Van Gogh Oil Development
Operations Environmental Plan: Public Summary
June 2009

This summary of the Van Gogh Oil Development Operations Environmental Plan has been submitted to comply with Regulation 11(7)(8) of the Petroleum (Submerged Lands) (Management of Environment) [P(SL)(MoE)] Regulations 1999.

INTRODUCTION

Apache Northwest Pty. Ltd. (Apache), on behalf of its joint venture participant INPEX Alpha Ltd (INPEX), proposes to develop and recover oil from the Van Gogh oil pool. The name of the proposal is the Van Gogh Oil Development (development). Apache is the operator for the operational phases of the development as specified for the environmental approvals associated with the development.

Apache prepared an Operations Environmental Plan (OEP) for the Van Gogh Oil Development, which was approved by the Department of Mines and Petroleum (DMP) on the 20th April 2009 and by the Department of the Environment, Heritage and the Arts (DEWHA) on the 9th June 2009. This document provides a summary of the OEP for the Van Gogh Oil Development and includes the proposed environmental controls to address the operational activities associated with the development.

LOCATION

The Van Gogh field is located in Commonwealth waters (previously within defined areas of petroleum exploration permit WA-155-P(1), which is now covered by production licence WA-35-L), 53 km north-northwest of Exmouth off the Western Australian coast. It is located approximately 58 km north-northwest of the Exmouth township on the Western Australian mainland and approximately 29 km from the northern boundary of the Ningaloo Marine Park (**Figure 1**). The proposed development occurs in water depths ranging from 340 m in the east of the production licence to 400 m depth in the west.

The proximity of the proposed development area to other key coastal or mainland features is outlined below:

- State/Commonwealth waters boundary – 29 km southeast.
- Muiron Islands Marine Management Area – 33 km southeast.
- Ningaloo Reef – 43 km south.
- North West Cape – 43 km south.

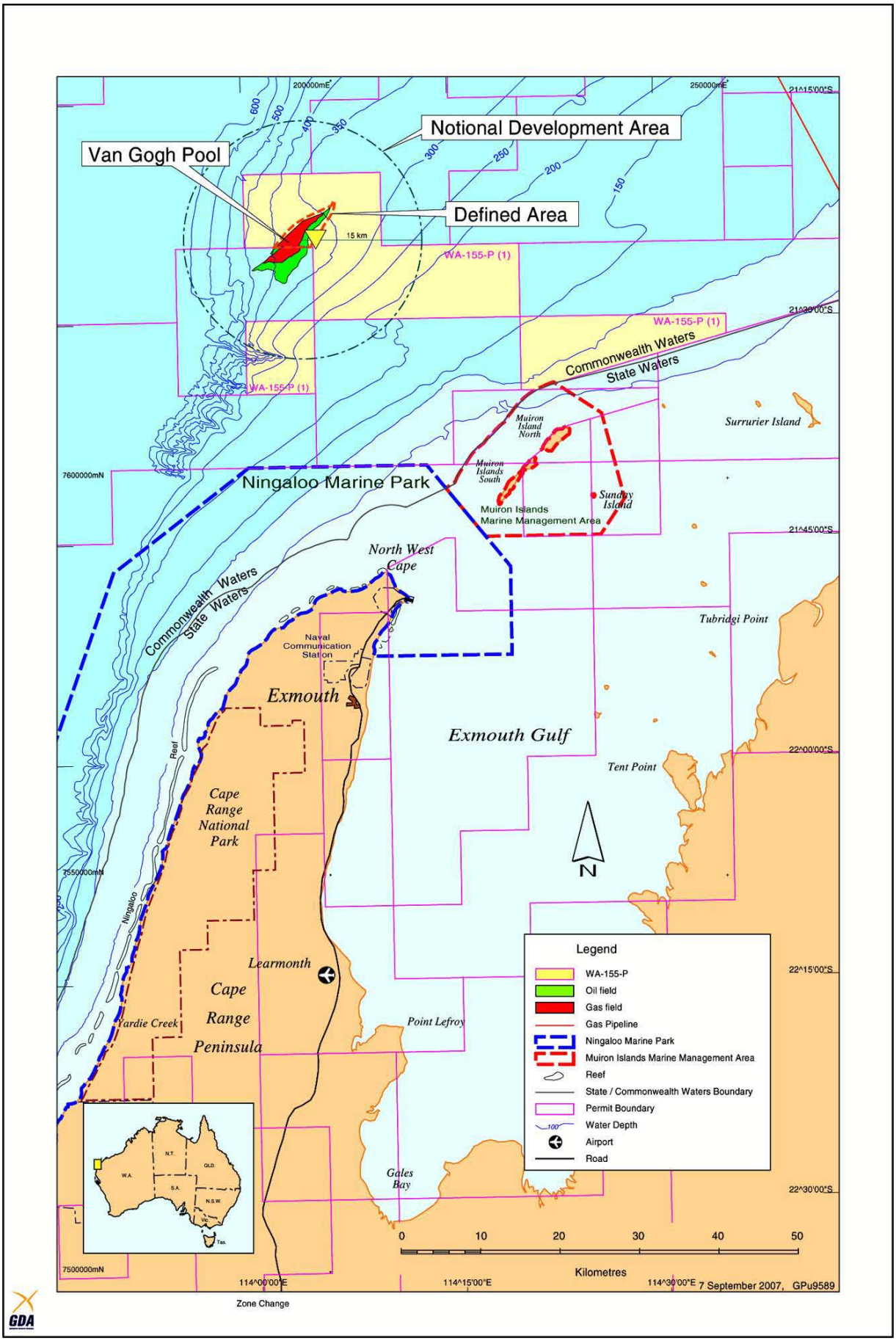
The Van Gogh oil pool lies within the Exmouth Sub-basin, a highly prospective and recently developed hydrocarbon province that is part of the Carnarvon Basin on the North West Shelf. The geographic coordinates of the Van Gogh development are provided in **Table 1** (see also **Figure 1**).

