Asset Removal Operations Environment Plan Summary

PROJECT / FACILITY	Asset Removal/VI Hub
REVIEW INTERVAL (MONTHS)	No Review Required
SAFETY CRITICAL DOCUMENT	NO

Revision History

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A	12/02/2019	Jacobs/Santos	Draft for Santos review
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Contents

Tables

Figures

1. Introduction

On 27 November 2018, Santos completed its acquisition of Quadrant Energy. This has the effect that Santos Limited is now the ultimate holding company of Quadrant Energy Holdings Pty Ltd and its subsidiaries (which includes the operator in respect of this environment plan, Quadrant Energy Australia Limited, now renamed Santos WA Northwest Pty Ltd (Santos WA) but with the same ABN).

Santos WA proposes to opportunistically remove Varanus Island (VI) Hub offshore facilities located within State waters as they reach retirement and are no longer needed. The Asset Removal Operations Environment Plan QE-02-BI-20001 ('the EP') covers the asset removal operations (ARO) in State waters, of potentially up to 17 offshore structures, for a period of five years from acceptance.

The EP only covers the removal of facilities and not pipelines. Notwithstanding this, Santos WA understands and commits to its ongoing asset removal and decommissioning obligations with regards to the TL/1, TL/5, TL/6, TL/8 and TL/9 licences under the *Petroleum (Submerged Lands) Act 1982* (PSLA).

Santos WA (as operator of the EP) will be responsible for all commitments and obligations in this EP.

1.1 Operator

Santos WA Northwest Pty Ltd (Santos WA) is the operator on behalf of the titleholders of production licences TL/1, TL/5, TL/6, TL/8 and TL/9 who are:

- Santos WA Northwest Pty Ltd (87.7771%); and
- Harriet (Onyx) Pty Ltd (12.2229%).

Operator details are as follows:

Name:	Santos WA Northwest Pty Ltd
ABN/ACN:	58 009 140 854/ 009 140 854
Business Address:	Level 7, 100 St Georges Terrace, Perth, WA, 6000
Telephone number:	(08) 6218 7100
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Email address:	Offshore.environment.admin@santos.com

1.2 Purpose

The overall purpose of the EP is to comply with statutory requirements of the *Petroleum (Submerged Lands) (Environment) Regulations 2012* and to ensure that the activity is planned and conducted in line with Santos WA's environmental policies and standards. This EP summary has been prepared in accordance with the requirements of Regulation 11(7) of the Petroleum (Submerged Lands) (Environment) Regulations.

2. Activity Location

2.1 Location

This EP covers ARO that occur within Santos WA operated production licences. The facilities located within these licences that may be removed are listed in **Table 2-1** and shown in **Figure 2-1**. The location and direction of these offshore facilities to key regional features are listed in **Table 2-2**.

Table 2-1: Santos WA facilities located within State water production licences

Production Licence	Facilities
TL/1	Linda
	Gipsy
	Bambra sea pole
	Harriet Alpha (Harriet A), Harriet Bravo (Harriet B) and Harriet Charlie (Harriet C) offshore facilities (including the flare)
	Simpson A and Simpson B offshore facilities
TL/5	Campbell
	Sinbad
TL/6	Agincourt
	Gibson/South Plato
	Victoria
TL/8	Wonnich
TL/9	Double Island
	Twickenham

Table 2-2: Location and direction of offshore facilities to key regional features

Facility / structure	Distance / Direction to Harriet Alpha	Distance / Direction from VI	Distance / Direction from Barrow Island	Distance / Direction from Dampier
Agincourt	12.74 km SW	6.46 km WSW	4.88 km E	124 km W
Bambra Sea pole	6.13 km NNW	11.3 km NNE	20.5 km NE	114 km W
Campbell	24.08 km NNE	30.4 km NNE	40.17 km NE	106 km WNW
Double Island	20.44 km SSW	13.13 km SSW	3.15 km E	125 km W
Gibson / South Plato	11.94 km SSW	4.58 km SSW	9.70 km E	119 km W
Gipsy	13 km ESE	16 km NE	27.5k m NE	100 km W
Harriet Alpha	-	6.33 km NE	17.42 km NE	114 km W
Harriet Bravo	3.86 km NE	10.18 km NE	22 km NE	112 km W
Harriet Charlie	2 km NNE	8.31 km NE	19.36 km NE	113 km W
(Harriet Flare)	110 m N	6.33 km NE	17.42 km NE	114 km W
Linda	11.17 km ENE	17 km NE	28.59 km NE	105 km W
Simpson A & B	8.32 km SSW	1.19 km S	12.14 km W	116 km W
Sinbad	16.66 km NNE	22.98 km NNE	33.47 km NE	106 km WNW
Twickenham	20.5 km SW	13.2 km SW	3.44 km E	105 km W
Victoria	15.84 km SSW	8.68 km S	9.83 km E	118 km W
Wonnich	22.37 km WNW	21.19 km NW	18.42 km N	135 km W

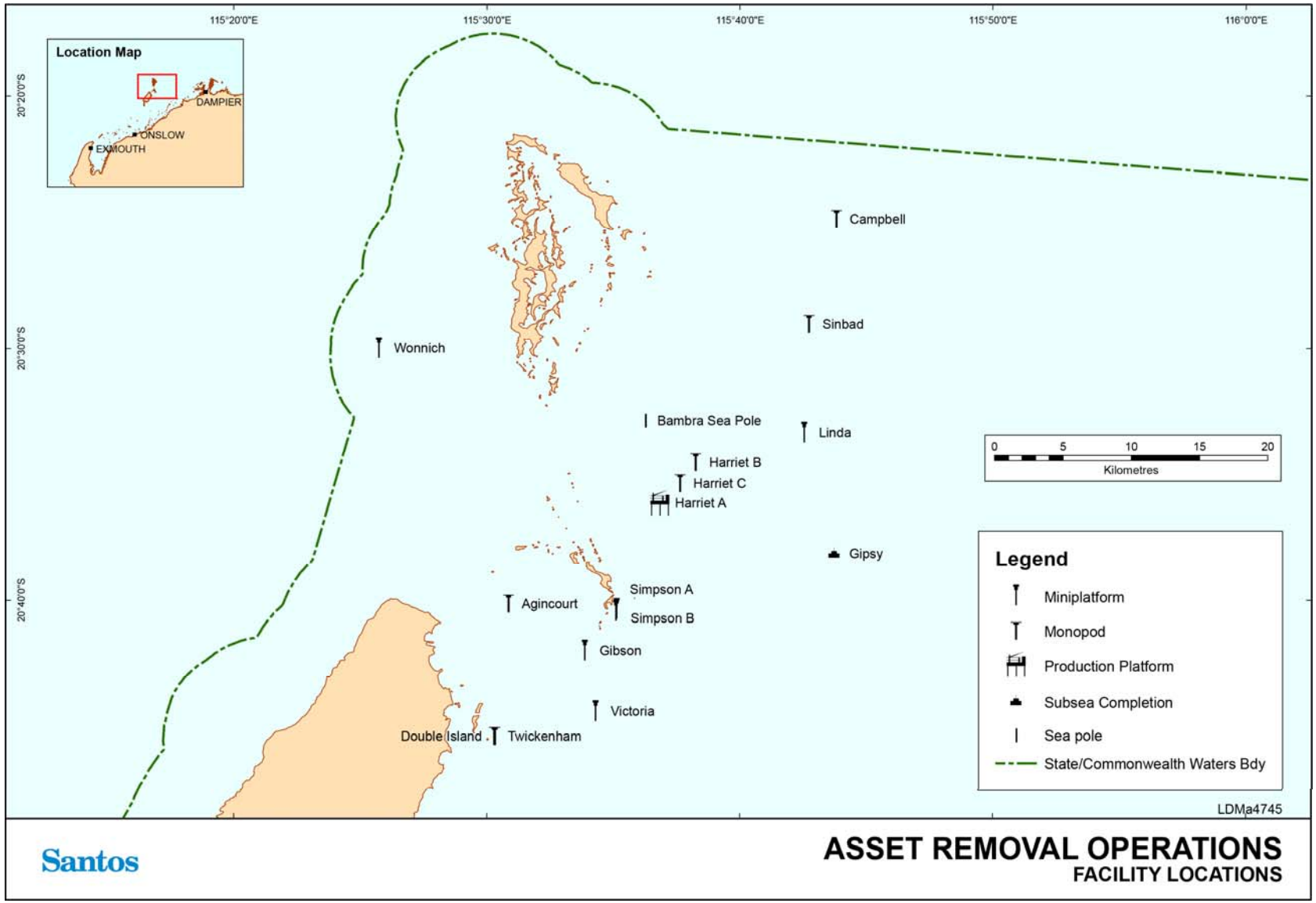

Figure 2-1: ARO facility locations

2.2 Operational Area

The EP provides for all ARO within the 500 m exclusion zone (petroleum safety zone) surrounding each facility, defined as the 'EP operational area' (referred to as the operational area from hereon).

