

# Santos

## Fletcher-Finucane Development Drilling Campaign (WA-191-P) Environment Plan Summary

December 2011

(FLFC-2000-SUM-0001)

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*This Environment Plan summary has been prepared to comply with Regulation 11(7) of the Offshore Petroleum & Greenhouse Gas (Environment) Regulations 2009.*

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### 1. Introduction

Santos Offshore Pty Ltd (Santos) is proposing to develop the Fletcher and Finucane South oil fields, located in petroleum permits WA-26-L and WA-191-P on Western Australia's North West Shelf (NWS). The proposal is a tie-back to an existing oil production facility and consists of:

- Drilling three development wells (Fletcher-5H, Finucane South-2H and Finucane South-3H) from two drill centres in the Fletcher and Finucane South oil fields;
- Connecting the wells to the existing operating Mutineer-Exeter Floating Production, Storage and Offloading (FPSO) vessel (the *MODEC Venture 11*) via flexible flowlines, located up to approximately 17 km to the east;
- Flowing oil from the wells through the existing FPSO for processing, storage and offloading.

These activities are collectively referred to as the Fletcher-Finucane Development.

The development wells will all be drilled by the *Nan Hai VI* semi-submersible mobile offshore drilling unit (MODU), with a scheduled commencement date around April/May 2012, subject to weather and rig availability. The drilling campaign will take place entirely within exploration permit WA-191-P.

The permit area is located 150 km north of Dampier in water depths ranging between 130 m and 160 m (Figure 1).

