Julimar Development Project Pipeline Installation Environment Plan Summary

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1. INTRODUCTION

The Julimar Development Project (JDP) is a subsea development that will supply raw gas from the Julimar and Brunello gas fields located approximately 168 km offshore west-northwest of the town of Dampier, Western Australia, to the Chevron-operated Wheatstone Development. First gas to the Wheatstone platform is expected in mid-2015 and first liquefied natural gas (LNG) shipment is expected in late 2016.

Apache is the operator of JDP on behalf of its joint venture partner Kuwait Foreign Petroleum Exploration Company (KUFPEC). Apache and KUFPEC are also foundation equity partners in the Chevron-operated Wheatstone Development.

The JDP will be developed over a number of phases commencing with the Brunello reservoir complex, which is closest to the proposed Wheatstone platform. Subsequent phases will be developed over the next 20 years.

The first phase of the JDP consists broadly of:

- Five production wells clustered around the Brunello A subsea production manifold;
- The Brunello cross over manifold that provides a tie-in point for the Brunello A production fluids and would facilitate future expansion to Julimar A fields;
- Two 22.5-km corrosion resistant alloy (CRA) 18-inch production flowlines from the Brunello cross over manifold to the Wheatstone platform; and
- A 4-inch mono-ethylene glycol (MEG) pipeline and 5.5-inch electric-hydraulic control umbilical.

This environment plan summary describes petroleum activities required to install flowlines, pipeline and associated subsea infrastructure for the Julimar Development Project (JDP). The approximate location of the JDP operational area and a schematic of the first phase of the JDP are presented in **Figure 1-1**. The proposed JDP production flowlines, MEG pipeline and control umbilical cross the existing Woodside Energy Limited (Woodside) Pluto subsea production pipelines, MEG pipeline and control umbilical.

1.1 Schedule

Activities will be 24 hours per day, seven days per week. It is envisaged that the total duration of all activities covered by the accepted Environment Plan (EP) will take approximately three months to complete.

Activities are scheduled to occur in a window between February and May, subject to contractor availability from existing commitments and receipt of all government approvals, although in the event of a delay the environment plan considers activities to be conducted outside of this period.

1.2 Compliance

The proposed Julimar Development Project was referred under the Environment Protection and Biodiversity Conservation (EPBC) Act to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) at that time in August 2011 (EPBC Reference: 2011/5936). A decision on this action was subsequently provided, approving the development on the basis that it is 'Not a controlled action if undertaken in a particular manner'.

The Julimar Development Project Pipeline Installation Environment Plan (EA-72-RI-008.01) was prepared to comply with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E)) under the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) (Cmlth). The EP has been reviewed and accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

This EP summary has been prepared as per the requirements of Regulation 11 (7) and (8) of the referenced OPGGS(E) Regulations.

