Ningaloo Vision Operations WA-35-L Environment Plan Summary

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1. INTRODUCTION

Apache PVG Pty Ltd, on behalf of the Coniston-Van Gogh Production Joint Venture titleholders (Apache PVG Pty Ltd [52.501% ownership] and Inpex Alpha Ltd [47.499% ownership]) recovers oil in production licence area WA-35-L using the *Ningaloo Vision* floating production, storage and offloading (FPSO) vessel (**Figure 1-1**). Oil recovered from the Van Gogh, Coniston and Novara fields via the subsea infrastructure shown in **Figure 1-2** will be processed and stored onboard the Ningaloo Vision topside facilities for loading and export. Oil has been recovered from the Van Gogh field using the *Ningaloo Vision* FPSO since 2009. Following additional subsea installation and FPSO rectification works, production re-commenced in Quarter 2 2015, allowing oil to be recovered from the additional Coniston and Novara fields. The estimated operational life of the Van Gogh, Coniston and Novara fields is 15 to 20 years.

The Ningaloo Vision Operations Environment Plan WA-35-L (the EP) has been written to meet the statutory requirements of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations). The EP ensures that activities are conducted in line with Apache environmental policies and standards (including the corporate Environmental Policy), all applicable legislation and in line with relevant stakeholder expectations.

The EP (Revision 7) has been reviewed and approved by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on 5 May 2015. Revision 7 reflects the intent to discharge produced formation water (PFW) as a contingency event in situations where injection to the reservoir is not possible (e.g. failure of the PFW injection system or ancillary systems). Re-injection remains the intended means of disposing of PFW.

This EP (Revision 7) summary has been prepared in accordance with the requirements of regulation 11 (4) of the OPGGS (E) Regulations for public disclosure.

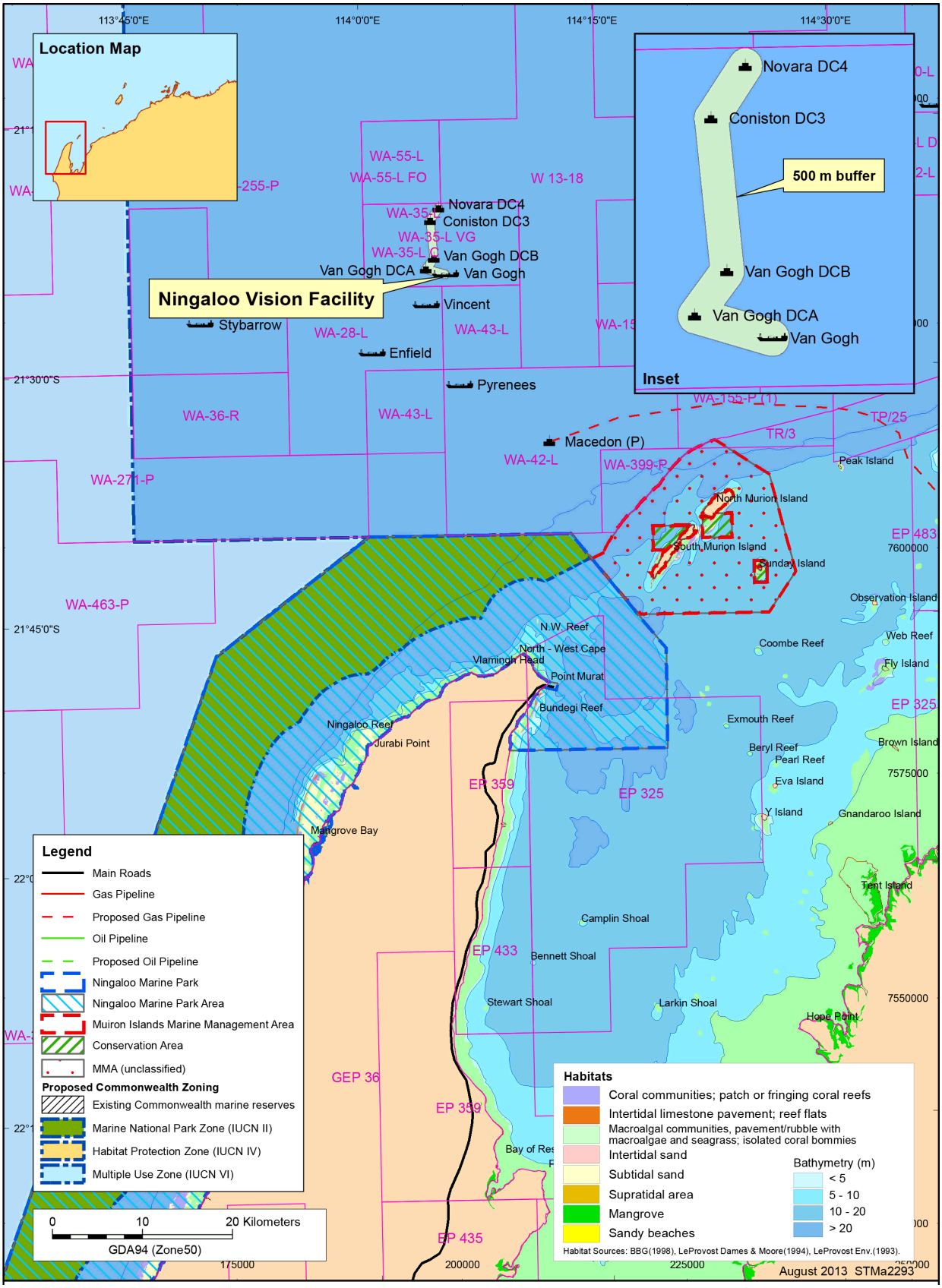

Figure 1-1: Location of Ningaloo Vision and associated infrastructure

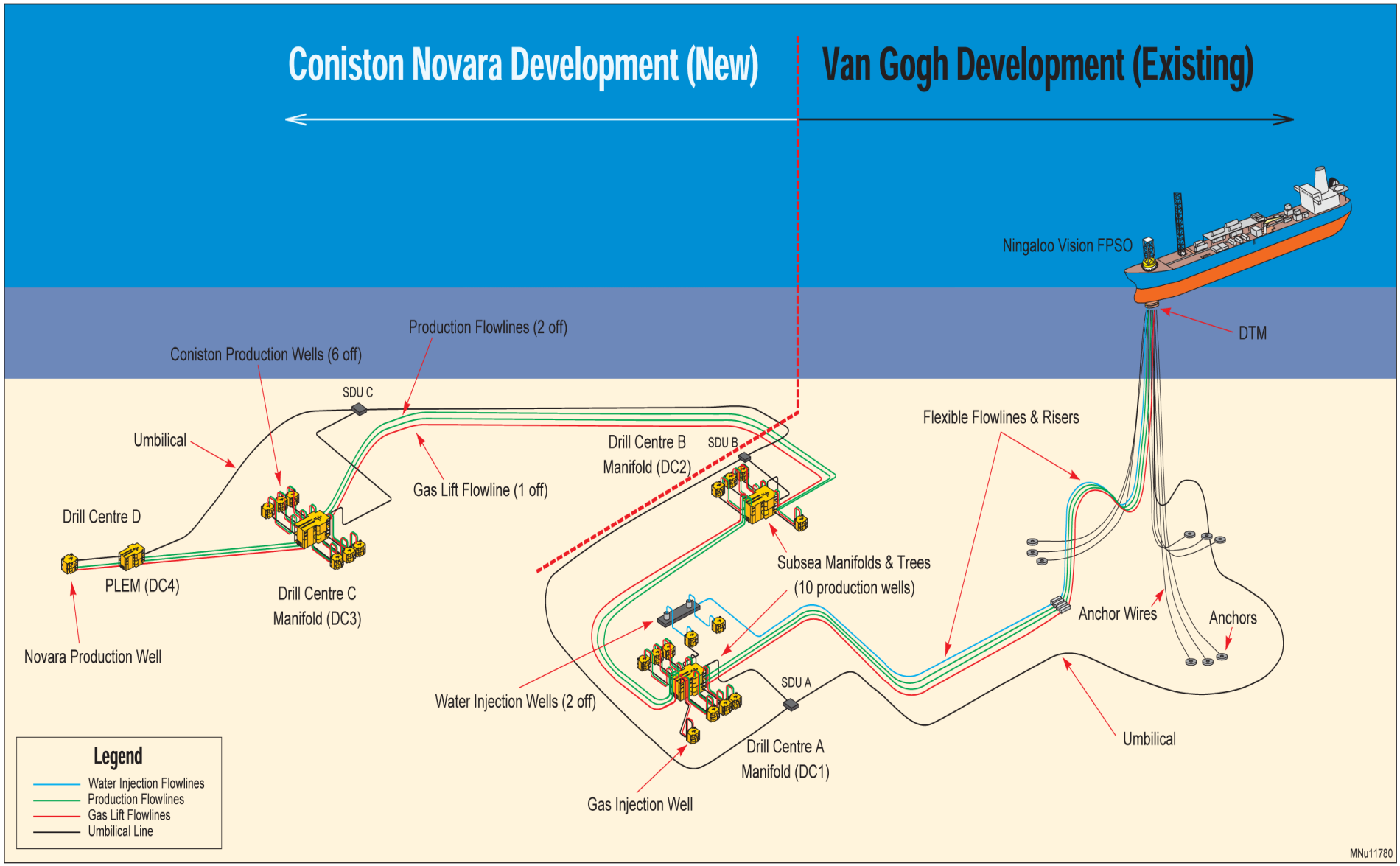

Figure 1-2: Schematic of the Ningaloo Vision Operations subsea infrastructure

2. ACTIVITY LOCATION AND COORDINATES

The FPSO and subsea infrastructure are located within Production Licence WA-35-L in Commonwealth waters, 45 km north-northwest off the Cape Range Peninsula in Western Australia. The FPSO is located 53 km north-northwest of the Exmouth township and 29 km from the northern boundary of Ningaloo Marine Park (**Figure 1-1**). The development occurs in water depths ranging from 340 m in the east of the production licence to 400 m depth in the west, with the FPSO moored in a water depth of 341 m. The EP covers all activities within a 500 m buffer, termed the Operational Area, around the FPSO and subsea infrastructure (**Figure 1-1**). The proximity of the development area to other key coastal or mainland features is:

- State/Commonwealth waters boundary – 30 km southeast.
- Ningaloo Marine Park boundary – 30 km southeast.
- Muiron Islands Marine Management Area – 35 km southeast.
- Ningaloo Reef proper – 45 km south.
- North West Cape – 45 km south.
- Barrow Island – 140 km northeast.