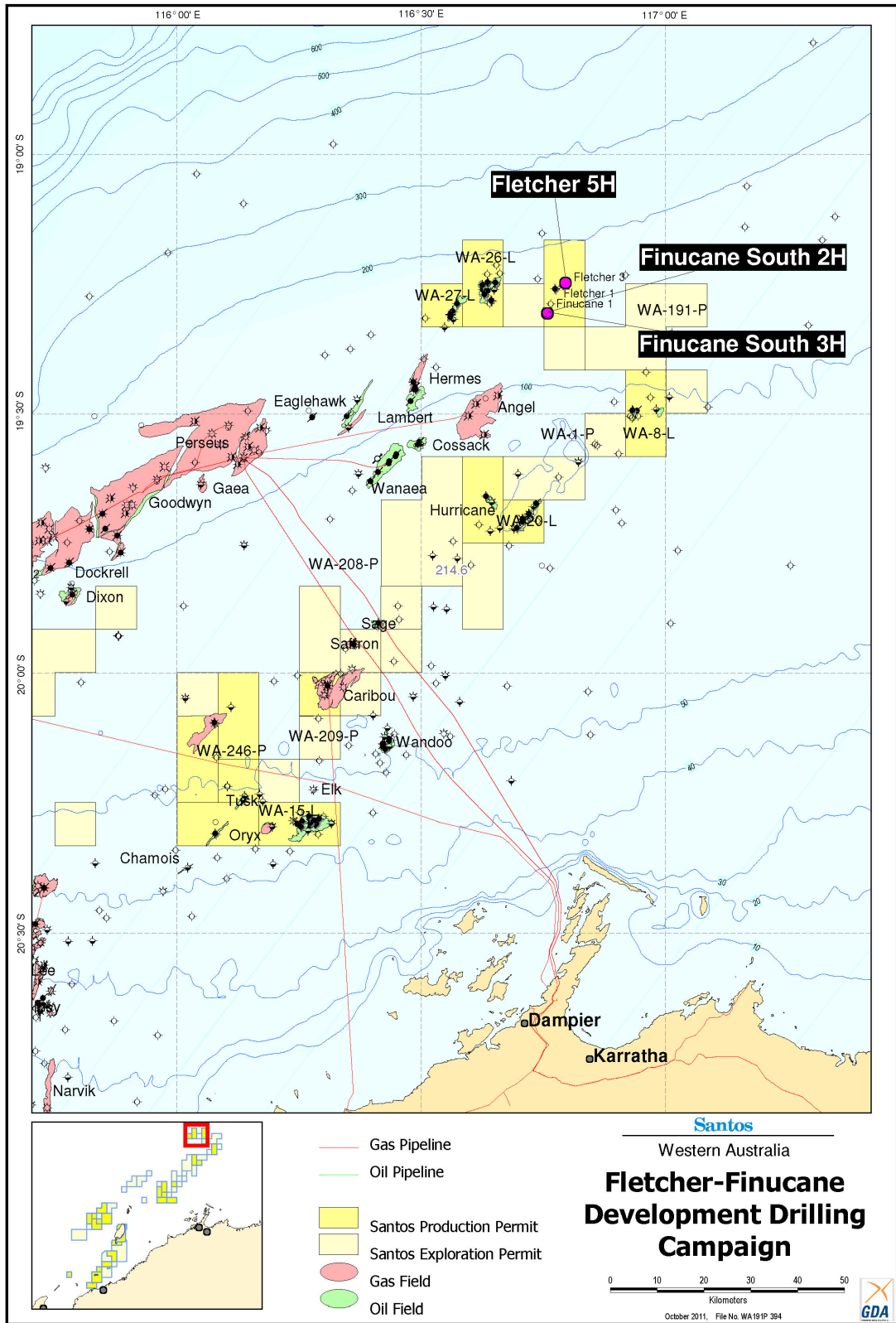


Figure 1. Location of the proposed development wells

The Environment Plan (EP) for the drilling campaign was approved by the WA Department of Mines and Petroleum (DMP) on the 23<sup>rd</sup> of December 2011 in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 1999.

## 2. Proponent

Santos is the designated operator of the permit with a 33.4% interest (Kufpec Australia Pty Ltd holds an equal share, JX Nippon Oil and Gas Exploration Corporation has a 25% interest and Tap (Shelfal) Pty Ltd holds the remaining 8.2%.

Santos has been operating in the North West Shelf (NWS) of Western Australia where it has been exploring and producing hydrocarbons for the last 20 years. Santos is an active oil and gas exploration and production company, having interests and operations in every major Australian petroleum province and in Indonesia, Papua New Guinea, Vietnam, India, Kyrgyzstan and Egypt. Santos has been actively producing hydrocarbons for the last 50 years.

Additional information regarding Santos can be obtained from its website at: [www.santos.com](http://www.santos.com).

## 3. Project Description

The wells will be drilled by the *Nan Hai VI* semi-submersible (MODU). The drilling campaign will be supported by at least two anchor handling, tug and supply (AHTS) vessels working from the Port of Dampier.

During the drilling campaign the AHTS vessels will be traversing to and from port for provisions and equipment to support the drilling operations. The vessels will return to port for refuelling – there will be no at-sea refuelling for these vessels unless required in an emergency situation. These vessels use dynamic positioning systems that enable them to remain on location using bow thrusters rather than anchoring.

The MODU will be towed to the first drill site from a nearby permit area on the North West Shelf by pumping water out of the four buoyancy tanks ('pontoons'), allowing the MODU to float and then be towed using one or more of the AHTS vessels.

Drilling will take place 24 hours a day, and is expected to take about 45 days for each well (about 4½ months in total). The drilling procedure for each well will follow a similar design, consisting of:

- Drilling a 36 x 26 inch (914 mm x 660 mm) hole to approximately 70 m below the seabed and then installing a 30 x 20 inch (762 mm x 508 mm) conductor casing. A 17½ inch (444 mm) hole will then be drilled to a depth of ~2,100 m below rotary

table (BRT) with sea water (90%) and gel sweeps (10%). A 13<sup>3</sup>/<sub>8</sub> inch (340 mm) casing string is then installed into the hole and cemented into position.