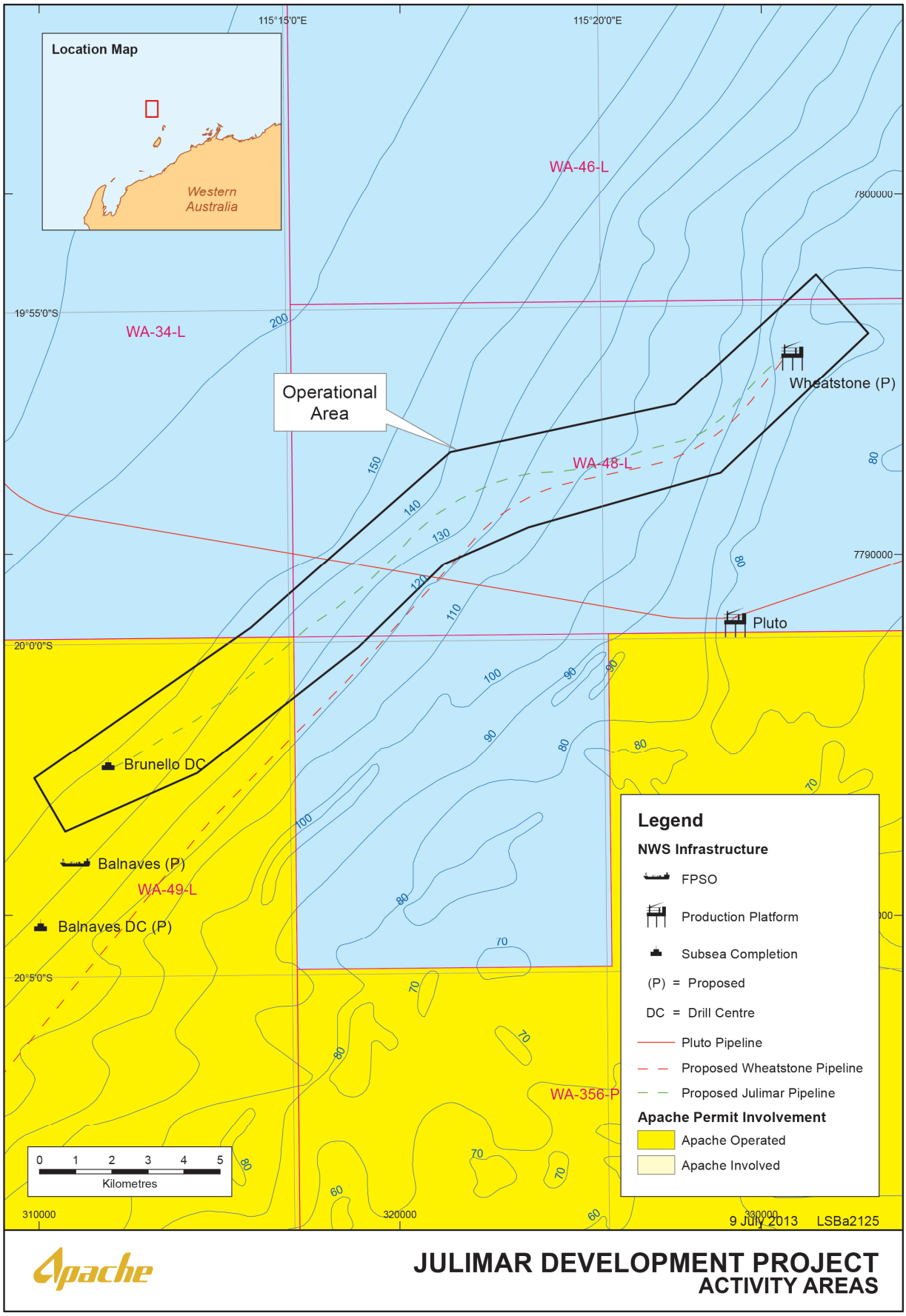

Figure 1-1: JDP operational area

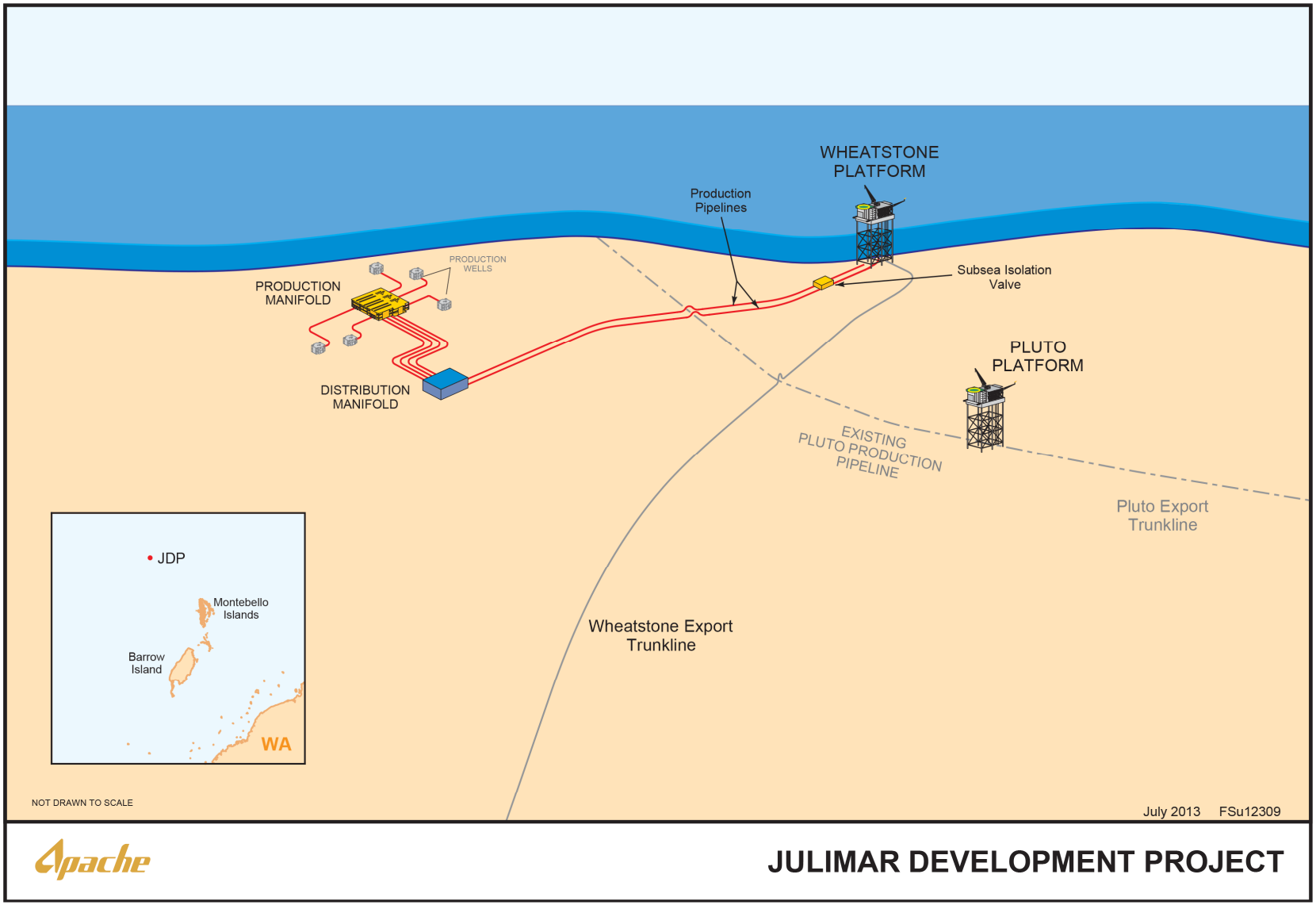

Figure 1-2: Julimar Development Project (Phase I) location and schematic

2. ACTIVITY LOCATION

Subsea facilities will be installed in Petroleum Pipeline Licence WA-48-L. The pipeline licence area is contained within a larger 'operational area' defined in **Table 2-1** and **Figure 1-1**. The 'operational area' defines the boundary within which activities described in the environment plan will occur. The operational area is approximately 47 km from the nearest territorial sea baseline (nearest land).

Table 2-1: Coordinates of the operational area

Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
-20.0334	115.1822
-19.9963	115.2399
-19.9528	115.2932
-19.9413	115.3529
-19.9091	115.3904
-19.9239	115.4041
-19.9587	115.3647
-19.9718	115.3137
-19.9808	115.2913
-20.0013	115.2684
-20.0325	115.2254
-20.0469	115.1903

The operational area is approximately 26 km long and 2 km wide. The water depth within the operational area ranges between approximately 70 m and 150 m. There are no grounding hazards within the operational area.

Existing facilities within the operational area include sections of the Woodside Pluto 20-inch production flowlines, 4-inch MEG (Mono-ethylene Glycol) pipeline and 5.5 inch control umbilical. Apache's Brunello Drill Centre A (BRUA) is also located within the southern extent of the operational area. Five wells have been drilled limited to intermediate hole sections, which do not intersect any hydrocarbon bearing formations. These wells have been cemented in place.

The proposed Wheatstone platform (WP) and sections of the subsea pipeline system (production lines and trunkline) also occur within the operational area. Chevron-managed construction and installation activities for these facilities could occur simultaneously with petroleum activities managed under the accepted EP.

3. DESCRIPTION OF THE ACTIVITY

The pipelay vessel will be used to install the two 18" 22.5 km flowlines and one 4' 22.5 km mono-ethylene glycol (MEG) pipeline in a common corridor from the BRUA drill centre to the WP. Once the pipelay is complete, the lines will be cleaned, gauged, flooded and pressure tested (FCGT). A second vessel will then be used to install approximately 60 post-pipelay mattresses for stabilisation near the Wheatstone platform. In addition to the specific activities covered by the EP (summarised below), other project vessels will transit through the operational area to provide construction support and supply (e.g. pipe supply, refuelling etc.)

3.1 Pipeline Production

Each pipe section is transferred from the pipelay vessel hold or pipe loading station to the ready rack towards the firing line tunnel where the welding is carried out. A mechanised welding system will be used to deliver a repeatable high quality weld with welds then subjected to Non Destructive Testing (NDT) by means of either an Automatic Ultrasonic Testing (AUT) system or Real Time Radiography (RTR) and then coated with Fusion Bonded Epoxy (FBE). For the flowlines an Injection Moulded Polypropylene (IMPP) infill system will be applied at the field joints on top of the FBE. For the MEG line shrink sleeves will be used. Each joint will progress down the firing line into the next station. After the last station (Coating), the pipeline departs the firing line and enters the stinger. The stinger extends from either the bow or the stern of the vessel to support the pipe as it is moved into the water and control the curvature of the installation.