Table 1: Coordinates for the Van Gogh Development

Infrastructure Locations	Latitude S	Easting (m)	Longitude E	Northing (m)
FPSO mooring position	21° 24' 12.39"	198 100	114° 05' 17.35"	7 630 400
Sub-sea Production Manifold 1 (PM1)	21° 23' 51.31"	196 002	114° 04' 04.91"	7 631 011
Sub-sea Production Manifold 2 (PM2)	21° 23' 12.86"	196 872	114° 04' 36.21"	7 632 214

AGD 94, Zone 50

Figure 1: Location of the Van Gogh Development



PROJECT OVERVIEW

The development involves recovering hydrocarbons from the Van Gogh production wells and installed subsea equipment (including two subsea manifolds, corrosion resistant alloy flexible production flowlines and associated dynamic risers) and directing them to a floating production, storage and offloading (FPSO) vessel, the *Ningaloo Vision*, which will recover, process and finally export oil from the Van Gogh field. Lift gas (natural gas that has been dried and compressed on the FPSO) will be reinjected into the production wells to assist with oil recovery. Produced formation water (PFW) separated on the FPSO from the recovered production fluids, will also be reinjected into the reservoir via dedicated reinjection wells. An internal disconnectable turret mooring (DTM) system connects the subsea infrastructure to the FPSO via a moonpool in the bow (forward) section of the FPSO. It is composed broadly of anchors, mooring lines, DTM buoy, moonpool and turret. The DTM buoy is anchored to the seabed at three mooring points. The *Ningaloo Vision* is to be moored in position when connected to the DTM buoy. A schematic of the Van Gogh development is shown in **Figure 2.**

The production and reinjection wells as well as the subsea equipment to control and direct reservoir production fluids to the FPSO, has already been installed and is awaiting the arrival of the *Ningaloo Vision* to hook-up and commence oil production. First oil production is planned for the last quarter of 2009, with an estimated operational life of between 12 and 15 years.

Decommissioning of the Van Gogh development will commence when production from the reservoir reaches the end of its economic life and will be undertaken in line with the decommissioning standards of the day. The design and construction of the subsea infrastructure associated with the Van Gogh development allows for the decommissioning of all structures and components above the sea floor.

EXISTING ENVIRONMENT

The following is a brief summary of the information provided in the OEP for the Van Gogh Oil Development.