- The BOP will then be installed and pressure tested and drilling will continue using synthetic-based mud (SBM) with an 8<sup>1</sup>/<sub>2</sub> inch (216 mm) pilot hole to 2,900 m true vertical depth (TVD)/ 3,125 m measured depth below rotary table (MDRT). A core of the Legendre reservoir will be cut as part of the pilot hole in Fletcher-5H only. The pilot holes will be plugged back and abandoned. A sidetrack will be kicked off below the 340 mm casing shoe and 12<sup>1</sup>/<sub>4</sub> inch (311 mm) hole drilled to 2,900 m TVD/3,198m MDRT. A 10<sup>3</sup>/<sub>4</sub> x 9<sup>5</sup>/<sub>8</sub> inch (273 mm x 244 mm) casing string will then be installed into the hole and cemented into position.
- A horizontal 8<sup>1</sup>/<sub>2</sub> inch (216 mm) diameter hole is then drilled across the reservoir section for approximately 600 m to 3,600-4,000 m MDRT (which will be defined in the drilling programme).
- The sandface completion will be run to depth on drill pipe and the sand-control packer set in the 9<sup>5</sup>/<sub>8</sub> inch casing, the running tool disengaged, and drill pipe will be pulled out of hole (POOH). An anchor latch, nipple profile, and retrievable nipple guide is then run in hole (RIH) on the drill pipe and stung into the sand control packer.
- A deepset slickline run plug and prong will be set in the nipple profile, and tested from above to provide a mechanical barrier between the formation and upper well bore. The wellbore above the sand control packer will be circulated to contain treated completion brine.
- The BOP will then be recovered to surface and parked into its garage located in the moonpool.
- The subsea tree and Tree Running Tool (TRT) will then be prepared in the moonpool for running subsea on Drillpipe (DP). A Remotely Operated Vehicle (ROV) will observe the subsea tree being installed on the 18<sup>3</sup>/<sub>4</sub> inch wellhead. With the subsea tree now locked on to the wellhead, the VX gasget profile will be pressure tested from the surface Installation/Workover Control System (IWOCS) unit to confirm Mule shoe and VX profile integrity.
- The TRT will then be recovered to surface and parked into the moonpool.
- The BOP will then be installed on top of the tree's 18<sup>3</sup>/<sub>4</sub> inch wellhead and then pressure tested.
- The MODU will then move into the upper completion phase.
- The BOP will then be recovered to the surface and parked into its garage located in the moonpool.

- The electric submersible pump (ESP) debris cap and debris cap running tool (DCRT) will be prepared in the moonpool for running on DP. The ROV will observe the debris cap/DCRT being installed onto the tree's 18¾ inch wellhead. From the surface, the debris cap will be tested for mechanical and electrical integrity.
- The DCRT will then be unlocked and recovered to surface.
- The upper completion (dual ESP – nominally 5½ inches [140 mm]) is then run in hole and landed off, packer set, and tubing/casing tested. The deep-set plug and prong is retrieved via slickline prior to circulating tubing to diesel (via sliding sleeve), and cleaning up the well to the rig flare for approximately 12 hours.
- The rig is then suspended with tubing retrievable, Sub-Surface Safety Valve (SSSV) closed, and crown plugs installed, and made ready to hand over for production.
- Vertical seismic profiling (VSP) may be conducted.

The drilling programme will use a combination of sea water with gel sweeps and SBM. Sea water will be used for drilling the top sections of each well (17½ inches and above), and consists of approximately 90% sea water, with the remaining 10% made up of drilling fluid additives that are either completely inert in the marine environment, naturally occurring benign materials or readily biodegradable organic polymers with a very fast rate of biodegradation in the marine environment. Drilling additives typically used include sodium chloride, potassium chloride, bentonite (clay), gel, guar gum, barite and calcium carbonate.

The use of SBM is required for the deviated sections of each well (typically the 311 mm and 216 mm bore sections), as water-based mud (WBM) is not well suited for these sections. Synthetic-based mud provides significant improvement in wellbore stability, in addition to providing better lubricity (reducing the friction factor, reducing the incidence of stuck pipe), high temperature stability, and low mud weight (important in highly fractured formations). Due to the nature of the manufacturing process, SBM has negligible or very low total aromatic hydrocarbon content (below 0.001% w/w).

During the riserless drilling (36 inch and 17½ inch sections), cuttings (ground rock fragments) and drilling mud adhered to it are carried back up the borehole by seawater and gel sweeps and discharged directly at the seabed (not via the MODU). The drill cuttings and adhered mud will likely settle to form a thin veneer over a small area around each well bore.

Once the marine riser and BOP stack are installed, drill cuttings are carried back up the borehole by the circulating drilling mud, and on the MODU the cuttings are separated from the mud by the shale shakers (a sequence of vibrating screens). The recovered mud is pumped to the mud tanks for reuse and the cuttings are discharged overboard via a

chute. The cuttings typically contain some residual mud that adheres to the surface of the cuttings piles. Santos will ensure that less than 10% oil-on-cuttings (OOC), as dried weight, is achieved prior to discharge, in accordance with DMP's Drilling Fluids Management (2006) guidelines.