2.3 Schedule

Each asset removal operation could take between approximately 15 to 120 days to complete. Delays could be incurred due to weather, vessel availability and/or unforeseen operational reasons. Activities could be undertaken at any time of the year, and would be continuous over a 24-hour period.

3. Description of the Activity

ARO include, but are not limited to, the following activities:

- Site surveys;
- Preparatory works prior to removal;
- Removal of topsides and support structures and associated steel work;
- Removal of plugged and abandoned well infrastructure;
- Cutting and capping/plugging production pipelines;
- Securing of removed structures on a project vessel(s);
- Installation of subsea caps (or similar) to cover remaining protruding structures on the seabed;
- Installation and/or replacement of cathodic protection systems and stabilisation structures for remaining infrastructure; and
- Auxiliary activities to support asset removal operations, such as, but not limited to, vessel, helicopter and unmanned aerial vehicle (UAV) operations.

Mobilisation and demobilisation of vessels, and transportation and disposal of the removed facilities, outside of the EP operational area are not provided for in this EP. These activities are subject to applicable maritime and onshore legislative requirements.

The facilities that may be removed are described in **Section 2.**

3.1 Planned Activity

3.1.1 Surveys

Prior to preparatory works, surveys including ROV and/or diver will be conducted to identify and locate any construction debris or sensitive seabed features, that may interfere with or restrict navigation/positioning/removal operations and/or safety. The survey results will be used to inform habitat mapping to identify and distinguish areas of environmental sensitivity for vessel navigation/positioning and planning of any works requiring temporary placement of materials on the seabed.

Geophysical and geotechnical vessel-based surveys, supported by ROV operations, may be required prior to the arrival of a jack-up MODU and pinning of legs. The surveys would be limited to the immediate area surrounding a platform.

Typical measurements for a geophysical site survey include:

- Multi-beam echo sounder (MBES).
- Side scan sonar (SSS).
- Sub bottom profiling (SBP).
- Seabed grab sampling and drop-coring (if seabed conditions permit).
- Towed camera for identification of debris or raised seabed features (e.g. coral bommies).

Typical measurements for geotechnical site survey:

- Cone penetrometer test (CPT).
- Coring/bore-hole; cutting and recovering core samples (often in short lengths) to surface to enable detailed lab analysis of rock properties of the shallow-geology strata.

Unmanned aerial vehicle (UAV) surveys of topside facilities may also be conducted prior to, and potentially during, asset removal operations.

Following completion of the facility removal activity, an as-left survey will be conducted.

If facilities are removed and pipelines are left suspended in-situ, monitoring activities of the pipelines will continue to be conducted under the Varanus Island Hub Operations Environment Plan and in accordance with Santos WA's pipeline integrity program.

3.1.2 Preparatory works

Prior to commencing the removal of facilities, the following preparatory tasks maybe undertaken:

- Deployment of temporary vessel positioning surface reference markers;
- Installation of moorings or pre-laid anchors;
- Pressure washing of structures;
- Installing lifting equipment (e.g. pad-eyes or similar) and setting up of equipment transfer rigging;
- Erecting topside scaffolding;
- Securing inner conductor within caisson with retaining bar;
- Welding lifting guides onto structures;
- Cutting off pipes, conductors and other structures as required.
- Cutting subsea pipelines or other subsea structures as required;
- Plugging and/or capping pipelines;
- Cutting mudline templates;
- ROV and/or divers diver inspections; and
- Other topside and subsea works in preparation for removal activities.

3.1.3 Structure removal

For facilities with larger topsides, the topsides may be removed prior to removal of the subsea structures. The topsides will be cut and lifted in single or multiple lifts onto a vessel.

For smaller structures and all underwater structures, abrasive cutting equipment (e.g. diamond wire saw cutter) will be used to cut the structure(s) into pieces for removal. The diamond wire saw cutter is powered by hydraulic downlines.

Most structures are likely to be removed in several sections. Temporary support bags (typically sand or grout bags) may be placed on seabed prior to laying structures down if cutting is required. The temporary supports will be retrieved at the end of the activity.

Cathodic protection systems (e.g. anode skids) may be removed, replaced or consolidated as required at the activity locations to ensure the preservation of remaining structures.

Remaining subsea infrastructure, such as pipelines, may need to be stabilised through the installation of concrete mattresses, sand and grout bags and other stabilisation structures.

3.1.4 Subsea cap

Structures, caissons and conductors are proposed to be cut as close to the mudline as practicable. Based on current information it is expected that the cut height should not be greater than 1 metre above the mudline. However, best endevours will be to cut the structures to within 25 cm of the mudline. All structures cut above the mudline will be covered with a pre-fabricated subsea cap. The caps will be sized to cover the subsea obstruction, most likely made of concrete for subsea application, have lifting points for installation and be of low profile to minimise snagging risks. Detailed engineering studies will be completed to determine the exact subsea cap specifications. An indicative size and design of the caps is shown in **Figure 3-1**, however where there are multiple protrusions (i.e. caissons or mudmats) in close proximity, a single larger cap may be used.

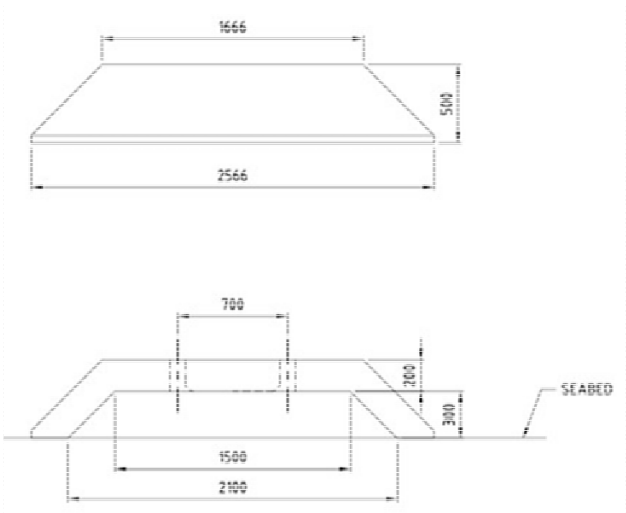

Figure 3-1: Example of subsea cap layout and dimensions (in mm)

3.1.5 Structure debris removal

A Remote Operated Vehicle (ROV) or divers will be used to assist with cutting activities, and with collection of the structure debris where safe and practicable to do so. A basket (typically 6 m long) may be deployed to aid in the removal of debris. Debris may be cut into smaller pieces using a grinder, shears or similar as required.

3.1.6 Structure disposal

The project or support vessels will commence transporting the structure, once secured on deck, to a disposal location outside of the operational area.

3.2 Vessel Operations

The activity will be carried out by one, or a combination of the following marine 'vessels':

- A moored or pinned crane barge;
- A self-elevating platform;
- A mobile offshore drilling unit (MODU); or
- A moored or dynamically positioned vessel.

Vessels maybe anchored, moored, pinned or dynamically positioned.

Vessel positioning surface reference markers may also be deployed within the operational area. Positioning beacons may also be placed on vessel equipment (e.g. cranes), ROVs, divers or structures while undertaking the activities.

ARO vessels are yet to be confirmed and will depend on vessel availability, operational and logistical constraints and requirements.

3.3 Logistics Support

Helicopters may be used to transfer crew and equipment to and from vessels and assist in emergency situations as required. Support vessels may also be required for materials, equipment, provisions, personnel and waste transfers.

4. Environment Description

While the area that could be impacted by the planned ARO is limited to the immediate vicinity of the facilities (i.e. the operational areas), an unplanned hydrocarbon (vessel fuel) release could potentially impact a wider area. To define this wider area, oil spill modelling was completed based on the worst-case credible spill scenario from a vessel collision or grounding leading to the rupture of the largest vessel fuel tank. This wider area, as defined by oil spill modelling, is referred to as the 'Environment that May Be Affected' or EMBA. The EMBA is the spatial extent considered when describing the potential sensitivities and receptors of the existing environment.

4.1 Regional Setting

The EMBA is within the North-west Marine Region of the Northwest Shelf Province. This region is characterised by shallow-water tropical marine ecosystems with high species richness. Most of the region's species are tropical and are also found in other parts of the Indian and western Pacific oceans. The southern part of the region is a transition zone between tropical and temperate waters and includes the northern extent of the ranges of some temperate species that are more typical of the South-west Marine Region. High diversity is partly driven by the interaction between seafloor features and the currents of the region. The interaction of seafloor features and oceanographic processes also supports unique ecosystems and associated trophic interactions and communities (SEWPaC, 2012a).