Coordinates of the *Ningaloo Vision* FPSO mooring position are provided in **Table 2-2-1**.

Table 2-2-1: Coordinates of the *Ningaloo Vision* FPSO

Infrastructure Locations	Coordinates (Datum/Projection: GDA 94 Zone 50)			
	Latitude (South)	Longitude (East)	Easting (m)	Northing (m)
FPSO mooring position	21°24'12.39"	114°05'17.22"	198096	7630400

3. DESCRIPTION OF THE ACTIVITY

Oil from the Van Gogh, Coniston and Novara fields will be recovered via subsea production wells and equipment which direct the production liquids to the FPSO for processing and storage (**Figure 1-2**). As part of production, produced water and excess gas produced (excludes gas required for fuel and gas lift) are reinjected, and offtake tankers load the recovered oil from the FPSO on a regular basis. If the re-injection of PFW to the reservoir is not possible due to the injection system being partly or wholly unavailable, PFW will be discharged to the marine environment as a contingency event. Support vessels provide logistical support for loading of supplies, offloading of wastes, oil spill response and carrying out maintenance and inspection activities. Helicopters are used for transport of personnel to and from the facility. Collectively, these activities are referred to as the Ningaloo Vision Operations in the EP. Further detail on key equipment and activities is provided below

3.1 Subsea System

The subsea system for Ningaloo Vision Operations includes oil production, gas injection and water injection wells (trees and spools connected), and subsea manifolds connected to the FPSO via flexible flowlines and risers **(Figure 1-2).**

3.2 Disconnectable Turret Mooring System (DTM)

The DTM buoy's main function is to collect the risers, connect them to the FPSO and provide the mooring system for the FPSO and tandem-moored offload tankers (**Figure 1-2**). The DTM buoy is anchored to the seabed at three mooring points. The anchors are Stevshark type, rated at 400 tonne holding capacity and designed to self-bury 3 to 4 m below the surface.

3.3 Moonpool and Turret

The moonpool is a water tight void created within the bow area of the FPSO through conversion of the forward most oil storage tank into a caisson. The moonpool houses the DTM buoy when the FPSO is moored and is arranged with internal inspection, access and escape ways.

The turret, being the topsides structure of the DTM buoy, sits directly above the moonpool. The turret serves as the junction point between the DTM buoy and the topsides production and treatment systems. Risers in the buoy are connected to a series of corresponding piping on the deck of the FPSO, leading to the processing and treatment facilities.

3.4 Ningaloo Vision: Floating Production, Storage and Offloading Vessel (FPSO)

The vessel is configured to meet the Flag State requirements, International Association of Classification Societies (IACS) class requirements (third party validation and classification by Lloyds Register of Shipping) and IMO (MARPOL and SOLAS) requirements. In accordance with IACS class requirements, the rebuild of the tanker resulted in an "as new condition" FPSO.

The FPSO maintains an In Water Survey (IWS) class notation, which means the vessel can remain at its mooring location for its entire service life without requiring dry-docking, subject to class UWILD inspections.

The FPSO is designed to withstand the anticipated environmental and operating conditions for the design life of the facility.

3.5 Offloading

Crude offloading operations take place on average every 15-20 days. The maximum offloading parcel size is 84,263 m^3 (530,000 bbl), and takes in the order of 30 hours to offload, excluding mooring and disconnection time of the offtake tanker. Offloading parcels to date have averaged about 400,000 bbl.

3.6 Vessel Based Support Activities

A number of vessel based support activities (VBSA) are undertaken from time to time to ensure the efficient day-to-day operation of the Ningaloo Vision FPSO. This includes logistical support for loading of supplies, offloading of wastes, oil spill response and carrying out maintenance and inspection activities. The vessels used for these activities depend on the specific requirements of the proposed activity, the water depth and the availability of vessels. The vessels are vetted by Apache to ensure appropriateness for the required activities. Most of the vessels are typically locally sourced from the northwest shelf region.

4. DESCRIPTION OF THE RECEIVING ENVIRONMENT

The following provides a description of the physical, biological and socio-economic environment within an area that could potentially be affected by planned or unplanned events associated with the activity. For routine planned events, localised environmental impacts are likely to occur within the Operational Area. For contingency discharges of PFW, which may occur if the PFW injection system is unavailable, impacts to flora and fauna within surface waters may occur within a larger area up to 2.5 km away from the FPSO. For unplanned events such as accidental hydrocarbon spills, impacts could occur within a larger area (termed a Zone of Potential Impact or ZPI) extending from Shark Bay in the south to offshore waters off Dampier Archipelago, in the north.

4.1 Physical Environment

Salinity in the region is relatively uniform at 34-35 parts per thousand (ppt) throughout the water column. Due to the low average rainfall in the region there is little freshwater run-off from the adjacent mainland (Blaber *et al*., 1985).

During summer (October–March), the prevailing non-storm winds in the region are from the southwest, west and northwest at an average speed of less than 10 knots, peak average speeds of 15–25 knots, and maximum speeds of 30 knots. In winter (May – August), winds are generally lighter and more variable in direction than in summer. Non-storm winds prevail from the northeast through to southeast at average speeds of 5–6 knots, peak average speeds of 10–15 knots, and maximum speeds of 20 knots.

Mean sea wave heights of less than 1 m with peak heights of less than 2 m are experienced in all months of the year (WNI, 1995). Mean swell heights are low at around 0.4–0.6 m in all months of the year. Tropical cyclones have generated significant swell heights of up to 5 m in this area, although the predicted frequency of swells exceeding 2 m is less than 5% (WNI, 1995).

The tides in the region have a strong semi-diurnal signal with four tide changes per day (Holloway and Nye, 1985). Measurements of tidal currents mid shelf are predicted to attain average speeds of approximately 0.25 knots during neap tides and up to 0.5 knots during spring tides (NSR, 1995; WNI, 1995).

The dominant sea surface offshore current (typically seaward of the 200 m isobath) is the Leeuwin Current, which carries warm tropical water south along the edge of WA's continental shelf, reaching its peak strength in winter and becoming weaker and more variable in summer.

4.2 Biological environment

4.2.1 Habitats

Table 4-1 provides details of all habitats within an area that could be impacted by unplanned events (i.e. oil spills reaching coastal waters) or planned events during the activity. Within the Operational Areasoft sediment is the dominant habitat. A survey of seabed habitat has previously been conducted at the Coniston/Novara fields (RPS, 2011a) and at the Van Gogh Field (Apache, 2009). The seabed survey at the Coniston/Novara fields, along the flowlines and production manifold locations, has revealed a flat soft sediment habitat comprising sand, silt and mud with a sparse epibenthic fauna (including anemones, sea stars, soft corals, crabs, shrimp and sea urchins) and an infaunal community dominated by polychaetes and crustaceans. This survey found no unique communities or communities of particular regional significance (RPS, 2011a). Similarly, a seabed survey at the Van Gogh field has revealed a flat substrate comprising mud and silts sediments with sparse epifauna (including sponges, echinoderms and crustaceans) and an infaunal community comprising mainly polychaetes and crustaceans (Apache, 2009). The discharge of PFW as a contingency event may result in contaminants settling out of the PFW plume in surface waters onto the seabed over an area larger than the Operational Area, however settlement and impacts to seabed organisms are expected to be negligible based on predicted seabed loadings.

The depth of the Operational Area (~340-400 m) precludes the existence of benthic primary producers (i.e. photosynthetic organisms including hard corals, seagrasses and macroalgae), which are typical of shallower

coastal areas, as seabed light availability at these depths is insufficient to support photosynthesis. Only unplanned events (i.e. accidental oil spills) could potentially impact these habitats.

Table 4-1: Summary of environmental values and sensitivities for habitats that may be impacted by the activity

Habitats	Environmental value	Sensitivities within the Operational Area
Soft sediments and benthic fauna	Unconsolidated sediments ranging from sand/gravel to silt that supports benthic infauna consisting predominantly of mobile burrowing species that include molluscs, crustaceans (crabs, shrimps and smaller related species), polychaetes, sipunculid and platyhelminth worms, asteroids (sea stars), echinoids (sea urchins) and other small animals. Biological activity occurs throughout the year.	**Yes –** gently sloping subtidal soft sediment (mud/silt) in 340-400 m is the dominant habitat that could be impacted by some planned and unplanned events
Hard coral habitat	Food and habitat for marine organisms; integral source of carbonate sediments; large component of primary productivity and habitat to regional marine ecology Peak coral spawning occurs March–April Coral spawning also occurs October–November	**No** – these habitats do not occur within the Operational Area but may be impacted by unplanned events (i.e. oil spills)
Macroalgae beds	Primary producers; dugong and turtle feeding habitat; support a diverse and abundant fauna of small invertebrates that are the principal food source for many inshore tropical fish species Produce reproductive structures and then senesce each winter (May–September)	
Seagrasses meadows	Primary producers; dugong feeding habitat Throughout the year they are growing or shedding fronds	
Hard substrates and epiflora/ fauna	Support higher diversity of epifauna than soft sediment habitats and provide surfaces for attachment of fauna (e.g. hard coral, soft corals, sponges) and macroalgae	
Mangroves	A common primary producer habitat along shorelines of the Pilbara mainland. Important habitat for birds, molluscs, crustaceans and juvenile fish. Important for shoreline stabilisation and nutrient recycling. Mangroves are highly susceptible to oil exposure; lighter oils are more acutely toxic to mangroves than are heavier oils (increased weathering generally lowers oil toxicity).	
Sandy beaches	Shorebird foraging/ breeding habitat; turtle nesting habitat Turtle nesting September to March; hatchling emergence November to April	
Mud/sand flats	Support a diverse assemblage of vertebrates and invertebrates, macroalgae	

Habitats	Environmental value	Sensitivities within the Operational Area
	and seagrass Biological activity occurs throughout the year. Can be important for shorebirds and waders including migratory species.	
Rocky shorelines	Foraging area for shorebirds. Invertebrates found in the vertical splash zone; roosting areas for seabirds Biological activity occurs throughout the year	

4.2.2 Matters protected under the EPBC Act

Two world heritage properties, The Ningaloo Coast and Shark Bay, overlap areas within which impacts from accidental hydrocarbon spills could occur, or have shorelines that may be impacted from hydrocarbon spill scenarios based on spill modelling (refer **Table 4-2**).