3.2 18" Flowline Pipelay

The pipelay activity commences at the flange location near the Wheatstone subsea isolation valve (SSIV) and ends at the flow line end termination (FLET) / pipeline end termination (PLET) near the BRUA manifold. Alternatively, the pipelay activity may commence at the FLET/ PLET and end at the flange location near the Wheatstone (SSIV). It involves setting up a 22 tonne stev shark anchor (Dead Man Anchor (DMA)) at an engineered distance to achieve the correct positioning of the start-up head location for the flange near the Wheatstone SSIV. A cable attached to the anchor will guide each pipe segment. The anchor will cover approximately 7 m^2. The two 18" flowlines will be laid down on the seabed with a laydown head installed. Adjustable pipe supports (APS) and FLETs will be installed at required locations near the laid down flowlines. The flowlines will then be lifted and placed in the FLET and over the APS. The APS adjusts the flowline height in order to correctly align and place the flowline in the FLET structure.

3.3 MEG Pipeline Pipelay

The 4" MEG pipeline will be laid down on the seabed with a laydown head installed. It will then be picked up again for installation of the PLET and laid down again, inserting the pipe in an almost vertical position to reduce stress on the pipeline.

3.4 Flooding, Cleaning, Gauging and Testing

Following completion of the flowline and MEG pipeline installation, the two 18" Flowlines and the 4" MEG Pipeline will be flooded, cleaned, gauged and tested (FCGT) from a support vessel equipped with a flooding spread. The treated seawater will be delivered to the lines via a 4" downline hose. During flooding, treated water pushes a pig train, consisting of up to six pigs, through the lines for cleaning, gauging and pressure testing. Treated seawater will also separate each pig in the train and also be discharged to sea. The treated seawater separating the pigs will be dosed with pipeline preservation chemicals. The last pig(s) in the train will be equipped with an electronic pinger system which allows checking the gauge-plate condition without retrieval of the receiver-head. A Gel Plug is produced on site prior to deployment by combining the individual chemical components and facilitated by pumping the Gel Plug behind a pig into one end of the pipeline. The Gel Plug remains in the pipeline until the Wheatstone platform tie-in scope commences. After confirmation of the pipeline integrity by reading the electronic system the lines will be pressure tested.

3.5 Post-pipelay Mattress Installation

Post-pipelay mattresses will be installed on the flowlines and MEG pipeline near the Wheatstone platform for stabilisation and also laid around the FLET and PLET structures. An estimated 60 mattresses will be crane lifted from a dynamically positioned vessel and placed on the lines. Each mattress weighs approximately 8 tonnes (t) and has a surface area of 20 m^2.

3.6 Post-installation Survey

Following completion of the pipeline installation, a post-lay survey of the flowlines and pipelines along the entire route and other subsea infrastructure (e.g. mattresses) will be conducted using an ROV which will be used to:

- Monitor pipelay activities at critical areas of installation;
- Support FCGT activities; and
- Post-lay survey.

4. DESCRIPTION OF ENVIRONMENT

4.1 Physical environment

The JDP operational area lies in the arid tropics experiencing high summer temperatures and periodic cyclones. Rainfall in the region is low with evaporation generally exceeding rainfall throughout the year, although intense rainfall may occur during the passage of summer tropical cyclones and thunderstorms (Condie *et al*., 2006).

Salinity is relatively uniform at 34–35 ppt throughout the water column and across the North West Shelf (NWS). Due to the low average rainfall in the region there is little freshwater run-off from the adjacent mainland (Blaber *et al*., 1985). NWS waters are usually thermally-stratified, with a marked change in water density at approximately 20 m (SSE, 1993). Surface temperatures vary annually, being warmest in March (32°C) and coolest in August (19°C). Vertical gradients are correlated to sea surface temperatures and are greatest during the warm-water season (SSE, 1991).

Wind shear on surface waters generates local-scale drift currents that can persist for extended periods (hours to days). During September–March, the prevailing non-storm winds are from the southwest ranging up to a maximum speed of ~30 knots. Winds from the southwest direction are generally strongest between September and January with wind speed frequently reaching 24 knots and weaker between February–March with wind speed generally less than 16 knots (APASA, 2013). During April–August, winds are generally lighter and more variable in direction. Non-storm winds prevail from the east-south quadrant and can attain a maximum speed of up to 30 knots, but are generally less than 16 knots, particularly during April and May (APASA, 2013). Extreme wind conditions in the area may be generated by tropical cyclones, strong easterly pressure gradients, squalls, tornados and water spouts.

The wave climate is generally composed of locally generated wind waves (seas) and swells that are propagated from distant areas (WNI, 1995; 1996). In summer, seas typically approach from the west and southwest, while in winter, seas typically approach from the south and east. 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 per cent (WNI, 1995).

The dominant offshore sea surface 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 (CMAR, 2007; Condie *et al*., 2006). The Indonesian Throughflow is the other important current influencing the upper 200 m of the outer NWS (Woodside, 2005; CMAR 2007). Modelling indicates that significant east–west flows occur across the NWS to the north of the North West Cape, possibly linking water masses in the area (Woodside, 2005; Condie *et al*., 2006). Due to the complex oceanography of the NWS offshore drift currents comprise a series of interconnected eddies and connecting flows that can generate relatively fast (1–2 knots) and complex water movement. These offshore drift currents also tend to persist longer (days to weeks) than tidal current flows (hours between reversals).

4.2 Biological environment

The JDP operational area is situated within Commonwealth waters of the North-west Marine Region (DSEWPaC, 2008). Low density benthic communities of bryozoans, molluscs and echinoids are supported within the bioregion. Sponge communities are also sparsely distributed on the shelf and are found only in areas of hard substrate.

The JDP operational area overlaps a small portion in the northwest corner of the Montebello Commonwealth Marine Reserve.

Key ecological features (KEFs) are components of the marine ecosystem that are considered to be important for biodiversity or ecosystem function (DSEWPaC, 2012). In a search of EPBC Act Protected Matters Database of the operational area, one KEF was identified: The Ancient Coastline at 125 m Contour. The Ancient Coastline at 125 m Contour is a submerged coastline which provides areas of hard substrate and may contribute to higher diversity and enhanced species richness relative to soft sediment habitat (DSEWPaC, 2012).

The expected benthic habitats within the area are soft sediments and outcropping cemented sediments (hard substratum). Benthic primary producer habitat (e.g. areas of hard corals, seagrass, macroalgae or mangroves) is unlikely to be present. The minimum depth of the water is approximately 50 m; at this depth benthic primary production, which relies on photosynthesis for energy production is limited due to insufficient light availability. Soft sediment benthic fauna comprises predominantly mobile burrowing species including molluscs, crustaceans (crabs, shrimps and smaller related species), polychaetes, sipunculid and platyhelminth worms, asteroids (sea stars), echinoids (sea urchins) and other small animals. Cemented sediments provide hard substrate which can be used as attachment points for sessile filter feeding invertebrates such as soft corals, gorgonians and sponges. These areas are also likely to be used by mobile invertebrates such as molluscs, crustaceans (crabs, shrimps and smaller related species), polychaetes, sipunculid and platyhelminth worms, asteroids (sea stars) and echinoids (sea urchins).