Key features of the North-west Marine Region include the Montebello/Barrow/Lowendals Islands which are part of a shallow submarine ridge that extends north from the mainland near Onslow.

The ridge contains extensive areas of intertidal and shallow subtidal limestone pavement surrounding the numerous, mostly small islands found in the region. The seabed is primarily less than 5 m deep and consists of sand veneered limestone pavement with patches of fringing coral reef.

4.2 Marine Environment within EMBA

This section provides an overview of the marine environment within the EMBA.

4.2.1 Marine habitats

Marine habitats are summarised in **Table 4-1** and **Table 4-2**, and are shown in **Figure 4-1**.

Table 4-1: Marine habitats identified within the EMBA

Value	EMBA Description
Seagrass	The main seagrasses of the region are small, ephemeral species that grow on soft sediments and have a seed bank in the surficial sediments that allows them to recover quickly from disturbance. Seagrass distribution is restricted to shallow areas with sufficient light availability for photosynthesis; seagrasses are uncommon in waters deeper than 30 m. Seagrasses in the Montebello/Lowendals/Barrow islands region do not form extensive meadows but rather are sparsely interspersed with macroalgae.
Macroalgae	Macroalgae are most prolific over shallow pavement limestone reefs adjacent to offshore islands. Macroalgae are the dominant macrophyte in the Montebello/Lowendals/Barrow islands region occupying approximately 40% of the benthic habitat (CALM, 2004). The most numerically abundant macroalgae are the species of *Sargassum* that cover the shallow subtidal rock platforms around the islands. At least 132 macroalgal taxa occur in marine habitats around Barrow Island with most thought to be distributed widely in the tropical Indo-Pacific region (Huisman pers. Comm., in Chevron, 2005).
Hard Corals	Approximately 6% of the Montebello/Barrow islands marine conservation reserves are comprised of shallow intertidal and subtidal reef communities. Quantitative sampling of seven sites around the Lowendals Islands showed a range of 34 to 63 species or taxa per site, with massive forms such as *Favites* sp. and *Porites* sp., and tubular and digitate species of *Acropora* dominating the assemblages (LeProvost Dames and Moore, 1994). No corals are present in the channel between the Lowendals Islands and the northern tip of Barrow Island. A small submerged fringing reef lies in shallow water on the northeast side of Barrow Island.
Mangroves	Mangroves occur in the Montebello and Lowendals islands, along the south eastern and southern shores of Barrow Island, eastern beaches of Bridled Island and western beaches on Varanus Island (VI).
Rocky Substrata	Rocky substrate may be either subtidal (e.g. low relief pavement or high relief reef) or intertidal (i.e. platforms and rocky shorelines). Rocky substrata are found around offshore islands.
Sand	Sandy areas may occur subtidally with or without sessile epibiota such as seagrasses, some algae species and sessile invertebrates (e.g. sea pens and anemones). Sandy beaches are an important habitat for nesting sea turtles on the NWS, including beaches of Montebello/Barrow/Lowendals Islands, with some beaches critically important for populations of certain sea turtles species.

