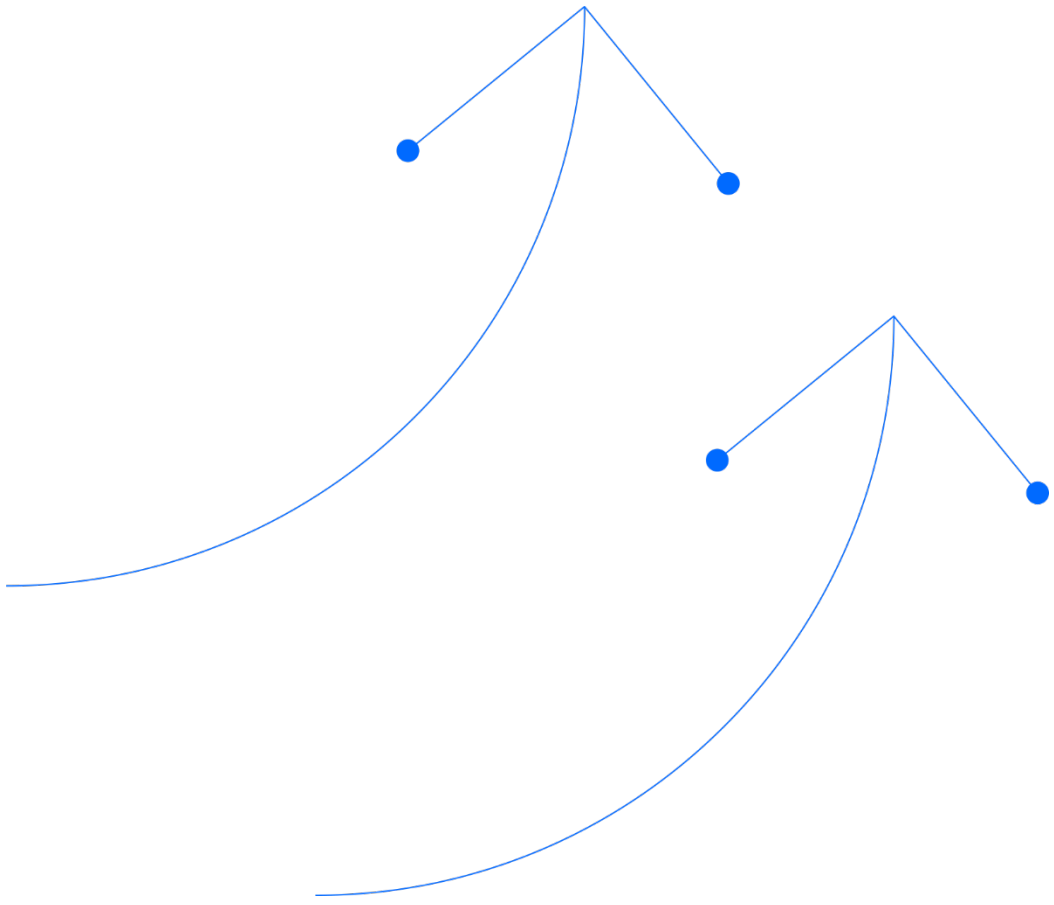
Santos

Operational and Scientific Monitoring

Bridging Implementation Plan: Northern Australia

24 November 2025



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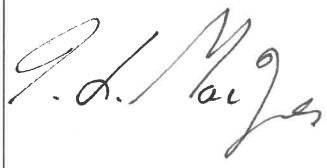
Bridging Implementation Plan: Northern Australia

Document No.: 7715-650-ERP-0003

Project / Facility	NA
Review interval (months)	12 Months
Safety critical document	No

Rev	Owner	Reviewer(s) *Managerial/Technical/Site*	Approver
	Lead Oil Spill Risk & Planning Coordinator	**Senior Oil Spill Risk and Planning Advisor** **Principal Oil Spill and Emergency Response Coordinator**	**Manager Environmental Approvals - WA, NA & TL)**
3		 	

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Rev	Rev Date	Author / Editor	Amendment
0	7 August 2024	BlueSands Environmental / Santos	Issued for use
1	12 September 2024	BlueSands Environmental / Santos	Issued for use
2	11 October 2024	BlueSands Environmental / Santos	- Additional baseline locations added to Table 2-1 for EOS and Tern-2 activities. - Revised EMBA figure. - Inclusion of EOS scenario in Table 2-1. - New baseline information sources for revised EMBA (Joseph Bonaparte Gulf, Kimberley Marine Park + others). - Minor revision to Appendix A, Step 3.
	14 January 2025	BlueSands Environmental / Santos	- Additional baseline locations added to Table 2-1 for Barossa Gas Export Pipeline (GEP) NT Waters Operations activities - Inclusion of Barossa GEP NT Waters Operations OPEP document number in Table 2-1 - Added additional receptor groupings to Table 4-3 that are relevant to Barossa GEP NT Waters Operations activities - New Call-off Order Form added to Appendix E
	3 April 2025	Santos	- Updated references to Santos Incident Management Plan – WANATL (7700-650-PLA-0016) and Santos Incident Response Telephone Directory (7700-650-PLA-0016.20) - Time-weighted average paragraph added to Section 15
3	24 November 2025	BlueSands Environmental / Santos	- Updated Section 8 (Resourcing Requirements) to reflect a change in resourcing approach; - Updated Section 2.2 to reflect the terminology used in the Joint Industry Framework OSM-BIP Template; - Modifications to Table 2 1 to highlight different hydrocarbon phases; - Updated Table 4-3 to include new receptors from new activities; - Updated Table 4-3 and Appendix C to meet EPS-OSM-004 ‘Regular review of existing baseline data’; - Minor updates to reflect OM and SM nomenclature used by OSM Services Provider; - Updated Section 9.1 (Personnel Competencies) to better demonstrate the requirements to the Joint Industry OSM Framework; - Inclusion of Appendix A (Demonstration of Meeting OSM Framework Regulatory Requirements) to assist regulatory assessment; - Updated Appendix B (Process for assessing new activities against OSM-BIP capability) to align with the changes made in Section 2 and Section 8.

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Terms

Term	Definition
AEP	Australian Energy Producers (formerly Australian Petroleum Production and Exploration Association [APPEA]; from 13 September 2023)
ALA	Atlas of Living Australia
AMOSC	Australian Marine Oil Spill Centre
AMP	Australian Marine Park
AMSA	Australian Marine Safety Authority
AODN	Australian Ocean Data Network
BACI	Before-After Control-Impact
BIP	Bridging Implementation Plan
BRUVS	Baited Remote Underwater Video Stations
BTEXN	Benzene, Toluene, Ethylbenzene and Xylenes And Naphthalene
CoC	Chain of Custody
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DBCA	Western Australian Department of Biodiversity Conservation and Attractions
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DEPWS	Department of Environment, Parks and Water Security
DWER	Western Australian Department of Water and Environmental Regulation
DPD	Darwin Pipeline Duplication
DPIRD	Western Australian Department of Primary Industries and Regional Development
DPLH	Western Australian Department of Planning, Lands and Heritage
EMBA	Environment that may be Affected
EP	Environment Plan
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cth)
EPS	Environmental Performance Standard
ESC	Environmental Scientific Coordinator
FOB	Forward Operating Base
FPSO	Floating Production, Storage and Offloading
GIS	Geographic Information System
GPS	Geographic Positioning System
HFO	Heavy Fuel Oil
IAP	Incident Action Plan
ICS	Incident Command System
IMOS	Integrated Marine Observing System
IMSA	Index of Marine Surveys for Assessments
IMT	Incident Management Team
IMTAG	Industry Member Technical Advisory Group
KEF	Key Ecological Feature
LEL	Lower Explosive Limits
LOWC	Loss Of Well Control
MDO	Marine Diesel Oil
MoC	Management of Change

Term	Definition
Monitoring Service Providers	The subcontracted specialist monitoring service providers subcontracted by OSRL to perform certain operational and scientific monitoring services
NATA	National Association of Testing Authorities
NEBA	Net Environmental Benefit Analysis
NT	Northern Territory
NT IMT	Northern Territory Incident Management Team
OM	Operational Monitoring
OMP	Operational Monitoring Plan
OPEP	Oil Pollution Emergency Plan
OPGGS (E)	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 Regulations
OSCP	Oil Spill Contingency Plan
OSM	Operational and Scientific Monitoring
OSM-BIP	Operational and Scientific Monitoring-Bridging Implementation Plan
OSM Services Provider	The operational and scientific monitoring services to be provided by OSRL via the OSM Supplementary Service Agreement
OSRA	Oil Spill Response Atlas
OSRL	Oil Spill Response Limited
OSTM	Oil Spill Trajectory Modelling
PAH	Polycyclic aromatic hydrocarbons
PPE	Personal Protective Equipment
QA/QC	Quality Assurance and Quality Control
ROV	Remotely Operated Vehicle
SBRUVS	Stereo Baited Remote Underwater Video Stations
SCAT	Shoreline Clean-up Assessment Technique
SM	Scientific Monitoring
SMP	Scientific Monitoring Plan
SSDI	Subsea Dispersant Injection
TRH	Total Recoverable Hydrocarbons
TPH	Total Petroleum Hydrocarbons
VOC	Volatile Organic Compound
VOO	Vessel of Opportunity
WA	Western Australia
WA DTMI	Western Australian Department of Transport and Major Infrastructure
WANATL	Western Australia, Northern Australia and Timor Leste
WAMSI	Western Australian Marine Science Institution

Part A – Preparedness

This Plan is presented in two parts:

- **Part A** outlines the relationship between Santos' environmental management document framework and the Joint Industry Operational and Scientific Monitoring (OSM) Framework (APPEA, 2021);
- **Part B** provides operationally focussed guidance for Santos personnel, OSM Services Provider and sub-contracted Monitoring Service Providers to coordinate the implementation of monitoring plans.

1. Introduction

Operational and Scientific Monitoring (OSM) is a key component of the environmental management document framework for offshore petroleum activities, which also include an Environment Plan (EP) and Oil Pollution Emergency Plan (OPEP). Operational Monitoring (OM) is instrumental in providing situational awareness of a hydrocarbon spill, enabling Incident Management Teams (IMT) to mount a timely and effective spill response and continually monitor the effectiveness of the response. Scientific Monitoring (SM) is also the principle tool for determining the extent, severity and persistence of environmental impacts from a hydrocarbon spill and for informing resultant remediation activities.

Santos has elected to use the Joint Industry OSM Framework and supporting operational monitoring plans (OMPs) and scientific monitoring plans (SMPs) as the foundation of its OSM approach. The Joint Industry OSM Framework is available on the AEP Environment Publications Webpage.

As outlined in NOPSEMA's Regulatory Advice Statement (RAS) regarding APPEAs Joint Industry OSM Framework, each Titleholder is required to develop a Bridging Implementation Plan (this document) that explains how the Framework aligns with their activities, oil spill risks and internal management systems. This plan and the Appendix titled 'Operational and Scientific Monitoring Assessment' in each activity OPEP, fulfils that requirement.

Appendix A provides guidance on the RAS requirements and reference to the relevant section of this document (or the broader suite of environmental management framework documents) which addresses that requirement.

Table 1-1 describes key documents that form Santos' environmental management document framework. Note that this is not an exhaustive list and additional documents are listed in the activity specific Santos OPEPs.

Mobilisation of OSM should follow the process listed in Part B: Section 12 Mobilisation and activation process.

Table 1-1: Key documents in Santos' environmental management framework

Document	Description
Activity specific Environment Plan (EP)	Each activity-specific EP describes the activity and the location, the environment, the risks to the environment as a result of the activity and the associated management controls. Of particular relevance to this BIP, it identifies sensitive receptors, potential impacts from hydrocarbon spills and the environment that may be affected (EMBA).
Activity specific Oil Pollution Emergency Plan (OPEP) / Oil Spill Contingency Plan (OSCP)	Each activity-specific OPEP / OSCP provides the activation and response process for the credible spill scenarios, including incident management, the net environmental benefit analysis (NEBA) process and detailed implementation guidance for individual response strategies. Of particular relevance to this BIP, it identifies the credible spill scenarios and protection priorities, presents the Scientific Monitoring Planning Area for the activity, and conducts a capability assessment to ensure that the OSM requirements of the activity are adequately covered by the existing information described within this OSM-BIP.
Incident Management Plan – WANATL (7700-650-PLA-0016)	The incident management plan establishes Santos incident management arrangements to: • Guide Western Australia, Northern Australia and Timor Leste (WANATL) Incident Management in emergency preparedness, emergency response and operational recovery; • Support site/facility Emergency Response Teams during emergencies; • Undertake incident action planning to manage the consequences of an emergency event, and; • Ensure WANATL incident management preparedness.
Santos Incident Management Handbook	The incident management handbook is a quick reference job aid to assist a response team member in filling specific Incident Command System (ICS) positions, understanding their position responsibilities, and how that position fits within the ICS structure.

Document	Description
Incident Response Telephone Directory (7700-650-PLA-0016.20)	Contains all relevant contact and communications information to enable effective communication amongst the response personnel and external stakeholders, including relevant OSM contacts.

1.1 Scope

This Operational and Scientific Monitoring - Bridging Implementation Plan (OSM-BIP) addresses the requirements of the Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2023 for all Santos activities within the Northern Australia Region (Figure 1-1), and was first submitted on 16th August 2024 with the now accepted Barossa Production Operations EP (BAA-200 0637) and OPEP (BAS-210 0134). This BIP applies to all Santos activities which have an EP accepted by Commonwealth and Territory/State regulators in the Northern Australia region. This Plan supersedes Santos' Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162).

For all new activities, there are three main steps for assessing whether this OSM-BIP adequately covers the OSM requirements for each new activity, these include the following, and are summarised in Appendix B:

1. Determine if the new activity Environment that May be Affected (EMBA) and Scientific Monitoring Planning Area fits within the Northern Australia OSM-BIP Consolidated Scientific Monitoring Planning Area, as outlined in Section 2.1.
2. Using stochastic modelling, determine the monitoring priorities for the activity, by identifying receptors predicted to be contacted ≥5 % probability within 7 days, determining whether these receptors are currently included in Table 2-1 and have been assessed for baseline data adequacy in Table 4-3.
3. Determine whether the capability requirements and monitoring arrangements of the new activity exceed or are met by the capability requirements outlined in Section 8 and capability arrangements described in Sections 9 and 10.

Prior to submission for regulatory approval, each new/revised OPEP shall assess whether the OSM-BIP adequately covers the OSM requirements as per the three elements described above. If additional operational and/or scientific monitoring capability is required for a new activity above the OSM capability described in Sections 9 and 10, prior to submission the Environment/Project Team will follow Santos' EP MOC process, and the OSM-BIP will be updated with the new capability requirements before the activity commences.

Santos activities within the North West Shelf Region of Western Australia are addressed by the Santos North West Shelf OSM-BIP (7715-650-ERP-0002).

Santos will implement OSM, as applicable, for oil spills across both Territory/State and Commonwealth waters. For oil spills that contact Northern Territory (NT) shorelines, Santos will liaise directly with the NT IMT and provide all of the required support to implement scientific monitoring on NT shorelines. In the event that control of scientific monitoring in State waters is taken over by the Western Australian Department of Transport and Major Infrastructure (WA DTMI) under advice from the State Environmental Scientific Coordinator (ESC), Santos will follow the direction of WA DTMI as Control Agency and provide all necessary resources (monitoring personnel, equipment and planning) to assist as a supporting agency.

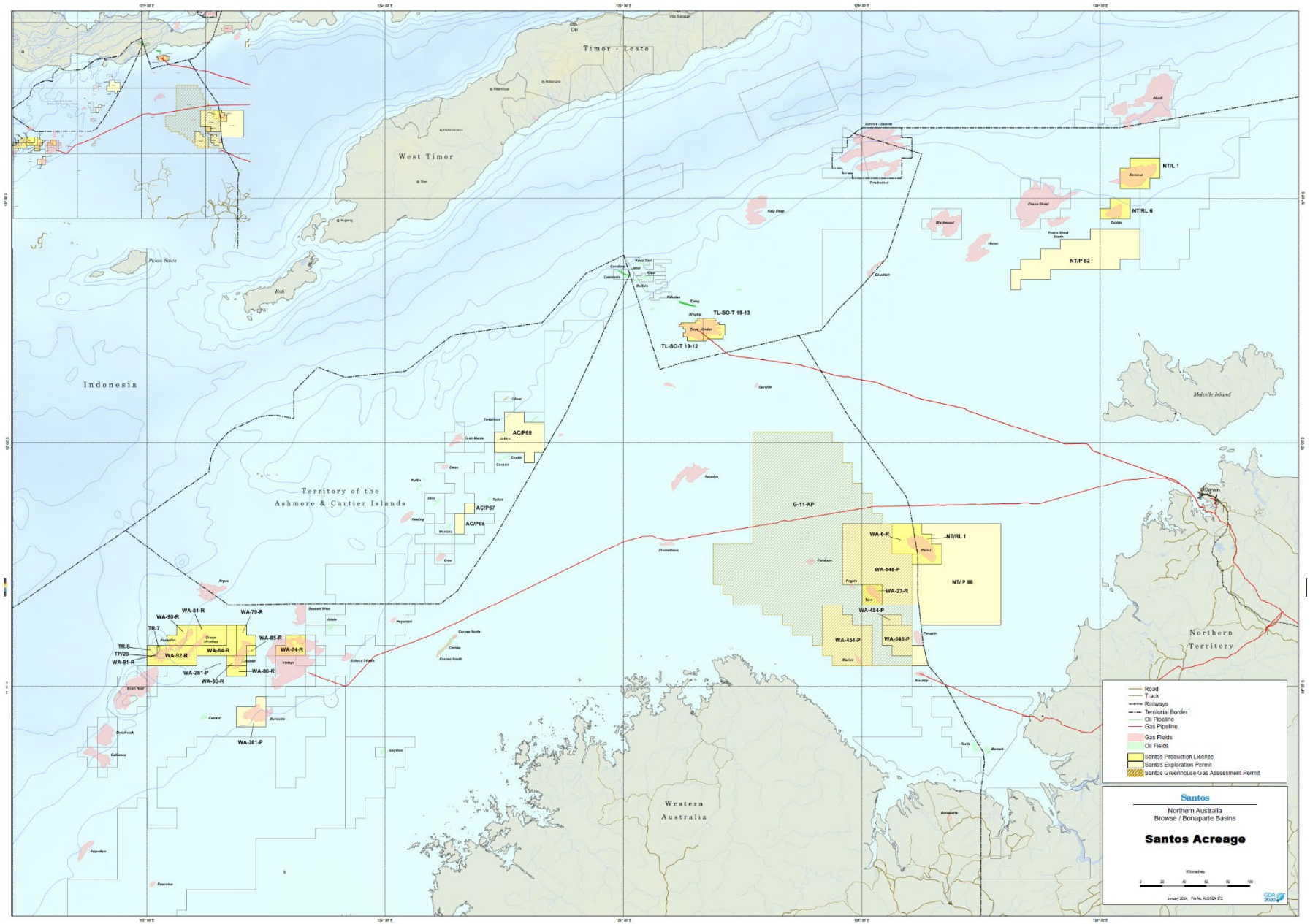


Figure 1-1: Santos acreage Northern Australia – Browse / Bonaparte Basins (January 2024)

2. Scientific Monitoring Planning Area and Monitoring Priorities

2.1 Consolidated Scientific Monitoring Planning Area

This OSM-BIP provides monitoring guidance and arrangements for all Santos activities referred in the Northern Australia Region. Therefore, a single Consolidated Scientific Monitoring Planning Area has been prepared to represent all of these activities and the resultant geographical extent of this OSM-BIP (Figure 2-1). The Consolidated Scientific Monitoring Planning Area corresponds to the low exposure values using stochastic modelling results applying the following thresholds:

- 1 g/m^2 floating oil thickness, which is considered to be below levels which would cause environmental harm and is more indicative of the areas perceived to be affected due to its visibility on the sea-surface
- 10 g/m^2 for accumulated (shoreline) oil, which represents the area visibly contacted by the spill
- 10 ppb for dissolved hydrocarbons, which corresponds generally with potential for exceedance of water quality triggers
- 10 ppb entrained hydrocarbons represents the low exposure zone and corresponds generally with potential for exceedance of water quality triggers.

