerged feature)	29 km (15 nm) southeast
Browse Island	39 km (21 nm) southeast
Heywood Shoal (submerged feature)	52 km (28 nm) southeast
Eugene McDermott Shoal (submerged feature)	94 km (51 nm) south
Nearest Australian mainland	86 km (46 nm) southeast
Goeree Shoal (submerged feature)	113 km (61 nm) south
Vulcan Shoal (submerged feature)	122 km (66 nm) south
Barracouta Shoal (submerged feature)	152 km (82 nm) south-southeast
Cartier Island	172 km (93 nm) south-southeast
Scott Reef (South)	194 km (105 nm) east
Seringapatam Reef	201 km (108 nm) southeast
Ashmore islands and reef	222 km (120 nm) southeast
Commonwealth Marine Reserves	
Kimberley	Southeast portion of WA-485-P overlaps
Cartier Island	165 km (89 nm) southeast
Ashmore Reef	213 km (115 nm) southeast
Coastal towns	
Derby	350 km (189 nm) north
Broome	420 km (227 nm) northeast
Other oil and gas infrastructure	
Ichthys wellhead platform (in development)	68 km (37 nm) southeast
Prelude Floating LNG (under construction)	81 km (44 nm) southeast
Montara unmanned wellhead platform	138 km (74 nm) south

* Using the nearest boundary of the proposed survey area.

4. Activity Description

The purpose of this survey is to acquire data to map the subsurface geology of the survey area to determine potential petroleum deposit locations. The data acquired over the permits will be processed by IPB to aid in accurately defining prospectivity and possible drilling locations for future exploration activities.

The survey proposed by IPB is typical of 3D surveys conducted in Australian marine waters (in terms of technical methods and procedures). No unique or unusual equipment or operations are proposed.

The survey vessel (as yet uncontracted) will tow seismic equipment along a series of predetermined sail lines within the survey area at a speed of ~8–9 km/hr (~4–4.5 knots). As the survey vessel travels along the sail lines, compressed air will be discharged from a source array towed behind the vessel at 6-9 m (+/- 1 m) below the water surface. A series of noise pulses (discharged every 8 to 10 seconds) will be directed down through the water column and seabed. The released sound will be attenuated and reflected at geological boundaries and the reflected signals are detected using sensitive microphones (hydrophones) arranged along a number of cables (known as streamers) that are towed behind the vessel at an approximate depth of 6 m (at the head of streamers) and 50 m (at the tail) (+/- 1 m). The reflected sound is evaluated to provide information on the structure and composition of the geological formation to identify and map hydrocarbon reserves below the seabed.

It is proposed that the survey will be conducted 24 hours a day except when sea states exceed operational parameters (~4.5 m significant wave height). One or two support vessels will accompany the survey vessel to maintain a safe distance between the survey array and other vessels, and also to manage interactions with shipping and fishing activities, if required.

4.1 Line Turns

The proposed survey will use the conventional methods of data acquisition where data is acquired along straight lines within the survey area, with acquisition suspended as the vessel turns (outside of the survey area) and runs into the next line. There are planned to be between 75 and 150 sail lines, spaced about 600 m apart. The orientation of the sail lines is yet to be decided, but likely to be northeast-southwest.

4.2 Air Guns

The seismic energy source for the survey will be provided by two airgun arrays (each containing 3 sub-arrays) at a tow depth of ~6-9 m (+/- 1 m). Each array will have a maximum volume of approximately 4,000 cubic inches (cui) and an operating pressure of up to 2,500 pounds per square inch (psi). The arrays will be fired alternately, with an expected shotpoint interval of 25 m horizontal distance, and will produce sound pulses in the order of 235 dB re 1µPa-m (at 1 metre) sound pressure level (SPL) at frequencies extending up to 100 Hz. The peak SPL amplitude for frequencies above 100 Hz and up to 350 Hz will be lower than 235 dB re 1µPa-m.

4.3 Streamers

The seismic array is likely to consist of up to 14 streamers with a maximum length of up to ~6,000 m. The space between the streamers will be about 100 m and line spacing will be about 600 m. The streamer tow depth will be ~8-25 m.

The streamers are likely to be solid core (not fluid filled). Solid streamers have an outer plastic jacket filled with a solid material that assists in maintaining the neutral buoyancy of the cable and prevents ingress of seawater that would damage the electronic components. The solid material does not leak out if the streamer is damaged. Hydrophones in the streamer are housed in a small volume of Isopar, a synthetic iso-paraffinic hydrocarbon, to allow for the detection of reflected pressure waves. Additionally, synthetic rope strain members ('stretchers') are inserted at the head and tail of the streamer to provide mechanical isolation from the various towing forces. The stretch sections are designed to elongate by up to 10% under towing forces and are filled with approximately 15 litres (Header Section) and 60 litres (Tail Elastic Section) of Isopar liquid.

The streamers will display appropriate navigational safety measures such as lights and reflective tail buoys. It is likely that the tail buoy design used by the seismic contractor will avoid turtle entrapment.

5. Stakeholder Consultation

IPB commenced stakeholder engagement for the survey with relevant persons in February 2014 when an information flyer was issued by email to government, commercial and recreational fishing, environment and industry organisations. The stakeholders consulted are listed below:

- Australian Maritime Safety Authority (AMSA).
- Border Protection Command.
- Australian Department of Defence.
- Australian Hydrographic Office (AHO).
- Department of Agriculture, Fisheries and Forestry (DAFF).
- WA Department of Mines and Petroleum (DMP).
- WA Department of Fisheries (DoF).
- WA Department of Transport (DoT).
- WA Department of Parks and Wildlife (DPaW).
- WA Museum.
- Marine Parks and Reserves Authority (MPRA).
- Commonwealth Fisheries Association.
- WA Fishing Industry Council (WAFIC).
- RecFish West.
- Game Fishing Association (WA).
- Pearl Producers Associations (PPA).
- North Coast Prawn Fishery (Kimberley Prawn) (37 licensees in total).