No whole SBM will be discharged overboard. Any unused or recovered SBM will be shipped back to the Port of Dampier and inspected by the mud systems contractor. If the properties of the recovered SBM do not meet a minimum standard (following onshore treatment), then the SBM will be disposed of to an authorised landfill site.

Table 1 summarises the drilling campaign.

**Table 1. Drilling campaign summary**

		Fletcher-5H	Finucane South -2H	Finucane South -3H
Permit area		WA-191-P		
Basin		Dampier Sub-basin		
Surface hole location - degrees (GDA 94, Zone 50)		19° 14' 44.6" S 116° 47' 43.7" E	19° 18' 16.9" S 116° 45' 31.7" E	19° 18' 18.6" S 116° 45' 32.7" E
Surface hole location - meters (MGA 94, Zone 50)		7,871,970 m S 478,505 m E	7,865,439 m S 474,692 m E	7,865,388 m S 474,695 m E
Type of well		Production		
Target		Oil		
Water depth (m LAT)		155	133	
Scheduled commencement date		April 2012	June 2012	July 2012
Campaign period		52 days	38 days	41 days
Drill rig		Semi-submersible		
Proposed total depth, vertical (MDRT)		2,900 m	2,980 m	2,980 m
Drill fluids	914 mm (36 inch) hole	Seawater (90%) and gel sweeps (10%)	-	Seawater (90%) and gel sweeps (10%)
	444 mm (17½ inch) hole		-	
	311 mm (12½ inch) hole	SBM	SBM	SBM
	216 mm (8½ inch) hole			
Volume of cuttings – WBM (estimate only)		450 m <sup>3</sup>	-	450 m <sup>3</sup>
Volume of cuttings –		185 m <sup>3</sup>	180 m <sup>3</sup>	135 m <sup>3</sup>

SBM (estimate only)			
Production testing	No, but well cleaning will take place, involving some flaring		
Vertical seismic profiling	Possible		
Shore base	Mermaid Marine – Port of Dampier		
AHTS vessels	Up to three anchor handling, tug and supply vessels (contract not finalised)		
Helicopter contractor	Not yet confirmed		
Estimated return helicopter flights per week	6		

#### 4. Stakeholder Consultation

As part of its recent activities in the WA-26-P and WA-191-P permit areas, Santos has continued its consultation with various stakeholders, all of whom have expressed no concerns with its petroleum exploration activities in this area. More than 20 government, commercial and recreational fishing, environment and industry organisations have been consulted about the drilling campaign. All correspondence with stakeholders is recorded.

#### 5. Receiving Environment

##### 5.1 Physical Environment

**Climate.** The North West Shelf lies in the arid tropics region of Australia, which experiences high summer temperatures and periodic cyclones (with associated heavy rainfall). Rainfall is generally low, with evaporation exceeding rainfall. Mean ocean temperatures range from a minimum of 11°C in winter to a maximum of 37°C in summer. Shelf waters are usually thermally stratified at a depth of about 20 m.

**Winds.** Wind patterns are monsoonal with a marked seasonal pattern. From October to March, the prevailing non-storm winds are from the south-west, west and north-west at an average speed of less than 10 knots. From June to August, winds are generally lighter and more variable in direction than in spring and summer. Non-storm winds prevail from north-east through to south-east at average speeds of 5-6 knots. Transitional wind periods, during which either pattern may predominate, can be experienced in April, May and September each year.

**Ocean currents.** The Indonesian Throughflow is the dominant surface current of the region, but water circulation is highly seasonal. The southern flow of the Indonesian Throughflow is greatest during winter and is weaker in summer, when strong winds from the southwest cause intermittent reversals of the currents, which may be associated with occasional weak upwellings of colder, deeper water onto the shelf.

**Bathymetry.** A geophysical and geotechnical survey of the Fletcher-Finucane project area was undertaken in August 2011 by Neptune Geomatics Pty Ltd. It shows that the seabed in the area is relatively flat and featureless, with an average grade of -0.13 degrees in an east-northeast direction. The seabed is composed of low relief unconsolidated calcareous silty fine sand. This survey also found that there are no significant bathymetric, seabed features (e.g., shipwrecks) or shallow hazards associated with the drilling locations.