The Consolidated Scientific Monitoring Planning Area is based on the above low thresholds as outlined in the NOPSEMA Oil Spill Modelling Environment Bulletin, April 2019 (NOPSEMA, 2019). However, the EMBA for each of the activities covered by this OSM-BIP may be defined by other thresholds, as presented in each relevant EP. Some EPs may use different thresholds for the EMBA, which typically indicates the area where both ecological and socio-economic receptors may be affected. The Scientific Monitoring Planning Area (all based on the low thresholds) can be considered as the absolute outer limit of OSM efforts.

The Consolidated Scientific Monitoring Planning Area has been determined based on the modelling results for the activities and worst-case credible spill scenarios outlined in Table 2-1. These spill scenarios are considered representative of Santos' worst-case credible scenarios given the extent of their Scientific Monitoring Planning Area, hydrocarbon types, proximity to receptors, minimum time to contact and their representation of Santos' activity locations within the Northern Australia Region.

For a description of the environment within each Scientific Monitoring Planning Area and respective EMBA, refer to the activity-specific EPs and the Environmental Values and Sensitivities section. This section includes the following pertinent information: protected matters and any associated recovery plans/conservation advice, key ecological features (KEFs), protected areas, significant socio-economic industries, and culturally significant places.

2.2 Monitoring Priorities

Monitoring prioritisation during a spill should focus on sensitive receptors with the highest risk of adverse consequences and where oil spill modelling predicts high probability of rapid contact. Santos identifies sensitivities and receptors with high conservation value as part of its Oil Spill Risk Assessment and Response Planning Procedure (SO-91-II-20003). An accumulated sensitivity score is attributed to protected and biologically important areas and receptors, with an overall ranking providing the overall environmental value (EV) of each receptor.

Oil spill modelling provides a useful tool in assessing monitoring priorities, as it predicts the probability and minimum time at which individual receptors may be contacted by a spill. High EV receptors with a higher probability of rapid contact from an oil spill should be the priority of a monitoring program, compared to similar sensitive receptors with a lower probability and longer time to contact following a spill, where time may permit the collection of reactive (post-spill but pre-contact) baseline data.

Santos has reviewed the oil spill modelling results for the scenarios listed in Table 2-1 (as provided in the activity-specific EPs and OPEPs) and have identified receptors contacted at a higher probability of rapid contact; Table 2-1 presents the receptors contacted by hydrocarbons at the low threshold for entrained (≥10 ppb), dissolved (≥10 ppb), floating (≥1 g/m^2), and shoreline contact (≥10 g/m^2), within 7.0 days (7.0 days was used to delineate the initial monitoring response) at a probability >5%. Appendix C lists the background information on key receptors/sensitivities associated with each of these receptors.

The inclusion of entrained hydrocarbons at concentrations greater than 10 ppb is used to denote exposure to hydrocarbons, but does not necessarily imply toxicity. For entrained whole-oil droplets, the toxic fraction is small, as many hydrocarbon constituents remain sequestered and not bioavailable (French-McCay 2024). During the initial

monitoring response, emphasis will be placed on receptors contacted by floating, shoreline, and dissolved hydrocarbon phases. If a receptor is only contacted by low concentrations of entrained hydrocarbons and not by any other hydrocarbon phase, it will be considered a lower priority during the initial monitoring response.

The availability of baseline data further influences monitoring priorities. Where receptors have little or no existing baseline, they are given higher scientific monitoring priority to facilitate effective post-impact comparisons. Section 4 outlines Santos' baseline review and evaluation process, and Table 4-3 summarises the baseline data assessment for the sensitive receptors identified in Table 2-1.

Monitoring priorities are subsequently identified as those locations and associated receptors predicted to be contacted within 7.0 days at a probability >5%, and where baseline data is either not available or not sufficient (as depicted in Table 4-3 and outlined in Section 4).

In addition to these receptors, there are receptors that are transient (i.e. cetaceans, seabirds, whale sharks) and others that are broad-scale, such as managed fisheries with large spatial extents, Key Ecological Features (KEFs) and Biologically Important Areas (BIAs).

As per the Santos Oil Spill Risk Assessment and Response Planning Procedure, Santos applies a sensitivity scoring approach to prioritise spill impact, where protected and biologically important area datasets intersecting the receptor contribute to the receptor's accumulated sensitivity score. The Santos receptors database includes a number of metadata fields for each receptor, which capture broad-scale features where these intersect with the receptor polygons, including:

- DBCA Legislated Lands and Waters features;
- Australian Marine Park (AMP) features;
- Biologically Important Areas (BIAs) behavioural and migratory features;
- Key Ecological Features (KEFs);
- World Heritage Area features;
- Commonwealth Heritage Areas features;
- National Heritage Areas features; and
- RAMSAR Convention wetland features of international importance.

Santos' EV ranking essentially takes account of all these metadata to drive the EV sensitivity score for each receptor. Therefore, broad-scale features are already accounted for within the Santos receptors database, and therefore are included by default within OSM planning for priority receptors.

KEFs are also described in detail in Section 3 of the activity-specific EPs. KEFs relevant to Santos activities in the Northern Australia Region include subsea receptors (benthic and pelagic habitats; demersal fish communities) that may be at risk from subsea releases. Therefore, OSM planning and resourcing for this activity has included relevant monitoring requirements, such as water quality, sediment quality, benthic habitats and fish for these features (refer to Section 8).

The Consolidated Scientific Monitoring Planning Area overlaps a number of BIAs and protected species potentially occurring in the area, as described in Section 3 of the activity-specific EPs. A number of the BIAs and protected species are located within or adjacent to monitoring priorities, for example, marine turtles within the Oceanic Shoals AMP, and are features that influence the receptor EV sensitivity scores, so would automatically be included in the relevant SMPs for any particular monitoring priority receptor (refer to Table 8-2). Where BIAs and protected species are situated away from listed monitoring priorities, they will be captured in the Offshore Environs monitoring unit described in Table 8-2.

Another important consideration for monitoring prioritisation is a receptor's vulnerability to different forms of hydrocarbon exposure as well as its inherent sensitivity. For example, coral is highly sensitive to hydrocarbons, but its vulnerability depends on the form of exposure. If the hydrocarbon is floating on the sea surface during calm conditions, it may pass over the coral without interaction. However, if the hydrocarbon is dissolved in the water column with sufficient exposure duration, the coral may become directly vulnerable to its toxic effects.

At the time of a spill, Santos will work with its OSM Services Provider, sub-contracted Monitoring Service Providers and key stakeholders in the initial stages of the spill to identify priority monitoring receptors and to assist in the finalisation of the monitoring design, ensuring that resources are allocated appropriately and according to the greatest risk of impact. This process is outlined in Section 13.

Table 2-1: Santos worst-case spill scenarios used to determine the Consolidated Scientific Monitoring Planning Area for the Northern Australia Region and key receptors

Environment Plan / OPEP	Hydrocarbon Type	Scenario	Release Duration	Volume (m^3)	Receptors predicted by stochastic modelling to be contacted ≥5 % probability within 7 days				
					Location	Floating	Shoreline	Entrained	Dissolved
Barossa Production Operations (BAA-200 0637)	Barossa Condensate (Group 1)	Surface release from the FPSO or offtake tanker from an external impact (vessel collision), which ruptures a condensate storage tank	1 hour	16,700	Margaret Harries Bank*	X	NA	√	√
					Outer Oceanic Shoals AMP*	X	NA	√	√
					Sunrise Bank*	X	NA	√	√
					The Boxers Area*	X	NA	√	√
	MDO (Group 2)	Surface release from the FPSO from an external impact (vessel collision), which ruptures an FPSO MGO / MDO tank	1 hour	2,418	Margaret Harries Bank*	X	NA	√	X
					Sunrise Bank*	X	NA	√	√
					Outer Oceanic Shoals AMP*	X	NA	√	X
					The Boxers Area*	X	NA	√	X
	MDO (Group 2)	Surface release from a tank onboard the inspection, maintenance and repair (IMR) vessel because of an external impact (vessel collision)	1 hour	500	Afghan Shoal*	X	NA	√	X
					Beagle Gulf-Darwin Coast	X	X	√	X
					Djukbinj NP	X	X	√	X
					Flat Top Bank*	X	NA	√	X
					Hancox Shoal*	X	NA	√	X
					Harris Reef*	X	NA	√	X
					Joseph Bonaparte Gulf - East Coast	X	X	√	X
					Lowry Shoal*	X	NA	√	X
					Marsh Shoal*	X	NA	√	X
					Moresby Shoals*	X	NA	√	X
					Outer Oceanic Shoals AMP*	X	NA	√	X
					Shepparton Shoal*	√	NA	√	X
					Skottowe Shoal*	X	NA	√	X
					The Boxers Area*	X	NA	√	X

Environment Plan / OPEP	Hydrocarbon Type	Scenario	Release Duration	Volume (m^3)	Receptors predicted by stochastic modelling to be contacted ≥5 % probability within 7 days				
					Location	**Floating**	**Shoreline**	**Entrained**	**Dissolved**
					Tiwi Islands	X	X	√	X
					Van Diemen Gulf Coast	X	X	√	X
					Van Diemen Gulf Shoals*	X	NA	√	X
					Vernon Islands CR	X	X	√	X
	Heavy Fuel Oil (HFO) (Group 4)	Surface release from the offtake tanker from an external impact (vessel collision), which ruptures an HFO tank on the offtake tanker	1 hour	460	Echo Shoals*	√	NA	X	X
					Margaret Harries Bank*	√	NA	X	X
					Outer Oceanic Shoals AMP*	√	NA	X	X
					Sunrise Bank*	√	NA	X	X
Barossa Darwin Pipeline Duplication (Operations) Territory waters (BAS-210 0226)	MDO (Group 2)	Vessel fuel tank rupture (at locations KP23, KP91.5 and KP114)	1 hour	300	**KP23:**				
					Afghan Shoal*	X	NA	√	X
					Shepparton Shoal*	X	NA	√	X
					Tiwi Islands	X	X	√	X
					KP91.5:				
					Darwin Harbour	X	√	√	X
					KP114:				
					Darwin Harbour	√	√	√	√
Bayu Undan Gas Export Pipeline Decommissioning (*in draft*)	MDO (Group 2)	Vessel fuel tank rupture (at locations KP30, KP200, KP300 and KP420)	1 hour	361	**KP30:**				
					Outer Ocean Shoals AMP*	√	NA	X	X
					KP200:				
					Outer Oceanic Shoals AMP*	√	NA	√	X
					KP300:				
					Newby Shoal*	√	NA	√	√
					Outer Oceanic Shoals AMP*	√	NA	√	X
					KP420:				
					Vernon Islands CR	X	√	X	X

Environment Plan / OPEP	Hydrocarbon Type	Scenario	Release Duration	Volume (m^3)	Receptors predicted by stochastic modelling to be contacted ≥5 % probability within 7 days				
					Location	Floating	Shoreline	Entrained	Dissolved
EOS 3D Marine Seismic (7710-650-ERP-0004)	MDO (Group 2)	Vessel fuel tank rupture (at locations 1 and 2)	1 hour	1,065	**Location 1:**				
					Kimberley AMP*	X	NA	√	X
					Outer Oceanic Shoals AMP*	X	NA	√	X
					Van Cloon-Deep Shoals*	X	NA	√	X
					Location 2:				
					Joseph Bonaparte Gulf East Coast	X	X	√	X
					Joseph Bonaparte Gulf AMP*	X	NA	√	X
Tern 2 P&A (7710-650-EMP-0009)	MDO (Group 2)	Vessel fuel tank rupture	1 hour	300	Kimberley AMP*	X	NA	√	X
Bayu Undan CCS GHG Pipeline (*in draft*)	MDO (Group 2)	Vessel fuel tank rupture (at location KP30)	1 hour	361	Margaret Harries Bank*	X	NA	√	X
					Outer Oceanic Shoals AMP*	√	NA	√	X
					Van Cloon Deep Shoals*	X	NA	√	X
	MDO (Group 2)	Vessel fuel tank rupture (at locations KP200, KP300, KP420 and in Darwin Harbour)	1 hour	186	**KP200**:				
					Outer Oceanic Shoals AMP*	√	NA	√	X
					The Boxers Area*	√	NA	√	√
					KP300:				
					Outer Oceanic Shoals AMP*	√	NA	√	X
					Flat Top Bank*	X	NA	√	X
					Newby Shoal*	√	NA	√	X
					The Boxers Area*	√	NA	√	√
					KP420:				
					Beagle Gulf- Darwin Coast	X	X	√	X
					Shepparton Shoal*	X	NA	√	X
					Skottowe Shoal*	X	NA	√	X
					Vernon Islands CR	X	X	√	X
					Darwin Harbour:				

Environment Plan / OPEP	Hydrocarbon Type	Scenario	Release Duration	Volume (m^3)	Receptors predicted by stochastic modelling to be contacted ≥5 % probability within 7 days				
					Location	Floating	Shoreline	Entrained	Dissolved
					Darwin Harbour	√	√	√	√

Key[1]	
Beagle Gulf-Darwin Coast	Includes RPS oil spill modelling default receptor locations of Cox-Finniss (Including Charles Point Wide), Darwin and Litchfield
Djukbinj	Includes western section of RPS oil spill modelling default receptor location South Alligator, also includes the geographical area known as Cape Hotham
Van Diemen Gulf Coast	includes eastern section of RPS oil spill modelling default receptor locations South Alligator and western section of West Arnhem
Joseph Bonaparte Gulf – East Coast	Include RPS oil spill modelling default receptor locations of Daly and Thamarrurr
NP	Not provided
NA	Not applicable
X	Not contacted by this hydrocarbon phase
*	Submerged receptor that has no features above the sea surface. Modelling indicates floating contact with these receptors when the hydrocarbons pass over the receptor on the sea surface.
	Receptor only contacted by entrained hydrocarbons

[1] *Coastline locations are listed in accordance with the Santos defined receptors provided in Santos' Oil Spill Risk Assessment and Response Planning Procedure (SO-91-II-20003). It should be noted that not all available oil spill modelling reports list receptor locations in accordance with the Santos defined receptors. Where sectors have alternative names, these are included here for cross reference*