  North Coast Demersal Scalefish Fishery (Fishing Area 2, Zone B) (8 licensees in total).
- Northern Prawn Fishery (Broome) fishers (8 licensees in total).
- NT Trawler Owners Association.
- Kimberley Professional Fishermen's Association.
- Northern Fishing Companies Association.
- Australian Council of Prawn Fisheries.
- Australian Marine Oil Spill Centre (AMOSC).
- Centre for Whale Research.
- Australian Institute of Marine Science (AIMS).
- Australian Marine Conservation Society.
- PTTEP Australasia.
- Inpex Corporation.
- Hunt Oil Company of Australia Pty Ltd.
- Total Oil Australia.
- Nexus Energy Ltd.
- Shell Development (Australia) Pty Ltd.
- CalEnergy Resources (Australia) Ltd.
- Woodside Energy Ltd.

The flyer outlined general details about the survey and invited stakeholders to provide questions or concerns directly to IPB. Eleven responses were received in response to the information flyer, with this feedback incorporated into the EP as relevant. There are no

outstanding issues requiring resolution. Stakeholder feedback and IPB responses are summarised in Table 3.

In undertaking this consultation, IPB has taken into account the consultation guidelines released by various Commonwealth and WA government agencies and industry associations in response to the consultation requirements of the OPGGS(E).

Table 3. Stakeholder responses and IPB assessment of merit

Stakeholder	Response	IPB assessment of merit of feedback
AMSA	Provided a map showing vessel traffic in the region, noting that not much commercial shipping traffic occurs in the proposed survey area.	The shipping traffic map has been incorporated into the EP. IPB will keep the AMSA Rescue Coordination Centre (RCC) advised of the MODU movements to enable AusCoast navigation warnings to be issued.
Department of Defence (DoD)	Formal letter of response received, stating that the DoD has no objection to the proposed survey. The DoD asked that IPB ensure continued liaison with the AHO, particularly providing three weeks notification prior to the survey starting.	IPB has undertaken consultation with the AHO and will provide sufficient notice prior to the survey commencing to allow a Notice to Mariners to be issued.
WA DMP	The DMP stated that no further information is required about the survey. DMP asked to be provided with a pre-start notification once the commencement date for the survey is confirmed.	This request is incorporated into the reporting requirements outlined in the EP.
WA DoF (Environmental Impact Assessment – Biodiversity section)	A formal letter of response was received. The letter provides a list of commercial fisheries that exist in or in close proximity to the proposed survey area. The DoF also states that IPB should initiate and maintain on-going consultation with fishers. The DoF states that seismic surveys may alter fish behaviour and asks that the EP include strategies to minimise these impacts. The DoF requires all vessels to minimise the risk of translocating pests and diseases into or within WA state waters, with contact details provided in case notification of biosecurity issues is required.	IPB has consulted with fishing interests in the region (as provided by the DOF's licencing section). Impacts to fish and commercial fisheries are outlined in the EP, as are the impacts of the unplanned introduction of marine pests.

Stakeholder	Response	IPB assessment of merit of feedback
Commonwealth Fisheries Association	A response was provided by a member stating "I will not accept this as consultation."	IPB responded by email stating that this flyer is intended as an introduction to IPB and the project and a way in which to identify people who may have concerns. IPB stated that it is happy to speak to any member at any stage to discuss concerns. No response has been provided to date. IPB's research on fisheries that may operate around the proposed survey area indicates there is very little fishing activity, and those that may be impacted have been directly consulted.
Latitude Fisheries Pty Ltd (licensed to fish the North Coast Prawn Fishery)	A company representative stated that it does not have any issues with the proposed survey. Specification sheets for their vessels that may be suitable for use as support vessels to scout the waters surrounding the survey vessel were provided to IPB.	IPB is likely to use support vessels contracted by the seismic vessel contractor, but will keep these details on file in case the need for alternative vessels arises.
Kimberley Clear Water Fisheries Pty Ltd (licensed to fish the North Coast Demersal Scalefish Fishery)	A company representative identified himself as a trap fisherman in this fishery. He was happy with the information in the flyer but wanted more discussion on the impacts to commercial fishing. For example, he said that if they lost one trap as a result of entanglement with seismic streamers, they would lose $2,500 for the trap plus income from about 700 kg of fish. He stated that he's seen evidence that it takes months for fish to return to an area post-survey. Even a month after the survey, the fish caught appear stunned rather than flapping around as is normal when they are brought to the surface. The representative said that 80% of fishing in this fishery is done in Zone B and fishing remains active year-round, though the wet season (Oct-Mar) is the peak fishing time. They normally follow the 100-140 m contour on the inside edge of the bank. Fishing was often concentrated around Browse Island. A detailed bathymetry map of the survey area was requested.	IPB advised that more flyers would be issued closer to the time of the survey to warn fishers about the activity and that support vessels would ensure that other vessels didn't come too close, thus avoiding issues of trap entanglement with seismic streamers. IPB advised that survey timing was not yet determined, and that it couldn't necessarily avoid key fishing times because the key concern was avoiding whale migration season. This, combined with the cyclone season and vessel availability, provided a very small window of opportunity to conduct the survey. The information regarding impacts to commercial fishing activity were included in the EP. A detailed bathymetry map was provided to the fishery.

Stakeholder	Response	IPB assessment of merit of feedback
AMOSC	AMOSC asked whether IPB is interested in membership with AMOSC.	IPB responded to AMOSC stating that membership with AMOSC would be considered.
WA DoT	IPB emailed a Powerpoint presentation to the DoT presenting a summary of the diesel spill modelling and the proposed spill response strategy for their consideration. IPB will continue to consult with the DoT during the planning phase of the survey as necessary.	The DoT acknowledged the email, but no comments have been provided to date.
WA DPaW	IPB emailed the DPaW to check whether the consultation guidelines issued as the former Department of Environment and Conservation (DEC) remain current. The DPaW stated that while the guidelines were no longer current, the intent of the guidelines remains the same and new guidelines will be issued later in 2014.	IPB is cognisant of DPaW's role since the split of the former DEC into the DPW and the Department of Environmental Regulation (DER).
	IPB emailed a Powerpoint presentation to the DPaW presenting a summary of the diesel spill modelling and the proposed spill response strategy for their consideration.	IPB followed up with a phone call after more than two months without a response. The Acting Area Manager in the Environmental Management Branch advised he would provide a response soon.
	The Acting Area Manager in the Environmental Management Branch issued DPaW's generic response to proponents, as outlined below:	
	• IPB should have appropriate baseline information on sensitivities that may be impacted by an oil spill and recommended that IPB develops and maintains a baseline understanding of shallow water and intertidal habitats (<2 m deep), sediment and water characteristics, turtle and seabird nesting.	Collecting comprehensive marine baseline data over the entire zone that could potentially be affected by a 300 m^3 diesel spill is not practicable. Baseline data collection has therefore not been undertaken. Diesel evaporates quickly, especially in tropical oceanic and climatic conditions.