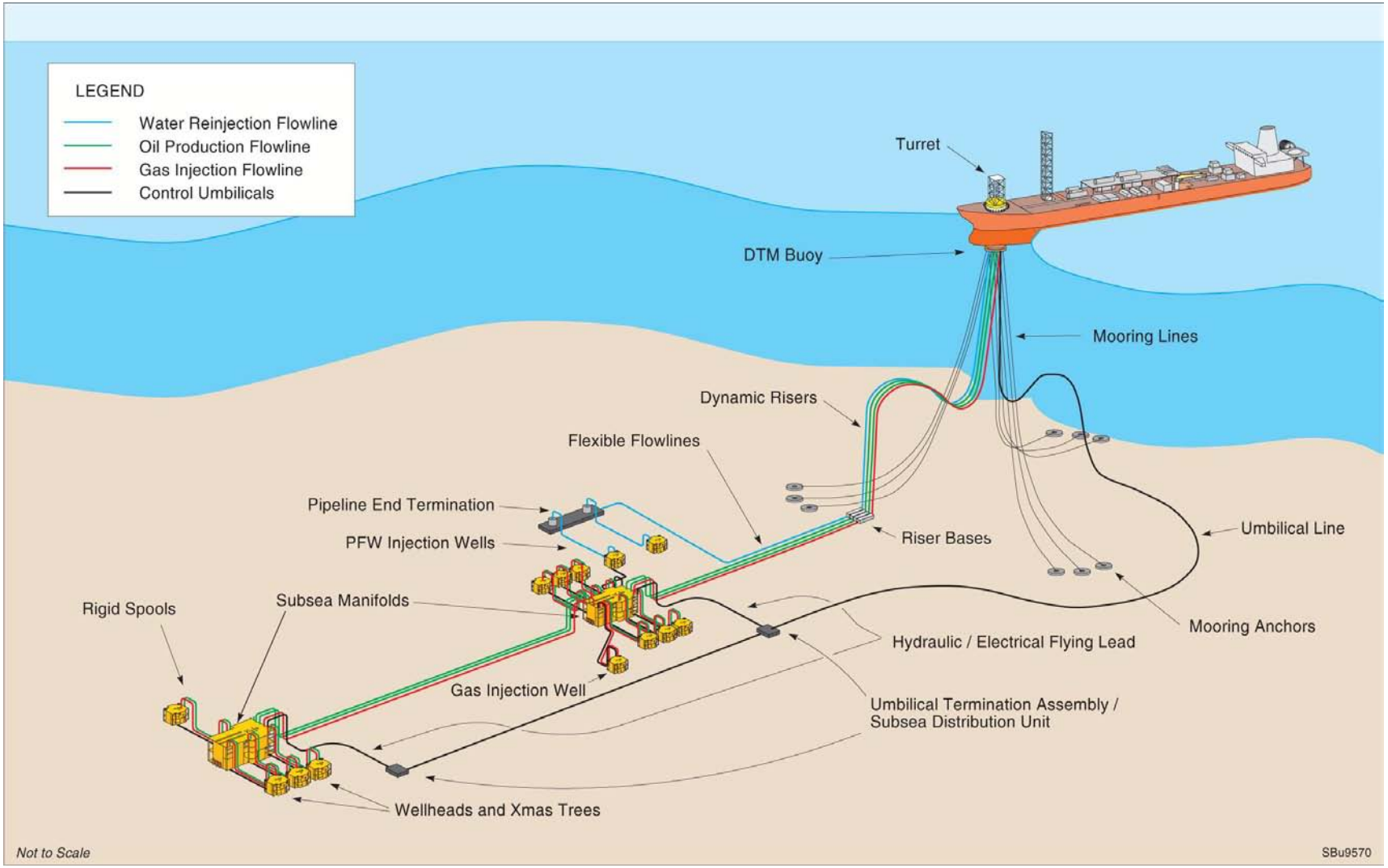
Physical Environment

The Exmouth region lies in the arid sub-tropical zone of Australia, experiencing two main seasons with a hot summer (October to April) and mild winter (May to September). Rainfall averages 260 mm a year. Summer winds are mainly from the southwest while winter winds are generally from the east and southeast. The region experiences two to three cyclones each year, mainly between January and March. The cyclone season is widely acknowledged as occurring annually between October and April for the Exmouth region.

The tides of the North West Shelf have a strong semi-diurnal signal with four tide changes (two low, two high) per day. The tides run on a northeast and southwest axis. Tidal and wind-forcing are the dominant contributions to local surface currents. The orientation and degree of drop off from the continental shelf slope influences the oceanography of the area.

The prevailing seasonal wind directions generate wind driven surface currents, which are predominantly from the southwest during summer and from the east, southeast and south during winter.