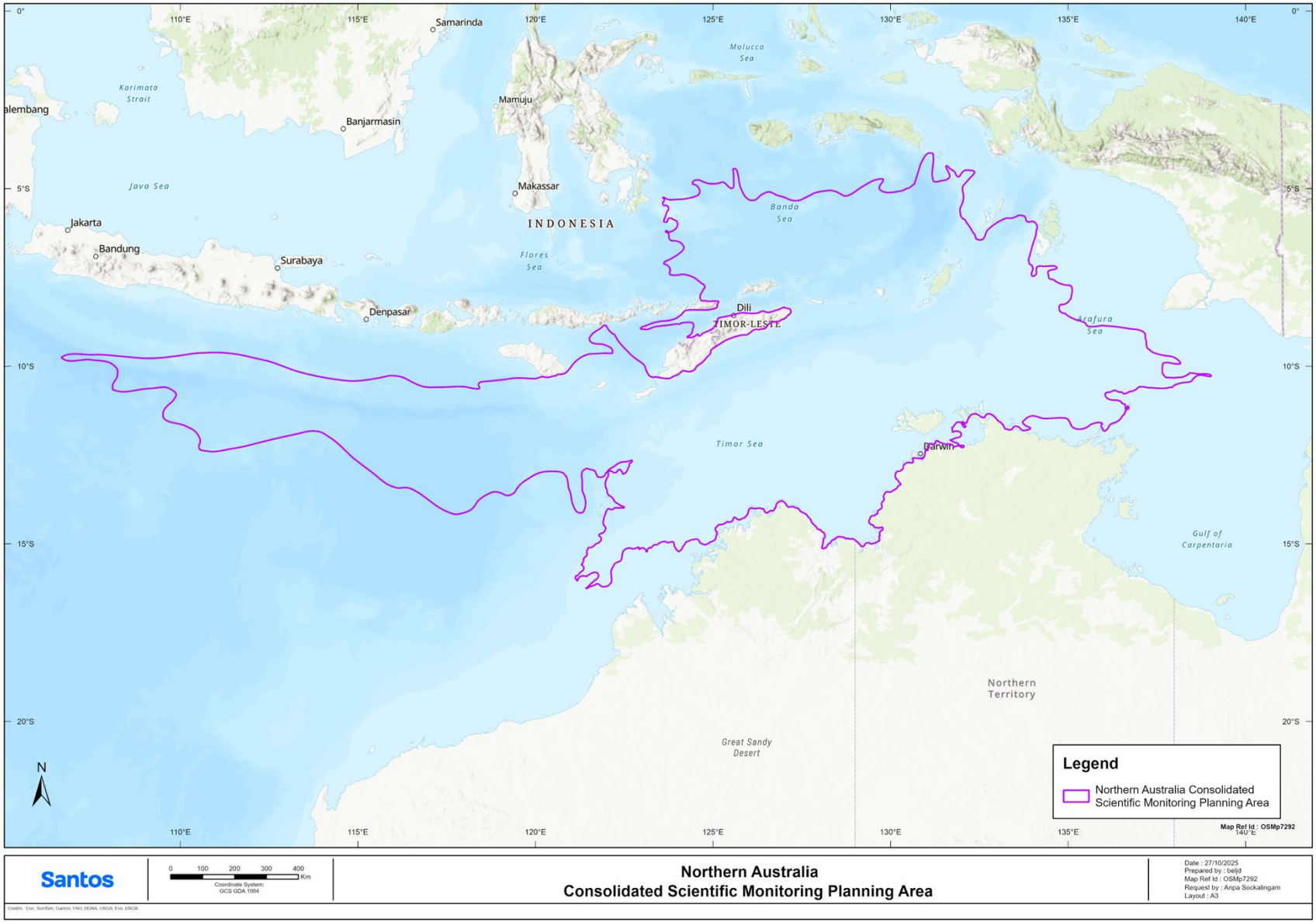


Figure 2-1: Consolidated Scientific Monitoring Planning Area for Santos Northern Australia OSM-BIP

3. Relevant existing baseline information sources

Santos has access to a number of different baseline data sources that are relevant to the high-value receptors in the Northern Australia OSM-BIP Consolidated Scientific Monitoring Planning Area. These include the Santos Geographic Information System (GIS) (including habitat/fauna distribution layers and satellite imagery) and the following external data sources:

3.1 Data.gov.au

Data.gov.au is the central source of Australian open government data published by federal, state and local government agencies. In addition, it includes publicly-funded research data and datasets from private institutions that are in the public interest.

3.2 Australian Ocean Data Network

The Australian Ocean Data Network (AODN) is the primary access point for search, discovery, access and download of data collected by the Australian marine community. Data is presented as a regional view of all the data available from the AODN. Primary datasets are contributed to by Commonwealth Government agencies, State Government agencies, Universities, the Integrated Marine Observing System (IMOS – an Australian Government Research Infrastructure project), and the Western Australian Marine Science Institution (WAMSI).

3.3 Western Australian Oil Spill Response Atlas

The Western Australian Oil Spill Response Atlas (OSRA) is a spatial database of environmental, logistical and oil spill response data. Using a GIS platform, OSRA displays datasets collated from a range of custodians allowing decision makers to visualise environmental sensitivities and response considerations in a selected location. Oil spill trajectory modelling (OSTM) can be overlaid to assist in determining protection priorities, establishing suitable response strategies and identifying available resources for both contingency and incident planning. OSRA is managed by the Oil Spill Response Coordination unit within WA DTMI Marine Safety and is part funded through the National Plan for Maritime Environmental Emergencies and the Australian Maritime Safety Authority (AMSA). Santos IMT members can log in to the OSRA on the Santos SharePoint site.

3.4 The Atlas of Living Australia

The Atlas of Living Australia (ALA) is a collaborative, online, open resource that contains information on all the known species in Australia aggregated from a wide range of data providers. It provides a searchable database when considering species within the Scientific Monitoring Planning Area. The ALA receives support from the Australian Government through the National Collaborative Research Infrastructure Strategy and is hosted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

3.5 Index of Marine Surveys Assessment

The Index of Marine Surveys for Assessments (IMSA) is an online portal to information about marine-based environmental surveys in Western Australia. IMSA is a project of the WA Department of Water and Environmental Regulation (DWER) for the systematic capture and sharing of marine data created as part of an environmental impact assessment.

3.6 Other Sources

Other sources include:

- the WA Department of Biodiversity and Attractions (DBCA) Biodiversity and Conservation Science Annual Reports;
- Australian Institute for Marine Science (AIMS) Research Data Platform;
- WA State of Fisheries Report;

- eAtlas.org.au;
- North West Atlas;
- Western Australian Marine Science Institution;
- Geosciences Australia data and publications;
- Australian Marine Parks Science Atlas; and
- Birdlife Data Zone.

Reports and peer reviewed journal articles were also accessed via research and journal databases such as PubMed and Google Scholar, as well as unpublished monitoring reports.

4. Baseline data review

Understanding the presence or absence, suitability and quality of baseline data for receptors predicted to be contacted within 7 days is an important preparatory measure for prioritising monitoring. During a spill event, prioritisation of monitoring capability may be given to those receptors with insufficient baseline data where it is possible to collect baseline data post-spill pre-impact. Where post-spill pre-impact monitoring is not feasible due to short contact times, understanding which receptors have insufficient baseline data will help quickly guide the finalisation of each SMP design and the need to include alternative designs (e.g. the Gradient Approach versus Before-After Control-Impact (BACI) design).

Santos is part of a Joint Industry Collaborative Group who are working together to determine the extent, quality and suitability of existing baseline data for the marine environments in the North West Shelf, Browse and Timor Sea Regions of Australia. The Marine Environment Baseline Database includes available data for all receptors relevant to the Joint Industry OSM Framework and has assessed the spatial and temporal relevance of this data and comparison of methods and parameters to those outlined in the Joint Industry SMPs.

Using the Marine Environment Baseline Database, Santos has reviewed the baseline data for all of the receptors listed in Table 2-1 to help determine which receptors have insufficient or no baseline data available and should be given a higher monitoring priority.

The baseline data assessment includes the following steps:

1) **Identification of receptors requiring a baseline review:** Receptors predicted to be contacted within 7 days, at a probability greater than 5%, are identified (Table 2-1) and aligned with OMPs and SMPs
2) **Collection of baseline data:** Environmental baseline monitoring data relevant to the receptors is located (as per sources outlined in Section 3) and included (if it is not already included) in the Marine Environment Baseline Database. Appendix D provides a high-level summary of selected data sources included in the Marine Environment Baseline Database.
3) **Assessment of baseline data**: The relevance of each data source is assessed. For each data source obtained, a meta-analysis is performed to determine if the parameters and methods align with the key parameters and methods outlined in the Joint Industry SMPs (Table 4-1), the spatial extent of the data, the sampling effort/duration, and the temporal relevance is also noted. Table 4-2 outlines the overall assessment criteria used for each data source.
4) **Assessment of baseline data:** A qualitative annual evaluation of the adequacy (in terms of the likely ability to detect changes between pre-impact and post-impact conditions) of the collective baseline data for each receptor is undertaken. This evaluation takes into consideration the following:
    a) Background historical information on the presence, distribution, seasonality, and if applicable, the reproductive state of the receptor (as outlined in Appendix C) is compared with the data available from monitoring within the last 5 years. Depending on the receptor and associated Joint Industry SMP, the following is considered:
        i) Does the data collectively cover the required spatial extent of the receptor within a location (taking into consideration any background historical information on the distribution of the receptor)?
        ii) Does the data collectively cover all the species/biological communities required for the relevant Joint Industry SMP and that may be present at the receptor/location?
5) **Assessment outcome:** Each location and associated receptor is then categorised as follows and summarised in Table 4-3:
    a) **Priority Survey:** Current baseline data is not in place, not suitable or not sufficient; and post-spill pre-impact baseline data collection should be prioritised; or

b) **Survey:** Collectively there is substantial baseline data or on-going monitoring from within the last 5 years. This data aligns with the key parameters and methodologies of the relevant Joint Industry SMP, encompasses the required species/biological communities, and covers the required spatial extent of the location. The current baseline data is therefore considered sufficient and could likely be used to detect a level of change in the event of a significant impact. Hence this receptor is considered a lower priority for post-spill, pre-impact data collection.

It is noted that it is difficult to obtain absolute statistical proof of oil spill impacts, due to the variability (spatially and temporally) of the natural environment, the lack of experimental control due to the nature of spills and because suitable baseline data may not be available (Kirby, *et al*. 2018). Alternative approaches exist for detecting impacts where post-spill, pre-impact monitoring may not be feasible. These include impact versus control design approaches and/or a gradient approach. The Joint Industry OSM Framework provides guidance and considerations for survey designs to enable the acquisition of sufficiently powerful data during SMP implementation.

Table 4-1: Key parameters and key methodology from the Joint Industry SMPs

SMP	Key parameter	Key methodology
SM1: Water quality impact assessment	At least one key parameter: • Total recoverable hydrocarbons (TRH); • Total petroleum hydrocarbons (TPH); • Benzene, toluene, ethylbenzene and xylenes and naphthalene (BTEXN); or • Polycyclic aromatic hydrocarbons (PAH)	In situ UV fluorometer and/or samples analysed at National Association of Testing Authorities (NATA) accredited lab using NATA accredited method
SM2: Sediment quality impact assessment	At least one key parameter: TRH, TPH, BTEXN, PAH, heavy metals	Sediment collected by corer/grab and samples analysed at NATA accredited lab using NATA accredited method
SM3: Intertidal and coastal habitat assessment	At least one key parameter: presence, diversity, distribution	Any of the following, as appropriate to the parameters: • Ground and vessel-based intertidal surveys (e.g. quadrats, transects, including video and still photography) • Remote sensing • Infauna sampling
SM4: Seabirds and shorebirds	At least one key parameter: species present, abundance / counts, behaviour (resting, roosting, foraging, nesting)	Ground surveys and standardised methodology for counting birds
SM5a: Marine megafauna - reptile	At least one key parameter: species identification, abundance / counts, key behaviour (foraging, mating, nesting, internesting)	As appropriate to the species and behaviour / life stage: • Nesting turtles: ground surveys • In water turtles: vessel and aerial surveys • Sea snakes: manta board and snorkel surveys • Estuarine crocodiles: vessel-based spotlight surveys at night
SM5b: Marine megafauna- whale sharks, dugong and cetaceans	At least one key parameter: species identification, abundance / counts, key behaviour	Aerial or vessel surveys, acoustic monitoring
SM6: Benthic habitat assessment	At least one key parameter: presence, diversity, distribution	Any of the following, as appropriate to the parameters: • Transects • Towed camera • Drop camera

SMP	Key parameter	Key methodology
		• Remotely Operated Vehicle (ROV) camera • Diver-based camera surveys • Remote sensing (coral & seagrass broad scale survey) • Sediment grab for infauna
SM7: Marine fish and elasmobranch assemblages assessment	At least one key parameter: species identification, abundance, habitat type	Any of the following, as appropriate to the parameters: • Baited remote underwater video stations (BRUVS) • Stereo Baited Remote Underwater Video Stations (SBRUVS) • ROV • Towed video survey
SM8: Fisheries impact assessment	At least one key parameter: Abundance, catch-rate, stock structure, size structure	Catch and effort for stock assessment

Table 4-2: Assessment criteria for baseline data review

Year of most recent data capture	Duration of monitoring program	Frequency of data capture	Similarity of methods to Joint Industry SMP	Similarity of parameters to Joint Industry SMP
High = less than 5 years old	High = > 4 years	High = 4+ sampling trips per year	High	High
Medium = between 5-10 years old	Medium = 2–4 years	Medium = 2–3 sampling trips per year	-	-
Low = greater than 10 years old	Low = <2 years	Low = one-off sampling trip	Low	Low

Table 4-3: Baseline data assessment versus SMPs for the worst-case spill scenarios in the Northern Australia OSM-BIP Consolidated Scientific Monitoring Planning Area

Receptor	SMP									
	SM1: Water quality impact assessment	SM2: Sediment quality impact assessment	SM3: Intertidal and coastal habitat assessment	SM4: Seabirds and shorebirds	SM5a: Marine mega-fauna assessment – reptiles	SM5b: Marine mega-fauna assessment – whale sharks, dugong and cetaceans	SM6: Benthic habitat assessment	SM7: Marine fish and elasmobranch assemblages assessment	SM8: Fisheries impact assessment[+]	SM9 & 10: Heritage and social impact assessment^
Kimberley AMP*										
Oceanic Shoals AMP*										
Darwin Harbour					Flatback turtle & saltwater crocodile Sea snake					
Beagle Gulf-Darwin					Flatback turtle & saltwater crocodile Sea snake					
Djukbinj					Saltwater crocodile					
Van Diemen Gulf Coast					Saltwater crocodile & flatback turtle at Field Island					
Joseph Bonaparte Gulf – East Coast					Saltwater crocodile in the Daly River					

Receptor	SMP									
	SM1: Water quality impact assessment	SM2: Sediment quality impact assessment	SM3: Intertidal and coastal habitat assessment	SM4: Seabirds and shorebirds	SM5a: Marine mega-fauna assessment – reptiles	SM5b: Marine mega-fauna assessment – whale sharks, dugong and cetaceans	SM6: Benthic habitat assessment	SM7: Marine fish and elasmobranch assemblages assessment	SM8: Fisheries impact assessment+	SM9 & 10: Heritage and social impact assessment^
Tiwi Islands					Turtle & saltwater crocodile Sea snakes		Seagrass			
Vernon Islands										
Reefs, shoals and banks*										
Water Quality Zones (Darwin Harbour only)										
Shipwrecks and Restricted Areas										

Key	
	Priority survey: Current baseline data is not in place, not suitable or not sufficient; and post-spill pre-impact baseline data collection should be prioritised
	Survey: Collectively there is substantial baseline data or on-going monitoring from within the last 5 years, therefore current monitoring/knowledge is considered adequate (i.e. could be used to detect level of change in the event of a significant impact) and is considered a lower priority for post-spill, pre-impact data collection
	N/A: not applicable

** Submerged EVA*

+ Locations to be determined in consultation with key stakeholders to reflect current fishing zones/effort

^ Locations to be determined in consultation with key stakeholders

5. OSM organisational structure

Santos uses the ICS to respond to incidents and therefore adopts the key roles and responsibilities used in this system, as described in the activity EPs and/or OPEPs. The IMT will be responsible for coordinating OSM activities, which will be implemented by the Planning Section within the IMT, with support from each Section, in particular the Operations Section.

The full Santos IMT structure is shown in the activity specific OPEPs. Where the NT IMT and/or WA DTMI is the Control Agency, the IMT will be managed through coordinated command and Santos will still be expected to continue monitoring activities in Territory/State waters, with oversight from the NT IMT and/or WA DTMI.

Figure 5-1 illustrates the structure of the IMT, including key OSM roles during the response phase. The IMT Incident Commander is ultimately accountable for managing the response operation, which includes this plan. Depending on the scale of the event, individual people may perform multiple roles; similarly, multiple people may share the same role.

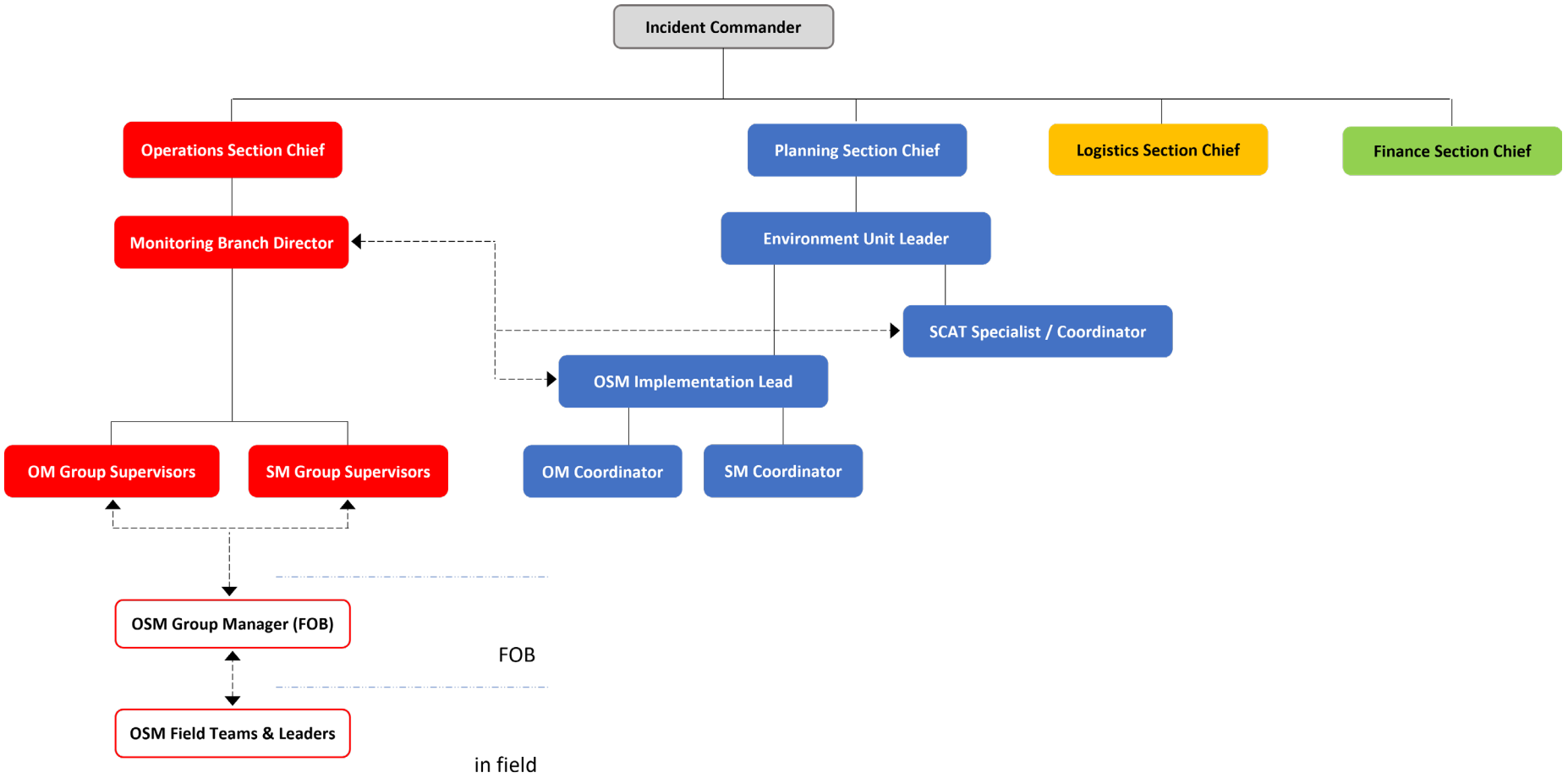


Figure 5-1: Santos IMT structure with key OSM roles

6. OSM roles and responsibilities

OSM roles and responsibilities are listed in Section 10.13.2 of the Joint Industry OSM Framework, which will be adopted by Santos and its OSM Services Provider. Table 6-1 outlines the roles held by Santos and the OSM Services Provider.