Four National Heritage Places overlap one or more areas of potential impact from planned or unplanned events, or have shorelines that could be contacted by oil based on results from spill modelling. These are the Ningaloo Coast and Shark Bay, the HMAS Sydney II and HSK Kormoran Shipwreck Sites and the Dirk Hartog Landing Site 1616 – Cape Inscription Area (refer **Table 4-2**).

One Commonwealth Reserve was identified from the EPBC Act Protected Matters search tool, the Ningaloo Marine Reserve. However, an additional three reserves (Gascoyne, Carnarvon Canyon and Shark bay) have been identified from overlaying the areas of potential impact on current known Commonwealth Marine Reserves. Two State marine reserves, Muiron Islands Marine Management Area and Ningaloo Marine park, have been identified within the areas potentially impacted by planned or unplanned events, or which could have oil accumulating on shorelines (refer **Table 4-2**).

Five marine key ecological features (KEFs) of the North-west Marine Region have boundaries that overlap areas that may be impacted by planned or unplanned events. These KEFs are considered to be of regional importance for either the region's biodiversity or ecosystem function and integrity, the include: Ancient coastline at 125 m depth contour, Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula, Commonwealth waters adjacent to Ningaloo Reef, Exmouth Plateau and Continental Slope Demersal Fish Communities (refer **Table 4-2**).

A search of the EPBC Act Protected Matters Database on 18th July 2013 identified 26 marine or coastal species listed as threatened (endangered or vulnerable) under the EPBC Act that could occur within the area potentially impacted by planned or unplanned events. The search identified 44 marine or coastal species listed as migratory, 22 of these are also listed as threatened (**Table 4-3**). No listed threatened ecological communities were identified within the based on the EPBC Protected Matters Database search.

4.3 Socio-economic environment

Socio-economic activities that may occur within the Operational Area and surrounds include commercial fishing, oil and gas exploration and production; and to a lesser extent, recreational fishing and tourism.

Local residents seeking aquatic recreation such as boating, diving and fishing use the coast and islands of the Exmouth Gulf, such as the Muiron Islands and Sunday Island. The deep open waters of the Commonwealth permit support limited recreational or tourism activity.

Offshore and coastal waters in the North-west Marine Region support a valuable and diverse commercial fishing industry. However, there is expected to be limited fishing effort in the vicinity of the Operational Area given the depth of water (340-400 m) and benthic habitat (bare sediments)(refer **Table 4-4**).

Commonwealth fisheries, such as the Western Tuna and Billfish Fishery (WTBF), Southern Bluefin Tuna Fishery (SBFTF) and Western Skipjack Tuna Fishery (WSTF), although licensed to fish within the Operational Area have had no recent fishing effort reported (AFMA, 2011) (refer **Table 4-4**). The North West Slope Trawl Fishery (NWSTF) has no current effort in the Operational Area and limited effort in the area potentially impacted by planned or unplanned events (refer **Table 4-4**).

There is a shipping route heading northeast approximately 40 km to the west of the FPSO location however, a relatively small number of vessels use this (AEL, 2010; Woodside 2006).

The airspace above the proposed activity location lies within a designated military exercise area. When activated by a Notice to Airmen (NOTAM), the restricted airspace can operate down to sea level.

The Operational Area and surrounding waters are predominantly used for petroleum exploration and development. The nearest FPSO is the Woodside Vincent Development (in production licence WA-28-L).

Four existing FPSO developments are currently operating in the region besides the Ningaloo Vision:

- Vincent Development (Maersk Ngujima-Yin FPSO) in WA-28-L, approximately 4 km south of the Operational Area;
- Pyrenees Development (Pyrenees Venture FPSO) in WA-42-L, approximately 13 km south east of the Operational Area;
- Enfield Development (Nganhurra FPSO) in WA-28-L, approximately 12 km south west of the Operational Area; and
- Stybarrow Development (Stybarrow Venture MV16 FPSO) in WA-32-L, approximately 28 km south west of the Operational Area.

In addition to the FPSOs and in close proximity to the Operational Area the BHPBP operated Macedon Gas Development, including an offshore pipeline, is located ~20 km south east of the Ningaloo Vision Development at its closest point.

Table 4-2: Area protected under the EPBC Act

Protected Area	Environmental value	Sensitivities within the Operational Area
World Heritage Areas		
The Ningaloo Coast	Extensive fringing reef and lagoonal system. Supports high diversity of corals, molluscs, fish, crustaceans and sponges. Important habitat for protected and iconic turtles (foraging and nesting), whales (migrating and resting) and whale sharks (feeding aggregations).	**No** – these areas do not occur within the Operational Area and will not be impacted by PFW discharges extending outside the Operational Area but may be impacted by unplanned events (i.e. oil spills)
Shark Bay	Shark Bay contains vast seagrass beds, which are the largest (4,800 km^2) and most species-rich in the world and a globally significant dugong population (estimated at 11,000). Shark Bay also has a strong salinity gradient across inner waters which support distinct flora and fauna assemblages including stromatolites. Dirk Hartog Island supports the largest breeding population of loggerhead turtles in Australia.	
National Heritage Properties		
HMAS Sydney II and HSK Kormoran Shipwreck Sites	The historic shipwrecks of the HMAS Sydney II and HSK Kormoran lay approximately 290 kilometres WSW of Carnarvon and 211 kilometres off the coast of Western Australia. These vessels were lost during a battle in World War II and represent an important moment in Australia's history.	**No** – these areas do not occur within the Operational Area and will not be impacted by PFW discharges extending outside the Operational Area but may be impacted by unplanned events (i.e. oil spills)
Dirk Hartog Landing Site 1616 – Cape Inscription Area	Cape Inscription is the site of the earliest known landings of Europeans on the western coast of the Australian continent. At the northernmost end of the Cape navigators, starting with Dirk Hartog in 1616, hammered posts with their memorials attached into a crack in the rock. The posts still remain at the site.	
Commonwealth Marine Reserves		
Gascoyne Marine Reserve	Contains important foraging areas for seabirds, hawksbill and flatback turtles and whale sharks. Includes seafloor features including canyon, terrace, ridge, knolls, deep hole/valley and continental rise and provides protection for sponge gardens in the SW of the reserve.	**No** – these areas do not occur within the Operational Area and will not be impacted by PFW discharges extending outside the Operational Area but may be impacted by unplanned events (i.e. oil spills)
Carnarvon Canyon Marine Reserve	Contains the whole of the Carnarvon Canyon - and provides a	

Protected Area	Environmental value	Sensitivities within the Operational Area
	wide range of habitats for benthic and demersal species.	
Ningaloo Marine Reserve	Values in Commonwealth waters are around feeding, migrating and aggregating areas for turtles, whales and whale sharks as well as diverse subtidal benthic habitats.	
Shark Bay Marine Reserve	Contains foraging areas adjacent to important breeding areas for several species of migratory seabirds. Adjacent to largest nesting area for loggerhead turtles–the in Australia on Dirk Hartog Island. The reserve also provides for connectivity between the inshore waters of the Shark Bay World Heritage Area and the deeper waters of the area.	
State Marine Reserves		
Ningaloo Marine Park	Extensive fringing reef and lagoonal system. Supports high diversity of corals, molluscs, fish, crustaceans and sponges. Important habitat for protected and iconic turtles (foraging and nesting), whales (migrating and resting) and whale sharks (feeding aggregations) as well as sea and shorebirds.	**No** – these areas do not occur within the Operational Area and will not be impacted by PFW discharges extending outside the Operational Area but may be impacted by unplanned events (i.e. oil spills)
Muiron Island Marine Management Area	Adjacent to Ningaloo Marine Park around Muiron Island. Regionally significant loggerhead turtle nesting beaches. Contains coral reef and macroalgae habitat.	
Key Ecological Features		
Ancient coastline at 125 m depth contour	Where the ancient submerged coastline provides areas of hard substrate it may contribute to higher diversity and enhanced species richness relative to soft sediment habitat. May facilitate increased availability of nutrients in particular locations off the Pilbara coast. This enhanced productivity may attract opportunistic feeding by larger marine life including humpback whales, whale sharks and large pelagic fish.	**No** – these areas do not occur within the Operational Area and will not be impacted by PFW discharges extending outside the Operational Area but may be impacted by unplanned events (i.e. oil spills)
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	Believed to be associated with upwelling. The upwelling zones at the canyon heads are sites of species aggregations such as sweetlip emperor fish. The soft bottom habitats within the canyons themselves are likely to support important assemblages of epibenthic species.	
Commonwealth waters adjacent to Ningaloo	Sensitivities as for Ningaloo Commonwealth Marine Reserve (above)	

Protected Area	Environmental value	Sensitivities within the Operational Area
Reef		
Exmouth Plateau	Plateau is thought to be dotted with numerous pinnacles. It is an important geomorphic feature that modifies the flow of deep waters.	
Continental Slope Demersal Fish Communities	High endemism and diversity of demersal fish species	**Yes –** this feature overlaps the Operational Area and there is potential for impact from settlement of PFW contaminants outside of Operational Area also. Entrained oil from oil spills could contact demersal fish communities as well as their eggs and larvae. The Operational Area comprises flat sand habitat and is unlikely to have natural features that aggregate fishes such as high relief rocky reef which provide greater feeding and sheltering opportunities than bare sand.