Figure 2: Schematic of the Van Gogh Development



The seabed within the Van Gogh development footprint ranges from 340 m LAT (lowest astronomical tide) at the FPSO location to a maximum of 366 m LAT at Production Manifold 1. The seabed is predominantly flat and featureless, sloping gently and uniformly in a west-northwest direction with a slope of 1.3% (or 0.74°) gradient. No significant seabed features, such as rock outcrops or canyons, were identified in the survey area.

Biological Environment

Habitats in the Exmouth Sub-basin can be categorised as oceanic, continental slope, continental shelf, reef, lagoonal, intertidal and shallow subtidal. The Van Gogh development occurs in the oceanic region, an area characterised by relatively low-nutrient waters, with a seabed consisting of fine, muddy or silty sediments. **Figure 3** illustrates the near shore and offshore habitats of the Exmouth region.

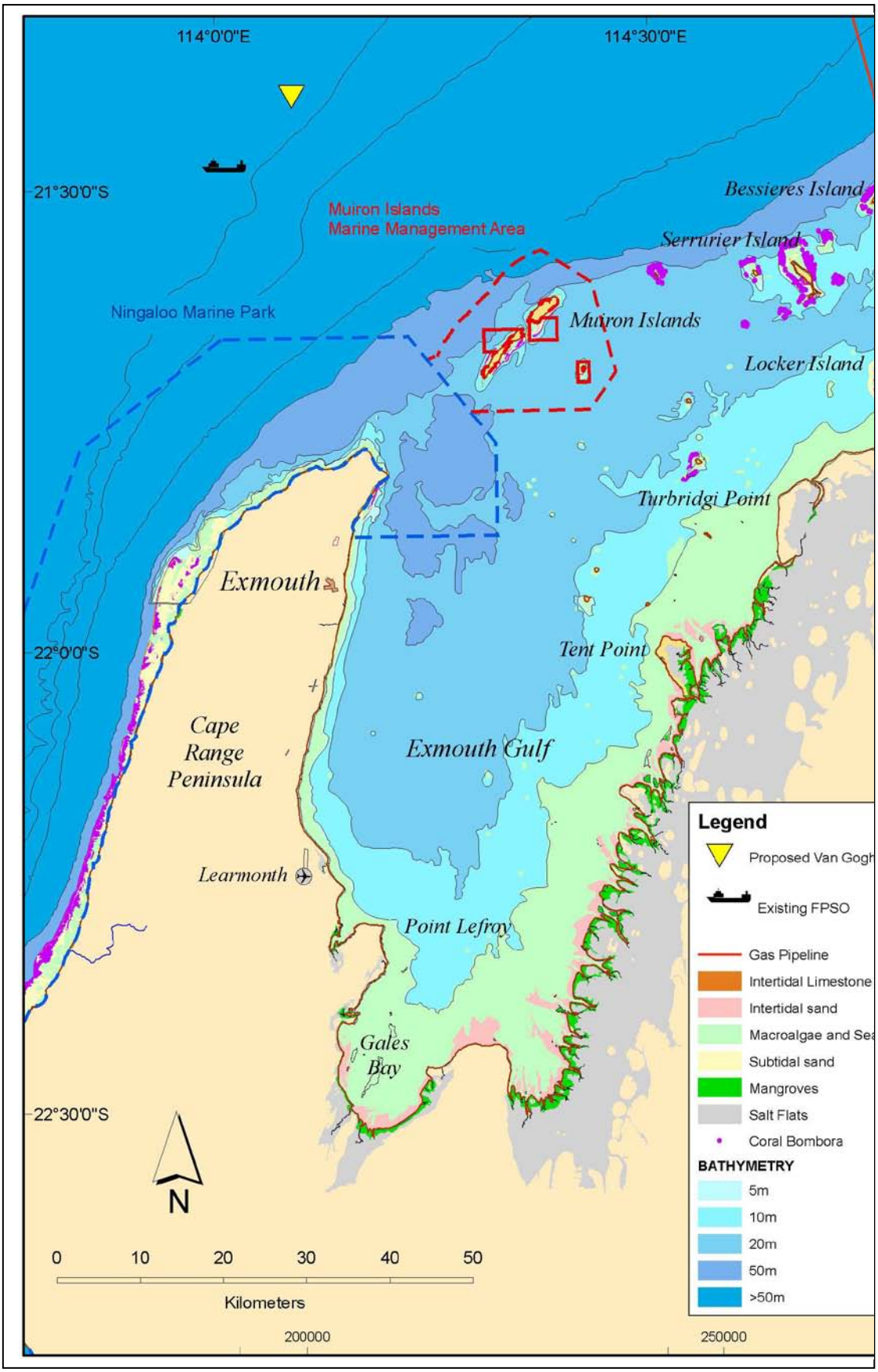
Faunal communities in these deep water environments feature low abundances of invertebrate infauna, with occasional deep-water sponges, echinoderms, polychaetes, crustaceans and bottom-dwelling fish. The water column is rich in plankton and pelagic fin-fish. Water depths at the Van Gogh site preclude seabed vegetation growth.