Stakeholder	Response	IPB assessment of merit of feedback
	• DPaW also stated that they will not implement oiled wildlife response on behalf of an operator except as part of a whole of government response and that their response will take place on a full cost recovery basis.	IPB understands that DPaW will not act on its behalf in terms of oiled wildlife response. IPB commits to full recompense of DPaW in the event that their services are used in an oiled wildlife response.
	• DPaW also asked that the DER be notified in the event of a spill occurring in State waters and contamination occurs in State jurisdiction.	This request is incorporated into the reporting requirements outlined in the EP.
	• The plan must also consider the method of disposal of oily waste within State sea or land areas.	This is not relevant for diesel spills, which are notoriously hard to recover. IPB is advocating a 'monitor and evaluate' approach (allowing for natural biodegradation) in the event of a diesel spill.
WA Museum	The museum confirmed that no underwater cultural heritage sites are recorded in the survey area.	Information from the museum confirms the information that IPB had found in online databases and that is included in the EP.

Consultation will be ongoing in the lead up to and during the survey. This is particularly important for key Commonwealth maritime agencies that have identified they need to be aware of the vessel's movements (i.e., AMSA, AHO). These agencies will be kept up to date with the timing of the survey.

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. 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 33°C while overnight minima are typically 26°C. Winters are milder, with July average maximum and minimum temperatures being 26°C and 12.0°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 Northwest Shelf 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 (October to 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, 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 proposed survey area is situated on the continental shelf, within the area known as the 'middle shelf' (where water depths range between 30 and 200 m). Seabed features in the permit area are largely small terrace formations, comprising part of the geomorphic feature known as the Rowley Terrace.

Seabed. Sand is the dominant fraction of the sediments (contents ranging between 15 and 100%), with gravel being the next most abundant fraction (up to 85% content) and mud content ranging between 1 and 62%. Isolated pockets of 'banks/shoals' features located within the proposed survey area have a similar seabed composition. Seabed surveys conducted around the Ichthys gas field, located adjacent to WA-471-P and in water depths of about 250 m, indicate a seabed composed of bare substrates with heavily rippled sand approximately 10 m apart. Calcium carbonate deposits are located on all parts of the shelf.

6.2 Biological Environment

Benthic Invertebrates. The high sand/gravel content and low mud content of the Kimberley Shelf sub-region heavily influences the benthic fauna types inhabiting this region. There is, however, little or no information regarding the region's benthic fauna, even those forming key habitats on the channels, banks, islands and shoals of the region.

Seabed surveys conducted in the southeast of the WA-285-P permit around the Ichthys gas field (near Browse Island), located adjacent to WA-471-P and in water depths of about 250 m, found a low cover (<40%) of filter-feeding communities with sponges, gorgonians (sea whips and sea fans), soft corals, hydroids, bryozoans, fan worms and other polychaetes.

Given the depth of water and sandy nature of the seabed in the proposed survey area, few significant benthic resources are expected to be located across the survey area as mobile sediments do not favour the development of diverse epibenthic communities. The depth of water limits the occurrence of algae, seagrasses, corals and some fish and reptile species.

Plankton. The influx of nutrients from coastal runoff and from outer-shelf mixing brought about by internal waves and benthic re-suspension, together with year-round high light levels and seasonal mixing means that the ecosystem is highly phytoplankton based in this region. The phytoplankton is characterised by diatoms, and although this communities is not described, it is likely to be complex. This contrasts dramatically with most parts of the North West Shelf, which are said to be oligotrophic (supporting low primary productivity)

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. Fish species associated with hard seabeds where ridges, rises and reefs occur include deep water snappers (*Pristipommoides* spp.), red snappers (*Lutjanus sebae*, *L. malabaricus*), sweetlip (*Lethrinus nebulosus*) and groupers (*Serranidae*). Demersal communities occurring in mid and out-shelf habitats between the channels, banks, islands

and shoals are described mainly from fishing trawl surveys. Demersal fish species are typically small to medium-sized fish, including monocle bream (Nemipteridae), grinners (Synodontidae), grunter (Haemulidae) and goatfish (Mullidae). Fish spawning in the Kimberley region during the summer/autumn period is thought to correspond with peaks in current movements. Four species listed under the EPBC Act may occur within the survey area, these being the shortfin mako shark (*Isurus oxyrinchus*), longfin mako shark (*I. paucus*), green sawfish (*Pristis xijsron*) and whale shark (*Rhincodon typus*).

The region also supports large populations of cartilaginous fishes such as sharks and rays. The most prolific of the sharks are the whalers, represented by at least 12 species in the region. Various species of shark, including whale sharks, tiger sharks and great white sharks, may occasionally reside in the proposed survey area, although little is known of their movements through the region.

Marine Mammals. Twenty-two mammal species listed under the EPBC Act may occur within the survey area, including nine dolphin species and 13 whale species.

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*), blue whale (*Balaenoptera musculus*) 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 Kimberley 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 (105 km south of the proposed survey area). The highest numbers of cows/calf pairs are present from mid-August to mid-September.

Reptiles. Twenty-three reptile species listed under the EPBC Act may occur within the survey area, comprised of 17 sea snakes and six turtle species.

Four of the turtle 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. Nesting patterns in the Kimberley region are less well known, however the Lacapede Islands just north of Broome are known to support a large rookery for the green turtle (*Chelonia mydas*), which is generally found in water depths less than 20 m. They are also known to nest at Ashmore, Cartier and Browse islands. There are no Biologically Important Areas (BIAs) for turtles in the proposed survey area.

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.