The EPBC Act Protected Matters Database identified nine species of marine fauna found within the operational area which are listed as threatened species (endangered or vulnerable) under the EPBC Act, most of which are also migratory; A further seven species listed as migratory were also identified in the search. The list included seven marine mammals, five turtles, one seabird and three fish.

Pelagic fish in the region may include tuna, mackerel, herring, pilchard and sardine, and game fish such as marlin and sailfish. The timing of spawning of fishes in the North-west Marine Region varies between fish species although peaks are usually observed over warmer months between spring and autumn (Department of Fisheries, pers comms.).

The activity timing may coincide with the start of humpback whale northbound migration, and as the route is based inshore of the 200m depth contour, whales are likely to be encountered at the operational area (approximately 70-150 m). There are no resting areas that have been identified nearby, with the closest sensitive area likely to be Exmouth Gulf. There is the potential for pygmy blue whales to transit through the operational area on their northern migration. However, the width of the blue whale migration corridor in the region (> 200 km) suggests that it is highly unlikely that there will be significant interactions with pygmy blue whales during the installation activities. Given the distance to the Ningaloo Marine Park where whale sharks aggregate (approximately 200 km southwest), large numbers are not expected to be encountered within the operational area. Encounters with individuals are possible (although not expected) as they migrate through the operational area and modelled spill trajectory area to the Ningaloo aggregation areas.

The nearest turtle nesting sites are the Montebello Islands, Lowendal Islands and Barrow Island (greater than 48 km southeast). The Southern giant petrel (*Macronectes giganteus*) may occasionally over-fly the operational area or greater potential spill trajectory area when in transit or during foraging, but are not expected to be encountered in significant numbers.

4.3 Socio-economic environment

The operational area is located approximately 168 km offshore from the Port of Dampier. Smaller regional settlements are further away at Onslow, Point Samson and Exmouth. Socio-economic activities that may occur within the area include commercial fishing and oil and gas exploration and production; and to a lesser extent, recreational fishing and tourism.

Offshore and coastal waters in the North-west Marine Region support a valuable and diverse commercial fishing industry, dominated by Pilbara fisheries. Of the active state commercial fishing boundaries, the Pilbara Trap Managed Fishery and Pilbara Line Fishery were identified as potentially interacting with the installation activities. The Pilbara Trap Managed Fishery is seaward of the 30 m isobath and landward of the

200 m isobath. The Pilbara Line Fishery licensees are permitted to operate 'anywhere' in Pilbara waters. The North West Slope Trawl Fishery (NWSTF) is the only Commonwealth fishery with historical effort within the area, targeting scampi and prawns. The NWSTF is restricted to depths of greater than 200 m.

Water-based tourism activities undertaken across the NWS include whale watching, recreational boating and fishing, charter boat fishing, snorkelling and diving, and surfing. Given the considerable distance of the operational area from the nearest population centre at Dampier (approximately 168 km away) and the nearest shoreline at Montebello Islands (approximately 48 km away) there is unlikely to be any tourism based activities in the area.

The JDP operational area is part of the proposed Chevron-operated Wheatstone Development and is in close proximity to the existing Woodside Pluto Development. During the Wheatstone construction phase, the area surrounding the operational area will experience increased traffic from construction and support vessels.

There are no recognised shipping routes in or near the operational area with the nearest designated shipping routes located 43 km northwest and 56 km east.

There are no World Heritage properties, National Heritage places, wetlands of international importance or Aboriginal heritage sites located within the area. The closest known historic shipwreck location is at Trial Rocks (approximately 35 km south-southeast of the operational area) where the wreck of the vessels *Trial* and *Tanami* are believed to occur.

5. STAKEHOLDER CONSULTATION

Apache maintains a comprehensive stakeholder database containing fishing interest groups, government and non-government authorities and other stakeholder parties including the community. This database was used to identify stakeholders located, or operating, in the proximity of the activity. Apache has maintained relationships to assist information sharing with key stakeholders for many years and regularly communicates with stakeholders on a variety of activities, always seeking comment and fielding enquiries.

Relevant interested parties for consultation directly relating to the activities were identified on the basis of the operational area. Stakeholders identified are listed in **Table 5-1**.

Table 5-1: Summary of stakeholders consulted

Group	Stakeholder
Commercial fisheries	• Australian Fisheries Management Authority (AFMA)[2] • Department of Fisheries (DoF) • Western Australian Fishing Industry Council (WAFIC) • Commonwealth Fisheries Association (CFA) • A Raptis and Sons. • WestMore Seafoods • Shark Bay Seafoods • Austral Fisheries • Jamaclan Marine • MG Kailis • Pearl Producers Association • State commercial fishing licence holders
Recreational fisheries	Recfishwest
Marine conservation	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC)[1]
Tourism	Marine Tourism WA (formerly Charter Boat Owners and Operators Association)
Shipping safety and security	Australian Maritime Safety Authority (AMSA) Department of Defence
Hydrocarbon spill response	Department of Transport (DoT)[2] Australian Marine Oil Spill Centre (AMOSC)[2]

1. Department consulted with as part of the EPBC Act referral and assessment; now Department of Environment (DoE).
2. Apache consults with these authorities on regular basis and is only required to submit an electronic copy of the approved OSCP for their records.

5.1 Consultation Summary

On 28 April 2011, Apache referred the Julimar Development Project to the then Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) for public comment and assessment in accordance with the *Environment Protection and Biodiversity Conservation Act 1999*. The project was deemed by DSEWPaC to be 'not a controlled action if undertaken in a particular manner'.

In the past year, Apache has consulted with stakeholders on its Brunello and Harmony exploration activities, and Julimar and Balnaves development activities. Given the close proximity of these activities to the operational area, the consultation outcomes from these activities have been considered in the development of this environment plan.

In addition to the above stakeholder consultation efforts, the majority of stakeholders identified in **Table 5-1** were forwarded a specific information package detailing the proposed JDP activities. In accordance with Regulation 11A (2) of the OPGGSE Regulations, the pack contained sufficient information to allow the relevant stakeholders to make an informed assessment of the possible consequences of the activity; and invited stakeholders to contact Apache to discuss any matter.