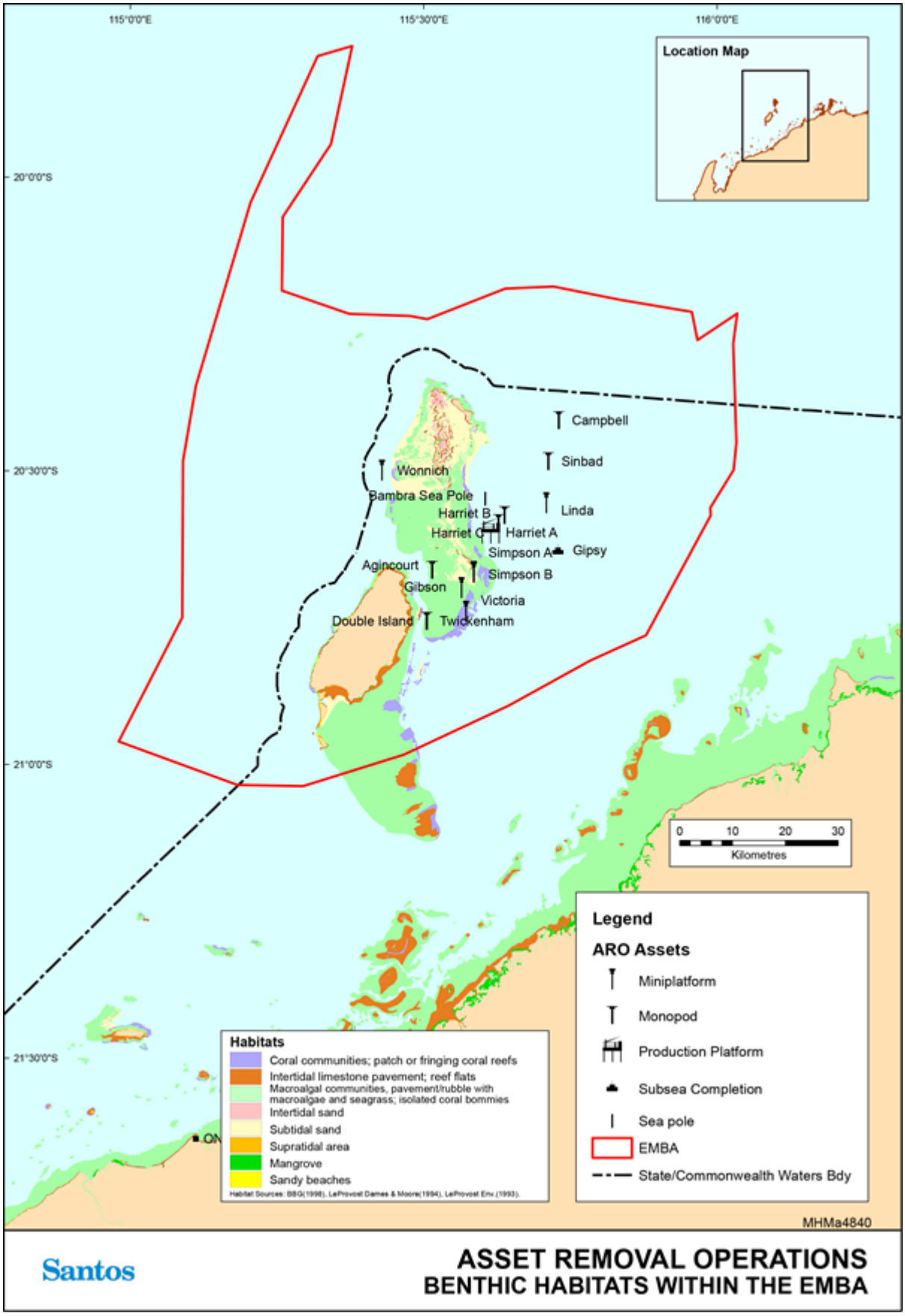

Figure 4-1: Benthic habitats within the EMBA

Table 4-2: Description of marine habitats identified for each asset

Asset	Operational Area Description
Wonnich	The Wonnich platform is located at a water depth of approximately 30 m at the lowest astronomical tide (LAT) in the Barrow Island Marine Management Area (MMA). No raised seabed features have been identified in the vicinity of the Wonnich platform and the area around the platform has been characterised as fine to medium grained carbonate sands with shell fragments. The closest coral reef to Wonnich is a patch of reef, which forms part of the Montebello fringing reef system (or Wonnich Reef), located ~3 km away (EPA, 1997). The Wonnich Reef consists of 100 coral species of 14 families (Apache Energy, 1996), with no endemic species (EPA, 1997).
Harriet facilities and Gipsy	The Harriet Offshore facilities consist of Harriet Alpha, Harriet Bravo and Harriet Charlie facilities. The seabeds surrounding the Harriet Alpha facilities are characterised in two types including, low relief unconsolidated carbonate silty fine to medium sand, and low relief unconsolidated carbonate silty medium to coarse sand. Benthic infauna (polychaete worms, small crustaceans, small mollusc) and sparsely distributed benthic macro fauna (sponges, sea whips, sea stars) are dominant. The seabed near Harriet Bravo is flat with no significant relief. The seabed ecology consists of sparse epibiotic assemblages dominated by occasional soft corals, flat branching, and cup sponges, gorgonians, seawhips, seapens and crinoids that indicates that the coarse sediments are underlain by limestone pavement. The seabed ecology around Harriet Charlie is gently undulating and featureless. A large sand drift (approximately 400 m wide and 2.5 m high) is located northwest of the facility and an irregular seabed morphology is south of the site on the north-western side of the sand drift. The predominant seabed type at the Harriet Charlie site is ripple, medium grained sand. The seabed around the Gypsy facility is relatively featureless, characterised by fine to coarse sediments. The sand forms a veneer over a well cemented calcarenite layer. Small isolated patches of hard substrate were identified with gorgonians, soft corals, sponges and seawhips in the vicinity of the Gypsy facility (Quadrant Energy, 2017).
Campbell, Sinbad, Linda and Bambra	Campbell and Sinbad facilities are located close to the Barrow Island Marine Management Area. The water depths for these facilities range between 27 m LAT to 40 m LAT. Overall the surrounding seabeds of the facilities are relatively featureless. The seabed near the Sinbad facility consists of carbonate sand with some areas of well-defined megaripples with amplitudes less than 0.5m and lengths up to 80m. No sensitive natural seabed features such as coral bommies or reefs have been identified near the Campbell facility. The superficial seabed deposits comprise unconsolidated calcareous sand. Approximately 50 m to the north-east of the facility there is a subcropping of cemented sediments; The seabed around the Bambra facility is relatively flat and featureless with medium to coarse sand with some with shell fragments. The seabed near the Linda platform is characterised by a thin veneer of gravelly, fine to coarse sand over smooth calcarenite and there are no coral pinnacles or significant seabed features.
Agincourt	The Agincourt facility is in the Barrow Island Marine Management Area. Water depths range from 0 to 6.5 m and the seabed south of the Agincourt monopod is relatively flat, sandy, gravelly and randomly irregular due to coral and other marine growth or low, discontinuous sand waves and mega ripples and irregularly eroded rock (Quadrant Energy, 2017). The seabed also consists of a thin veneer of uncemented sand over variably cemented calcarenite (Quadrant Energy, 2017). No large seabed grass meadows have been recorded in the immediate vicinity of the Agincourt facility. Coral pinnacles are scattered throughout the area. The coral pinnacles are generally less than 1.0 m high and can be up to 1.5 m high (Quadrant Energy, 2017). Five pinnacles were detected within 100 m of the Agincourt platform and another patch of pinnacles were identified 500 m to the northwest (Apache Energy, 2005).
String of Pearls (Simpson A and B, Gibson/South Plato, Victoria, Double Island, Twickenham)	The String of Pearls offshore facilities include Simpson A and B, Gibson/South Plato, Victoria and Double Island and Twickenham. Gibson is located within the Barrow Island Marine Management Area and Simpson A and B, South Plato, Victoria and Twickenham are located outside of the Barrow Island Marine Management Area. The seabed near the Simpson development is characterised by mainly limestone pavement with variable cover of macro algae, occasional small coral colonies, sponges and sand veneer. A few low-profile outcrops and an area of fringing coral occurs about 300 m to the east of Abutilon Island. The low-profile outcrops slope up to approximately 2 m above the surrounding permanent reef and are covered with a denser macroalgal assemblage (Quadrant Energy, 2017). The marine habitat near Simpson A are characterised by sand sheets overlying flat limestone pavement reef. The closest sensitive habitat is an area of scattered coral colonies 80-150 m to the west of the Simpson B location. Coral bommies of local significance occur predominantly as large *Porites* spp. located west of the Simpson B facility (Apache Energy, 2004; Quadrant Energy, 2017). Areas of exposed

	reef were covered with macroalgal and low densities of corals and sponges. Rocky shores are the pre-dominate shoreline habitat adjacent to the locations of Simpson A and B. There are two small sandy beaches on the east side of the facility and turtles nest on these beaches and seabirds use them primarily for foraging and resting. Between the Simpson and Gibson platforms, the limestone is characterised with a series of emergent rocks and islets and associated shallow reefs, dominated by macroalgae and sponges (Quadrant Energy, 2017). A deeper limestone pavement fringes the southern side of the reef between Abutilon Island and Gibson/South Plato platform. Coral are well represented on the pavement. To the south-east from the reef, the exposed limestone pavement habitat is replaced by deeper sandy veneers. These sands support occasional sea whips and small patches of annual seagrass (Quadrant Energy, 2017). Coral bommies have been identified within 200 m of the Gibson/South Plato platform and 14 significant seabed features including a large bombora, an area of scattered coral colonies and 13 bomboras have also been identified near the Gibson/South Plato facility (Quadrant Energy, 2017). The water depth at the Victoria facility is 5 m and beyond 25 m from the platform location, the benthic community generally appears typical of the region. The dominant macroalgae around the Victoria platform is *Sargassum* spp. A few corals and sea whips were also evident in areas distant from the platform. The sediments were coarser distant from the platform, particularly below the sediment surface (Quadrant Energy, 2017). The habitat near the Victoria platform is low undulating rocky and sandy substrate interspersed with macroalgae. Rocky outcrops or lumps with isolated coral colonies, sponges, crinoids, macroalgae and three *Porites* bommies were identified near the Victoria facility. Marine fauna sighted near the Victoria facility include corals, sponges, ascidians, hydroids, crinoids, pearl oysters, crayfish, fish and moray eels (Quadrant Energy, 2017). The bathymetry between Double Island and Victoria consists of a shallow subtidal limestone pavement that decreases in depth to the north to very shallow conditions (Quadrant Energy, 2017). The seabed near the Double Island and Twickenham facility (~60 m distance apart) are characterised by sand and limestone pavement with a macroalgal cover (Quadrant Energy, 2017).

4.2.2 Marine fauna

Table 4-3 summarises the marine fauna, including threatened and migratory species, that occur or could potentially occur within the EMBA.

Table 4-3: Marine fauna within the EMBA

Value	Description
Plankton	Plankton is divided into two categories: phytoplankton and zooplankton. Phytoplankton, in tropical regions, has marked seasonal cycles, with higher concentrations occurring during the winter months (June–August) and low in summer months (December–March) (Hayes *et al.*, 2005; Blondeau-Patissier *et al.*, 2011). Zooplankton which rely on them for food, are subject to similar seasonality. Spatial distribution of plankton is patchy and uneven, both vertically and horizontally.
Invertebrates	Pelagic invertebrates other than zooplankton include mobile cnidarians (jellyfish) and squid. The infauna assemblages observed during surveys around VI (IRCE, 1999) were typical of benthic infaunal communities occurring elsewhere on the NWS. They were dominated by polychaete worms and crustaceans and represented by a diverse range of other taxa at lower abundances. The study concluded that, on a regional scale, natural local processes rather than effects of petroleum production activities influenced infaunal assemblages
Fish and Sharks	Ten species of fish and sharks listed as threatened and/or migratory under the EPBC Act could occur within the EMBA. Whale sharks are occasionally observed from Santos' offshore facilities.
Marine Reptiles	Seasnakes are frequently observed in the surrounding waters of VI. The most common seasnake sighted in the waters surrounding VI is the olive sea snake (*Aipysurus laevis*). One sea snake listed as threatened under the EPBC Act could occur within the EMBA, although it has not been recorded. Five turtle species listed as threatened or migratory under the EPBC Act could occur within the EMBA. Peak turtle nesting and egg hatching on VI occurs between October and April.
Marine Mammals	Eleven species of marine mammals listed as threatened or migratory under the EPBC Act could occur within the EMBA. A number of marine mammals are known to occur in the EMBA, including dolphins, whales and the dugong. Some species are seasonal visitors, migrating through NWS waters, while others occur all year round.

Value	Description
Seabirds	Twenty three species of birds listed as threatened or migratory under the EPBC Act could occur within the EMBA.

4.3 Marine Protected Areas

There are multiple marine protected areas that overlap the EMBA as listed in **Table 4-4**. ARO facilities that fall within the Barrow Island Marine Management Area are Gibson, Agincourt and Wonnich.

Table 4-4: Marine protected areas within the EMBA

Marine Protected Area	Operational Area Presence	EMBA Presence
State Marine Parks		
Montebello Islands Marine Park	x	✓
Barrow Island Marine Park	x	✓
Barrow Island Marine Management Area (MMA)	✓	✓
Australian Marine Parks		
Montebello Marine Park (IUCN Category VI)	x	✓

4.4 Marine Key Ecological Features

There are two marine Key Ecological Features (KEF) that overlap a small portion of the EMBA in deeper Commonwealth waters. Namely, the Ancient Coastline at 125 m Depth Contour and Continental Slope Demersal Fish Communities. No KEF overlap the operational areas.

4.5 Terrestrial Conservation Reserves

There are four terrestrial conservation reserves present within the EMBA.

Table 4-5: Terrestrial conservation reserves within the EMBA

Terrestrial Conservation Reserve	Operational Area Presence	EMBA Presence
Lowendals Islands Nature Reserve	x	✓
Varanus Island Nature Reserve	x	✓
Barrow Island Nature Reserve	x	✓
Boodie, Double Middle Islands Nature Reserve	x	✓

4.6 Cultural Environment

There are no current Native Title claims over the EMBA.