Little is known of the distribution of individual sea snake species, population sizes or aspects of their ecology. Sea snakes are widespread through tropical waters in offshore and near-shore habitats.

Coral. Key coral reef habitat occurs to the west (Scott, Seringapatam, Browse Island reefs), west (Ashmore and Cartier reefs) and the north and northeast (various shoals) of the proposed survey area. Echuca Shoal, located within the survey area, contains a small area of reef habitat (13% of total benthic composition). 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. Three bird species listed under the EPBC Act may occur within the survey area, these being the Australian lesser noddy (*Anous tenuirostris melanops*), osprey (*Pandion haliaetus*) and streaked shearwater (*Puffinus leucomelas*).

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 survey 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.

Browse Island, located 10 km west of the survey area, is a roosting site for seabirds and shorebirds including a breeding colony of crested terns (*Thalasseus bergii*) on the western side of the island (over 4,000), with seven other species (not showing breeding activity) found including the brown booby (*Sula leucogaster*), lesser frigatebird (*Fregata ariel*), eastern reef egret (*Egretta sacra*), Pacific golden plover (*Pluvialis fulva*), ruddy turnstone (*Arenaria interpres*), crested tern (*Sterna bergii*), sooty tern and common noddy (*Anous stolidus*).

6.3 Socio-economic Environment

Settlements. The proposed survey area is located approximately 420 km north-northeast of Broome, which has a population of about 15,800 and is the main service and population centre for the Kimberley region. The shire's main industries are tourism, pearling, fishing, aquaculture, pastoralism and horticulture.

The proposed survey area is located approximately 350 km north of the township of Derby, located on the edge of King Sound. Derby has a population of 4,500 people, about 50% of which are 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 the survey area 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 minimal traffic will be encountered in the survey area, with most traffic passing to the west of Browse Island.

Petroleum Exploration and Production. The Browse Basin is one of Australia's most hydrocarbon-rich basins, with estimated gas reserves in excess of 538 billion cubic meters (bcm^3).

While the basin currently contains no petroleum production facilities, this will soon change when the Ichthys (Inpex) and Prelude (Shell) Liquefied Natural Gas (LNG) projects are completed.

Commercial Fisheries. Several WA and Commonwealth-managed fisheries have jurisdiction to fish in the survey area.

Western Australian-managed fisheries that may fish the area include the North Coast Demersal Scalefish Fishery (Area 2, Zone B), 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. Wild pearl oyster harvesting does occurs south of the Lacapede Islands, 322 km southwest of the proposed survey area. Pearl farm leases occur along the mainland and fringing islands coasts, over 80 km from the proposed survey area.

Traditional Fisheries. The western-most portion of the survey area overlies the 'MoU Box' (the Memorandum of Understanding between Australia and the Republic of Indonesia in 1974), which allows 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 Heritage Values and Sensitivities. The conservation of natural and anthropological heritage in Commonwealth marine areas is grouped into the categories outlined in Table 3, with the nearest sites to the survey area briefly described here.

Table 3. Conservation heritage areas and their classifications in the vicinity of the proposed survey area

Heritage Place	Commonwealth Marine Reserve (CMR)	World Heritage	Commonwealth Heritage	National Heritage	Ramsar Wetland	State marine park
Kimberley	✓	×	×	×	×	×
Ashmore Reef	✓	×	✓	×	✓	×
Cartier Island	✓	×	×	×	×	×
West Kimberley	×	×	×	✓	×	×
Browse Island	×	×	×	×	×	✓
Camden Sound	×	×	×	×	×	✓

The Kimberley CMR overlaps the southern portion of the WA-485-P permit area (and the proposed survey area, see Figure 1). It covers an area of 74,469 km^2 in water depths ranging from 15 to 800 m. This marine reserve was declared in November 2012 and is yet to have a management plan prepared by the Department of Environment (DoE), so little is known of its sensitivities. However, the Kimberley CMR is known to be an important foraging area for seabirds, migratory dugongs, dolphins and turtles, an important migratory pathway and nursery area for humpback whales and an important foraging and pupping area for sawfish.

The Ashmore Reef CMR is located approximately 213 km northwest of the survey area 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. Ashmore Reef is as an important breeding site for 20 species of seabirds. 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, located 165 km north-northwest of the proposed survey area, 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. Cartier 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 marine turtles.

The West Kimberley National Heritage Area is located immediately south of the proposed survey area (and adjacent to IPB's southern-most exploration permit, WA-424-P). The majority of this heritage listing relates to terrestrial heritage, though state waters are included due to the history of pearling.

Browse Island is located 39 km to the west of the proposed survey area and is designated as a 'Class C Nature Reserve' for the conservation of flora and fauna. It coves an area of 17 ha and is an isolated sandy cay surrounded by an intertidal reef platform and shallow fringing reef that is important for green turtle nesting and some breeding seabirds (crested terns) and migratory shorebirds.

The Camden Sound Marine Park is the first state marine park created in the Kimberley region, covering 7,062 km^2 and located about 300 km north of Broome and 85 km south of the proposed survey area. The western boundary of the marine park is the Limit of Coastal of the State of Western Australia, adjoining the Kimberley CMR. One of the key reasons for creating the park is for the conservation of humpback whales, and specifically their breeding and calving habitat.

Ecologically rich shoals are found in and around the survey area, mostly within a 200 km radius to the north and northeast. 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 and the Western Australian Shipwrecks Database indicate there are no shipwrecks registered within the survey area, though there is a shipwreck on the eastern side of Browse Island. There are no historic shipwreck protected zones in the survey area.

7. Environmental Impact Assessment

The known and potential environmental impacts resulting from the proposed survey are outlined in detail in the EP.

For this EP, the environmental impact assessment (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.

7.1 Methodology

The EIA and ERA approach used within this EP is consistent with the approach outlined in AS14001, AS/NZS ISO31000:2009 (Risk Management) and HB203: 2012 (Environmental Risk Management).

7.2 Establishing the Context

The objective of establishing the context is to define the objectives, strategies, scope and parameters of the activities to which the risk management process is being applied.

The description on the methodology adopted is divided into planned and unplanned events.

7.3 Planned Events

The risk evaluation is undertaken in accordance with the matrix provided in Table 4.