Apache conducts a secondary form of consultation in the Apache Energy Stakeholder Consultation Quarterly Project Update (latest version released in December 2013) to all stakeholders listed in its comprehensive stakeholder database. The quarterly update has been progressively developed in consultation with interested stakeholders, and includes a summary of Apache's activities for the next six to nine months. The quarterly update is intended to trigger feedback, comments and requests for additional information or consultation opportunities for future activities, and provides an update of the activities that are underway or have previously been consulted on. All feedback and enquiries received regarding the above information have been responded to, addressed and closed off with the stakeholder in question. Apache will remain available before, during and after completion of the activity to listen to the concerns of stakeholders, as contact details of the relevant project personnel are provided in consultation material.

6. ENVIRONMENTAL HAZARDS AND CONTROLS

Identification of hazards and assessment of risks was determined using a qualitative assessment process defined by the *Apache Environmental Risk Identification Procedure (EA-91-IG-004)*. The Environmental Risk Assessment (ERA) identifies potential and expected hazards and environmental impacts and determines the risk of the impact occurring. For each impact the risk is determined prior to implementation of proposed management controls (inherent risk), and again after management controls have been implemented (residual risk). The control measures adopted are designed to eliminate the risk, or reduce the risk to a level that is tolerable or as low as reasonably practicable (ALARP). This assessment process was undertaken at a risk assessment workshop held on 23 and 24 May 2013. This workshop was facilitated by the risk specialist consulting firm Oracle Risk Consultants.

The environmental risk assessment identified nine hazards associated with planned operations and six hazards from unplanned operations. The key environmental hazards and control measures to be applied are provided in **Section 9**. These are consistent with Apache corporate and project specific performance objectives, standards and criteria. All commitments associated with these will be used to reduce environmental risk to ALARP and will be of an acceptable level.

7. MANAGEMENT APPROACH

The JDP pipeline installation activity will be managed in compliance with the *Julimar Development Project Pipeline Installation Environment Plan (EA-72-RI-008.01)* accepted by NOPSEMA under the OPGGS(E) Regulations, other environmental legislation and Apache's Management System (e.g. Apache Environmental Management Policy).

The objective of the EP is to ensure that potential adverse environmental impacts associated with the activity during both planned operational activities and unplanned events, are identified and assessed and to stipulate mitigation measures to avoid and/or reduce any adverse impacts to the marine environment to ALARP.

The EP details, for each environmental impact identified (and assessed in the Environmental Risk Assessment) specific performance objectives, standards and procedures and identifies the range of controls to be implemented (consistent with the standards) to achieve the performance objectives. The EP also identifies the specific measurement criteria and records to be kept to demonstrate the achievement of each performance objective.

The goals of the environmental implementation strategy as detailed in the EP are to direct, review and manage activities so that environmental impacts and risks are continually being reduced to ALARP, and performance objectives and standards are met. The implementation strategy includes the following elements:

1. Systems, practices and procedures;
2. Key roles and responsibilities;
3. Training, competencies and on-going awareness;
4. Monitoring, auditing, management of non-conformance and review;
5. Records management;
6. Incident response and preparedness including oil spill contingency planning; and
7. Reporting.

The reporting requirements for routine activities and environmental incidents (recordable and reportable) and reporting on overall compliance of the activity with the EP (e.g. conformance reports submitted to NOPSEMA within 3 months of completion of the activity) are also detailed in the EP.

8. CONTACT DETAILS

Further information about the Julimar Development Project Pipeline Installation activity can be obtained from:

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9. ENVIRONMENTAL IMPACTS AND CONTROLS

The following tables (refer to **Table 9-1** and **Table 9-2** below) provide a summary of potential environmental impacts that could be expected from the JDP pipeline installation activity for planned activities and unplanned events. It lists the activities which might give rise to environmental impacts and the subsequent controls and measures which eliminate or ensure the environmental risk is reduced to ALARP.

Table 9-1: Environmental risk summary for planned activities

PLANNED ACTIVITIES			
Hazard	**Cause**	**Potential Impacts**	**Risk Treatment** **Avoidance, Mitigation & Management Controls**
Introduction of Invasive Marine Pest Species	Bringing project vessels into operational area (from international waters); and Introduction through ballast water and biofouling	Establishment of invasive marine species.	• Vessel anti-foulant systems are maintained and vessels in possession of Current International Anti-fouling System Certificate. • Vessel has record of formal AQIS clearance to be in Australian waters. • Completed biofouling vessel risk assessment (VRASS) prior to mobilisation to Australia, demonstrating vessel has low risk of introducing marine pests to Australian and West Australian waters. • Ballast water log to show vessels exchange 'high-risk' ballast water, as defined in Australian Ballast Water Management Requirements, outside Australian territorial seas and in waters at least 200 m deep. • Ballast water log completed and details uptake and discharge volumes and position and water depth of exchange.
Vessel Movements	The physical presence of project vessels within the operational area.	Behavioural and physiological effects on marine fauna; Interference with other marine users.	• Marine fauna interaction procedures are in accordance with Part 8 of the EPBC Regulations 2000, and Apache Whale Interaction and Sighting Procedure (EA-91-11-003) • Binoculars and Marine Fauna Sighting Datasheet present and available on all vessels. • Apache Marine Fauna Sighting Database and Datasheets completed and submitted to DSEWPaC. • Any vessel collision with an EPBC Act-listed marine fauna reported to DSEWPaC through a written report and recorded in daily environmental report. • All crew must attend an environmental induction containing basic information on procedures to manage interactions between vessels and marine fauna, including completed assessment forms and attendance records. • Australian Hydrographic Office (AHO) notified of operational area (AHO Notice to Mariners), activities and durations, which triggers AHO to issue a Notice to Mariners priority to the activity. • Australian Maritime Safety Authority (AMSA) Rescue Coordination Centre (RCC) notified of operational area, activities and durations, which triggers RCC to issue an AusCoast Warning prior to the activity.

Installation of Subsea Infrastructure	Installation of temporary and permanent structures
	ROV propeller wash
	Sedimentation as facilities placed on seabed
	Dropped objects
		Damage / loss to benthic habitat and associated biota;
		Sedimentation;
		Reduction in water quality from turbidity.
			• No project vessel anchoring within operational area as recorded in vessel log.
			• As-built drawings of the activity prepared within 10 weeks of completion of installation and supplied to AHO for marine chart update
			• Post-installation site survey verifies subsea infrastructure constructed and installed to design. Adherence to the selected pipeline route ensures minimal disturbance to benthic communities
			• Installation activities will occur within the operational area through adherence to the following procedures and drawings:
			  ○ Installation of subsea infrastructure according to alignment sheets and field layout drawings which specify the predetermined structure locations and pipeline corridors for installation of the subsea infrastructure;
			  ○ Installation procedure provides instruction on sequence of pipeline placement, pipelay parameters (tensions, radii, vessel position, etc.), weather limitations, and other information to facilitate successful installation of the pipelines and structures, and mitigate the potential for damage during installation operations; and
			  ○ Survey positioning and navigation procedure adhered to for operations undertaken by installation and associated vessels.
			• Competent crew to conduct rigging and lifting operations
			• All facilities installed in accordance with the Installation Procedure endorsed by the Apache Project Manager, which includes a work/job risk assessment
			• Lifts completed in accordance with work/job risk assessments.