A number of shipwreck sites have been recorded within the EMBA and are listed on the Register of the National Estate:

- Trial;
- Tanami;
- Plym HMS;
- Tropic Queen;
- Parks Lugger; and
- Perentie.

The Trial was wrecked on Trial Rocks in 1622, it is the oldest known shipwreck in Australian waters.

4.7 Socio-economic Environment

Table 4-6 provides a summary of the socio-economic environment in the vicinity of the EMBA.

Table 4-6: Socio-economic environment in the vicinity of the EMBA

Value	Description
Population Centres	Karratha, Dampier and Exmouth are the main service and population centres for the region and located outside of the EMBA. Smaller coastal and fishing towns are Exmouth, Onslow and Point Samson, also located outside of the EMBA. Land uses within the EMBA include the Montebello/Barrow Islands marine conservation reserves, ecotourism, pearling interests, existing oil and gas infrastructure and permits, and commercial fisheries.
Fisheries	The EMBA overlaps with 4 Commonwealth and 13 State fisheries. Limited fishing has occurred within the vicinity of the operational areas due to the presence of petroleum assets and operations, however, future fishing may occur following asset decommissioning.
Tourism and Recreation	The majority of tourism and recreation activities are confined to coastal areas and islands, plus luxury cruises that take tourists along the coastline and increasingly out to isolated coral atolls for fishing and diving (Gaughan and Santoto, 2018). Recreational and charter vessel passengers participate in SCUBA diving, snorkelling, fishing, mud crabbing, wildlife appreciation, island exploring and a limited amount of surfing. The area of the Montebello Islands visited depends on the activity being undertaken and charter operators have preferred areas of operation (DEC, 2007).
Petroleum Industry	Petroleum related activities are located within the Carnarvon Basin which is a highly developed petroleum province. Activities are undertaken as a regular occurrence in the surrounding waters. All petroleum-related activities within the operational areas is Santos WA operated. The closest non-Santos WA operating petroleum field is Barrow Island, operated by Chevron Australia Pty Ltd. A number of Santos' platforms are situated within the Barrow Island port limits (Double Island, Twickenham and Victoria), being an active port for LNG and oil export.
Shipping	In the Pilbara region there is significant commercial shipping activity, the majority of which is associated with the mining and oil and gas industry. The Australian Maritime Safety Authority (AMSA) has introduced a network of commercial shipping fairways in order to reduce the risk of vessel collisions with offshore infrastructure. There are a number of commercial shipping lanes that exist in the proposed EMBA, or in adjacent waters. Commercial shipping vessel are likely to be transiting through the EMBA en-route to and from marine terminals at Varanus and Barrow Islands (located within the EMBA). Other shipping activity adjacent to the EMBA includes iron ore carriers, LNG and oil tankers and other vessels transiting to and from regional ports (located outside the EMBA). In addition to the abovementioned facilities within the Port of Barrow Island, the following facilities are within the Port of Varanus Island – Simpson A and B, Harriet Alpha and Harriet Charlie.

5. Stakeholder Consultation

Stakeholders identified in **Table 5-1** were informed of activities covered in this EP in December 2018. Assessment of the activities covered under this EP showed there would be no additional risk or impact to the functions, interests and activities of other users of the sea, such as fishers, commercial shipping or the tourism industry, during the ARO activities, as activities will be occurring within an existing petroleum safety zone.

Table 5-1: Varanus Island ARO stakeholder list

Group	Stakeholder
Commercial fishing stakeholders	Department of Primary Industry and Regional Development (DPIRD) Western Australian Fishing Industry Council (WAFIC)
Recreational stakeholders	Marine Tourism WA Recfishwest
Conservation	Department of Biodiversity, Conservation and Attractions (DBCA) Department of Water and Environmental Regulation (DWER)
Marine activities, incident response and safety	Australian Maritime Safety Authority (AMSA) Australian Hydrographic Office (AHO) Department of Transport (DoT) Pilbara Port Authority
Neighbouring operators	Chevron Australia Pty Ltd
Montebello and Barrow Island area tourism operators	Absolute Ocean Charters Blue Horizon Charters Blue Juice Charters Blue Lightning Game Fishing Charters Diversity Charter Company Eco Abrolhos Accommodation Keshi Mer Expeditions Kimberley Expeditions Kimberley Pearl Charters Lady M Luxury Cruises Leeuwin Ocean Adventure Foundation Ltd Montebello Island Safaris Ocean Eco Adventures Odyssey Expeditions Pelican Charters Reel Teaser Fishing Adventures Sail Ningaloo Sealife Charters Silverado Charters The Great Escape Charter Company Top Gun Charters True North Adventure Cruises

5.1 Ongoing Consultation

Stakeholder functions, interests or activities are not expected to be negatively impacted by ARO, given the short duration of the activity and location within existing petroleum exclusion zone.

To ensure stakeholders remain informed and are provided with ongoing opportunities to comment on Santos WA activities, relevant stakeholders will be provided with Notification Package(s) prior to the commencement of each activity/campaign.

5.2 Addressing Consultation Feedback

All correspondence with external stakeholders is recorded in Santos WA's database. Santos WA's Consultation Coordinator is available before, during and after completion of the proposed activity to ensure opportunities for stakeholders to provide feedback are available. Consultation material is provided internally to relevant activity personnel to ensure the Santos WA business has a thorough understanding of how the activity is being received by relevant persons.

6. Environmental Assessment

6.1 Overview of Process

Santos WA operates under an overarching Risk Management Policy (QE-91-IF-10050). The Risk Management Framework (QE-91-IF-10051) underpins the risk management policy and is consistent with the requirements of AS/NZS ISO 31000 Risk Management – Guidelines (2018). The key steps to risk management are illustrated in **Figure 6-1**.

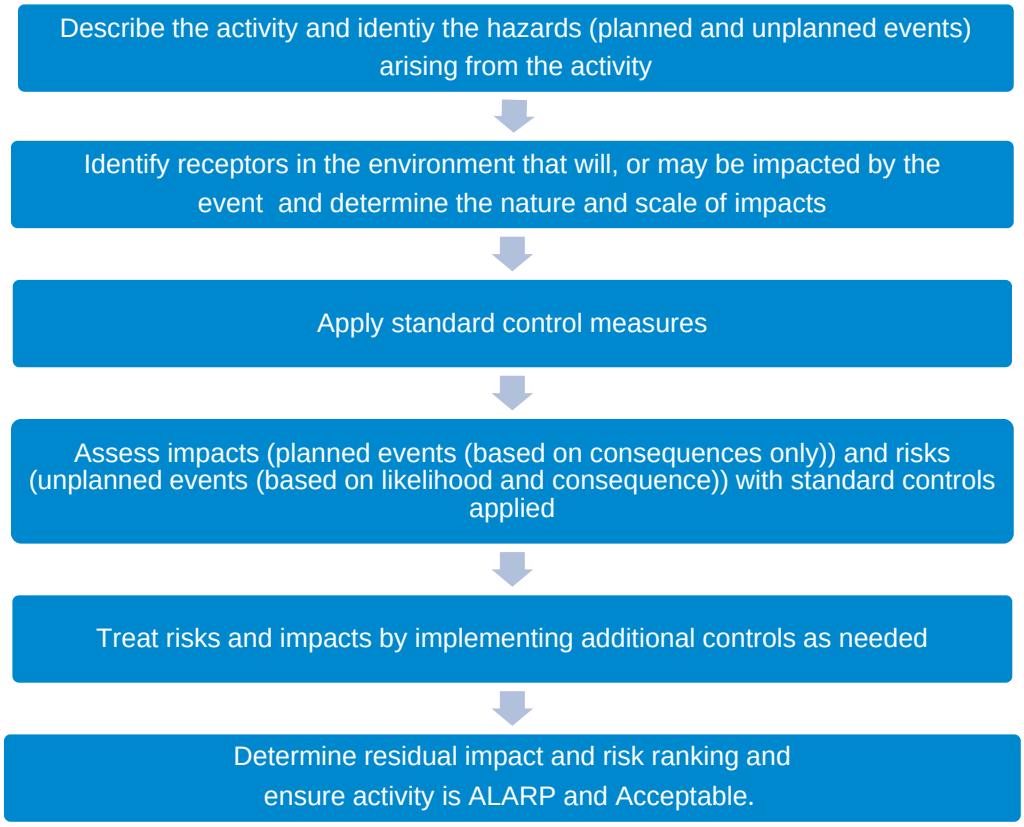

Figure 6-1: Environmental assessment process

The extent of actual impacts from planned events or potential impacts from unplanned events is assessed using, where required, modelling (e.g. for MGO spill), published information, subject matter expert opinions and scientific reports. The duration of the event is also described including the potential duration of any impacts should they occur. Receptors identified as potentially occurring within impacted area(s) are detailed in **Section 4.**

The consequence level of the impact is determined for each planned and unplanned event based on the severity of the impact to relevant receptors. This process determines a consequence level based on set criteria for each receptor category and takes into consideration the duration and extent of the impact, receptor recovery time and the effect of the impact at a population, ecosystem or industry level. For unplanned events, a risk ranking is also determined using an assessment of the likelihood (likelihood ranking) of the event occurring as well as the consequence level of the potential impact should that event occur using a Risk Matrix (QE-91-IF-039) (**Figure 6-2**).