Table 4. Risk assessment matrix

Consequence	Likelihood				
	Very Unlikely	Unlikely	Possible	Likely	Very Likely
Major Habitat loss to an ecosystem (recovery in >25 years)					High
Significant Habitat loss to an ecosystem (recovery in <25 years)					
Serious Measurable medium term impact to an ecosystem (recovery in 1-10 years)			Medium		
Minor Measurable short term impact to an ecosystem (recovery in <1 year)					
Negligible Measurable short term impact to an ecosystem (recovery in <3 months)	Low				

Impact Identification. The aim of the impact identification step is to generate a comprehensive list of hazards arising from the planned petroleum activity that will result in an environmental impact. The impact identification process identifies the causes and range of potential consequences of each impact identified.

The term 'impact' is defined as *a change to the environment, whether negative or positive*.

Impact Analysis. Impact analysis is undertaken to determine the consequence of impact and assist in determining what controls are required to avoid, mitigate or minimise those consequences.

Planned discharges or emissions (e.g., air, water, noise) are assigned an environmental impact rating from 'Negligible' through to 'Major'. The focus of controls is reducing the impact of the controls to As Low As Reasonably Practicable (ALARP).

This impact and risk assessment was reviewed and revised by IPB and its consultants to take into account the combined experience of planning for and undertaking marine seismic surveys.

The term 'consequence' is defined as *the outcome of an event affecting objectives* (ISO 31000:2009).

Inherent and Residual Impact Consequence. Routine controls are those that are routinely applied to manage an event (i.e., these controls are standard industry practice and put in place regardless of the project location, legislation, nature of the surrounding environment, etc.).

An inherent impact consequence is then assigned to the hazard based on the application of the routine controls.

Additional non-routine controls are also considered. Additional controls are defined as controls put in places that are survey-specific due to the project location, legislation, nature of the surrounding environment, or the high inherent impact ranking of the hazard.

A residual impact consequence is ultimately assigned to the hazard based on the application of routine and non-routine controls. It is important to note that additional controls do not always lead to a lower residual impact consequence compared to the inherent impact consequence.

7.4 Unplanned Events

Risk Identification. The aim of the risk identification step is to generate a comprehensive list of hazards arising from the planned petroleum activity that may result in an environmental impact. The risk identification process identifies the causes, likelihood and consequences of each risk identified.

The term 'risk' is defined as the effect of uncertainty on objectives (ISO 31000:2009).

Risk Analysis. Risk analysis is undertaken to determine the likelihood of the hazard occurring and the resulting consequence. This assists in determining what controls are required to avoid, mitigate or minimise the risk of the hazard occurring.

Analysis is focused on not only the consequence or impact of the event occurring, but also on the likelihood of the event occurring in the first place (for example, a diesel spill from the survey vessel may occur). This combination of consequence and likelihood provides a risk rating. The assigning of a likelihood and consequence ranking is based on the knowledge and experience of those involved in the risk assessment as well as utilising historical data on event probabilities (e.g., vessel collision frequencies).

When likelihood and consequence are multiplied, the risk falls into one of three risk bands – low, medium or high. The focus of risk controls is reducing the risk rating of the activity to ALARP and its acceptability to IPB and its stakeholders.

The term 'likelihood' is defined as *the chance of something happening* (ISO 31000:2009).

Inherent and Residual Risk Consequence. As per 'planned events.'

7.5 Demonstration of ALARP

The ALARP principle states that it must be possible to demonstrate that the cost involved in reducing the risk further would be grossly disproportionate to the benefit gained. The ALARP principle arises from the fact that infinite time, effort and money could be spent attempting to reduce a risk or impact to zero.

An iterative risk evaluation process is employed until such time as any further reduction in the residual risk ranking is not reasonably practicable to implement. At this point, the impact or risk is reduced to ALARP. For planned activity impacts, residual impact ratings of 'negligible' or 'minor' are considered by IPB to be ALARP.

For unplanned activities, residual risk rankings of 'Low' in the risk matrix is considered by IPB to be ALARP. 'Medium' residual risk rankings may be considered to be ALARP if further risk reduction measures are shown not to be practicable, while 'High' residual risk rankings are unacceptable and must be reduced to a lower level of risk.

When formulating risk treatments or impact controls for each activity, the 'Hierarchy of Controls' philosophy was applied. The 'Hierarchy of Controls' is a system used to minimise or eliminate exposure to hazards. The hierarchy of controls is, in order of effectiveness:

- Eliminate;
- Substitute;
- Engineer;
- Isolate;
- Administration; and
- Protection.

Those treatments that were considered by the teams to be reasonably practicable have been implemented, while those considered to be not reasonably practicable have not been implemented, and a description of the justification for this position is provided in the EP.

7.6 Demonstration of Acceptability of Environmental Impact

IPB considers a range of factors when evaluating the acceptability of environmental impacts associated with its activities. These are:

- Policy compliance;
- Management system compliance;
- Social acceptability;
- Laws and standards;
- Industry practice;
- Environmental context;
- Environmentally sustainable development principles; and
- ALARP.

Table 5 provides a summary of the EIA and mitigation measures that are in place, which have been assessed to be ALARP.

Table 5. Summary EIA and ERA for the proposed survey

Potential risk	Potential consequences	Key avoidance, mitigation & management measures	Residual risk ranking
Planned events			
Underwater noise from the seismic airgun array and engine noise transmitted through the hull and propeller	Temporary physiological impacts on sensitive fauna, such as cetaceans. Sound pulses for air guns arrays with a 3,000-4,000 cui volume decrease to levels in the order of 160-170 dB re 1 µPa (SPL) within 1 km horizontal radius of the source. Thus, noise emanating from the survey is likely to reach background ambient levels (i.e., <120 dB) within just over 10 km from the sound source, dependent on the sound propagation characteristics of the area. Impacts to cetaceans (generally considered to be the most sensitive marine species to anthropogenic sound) are generally limited to attraction (to the sound), increased stress levels, disruption to underwater acoustic cues, behavioural changes and localised avoidance.	• The survey will not be conducted during peak whale migration seasons (start of July to end of October). • Vessel engines maintained in accordance with planned maintenance systems. • Two experienced and qualified marine fauna observers (MFOs) will be onboard the seismic survey vessel to implement the EPBC Act Policy Statement 2.1 (Section A.1 to A.4), which involves the following: <u>Start-up procedures</u> • Pre-start visual observations - for 30 minutes out to 3 km. • Soft start, increasing power over a 30 minute period, with visual observations out to 3 km. • Delay start up procedures/power down any operating acoustic source if whales are observed within 2 km of the airgun array and shut down if they approach the source vessel within 500 m. Resume soft start procedures once the whale has been observed to move outside the low power (2 km) zone. • In addition to the Part A requirements, two experienced MFO will be used on the survey vessel to maintain permanent watch for megafauna and enforce the Part A provisions at all times. <u>Operations procedure</u> • If a whale is spotted within the low power zone, the acoustic source will be reduced to minimum power. • If a whale is observed within the shutdown zone, the acoustic source will be shut down. • Soft-start procedures will only resume after the whale has been observed to move outside the low power zone or if the whale has not been sighted for 30 minutes.	Negligible