Table 4-3: EPBC Act listed threatened and migratory marine/coastal species

Group	Common Name	Scientific Name	EPBC Act– Status
Fish	Whale shark	*Rhincodon typus*	Threatened – 'Vulnerable', Migratory
	Grey nurse shark (west coast population)	*Carcharias taurus*	Threatened – 'Vulnerable'
	Great white shark	*Carcharodon carcharias*	Threatened – 'Vulnerable', Migratory
	Dwarf sawfish, Queensland sawfish	*Pristis clavata*	Threatened – 'Vulnerable'
	Shortfin mako	*Isurus oxyrinchus*	Migratory
	Longfin mako	*Isurus paucus*	Migratory
	Porbeagle, Mackerel Shark	*Lamna nasus*	Migratory
Marine Mammals	Humpback whale	*Megaptera novaeangliae*	Threatened – 'Vulnerable', Migratory
	Blue whale	*Balaenoptera musculus*	Threatened – 'Endangered', Migratory
	Fin whale	*Balaenoptera physalus*	Threatened – 'Vulnerable', Migratory
	Southern right whale	*Eubalaena australis*	Threatened – 'Endangered, Migratory
	Sei whale	*Balaenoptera borealis*	Threatened – 'Vulnerable', Migratory
	Australian Sea-lion	*Neophoca cinerea*	Threatened – 'Vulnerable'
	Antarctic minke whale	*Balaenoptera bonaerensis*	Migratory
	Bryde's whale	*Balaenoptera edeni*	Migratory
	Pygmy right whale	*Caperea marginata*	Migratory
	Dusky dolphin	*Lagenorhynchus obscurus*	Migratory
	Killer whale	*Orcinus orca*	Migratory
	Sperm whale	*Physeter macrocephalus*	Migratory
	Indo-Pacific humpback dolphin	*Sousa chinensis*	Migratory
	Spotted bottlenose dolphin (Arafura/ Timor Sea Populations)	*Tursiops aduncus*	Migratory
	Dugong	*Dugong dugon*	Migratory
Marine Reptiles	Loggerhead turtle	*Caretta caretta*	Threatened – 'Endangered, Migratory
	Green turtle	*Chelonia mydas*	Threatened – 'Vulnerable', Migratory
	Leatherback turtle	*Dermochelys coriacea*	Threatened – 'Endangered, Migratory
	Hawksbill turtle	*Eretmochelys imbricata*	Threatened – 'Vulnerable', Migratory
	Flatback turtle	*Natator depressus*	Threatened – 'Vulnerable', Migratory
	Short-nosed seasnake	*Aipysurus apraefrontalis*	Threatened – 'Critically endangered'
Birds	Australian lesser noddy	*Anous tenuirostris melanops*	Threatened – 'Vulnerable'
	Wandering albatross	*Diomedea exulans* (sensu lato)	Threatened – 'Vulnerable', Migratory

Group	Common Name	Scientific Name	EPBC Act– Status
	Indian yellow-nosed albatross	*Thalassarche carteri*	Threatened – 'Vulnerable', Migratory
	Shy albatross, Tasmanian shy albatross	*Thalassarche cauta cauta*	Threatened – 'Vulnerable', Migratory
	Black-browed albatross	*Thalassarche melanophris*	Threatened – 'Vulnerable', Migratory
	Northern giant-petrel	*Macronectes halli*	Threatened – 'Vulnerable', Migratory
	Soft-plumaged petrel	*Pterodroma mollis*	Threatened – 'Vulnerable'
	Amsterdam albatross	*Diomedea exulans amsterdamensis*	Threatened – 'Endangered', Migratory
	Tristan albatross	*Diomedea exulans exulans*	Threatened – 'Endangered', Migratory
	Southern giant-petrel	*Macronectes giganteus*	Threatened – 'Endangered', Migratory
	Fork-tailed swift	*Apus pacificus*	Migratory
	White-tailed tropicbird	*Phaethon lepturus*	Migratory
	Flesh-footed shearwater, Fleshy-footed shearwater	*Puffinus carneipes*	Migratory
	Little tern	*Sterna albifrons*	Migratory
	Bridled tern	*Sterna anaethetus*	Migratory
	Lesser crested tern	*Sterna bengalensis*	Migratory
	Caspian tern	*Sterna caspia*	Migratory
	Roseate tern	*Sterna dougallii*	Migratory
	Great egret, White egret	*Ardea alba*	Migratory
	Cattle egret	*Ardea ibis*	Migratory
	Oriental plover, Oriental dotterel	*Charadrius veredus*	Migratory
	Oriental pratincole	*Glareola maldivarum*	Migratory
	White-bellied sea eagle	*Haliaeetus leucogaster*	Migratory
	Rainbow bee-eater	*Merops ornatus*	Migratory

Table 4-4: Commercial fisheries

Fishery	Target Species	Fishing Method and Area
Commonwealth-managed Fisheries		
North West Slope Trawl	Scampi (crayfish): velvet scampi (*Metanephrops velutinus*) and boschmai scampi (*Metanephrops boschmai*). Deepwater prawns (penaeid and carid): pink prawn (*Parapenaeus longirostris*), red prawn (*Aristaeomorpha foliacea*), striped prawn (*Aristeus virilis*), giant scarlet prawn (*Aristaeopsis edwardsiana*), red carid prawn (*Heterocarpus woodmasoni*) and white carid prawn (*Heterocarpus sibogae*).	Demersal trawl seaward of the 200 m isobath, but no current effort in vicinity of the Operational Area and limited effort within ZPI.
Western Deepwater Trawl	Deepwater bugs and ruby snapper are the target species.	Demersal trawl seaward of the 200 m isobath, but fishing restricted in vicinity of the Operational Area and limited effort within ZPI.
Western Skipjack	Skipjack tuna (*Katsuwonus pelamis*) is the only target species. Landings of species other than skipjack (may include bigeye (*Thunnus obesus*), and yellowfin tuna (*T. albacares*), frigate mackerel (*Auxis thazard*), sharks, mahi mahi, rays and marlins are believed to be much less than 2% of the total landings.	Purse seine November to June, but no current effort on the NWS.
Western Tuna and Billfish	Broadbill swordfish (*Xiphias gladius*), yellowfin tuna, bigeye tuna, albacore tuna (*Thunnus alalunga*) and longtail tuna (*T. tonggol*).	Pelagic longline year round, but no current effort on the NWS.
Southern Bluefin Tuna	Southern bluefin tuna (*Thunnus maccoyii*).	Purse seine vessels primarily in Great Australian Bight year round and longline off southern NSW in winter. No current effort on the NWS.
State-managed Fisheries		
Onslow Prawn Managed Fishery	Western king prawn (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*) and endeavour prawns (*Metapenaeus* spp.)	Otter trawls used within the boundaries of the OPMF being 'all the Western Australian waters between the Exmouth Prawn Fishery and the Nickol Bay prawn fishery east of 114°39.9' on the landward side of the 200 m depth isobaths. No effort in vicinity of the Operational Area due to offshore location and depth of these areas (>300 m)
Mackerel Managed Fishery	Spanish and grey mackerel	Trolling or handline year round in all waters to the

Fishery	Target Species	Fishing Method and Area
		200 nautical mile AFZ between 114° E to 121°. Fishing effort recorded within ZPI for Area 2 (Pilbara). No effort in the vicinity of the Operational Area due to offshore location and depth of these areas (>300 m)
Pilbara Demersal Scalefish Fishery (Line, Trawl and Trap)	Variety of demersal scalefish including goldband snapper (*Pristipomoides multidens*), red emperor (*Lutjanus sebae*) and bluespotted emperor (*Lethrinus punctulatus*).	Demersal trawl and trap in various zones and operates year round. No fishing in the vicinity of the Operational Area. Northern portion of ZPI overlies both trawl and trap areas.
Pearl Oyster Managed Fishery	Silver-lipped pearl oyster (*Pinctada maxima*)	Drift diving restricted to shallow diveable depths and there has been no fishing in Zone 1 since 2008. Therefore no fishing in the vicinity of the Operational Area
WA North Coast Shark Fishery	Sandbar (*Carcharhinus plumbeus*), blacktip (*Carcharhinus* spp.), tiger (*Galeocerdo cuvier*) and lemon (*Negaprion acutidens*) sharks	Area between North West Cape and a line of longitude at 120° E and all waters south of latitude 18° S has been closed indefinitely to protect shark stocks.
Pilbara Developing Crab Fishery	Blue swimmer crab (*Portunus armatus*)	Hourglass traps used in inshore waters from Onslow through to Port Hedland with most commercial and activity occurring in and around Nickol Bay. Therefore no fishing in the vicinity of the Operational Area
Exmouth Gulf Prawn Fishery	Target western king prawns (*Penaeus latisulcatus*), brown tiger prawns (*Penaeus esculentus*), endeavour prawns (*Metapenaeus* spp.) and banana prawns (*Penaeus merguiensis*).	Otter trawls used within Exmouth Gulf. Therefore no fishing in the vicinity of the Operational Area
Gascoyne Demersal Scalefish Fishery	A range of demersal species including pink snapper (*Pagrus auratus*), goldband snapper (*Pristipomoides* spp., mainly *P. multidens*), red emperor (*Lutjanus sebae*), emperors (Lethrinidae, includes spangled emperor, *Lethrinus nebulosus*, and redthroat emperor, *L. miniatus*), cods (Serranidae), ruby snapper (*Etelis carbunculus*), pearl perch (*Glaucosoma*	The GDSF licensed vessels fish throughout the year with mechanised handlines in the waters of the Indian Ocean and Shark Bay between latitudes 23°07'30"S and 26°30'S. Therefore no fishing in the vicinity of the