Table 6-1: Santos consequence level descriptions

Consequence Level		Consequence Level description
A	Negligible	No impact or negligible impact.
B	Minor	Detectable but insignificant change to local population, industry or ecosystem factors. Localised effect with rapid recovery
C	Moderate	Significant impact to local population, industry or ecosystem factors. Medium term recovery
D	Major	Major long-term effect on local population, industry or ecosystem factors. Slow recovery over decades
E	Critical	Complete loss of local population, industry or ecosystem factors AND/ OR major wide-spread regional impacts with slow recovery.

6.2 ALARP and Acceptability Evaluation

For planned and unplanned events, an ALARP assessment is undertaken to demonstrate that the standard control measures adopted reduce the impact (consequence level) or risk to a level that is as low as reasonably practicable (ALARP). This process relies on demonstrating that further potential control measures would require a disproportionate level of cost/effort in order to reduce the level of impact or risk. If this cannot be demonstrated, then further control measures are considered. The level of detail included within the ALARP assessment is based upon the nature and scale of the potential impact or risk.

It is expected that if the structures were left in place, they could eventually topple and may become a hazard to other marine users. The option to leave the topside structures in-situ indefinitely is therefore not considered an acceptable alternative.

6.3 Summary of Impacts and Risks

Table 6-2 and **Table 6-3** summarise the identified hazards and the final consequence ranking (for planned events) and residual risk ranking (for unplanned events) respectively. All identified potential impacts and risks are considered by Santos WA to be at an acceptable level.

Table 6-4 summarises the potential impacts and control measures for planned events, and **Table 6-5** summarises the potential risks and control measures for unplanned events.

Table 6-2: Summary of impact consequence levels associated with planned events

Hazard	Final Consequence Ranking
Light emissions	B – Minor
Noise emissions	B – Minor
Atmospheric emissions	A – Negligible
Operational discharges	A – Negligible
Habitat disturbance	B – Minor
Interactions with marine users	A – Negligible

Table 6-3: Summary of the residual risks associated with unplanned events

Hazard	Likelihood	Potential Consequence Level	Residual Risk Ranking
Introduction of invasive marine species	1 – Rare	C – Moderate	Low
Marine fauna collisions	2 – Very Unlikely	B – Minor	Low
Accidental disturbance to benthic habitat	2 – Very Unlikely	C – Moderate	Medium
Accidental discharge of solid wastes	4 – Likely	A – Negligible	Low
Accidental spill of hazardous liquids (minor hydrocarbon and non-hydrocarbon release)	5 – Probable	B – Minor	Medium
Accidental spill of vessel hydrocarbon (major fuel tank rupture)	2 – Very Unlikely	C – Moderate	Medium

Figure 6-2: Risk matrix

Table 6-4: Environmental management for planned events

Event	Potential Impacts	Management Controls/ Performance Standards
Light Emissions	Disturbance to marine fauna from artificial lighting	+ Vessel navigation equipment and procedures are compliant with requirements under the International Convention of the Safety of Life at Sea (SOLAS) 1974 and Navigation Act 2012 (or equivalent). + Light levels minimised to that required for safe operations and marine standards and regulations. + For night-time operations between 1 October and 30 April that are planned for more than one (1) consecutive night and within 3 km of a known turtle nesting beach or shearwater rookery, lighting managed in accordance with a DMIRS-accepted Illumination Plan. DBCA consulted in the development of the management plan. A plan shall contain the following: – Description of activity lighting requirements. – Review of practicable measures to reduce light spill through shielding, height adjustment and directional alignment. – Determination of monitoring requirements, including for the presence of turtle hatchlings near the vessel and light spill onto turtle nesting beaches. – Description of crew awareness initiatives. + For night-time operations between 1 October and 30 April that are planned for more than one (1) consecutive night, a DMIRS-accepted Bridging Document and Illumination Plan is in place prior to conducting night time operations at Simpson A and B, Double Island and Twickenham facilities. + Project inductions to include information on: – Operational area. – Sensitive environmental areas and receptors. – Regulatory regime. – Highest risk activities. – Key environmental management control measures. – Reporting requirements.
Noise Emissions	Disturbance to marine fauna from noise	+ Vessels comply with Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003) which ensures compliance with Part 8 of the *Environment Protection and Biodiversity Conservation Regulations 2000* and controls for minimising the risk of collision with marine fauna. + Helicopters comply with Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003) which ensures compliance with Part 8 of the *Environment Protection and Biodiversity Conservation Regulations 2000* and controls for minimising interaction with marine fauna. + Project inductions to include information on: – Operational area. – Sensitive environmental areas and receptors. – Regulatory regime. – Highest risk activities. – Key environmental management control measures.

Event	Potential Impacts	Management Controls/ Performance Standards
		– Reporting requirements. + Documented maintenance program in place for a vessel that provides a status on vessel maintenance. + Documented maintenance program in place for project equipment that provides a status on equipment maintenance. + Geophysical surveys comply with Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003), plus the additional measure not to approach within 100 metres of a whale, whale shark, dolphin, dugong or turtle so to minimise the potential effects of underwater noise.
Atmospheric Emissions	Air emissions may result in a temporary, localised reduction of air quality	+ Vessels will not use IFO or HFO during the activity + Sulphur content of vessel fuel oil complies with MARPOL Annex VI (Marine Order 97) to reduce air emission impacts. + Vessel incinerator operated in accordance with MARPOL Annex VI (Marine Order 97) to reduce air emission impacts. + Vessel ozone-depleting substances (ODS) managed in accordance with MARPOL Annex VI (Marine Order 97) to reduce the risk of an accidental release of ODS to air. + Documented maintenance program in place for a vessel that provides a status on vessel maintenance. + Documented maintenance program in place for project equipment that provides a status on equipment maintenance.
Operational Discharges	Temporary, localised reduction of marine water quality	+ Oily bilge water is only discharged from vessel to sea within the operational area if oil content is not more than 15 parts per million (ppm) and in accordance with the *Pollution of Waters by Oil and Noxious Substances Act 1987.* + Oily water shall not be discharged within VI or Barrow Island port limits without an exemption from the WA Department of Transport. + Documented maintenance program in place for a vessel that provides a status on vessel maintenance. + Sewage discharged from vessel to sea within the operational area in accordance with the WA Department of Transport Strategy for Management of Sewage Discharge from Vessels into the Marine Environment, with the exception that no untreated sewage shall be discharged within the operational area. + Vessel sewage system shall be of a type compliant to MARPOL Annex IV (Marine Order 96). + No discharge of any sewage within VI or Barrow Island port limits without an exemption from the Department of Transport. + Documented maintenance program in place for a vessel that provides a status on vessel maintenance. + Food waste will not be discharged to sea within the operational area. + Placards will be displayed on vessels to provide guidance on food waste management requirements. + Vessel waste managed to reduce the risk of an unplanned release of waste to sea by: – Clearly labelled waste containers. – Covering waste containers if there is a risk of windblown litter.