PLANNED ACTIVITIES			
Hazard	**Cause**	**Potential Impacts**	**Risk Treatment** **Avoidance, Mitigation & Management Controls**
			• Lifting equipment certified; certificates valid and current. • Dropped objects recovered if scheduling and weather permit in order to avoid long-term disturbance to seabed and dropped objects recorded in vessel log. • Equipment and structures securely sea fastened prior to deployment to ensure no dropped objects.
Artificial light	Deck and navigational lighting on vessels.	Disorientation or mis-orientation caused by direct attraction to the light; Increased vessel interactions with animals attracted to the light; and Altered feeding behaviours, including increased predation risks.	• Deck lighting configuration reviewed prior to mobilisation and any opportunities to reduce direct light spill to marine waters will be implemented, whilst still ensuring that light regime fulfills navigation and safety requirements • Night-time in-sea equipment inspections avoided to reduce direct lighting onto marine waters, unless required for logistical or safety reasons.
Noise Emissions	Vessel equipment and machinery; Helicopter (crew transfers).	Physiological or behavioural effects to fauna.	• Noise emissions minimised by maintaining vessel machinery/equipment in accordance with manufacturer specifications as per vessel planned maintenance system. • Marine fauna interaction procedures are in accordance with Part 8 of the EPBC Regulations 2000, and Apache Whale Interaction and Sighting Procedure (EA-91-11-003). • Binoculars and Marine Fauna Sighting Datasheet present and available on all vessels. • Apache Marine Fauna Sighting Datasheets submitted to DSEWPaC and completed Apache Marine Fauna Sighting Database. • Daily environmental report details any incident that resulted in harm or mortality to marine fauna. • All crew must attend an environmental induction containing basic information on procedures to manage interactions between survey vessels and marine fauna. • Helicopters operate in accordance with the Australian National Guideline for Whale and Dolphin Watching (2005) and Apache Whale Interaction and Sighting Procedure (EA-91-11-003).

Oily Water Discharges	Vessel drainage (e.g. bilge water, machinery space).	Temporary reduction of water quality in the vicinity of the release point;
		Potential for toxicological impacts to marine flora and fauna.
			• Oily water discharged to marine waters through filtering equipment in accordance with Regulation 15 of MARPOL Annex I:
			  ○ Oily water discharged to sea after passing through filtering equipment has an oil content not exceeding 15 parts per million (ppm).
			  ○ On detection of OIW content greater than 15 ppm, the discharge stream shall automatically shut-in or be directed in-board for further treatment or storage.
			  ○ Oily water discharged while proceeding en route.
			• Vessel fitted with oil filtering equipment in accordance with Regulation 14 of MARPOL Annex I.
			• Oil filtering equipment maintained and calibrated with an alarm system in accordance with manufacture's specifications to ensure oil content is not exceeding 15 parts per million (ppm).
			• All transfer and movement of oil is recorded in the vessel's oil record book.

PLANNED ACTIVITIES			
Hazard	**Cause**	**Potential Impacts**	**Risk Treatment** **Avoidance, Mitigation & Management Controls**
Liquid Discharges	Food waste, sewage, brine, deck drainage, and cooling water discharges.	Temporary and localised water column turbidity; Localised nutrient enrichment (leading to eutrophication); and Increased toxicity.	• Treated sewage discharge procedures compliant with Regulation 11 of MARPOL Annex IV • Untreated sewage is discharged at a distance of more than 12 nautical miles from the nearest land in accordance with Regulation 11 of MARPOL Annex IV • Sewage treatment system compliant with Regulation 9 of MARPOL Annex IV w • Sewage treatment system maintained in accordance with manufacturer's specifications • Daily environmental report details any problems with sewage treatment system that resulted in discharge of untreated sewage to the marine environment. • Maximum carrying capacity of the sewage system is not exceeded, • As per MARPOL Annex IV / AMSA Marine Order 96 any vessel licensed to carry more than 15 persons will have a current International Sewage Pollution Prevention Certificate • Food waste collected, stored, macerated and disposed of in accordance with a Garbage Management Plan as required under Regulation 9 of MARPOL Annex V. • Garbage Record Book indicates volume and location of discharged food waste in accordance with Regulation 3 of MARPOL Annex V food waste. • Macerator capable of reducing food to 25 mm or less that is installed and is maintained in accordance with manufacture's specifications • Equipment is MARPOL compliant in accordance with Annex V. • Cleaning agents or additives that will be released to the sea via deck drains are not 'harmful substances' as defined by MARPOL Annex III. • Water treatment system maintained in accordance with manufacturer's specifications • Anti-scale products are not 'harmful substances' as defined by MARPOL Annex III, as per the onboard inventory of MARPOL-compliant cleaning agents and additives. • Machinery maintained in accordance with manufacturer's specifications.
Discharge of Treated Water	Flooding, Cleaning and Gauging operations will involve flooding the flowlines with treated seawater, and small release to sea.	Reduction in water quality; and Impacts to marine fauna through exposure.	• Chemicals packaged, marked, labelled and stowed in accordance with MARPOL 73/98 Annex III regulations. • Chemicals (environmentally hazardous) and hydrocarbons stored in bunded areas. • Material Safety Data Sheet (MSDS) available for FCGT chemical fluids stored onboard. • All vessel crew must attend an environmental induction containing basic information on chemical management, waste management practices as well as spill prevention and response measures. • Competent crew to conduct pipeline installation operations. • All facilities installed in accordance with the Installation Procedure endorsed by the Apache Project Manager, which includes a work/job risk assessment. • Procedures for chemical handling and pumping FCGT seawater endorsed by Apache Project Manager. • Hydrosure 03670-R and Fluorescein Liquid Dye will be diluted and injected at 500 ppm (vol) and 50 ppm (vol) respectively using a calibrated flow meter. • Scupper plugs or equivalent deck drainage control measures available where chemicals and hydrocarbons are stored and frequently handled.