Fishery	Target Species	Fishing Method and Area
	burgeri), mulloway (*Argyrosomus japonicus*), amberjack (*Seriola dumerili*) and trevallies (Carangidae).	Operational Area
Roe's Abalone	Western Australian Roe's abalone (*Haliotis roei*)	Dive and wade fishery, operating in shallow coastal waters along WA's western and southern coasts. Area 8 (north of Moore River) within ZPI was closed indefinitely for the 2011/12 season and beyond. Therefore no fishing in the vicinity of the Operational Area
Shark Bay Prawn and Scallop Managed Fisheries	The Shark Bay Prawn Managed Fishery targets the western king prawn (*Penaeus latisulcatus*) and brown tiger prawn (*Penaeus esculentus*) and takes a variety of smaller prawn species including endeavour prawns (*Metapenaeus* spp.) and coral prawns (various species). The Shark Bay Scallop Managed Fishery targets the saucer scallop (*Amusium balloti*).	Both fisheries utilise low-opening otter trawls within Shark Bay waters. Historical trawl areas are inshore of the modelled ZPIs. Therefore no fishing in the vicinity of the Operational Area
West Coast Rock Lobster Managed Fishery	Western rock lobster (*Panulirus cygnus*)	Baited pots fished along the west coast of Australia between Latitudes 21°44´ to 34°24´ S. Therefore no fishing in the vicinity of the Operational Area
Beche-de-mer Managed Fishery	Sandfish (*Holothuria scabra*) and deepwater redfish (*Actinopyga echinites*).	Hand-harvest fishery, animals caught principally by diving (restricted to diving depths) and a smaller amount by wading. Therefore no fishing in the vicinity of the Operational Area
Marine Aquarium Fish Managed Fishery	Fish, coral, algae, live rock	Dive based fishery operating all year throughout WA waters, but restricted by diving depths. Therefore no fishing in the vicinity of the Operational Area
West Coast Deep Sea Crab (Interim) Managed Fishery	Crystal (Snow) crabs (*Chaceon albus*), Giant (King) crabs (*Pseudocarcinus gigas*) and Champagne (Spiny) crabs (*Hypothalassia acerba*)	Baited pots in waters lying north of latitude 34° 24' S (Cape Leeuwin) and west of the Northern Territory border on the seaward side of the 150 m isobath out to the extent of the Australian Fishing Zone, mostly in 500 to 800 m of water. Year round. Fishing unlikely in the vicinity of the Operational Area

Fishery	Target Species	Fishing Method and Area
Specimen Shell Managed Fishery	Shells (cowries, cones)	Dive based fishery operating all year throughout WA waters, but restricted by diving depths. Therefore no fishing in the vicinity of the Operational Area

5. ENVIRONMENTAL HAZARDS AND CONTROLS

The EP identifies all hazards (planned and unplanned events) that will or could potentially result in an environmental impact from the proposed activities (both routine and non-routine activities). The EP identifies the controls that will be used to reduce impacts and the risk of unplanned impacts to as low as reasonably practicable (ALARP) and to an acceptable level. Hazard identification (HAZID) workshops have been used to capture relevant expertise within Apache and to identify impacts, risks and appropriate management controls for the activity.

The environmental impacts and risks associated with the Ningaloo Vision Operations have been assessed using the methods consistent with HB 203:2012 and AS/NZS ISO 31,000:2009. The key steps of the impact and risk assessment are:

1. Define the activity and associated environmental hazards (planned and unplanned events);
2. Identify the environmental values and sensitive receptors that will be impacted or at risk of impact from planned and unplanned events within the Operation Area and any larger area that could be affected (i.e. the environmental context of the activity);
3. Define acceptable levels for impacts and risks arising from planned and unplanned events, respectively;
4. Determine the type of environmental impact that will or may arise from each of the hazards (planned and unplanned events);
5. Determine the inherent (pre-treatment) environmental consequence level (severity) for planned events and the inherent (pre-treatment) risk (consequence level x likelihood) for unplanned events. The inherent consequence or risk level is based on lack of (or failure of) control measures. The likelihood of event occurrence and consequence is determined by reference to industry statistics and/or professional judgment;
6. Identify control measures and assess the residual (post-treatment) consequence level or risk level after the identified control measures are adopted;
7. With controls implemented, establish if the residual impact or risk is reduced to as low as reasonably practicable (ALARP). If not, review the activity and/or additional control measures until the residual risk can be demonstrated to be ALARP by reducing the consequence and/or likelihood; and
8. Determine whether the environmental impact or the risk of impact is acceptable based on previously determined acceptable levels.

The impact and risk assessment identified seven planned events and associated impacts arising from operational activities, and a further eight unplanned events with an associated risk of an impact occurring. These environmental hazards and control measures to be applied are detailed in **Table 5-1** and **Table 5-2**. Commitments arising from these control measures will be used to assess Apache's environmental performance throughout the operational activities.

Table 5-1: Summary of hazards (planned events) and mitigation controls

Hazard	Mitigation Controls
Disturbance to the seabed and marine environment	• Vessels undertaking subsea inspection activities will be 'in Class' dynamic positioning (DP2) vessels. • A risk-based assessment is used to determine the frequency of subsea inspections • No anchoring activities take place in the Operational Area, by support vessels or offtake tankers • FPSO and support vessel lifting equipment will be tested, certified and maintained in a lifting equipment register • The paint coating on the FPSO and DTM follows the *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* requirements for not using organotin compounds in the anti-fouling paint system • Any FPSO in-water cleaning will be performed in line with *Anti-fouling and In-water Cleaning Guidelines* (DAFF, 2013): • Lifting personnel have all required certifications and required levels of competency
Marine fauna disturbance from vessel and helicopter movements	• Support vessel masters and crew are to abide by EPBC conditions of approval for Van Gogh and Part 8 of the *EPBC Act Regulation 2000* with respect to whale shark and cetacean interactions. • Helicopters will only flight during daylight hours, unless required in an emergency. • Except for landing and take offs, helicopters must not be operated at a height lower than 1650 feet or within a horizontal distance of 500 metres from a cetacean. • Death or injury to EPBC Act listed marine fauna (including cetaceans or whale sharks) recorded in an incident report from operational activities within the Operational Area
Artificial lighting attracting marine fauna	• Floodlights on the FPSO use Sodium vapour lights • The maximum flaring volume targets for the FPSO will be adhered to. • Aft FPSO mooring light is turned inboard when not required for offloading crude • External lights on FPSO are shielded where practicable and consistent with safety requirements to reduce overboard light spill
Acoustic disturbance to marine fauna from FPSO, support vessels and helicopter operations	• FPSO computerised maintenance management system (CMMS) includes testing and maintenance of noise generating equipment in accordance with manufacturer's specifications • Supply/maintenance vessel engines maintained as per vessel's planned maintenance system • Helicopter engines maintained as per the helicopter's planned maintenance system • Support vessel masters and crew are to abide by EPBC conditions of approval for Van Gogh and Part 8 of the EPBC 2000 Regulation with respect to whale shark and cetacean interactions. • Except for landing and take offs, helicopters must not be operated at a height lower than 1650 feet or within a horizontal distance of 500 metres from a cetacean. • Maintenance activities that will generate additional underwater noise (e.g. from an activity such as sidescan sonar, sub bottom profiling) are risk assessed and managed in line with Part 2 Div. 2.1 of *OPPGS(E) Regulations 2009* prior to activity being carried out

Hazard	Mitigation Controls
Reduction of water quality and impacts to sensitive receptors from planned discharges	• Sewage discharge and FPSO/support vessel sewage systems is compliant with relevant MARPOL and Marine Order requirements. • Sewage systems, food macerators, fresh water makers, oily water separators and cooling water systems (including boilers) on vessels are maintained as per the vessels planned maintenance system • Vessel food waste discharge, recording and macerators are compliant with relevant MARPOL and Marine Order requirements • Scale inhibitors used in fresh water systems and boiler water treatment chemicals are deemed to have low environmental risk under Apache's Operations Chemical Selection Evaluation and Approval Procedure • Oily water discharge and oily water separation equipment is compliant with relevant MARPOL and Marine Order requirements. • On the FPSO, oily water is directed to the slops tank system and not discharged overboard • For the FPSO and support vessels, secondary containment is present around all rotating equipment, equipment containing hydrocarbon products (e.g. refuelling points) and chemical/hydrocarbon storage areas • FPSO drainage and bunding systems are regularly inspected and maintained as per the FPSO computerised maintenance management system (CMMS). • Main deck on the FPSO is totally enclosed by coaming (also called kick-boarding or freeboard), and scupper plugs have been fitted at drainage points and kept closed during normal operations (except during heavy rainfall events) • All hazardous materials on FPSO are labelled, securely stored and have a current Material Safety Data Sheet (MSDS) is available near storage location • Harmful substances transported by support vessels in packaged form, are marked, labelled and stowed in accordance with MARPOL requirements • Spill kits and equipment are located near high risk spill areas on the FPSO/support vessels and inspected regularly • Continuous cooling water temperatures onboard the FPSO are recorded daily and turbo alternator condenser overboard discharge triggers alarm when temperature exceeds 50°C • Tankers and the FPSO have segregated ballast tanks in line with MARPOL requirements • Only water/glycol based subsea hydraulic control fluid is used for control of subsea valves on Van Gogh, Coniston and Novara wells • Any proposed new subsea hydraulic fluids will be risk assessed using Apache's Operations Chemical Selection Evaluation and Approval Procedure • No Produced Formation Water (PFW) is disposed overboard • During process upset where PFW reinjection is not possible, PFW will be hold in slop tanks on FPSO prior to reinjection.
Reduction of air quality from air emissions during normal operations	• NOx and SOx emission levels for applicable vessels meet MARPOL requirements • All engines, compressors and machinery (including burners) on the FPSO and support vessels are maintained on a regular basis as outlined in the planned maintenance system • Produced gas is re-injected unless gas re-injection system is out of service • Primary fuel used on FPSO is produced gas

Hazard	Mitigation Controls
	• Diesel with sulphur content of 3.5% m/m is the only fuel oil used on FPSO • Cargo tanks are blanketed with inert gas
Loss of access to the area by other users of the sea or of visual amenity due to the presence of the FPSO and its support activities	• The Ningaloo Vision FPSO is charted on Australian Hydrographic Service (AHS) nautical charts • External stakeholder consultation continues throughout the production phase of the Ningaloo Vision Operations • Any external stakeholder complaints regarding operational activities will be reported and managed • FPSO and support vessel navigation equipment is compliant with relevant SOLAS and Marine Order requirements • Visual bridge-watch on all vessels 24 hours per day (during marine mode only) • Crew undertaking vessel bridge watch are qualified as per applicable STWC and Marine Order requirements