Potential risk	Potential consequences	Key avoidance, mitigation & management measures	Residual risk ranking
		Start-up delay procedures • If during the soft start procedure a whale is observed to enter the low power zone, the acoustic source will be reduced to minimum power. • If a whale is observed within approximately 500 m ('the shutdown zone') of the vessel, the power source will be shut down. • Soft-start procedures will only resume after the whale has been observed to exist the low power zone or if the whale has not been sighted for 30 minutes.	
Artificial lighting	Attractant to fauna, temporary increase in predation rates on fauna attracted to lights and light glow. Seabirds may be attracted to the vessels at night due to the light glow. Bright lighting can disorientate birds, thereby increasing the likelihood of seabird injury or mortality through collision with infrastructure, or mortality from starvation due to disrupted foraging at sea. Bright lights can also impact on migrating birds. Other marine life may also be attracted to the waters around the vessels as a result of an attraction by prey items (e.g., worms, squid, plankton) that can aggregate directly under downward facing lights.	• Vessel lighting will be managed in accordance with maritime safety standards, including: ○ Marine Orders Part 21 (Safety of navigation and emergency procedures). ○ Marine Orders Part 30 (Prevention of collisions). ○ The Australian Offshore Support Vessel Code of Safe Working Practice (Section 9.1.4 Deck lighting).	Negligible
Atmospheric emissions	Temporary and localised reduction in air quality due to particulate matter from diesel combustion, and contribution to the greenhouse gas effect.	• Marine-grade (low sulphur) diesel will be used. • Vessel engines and machinery will be maintained in accordance with planned maintenance systems. • No onboard waste incineration will take place.	Negligible
Cooling and brine water discharge	Localised and temporary elevation in surface water temperature (which is likely to be between 1 and 6 C warmer than background	• Cooling water and reverse osmosis systems will be maintained in accordance with the planned maintenance system.	Negligible

Potential risk	Potential consequences	Key avoidance, mitigation & management measures	Residual risk ranking
	water temperature) and salinity (likely to be about 40,000 ppm, about 5,000 ppm above background levels). Discharges will be rapidly diluted in the water column.		
Sewage, grey water and putrescible waste discharge	Temporary and localised reduction in water quality from organic compounds, detergents, suspended solids, chemical nutrients and food waste, though discharges will be rapidly diluted and dispersed in the water column. Modification of fauna feeding patterns created through the discharge of food scraps (i.e., increase in scavenging marine fauna and seabirds).	• A MARPOL-approved (Annex IV) sewage treatment plant will be fitted to the vessel. • The sewage treatment plant will be maintained in accordance with the planned maintenance system. • No discharge of sewage and putrescible waste will take place within 12 nm of land. • Putrescible waste will be macerated to <25 mm in size prior to discharge. • Non-food galley wastes will be bagged and returned to shore for disposal.	Negligible
Deck and bilge water drainage, streamer fluid losses	Temporary and localised reduction in water quality due to: • deck wash, ocean spray and rain that capture trace quantities of contaminants such as oil, grease and detergents on the deck prior to draining overboard; • discharge of bilge waters with < 15 ppm oil-in-water (OIW) content; and • streamer damage resulting in loss of minor quantities of light oil. Chemicals discharged to the marine environment have the potential to cause physiological damage to marine fauna that may ingest or absorb the chemicals. The greatest risk at the proposed survey area will be to plankton and pelagic fish given the absence of sensitive habitat types in the area.	• An OIW treatment system will be in place, with no water discharges greater than 15 ppm OIW. • Oil captured from the OIW treatment system will be transferred to shore for disposal. • Chemical storage and fuel transfer areas are bunded. • Vessel will have a valid International Oil Pollution Prevention Certificate. • Spills to decks will be cleaned immediately. • Shipboard Oil Pollution Equipment Plan (SOPEP) kits will be available on board for rapid clean-up response. • If fluid-filled streamers are used, ensure only light oils (e.g., kerosene, Isopar) are used. • Streamers are routinely maintained and inspected for wear and tear, and are fit-for-purpose.	Negligible
Hazardous	Temporary and localised reduction in water	• A Vessel Waste Management Plan will be in place and	Negligible

Potential risk	Potential consequences	Key avoidance, mitigation & management measures	Residual risk ranking
and non-hazardous solid waste discharges	quality created by accidental loss of waste overboard (e.g., during storms or vessel to vessel transfers). Hazardous wastes released to the sea may have direct or indirect effects on marine organisms. For example, chemical spills can impact on marine life from plankton to pelagic fish communities, causing physiological damage through ingestion or absorption through the skin. Ngon-hazardous wastes can cause smothering of benthic habitats as well as injury or death to marine fauna or seabirds through ingestion or contact (e.g., high-order fish mistaking plastics for jellyfish, rope getting caught around the necks of turtles and seabirds).	implemented (for vessels >400 gross tonnes or certified to carry 15 persons or more): ○ 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 capabilities. ○ Garbage Record Book will be maintained. • Large, bulky items are secured to main deck in accordance with the Sea Fastening Procedure.	
Unplanned events			
Seabed disturbance	Temporary and localised turbidity due to anchoring or dropped objects. The stirring up of sand and other seabed material is not considered a significant environmental impact. Surveys of seabed disturbance from anchoring activities indicate that recovery of benthic fauna in soft sediment substrates occurs between 6 to 12 months after the disturbance was created.	• The vessel will avoid anchoring in known sensitive areas (i.e., Echuca Shoal). • Procedures will be in place to control materials handling and transfer from vessels. • Large bulky items will be securely stored on the deck.	Low
Interaction with third-party vessels	Damage to and/or loss of fishing equipment. Loss of commercial fish catches. Disruption to commercial shipping activities. The proposed survey area and surrounds do not represent core fishing grounds. It is unlikely that fishing gear (such as trawl nets) would be damaged, as trawling is not known to	• The vessel and streamers will be readily identifiable to other vessels. • Vessel location will be communicated to other users via the Notice to Mariners and AusCoast warnings. • Stakeholder consultation indicates very low fishing effort and shipping in and around the survey area. • Vessel will employ standard maritime safety measures (e.g.,	Low