## 6.2 Biological Environment

**Benthic Invertebrates.** Diverse assemblages of benthic fauna are likely to exist at the site, especially if unconsolidated sediments are present. Mobile burrowing species that may be present include crustaceans (crabs and shrimps), worms, sea stars, sea urchins and other small animals. Spatial and seasonal distribution of such species depends on factors such as substrate composition, season, water depth and temperature.

**Marine Mammals.** Dolphins are relatively common in the region. Species known to occur in the region are the bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), Indo-pacific humpback dolphins (*Sousa chinensis*) and the striped dolphin (*Stenella coeruleoalba*). A number of whale species, including the short-finned pilot whale (*Globicephala macrorhynchus*), false killer whale (*Pseudorca crassidens*), tropical byrdes whale (*Balaenoptera edeni*), southern minke whale (*Balaenoptera acutorostrata*) and humpback whale (*Megaptera novaeangliae*), also occur in the region, the most commonly sighted of these being the humpback whale. This species migrates between the Antarctic waters and the Kimberly region of Western Australia. The peak of their northerly migration between the Exmouth Gulf and the Dampier Archipelago occurs around late July to early August, while the southerly return migration peaks around late August – early September. The WA-191-P permit is located on the northern edge of the humpback whale migration route.

**Fish.** The demersal habitat of the NWS hosts a diverse assemblage of fish, many of which are commercially exploited by trawl and trap fisheries, for example the genera *Lethrinus* (emperor) and *Lutjanus* (snapper). Pelagic fish in this area include tuna, mackerel, herring, pilchard and sardine. The inshore habitats in this region are not considered to be significant nursery grounds for commercially important deeper-water fish species.

**Reptiles.** Four species of marine turtle nest on sandy shore sites of the Dampier Archipelago, Montebello Islands, Lowendal Islands, Barrow Island, and other coastal islands in the region. These are the green turtle (*Chelonia mydas*), flatback turtle (*Natator depressus*), hawksbill turtle (*Eretmochelys imbricata*), and the loggerhead turtle (*Caretta caretta*). All four species are on the National List of Threatened Species. The leatherback turtle (*Dermochelys coriacea*) may also visit the open waters of the shelf. The loggerhead, flatback and leatherback turtles are known to feed on mid-water plankton and benthic



animals, and can forage in continental shelf waters, so may occur around through the permit area.

**Birds.** Eighteen species of seabird have been recorded over the NWS waters. These include petrels, shearwaters, tropicbirds, frigate birds, boobies and terns, and silver gulls. Of these, eight species occur year round and the remaining 10 are seasonal visitors.

### 6.3 Socio-economic Environment

**Settlements.** Dampier and Karratha are the main service and population centres for this region. Local people seeking aquatic recreation such as boating, diving and fishing use the coast and islands of the Pilbara. The open waters of the Commonwealth permit areas do not support significant recreational or tourism activity.

**Marine Conservation Reserves.** The Mermaid Reef Marine National Nature Reserve is located about 380 km northeast of the proposed drilling sites. This reserve surrounds Mermaid Reef and covers 53,987 ha (540 km<sup>2</sup>) near the edge of the continental shelf and in waters as deep as 500 m. Mermaid Reef is the most north-easterly of the three reefs forming the Rowley Shoals, and is totally submerged at high tide. Mermaid Reef contains a diverse array of biota, including over 216 species of hard corals and 12 genera of soft corals, and more than 390 species of fish.

The Ningaloo Marine Park (Commonwealth Waters) is located about 370 km to the southwest of the proposed drilling sites, and covers 246,000 ha (2,435 km<sup>2</sup>) of Commonwealth ocean territory. The reserve was declared in 1987 and stretches for 260 km along the west coast of the Cape Range Peninsula. It is the longest fringing barrier reef in Australia, and the only example in the world of extensive fringing coral reef on the west coast of a continent. The reserve is recognised internationally for its annual aggregations of whale sharks.

The Dampier Archipelago (consisting of 42 islands, islets and rocks within a 45 km radius of Dampier) has also been proposed as a marine park under Western Australia's *Conservation and Land Management Act 1984*, and the area between Cape Preston and the Dampier Archipelago has been proposed as a marine management area. The proposed Dampier Archipelago Marine Park comprises a number of management zones, including sanctuary zones, special-purpose zones for benthic and mangrove protection, and recreational use zones. All other areas within the park are designated for general use (approximately 50% of the marine park). This proposed marine park encompasses many of the islands of the Dampier Archipelago and is the richest area of marine biodiversity known in Western Australia, and is an important nesting area for many turtle species.