During the post-response phase the Santos Environment Unit Lead and the Santos OSM Implementation Lead and/or OSM Services Provider OSM Implementation Lead will continue to be responsible for the coordination and delivery of monitoring plans.

Table 6-1: Roles and responsibilities for OSM

Role	Held by
Environment Unit Lead	Santos (IMT)
OSM Implementation Lead	Santos to hold this position initially, followed by OSM Services Provider, if required[2]
Operational Monitoring Coordinator and/or Scientific Monitoring Coordinator	OSM Services Provider
OM and/or SM Group Supervisors and Managers	Santos / OSM Services Provider
OSM Field Teams	OSM Services Provider

7. Mobilisation and timing of OMP and SMP implementation

Table 7-1 provides an indicative implementation schedule for OMPs and SMPs in the Northern Australia OSM-BIP Consolidated Scientific Monitoring Planning Area and adjacent waters. 'Implementation' of an OMP/SMP is defined as being ready, at the point of staging or departure, to mobilise for monitoring. If the monitoring plan is desktop-based, implementation is defined as commencing the work (e.g. computer model inputs). Refer to activity specific OPEPs for an indication of worst-case minimum contact times based on stochastic modelling (stochastic modelling represents all possible outcomes that could potentially occur, in reality, only a subset of receptors will likely be contacted during a spill event).

Through Santos' membership in the OSRL OSM Supplementary Agreement, OSM services are available for preparedness, activation, and monitoring (Section 9). This agreement ensures operational monitoring personnel can deploy within 72 hours of notification, and scientific monitoring personnel within 5-7 days, which is reflective of the implementation schedule provided in Table 7-1. In addition to these OSM services, Santos has personnel trained in Shoreline Clean-up Assessment Technique (SCAT) and aerial surveillance who are available within 24-48 hours of spill notification, as noted in the activity OPEP (Monitor and Evaluate Section, and Appendix titled 'Resourcing Requirements for OM6: Shoreline Clean-up Assessment') and deployed in a timeframe relevant to assisting the relevant response operations for that OPEP.

Santos also has an initial oil sampling and analysis capability as per Appendix E, which can include the collection of initial water samples to support OM1: Hydrocarbon Characterisation, when safe to do so.

Due to short contact times, there may be instances where post-spill pre-impact monitoring is not feasible. For these receptors, and where baseline data does not exist, or may not be recent and applicable, the application of a BACI design may not be possible. The finalisation of each SMP design will consider this and may need to include alternative designs (e.g. data from an expected BACI design may need to be analysed as a Gradient Approach).

[2] *Santos may fill the OSM Implementation Lead role throughout the monitoring effort, if it choses to. This will depend upon the individual circumstances of the spill.*

Table 7-1: Indicative OMP and SMP implementation schedule for OSM activities if initiation criteria are met

Proximity to spill source	Monitoring type	0–48 hours from OSM activation	Within 72 hours of OSM activation	~5-7 days from OSM activation	1-2 weeks from OSM activation	Ongoing
Spill site and surrounding waters	OM	• Activation of OMP Team Leads. • Finalise OMPs. • Aerial surveillance – which will also document fauna observations. • Commence activation and mobilisation of OM personnel.	• OM1: Hydrocarbon Characterisation, where resources are available (e.g. Supply Vessel with onboard sampling equipment). • OM2: Hydrocarbons in Water Assessment • OM3: Hydrocarbons in Sediment Assessment • OM4: Surface Chemical Dispersant Effectiveness (commencing with Tier 1 SMART Protocol) • OM5: Rapid Marine Fauna Surveillance • OM7: Air Quality Modelling • Continue to finalise OMPs. • Continue to activate and mobilise OM personnel.	Continued (as per on-going arrangements)	Continued (as per on-going arrangements)	As results from implemented OMPs are available, data are provided to relevant personnel in IMT (e.g. Situation/Intelligence Unit) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill.
	SM	• Commence activation and mobilisation process. • Activation of SMP Team Leads.	• Continue to activate and mobilise personnel. • Work on finalising SMPs.	• SM1: Water Quality Impact Assessment • SM2: Sediment Quality Impact Assessment • SM6: Benthic Habitat Assessment • SM7: Marine fish and elasmobranch assemblages assessment	Continued	Continue SMP monitoring until termination criteria are met
Sensitive receptors (including shorelines, reefs,	OM	• Activation of OMP Team Leads.	• OM1: Hydrocarbon Characterisation	Continued (as per on-going arrangements)	Continued (as per on-going arrangements)	As results from implemented OMPs are available, data are provided to relevant

Proximity to spill source	Monitoring type	0–48 hours from OSM activation	Within 72 hours of OSM activation	~5-7 days from OSM activation	1-2 weeks from OSM activation	Ongoing
banks and shoals) predicted to be contacted within 7 days		• OM6: Shoreline Clean-up Assessment • Finalise OMPs. • Commence activation and mobilisation of OM personnel.	• OM2: Hydrocarbons in Water Assessment • OM3: Hydrocarbons in Sediment Assessment • OM5: Rapid Marine Fauna Surveillance • Continue to finalise OMPs. • Continue to activate and mobilise OM personnel.			personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met
	SM	Activation of SMP Team Leads and finalisation of SMPs	Continue to activate and mobilise personnel. Work on finalising SMPs.	• SM1: Water Quality Impact Assessment • SM2: Sediment Quality Impact Assessment • SM3: Intertidal and Coastal Habitat Assessment • SM4: Seabirds and Shorebirds • SM5: Marine Mega-fauna Assessment-Reptiles • SM5: Marine Mega-fauna Assessment-Cetaceans, Whale Sharks, Dugong • SM6: Benthic Habitat Assessment • SM7: Marine Fish and Elasmobranch Assemblages assessment • SM8: Fisheries impact assessment • SM9: Heritage Features Assessment • SM10: Social Impact Assessment	Continued.	Continue SMP implementation until termination criteria are met.

Proximity to spill source	Monitoring type	0–48 hours from OSM activation	Within 72 hours of OSM activation	~5-7 days from OSM activation	1-2 weeks from OSM activation	Ongoing
Sensitive receptors (including shorelines, reefs, banks and shoals) predicted to be contacted week 1-2	OM	-	-	• Additional Activation of OMP Team Leads. • Commence activation and mobilisation of additional OM personnel.	• Continue to finalise OMPs. • Continue to activate and mobilise OM personnel. • OM1: Hydrocarbon Characterisation • OM2: Hydrocarbons in Water Assessment • OM3: Hydrocarbons in Sediment Assessment • OM5: Rapid Marine Fauna Surveillance • OM6: Shoreline Clean-up Assessment	As results from implemented OMPs are available, data are provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met
	SM	-	-	• Additional Activation of SMP Team Leads. • Commence activation and mobilisation of additional SM personnel.	• SM1: Water Quality Impact Assessment • SM2: Sediment Quality Impact Assessment • SM3: Intertidal and Coastal Habitat Assessment • SM4: Seabirds and Shorebirds • SM5: Marine Mega-fauna Assessment-Reptiles • SM5: Marine Mega-fauna Assessment-Cetaceans, Whale Sharks, Dugong • SM6: Benthic Habitat Assessment • SM7: Marine Fish and Elasmobranch Assemblages assessment • SM8: Fisheries impact assessment	Continue SMP monitoring until termination criteria are met

Proximity to spill source	Monitoring type	0–48 hours from OSM activation	Within 72 hours of OSM activation	~5-7 days from OSM activation	1-2 weeks from OSM activation	Ongoing
					• SM9: Heritage Features Assessment • SM10: Social Impact Assessment	

8. Resourcing requirements

To guide OSM resourcing requirements, the spill scenario most likely to require the greatest initial and on-going capability was selected from those informing the Northern Australia OSM-BIP Consolidated Scientific Monitoring Planning Area. Selection was based on stochastic modelling results (refer to Table 2-1), focussing on the scenario with the greatest predicted number of receptors contacted at the low hydrocarbon thresholds for floating, shoreline or dissolved hydrocarbon contact (Section 2.1) within 7 days; followed by the greatest number of receptors contacted within 7-14 days; and at the highest contact probabilities. If a receptor is only contacted by low concentrations of entrained hydrocarbons and not by any other hydrocarbon phase, it will be considered a lower priority during the initial monitoring response as outlined in Section 2.2.

Other factors influencing the selection of the scenarios with the highest capability requirements were location of the spill, proximity to receptors, and hydrocarbon properties. The chosen scenarios and reasons for their selection are presented in Table 8-1.

Table 8-1: Scenarios selected for OSM capability analysis

OSM Scenario #	Scenario	Rationale for selection
1	Barossa Production Operations: surface release of 16,700 m^3 of Barossa Condensate over 1 hour from the FPSO or offtake tanker	• Represents a light, non-persistent hydrocarbon (Group 1)[3] • Highest number of receptors with a probability >5% predicted to be contacted by dissolved hydrocarbons within the first 7 days (Table 8-3)
2	Barossa Production Operations: surface release of 460 m^3 of HFO over 1 hour from the offtake tanker	• Represents a heavy, persistent hydrocarbon (Group 4)[4] • Highest number of receptors with a probability >5% predicted to be contacted by floating hydrocarbons within the first 7 days (Table 8-4)
3	Bayu Undan CCS GHG Pipeline: surface release of 186 m^3 of MDO over 1 hour from a vessel collision in Darwin Harbour	• Represents a light, non-persistent hydrocarbon (Group 1)[5] • Located within Darwin Harbour • Highest number of receptors with a probability >5% predicted to be contacted by shoreline hydrocarbons within the first 7 days (Table 8-5)

8.1 Monitoring units

Using stochastic modelling results, Santos has grouped its monitoring priorities into monitoring 'units' (Table 8-2). These units incorporate all of the possible receptors that may be contacted by the scenarios shown in Table 2-1. These unit groupings are based on consultation with experienced monitoring personnel and planners, who often group these receptors together for time-bound monitoring projects. The grouping of units is based on factors such as access and distance to ports, SIMOPS of multiple vessels and teams working in a close area, travel time between individual locations/receptors and time taken to collect samples for each SMP.

The monitoring units presented in Table 8-2 also include KEFs, BIAs and transient species. Additional information on the seasonality of the receptors can be found in Appendix C and in Section 3 of the relevant EP. Each monitoring unit will require 1-2 teams during the initial response (1-2 weeks). The number of teams allocated to each unit will depend on the extent of the spill, the outcome of the monitoring prioritisation finalised at the time of the spill (Section 13), the Operational Net Environmental Benefit Analysis and SIMOPs.

It should be noted that not all monitoring units will be contacted by a single spill and that the list below has been generated from stochastic modelling results from all receptors identified in Table 2-1.

[3] *Barossa Condensate – API =50.6 ; residual components = 7%*

[4] *HFO Properties – API = 12.3; residual components = 82.8%*

[5] *MDO – API =37.6 ; residual components = 5%*

Table 8-2: Monitoring units relevant to stochastic modelling results

Monitoring Unit	Receptors within Monitoring Unit
Darwin	Beagle Gulf-Darwin Coast (Includes RPS oil spill modelling default receptor locations of Cox-Finniss [Including Charles Point Wide], Darwin and Litchfield)
	Darwin Harbour (Including East Arm, West Arm, Wickham Point, Middle Harbour, Outer Harbour, Outer Harbour East, Outer Harbour West, Shoal Bay)
	Indo-Pacific humpback dolphin BIA (breeding)
	Australian snubfin dolphin BIA (breeding)
	Indo-Pacific spotted bottlenose dolphin BIA (breeding)
Van Diemen	Van Diemen Gulf Coast (includes eastern section of RPS oil spill modelling default receptor locations South Alligator and western section of West Arnhem)
	Djukbinj (Includes western section of RPS oil spill modelling default receptor location South Alligator)
	Van Diemen Gulf Shoals*
	Indo-Pacific humpback dolphin BIA (breeding)
Tiwi's	Tiwi Islands (including Bathurst and Melville Islands)
	Vernon Islands CR
	Afghan Shoal*
	Shepparton Shoal*
	Hancox Shoal*
	Moresby Shoals*
	Lowry Shoals*
	Harris Reef*
	Marsh Shoal*
	Skottowe Shoal*
	Marine turtle BIAs
	Seabird and shorebird BIAs
	Carbonate bank and terrace system of Van Diemen Rise*
Joseph Bonaparte	Joseph Bonaparte Gulf – East Coast (Includes RPS oil spill modelling default receptor locations of Daly and Thamarrurr)
	Joseph Bonaparte Gulf AMP*
	Australian snubfin dolphin BIA (breeding)
	Marine turtle BIAs
	Seabird and shorebird BIAs
	Carbonate bank and terrace system of Sahul Shelf*
Boxers	The Boxers Area*
	Margaret Harries Bank*
	Echo Shoals*
	Sunrise Bank*
	Sahul Banks
	Marine turtle BIAs
	Outer Oceanic Shoals AMP*
	Shelf break and slope of the Arafura Shelf KEF*

Monitoring Unit	Receptors within Monitoring Unit
	Carbonate bank and terrace system of Van Diemen Rise*
Northern Kimberley	Kimberley AMP*
	Seabird BIAs*
	Whale shark BIA*
	Marine Turtle BIA
Offshore Environs	Oceanic Shoals AMP*
	Van Cloon-Deep Shoals*
	Newby Shoal*
	Flat Top Bank*
	Whale shark BIA (foraging)
	Marine turtle BIAs
	Pinnacles of the Bonaparte Basin KEF*
	Carbonate bank and terrace system of Sahul Shelf*
Control	Control sites
Key	
Stochastic modelling predicts contact by only entrained hydrocarbons for all scenarios listed in Table 2-1	
*Submerged receptor that has no features above the sea surface	

8.2 Worst case OSM resourcing requirements

OSM resourcing requirements were determined using stochastic modelling. Deterministic modelling was not undertaken, as the existing response capability arrangements (refer Sections 9 and 10) provide sufficient capacity to meet or exceed the resourcing requirements for all receptors forecast to be contacted by floating, shoreline and/or dissolved hydrocarbons (at >5% probability) by stochastic modelling within the initial two weeks of the worst-case OSM spill scenarios.

Based on the stochastic modelling results for the Barossa Production Operations surface release of 16,700 m³ of Barossa Condensate (Table 8-3), it is anticipated that teams would be required for two monitoring units (Boxers Unit and Control Unit) within the first 14 days of a spill (Table 8-7 and Table 8-8). Beyond 14 days, no receptors are predicted to be contacted at a probability greater than 5% for any of the low hydrocarbon thresholds.

Similarly, the stochastic modelling results for the Barossa Production Operations release of 460 m³ of HFO (Table 8-4) indicate that teams would be required for two monitoring units (Boxers Unit and Control Unit) within the first 14 days of a spill (Table 8-7 and Table 8-8), with no receptors contacted beyond 14 days at a probability greater than 5% for any low hydrocarbon threshold.

For the Bayu Undan CCS vessel spill within Darwin Harbour involving 186 m³ of MDO, stochastic modelling (Table 8-5) predicts that teams would be required for two monitoring units (Darwin Unit and Control Unit) within the first 14 days of a spill (Table 8-7 and Table 8-8).

The resources required to support the IMT in coordinating and managing OSM activities for the worst-case scenarios are presented in Table 8-6. Resources required to commence OM and SM components during weeks 1-2 are presented in Table 8-7 and Table 8-8, respectively. These estimates are based on the monitoring priorities for the worst case OSM scenarios (Table 8-1), the implementation schedule outlined in Table 7-1, and the stochastic modelling predictions (Table 8-3, Table 8-4 and Table 8-5).

If additional resources are required to be scaled in to support the monitoring effort, this will be identified as soon as practicable following the spill and mobilised via the OSM Services Provider contract, which includes provision of scale-up resources.

Each new activity will be assessed, as outlined in Section 1.1 and Appendix B, to determine whether their spill scenario(s) exceed the resourcing requirements of the OSM scenarios listed in Table 8-1.

8.3 Co-Mobilisation of Monitoring Teams

Where monitoring programs share compatible objectives, spatial footprints, sampling methods or logistical dependencies, co-mobilisation of OMP and/or SMP teams may be undertaken to maximise efficiency and minimise vessel movements, provided that safety, data integrity and analytical objectives are not compromised. Table 8-7 and Table 8-8 outline when co-mobilisation of OMP and/or SMP teams may be undertaken. Co-mobilisation is particularly applicable where monitoring programs:

- target the same or adjacent environmental compartments (e.g. water column and sediment);
- use comparable sampling and analytical techniques (e.g. grab or water sampling, fluorometry, or visual transects);
- operate within the same geographic area or under the same environmental conditions (e.g. similar tidal or meteorological windows); and
- are required within a comparable timeframe following the spill (e.g. within 0–14 days post-activation).