Event	Potential Impacts	Management Controls/ Performance Standards
		– Segregating hazardous waste and storing in a manner that provides for secondary containment in the event of a leak. + Safety data sheet (SDS) available for chemicals to aid in the process of hazard identification and chemical management. + Chemicals managed in accordance with SDS in relation to handling and storage, spill-response and disposal considerations. + For environmentally hazardous chemicals present on vessels, including hydrocarbons, the following standards apply to reduce the risk of an accidental release to sea: – Storage containers closed when the product is not being used. – Storage containers managed in a manner that provides for secondary containment in the event of a spill or leak. – Storage containers labelled with the technical product name as per the SDS. – Spills and leaks to deck, excluding storage bunds and drip trays, immediately cleaned up. – Storage bunds and dip trays do not contain free flowing volumes of liquid. – Spill response equipment readily available. + Vessel deck and petroleum structure cleaning products that will enter the marine environment shall not be a "harmful substance" in accordance with the criteria in MARPOL Annex III (Marine Order 95). + Vessels selected and on-boarded in accordance with the Marine Assurance Standard (QE-91-ZH-10001) to ensure contracted vessels are operated, maintained and manned in accordance with industry standards and regulatory requirements. + Pipelines on the seabed will be plugged following cut to minimise the risk of minor hydrocarbon releases to sea. + Washwater chemical additives are Gold/Silver/D or E rated through OCNS, or PLONOR substances listed by OSPAR, or have a completed risk assessment as per Santos' Chemical Risk Assessment Procedure so that only environmentally acceptable products are used.
Habitat disturbance	Disturbance to sensitive benthic habitat	+ Site survey equipment, anchors, dynamic positioning (DP) reference markers, positioning beacons, project equipment (e.g. cutting tools, ROV baskets, sand bags), and removed structures only placed in pre-identified locations on the seabed to minimise impacts to naturally occurring sensitive features and to avoid disturbing coral bommies. + Santos will preferentially place equipment and objects on featureless seabed areas followed by previously disturbed seabed areas. + Pre-identified seabed locations determined by Santos WA using available bathymetry and site survey data. + Santos WA will provide bathymetry survey data indicating known shallow areas and seabed hazards to vessel contractors to minimise the risk of vessel grounding and damage to sensitive seabed receptors including coral bommies. + Unless placed on the seabed as part of the planned activity for long term use, all activity-related equipment, debris (excluding metal and concrete cuttings) and accidentally dropped objects (if locatable) are removed from the seabed.

Event	Potential Impacts	Management Controls/ Performance Standards
		+ As-left survey of the seabed completed around the removed platform + Facility topsides will be checked prior to commencement of removal activities. If a nest is located, it will be checked for egg and/or chick presence. If eggs and/or chicks are present and relocation options are viable the nest may be relocated in consultation with the DBCA.
Interactions with other users of the sea	Disruption to commercial shipping, future fishing activities and other marine users.	+ Notification provided to AMSA RCC, AHO and nearest port authority for consideration to include the proposed activities in marine notices. Information to be provided on the operational area, requested exclusion zones, project vessel details, and project vessel arrival and departure departs, so that the maritime industry is aware of the petroleum activities. + Relevant stakeholders, including DMIRS, notified at least four weeks prior to each removal activity or campaign. Basis for determining stakeholder relevance documented by Santos WA. + Santos WA will notify AHO of the petroleum structures removed within 60 days so that they can update their nautical charts + Competent crew will maintain constant bridge-watch in order to identify and, if required, communicate with approaching third party vessels. + Crew undertaking constant bridge watch will be qualified in accordance with AMSA Marine Orders – Part 3: Seagoing Qualifications (or equivalent). + Bridging Document will be submitted when structure cut heights are proposed to be greater than 25 cm above the mud line. The document will include the following details: – Cut height of remaining structures. – Subsea caps. – As-left state of the seabed. – Any changes to the environmental risk and impacts as described in the accepted environment plan. – ALARP assessment of structure cut heights and proposed management measures. – A report on stakeholder consultation.

Table 6-5: Environmental management for unplanned events

Event	Potential Impacts	Management Controls/ Performance Standards
Introduction of invasive marine species	Introduction of marine species not native to the local marine waters, including within a Marine Management Area	+ International vessels will have a Ballast Water Management Plan to demonstrate compliance with the DAWR Australian Ballast Water Management Plan Requirements or as defined under the *Biosecurity Act 2015*. + Vessel managed in accordance with the Invasive Marine Species Management Plan (EA-00-RI-10172) prior to movement into or within the defined invasive marine species management zone, which requires the use of DPIRD Vessel Check Tool and the vessel and immersible equipment to be 'low risk.

Event	Potential Impacts	Management Controls/ Performance Standards
		+ Vessel anti-foulant system maintained in compliance with International Convention on the Control of Harmful Anti-fouling Systems on Ships or *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* to ensure harmful chemical compounds in anti-foulant systems are managed.
Marine fauna collisions	Injury or fatality to individual marine fauna, some being of conservation significance	+ Vessels comply with Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003) which ensures compliance with Part 8 of the *Environment Protection and Biodiversity Conservation Regulations 2000* and controls for minimising the risk of collision with marine fauna. + Helicopters comply with Protected Marine Fauna Interaction and Sighting Procedure (EA-91-II-00003) which ensures compliance with Part 8 of the *Environment Protection and Biodiversity Conservation Regulations 2000* and controls for minimising interaction with marine fauna. + UAVs comply with Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which includes controls for minimising the risk of collision with marine fauna. + ROV thruster guards will be installed to prevent ingress of marine fauna into the thrusters, unless safe operation of the ROV is compromised. + Vessel collision with EPBC Act-listed marine fauna will be recorded in an incident report form and reported to the Commonwealth Department of the Environment and Energy (DoEE). + Competent crew will maintain constant bridge-watch in order to identify and if required, communicate with approaching third party vessels. + Crew undertaking constant bridge watch will be qualified in accordance with AMSA Marine Orders – Part 3: Seagoing Qualifications (or equivalent). + Project inductions will include information on: – Operational area. – Sensitive environmental areas and receptors. – Regulatory regime. – Highest risk activities. – Key environmental management control measures. – Reporting requirements.
Accidental disturbance to benthic habitat	Disturbance to sensitive benthic habitat	+ Vessels selected and on-boarded in accordance with the Marine Assurance Standard (QE-91-ZH-10001) to ensure contracted vessels are operated, maintained and manned in accordance with industry standards and regulatory requirements. + Competent crew will maintain constant bridge-watch in order to identify and, if required, communicate with approaching third party vessels. + Crew undertaking constant bridge watch will be qualified in accordance with AMSA Marine Orders – Part 3: Seagoing Qualifications (or equivalent). + Santos WA will provide bathymetry survey data indicating known shallow areas and seabed hazards to vessel contractors to minimise the risk of vessel grounding and damage to sensitive seabed receptors including coral bommies. + Vessel contractor has a Lifting Equipment Management System which requires:

Event	Potential Impacts	Management Controls/ Performance Standards
		– Vessel cranes to be equipped with load indicators. – Documented maintenance program for lifting equipment. – Certification requirements for lifting equipment. – Lifting plans for heavy/engineered lifts. + Unless placed on the seabed as part of the planned activity for long term use, all activity-related equipment, debris (excluding metal and concrete cuttings) and accidentally dropped objects (if locatable) are removed from the seabed. + A pre-survey of structures will be completed and if required, actions will be taken to secure or remove objects at risk of dropping into the ocean or onto the vessel during the removal activities. + DP equipment design, redundancy, equipment maintenance and operation in accordance with the IMCA Guideline for the Design and Operation of Dynamically Positioned Vessels. + DP trials completed prior to entering operational area to ensure correct operation. + Documented maintenance program in place for a vessel that provides a status on vessel maintenance. + Vessel navigation equipment and procedures are compliant with requirements under the International Convention of the Safety of Life at Sea (SOLAS) 1974 and *Navigation Act 2012* (or equivalent).
Accidental discharge of solid wastes	Temporary, localised reduction of marine water quality. Potential impacts to marine fauna who may come into contact with the waste.	+ Vessel waste managed to reduce the risk of an unplanned release of waste to sea by: – Clearly labelled waste containers. – Covering waste containers if there is a risk of windblown litter. – Segregating hazardous waste and storing in a manner that provides for secondary containment in the event of a leak. + Vessel contractor has a Lifting Equipment Management System which requires: – Vessel cranes to be equipped with load indicators. – Documented maintenance program for lifting equipment. – Certification requirements for lifting equipment. – Lifting plans for heavy/engineered lifts. + Unless placed on the seabed as part of the planned activity for long term use, all activity-related equipment, debris (excluding metal and concrete cuttings) and accidentally dropped objects (if locatable) are removed from the seabed. + A pre-survey of structures will be completed and if required, actions will be taken to secure or remove objects at risk of dropping into the ocean or onto the vessel during the removal activities. + Safety data sheets (SDS) available for chemicals to aid in the process of hazard identification and chemical management. + Chemicals managed in accordance with SDS in relation to handling and storage, spill-response and disposal considerations. + For environmentally hazardous chemicals present on vessels, including hydrocarbons, the following standards apply to reduce the risk of an accidental release to sea: – Storage containers closed when the product is not being used.