**Commercial Fisheries.** Consultation with the Australian Fisheries Management Authority (AFMA) indicates that the North West Slope Fishery was the only Commonwealth-managed fishery with logbook data for the region from 2008-2010, with only periodic activity through the year concentrated from January to mid-March and June-July (when

the nearby Northern Prawn Fishery is not operational).

**Petroleum Exploration and Production.** The North West Shelf is Australia's most prolific oil and gas production area, resulting in Western Australia accounting for 77% of the country's oil and condensate production and 55% of the country's gas production in 2010.

The Santos Mutineer-Exeter Floating Production, Storage and Offtake (FPSO) development is located 17 km to the west of the proposed drill sites. Other nearby petroleum production facilities include:

- Cossack-Wanaea FPSO – 47 km southwest, operated since 1995 by Woodside.
- Legendre oil platform – 44 km southeast, operated since 2001 by Apache Energy (previously operated by Santos).
- North Rankin A gas platform – 73 km southwest, operated since 1984 by Woodside.
- Goodwyn A gas platform – 97 km southwest, operated since 1995 by Woodside.
- Angel gas platform – 26 km south, operated since 2009 by Woodside.

**Shipping.** The ports of northwest Australia (Onslow, Dampier, Cape Lambert, Port Hedland and Broome) handle large tonnages of iron ore and petroleum exports, resulting in very busy shipping routes through the area. For example, the closest port to the permit area is Dampier, and in 2006-07, it had 3,404 vessel visits. In 2006, offshore support vessels made up 40% of total vessel movements in the region. Advice from the Australian Maritime Safety Authority (AMSA) indicates that the the Dampier Shipping Fairway is located several kilometres west of the proposed drilling sites; traffic travelling to or from the Port of Dampier is concentrated in this area and should not come near the drilling operations.

**Maritime Heritage.** The Australian National Shipwreck Database lists 51 shipwrecks registered as occurring within the Dampier region, generally in and around Butchers Inlet, Flying Foam Passage, Nickol Bay and Roebourne. There are no historic shipwreck protected zones in the permit areas. Likewise, the Western Australian Shipwrecks Database (WA Museum, 2010) indicates 58 shipwrecks around the Dampier area.

The geophysical and geotechnical survey conducted in the project area in August 2011 did not record any shipwrecks.

## **6. Environmental Impact Assessment**

The known and potential environmental impacts resulting from the Fletcher-Finucane drilling campaign are outlined in detail in the Environment Plan.

Table 2 provides a summary of the detailed environmental impact assessment and mitigation measures that will be put in place to ensure that impacts are as low as reasonably practicable.

**Table 3. Summary environmental impact assessment for the proposed Fletcher-Finucane drilling campaign**

Potential risk	Potential consequence	Avoidance, Mitigation & Management Measures	Risk ranking
<i>Physical impacts</i>			
MODU and AHTS vessel anchoring	Temporary and localised seabed disturbance, shallow seabed depressions.	<ul style="list-style-type: none"> <li>Pre-drilling seabed survey reveals no sensitive seabed features or shipwrecks.</li> <li>Depressions caused by anchors fill rapidly after drilling ceases.</li> <li>AHTS vessels unlikely to anchor.</li> </ul>	Negligible
Underwater vessel noise	Temporary physiological impacts on sensitive fauna, such as cetaceans. Disruption to migration, feeding or breeding patterns.	<ul style="list-style-type: none"> <li>Drilling not undertaken in key migration path of threatened cetaceans.</li> <li>VSP to be undertaken only for a few hours per well using recognised industry standards. It will be undertaken in accordance with the DSEWPC EPBC Act Policy 2.1 (Part A).</li> </ul>	Negligible
Artificial lighting	Attractant to fauna, temporary increase in predation rates on fauna attracted to lights. Nuisance to fishers.	<ul style="list-style-type: none"> <li>Few light-sensitive species in vicinity of MODU locations.</li> <li>Lighting will be kept as minimal as possible but in accordance with safety standards.</li> <li>Lights directed downwards to the water will be minimised.</li> <li>Well clean-up activities (involving flaring) will be kept to the minimum time possible.</li> </ul>	Negligible
Atmospheric emissions	Temporary and localised reduction in air quality.	<ul style="list-style-type: none"> <li>Marine-grade (low sulphur) diesel used.</li> <li>All engines and machinery maintained in accordance with maintenance systems.</li> <li>Well clean-up activities (involving flaring) will be kept to the minimum time possible.</li> <li>No waste incineration.</li> </ul>	Negligible
Introduction of foreign organisms from vessel hulls and/or ballast	Establishment of foreign species to open ocean and/or seabed, competing with and displacing native species.	<ul style="list-style-type: none"> <li>MODU has been cleared by AQIS to enter Australian waters.</li> <li>MODU and AHTS vessels have been working in waters of the North West Shelf for a considerable time.</li> <li>MODU had a hull clean and anti-fouling paint re-applied in early 2011.</li> </ul>	Minor
<i>Routine liquid and solid discharges</i>			
Discharge of cuttings and	Temporary and localised	<ul style="list-style-type: none"> <li>Only drilling additives ranked highly under the CHARM North Sea OCNS will be</li> </ul>	Negligible