PLANNED ACTIVITIES			
Hazard	**Cause**	**Potential Impacts**	**Risk Treatment** **Avoidance, Mitigation & Management Controls**
			• All subsea infrastructure will undergo factory acceptance testing (FAT) to ensure strength, minimising the offshore testing required to only a system leak test. Offshore leak testing will be conducted to ensure the integrity of joints between components. • Apache's Environmental Chemical Approval Procedure for Operational Activities (EA-91-II-10001) will be followed to select chemical additives for FCGT chemical fluids which are of the lowest toxicity whilst achieving technical requirements for known volumes used. • As per Apache's Environmental Chemical Approval Procedure for Operational Activities (EA-91-II-10001), when chemical additives are not ranked Gold or Silver using the OCNS CHARM model or non-CHARM-able E and D or if the chemical additives are not assessed under OCNS CHARM model or non-CHARM-able models, they will be risk assessed by the Apache Operations Chemist to ensure the product is environmentally acceptable for discharge to the marine environment.
Atmospheric Emissions	Operation of machinery and vessels by combustion engines; Incinerator; Refrigeration equipment (Ozone Depleting Substances, ODS)	Temporary and localised decrease in air quality; and Contribution to greenhouse gas loadings.	• Vessel machinery maintained in accordance with the manufacturer's specifications and the vessels planned maintenance system. • Vessel engines meet NOx emission levels as required by Regulation 13 of MARPOL Annex VI. • Sulphur content of diesel/fuel oil complies with Regulation 14 of MARPOL Annex VI. • Incinerator certified and operated according to Regulation 16 of MARPOL Annex IV. • ODS to be current and licensed under the Ozone Protection and Synthetic GHG Regulations. • ODS managed in accordance with Regulation 13 of MARPOL Annex VI. • ODS only handled by a qualified or experienced tradesperson.

Table 9-2: Environmental risk assessment summary for unplanned events

UNPLANNED EVENTS			
Hazard	**Cause**	**Potential Impacts**	**Risk Treatment** **Avoidance, Mitigation & Management Controls**
Hydrocarbon Spill from Vessel Collision	Significant vessel collision capable of rupturing fuel tanks.	Chemical and physical impacts to marine species; Decline in water quality; and Disruption to other marine users.	• Navigation equipment and vessel procedures compliant to applicable AMSA Marine Orders. • All vessels undergo International Marine Contractors Association (IMCA), Common Marine Inspection Audit (CMID) or Offshore Vessel Inspection Document (OVID) inspections to confirm that they meet international HSE and maintenance standards prior to mobilisation. • Vessels equipped with an automatic radar plotting aid (ARPA) system. • Visual vessel bridge-watch 24 hours per day by crew qualified by an accredited trainer. • Dynamic Positioning (DP) trials to ensure correct operation prior to activity. • Use of Yokahama fenders during vessel to vessel transfers. • All work will be carried out under the WP Upstream Marine Co-ordination and SIMOPs Framework which recognises the potential for SIMOPs activities between the installation activities associated with the WP and the JDP pipelay construct-install phase. • Implementation of the simultaneous operations (SIMOPS) plan. • Australian Hydrographic Office (AHO) notified of operational areas, activities and durations prior to the activity, which triggers AHO to issue a Notice to Mariners. • Australian Maritime Safety Authority (AMSA) Rescue Coordination Centre (RCC) notified of operational areas, activities and durations prior to the activity, which triggers RCC to issue an AusCoast Warning. • AMSA notified in the event of a spill as detailed in the OSCP, who release Notices to Mariners to other sea users.

UNPLANNED EVENTS			
Hazard	**Cause**	**Potential Impacts**	**Risk Treatment** **Avoidance, Mitigation & Management Controls**
			• Vessel maintained in accordance with the vessel maintenance system. • 500 m exclusion zone maintained at all times, with permission required to enter. • AEL will identify whether sensitive activities and discuss with contractor limits which ensure weather windows are identified prior to commencing activities. • Oil spill response executed in accordance with Apache Julimar Development Project Pipeline Installation OSCP Oil Spill Contingency Plan (OSCP) (EA-72-RI-008.02). • Oil spill response executed in accordance with the vessel's current (<12 months) Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP) as required under MARPOL. • Spill response exercise conducted in accordance with the SOPEP or SMPEP requirements and conducted prior to the commencement of the activity • All crew must attend an environmental induction containing basic information on spill response measures. • Crew undertaking vessel watch qualified in accordance with International Convention of Standards of Training, Certification and Watch-keeping for Seafarers (STCW95), AMSA Marine Orders Part 3: Seagoing Qualifications or certified training equivalent.
Hydrocarbon Spill During at Sea Refuelling	Damaged refuelling hose, coupling failures, loss of connection, vessel collision, or loss of vessel position.	Chemical and physical impacts to marine species; and Decline in water quality.	• Dynamic Positioning (DP) trials to ensure correct operation prior to activity. • Fuel transfer will take place in accordance with Apache endorsed vessel fuel bunkering procedure. • Fuel oil compliant with MARPOL Annex VI Regulation 14.2 (i.e. sulphur content of less than 3.50% m/m) is the only fuel recorded on vessel fuel bunkering register. • Adequate bunding in fuel transfer areas as per MARPOL Annex IV. • Deck drains closed prior to fuel transfer, drainage and bunding systems are subject to ongoing monitoring and maintenance to ensure integrity and capacity. • Vessels fitted with oil filtering equipment in accordance with Regulation 14 of MARPOL 73/78 Annex I. • Oil spill response executed in accordance with Apache Julimar Development Project Pipeline Installation OSCP (EA-72-RI-008.02). • Oil spill response executed in accordance with the vessel's current (<12 months) Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP) as required under MARPOL. • HFO/IFO storage tanks and fuel transfer hose maintenance undertaken in accordance with the manufacturer's specifications and vessels planned maintenance system. • Spill response exercise conducted in accordance with the SOPEP or SMPEP requirements and conducted prior to the commencement of the activity. • All crew must attend an environmental induction containing basic information on spill response measures. • All crew involved in refuelling will adhere to Apache endorsed vessel fuel bunkering procedure with a PTW completed. • In line with MARPOL 73/78 Annex 1, vessels over 400 gross tonnage will have a current SOPEP/SMPEP and IOPP in place.
Hazardous Chemical and Hydrocarbon Release from Woodside Pluto Line Rupture	Pluto pipeline rupture, from a dropped or snagged object.	Reduction in water and sediment quality; Lethal or sub-lethal chemical or physical effects on marine fauna; Asphyxiation of marine	• Vessel maintained in accordance with the vessel maintenance system. • Dynamic Positioning (DP) trials to ensure correct operation prior to activity. • ROV survey to establish the as-found and as-built condition of the Woodside Pluto lines. • ROV will be deployed and retrieved within a minimum distance of 200 m and outside of an engineered overboard 'no loading exclusion zone' over the Woodside Pluto lines. The MEG, flowlines, mattresses etc. will be deployed within a minimum distance of 500 m and also