Potential risk	Potential consequences	Key avoidance, mitigation & management measures	Residual risk ranking
	occur within the proposed survey area and vessels would have enough advanced warning to detour around the survey vessel. No line fishing has been reported since 2002.	lighting, 24-hr visual, radio and radar watch). • Vessel Master will maintain constant communications with any third-party vessels tracked by radar to ensure they remain away from the vessel and its streamers.	
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 Requirements, which requires: ○ That a Quarantine Pre-Arrival Report (QPAR) is available and signed off by AQIS. ○ Ballast water exchange logs are signed off by AQIS.	Low
Vessel strike with cetaceans	Injury or death to megafauna (e.g., whales, dolphins, turtles).	• Streamer tail buoys will be fitted with turtle guards. • The Australian Guidelines for Whale and Dolphin Watching (2005) for sea-faring activities will be implemented by the MFOs, which involves: ○ Caution zone (300 m either side of whales and 150 m either side of dolphins) – vessels must operate at no wake speed in this zone. ○ No approach zone (100 m either side of whales and 50 m either side of dolphins) – vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod. ○ Do not encourage bow riding. ○ If animals are bow riding, do not change course or speed suddenly. ○ If there is a need to stop, reduce speed gradually.	Low

Potential risk	Potential consequences	Key avoidance, mitigation & management measures	Residual risk ranking

Diesel spill (refuelling spill or 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 'Interaction with third-party vessels'.
		• The vessel bunkering procedure will be implemented, which includes:
		  ○ Participating in pre-bunkering toolbox talk and risk assessment.
		  ○ The use of fenders by the supply vessel.
		  ○ Supervision of mooring lines for deck officers.
		  ○ Communication tests by the vessel Masters prior to the commencement of bunkering.
		  ○ Supervision of the bunkering operation by the Chief Engineer.
		• Shipboard Oil Pollution Emergency Plan (SOPEP) and Emergency Response Plan (ERP) will be in place, and implemented in the event of a diesel spill.
		• Diesel spill will be promptly reported internally and externally.
		• Operational and scientific monitoring will take place to support the spill response and characterise environmental impacts.
			Low

Hierarchy of consequence and risk

Consequence (planned events)	Risk (unplanned events)
Major	High
Significant	-
Serious	Medium
Minor	Low
Negligible	

8. Hydrocarbon Spill Preparedness and Response

In the case of a diesel spill from refuelling or a vessel-to-vessel collision, IPB has determined that the primary response is to allow the spill to naturally disperse and biodegrade, while monitoring and evaluating the situation. This is because oil spill modelling indicates there is only a low probability of shoreline contact (1-6% for Browse Island above the 100 g/m^2 threshold) and no other reefs or other environmental sensitivities are likely to be contacted. This response strategy is supported by a Net Environmental Benefit Analysis (NEBA) that assesses the strengths and weaknesses or each 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.

A step-by-step list of immediate actions to be taken in the event of a diesel spill is provided in the Oil Pollution Emergency Plan (OPEP) section of the EP. The Vessel Emergency Response Team, Vessel Contractor Incident Management Team and IPB's Crisis Management Team will respond to hydrocarbon spills. Key components of the OPEP are outlined below.

8.1 Tiered Response Strategy

Marine oil spills are classified under international classifications according to size or 'tiers'. This assists with identifying the level/nature of assistance required to combat spills.

A Tier 1 (0-10 tonnes) response to small spills can generally be managed and minimised by the Vessel Master with on-board equipment and trained vessel crew. These small spills are not likely to impact shorelines or other sensitive resources.

The Vessel Master is also responsible for notifying AMSA or DoT (depending on the location or potential direction of travel) of the spill. The Vessel Master (or delegate) will monitor the spill and provide regular situation reports (SITREP) to AMSA. In a Tier 1 response in Commonwealth waters, AMSA is the combat agency. Combat agencies have responsibility for monitoring the spill, undertaking oil spill trajectory modelling and deploying resources to protect sensitive environmental resources.

A Tier 2 (10-1,000 tonnes) or Tier 3 (>1,000 tonnes) spill cannot be managed by onsite resources and/or could have serious impacts on the environment. The Vessel Master will notify AMSA or DoT as soon as possible. Onsite resources will continue to provide SITREPs at the direction of AMSA or DoT throughout the response activity. In a Tier 2 or 3 response in Commonwealth waters, AMSA is the combat agency.

8.2 Protection Priorities

The following oil spill response priorities have been identified for the survey:

- Remove marine users from areas that present a safety hazard;
- Minimise exposure to diesel to threatened species that may transit area;
- Prevent exposure to the spill by commercial fisheries in proximity to the survey area; and
- Prevent, or minimise, diesel exposure to Browse Island through physical agitation of the slick in deeper waters.

8.3 Spill Response

Based on the spill modelling results for a 300 m^3 spill, and a Net Environmental Benefit Analysis (NEBA), the favoured response options for a Tier 2 MDO spill (for which 300 m^3 is classified) during the survey are as follows:

Primary response

The primary response is to allow for natural weathering and biodegradation while undertaking operational monitoring:

- Commission real-time oil spill modelling (using forecast data) in order to determine the spill's trajectory.
- Deploy vessel and/or fixed-wing aircraft (through AMSA) to monitor the trajectory of the spill, and provide feedback from this monitoring to APASA.
- Do not apply chemical dispersant - due to the high proportion of toxic materials and their persistence and toxicity in the marine environment, this may cause greater impacts that the MDO/MGO itself.
- Do not use contain and recover strategies (e.g., booms) for diesel in open waters - it spreads rapidly into thin layers that are not easily recoverable.