Benthic infauna (small invertebrates that live within the upper layers of seabed sediments) have been surveyed at the Van Gogh location with sediment infaunal abundance being low, ranging from 40-170 individuals/m^2, with an average of 104 individuals/m^2. The fauna was dominated by polychaetes (68%) with crustaceans (29%) the only other dominant phyla. Twenty of the 36 species collected were recorded from single specimens. This is comparable to those found over similar substratum, and at similar depths in the region.

Species listed as threatened under the EPBC Act for the offshore Van Gogh site and Exmouth Gulf include mainly migratory whales, dolphins, turtles, sharks, seasnakes and seahorses/pipefish (the latter restricted to shallow coastal areas). Megafauna, such as humpback whales, whale sharks, dolphins, dugong and turtles frequent coastal areas of the Exmouth region. A diverse array of seabirds and fin-fish species are recorded in the region.

Whale sharks (*Rhincodon typus*), the world's largest fish (growing up to 12 m in length) are oceanic and cosmopolitan in their distribution; however, they do aggregate in and near the waters of the Ningaloo Marine Park during autumn. The whale shark is declared a "vulnerable" species under the EPBC Act and thus afforded protection in Australian waters. The main period of the whale shark aggregation off Ningaloo Reef is late March to June, with the largest numbers generally being recorded in April. However, the season is variable; and individual whale sharks have been recorded at other times of the year. Whale shark presence coincides with the coral mass spawning period, when there is an abundance of food (krill, planktonic larvae and schools of small fish) in the waters adjacent to the reef associated with upwelling of nutrient-rich waters from the deep ocean.

Figure 3: Coastal Habitats of the Exmouth Region



The most commonly sighted whale for the area is the humpback whale. This species migrates between its feeding grounds in Antarctic waters and breeding and calving grounds in the Kimberley region of Western Australia. The peak of the northerly migration between Exmouth Gulf and the Dampier Archipelago occurs around late July, concentrated along the 200m depth contour, with a northerly migration from early June to early August. The southerly return migration peaks around early September, with pods preferring to travel in shallower waters, typically between 30 and 100 m deep. The migratory whale route, where most whales are observed, occurs in waters within 9 nautical miles (17 km) of the coast (generally less than 200 m water depth). The transition period (the crossover between the northern and southern migrations), occurs between early August and early September. Pod sizes off the North West Cape during this time are higher than at any other time of the year. During the transition period, whale pods are more dispersed, occurring in shallow waters and in waters as deep as 1,100 m and also covering the Van Gogh development area.

The Ningaloo Marine Park is the most iconic conservation reserve of the region. It protects the Ningaloo Reef, and the park stretches for more than 300 km from the North West Cape south to Red Bluff. Ningaloo Reef is the largest fringing coral reef in Australia, and contains over 217 species of coral, over 600 species of mollusc, over 460 species of fish and over 25 species of migratory wading birds. The Muiron Islands Marine Management Area lies adjacent to the northern portion of the Ningaloo Marine Park and also protects coral reef and shallow, sub-tropical marine environments (see **Figure 3**).

Socio-economic Environment

The Shire of Exmouth encompasses 6,261 km^2 of the Cape Range Peninsula, including the largest town in the Shire, Exmouth, located in the northeast part of the Cape. Exmouth is located 1,270 km north of Perth, has a population of approximately 2,400 and is the closest town to the proposed Van Gogh development. Exmouth was originally established in 1963 to support personnel who built and operated the United States Naval Communications Station (now named the Harold E. Holt Naval Communication Station).