adhered mud	smothering/burial and disturbance of immediate seabed area. Temporary and localised loss of water quality from suspended sediments.	used. <ul style="list-style-type: none"> <li>• Use of DMP-approved SBM base fluid.</li> <li>• No disposal of whole muds overboard.</li> <li>• Use of a containment specialist company on board to assist with fluids management and ensure than &lt;10% oil-on-cuttings is achieved.</li> <li>• Benthic fauna likely to rapidly recolonise.</li> <li>• No sensitive seabed features at drill sites.</li> <li>• Use of experienced mud engineers.</li> </ul>	
Overboard discharge of contaminated deck drainage	Temporary and localised reduction in water quality.	<ul style="list-style-type: none"> <li>• Oily water treatment systems in place, with no discharge over 15 ppm oil-in-water.</li> <li>• Chemical storage and fuel transfer areas bunded.</li> <li>• Spills to decks cleaned immediately.</li> <li>• Decks cleaned with biodegradable detergents.</li> </ul>	Negligible
Overboard discharge of sewage and putrescible waste	Temporary and localised reduction in water quality. Modification of fauna feeding patterns.	<ul style="list-style-type: none"> <li>• MARPOL-approved sewage treatment systems used.</li> <li>• No discharge of sewage and putrescible waste within 12 nm of land.</li> <li>• Putrescible waste macerated prior to discharge.</li> </ul>	Negligible
Cooling water discharge	Localised elevation in surface water temperature.	<ul style="list-style-type: none"> <li>• No chemicals (e.g., corrosion inhibitors) used in cooling water.</li> <li>• Discharge water rapidly cools, little impact beyond 100 m of discharge point.</li> </ul>	Negligible
Brine water discharge	Localised elevation in surface water temperature and salinity levels.	<ul style="list-style-type: none"> <li>• No biocides or anti-scale chemicals added.</li> <li>• Most marine species able to tolerate short-term fluctuation in water salinity in the order of 20-30%.</li> </ul>	Negligible
Cement discharges	Temporary and localised loss of water quality from suspended sediments. Smothering of benthic habitat and fauna.	<ul style="list-style-type: none"> <li>• Minor volumes (1-2 m<sup>2</sup>) of cement released at seabed during grouting of upper bore casing.</li> <li>• Cement hose flushing and minor releases rapidly diluted and dispersed by ocean currents.</li> <li>• Minimisation of left-over product through inventory control and well planning.</li> <li>• The volume of concrete mixed will be accurately calculated to ensure only that which is necessary for drilling requirements is mixed.</li> </ul>	Negligible
Solid waste discharges	Marine pollution.	<ul style="list-style-type: none"> <li>• Solid wastes bagged and sent ashore for disposal.</li> <li>• All bins secured to deck and covered with</li> </ul>	Negligible