Secondary response

If the modelling and/or slick trajectory indicates contact with Browse Island, consider physical breakup of the slick (using propeller wash from the survey and support vessels) by repeated transits through surface slicks (to aid in dispersion, dilution and evaporation of hydrocarbons), if safe to do so (engines present an ignition source for spilled diesel) and only after consultation with the Vessel Director and Technical Operations Manager.

If diesel reaches Browse Island, allow natural biodegradation to break down stranded hydrocarbons. The majority of the toxic components in the fuel will have evaporated by the time it strands, and thus toxicity impacts to fauna that come into contact with, or ingest the diesel are unlikely to occur. A physical clean up response on Browse Island, with associated waste removal requirements, is likely to create more environmental harm that the spill itself, and is therefore not recommended.

8.4 Spill Response Resources

On-site response equipment for the prevention/minimisation of loss of diesel to sea during the survey will include the vessel's on-board spill containment and recovery kits with sufficient absorbent booms and materials to contain small to medium scale deck spills. These will not be able to be deployed for spills to the sea.

As the primary recommended response strategy is to allow natural dispersion and degradation, no additional equipment other than that already on the support vessels is required. The secondary response strategy of physical agitation using propellers will only be employed if observations or real-time trajectory modelling indicates contact with Browse Island is likely. In the event this occurs, the onsite support vessels will be used.

8.5 Training

All personnel receive environmental awareness training as part of their basic introductory and technical training on the survey vessel. Training and competency assessment is managed using the survey contractor's management system.

Quarterly drills and exercises are carried out on all vessels in line with IMO/SOPEP requirements in order to provide an opportunity for crew to gain confidence in using the equipment and implementing incident response procedures, increase efficiency in the event of an emergency, review the efficiency of procedures and detect any failures in equipment.

These drills include, but are not limited to spill response, collision and grounding, fire and explosion and helicopter emergency.

Additionally, IPB, in conjunction with the survey contractor, will undertake a desktop emergency response exercise (including a spill scenario) either prior to, or soon after the survey has commenced. This will test the capacity of IPB and the survey contractor to implement the emergency response tasks.

9. Implementation Strategy

IPB retains full and ultimate responsibility for environmental management of the proposed survey as the Titleholder of the WA-471-P and WA-485-P exploration permits; it is responsible for ensuring that the activities associated with the survey are implemented in accordance with the performance objectives outlined in this EP. However, IPB will rely on the chosen reputable vessel contractor to implement its Health, Safety and Environmental (HSE) management system to ensure full compliance with the EP.

A large part of IPB's survey contractor selection process will be focused on ensuring that contractors have HSE management systems in place to successfully implement the commitments of this EP.

An HSE Management Plan will be developed for the survey, which will outline IPB's HSE requirements for the survey, procedures to comply with State and Commonwealth regulations, cyclone evacuation considerations and so forth.

9.1 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 IPB Client Site Representative to the IPB Technical Director, who in turn reports to the IPB Managing Director. The Vessel Master has over-riding authority and responsibility to make decisions with respect to personnel safety as well as 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.

9.2 Training and Awareness

During the contractor selection process, IPB will ensure that the chosen contractor has in place procedures to ensure the correct selection, placement, training and ongoing assessment of employees, with position descriptions (including a description of HSE responsibilities) for key personnel being readily available. Procedures should also be in place to identify the training needs of an individual to competently perform his/her role, and evidence of corporate and/or vessel inductions will also be required.

All vessel-based personnel will be provided with an HSE and 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 hazards;
- Overview of Marine Fauna Observer duties and obligations, and cetacean interaction procedures.
- Key environmental management actions, including but not limited to:
    - Waste segregation, containment and disposal;
    - Housekeeping and spill prevention;

- Spill preparedness and response; and
- Environmental incident reporting.

The IPB Client Site Representative is responsible for ensuring personnel receive this induction prior to the commencement of the survey.

9.3 Emergency Response and Preparedness

Survey-specific emergency response procedures for the proposed survey will be included in the Survey HSE Plan. The Survey HSE Plan contains instructions for vessel emergency, medical emergency, search and rescue, reportable incidents, incident notification and emergency contact information.

In the event of an emergency of any type, the survey Vessel Master will assume overall onsite command and act as the Emergency Response Coordinator (ERC). All persons aboard the vessel/s will be required to act under the ERC's directions. The survey vessel will maintain communications with the Vessel Director and Technical Operations Manager and/or other emergency services in the event of an emergency. Emergency response support can be provided by IPB if requested by the ERC.

The survey and support vessel/s will have equipment aboard for responding to emergencies, including but not limited to medical equipment, fire fighting equipment and oil spill equipment.

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.

9.4 Incident Recording and Reporting

The survey contractor will have internal requirements for the recording and reporting of incidents. There are legal obligations under the OPGGS(E) for IPB, as the Titleholder, to report incidents to NOPSEMA within a specified time period. These requirements are outlined in detail in the EP.

Non-compliances with the EP may be identified during an audit, inspection, crew observation or as a consequence of an incident. These will be appropriately investigated. Following an investigation, remedial actions will be developed to prevent recurrence and tracked to completion.

9.5 Environmental Monitoring

IPB will maintain a quantitative record of emissions and discharges as required under Regulation 14(7) of the OPGGS(E) and as outlined in the EP. Results will be reported in the EP performance report submitted to NOPSEMA after the completion of the survey.

9.6 Audit and Review

Daily and weekly inspections will be made by the IPB Client Site Representative on the survey vessel to ensure that vessel standards and equipment meet the performance standards of the EP. Any departures from the performance standards will be documented as a non-compliance with follow-up actions recorded, communicated to affected parties and remedial actions implemented and tracked to closure.

These results will be included with the EP performance report submitted to NOPSEMA after the completion of the survey.

10. Further Information

For further information about this seismic survey, please contact:

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