The predominant terrestrial-based land use in the Shire of Exmouth is pastoral activity with numerous cattle stations operating throughout the Peninsula and eastern side of Exmouth Gulf. The Cape Range National Park occupies a vast area of the western portion of the Cape Peninsula (see **Figure 1**), and its deep rocky gorges are the focus of much tourism activity.

There is little, if no commercial deep water fishing at the Van Gogh location. There are numerous aquaculture (pearl and prawn farming) leases in the Exmouth Gulf which are all located very close to the shoreline, and recreational fishing in the Gulf and within the Ningaloo Marine Park is a popular local and tourist activity. The commercial prawn fishery in the Gulf is the largest prawn fishery in Western Australia and uses Otter trawls as the fishing method. Opening and closing dates for the prawn season vary each year, however prawns are normally fished between March and the 4th December, with fishing closed during summer.

Tourist activity in the region peaks in the winter months when the sub-tropical climate offers the prime weather conditions for marine activities such as boating, diving and fishing, and when humpback whale and whale shark migration is at its peak.

In recent years, oil and gas exploration and production has increased in the region,

with several FPSO developments approved for operation near the proposed Van Gogh development.

Aboriginal and non-Aboriginal sites of significance do not occur in the development location, though in shallower waters of the Exmouth Gulf and closer to the reef, numerous shipwrecks are known to occur.

POTENTIAL ENVIRONMENTAL HAZARDS AND PROPOSED MANAGEMENT CONTROLS FROM ROUTINE AND NON-ROUTINE ACTIVITIES

The potential environmental impacts resulting from routine activities and non-routine or accidental discharges associated with the Van Gogh Oil Development are outlined in detail in the Van Gogh Oil Development OEP.

The routine environmental hazards associated with the presence of the *Ningaloo Vision* and subsea equipment during the operations phase of the development were identified as:

- Physical impacts;
- Solid waste impacts;
- Liquid emissions impacts;
- Atmospheric emissions impacts;
- Socio-economic impacts; and
- Biodiversity impacts.

Table 2 summarises the potential environmental impacts and management measures of the development.

The non-routine environmental hazards associated with the production phase included the discharge of non-routine liquid wastes, defined as spills of chemicals and hydrocarbons, with hydrocarbons being the main focus. **Table 3** summarises these accidental discharge impacts and management measures.

CONSULTATION

Apache developed a four-point consultation process for the Van Gogh development which it has employed to date, as follows:

1. Introductory meetings with potential Exmouth and Perth stakeholders, including government agencies, non-government organisations (NGOs), Aboriginal groups, industry and business interests.

2. Formation of Stakeholder Consultation Groups (SCGs) in Exmouth and Perth, comprising interested stakeholders. This consultation is designed around a program of meetings, held as-needed to facilitate information exchange between Apache and stakeholders. The first SCG meeting was held in May 2007.

3. Project newsletters (double-sided A4 documents) produced and distributed on an as-required basis (dependent on project milestones). Updates are distributed via email to SCG members and also distributed to the wider

Exmouth community via the Exmouth Shire Library, police station, display in the Ross Street Mall and the Milyering and Exmouth visitor centres.

4. Development and maintenance of a project-specific website designed to provide the latest and comprehensive information on the project (www.apachevangogh.com.au).

Apache's consultation programme will continue throughout the operational phase of the development. It is expected that once the FPSO is operational, the frequency of meetings may reduce.

FURTHER DETAILS

For further information about the Van Gogh Oil Development Operations Environmental Plan (TV-00-RI-003), please contact:

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Table 2: Summary of Environmental Hazards for Routine Operations associated with the Van Gogh Development