Compatibility of OMPs and SMPs arises because many operational and scientific monitoring elements are designed to be complementary rather than sequential. For example, data collected under OM1–OM3 (hydrocarbon characterisation, water and sediment assessments) provide the initial exposure information required to inform SMPs such as SM1 and SM2 (water and sediment impact assessments). These programs use consistent sample media, laboratory protocols and QA/QC chains, enabling co-deployment without compromising scientific rigour. Similarly, concurrent vessel-based aerial or visual surveys for OM5 (Rapid Marine Fauna Surveillance) can support the early stages of SM4 and SM5 (Seabird, Shorebird and Marine Megafauna Assessments) through shared platforms and observation windows.

This approach reduces duplication of mobilisation logistics, minimises transit times between sites and sample transport while maintaining representative spatial and temporal coverage. It also supports ALARP principles by limiting the number of concurrent field assets, thereby reducing SIMOPs, vessel congestion, and overall operational risk. Where subsequent SMP phases require extended sampling or increased replication, these will be implemented independently once initial monitoring is underway.

Co-mobilisation decisions will be confirmed post-spill through the Incident Action Planning process, in consultation with the OSM Services Provider, monitoring specialists and relevant stakeholders, taking into account safety, receptor access, timing and data-quality considerations.

Table 8-3: OSM Scenario 1 - stochastic modelling results at >5% probability - Barossa FPSO tank rupture spill of 16,700 m^3 of Barossa condensate over 1 hour (RPS, 2023)

Receptor	Probability (%) of dissolved hydrocarbon exposure at ≥ 10 ppb	Minimum arrival time dissolved exposure at ≥ 10 ppb (days:hours)	Probability (%) entrained oil at ≥ 10 ppb"	Minimum arrival time entrained ≥ 10 ppb (days:hours)	Total contact probability (%) floating oil ≥1 g/m²	Minimum arrival time floating oil ≥1 g/m² (days:hours)	Total probability (%) shoreline oil accumulation ≥10 g/m²	Minimum arrival time shoreline oil accumulation ≥10 g/m² (days:hours)
Sunrise Bank*	23.3	1 day: 11 hours	35.0	1 day: 9 hours	4.7	1 day: 13 hours	NA	NA
Outer Oceanic Shoals AMP*	13.3	2 days: 15 hours	20.3	2 days: 13 hours	2.3	2 days: 19 hours	NA	NA
Margaret Harries Bank*	14.0	4 days: 18 hours	21.0	4 days: 15 hours	3.7	6 days: 6 hours	NA	NA
The Boxers Area*	6.7	5 days: 9 hours	11.3	4 days: 15 hours	1.7	4 days: 12 hours	NA	NA
Indonesia East and Timor Leste	7.0	8 days: 9 hours	11.7	8 days: 8 hours	1.0	11 days: 16 hours	3.7	9 days: 22 hours
Echo Shoals*	8.3	9 days: 2 hours	15.7	8 days: 21 hours	0.7	9 days: 2 hours	NA	NA
Minor Indonesian Islands	4.0	12 days: 9 hours	6.0	11 days: 23 hours	0.3	18 days: 23 hours	2.0	12 days: 7 hours
Sahul Banks*	4.0	13 days: 17 hours	9.0	13 days: 13 hours	0.7	17 days: 8 hours	NA	NA

**Submerged receptor that has no features above the sea surface. Modelling indicates floating contact with these receptors when the hydrocarbons pass over the receptor on the sea surface.*

NC: No contact to receptor predicted for specified threshold

NA: Not applicable

Table 8-4: OSM scenario 2 - stochastic modelling results – offtake tanker spill of 460 m³ of HFO over 1 hour (RPS, 2023)

Receptor	Total contact probability (%) floating oil ≥1 g/m²	Minimum arrival time floating oil ≥1 g/m² (days:hours)	Total probability (%) shoreline oil accumulation ≥10 g/m²	Minimum arrival time shoreline oil accumulation ≥10 g/m² (days:hours)	Probability (%) entrained oil at ≥ 10 ppb"	Minimum arrival time entrained ≥ 10 ppb (days:hours)	Probability (%) of dissolved hydrocarbon exposure at ≥ 10 ppb	Minimum arrival time dissolved exposure at ≥ 10 ppb (days:hours)
Sunrise Bank*	15.3	1 day: 6 hours	NA	NA	1.7	1 day: 13 hours	NC	NC
Outer Oceanic Shoals AMP*	6.0	1 day: 9 hours	NA	NA	0.7	1 day: 22 hours	NC	NC
Margaret Harries Bank*	6.3	3 days: 9 hours	NA	NA	NC	NC	NC	NC
Echo Shoals*	5.7	6 days: 19 hours	NA	NA	NC	NC	NC	NC
Indonesia East and Timor-Leste	2.7	8 days: 14 hours	7.3	9 days: 4 hours	NC	NC	NC	NC

**Submerged receptor that has no features above the sea surface. Modelling indicates floating contact with these receptors when the hydrocarbons pass over the receptor on the sea surface.*

NC: No contact to receptor predicted for specified threshold

NA: Not applicable

Table 8-5: OSM scenario 3 - stochastic modelling results – vessel spill within Darwin Harbour of 186 m³ of MDO over 1 hour (RPS, 2025)

Receptor	Total contact probability (%) floating oil ≥1 g/m²	Minimum arrival time floating oil ≥1 g/m² (days:hours)	Total probability (%) shoreline oil accumulation ≥10 g/m²	Minimum arrival time shoreline oil accumulation ≥10 g/m² (days:hours)	Probability (%) entrained oil at ≥ 10 ppb"	Minimum arrival time entrained ≥ 10 ppb (days:hours)	Probability (%) of dissolved hydrocarbon exposure at ≥ 10 ppb	Minimum arrival time dissolved exposure at ≥ 10 ppb (days:hours)
Darwin Harbour	32.7	3 hours	52.3	5 hours	98.3	2 hours	10.3	11 hours

Table 8-6: Resources required for key OSM coordination roles

Role	Resources required	Arrangement
OSM Implementation Lead (Santos / OSM Services Provider)	1 x OSM Implementation Lead	Oil Spill Response Limited (OSRL) OSM Supplementary Service Agreement
Operational Monitoring Coordinator and Scientific Monitoring Coordinator (OSM Services Provider)	1 x Operational Monitoring Coordinator 1 x Scientific Monitoring Coordinator	
OM and/or SM Group Supervisors and Managers (Santos / OSM Services Provider)	1 x OM Group Supervisor 1 x SM Group Supervisor 1 x OM Group Manager 1 x SM Group Manager	

Table 8-7: Resources required for implementing operational monitoring plans for the identified worst-case scenario from the Northern Australia OSM-BIP Consolidated Scientific Monitoring Planning Area

OMP	Week 1 (total) #	Week 2 (total) #	Arrangement
OM1: Hydrocarbon characterisation*+	**OSM scenarios 1 and 2** 1 team - (spill site and surrounds) 1 team - Boxers Unit **Total 2 teams**	**OSM scenarios 1 and 2** 1 team - (spill site and surrounds) 1 team – Boxers Unit **Total 2 teams**	OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Laboratory arrangements
	OSM scenario 3 1 team - (spill site and surrounds) 1 team - Darwin Unit **Total 2 teams**	**OSM scenario 3** 1 team - (spill site and surrounds) 1 team - Darwin Unit **Total 2 teams**	
OM2: Hydrocarbon in water assessment*	Refer to OM1: Hydrocarbon characterisation* (all sites)		OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Laboratory arrangements
OM3: Hydrocarbon in sediment assessment*	Refer to OM1: Hydrocarbon characterisation* (all sites)		OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Laboratory arrangements
OM4a: Surface dispersant effectiveness monitoring	**Relevant scenarios^** 1 team for visual observations, which may be performed by trained aerial observers used during monitor and evaluate if trained in		OSRL OSM Supplementary Service Agreement AMOSC Participant Member Agreement Santos Contracted Vessel Providers

OMP	Week 1 (total)#	Week 2 (total)#	Arrangement
	observation and verification of chemical dispersant effectiveness For water quality observations, refer to OM2: Hydrocarbon in water assessment		
OM4b: Subsea dispersant injection effectiveness monitoring	**Relevant scenarios^** No subsea dispersant injection until week 2 due to mobilisation requirements	**Relevant scenarios** 1 team	OSRL OSM Supplementary Service Agreement AMOSC Participant Member Agreement Santos Contracted Vessel Providers
OM5: Rapid marine fauna surveillance+	**Any scenario** 1 team to conduct initial aerial surveys for all sites (2 observers per aircraft)		OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Aviation contractors
OM6: Shoreline clean-up assessment	Detail on resources required for SCAT are presented in the activity-specific OPEP		AMOSC Participant Member Agreement and/or OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers State/Territory Response Teams and AMSA National Response Team
OM7: Air quality modelling (responder health and safety)	**Any scenario** 1 model	**Any scenario** 1 model	RPS via Santos contract

** Initial co-mobilisation between OM1: Hydrocarbon characterisation, OM4a: Surface dispersant effectiveness monitoring, OM2: Hydrocarbon in water assessment and OM3: Hydrocarbon in sediment assessment.*

 # Specific units are mentioned for planning and guidance purposes based on a worst case planning approach. In the event of an actual spill, other locations and/or receptors may be contacted. This would be identified and managed as part of implementation as per the guidance in Section 13.

^ Surface and subsea dispersant injection monitoring are not included as applicable response strategies in the Barossa DPD (Construction) OPEP (BAS-210 0131), however, they are included in this resourcing analysis as they are suitable secondary response strategies for other activities listed in Table 2-1.

+ These resources may not be required if relevant scientific monitoring components initiation criteria have already been triggered.

Table 8-8: Resources required for implementing scientific monitoring plans for the identified worst-case scenario from the Northern Australia OSM-BIP Consolidated Scientific Monitoring Planning Area

SMP	Week 1 (total)#	Week 2 (total)#	Arrangement
SM1: Water quality impact assessment+	**OSM scenarios 1 and 2** 1 team (spill site and surrounds) 1 team - Boxers Unit 1 team - control site(s) **Total 3 teams**	**OSM scenarios 1 and 2** 1 team (spill site and surrounds) 1 team - Boxers Unit 1 team - control site(s) **Total 3 teams**	OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Laboratory arrangement

SMP	Week 1 (total)[#]	Week 2 (total)[#]	Arrangement
	Note: can initially be performed by the same team as OM2: Hydrocarbon in water assessment	Note: can initially be performed by the same team as OM2: Hydrocarbon in water assessment	
	OSM scenario 3 1 team (spill site and surrounds) 1 team - Darwin Unit 1 team - control site(s) **Total 3 teams**	**OSM scenario 3** 1 team (spill site and surrounds) 1 team - Darwin Unit 1 team - control site(s) **Total 3 teams**	
SM2: Sediment quality impact assessment	Refer to SM1: Water quality impact assessment* (all sites)	Refer to SM1: Water quality impact assessment* (all sites)	OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Laboratory arrangement
SM3: Intertidal and coastal habitat assessment	**OSM scenarios 1 and 2** Not required – no contact with emergent receptors predicted	**OSM scenarios 1 and 2** Not required – no contact with emergent receptors predicted	OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Laboratory arrangement
	OSM scenario 3 1 team - Darwin Unit 1 team - control site(s) **Total 2 teams**	**OSM scenario 3** 1 team - Darwin Unit 1 team - control site(s) **Total 2 teams**	
SM4: Seabirds and shorebirds[+]	**OSM scenarios 1 and 2** **Aerial** 1 team to conduct initial aerial surveys for Boxers Unit (2 observers per aircraft) **Total 1 aerial team** **Vessel** 1 team to conduct vessel-based surveys for Boxers Unit 1 team control site(s) (surveys would include all fauna [birds, reptiles, cetaceans, dugong and whale shark]) **Total 2 vessel-based teams** **Ground**	**OSM scenarios 1 and 2** **Aerial** 1 team to conduct initial aerial surveys for Boxers Unit (2 observers per aircraft) **Total 1 aerial team** **Vessel** 1 team to conduct vessel-based surveys for Boxers Unit 1 team control site(s) (surveys would include all fauna [birds, reptiles, cetaceans, dugong and whale shark]) **Total 2 vessel-based teams** **Ground**	OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Laboratory arrangement

SMP	Week 1 (total) #	Week 2 (total) #	Arrangement
	Not required – no contact with emergent receptors predicted Note: can initially be performed by the same team as OM5: Rapid marine fauna surveillance	Not required – no contact with emergent receptors predicted Note: can initially be performed by the same team as OM5: Rapid marine fauna surveillance	
	OSM scenario 3 **Aerial** 1 team to conduct initial aerial surveys for Darwin Unit (2 observers per aircraft) **Total 1 aerial team** **Vessel** 1 team to conduct vessel-based surveys for Darwin Unit 1 team control site(s) (surveys would include all fauna [birds, reptiles, cetaceans, dugong and whale shark]) **Total 2 vessel-based teams** **Ground** 1 team to conduct ground-based surveys for Darwin Unit 1 team control site(s) (1 experienced ornithologists per team) **Total 2 ground-based teams** Note: can initially be performed by the same team as OM5: Rapid marine fauna surveillance	**OSM scenario 3** **Aerial** 1 team to conduct initial aerial surveys for Darwin Unit (2 observers per aircraft) **Total 1 aerial team** **Vessel** 1 team to conduct vessel-based surveys for Darwin Unit 1 team control site(s) (surveys would include all fauna [birds, reptiles, cetaceans, dugong and whale shark]) **Total 2 vessel-based teams** **Ground** 1 team to conduct ground-based surveys for Darwin Unit 1 team control site(s) (1 experienced ornithologists per team) **Total 2 ground-based teams** Note: can initially be performed by the same team as OM5: Rapid marine fauna surveillance	
SM5: Marine mega-fauna assessment (whale shark, dugong and cetaceans) +	Aerial surveys refer to SMP: Seabirds and shorebirds Vessel surveys refer to SMP: Seabird and shorebirds	Aerial surveys refer to SMP: Seabirds and shorebirds Vessel surveys refer to SMP: Seabird and shorebirds	OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Laboratory arrangement

SMP	Week 1 (total)[#]	Week 2 (total)[#]	Arrangement
SM5: Marine mega-fauna assessment (reptiles)[+]	Aerial surveys refer to SMP: Seabirds and shorebirds Vessel surveys refer to SMP: Seabird and shorebirds Ground based survey refer to SMP: Seabird and shorebirds (including 1 member experienced with ground turtle surveys)	Aerial surveys refer to SMP: Seabirds and shorebirds Vessel surveys refer to SMP: Seabird and shorebirds Ground based survey refer to SMP: Seabird and shorebirds (including 1 member experienced with ground turtle surveys)	OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Laboratory arrangement
SM6: Benthic habitat assessment	**OSM scenarios 1 and 2** 1 team (spill site and surrounds) 1 team - Boxers Unit 1 team - control site(s) **Total 3 teams**	**OSM scenarios 1 and 2** 1 team (spill site and surrounds) 1 team - Boxers Unit 1 team - control site(s) **Total 3 teams**	OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Laboratory arrangement
	OSM scenario 3 1 team (spill site and surrounds) 1 team - Darwin Unit 1 team - control site(s) **Total 3 teams**	**OSM scenario 3** 1 team (spill site and surrounds) 1 team - Darwin Unit 1 team - control site(s) **Total 3 teams**	
SM7: Marine fish and elasmobranch assemblages assessment	**OSM scenarios 1 and 2** 1 team (spill site and surrounds) 1 team - Boxers Unit 1 team - control site(s) **Total 3 teams**	**OSM scenarios 1 and 2** 1 team (spill site and surrounds) 1 team - Boxers Unit 1 team - control site(s) **Total 3 teams**	OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Laboratory arrangement
	OSM scenario 3 1 team (spill site and surrounds) 1 team - Darwin Unit 1 team - control site(s) **Total 3 teams**	**OSM scenario 3** 1 team (spill site and surrounds) 1 team - Darwin Unit 1 team - control site(s) **Total 3 teams**	
SM8: Fisheries impact assessment	**Any scenario** Total 2 teams to cover all relevant Commonwealth and State fisheries.	**Any scenario** Total 2 teams to cover all relevant Commonwealth and State fisheries.	OSRL OSM Supplementary Service Agreement Santos Contracted Vessel Providers Laboratory arrangement
SM9: Heritage features assessment	**Any scenario** 1 team	**Any scenario** 1 team	OSRL OSM Supplementary Service Agreement

SMP	Week 1 (total)[#]	Week 2 (total)[#]	Arrangement
			Santos Contracted Vessel Providers Laboratory arrangement
SM10: Social impact assessment	**Any scenario** 1 team	**Any scenario** 1 team	OSRL OSM Supplementary Service Agreement

[#] Specific units are mentioned for planning and guidance purposes based on a worst case planning approach. In the event of an actual spill, other locations and/or receptors may be contacted. This would be identified and managed as part of implementation as per the guidance in Section 13.

** Initial co-mobilisation between SM1: Water quality impact assessment and SM2: Sediment quality impact assessment.*

+ This SMP may replace the relevant OMP if the OMPs termination criteria are triggered.

9. Capability arrangements

Santos is a Member of the OSRL OSM Supplementary Service Agreement, which provides shared OSM Annual Services and Response Services to members who have subscribed this supplementary service. This OSM Supplementary Service Agreement includes access to OSRL's sub-contracted Monitoring Service Providers in Australia (who will report through OSRL) to deliver monitoring capability. The OSM Supplementary Service Agreement includes provision of scale-up capability in the event of response activation, allowing for scalability and adaptability of OSM resourcing.

Details of OSM services are provided in Table 9-1. Santos will maintain responsibility for implementing OM7: Air Quality Modelling (responder health and safety).