		<p>lids.</p> <ul style="list-style-type: none"> <li>Waste streams will be sorted on board according to shore-based recycling capabilities.</li> <li>MODU waste management procedures in place.</li> </ul>	
Hazardous waste discharges	Temporary and localised reduction in water quality.	<ul style="list-style-type: none"> <li>Drilling additives and other chemicals are selected for their highest environmental performance.</li> <li>Only small volumes of chemicals kept on board.</li> <li>Chemical drums will be stored in secured drums in bunded areas away from open drains.</li> <li>Bunded areas drain through a closed system, processed through the OIW separator.</li> <li>Material Safety Data Sheets (MSDS) available in appropriate locations throughout the MODU.</li> <li>SOPEP kits available on board for rapid clean-up response.</li> </ul>	Minor
<i>Socio-economic impacts</i>			
Commercial fishing and shipping	Temporary loss of fishing grounds from drill rig safety exclusion zone, resultant loss of income. Collision risk. Trawling gear snagging on anchors and anchor lines.	<ul style="list-style-type: none"> <li>Consultation with key fisheries in the region indicates low fishing effort around drill sites.</li> <li>Dampier Shipping Fairway is several kilometres west of nearest drill site.</li> <li>Temporary Notice to Mariners will be issued.</li> <li>A 500-m radius safety exclusion around the MODU will be gazetted.</li> <li>Standard maritime safety measures will be in place.</li> </ul>	Negligible
Recreational activities	Collision risk.	<ul style="list-style-type: none"> <li>Recreational fishing associations indicate drill sites are located too far offshore to be of concern.</li> </ul>	Negligible
<i>Non-routine activities</i>			
Loss of well control (i.e., blowout)	Marine pollution. Tainting of commercial fisheries species (e.g., shellfish). Injury and death of species such as seabirds. Pathological effects on fish larvae and plankton. Pollution of shoreline habitats such as sandy beaches and cliff faces.	<ul style="list-style-type: none"> <li>Well bore and casing designed to minimise risks.</li> <li>BOP preventer tested and installed.</li> <li>Oil spill contingency plan (OSCP) and Emergency Response Plan (ERP) in place.</li> <li>Approved Safety Case Revision in place.</li> <li>Oil spill modelling indicates only a 5% chance of oil reaching a coastline in a worst-case blowout scenario, and this would take 30-40 days, giving adequate</li> </ul>	Minor

		<p>time to develop a response.</p> <ul style="list-style-type: none"> <li>64% of oil (condensate) would evaporate within 24 hours.</li> </ul>	
Refuelling spill or spill due to vessel to vessel collision	Temporary marine pollution.	<ul style="list-style-type: none"> <li>Maersk Drilling refuelling procedures in place.</li> <li>Use of dry-break couplings.</li> <li>Job hazard analysis undertaken prior to refuelling.</li> <li>Oil spill modelling indicates that 45-60% of spilled diesel would evaporate within 24 hours.</li> <li>MODU diesel tanks located well above water line with minimal risk of vessel impact.</li> <li>Oil spill contingency plan (OSCP) and Emergency Response Plan (ERP) in place.</li> <li>Drain scuppers used in fuel transfer area to contain spills.</li> </ul>	Minor
Oil fall out during well clean-ups	Short-lived, widespread surface slick of light oil with temporary decrease in water quality.	<ul style="list-style-type: none"> <li>The Fletcher and Finucane oils are not expected to contain waxes that would normally inhibit the capacity to process burn. Foaming is also not expected.</li> <li>Well flows will be initiated during suitable weather conditions as defined by pre-start checks.</li> <li>The early flow will be directed to separator tanks.</li> <li>An evergreen burner will be used to reduce liquid drop- out risks.</li> <li>A flare watch will be used for immediate system shutdown in the event of a drop out being observed.</li> <li>A liquids 'knock out' vessel will be used if deemed necessary.</li> <li>Spill drills will be conducted on board.</li> <li>SOPEP kits will be in close proximity to clean-up equipment.</li> </ul>	Minor

## 7. Environmental Management

Santos manages the environmental and safety impacts of all its activities and operations, both existing and planned, through implementation of its Environment, Health and Safety Management System (EHSMS). The EHSMS is certified against ISO 14001 (Environmental Management Systems) and meets the requirements of AS4801-2001 (Occupational Health and Safety Management Systems). The EHSMS includes 18 management standards and 30 hazard standards.

An environmental implementation strategy for the Fletcher-Finucane drilling campaign is detailed in the EP and approved by the DMP. This strategy involves a crew training and awareness program, environmental audits, government communication, environmental monitoring and recording and incident reporting, and is supported by the Santos EHSMS.

## 8. Further Information

For further information about the Fletcher-Finucane drilling campaign, please contact:

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