Kay Hazard	Avoidance, Mitigation and Management Measures
Artificial habitat from additional near-surface infrastructure (such as the submerged FPSO hull, DTM buoy, risers and upper sections of the mooring lines) and subsea infrastructure provides hard substrate for the settlement of marine organisms	Mitigation • A TBT free anti-fouling coating will be applied to the FPSO hull and DTM buoy • No anti-fouling paint applied to subsea infrastructure • Subsea infrastructure will be removed when decommissioning
Artificial lighting from FPSO and impact on turtle hatchlings	Avoidance • FPSO located 43 km from nearest turtle nesting beaches and generally over the horizon from the mainland – direct light from FPSO not likely to be visible from mainland Mitigation • FPSO deck lighting has been designed to minimise overboard light spill (including shielding on lights near edge of vessel) • Majority of surplus produced gas will be reinjected reducing the amount of time the intense light associated with flaring occurs • Where possible, lights from the FPSO will not be directed onto the water surface • Light from FPSO would only serve to initially attract turtle hatchlings away from beach (positive) Management • Periods of flaring will be recorded so as to measure performance against internal target
Intermittent disposal of non-hazardous solid wastes (e.g., packaging, wood, steel)	Mitigation • Limit waste creation through selection process and operational procedures • Segregation of recyclable and non-recyclable wastes on board • All wastes stored in covered receptacles secured to the deck Management • Waste management plans for FPSO will be implemented • Waste measuring and tracking documentation to assess quantity and fate of wastes
Intermittent PFW discharge from FPSO	Avoidance • Majority of produced formation water reinjected • Metals present in marine sediments as hydroxides or sulphides are not generally available for biological uptake Mitigation • Onboard oil water treatment circuit with off-spec storage • <30 mg/l oil-in-water for overboard disposal (daily average) • Automatic diversion of off-spec produced formation water to slops tank

Kay Hazard	Avoidance, Mitigation and Management Measures
	• Daily laboratory sampling to verify continual automatic sampling • 6 hourly laboratory sampling to verify overboard OIW concentration • Use of corrosion-resistant alloys • Selecting injection chemicals with the lowest environmental harm • Scheduled maintenance of production equipment to reduce the incidence of process upsets Management • Periods of PFW discharge will be recorded so as to measure performance against internal target
Continuous sewage and greywater discharge	Mitigation • Sewage will be treated to OPGGS Act and MARPOL specifications – macerated to less than 25 mm, treated and discharged more than 12 nm (22 km) from land • Disinfection of sewage and greywater (UV treatment) from the FPSO prior to discharge Management • Planned maintenance of sewage treatment plants to ensure peak efficiency
Intermittent overboard release of hydrocarbon contaminated deck drainage water	Avoidance • Design of drainage system incorporates bunds around hazardous and hydrocarbon storage areas and segregation of hazardous and non-hazardous areas for drainage collection • Design of pipework to minimise flange connections (and thus minimise leaks), with a preference for welded connections Mitigation • Selection of low-toxicity process chemicals • FPSO deck will be bunded (scupper plugs in place during normal operation) • Strict house-keeping procedures – decks on all vessels will be kept clean and spills cleaned immediately • Closed and open drainage systems, will be directed to an oil-in-water separator prior to overboard discharge • Drip trays will be provided where required • Continuous monitoring of oil-in-water in slops tank discharges
Continuous emissions of greenhouse gases – CO_2, CH_4, N_2O, PFCs, HFCs, SF_6	Avoidance • No well testing from FPSO Mitigation • Reinjection of produced gas • Produced gas used as primary fuel • Ultra-low sulphur diesel to be used for emergency back-up generators • Flare tip is designed to be 95% efficient

Kay Hazard	Avoidance, Mitigation and Management Measures
	Management • Apache NPI reporting • Apache greenhouse gas reporting • Apache Energy Efficiency Opportunities program participation • NGERS reporting • FPSO scheduled maintenance program to maintain systems efficiency
Impacts on shipping from an increase in regional commercial shipping activity, with the potential for an increase in collision risk	Mitigation • FPSO is not located in a designated shipping lane • Establishment of 500-m exclusion zone around FPSO to minimise collision risk (and around offtake tanker when moored to the FPSO) • Small exclusion zone relative to area available for shipping • Gazetting the FPSO and its 500-m-radius safety exclusion zone, and subsea wells and manifolds on navigational charts • Issue of Notice to Mariners (about the change to Australian Navigational Charts) through the Australian Hydrographic Office • Providing a complete range of communications equipment on the FPSO • Operational lighting on FPSO • Anti-collision radar on FPSO (Shipborne AIS system) Management Bridge watch and radio standby on all vessels
Underwater noise from FPSO, support vessels, helicopters and offtake tankers	Avoidance • FPSO will be located a significant distance from the humpback whale resting grounds of the Exmouth Gulf Mitigation • Helicopters will take most direct flight path between Learmonth and FPSO and will avoid approaching observed whales, in accordance with Section 8.05 of EPBC Act Regulations • Support vessels will take most direct route between Exmouth Gulf and FPSO and avoid approaching observed whales • Flight paths will be routed to avoid identified sensitive environmental resources, such as the Muiron Islands seabird colonies • FPSO engines and other noise-generating equipment will be appropriately maintained Management • Noise modelling suggests minimal impacts to migrating humpback whales • Whale sightings will be recorded and forwarded to APPEA and the DEWHA to increase knowledge on the regional distribution and abundance of humpback whales
Introduction of invasive marine species	Avoidance • FPSO and most offtake tankers will have segregated ballast water tanks