Impacts to water column and seabed organisms from the contingency discharge of produced formation water	• PFW will not be discharged overboard for a continuous or cumulative period that is greater than 4 months (120 days), or discharged over a volume of 1, 382, 400 m^3 within any 12-month period.
	• PFW will be diverted to the slops tank until filled in the event that PFW cannot be re-injected.
	• PFW will only be discharged where oil in water (OIW) concentration is <30 mg/L and where the slops tank is not available for receiving PFW
	• OIW concentration of PFW will be continuously monitored by an inline OIW analyser during discharges to the marine environment. The analyser will be:
	  ○ Fitted with an alarm that sounds if OIW concentration is >30 mg/L; and
	  ○ Displayed in the NVFPSO control room
	• Manual laboratory sampling will be undertaken of PFW to confirm OIW concentrations. Two (2) samples will be taken per 24hrs
	• Produced water injection system, ancillary power generation equipment, produced water treatment system and OIW monitoring equipment is maintained in accordance with the CMMS
	• Monthly accuracy calibrations of FPSO spectrophotometer are performed by NV chemist
	• FPSO spectrophotometer calibrated and OIW standard prepared biannually by independent chemist.
	• Production chemicals are rated and selected according to AEL's Operations Chemical Selection Evaluation and Approval Procedure (EA-91-II-1001).
	• Optimal dosages (i.e. not too low or too high) of production chemicals are maintained by sampling and analysis of production equipment at a frequency defined in Frequency of Onsite Testing (NV-22-IG-10027)
	• PFW will be characterised through an independent laboratory analysis, testing will follow the following schedule:
	  ○ Tests will be conducted at a minimum biannually, regardless of whether any PFW has been discharged.
	  ○ Tests will also be done for every contingency discharge unless one has been done within the previous 30 days.
	  ○ If a PFW discharge occurs for a period of at least a month then test(s) will occur monthly until PFW discharge stops.
	• For PFW discharges >96 hrs duration or over an equivalent volume of 92, 160 m^3, a Microtox test of the PFW will be conducted.
	• If a new production chemical is added or the concentration of a chemical parameter increases >25% above a historical maximum a Microtox

Hazard	Mitigation Controls
	assay of the PFW will be performed. • A Sediment Quality Validation Monitoring Study will be carried out within one year of the first contingency PFW discharge • For every PFW discharge to the marine environment a predicted contaminant loading concentration at the seabed will be determined • If predicted contaminant concentrations on the seabed exceed the corresponding trigger levels Sediment Quality Triggered Monitoring will be undertaken. • If actual contaminant concentrations in sediments have exceeded trigger levels then subsequent studies/actions will be undertaken • The Apache environmental management of change procedure (EA-91-IQ-10001), to re-evaluate impacts from the contingent discharge of PFW, will be initiated by the following events: o Addition of a new reservoir; or o Increase in PFW toxicity determined from Microtox assay results; or o An increase in the stated maximum PFW production rate of 960 m^3/hr; or o Following completion of the Sediment Quality Validation Monitoring Study; or o A measured exceedance of a contaminant of concern trigger. • If/when a new reservoir is added, ecotoxicity testing and model re-evaluation, will be undertaken as part of the MOC process. • Personnel operating, maintaining and using equipment associated with the re-injection of PFW have completed competency based training assessment (CBTA) for this aspect • WA Department of Fisheries notified within 24 hours of discharging PFW to the marine environment, as requested in response to stakeholder consultation. • If PFW discharge has occurred, the following quarterly HSE audit will prioritise assessment of performance against PFW contingency discharge management controls and performance standards.

Table 5-2: Summary of hazards (unplanned events) and prevention/mitigation controls

Hazard	Prevention & Mitigation Controls
Accidental disposal of non-hazardous solid wastes to the marine environment	• Waste segregation is in place onboard the FPSO and supply/maintenance vessels • All bins (except scrap metal and wooden pallets) have covers and are kept closed • FPSO solid non-biodegradable and non-hazardous wastes are transported to shore and disposed to a licensed disposal facility • Vessels have Garbage Management Plans as required under relevant *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* /MARPOL/Marine Order requirements • An incident notification is completed for any non-hazardous wastes accidentally disposed overboard
Accidental disposal of hazardous materials to the marine environment	• All stored hazardous materials are packaged and labelled, securely stored in bunded areas and current SDS are available near storage location • All chemicals onboard vessels are listed within a chemical inventory register containing information on product name, quantity, hazard class, and storage location in line with *Work Health and Safety Regulations* (2011) • Dangerous goods / harmful substances transported in packaged form, are marked, labelled, stowed and documented in accordance with relevant MARPOL / IMDG Code / Marine Order requirements • FPSO hazardous wastes are transported to shore and disposed to a licensed disposal facility • All disposed wastes from the FPSO and support/maintenance vessels have been manifested and/or tracked with volumes/weights recorded. • Vessels have Garbage Management Plans as required under relevant *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* /MARPOL/Marine Order requirements • Offsite NORMS testing (U- and Th- series elements) of FPSO produced sands is conducted annually at a NATA accredited lab • Any NORMs contaminated waste is to be stored and disposed of as outlined in the Radiation and Naturally Occurring Radioactive Material (NORMS) Procedure and in accordance with the Apache Controlled Waste Procedures • As per Apache's Operations Chemical Selection Evaluation and Approval Procedure, chemicals selected for use on the FPSO are risk assessed to favour chemicals with low toxicity • An incident notification is completed for any hazardous material (liquid or solid) accidentally discharged overboard.
Accidental introduction of marine pests	• Vetting process for out-of-State contracted support / maintenance vessels identifies a 'low risk' of introducing marine pest species of concern into the Operational Area • FPSO manages ballast in accordance with a Ballast Water Management Plan and the Ballast Record Book is up to date • Support vessels arriving from international waters to the Operational Area will have a Ballast Water Management Plan and Ballast Water Record Book • The FPSO's internal seawater intake systems are treated via the marine growth prevention system which is maintained to prevent fouling growth within the seawater intake pipework • Marine growth removed during inspection / maintenance of FPSO internal seawater systems is not disposed to the marine environment

Hazard	Prevention & Mitigation Controls
	• No vessel hull cleaning, except that required for Class inspection of the FPSO will be carried out in the Operational Area • Inspections of in-water surfaces to assess marine 'fouling' growth thickness on the FPSO are carried out in line with CMMS • When the FPSO is within the Operational Area, an in-water cleaning self-assessment is carried out as per 'In-water Cleaning Guidelines (DAFF, 2013a) • A Biofouling Management Plan will be in place for the FPSO for management of marine pest during overseas shipyard activities • FPSO follows requirements of the Biofouling Management Plan. • The FPSO has a Biofouling Record Book including details of any in-water and dry-dock inspections and inspection / maintenance of anti-fouling systems and marine growth areas
Unplanned release of diesel	• The FPSO and cautionary zone is marked on Australian Hydrographic Service (AHS) marine charts • The FPSO is fitted with an automatic radar plotting aid (ARPA) System integrated with an Automatic Identification System (AIS), to SOLAS requirements, to identify and track collision threats • The FPSO communication and navigation equipment complies with relevant IMO requirements and is regularly tested. • Support vessel communication and navigation equipment complies with relevant IMO requirements • A procedure for support vessels entering FPSO 500 m exclusion zone is in place. • Offtake tanker will follow the procedures outlined within the Berthing and Terminal Handbook during berthing and cargo loading • Offtake tanker berthing to be coordinated by a Pilot/Mooring Master • Consultation with stakeholders including the commercial fishing industry is undertaken • Vessel hulls comply with and are surveyed as per Class requirements. • Seagoing qualifications of vessel crew comply with relevant STCW / Marine Order requirements • FPSO diesel bunkering hose has dry-break coupling • FPSO bunkering equipment including valves, tanks and connections, shutdown systems, and hoses maintained as per CMMS • All FPSO refuelling operations will comply with Ningaloo Vision Bunkering Operation Procedure • Testing of FPSO main and essential diesel engines, diesel generators, pumps, quick closing valves, and diesel oil tanks occur every 5 years • Vessels have Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plans (SMPEP) as required by MARPOL • Ningaloo Vision Operations Oil Spill Contingency Plan is located onboard the FPSO • Spill kits contents are checked as per CMMS and restocked after usage • Weekly inspection of support vessel spill kits is undertaken and recorded • Unplanned hydrocarbon release to the marine environment is reported, investigated and managed in line with Apache Hazard Reporting Incident Notification and Investigation Procedure and Environmental Reporting Procedure
Unplanned release of HFO	• Offtake tankers are double-hulled as per MARPOL and Class requirements • Other prevention and mitigation controls are include in the above (Unplanned release of diesel)