UNPLANNED EVENTS			
Hazard	**Cause**	**Potential Impacts**	**Risk Treatment** **Avoidance, Mitigation & Management Controls**

		fauna exposed to concentrated natural gas;
		Reduction in local air quality caused by greenhouse gas emissions.
			outside the 'no loading exclusion zone'. The zone will be endorsed by the Apache Project Manager and Woodside representative.
			• An ROV shall not:
			  ○ Approach within 2 m of a Woodside Pluto facility (i.e. pipeline).
			  ○ Exceed 8 knots.
			• All facilities installed in accordance with the Installation Procedure endorsed by the Apache Project Manager, which includes a work/job risk assessments.
			• Dropped objects recovered if scheduling and weather permit in order to avoid long-term disturbance to seabed.
			• Equipment and structures securely sea fastened prior to deployment.
			• Lifting equipment certified.
			• At least one Woodside representative on a project vessel within the operational area.
			• AEL will identify weather sensitive activities and discuss with contractor limits which ensure weather windows are identified prior to commencing activities.
			• Pipeline installation procedures, endorsed by Apache Project Manager, will ensure the structural integrity of the pipework being lifted and laid.
			• Pipelay operations will include precautions as per documented HSE inspections/checks, tensioner specification sheets, tensioner slip test records and instrumentation calibration records.
			• Activities in vicinity of Woodside Pluto flowline crossing performed under Woodside's Permit To Work (PTW) system a.
			• Adherence to the vessel emergency response plan, which addresses a Woodside Pluto line rupture. The plan shall be endorsed by the Apache Project Manager and Woodside representative.
			• Communication protocols of the vessel emergency response plan tested prior to the project vessels entering the operational area. Woodside representative to be present during the test.
			• Competent crew to conduct rigging and lifting operations.
			• Operators of Pluto pipeline have ESD systems in compliance with the pipeline safety case.
			• Oil spill response executed in accordance with Apache Julimar Development Project Pipeline Installation Oil Spill Contingency Plan (EA-72-RI-008.02).

Hazardous Chemical and Hydrocarbon Spills from Marine Operations	Chemicals and hydrocarbons could be spilt or leak on-board or during activity, and potentially enter the marine environment.	Chemical and physical impacts to marine species; and Reduction in water quality.	• Chemicals and hydrocarbons packaged, marked, labelled and stowed in accordance with MARPOL Annex III regulations. • Vessel shall maintain an environmentally hazardous chemicals and hydrocarbons manifest setting forth the environmentally hazardous chemicals and hydrocarbons on board and the location thereof. • Material Safety Data Sheet (MSDS) available for environmentally hazardous chemicals and hydrocarbons onboard. • Environmentally hazardous chemicals and hydrocarbon storage areas inspected weekly. • Any equipment or machinery with the potential to leak chemicals or hydrocarbons will be enclosed in continuous bunding. • FCGT conducted in accordance with the FCGT procedure endorsed by the Apache Project Manager, which includes a work/job risk assessment. • Maintenance records on vessels indicate that all machinery and equipment containing hydrocarbons and equipment involved in the discharge and transfer of liquids have maintenance scheduled on their respective planned maintenance system and are maintained in accordance with manufacturer's maintenance specifications. • Header tank limit switches maintained and tested in accordance with the manufacturer's specifications and the vessels planned

UNPLANNED EVENTS			
Hazard	**Cause**	**Potential Impacts**	**Risk Treatment** **Avoidance, Mitigation & Management Controls**
			maintenance system. • ROV hydraulics maintenance records and maintained in accordance with manufacturer's specifications. • ROV hydraulic hoses and fittings checked prior to deployment. • Spill clean-up equipment located where environmental hazardous chemicals and hydrocarbons are stored and frequently handled. • Scupper plugs or equivalent deck drainage control measures available where chemicals and hydrocarbons are stored and frequently handled. • Cleaning agents or additives that will be released to the sea via deck drains are not 'harmful substances' as defined by MARPOL Annex III. • Environmentally hazardous chemical and hydrocarbon leaks and spills on the vessel immediately cleaned up (including in deck bunds), and contaminated material contained securely onboard. • Shipboard oil spill response executed in accordance with the vessel's current (<12 months) Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP) as required under MARPOL 73/78. • Oil spill response executed in accordance with Apache Julimar Development Project Pipeline Installation OSCP Oil Spill Contingency Plan (OSCP) (EA-72-RI-008.02). • All crew must attend an environmental induction containing basic information on chemical and hydrocarbon management, as well as spill prevention and response measures. • Spill response exercise conducted in accordance with the SOPEP or SMPEP requirements and conducted prior to the commencement of the activity. • In line with MARPOL 73/78 Annex 1, vessels over 400 gross tonnage will have a current SOPEP/SMPEP and IOPP in place.
Non-hazardous and Hazardous Solid Waste	Solid waste may unintentionally enter the marine environment if not appropriately secured onboard e.g. overfull or uncovered bins, adverse weather.	Chemical and physical impacts to marine species; and Reduction in water quality.	• Non-hazardous and hazardous wastes collected, labelled, segregated, stored, processed and disposed of in accordance with the project vessel's Garbage Management Plan as required under Regulation 9 of MARPOL Annex V. • Incinerator meets the requirements of Regulation 16 of MARPOL Annex VI. • Incinerator operated in accordance with Regulation 16 of MARPOL Annex VI. • All crew must attend an environmental induction containing basic information on waste management. • Accidental release of waste to the marine environment is reported and investigated and corrective actions are implemented. • Grouting procedures endorsed by Apache Project Manager specify manned operation using grout bags designed for cement loading and pumping of known volumes into grout bags. • Hazardous wastes (e.g. used oils, lithium batteries, chemical and metallic wastes) documented, tracked, segregated, labelled and stored onboard with secondary containment (e.g. bin located in a bund).

Hydrocarbon and Chemical Spill Response	Implementation of hydrocarbon spill response strategies.	Hydrocarbon spill, response activities can exacerbate or cause further environmental harm.	• OSCP that provides response strategies for the combat of floating oil, provision of intelligence on dispersion behaviour in the marine environment, and quantitative assessment of environmental impact and recovery due to contact by released hydrocarbon.
			• Chemical dispersants recorded in the daily incident action plan and completed risk assessment of chemical dispersant prior to application; found to be acceptable for use in the marine environment by:
			  ○ Being approved with the Australian NatPlan OSCA register as either 'listed'; or
			  ○ Evaluated as acceptable using Apache's Environmental Chemical Approval Procedure for Operational Activities (EA-91-II-10001).
			• Application of chemical dispersants will only occur within a pre-selected application zone.
			• Daily monitoring of dispersant efficacy to ensure floating oil remains amenable to chemical dispersant application.

UNPLANNED EVENTS			
Hazard	**Cause**	**Potential Impacts**	**Risk Treatment** **Avoidance, Mitigation & Management Controls**
			• Dispersant operations will be constantly reviewed through the Incident Action Planning process, which includes a NEBA, to ensure environmental priorities for protection decreed by NatPlan can be achieved.

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