Kay Hazard	Avoidance, Mitigation and Management Measures
	• Support vessels based in local ports <u>Mitigation</u> • Application of Apache offtake tanker vetting procedures • All vessels involved in the development entering from foreign waters will follow the AQIS (2008) ballast water requirements prior to entry into Australian waters <u>Management</u> • Completion of AQIS ballast water logs to track discharges and vessels

Avoidance – preventing an impact from occurring.
Mitigation – moderating an impact to reduce its force or intensity.
Management – handling, controlling, or taking charge of an impact, usually once it has occurred.

Table 3: Summary of Environmental Hazards for Non-Routine Operations associated with the Van Gogh Development

Kay Hazard	Avoidance, Mitigation and Management Measures
Diesel spill overboard from refuelling (bunkering)	Mitigation • Minimal diesel use; FPSO needs refuelling on average only 3 times per year • Refuelling procedures for all vessels, which include: - Daytime refuelling only - Manned operations - Calm sea refuelling only - Radio communications between bunkering station, barge engineer, engine room and supply vessel - Dry-break couplings on bunkering hose - Hose inspections - Agreement between vessels on quantity of fuel transfer - Commence bunkering at minimum pumping rate - Monitor supply line pressure - Ensure oil absorbent material and spill cleanup material is available at key locations - Routine maintenance of refuelling equipment • FPSO diesel spill modelling completed – 0.1% risk of reaching outer boundary of Ningaloo Marine Park in worst-case weather scenario Management • Implementation of Oil Spill Cleanup Procedure in the event of a spill • Real-time oil and diesel spill modelling available
FPSO crude oil spill overboard – surface	Mitigation • FPSO located a long distance from sensitive coastal habitats • Dropped-object protection built into design • Shut-in systems • FPSO disconnectable in worst-case weather scenarios • Use of corrosion-resistant alloys • Topsides leak frequency study completed – total leak frequency by system calculated as 0.163 leaks/year • Double-sided hull • Corrosion monitoring • Corrosion protection • FPSO designed for life of field • Sea stability FPSO model testing

Kay Hazard	Avoidance, Mitigation and Management Measures
	• Cyclone monitoring and related procedures • Double-carcass offloading hose • Vetting procedures for offtake tankers • Surface crude oil spill modelling completed – 0% risk of oil reaching Ningaloo Reef, and less than 0.001% chance of oil reaching outer boundary of Ningaloo Marine Park in worst-case spill and weather scenario • Dominant winds and ocean currents drive spills away from coastline • Crude transfer procedures will be used, which include: - Third-party pilot on board offtake tankers - static tow by support vessel - use of dry-break couplings on crude transfer hose - flushing of export hose back to facility after each crude transfer - ensure oil absorbent material and spill cleanup material is available at key locations <u>Management</u> • Shut-down, isolation and blowdown procedures • Implementation of Oil Spill Cleanup Procedure in the event of a spill • Real-time oil spill modelling available
Crude oil leaks – subsea infrastructure	<u>Mitigation</u> • FPSO located a large distance from sensitive coastal habitats • Fail-safe emergency shutdowns • Subsurface safety valves • System designed for snag loads • Issue of Notice to Mariners (and change to Australian Navigational Charts) through the Australian Hydrographic Office • Water depth means no trawling • Leak frequency study completed – total leak frequency by system calculated as 0.16 leaks/year • Emergency shutdown valves on DTM buoy • Well control systems • Hydrotest of system • ROV inspections of subsea infrastructure • Subsea crude oil spill modelling completed – 0% risk of reaching Ningaloo Reef in worst-case spill and weather scenario • Fire and gas detection system <u>Management</u> • Shut-down, isolation and blowdown procedures

Kay Hazard	Avoidance, Mitigation and Management Measures
	• Implementation of Oil Spill Cleanup Procedure in the event of a spill • Real-time oil spill modelling available

Avoidance – preventing an impact from occurring.
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