OSRL (referred to as the OSM Services Provider in this BIP), via the OSM Supplementary Service Agreement is contracted to provide Members with a monthly Capability Register, which details personnel requirements for OMPs/SMPs, numbers of available personnel and competencies for service provider and sub-contracted personnel.

Personnel listed on the monthly update are accessible following a Member's initial activation of OSM Services.

Table 9-1: OSM services provider preparedness and activation / monitoring services

OSM Services Provided During Preparedness and Activation / Monitoring Phases
Preparedness[6]
24/7 Duty Manager accessed through 24 hr. hotline
Provision of suitably trained operational monitoring personnel
Monthly reports on personnel and equipment availability
Access to OSM Services Provider's sub-contracted Monitoring Service Providers
Access to OSM Services Provider's network of laboratories and equipment providers
Activation / Monitoring[7]
Provision of an OSM Services Lead and OSM Implementation Lead to the Santos IMT within 12 hours of notification
Provision of an initial monitoring team within 72 hours of notification, ready to deploy from a nominated port(s) or staging location (e.g. Forward Operating Base [FOB])
Assisting Santos in the finalisation of monitoring plans
Provision of scientific monitoring personnel within 5-7 days of notification
Access to OSM Services Provider laboratories and equipment

9.1 Personnel competencies

The OSRL OSM Supplementary Service Agreement specifies the training and competency requirements for key OSM personnel consistent with the specified training and competencies stated in Table 11-1 of the Joint Industry OSM Framework. In addition, competencies of SMP Field Teams are consistent with Appendix D of the Joint Industry OSM Framework.

The OSM Supplementary Service Agreement commits to nominated monitoring personnel providing copies of their CVs/Resumes, along with certificates or evidence meeting the competency requirements. This information is stored in the OSRL Operational and Scientific Monitoring Document Management System for capability tracking and assurance purposes. The Monthly Capability Register is updated so that it reflects changes to personnel availability or gaps in competency and training. The role of the OSM Implementation Lead aligns with the responsibilities listed in the Joint Industry OSM Framework.

Where the key OSM role is held by the Member, this is outlined in the Santos Crisis, Incident Management & Emergency Response Procedure (SMS-HSS-OS05-PD01) and Santos Incident Management Plan - WANATL (7700-650-PLA-0016).

[6] *Defined as Annual OSM Services in OSM Supplementary Service Agreement.*

[7] *Defined as Response Services in OSM Supplementary Service Agreement.*

In addition and where practicable, Santos will engage its most qualified local environmental advisors in the initial stages of the monitoring program to help activate and mobilise monitoring teams and support the OSM Services Provider in the finalisation of monitoring designs.

9.2 Equipment

Equipment requirements are listed in the individual OMPs and SMPs. A generalised breakdown of equipment types and the source is listed in Table 9-2.

In accordance with the OSRL OSM Supplementary Service Agreement, the OSM Services Provider will provide specialised field monitoring equipment to implement individual OMPs and SMPs. Santos will remain responsible for support and field logistics, including monitoring platforms (e.g. vessels, vehicles and aircraft), flights and accommodation for personnel and transportation/couriers for samples to be sent back to laboratories.

Santos also maintains its own initial sampling kits, as shown in Table 9-2.

Availability of key equipment will be listed in the OSM Services Provider's Equipment Register.

Table 9-2: OSM equipment

Equipment type	Source
Santos and third-party equipment	
Desktop equipment (e.g. Oil Spill Response Atlas, GIS)	Coordinated through IMT GIS Team
Logistical equipment (e.g. in-field accommodation, vessels, aircraft)	Refer to list of external support agencies and contracts held by Santos as listed in the activity specific OPEPs
Dispersant shake test kits (initial shake jar test only)	AMSA (2 x test kits in Darwin)
Oil sampling kits (full kit) – 1 located in Darwin	Santos
Oil sampling kits (rapid kit) – 5 located in Darwin / Tiwi Islands	Santos
Bulk oil sampling bottles	Intertek and/or Leeder Analytical (via Santos managed contract)
OSM Services Provider equipment	
In-field specialised monitoring equipment (e.g. fluorometers, sample bottles, ROVs)	Coordinated through the OSM Services Provider's OSM response and implementation services

9.3 Exercises

The OSM Services Provider, via the OSM Supplementary Service Agreement, is contracted to maintain an OSM Services Annual Assurance Program. As part of this program, the OSM Services Provider conducts a number of different exercise types, which are outlined in Table 9-3. The purpose of this testing is to confirm that the response arrangements and capability in place are available when needed and function as intended. Following the Notification and Tabletop excises listed in Table 9-3, the OSM Services Provider will prepare exercise reports and track any action items to complete.

In addition, Santos will conduct an annual notification test of the OSM Services Provider, outlined in Santos Offshore Oil Spill Response Readiness Guideline (7710-650-GDE-0001).

Table 9-3: Exercise types

Exercise Type	Responsibility	Description	Frequency
Assurance Program Workshop	OSRL, Industry Member Technical Advisory Group (IMTAG) and Monitoring Service Providers	The outputs from the annual OSM Services and Assurance Program Workshop will form the basis of the OSM Annual Services and Assurance Program for the coming Contract Year.	Annually
Notification exercise	Santos with OSRL	Test procedures to notify and activate the OSM Services, including subcontracted Monitoring Service Providers.	Annually

Exercise Type	Responsibility	Description	Frequency
Tabletop exercise	IMTAG and OSRL to agree a lead Titleholder for each Calendar Year	A discussion-based exercise that involves no physical deployment of personnel or equipment. The exercise will simulate all actions to validate the enactment of plans, procedures, protocols, roles and tasks during a simulated incident.	Annually
Desktop review	Monitoring Service Providers & OSRL	A desktop review of capability for any OMP and/or SMP not tested during the annual table-top exercise. The review can also be based on the outcomes/findings of the OMPs and/or SMPs that were tested.	Annually

10. Capability assessment

Table 10-1 provides a comparison of Santos' worst-case OSM capability requirements (as outlined in Table 8-7 and Table 8-8) with the OSRL OSM Supplementary Service Agreement capability to implement each OMP and SMP. Where there are synergies between OMPs and SMPs, the same personnel may implement multiple OMPs/SMPs simultaneously, as identified in Table 10-1. For example, personnel assigned to OM1: Hydrocarbon Characterisation can also carry out OM2: Hydrocarbon in water assessment and OM3: Hydrocarbon in sediment assessment concurrently.

Table 10-1: OSM capability

Component	Total personnel required (Weeks 1–2) [8]	Personnel available via OSM Services Provider	Personnel available via OSROs	Santos	Total personnel available
OSM Personnel embedded in IMT	1 OSM Implementation Lead 1 OM Coordinator 1 SM Coordinator 2 Group Supervisors 2 Group Managers	1 OSM Implementation Lead 1 OM Coordinator 1 SM Coordinator 1 OM/SM Group Manager	-	1 OSM Implementation Lead (initial) 3 x Group Supervisors and/or Group Managers	2 OSM Implementation Leads 1 OM Coordinator 1 SM Coordinator 2 Group Supervisors 2 Group Managers
OMPs					
OM1: Hydrocarbon characterisation*	2 teams	6 teams#	-	Initial sampling kits (Darwin) and procedures for untrained personnel to obtain samples[9]	6 teams
OM2: Hydrocarbon in water assessment*	Refer to OM1: Hydrocarbon characterisation				
OM3: Hydrocarbon in sediment assessment*	Refer to OM1: Hydrocarbon characterisation				
OM4a: Surface dispersant effectiveness monitoring	Visual observations: 1 team Water quality assessment – refer to OM2: Hydrocarbon in water assessment*	1 visual observation team# Refer to OM2: Hydrocarbon in water assessment*	4 AMOSC Staff 2 AMOSC Core Group trained personnel	7 Santos trained aerial observers	Visual observations: 1 team (OSM Services Provider) 4 AMOSC Staff 2 AMOSC Core Group trained personnel 7 trained Santos aerial observers
OM4b: Subsea dispersant injection effectiveness monitoring	1 team (week 2 onwards)	1 team#	-	-	1 team
OM5: Rapid marine fauna surveillance+	1 aerial team	2 teams#	N/A	7 Santos trained aerial observers	2 aerial teams 7 Santos trained aerial observers

[8] *If additional resources are required for week 3 onwards then this will be identified early in the monitoring process and Santos will activate additional contracted resources through its OSM Services Provider to increase capacity*

[9] *For OM1: Hydrocarbon characterisation only*

Component	Total personnel required (Weeks 1–2) [8]	Personnel available via OSM Services Provider	Personnel available via OSROs	Santos	Total personnel available
OM6: Shoreline clean-up assessment	As per activity specific OPEP				
OM7: Air quality modelling (responder health and safety)	1 model	-	-	RPS Contract for Air Quality Modelling held by Santos	RPS Contract for Air Quality Modelling held by Santos
SMPs					
SM1: Water quality impact assessment[+]	3 teams Note: can initially be performed by the same team as OMP: Water quality assessment. This SMP may replace OMP: Water quality assessment if the OMPs termination criteria are triggered	6 teams[#]	-	-	6 teams
SM2: Sediment quality impact assessment	Refer to SM1: Water quality impact assessment* (all sites)				
SM3: Intertidal and coastal habitat assessment	2 teams	6 teams[#]	-	-	6 teams
SM4: Seabirds and shorebirds[+]	1 aerial team 2 vessel teams (surveys would include all fauna [birds, reptiles, cetaceans, dugong and whale shark]) 2 ground-based teams	2 aerial teams[#] 5 vessel teams[#] 5 ground based teams[#] (plus 1 team member per team experienced with ground turtle surveys – see Marine mega-fauna assessment [reptiles])	-	-	2 aerial teams 5 vessel teams 5 ground based teams (plus 1 team member per team experienced with ground turtle surveys – see Marine mega-fauna assessment [reptiles])
SM5: Marine mega-fauna assessment (whale shark, dugong and cetaceans) [+]	Refer to SM4: seabirds and shorebirds				
SM5: Marine mega-fauna assessment (reptiles) [+]	Aerial and vessel - Refer to SM4: seabirds and shorebirds Ground surveys - Refer to SM4: seabirds and shorebirds (plus 1 team member per team experienced with ground turtle surveys)				

Component	Total personnel required (Weeks 1–2) [8]	Personnel available via OSM Services Provider	Personnel available via OSROs	Santos	Total personnel available
SM6: Benthic habitat assessment	3 teams	6 teams#	-	-	6 teams
SM7: Marine fish and elasmobranch assemblages assessment	3 teams	6 teams#	-	-	6 teams
SM8: Fisheries impact assessment	2 teams	2 teams#	-	-	2 teams
SM9: Heritage features assessment	1 team	1 team#	-	-	1 team
SM10: Social impact assessment	1 team	1 team#	-	-	1 team

** Initial co-mobilisation between OM1: Hydrocarbon characterisation, OM4a: Surface dispersant effectiveness monitoring, OM2: Hydrocarbon in water assessment and OM3: Hydrocarbon in sediment assessment*

 # During capability assessment, available personnel were allocated to one monitoring team only.

+ Can initially be performed by the same team as the relevant OMP. This SMP may replace the relevant OMP, if the relevant OMP's termination criteria are triggered.

11. Document review

As part of the Environment Plan review cycle, this document will be reviewed annually and revised, if required, in accordance with the Santos Offshore Division Environment Management of Change Procedure (EA-91-IQ-10001). This could include changes required in response to one or more of the following:

- When major changes have occurred which affect Operational and/or Scientific Monitoring coordination or capabilities (e.g. change of services provider);
- Changes to the activity that affect Operational and/or Scientific Monitoring coordination or capabilities (e.g. a significant increase in spill risk);
- Changes to legislative context related to Operational and/or Scientific Monitoring (e.g. *Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act] protected maters requirements);
- Following routine testing of the OSM if improvements or corrections are identified; or
- After a Level 2/3 spill incident.

The extent of changes made to this OSM Bridging Implementation Plan and resultant requirements for regulatory resubmission will be informed by the relevant Commonwealth regulations, i.e. the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 Regulations (OPGGS (E) Regulations).

Part B – Implementation

Control Agencies and Jurisdictional Authorities

Section 4 of Santos OPEPs provide detailed information on Control Agency responsibilities, and should be referred to when planning operational and scientific monitoring activities, particularly in NT waters and/or WA State Waters and along NT and WA shorelines. Where the Department of Environment, Parks and Water Security (DEPWS) or WA DTMI are the Control Agency, OM6: Shoreline Clean-up Assessment will be implemented under their direction, with resources provided by Santos.

In addition, Section 7 of Santos OPEPs provide regulatory and stakeholder notification and reporting requirements. Whilst all notification and reporting will be performed by Santos IMT personnel, monitoring personnel should be aware of these requirements, and confirm all relevant notifications and reporting have been completed prior to undertaking monitoring activities.

Note: for oil spills in Commonwealth waters, NOPSEMA are the jurisdictional authority. However, the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) oversee scientific monitoring activities within Ashmore Reef AMP and Cartier Island AMP[10]; therefore the Santos IMT (as Control Agency for Commonwealth waters) will liaise with DCCEEW to direct resources for the purposes of shoreline assessment and scientific monitoring activities.

12. Mobilisation and activation process

The Santos IMT Environment Unit Lead is responsible for activating OSM components, subject to approval from the Incident Commander. Table 12-1 outlines Santos' OSM activation process.

Table 12-1: OSM mobilisation and activation process

Responsibility	Task	Timeframe[11]	Complete
Santos Environment Unit Lead	Review initiation criteria of OMPs and SMPs (provided in Table 9-1 (OMPs) and Table 9-2 (SMPs) of the Joint Industry Operational and Scientific Monitoring Framework) during the preparation of the initial Incident Action Plan (IAPs) and subsequent IAPs; and if any criteria are met, activate relevant OMPs and SMPs	Within 4 hours of spill notification	☐
	Obtain approval from Incident Commander to activate OSM Services Provider	Within 4 hours of spill notification	☐
	Initiate initial oil and water sampling, if safe and possible, using the procedures in Appendix E	Within 24 hours of spill notification	☐
	Contact OSM Services Provider and verbally notify their Duty Manager of the incident, requesting provision of OSM Implementation Lead (if required by Santos) to the IMT. Complete Call Off Order Form (Appendix F) and submit to OSM Services Provider[12] to confirm activation of OSM Services	Within 4 hours of spill notification	☐
	Provide monitor and evaluate data (e.g. aerial surveillance, fate and weathering modelling, tracking buoy data, current IAPs) to OSM Services Provider	Within 1 hour of data being received by IMT	☐
	Liaise with Santos' Logistics Section Chief to identify potential staging and departure location/s for monitoring activities. Provide this information to OSM Services Provider	Within 4-6 hours of spill notification	☐

[10] Oil spill modelling did not predict contact with Ashmore or Cartier Island for any scenario listed in Table 2-1. However, the information on monitoring arrangements is included on a precautionary basis due to the proximity of low-threshold exposure to these sensitive receptors.

[11] All timeframes stated in Part B are based on best endeavours as per the OSRL OSM Supplementary Service Agreement.

[12] A copy of the Call Off Order Form is provided in Appendix F, however a copy of the Call-off Order Form will also be available via OSRL Duty Manager upon request.

Responsibility	Task	Timeframe[11]	Complete
	Record tasks in Personal Log	At time of completion of task	☐
Safety Officer (Santos)	Develop and maintain ICS 201-5 – Site Safety and Control Analysis (refer Santos Oil Spill Response HSE Management Manual [SO-91-RF-10016])	Within 6 hours of spill notification	☐
Logistics Section Chief (Santos)	Commence arrangements for vessels, accommodation and transport to mobilise monitoring teams	Within 24 hours of spill notification	☐
OSM Services Provider	Duty Manager to activate relevant Monitoring Service Providers	Within 30 minutes of Call Off Order Form being received by OSM Services Provider	☐
	OSM personnel (OSM Implementation Lead and OM/SM Coordinators) requested by Titleholder (via Call Off Order Form) to be sent to Titleholder's IMT	Within 12 hours of notification being made to OSM Services Provider	☐
	Liaise directly with Environment Unit Lead to confirm which OMPs and SMPs are to be fully activated	Within 4 hours of monitor and evaluate data being received from IMT	☐
	Confirm availability of initial personnel and equipment resources	Within 5 hours of monitor and evaluate data being received from IMT	☐

13. Monitoring priorities

As described in Section 2 and Section 4, the available stochastic spill modelling has been analysed to understand the likely monitoring priorities. Table 4-3 provides a summary of available baseline data for receptors, to assist in identifying where post-spill, pre-impact monitoring should be prioritised.

The monitoring priorities provided in Section 2 and Table 4-3 are to be used for guidance when confirming monitoring priorities in consultation with key stakeholders and sub-contracted Monitoring Service Providers (including subject matter experts, where available) at the time of the spill. Table 13-1 provides a checklist to assist in the confirmation of monitoring priorities for individual spills.

Table 13-1: Checklist for determining monitoring priorities

Responsibility	Task	Timeframe	Complete
Santos Environment Unit Lead	Evaluate monitoring priorities in consultation with key stakeholders, including the appointed State / Territory Environmental Scientific Coordinator	Within 12 hours of monitor and evaluate data being received from IMT	☐
Santos Environment Unit Lead with input from OSM Services Provider	Confirm monitoring receptors/locations for activated OMPs and SMPs based on: • Current monitor and evaluate data (i.e. situational awareness data, including predicted time to receptor impact, aerial/vessel surveillance observations, tracking buoy data, satellite data); • EV ranking of receptors (Section 2.2); • Analysis of the Joint Industry Marine Environment Baseline Database for relevant receptors; • Nature of hydrocarbon spill (i.e. subsea blow out, surface release, hydrocarbon characteristics, volume, expected duration of release); • Seasonality and presence of receptors impacted or at risk of being impacted; • Current information on transient and broadscale receptors (surface and subsea); • Current operational considerations (e.g. weather, logistics); • Monitoring priorities identified in Section 2.	Within 12 hours of monitor and evaluate data being received from IMT	☐
	Using the results of the Santos EV rankings (Section 2.2), baseline data analysis in Table 4-3 and the information above, determine receptors for initial post-spill, pre-impact monitoring	Within 12 hours of monitor and evaluate data being received from IMT	☐
	Confirm the need for any additional reactive baseline monitoring data for SMPs and determine suitable locations, noting that suitable control or reference sites may be outside of the Scientific Monitoring Planning Area	Within 12 hours of monitor and evaluate data being received from IMT	☐
	Continually re-evaluate monitoring priorities in consultation with Environment Unit Lead and relevant key stakeholders throughout spill response	Ongoing	☐

14. Protected Matters requirements

Table 14-1 provides a checklist to ensure monitoring personnel consider protected matters requirements in the finalisation of OMPs and SMPs.