Hazard	Prevention & Mitigation Controls
Unplanned surface release of crude oil	• FPSO has double sides protecting crude oil storage tanks (as per Class requirements) • FPSO and offtake tanker hulls are inspected as required for Class certification • Offtake tanker activities and equipment will adhere to the Berthing and Terminal Handbook • FPSO will adhere to the offtake operations procedures within the Offtake Operational Procedure • FPSO Offtake hose is fitted with quick release dry-break coupling • The performance of FPSO mooring hawser, cargo system pumps and the cargo pump and piping system is regularly tested against Apache documentation. • FPSO Offtake equipment is maintained as outlined within the computerised maintenance management system (CMMS) • Dropped object protection is present at pipe racks and inert gas headers and regularly inspected • Limit switches are present on FPSO cranes to prevent lifting over process equipment • Process system vessels and process system pump are regularly inspected and assessed • Process system equipment (including vessels, piping, valves and pumps) are inspected and maintained as per the CMMS • The performance of FPSO Process System Pressure Safety Valves (PSVs), the Emergency Blowdown System, Emergency Shutdown System (ESD) and ESD valves are regularly tested against relevant Apache documentation. • ESD push buttons are available on the FPSO • A permit to work system is in place where isolation and maintenance of process system is required • Other relevant prevention and/or mitigation controls are include in the above (Unplanned release of diesel) and in **Table 5-1** (Reduction of water quality and impacts to sensitive receptors from planned discharges)
Unplanned subsea release of crude oil	• The FPSO has current Class certification • The Disconnectable Turret and Mooring (DTM) Buoy is regularly inspected and assessed • The FPSO riser system integrity and control functionality is regularly inspected/tested • A working copy of the Dis-connection Procedure is available onboard the FPSO • PTW and JSA completed for each DTM disconnection event • Vessels undertaking subsea inspection activities will in Class dynamic positioning (DP2) vessels. • Subsea production system inspection, monitoring and maintenance (IMM) conducted at a frequency determined by a risk based assessment. • The performance of ESD Valves, Subsea ESD Valves and ESD Control Logic System is regularly tested against relevant Apache documentation. • ESD pushbuttons are available on the FPSO • Ningaloo Vision Operations Oil Spill Contingency Plan is located onboard the FPSO • Other relevant prevention and/or mitigation controls are include in the above (Unplanned release of diesel) and in **Table 5-1** (Disturbance to the seabed and marine environment)

Hazard	Prevention & Mitigation Controls
Impacts from oil spill response activities	• Relief well drilling activities implemented as per approved EP for the activity • Spill response plans implemented as per the Ningaloo Vision Operations Oil Spill Contingency Plan

6. SUMMARY OF OIL SPILL RESPONSE ARRANGEMENTS

Credible hydrocarbon spill scenarios identified for the Activity are:

- Small spill of stored hydrocarbons (<4 m^3)(various lubricants, hydraulic fluids, fuels, crude oil).
- Diesel spill from support vessel/ FPSO fuel tank, diesel transfer operations or day tanks, hoses and pipework (up to 329 m^3).
- Heavy Fuel Oil (HFO) spill from offtake tanker fuel tank (up to 950 m^3).
- Crude oil release at sea surface from FPSO cargo tanks, pipework and crude oil loading operations, (up to 8630 m^3).
- Subsea crude oil release from subsea system damage or failure (up to 329 m^3).

In the unlikely event of an oil spill, response activities will be will be undertaken as per the Ningaloo Vision Operations Oil Spill Contingency Plan (Van Gogh and Coniston-Novara fields)(TV-00-RI-003/2).

Response strategies that have been identified as appropriate for the above spill scenarios are detailed within the OSCP and summarised in **Table 6-1**.

Table 6-1: Summary of applicability of Oill Spill Response strategies

OSR strategy	Activity	Applicability	Considerations
Source control	Crude offloading watch alert	✔	Applicable: Use of emergency shutdown switch, dry-break couplings on crude transfer hoses during offloading from FPSO to tanker.
	Bunded areas around machinery and engines	✔	Applicable: Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment on board the support vessels or FPSO. Bunded areas will minimise the volume of hydrocarbons escaping to marine waters.
	Refuelling: watch alert	✔	Relevant for spillage during bunkering activities.
	Production flowline isolation	✔	Applicable: Isolation of ruptured section of flowline, flow stopped or redirected. Subsea inspection and repair to follow. Preventative inspections and maintenance carried out periodically.
	Relief well	✔	Applicable: In the event of a loss of well control, information from a site assessment will be used to determine the method of source control; inject plugging fluids into a relief well and/or well intervention options.
	First response tool kit	X	Not Applicable: First response tool kit is only required when preparing a sheared well head for a Capping Stack installation, or if implementing sub-sea dispersant injection. Both are not required for a partial failure of a well to control the source. Installation of a capping stack will not occur due to the likely presence of obstructing subsea infrastructure.
	Capping stack		
	Securing cargo / trimming	✔	Applicable: In the event a vessel hydrocarbon storage tank is ruptured, cargo of the affected tank is to be secured via transfer to another storage area on-board the vessel, transfer to another vessel, or through pumping in water to affected tank to create a water cushion (tank water bottom). Trimming the vessel may also be used to avoid further damage to intact tanks. These actions will minimise the volume of fuel spilt.

OSR strategy	Activity	Applicability	Considerations
Monitor and Evaluate	Aerial, Vessel, Tracking Buoys, Trajectory Modelling	✔	Applicable: Used to monitor the dispersion of the released hydrocarbon, and to identify and report on any potential impacts to flora and fauna that may occur while the spill disperses.
Chemical Dispersants	Aerial or vessel dispersant application.	✔	Applicable: Van Gogh, Coniston and Novara Crude Oil and HFO are considered persistent hydrocarbons with a medium to low natural dispersion rate in the marine environment. Dispersant application is recommended as a beneficial option, as it has a high probability of reducing the net environmental impacts of the spill if shoreline contact is predicted. In the instance where there is a continuous subsurface release of Coniston, Novara and / or Van Gogh Crude from infrastructure failure of the subsea production system, two vessels will be immediately positioned on a permanent basis to apply dispersant to the slick as it surfaces. There will be no requirement for aerial dispersant application in this scenario due to the breaking up of oil as it surfaces, leading to small patches which are more suitable to vessels precise dispersant applications.
		X (diesel only)	Not Applicable: Marine diesel is not considered a persistent hydrocarbon, has high natural volatilisation rates and dispersion rates in the marine environment. Diesel will naturally entrain with slight water chop. Chemical dispersant application is not recommended as a beneficial option as it has a low probability of increasing the natural dispersal rate of the spill while introducing more chemicals to the marine environment. The expected thickness of the light hydrocarbons on the water surface as they disperse is not conducive to mixing chemical dispersants, thereby wasting chemicals and adding unnecessary chemicals to the water column.
	Subsea dispersant injection	**X**	Not Applicable: Will not be efficient due to the slow release rate of a loss of well control event. Effective surface response strategies negate the need to apply sub-sea dispersants to reduce impacts to ALARP.
Mechanical Dispersion	Vessel prop-washing	✔	Applicable: Diesel is a very light oil that can be easily dispersed in the water column by running vessels through the plume and using the turbulence developed by the propellers to break up the diesel slick. Once dispersed in the water column the smaller droplet sizes enhance the biodegradation process. Can be used on thin rainbow/silver break-away sheens of heavy oil releases. Not to be used in thick oil. Oils like HFO, CCO/NCO and VGCO become entrained and can eventually float back up to the surface.
In-situ burning	Controlled combustion of floating oil	**X**	Not suitable: Coniston, Novara and Van Gogh Crude oils are highly weathered in reservoir and carry a small percentage of volatile components. These light-end hydrocarbon components will volatilise to atmosphere quickly when the oil reaches the surface. The remaining weathered oils continue to emulsify quickly, producing an emulsified mixture that is not conducive to in-situ burning. In situ

OSR strategy	Activity	Applicability	Considerations
			burning is most efficient on thick layers of fresh oil with a significant percentage of volatile components, but not too volatile to cause an explosion hazard.
Containment & recovery	Booms and skimming	✔	Applicable: Effective for more persistent oils like VGCO, HFO and CCO/ NCO in reducing the net environmental impacts of the spill. The ability to contain and recover spreading oil is weather dependent. This method is not effective during moderate to high sea states.
		X (diesel only)	Not Applicable: Not very effective for diesel as it is volatile, not easy to contain and will easily spread by wind and wave action. The ability to contain and recover spreading diesel on the ocean water surface is extremely limited. Diesel has relatively low viscosity. Given their fast spreading nature, high evaporation rate and the expected moderate to high sea states of the area causing the slick to break up and disperse, this response is not considered to be effective in reducing the net environmental impacts of the spill.
Nearshore & shoreline protection and deflection	Deflection booms	✔	Applicable: Applicable if spill is predicted to impact sensitive shorelines and is visible.
Shoreline clean-up	Physical removal, surf washing, flushing, natural dispersion	✔	While diesel is unlikely to be recoverable, it will generate significant volumes of contaminated material that must be cleaned or removed as a waste. Shoreline clean-up techniques shall be assessed and deployed if they will result in net environmental benefit (as assessed through the operational NEBA).
Oiled Wildlife Response	Hazing	✔	Applicable: For marine and shoreline animals that may come in contact with the spill. Care to be taken not to drive marine animals into spill or split up the pods, schools, and flocks.
	Wildlife Husbandry	✔	Applicable: This is applicable for marine animals that are contacted by the oil to a level that can cause adverse impacts.
Type II monitoring	Water quality, plankton, marine fauna, commercial fishes, etc	✔	Applicable: Surveillance information defining the plume extent will assist in determining the extent and nature of Type II monitoring.

6.1 Net Environmental Benefit Analysis (NEBA)

During any response incident, the Incident Control Team (ICT) use the NEBA process to inform the development and refinement of Incident Action Plans (IAPs), so the most effective response strategies with the least detrimental environmental impacts can be identified, documented and executed. The Environmental Team Lead is responsible for reviewing the priority receptors identified within the EP and OPEP, and with knowledge of the fate and transport of the spill, apply the NEBA.

The application of the Operational NEBA is to:

- Identify sensitivities within the area potentially affected by a spill at that time of the year;
- Assist in prioritising and allocating resources to sensitivities with a higher ranking; and
- Assist in determining appropriate response strategies

6.2 Oil Spill Response Resources

Oil spill response equipment and resources are a combination of Apache, AMOSC, AMSA, DoT, National Plan (NatPlan), OSRL, and other operator resources available through the AMOSPlan mutual aid arrangements. Under the MOU between AMSA and Apache, AMSA will provide all resources available through NatPlan to support an Apache spill response. The DoT coordinates the State Response Team (SRT) oil spill response personnel and equipment resources. The DoT will work with Apache in an oil spill response and will define termination criteria for the shoreline operations designed to reduce the environmental impacts and risk to ALARP in State waters. Where oil contacts shorelines in Commonwealth waters, Apache will work with the Department of the Environment to establish shoreline clean-up priorities, activities and termination criteria.