Event	Potential Impacts	Management Controls/ Performance Standards
		– Storage containers managed in a manner that provides for secondary containment in the event of a spill or leak. – Storage containers labelled with the technical product name as per the SDS. – Spills and leaks to deck, excluding storage bunds and drip trays, immediately cleaned up. – Storage bunds and dip trays do not contain free flowing volumes of liquid. – Spill response equipment readily available. + Vessel dangerous goods managed in accordance with International Maritime Dangerous Goods Code (IMDG Code) to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction. + Implementation of the Radiation Management Plan (QE-91-IG-10017) should Naturally Occurring Radioactive Material (NORM) be detected to ensure the material remains contained with the petroleum infrastructure being removed.
Accidental spill of hazardous liquids (minor hydrocarbon and non-hydrocarbon release)	Temporary, localised reduction of marine water quality.	+ Project inductions will include information on: – Operational area. – Sensitive environmental areas and receptors. – Regulatory regime. – Highest risk activities. – Key environmental management control measures. – Reporting requirements. + Safety data sheets (SDS) available for chemicals to aid in the process of hazard identification and chemical management. + Chemicals managed in accordance with SDS in relation to handling and storage, spill-response and disposal considerations. + For environmentally hazardous chemicals present on vessels, including hydrocarbons, the following standards apply to reduce the risk of an accidental release to sea: – Storage containers closed when the product is not being used. – Storage containers managed in a manner that provides for secondary containment in the event of a spill or leak. – Storage containers labelled with the technical product name as per the SDS. – Spills and leaks to deck, excluding storage bunds and drip trays, immediately cleaned up. – Storage bunds and dip trays do not contain free flowing volumes of liquid. – Spill response equipment readily available. + Vessel dangerous goods managed in accordance with International Maritime Dangerous Goods Code (IMDG Code) to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction. + Documented maintenance program in place for subsea hydraulic equipment that provides a status on maintenance to reduce the risk of hydraulic fluid releases to sea.

Event	Potential Impacts	Management Controls/ Performance Standards
		+ Subsea hydraulic equipment inspection completed to reduce the risk of hydraulic fluid releases to sea. + Hydraulic downline pressure is monitored while subsea hydraulic equipment is deployed in-water to identify leaks and to minimise any resultant losses to sea. + Subsea hydraulic equipment is equipped with alarms and gauges on hydraulic system to facilitate emergency shut down. – Vessel contractor has a Lifting Equipment Management System which requires: – Vessel cranes to be equipped with load indicators. – Documented maintenance program for lifting equipment. – Certification requirements for lifting equipment. – Lifting plans for heavy/engineered lifts. + No vessel-to-vessel refuelling within the operational area. + In the event of a spill to sea, the vessel SOPEP and/or Varanus Island Hub OPEP will be implemented to mitigate impacts to the marine environment. + Oil spill exercises conducted as per the Varanus Island Hub OPEP and vessel SOPEP. + Santos WA Company Site Representative(s) for the activity to have completed an induction on the content of, and their responsibilities in, the OPEP. + Hydrocarbon spill incidents are reported to DMIRS as per Section 9.15 of the EP.
Accidental spill of vessel hydrocarbon (major fuel tank rupture)	Temporary, localised reduction of marine water quality, and impacts to marine fauna and their habitat within the EMBA	+ Vessel navigation equipment and procedures are compliant with requirements under the International Convention of the Safety of Life at Sea (SOLAS) 1974 and *Navigation Act 2012* (or equivalent). + Santos WA will provide bathymetry survey data indicating known shallow areas and seabed hazards to vessel contractors to minimise the risk of vessel grounding and damage to sensitive seabed receptors including coral bommies. + Competent crew will maintain constant bridge-watch in order to identify and if required, communicate with approaching third party vessels. + Crew undertaking constant bridge watch will be qualified in accordance with AMSA Marine Orders – Part 3: Seagoing Qualifications (or equivalent). + DP equipment design, redundancy, equipment maintenance and operation in accordance with the IMCA Guideline for the Design and Operation of Dynamically Positioned Vessels. + DP trials completed prior to entering operational area to ensure correct operation. + Documented maintenance program in place for a vessel that provides a status on vessel maintenance. + Vessels selected and on-boarded in accordance with the Marine Assurance Standard (QE-91-ZH-10001) to ensure contracted vessels are operated, maintained and manned in accordance with industry standards and regulatory requirements. + Interface Management Plan will be developed to ensure interfaces between project vessels and Varanus Island Hub operations are managed, including emergency response arrangements. + Project inductions to include: – Operating environment (e.g. sensitive areas and receptors);

Event	Potential Impacts	Management Controls/ Performance Standards
		– Regulatory regime (DMIRS); – Highest risk activities; – Key environmental management requirements and controls; and – HSE expectations, including reporting. + Notification provided to AMSA RCC, AHO and nearest port authority for consideration to include the proposed activities in marine notices. Information to be provided on the operational area, requested exclusion zones, project vessel details, and project vessel arrival and departure departs, so that the maritime industry is aware of the petroleum activities + Vessels will not use IFO or HFO during the activity. + IFO or HFO permitted to be stored on the vessel providing only residual volumes and not stored in tanks that have direct exposure to the marine environment. For a vessel to store IFO or HFO then a risk assessment must conclude that the high cost of removing and disposing of the IFO or HFO onshore is grossly disproportionate to the low risk of a vessel collision and rupture of an in-board fuel tank containing small volumes of the fuel.

7. Management Approach

The activity will be managed in compliance with all measures and controls detailed within the EP once accepted by DMIRS under the Petroleum (Submerged Lands) (Environment) Regulations.

The EP details specific environmental performance objectives and standards, and identifies a range of control measures to be implemented to meet the objectives and standards. The control measures for the activities are summarised in **Section 6.3**. The EP also identifies the measurement criteria and records to be kept, to demonstrate the achievement of each control measure.

As described in the EP, the implementation strategy includes the relevant details of the following:

- Environmental management system and policy.
- Leadership, accountability and responsibility.
- Workforce training and competency.
- Hazard identification, risk and impact assessment and controls.
- Workforce involvement and stakeholder communication.
- Information management and document control.
- Management of change.
- Operations management.
- Emergency preparedness and response.
- Incident reporting, investigation and follow up.
- Regulatory notifications and compliance reporting.
- Monitoring and recording of emissions and discharges.
- Reviews, audits and inspections.
- Continuous improvement.

During the period that the activities are undertaken, Santos will ensure environmental performance is managed through an inspection, audit and monitoring regime undertaken by Santos representatives or delegates. Improvement opportunities identified through inspections, audits, monitoring and incident investigations are implemented in a controlled manner and communicated to the workforce.

Any non-conformances against the EP will be addressed and resolved by a systematic corrective action process and will be reported to DMIRS as required. Senior Santos and contractor personnel will be accountable for ensuring conformance with environmental performance objectives and standards and all personnel will be empowered to 'stop-the-job' to ensure the activity is being implemented in an environmentally responsible manner. The EP identifies specific responsibilities for each role during the activity.

Incident notification and reporting to DMIRS and other regulators will be conducted as per the regulations, as detailed within the EP. The requirement to report environmental incidents and hazards will be communicated to personnel at project inductions and during operational meetings.

8. Hydrocarbon Spill Arrangements

The risk assessment for the activity has identified credible spill scenarios as provided in **Table 8-1**. The worst-case spill, requiring the greatest potential level of response is a vessel collision or grounding spill releasing in the order of 329 m^3 of marine gas oil (MGO).

Table 8-1: Credible spill scenarios for the activity

Spill scenario	Spill volume	Response Level
Vessel grounding or collision	<329 m^3 MGO	1/2
MGO, lube and hydraulic oil spills	<1 m^3	1

The DMIRS-accepted VI Hub Oil Pollution Emergency Plan (OPEP) (EA-60-RI-00186.02) is considered fit for purpose for the activity and will be referred to in response to accidental hydrocarbon spills, providing guidance on notification and spill response requirements. The VI Hub OPEP specifically references a vessel collision/ grounding scenario at the Wonnich platform location

releasing up to 329 m^3 of MGO as well as much larger spills of heavier fuels in the vicinity of VI and associated infrastructure (e.g. crude oil and HFO spills on scale of 1,000s of m^3). These spills could result in residual (persistent) hydrocarbons within the marine environment on a scale of an order of magnitude higher than for a MGO spill of the size considered for this activity. The response strategies and support arrangements included within the VI Hub OPEP are appropriate for the worst case spill associated with this activity.

This vessel collision/grounding scenario is the only scenario that might require a Level 2 response (i.e. the activation of a Perth based Incident Commander and Incident Management Team and external resources outside of those provided onsite). The activation process and underlying response strategies outlined in the VI Hub OPEP are considered appropriate for this scenario, noting that the initial response actions for a vessel grounding/collision scenario will be as per the vessel-specific Shipboard Oil Pollution Emergency Plan (SOPEP).

Given that the activity is contained within State waters, any spill requiring Level 2 activation will require notification to DoT as the relevant Controlling Agency. Santos WA will provide initial control of the incident and then necessary resources and assistant to support DoT once DoT assumes control of the incident as defined in the OPEP.

9. Contact Details

Further information about the asset removal activity can be obtained from:

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Business address:	Level 7, 100 St Georges Terrace, Perth, WA 6000
Telephone number:	(08) 6218 4972
Email address:	consultation@santos.com.au

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