Santos' Values and Sensitivities of the Marine and Coastal Environment (EA-00-RI-10062) outlines the management plans, recovery plans and conservation advice statements relevant for the protected matters within the relevant EP's EMBA that are likely to be relevant to the final design of the OMPs and SMPs. The Santos Values and Sensitivities of the Marine and Coastal Environment (EA-00-RI-10062) and Appendix C also includes relevant locations where these receptors are known to occur in order to expedite consideration of relevant information into finalised monitoring designs.

Table 14-1: Checklist for inclusion of protected matters into monitoring designs

Responsibility	Task	Complete
Santos Environment Unit Lead with input from OSM Services Provider	Review Monitoring, Evaluation and Surveillance data and available OMP data to determine likely presence and encounter of protected species in predicted trajectory of the spill	☐
	Review the relevant recovery plan/conservation advice/management plan in Santos Values and Sensitivities of the Marine and Coastal Environment (EA-00-RI-10062) and online protected matters search tool and determine if there have been any updates to the relevant conservation threats/actions. Integrate relevant considerations into the final monitoring design for affected OMPs and SMPs	☐
	Review restrictions on marine mammal buffer distances in SMP: Marine mega-fauna and ensure this is included in all relevant response and monitoring IAPs (e.g. Shoreline Protection Plan, Shoreline Clean-up Plan, OSM Plan), so that response and monitoring field teams maintain required buffer distances from fauna during operations	☐

15. Finalising monitoring design

The methods presented in the Joint Industry OMPs and SMPs are designed to allow the OSM Services Provider and their sub-contracted Monitoring Service Providers with the flexibility to modify the standard operating procedures, so that the latest research, technologies, equipment, sampling methods and variables may be used. Monitoring designs may also be varied in-situ, according to the factors presented in Section 10.6 of the Joint Industry OSM Framework.

Santos' checklist for finalising monitoring designs post-spill is provided in Table 15-1. The OSM Implementation Lead will be responsible for approving the finalised monitoring design used in the OMPs and SMPs.

Whilst instantaneous low thresholds, used to define the planning area for scientific monitoring, shows a greater geographical extent, the hydrocarbons in areas defined by low threshold limits may not be detectable. Therefore, final monitoring design may also consider time-weighted average predictions from the incident oil spill modelling to optimise the monitoring efforts.

Table 15-1: Checklist for finalising monitoring design

Responsibility	Task	Timeframe	Complete
Santos Environment Unit Lead with input from OSM Services Provider	Confirm survey objectives, sampling technique, for each initiated OMP and SMP	Within 48 hours of initial monitoring priorities being confirmed by IMT	☐
	Determine suitable sampling frequency	Within 48 hours of initial monitoring priorities being confirmed by IMT	☐
	Finalise standard operating procedures	Within 48 hours of initial monitoring priorities being confirmed by IMT	☐
	Review Table 10-4 of the Joint Industry OSM Framework to ensure potential impacts from response activities are	Before finalising monitoring designs	☐

Responsibility	Task	Timeframe	Complete
	considered and incorporated into relevant OMP/SMP designs		
	Liaise with the Santos Environment Unit Lead to review the Environmental Performance Standards listed in the activity-specific OPEP and integrate checks into the monitoring design that will help determine if relevant Environmental Performance Standards are being met	Before finalising monitoring designs	☐
	Scientific monitoring: • Establish benchmarks and guidelines to be used • Confirm indicator species • Confirm parameters and metrics	Within 96 hours of initial monitoring priorities being confirmed by IMT	☐

16. Mobilisation of monitoring teams

When the monitoring design has been finalised for each OMP and SMP, the OSM Services Provider shall work in conjunction with Santos to develop and execute a monitoring mobilisation plan, which will be incorporated into the Incident Action Planning process.

The OSM Services Provider will be required to coordinate the availability of personnel and equipment for all monitoring programs, with the exception of OM7: Air Quality Modelling, which will be coordinated by Santos. Santos is responsible for flights, accommodation and victualing for field personnel. Santos will also be required to procure all vessels, aerial platforms and vehicles for OMP and SMP implementation.

A checklist for mobilising monitoring teams is provided in Table 16-1.

Note: OM7: Air quality modelling is a desk top assessment and should be mobilised as soon as practicable as it is not reliant on any mobilisation of field personnel.

Table 16-1: Checklist for mobilisation of monitoring teams

Responsibility	Task	Complete
OSM Services Provider with input from Santos Environment Unit Lead	Confirm availability of all monitoring personnel (noting required competencies in Section 9.1 and individual OMPs/SMPs)	☐
	Allocate number of teams, personnel, equipment and supporting resource requirements	☐
	If additional resources are likely to be required to implement monitoring from week 2 onwards, this should be raised by the OSM Implementation Lead with the Environment Unit Leader and arranged via the OSM Services Provider	☐
	As part of the Incident Action Planning Process, liaise with IMT regarding co-mobilisation of monitoring teams, giving due consideration to safety, access to sensitive receptors, timing, and data quality requirements	☐
	Undertake HAZIDs as required and consolidate/review field documentation including safety plans, emergency response plans, and daily field reports	☐
	Develop site-specific health and safety plans which is compliant with health safety and environment systems (including call in timing and procedures)	☐
	Conduct pre-mobilisation meeting with monitoring team/s on survey objectives, logistics, safety issues, reporting requirements and data management collection requirements	☐
	Determine data management delivery needs of the IMT and process requirements, including data transfer approach and frequency/timing	☐
	Confirm data formats and metadata requirements with personnel receiving data	☐
	Logistics	
	Confirm Santos Logistics Section have arranged flights, accommodation, and car hire arrangements are in place	☐
	Develop field survey schedules, detailing staff rotation	☐
	Equipment	

Responsibility	Task	Complete
	Confirm Santos Logistics Section have arranged survey platforms (vessel, vehicle, aircraft) as required to survey or access survey sites and ensure they are equipped with appropriate fridge and freezer space for transportation of samples (and carcasses if collecting)	☐
	Confirm Santos Logistics Section have arranged vessels with correct fit-out specifications (e.g. winches, Geographic Positioning System [GPS], satellite, deck crane, sufficient deck space, water supplies (fresh and/or salt), accommodation)	☐
	Confirm consumables (including personal protective equipment) have been purchased and will be delivered to required location	☐
	Liaise with NATA-accredited laboratories to confirm availability, limits of detection, sampling holding times, transportation, obtain sample analysis quotes and arrange provision of appropriate sample containers, Chain of Custody (CoC) forms and suitable storage options for all samples. Make arrangements for couriers (if necessary)	☐
	Confirm specialist equipment requirements and availability (including redundancy)	☐
	Check GPS units and digital cameras are working and that sufficient spare batteries and memory cards are available	☐
	Confirm sufficient equipment to allow integration of survey software and navigational systems (e.g. GPS, additional equipment and adaptors), and additional GPS units prepared	☐
	Confirm GPS survey positions (where available) have been Quality Assurance and Quality Control (QA/QC) checked and pre-loaded into navigation software/positioning system	☐
	Check field laptops, ensuring they have batteries (including spares), power cable, and are functional	☐
	Check if a first aid kit or specialist personal protective equipment (PPE) is required	☐
	Confirm arrangements for freight to mobilisation port is in place	☐

17. Permits and access requirements

Permit and access requirements apply to Marine Parks, Marine Protected Areas, restricted heritage areas, operational areas of industrial sites, defence locations, certain fauna and managed fisheries, as listed in Table 17-1. For a list of all relevant locations and fisheries refer to the Santos Values and Sensitivities of the Marine and Coastal Environment (EA-00-RI-10062).

The OSM Services Provider will work with Santos to request access and permit applications to all relevant Jurisdictional Authorities to conduct monitoring for OMPs and SMPs.

Safety Note: Due to the risk posed by unexploded ordnances, landing on Cartier Island or anchoring anywhere within the Cartier Island Marine Park[13] is strictly prohibited without express prior written approval.

If anchoring is unavoidable due to emergency (e.g. extreme weather conditions), great care should be taken to ensure anchoring is on sand, and anchors do not drag.

Any metal objects or suspicious objects found in the reserve should not be touched or disturbed and reported immediately to the police and the Parks Australia Work Health and Safety Advisor on 02 6274 2369 or parkshealthandsafety@dcceew.gov.au .

[13] *Oil spill modelling did not predict contact with Ashmore or Cartier Island for any scenario listed in Table 2-1. However, the information on monitoring arrangements is included on a precautionary basis due to the proximity of low-threshold exposure to these sensitive receptors.*

Table 17-1: Permits required in Scientific Monitoring Planning Area

Receptor	Jurisdictional Authority	Relevant information on permits
Permits for monitoring fauna	DCCEEW Parks and Wildlife Commission (NT) DBCA (WA)	Any interactions involving nationally listed threatened fauna may require approval from DCCEEW - https://www.dcceew.gov.au/environment/biodiversity/threatened/permits NT – information can be found at - https://nt.gov.au/environment/animals/wildlife-permits WA- appropriate permits can be found at: https://www.dbca.wa.gov.au/licences-and-permits/fauna
State Marine Protected Area	DBCA (WA) State/Territory government department with jurisdiction for fisheries	No specific permitting requirements exist for monitoring in WA marine protected areas, but additional information is available at: https://www.dbca.wa.gov.au/management/marine-planning No specific permitting requirements exist for monitoring in NT fish protection areas, but zones are described here - https://nt.gov.au/marine/recreational-fishing/when-and-where-to-fish/reef-fish-protection-areas
Ramsar wetland	DCCEEW	Additional information on Ramsar wetlands and how they are protected as a matter of national environmental significance under the EPBC Act is available at: https://www.dcceew.gov.au/environment/epbc/our-role/what-is-protected
Australian (Commonwealth) Marine Parks	Director of National Parks Parks Australia	Permit and licence application information for Marine Protected Areas (including monitoring) can be found at: https://onlineservices.environment.gov.au/parks/australian-marine-parks Additional information on permitting requirements in Australian Marine Parks can be obtained through Parks Australia via email marineparks@environment.gov.au or phone 1800 069 352 Information on permits to access biological resources in Commonwealth areas can be found at: https://www.dcceew.gov.au/science-research/australias-biological-resources/access-biological-resources-commonwealth
State/Territory Managed Fisheries	State/Territory government department with jurisdiction for fisheries	No specific permitting requirements exist for WA Fisheries, but additional information is available at – https://www.fish.wa.gov.au/Fishing-and-Aquaculture/Pages/default.aspx No specific permitting requirements exist for NT Fisheries, but additional information is available at - https://daf.nt.gov.au/fisheries
Commonwealth Managed Fisheries	Australian Fishing Management Authority	Commonwealth Managed Fisheries (scientific permit for research/monitoring in an Australian Fishing Zone) https://www.afma.gov.au/fisheries-services/fishing-rights-permits
Indigenous Cultural Heritage	Territory government department with jurisdiction for indigenous heritage	Indigenous heritage information in NT - https://nt.gov.au/leisure/arts-culture-heritage/visit-a-cultural-or-heritage-site/indigenous-heritage-information Entry access permits to Aboriginal Lands in WA: https://www.wa.gov.au/service/aboriginal-affairs/aboriginal-heritage-conservation/apply-permit-access-or-travel-through-aboriginal-land

Receptor	Jurisdictional Authority	Relevant information on permits
	Department of Planning, Lands and Heritage (DPLH)	Aboriginal heritage sites in WA: https://www.wa.gov.au/service/aboriginal-affairs/aboriginal-cultural-heritage/search-aboriginal-sites-or-heritage-places and https://www.dplh.wa.gov.au/information-and-services/aboriginal-heritage
Defence/ restricted military area	Department of Defence	Unexploded Ordnances (mapping information): https://www.defence.gov.au/UXO/default.asp Maritime military firing practice and exercise areas: https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.hydro.gov.au/n2m/2010/annual/n2m/9.pdf&ved=2ahUKEwi08LDJ_c-PAxWiamwGHUmjCiQQFnoECB0QAQ&usg=AOvVaw0A_L5br6pqJx_IZgW7N15M
Industry (e.g. operational zone of offshore oil or gas platform)	Operating company	Safety zones (up to 500 m from outer edge of well or equipment) – https://www.nopsema.gov.au/safety/safety-zones/
Shipwrecks	DCCEEW	Refer to the Underwater Cultural Heritage Act 2018 (Commonwealth): https://www.dcceew.gov.au/parks-heritage/heritage/underwater-heritage/underwater-cultural-heritage-act

18. Use of data in response decision-making

18.1 Operational monitoring to inform response activities

The OSM Services Provider is responsible for the collection of data by field teams, which shall be QA/QC checked by the Field Team Lead in accordance with the requirements listed in the finalised OMPs and SMPs (where applicable). Table 18-1 provides a checklist to assist in utilising OM data to inform decision making.

The Field Team Lead will be responsible for communicating data back to the Monitoring Branch via field reporting forms, debriefs and reports. Laboratory analysis reports should also be directed to the Monitoring Branch.

The OSM Implementation Lead is responsible for the interpretation and analysis of data. OMP data should be analysed rapidly so that it may be used to inform response planning and decisions in the current and/or next operating period. SMP data is designed to be more scientifically robust and long-term in nature and is not relied upon by the IMT for decision-making. Therefore, SMP data will be analysed more thoroughly by the OSM Implementation Lead.

Once OM data is analysed and checked by the Field Team Lead, it will be provided to the Monitoring Branch and OSM Implementation Lead, who will then distribute the data from each monitoring component to the relevant IMT Section. Table 18-2 provides guidance on the type of data generated from each OMP, which IMT Section / Unit requires the data and how the data may be used during a response. All SMP data received during a response will be received by the Planning Section via the Monitoring Branch.

Analysed data will then be incorporated into the Common Operating Picture (managed by the Situation Unit Lead) and used by the Environment Unit Lead during development of the operational NEBA, which would be included in the IAP for the current or next operating period.

As ultimately responsible for the IAPs, the Planning Section Chief will be required to utilise the OMP data to aid in decision making and determine if the response strategies can be commenced, continued, escalated, terminated, or if controls need to be put in place to manage impacts of the response activities. These decisions will be communicated to the broader IMT during regular situation debriefs.

Table 18-1: Checklist for utilising OMP data to inform IMT decision making

Responsibility	Task	Timeframe	Complete
OSM Services Provider - Field Team Lead	Data collected whilst implementing OMPs and SMPs is checked that it aligns with the requirements listed in the finalised OMPs and SMPs (where applicable)	Ongoing	☐
	OMP data provided to the IMT Situation Unit Lead	Daily and ongoing	☐
Shoreline Response Program Manager	Reports from OM6: Shoreline Clean-up Assessment will be provided to the IMT daily, detailing the assessed areas to maximise effective utilisation of resources.	Daily reporting	☐
Santos Situation Unit Lead	Incorporate OMP data into Common Operating Picture	Daily and ongoing	☐
Santos Environment Unit Lead	Incorporate OMP data into operational NEBA and IAP for the next operating period	Each operational period	☐

Table 18-2: Data generated from each OMP and how this may be used by IMT in decision-making

OMP	Data generated[14]	IMT Section requiring data	How data may be used by IMT
OM1: Hydrocarbon characterisation	Hydrocarbon physical characteristics (e.g. viscosity, asphaltene content, fingerprinting, weathering ratios of hydrocarbon chains)	Planning Section to aid in response option selection / modification	Changes to the hydrocarbon properties will affect the window of opportunity for particular responses and the associated logistical requirements of these responses, such as use of chemical dispersants, recovery and pumping equipment suitability, hydrocarbon storage and hydrocarbon disposal requirements
OM2: Hydrocarbon in water assessment	Distribution of oil in water column and change in hydrocarbon concentrations (e.g. total recoverable hydrocarbons, BTEXN, PAH), physio-chemical parameters and dispersant detection	Situation Unit Lead to validate surveillance and modelling data; Planning Section for use in IAP	Confirm spatial extent of spill within the water column and verify spill modelling and surveillance data; extent of spill can in turn influence location of other OMP and SMP monitoring components and sites. Data can also influence ongoing use of dispersant through ongoing operational NEBA.
OM3: Hydrocarbon in sediment assessment	Distribution of oil in sediment and change in hydrocarbon concentrations (e.g. Total recoverable hydrocarbons, BTEXN, PAH)	Situation Unit Lead to validate surveillance and modelling data; Planning Section for use in IAP	Confirm spatial extent of spill; extent of spill can in turn influence location of other OMP and SMP monitoring components and sites
OM4a: Surface dispersant effectiveness monitoring	Visual observations of dispersant efficacy; Fluorometric readings in water column (see also water quality assessment)	Environment Unit for use in operational NEBA; Planning Section to aid in IAP development; Operations Section to confirm dispersant effectiveness for decision-making purposes in current operations period.	Determine the effectiveness of dispersant in removing oil from sea surface and how dispersed oil is being distributed through the water column. This information can be used in NEBA to help decide if dispersants are being effective at minimising oil reaching sensitive receptors (NEBA to evaluate any trade-offs between receptors)
OM4b: Subsea dispersant injection effectiveness monitoring	Visual observations of dispersant efficacy; Fluorometric readings in water column (see also water quality assessment)	Source Control Branch to aid decision-making for other source control operations; Environment Unit for use in operational NEBA; Planning Section to aid in IAP development.	Determine efficacy of subsea dispersant in treating oil to help understand if injection should continue or be modified; understand the nature and extent of the subsea plume; and provide an initial assessment of potential ecological effects. This information can be used in NEBA to help decide if dispersants are being effective at minimising oil reaching sensitive receptors (NEBA to evaluate any trade-offs between receptors) and also if subsea dispersants are effectively reducing volatile organic compound (VOC) levels so that operations are within lower explosive limits (LEL)
OM5: Rapid marine fauna surveillance	Rapid assessment of presence and distribution of marine fauna; evaluate impact of spill and response activities on fauna	Planning Section for use in IAP; Oiled Wildlife Unit/Division to help in developing Wildlife Response Sub-plan	Understanding of species, populations and geographical locations at greatest risk from spill impacts. IMT can use this information to help qualify locations with highest level of protection priority (e.g. dugong nursery area is at risk of high contact therefore dispersant use closest to spill source may be a preferred option); understanding the impacts of spill response activities can help IMT to modify or terminate activities if