In the event of an oiled wildlife response, Apache will activate the West Australian Oiled Wildlife Response Plan (WAOWRP) and work with DPaW in determining resources and capability requirements. DPaW and Industry (AMOSC) Oiled Wildlife Advisors (OWAs) ensure minimum standards for oiled wildlife response, as outlined within the WAOWRP, are met and ensure timely mobilisation of appropriate resources (equipment and personnel) through communication with the wildlife logistics team. Apache are able to access:

- AMOSC core group responders;
- DPaW staff and approved volunteers/SMEs;
- Additional local resources under current contracts and suppliers; and
- Access international support through Wildlife Response Services.

During and post-spill scientific response monitoring activities require resources external to Apache and include specialist technical capabilities. Astron Environmental Services Pty Ltd (Astron) is contracted as Apache's primary Control support agency for scientific response monitoring activities. If additional support is required, Apache has Master Service Agreements with other service providers to support scientific response monitoring activities.

7. MANAGEMENT APPROACH

The Ningaloo Vision operations will be managed in compliance with all measures and controls detailed within the EP and accepted by NOPSEMA under the OPGGS (E) Regulations, all relevant EPBC Act referral conditions, other environmental legislation and Apache's Management System (e.g. Apache Environmental Management Policy).

The objective of the EP is to ensure that all environmental impacts and risks associated with the activity are identified and assessed, and to stipulate prevention and/or mitigation controls to avoid and/or reduce any adverse impacts to the environment to ALARP and to an acceptable level.

The EP details specific performance standards associated with each control which are to be met in order to achieve the environmental performance objectives of the EP. The controls for the activity are summarised in **Section 5**. The EP also identifies the specific measurement criteria and records to be kept to demonstrate the achievement of performance standards and objectives.

The EP contains an implementation strategy which demonstrates how performance standards and objectives will be met and includes the following:

1. Details on the systems, practices and procedures to be implemented;
2. Key roles and responsibilities;
3. Training, competencies and on-going awareness;
4. Monitoring, auditing, management of non-conformance and review;
5. Incident response including an Oil Spill Contingency Plan;
6. Records Keeping;
7. Stakeholder Consultation; and
8. Details of reporting arrangement to relevant regulatory authorities with respect to recordable and reportable incidents and overall environmental performance.

7.1 Monitoring

Apache manages environmental performance of the Ningaloo Vision operations activities through an inspection and monitoring regime which includes daily, weekly and monthly monitoring. This is recorded via a number of checklist and inspection documents which are completed by the appropriate person (i.e. FPSO OIM or delegate or Support vessel master) and reviewed by the Apache HSE Manager or delegate. Issues identified by the review are attended to immediately with any required actions to address issues added to an action tracker for management and completion. The monitoring items are correlated with the risks they manage, and ensure environmental performance is being monitored to meet the requirements of this EP. Feedback from the ongoing monitoring also informs the environment plans developed for other oil and gas activities, through the risk assessment stage, and the internal review of these documents prior to submission, providing an opportunity for continuous improvement.

Monitoring of some aspects of production activities occurs daily as various metering devices are installed throughout the FPSO that provide performance monitoring data to comply with regulatory and performance reporting requirements.

Monitoring of the OIW content of PFW occurs through an installed OIW monitor that provides a continuous read-out in the control room and allows the performance of the produced water treatment system to be assessed. Manual analyses of PFW OIW content is also made twice per 24-hour period by the onboard chemist which confirms the readings provided by the OIW monitor. The continuous/daily monitoring of OIW content within PFW provides a means of monitoring the performance of the produced water treatment system. A low OIW content is desirable from both a production perspective and an environmental perspective given that reducing OIW through production separation equipment increases the proportion of oil recovered from well fluids as well as potentially reducing environmental impacts from PFW in the event that a contingency discharge to the marine environment is made.

Monitoring of production chemicals is also performed and recorded daily by the onboard chemist in order to maintain optimum levels within production equipment. Reducing the use of production chemicals may reduce the level of environmental impact if a contingency PFW discharge is made since production chemicals may contribute to the toxicity of the PFW.

Monitoring of PFW composition occurs through biannual laboratory analysis by an independent chemist and at any time a contingency discharge is made. Monitoring of PFW toxicity is undertaken during contingency discharges over 96 hours (Microtox testing), and full suite ecotoxicity testing occurs, at a minimum, when new reservoirs are brought online thereby contributing to the PFW composition. Review of PFW anlaysis results is conducted by Perth based HSE personnel and chemist.

7.2 Auditing

All support vessels will have a current (updated in the past 12 months) Oil Companies International Marine Forum (OCIMF) Offshore Vessel Inspection Database (OVID) or equivalent (e.g. An International Marine Contractors (IMCA) Common Marine Inspection Document (CMID)) prior to mobilisation.

Apache has a scheduled environmental audit program and undertakes regular audits of the FPSO and support vessels. The FPSO is audited approximately every four months. Support vessels are audited approximately every six months.

With respect to controls in place to manage contingency PFW discharges, performance standards associated with these controls will be prioritised during FPSO audits if a contingency discharge to the marine environment has occurred within the previous quarter.

Apache does not conduct physical audits of offtake tankers due to the nature of engaging offtake tankers; however, Apache ensures the tankers meet Apache and international environmental standards by ensuring offtake tankers complete a questionnaire within the Ningaloo Vision Offtake Tanker Vetting procedure (NV-91-IG-10010). This questionnaire and a current OCIMF SIRE (Ship Inspection Report) must be completed for each offtake tanker before they can enter the Operational Area. A specialist third party vessel vetting company reviews these documents to ensure that all Apache, applicable legislative and industry requirements have been met.

Audits are undertaken by Apache Environment Department personnel or their delegate and follow the requirements detailed in the Apache *Environmental Auditing and Inspection Procedure (EA-91-IG-003)*. Audits ensure environmental performance outcomes are being implemented, review their applicability and when necessary conclude with potential amendments (any potential amendments to performance outcomes on an active environmental plan would only be made post liaison and agreement with NOPSEMA and/ or DoE.

The findings, opportunities for improvement and corrective actions from the audit are formally documented in the audit report which is distributed to personnel including the Apache Operations and Production Managers, FPSO Vessel Master and support vessel masters and are entered into the Apache's online Hazard and Incident reporting program (e.g. Enablon). A copy of the audit report is kept onboard the facility/vessel for future reference.

8. STAKEHOLDER CONSULTATION

Apache recognises that its activities have the potential to impact the community and the environment, particularly in locations which feature or are near sensitive receptors, or that overlap with other economic, cultural or community uses.

To facilitate informed assessment by stakeholders of the likely potential impact of Apache's activities, Apache seeks to establish long-term and meaningful dialogue with those stakeholders who have an interest in its present and planned future activities in Australia.

To achieve this, Apache clearly articulates engagement and consultation standards, goals, and mechanisms, seeks to effectively manage change during the life of its projects and activities, and strives to continuously improve all aspects of its stakeholder engagement processes.

The identified stakeholders are commercial fishers in the region, fishing bodies, federal departments, regulators and non-government organisations. Relevant stakeholders identified for the activity are summarised in **Table 8-1**.

Table 8-1: Summary of stakeholders consulted

Group	Stakeholder
Commercial fisheries	• Australian Fisheries Management Authority (AFMA) • Department of Fisheries (DoF) • Western Australian Fishing Industry Council (WAFIC) • Commonwealth Fisheries Association (CFA) • A Raptis and Sons • Austral Fisheries • WestMore Seafoods • Shark Bay Seafoods • MG Kailis • Pearl Producers Association • State commercial fishing licence holders
Recreational fisheries	• Recfishwest • Marine Tourism WA
Marine conservation	• Department of Parks and Wildlife (DPaW)
Tourism	• Marine Tourism WA (formerly Charter Boat Association)
Shipping safety and security	• Australian Maritime Safety Authority (AMSA) • Department of Defence (DoD)
Hydrocarbon spill response	• Australian Marine Oil Spill Centre (AMOSC) • Department of Transport (DoT)
Adjacent Regulator	• Commonwealth Department of the Environment (DoE) • Department of Mines and Petroleum (DMP)
Exmouth Stakeholder Reference Group	• Cape Conservation Group • DPaW (Exmouth) • DoT (Exmouth) • Exmouth Chamber of Commerce • Exmouth District High School • Exmouth Game Fishing Club • Gascoyne Development Commission • Member of the Legislative Assembly • Ningaloo Station owners • North West Cape Exmouth Aboriginal Corporation • Shire of Exmouth Council • Toll Exmouth

The consultation methods planned for the life of *Ningaloo Vision* Operations includes consultation in accordance with regulatory guidelines (NOPSEMA), regular briefings and meetings as requested or required with stakeholders and two-way communication with Apache's Exmouth SRG, including project briefings regarding *Ningaloo Vision* Operations and other Apache projects.

Prior to the specific *Ningaloo Vision* Operations Stakeholder Information Pack distribution to stakeholders in June 2013, stakeholders have received extensive consultation relating to the Van Gogh and Coniston/ Novara Developments. This includes two information packs relating to the drilling phases of the Coniston Novara development, Phase I consulted on in September 2012 and Phase II in May 2013 and well as Coniston Construction and Installation consulted on in February 2013.

Stakeholders have received regular updates regarding the Coniston Novara Development and *Ningaloo Vision* Operations through Apache's Quarterly Project Updates. These are provided in response to stakeholder requests for a more streamlined consultation process, and include information previously requested by stakeholders.

With respect to contingency PFW discharges, Department of Fisheries (DoF) were consulted with in December 2014, and at DoF's request Apache will notify DoF whenever a contingency discharge occurs. Stakeholders were further notified in March 2015 of the mobilisation of the Ningaloo Vision to site following rectification works in Singapore.

At each contact point, stakeholders are urged to contact Apache should they require more information or have concerns with any activities showcased. While correspondence was received in response to a number of the Quarterly Updates, no specific concerns with the *Ningaloo Vision* Operations have been raised.

No major concerns were raised by stakeholders between distribution of the *Ningaloo Vision* Operations consultation package and the submission of the EP.

9. CONTACT DETAILS

Further information on Ningaloo Vision operations activities can be obtained from:

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