[14] *Summary only. For additional detail, please refer to individual OMPs. Also note data outputs will be reliant on finalised monitoring design.*

OMP	Data generated[14]	IMT Section requiring data	How data may be used by IMT
			they are assessed as creating more harm than the oil alone (e.g. large shoreline clean-up teams and staging areas may disturb shorebird nesting resulting in adults abandoning chicks)
OM6: Shoreline clean-up assessment	Assessment of shoreline character; assessment of shoreline oiling; recommendations for response activities; post-treatment surveys	Planning Section to aid in IAP development and response option selection / modification	• Confirmation of shoreline character, habitats and fauna present which may influence selection of response tactics (e.g. no mechanical recovery if turtles are known to be nesting); • Oil deposition and/or removal rate for a shoreline sector will help determine effectiveness of relevant tactics (e.g. shoreline protection and/or clean-up operations); Assessment teams provide ground truthing of sites that are not possible via satellite imagery, therefore the IMT can rely on the recommendations of Assessment Teams (e.g. flagging access issues, suitable tactics, likely resourcing needs).
OM7: Air quality modelling (responder health and safety)	Modelled outputs of VOCs	Operations Section to help determine safe zones in close vicinity of spill; Planning Section for use in IAP	Determine safe distances from spill source for response personnel; determine the presence and persistence of volatile organic compounds to know if response areas are safe for personnel

18.2 Impacts from response activities

Table 10-4 of the Joint Industry OSM Framework outlines the potential impacts from response activities and the relevant OMP/SMP for monitoring impacts. For example, if shoreline clean-up was being considered as a response option, then possible impacts resulting from that activity could include physical presence, ground disturbance, water/sediment quality decline and lighting/noise impacts to fauna.

When finalising monitoring designs, the OSM Implementation Lead shall review Table 10-4 of the Joint Industry OSM Framework and the relevant activity EP to ensure potential impacts from response activities are considered and incorporated into relevant OMP/SMP designs.

18.3 Operational monitoring of effectiveness of control measures and to ensure EPS are met

As stated in Table 15-1, when finalising monitoring designs, the OSM Implementation Lead and Santos Environment Unit Lead (or delegate) shall review the Environmental Performance Standards (EPSs) listed in the activity-specific OPEP and integrate checks into the monitoring design that will help determine if relevant EPSs are being met.

Table 18-3 provides relevant EPSs listed in Santos' activity-specific OPEPs and how operational monitoring may be able to confirm it is being met.

Table 18-3: Relevant OPEP Environmental Performance Standards related to operational monitoring

Environmental Performance Standard	Confirmation that EPS is being met
[EPS-SCU-018] Access plans for shoreline operations will be developed. Unless directed otherwise by the Control Agency, Access plans will prioritise use of existing roads and tracks, establish demarcation zones to protect sensitive areas and select vehicles appropriate to conditions	Implementation of OM6: Shoreline Clean-up Assessment will involve assessment teams determining suitable access routes, including utilisation of existing roads and tracks and establishing demarcation zones to protect sensitive areas
[EPS-SCU-020] Unless directed otherwise by the designated Control Agency, a soil profile assessment is conducted prior to earthworks	Implementation of OM6: Shoreline Clean-up Assessment and OM3: Hydrocarbon in Sediment Assessment will involve a soil profile assessment being conducted prior to earthworks taking place
[EPS-SCU-024] Unless directed otherwise by the designated Control Agency, demarcation zones are mapped out in sensitive habitat areas for vehicle and personnel movement, considering sensitive vegetation, bird nesting/ roosting areas and turtle nesting habitat.	Implementation of OM6: Shoreline Clean-up Assessment will involve assessment teams mapping any demarcation zones in sensitive habitat areas
[EPS-SCU-019] Unless directed otherwise by the designated Control Agency, operational restrictions on movement of personnel and vehicles, including vehicle types and traffic volumes, are established to minimise impacts from erosion and compaction	Implementation of OM6: Shoreline Clean-up Assessment will involve assessment teams determining any operational restrictions for vehicle and personnel movement

19. Data management

Minimum standards for data management are provided in Section 10.11 of the Joint Industry OSM Framework and will be adopted by Santos and the OSM Services Provider.

20. Quality assurance and quality control

Refer to Section 10.11 of the Joint Industry OSM Framework for QA/QC minimum standards which will be adopted by Santos and the OSM Services Provider.

Once SMP monitoring reports are drafted (post-spill) they will be peer reviewed by an expert panel (refer to Section 10.10 of the Joint Industry OSM Framework).

21. Communication protocols

21.1 OSM Services Provider

Communication protocols between Santos and its OSM Services Provider with respect to delivery of the OMPs and SMPs (during both preparedness and implementation) are intentionally defined to ensure clear and consistent information is provided in both directions.

The following communication protocols must be observed:

- Communication between Santos and its OSM Services Provider during the preparedness phase (pre-spill) will be between the nominated Industry Member Technical Advisory Group representative and the OSM Services Provider.
- Communication between Santos and its OSM Services Provider during activation (prior to deployment) will be between the Environment Unit Lead (or delegate) and the OSM Services Provider representative.
- During implementation (post deployment), primary communication occurs via two pathways:
  - Environment Unit Lead and the OSM Services Provider Duty Manager for contractual, management, scientific and general direction matters; and
  - Santos Division Commander / On-Scene Commander and the OSM Services Provider's Group Manager/s / Field Team Leaders for on-site matters.
- All key OSM decisions should be logged in an ICS 214 Log maintained by the OSM Implementation Lead.
- All key OSM tasks, actions and requirements should be documented in an IAP during the response phase of the spill.
- The Santos Environment Unit Lead will keep the Operations Section Chief, Logistics Section Chief and Planning Section Chief briefed of the OSM status as required.
- All correspondence (copies of emails and records of phone calls) between Santos and the OSM Services Provider during a response should be recorded and kept on file.
- All communication received by OSM Services Provider not in line with these protocols should be reported to the Environment Unit Lead who will seek guidance on the accuracy of the information received.
- Unless related to safety (e.g. evacuation), any direction or instruction received by the OSM Services Provider outside of these protocols should be confirmed via the Santos Environment Unit Lead or On-Scene Commander prior to implementation.

During the post-response phase all communications shall be between the Santos Environment Advisor and the OSM Services Provider.

21.2 External stakeholders

Results of OMPs and SMPs will be discussed with relevant stakeholders. Information will be shared with regulatory agencies/authorities as required and inputs received from stakeholders will be evaluated and where practicable, will be used to refine the ongoing spill response and/or ongoing operational and/or scientific monitoring.

The Santos IMT Public Information Officer will be the focal point for external engagement during the response operation.

Stakeholder communications post-response will be managed by the Santos Government and Public Affairs Team.

22. Stand down process

Monitoring for each component will continue until termination criteria for individual components are reached. Typically, OMPs will terminate when agreement has been reached with the Jurisdictional Authorities relevant to the spill to terminate the response or a relevant SMP has been activated. SMPs will continue after the spill response has been terminated and until such time as their termination criteria are also reached. A list of criteria is provided in the OSM Framework.

After OMPs are terminated, the OMP monitoring teams will be advised to stand down. Following this stage, Santos is responsible for coordinating a lessons-learnt meeting between the OSM Services Provider, sub-contracted

Monitoring Service Providers and other relevant stakeholders. It is the responsibility of Santos to ensure that lessons learnt are communicated to the relevant stakeholder groups. The lessons discussed should include both positive actions to be reinforced and lessons for actions that could be improved in future standby or response campaigns. Table 22-1 provides a checklist to assist in terminating the OMPs and SMPs and the monitoring effort.

Table 22-1: Checklist for terminating monitoring components

Responsibility	Task	Complete
Santos Environment Unit Lead / Environment Advisor with input from OSM Services Provider	Review termination criteria of OMPs and SMPs (provided in Table 9-1 (OMPs) and Table 9-2 (SMPs) of the Joint Industry Operational and Scientific Monitoring Framework) to ensure OMPs and SMPs are terminated in accordance with these criteria	☐
	Ensure all drafted SMP monitoring reports are peer reviewed by an expert panel (refer to Section 10.10 of the Joint Industry OSM Framework)	☐
	Conduct lessons-learnt meeting	☐

23. References

APPEA (2021) Joint Industry Operational and Scientific Monitoring Plan Framework. Rev D. Report prepared by BlueSands Environmental for APPEA Marine and Environmental Science Working Group.

French-McCay D (2024) Considerations for Development of Entrained Oil Thresholds for Oil Spill Risk Assessments. RPS Ocean Science. Australian Energy Producers. Available at: https://energyproducers.au/wp-content/uploads/2024/09/Oil-in-Water-Threshold-Review_French-McCay_2024Feb19-002.pdf

Kirby MF, Brant J, Moore J, Lincoln S (eds) (2018) PREMIAM – Pollution Response in Emergencies – Marine Impact Assessment and Monitoring: Post-incident monitoring guidelines. Second Edition. Science Series Technical Report. Cefas, Lowestoft.

Appendix A Demonstration of Meeting OSM Framework Regulatory Requirements

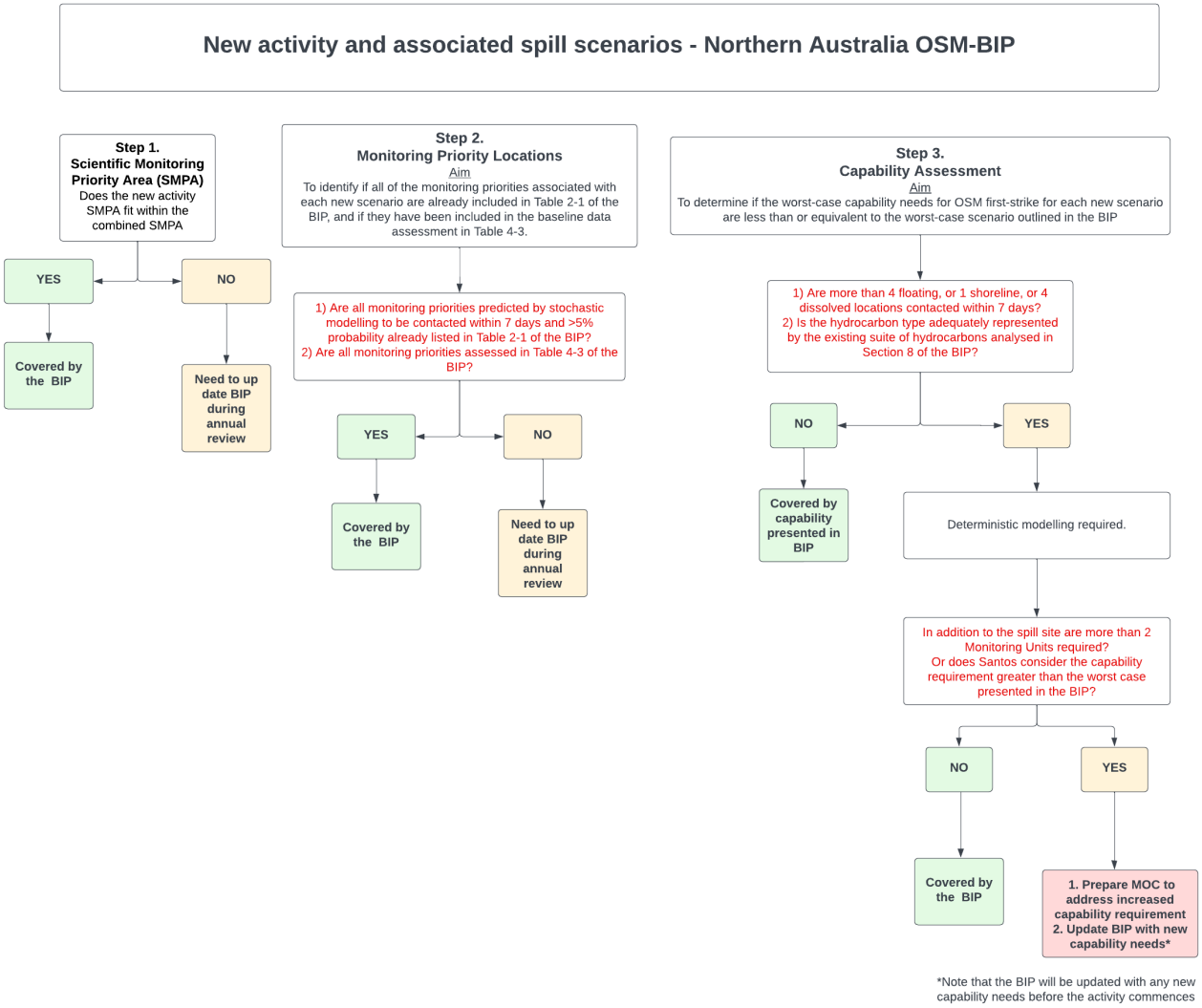
RAS Requirement	Relevant Section of Documentation that Addresses the Requirement
Conducted an appropriate risk assessment of worst-case oil pollution scenario(s) supported by spill modelling.	Santos has analysed all of its worst-case oil pollution scenario(s), including volumes, hydrocarbon types and spill locations in its OSM Baseline and Monitoring Assessment Matrix (7715-650-DAS-0002) which is updated to include each new activity. As part of this assessment, Santos reviews the stochastic spill modelling results for each activity to determine spill risk relevant to OSM planning (Appendix - Operational and scientific monitoring assessment). A comprehensive assessment of worst-case oil pollution scenario(s) for each activity is also included in the activity EP and OPEP.
Evaluated and adopted all reasonably practicable measures to reduce oil pollution risks by preventing incidents and preparing for a timely and effective response to pollution events.	The control measures for reducing oil pollution risks are included in the activity EP in the unplanned activities risk assessment section. Information pertaining to response preparedness is provided in the activity OPEP.
Identified monitoring arrangements and resource requirements based on the worst-case oil pollution scenario(s).	Section 8 Resourcing requirements outlines the process for determining the greatest OSM resource requirements based on the worst-case scenarios for Santos activities, including the use of deterministic modelling. Monitoring arrangements, including contracted and internal capability are presented in Sections 9 Capability arrangements and 10 Capability assessment
Presented monitoring arrangements and capability that are scalable and adaptable and will provide timely information.	Section 9 Capability arrangements outlines Santos' monitoring arrangements via OSRL's OSM Supplementary Service Agreement, including scalable resourcing, if it is required.
Identified suitably qualified personnel who will be in decision making roles and implementing the monitoring and who are prepared for their responsibilities in advance of the incident occurring.	Section 6 OSM roles and responsibilities outlines personnel who will fill key OSM decision making roles. Roles filled by the OSM Services Provider are managed via the OSRL OSM Supplementary Services Agreement which specifies responsibilities for OSM response.
Established operational monitoring requirements based on the response needs and capacity reasoning applied to demonstrate ALARP for the response control measures detailed in the OPEP	Santos has assessed its OSM control measures and required capability in preparing this OSM-BIP. In addition, Santos has undertaken an activity-specific OSM ALARP assessment in Appendix B (Oil spill response ALARP framework & assessment) of each OPEP to determine if any improvements could be made to the existing suite of control measures.
Demonstrated all feasible preparatory actions to improve reliability, effectiveness and timeliness of response arrangements and capability (including operational monitoring), have been implemented where costs are not grossly disproportionate to the environmental benefit gained	Appendix B of the activity OPEP (Operational and Scientific Monitoring – ALARP Assessment) demonstrates a detailed control measure options analysis was undertaken and all feasible control measures for OSM have been implemented.
Set environmental performance standards that reflect the level of performance required of the response control measures (including monitoring) to achieve the defined environmental performance outcomes.	The activity OPEPs include a section 'Environmental performance – operational and scientific monitoring', which details all OSM control measures and performance standards, many of which relate directly to the RAS Requirements. Section 18.3 Operational monitoring of effectiveness of control measures and to ensure EPS are met outlines tasks for the OSM Implementation Lead and Environment Unit Leader to ensure environmental performance standards are met via operational monitoring activities.

RAS Requirement	Relevant Section of Documentation that Addresses the Requirement
The EP clearly commits to initiate all OMPs as listed in Table 5-1 as per initiation criteria listed in Table 9-1.	Table 12-1: OSM mobilisation and activation process provides guidance during mobilisation, and in the activity OPEPs, the Section 'Environmental performance – operational and scientific monitoring' commits to OM activation in accordance with the initiation criteria in the Framework.
The EP clearly commits to initiate all SMPs as listed in Table 6-1 as per initiation criteria listed in Table 9-2.	Table 12-1: OSM mobilisation and activation process provides guidance during mobilisation, and in the activity OPEPs, the Section 'Environmental performance – operational and scientific monitoring' commits to SM activation in accordance with the initiation criteria in the Framework.
The EP clearly commits to the Termination Criteria listed in Table 9-1 for operational monitoring and Table 9-2 for scientific monitoring.	Table 22-1: Checklist for terminating monitoring components provides guidance during termination of monitoring, and in the activity OPEPs, the Section 'Environmental performance – operational and scientific monitoring' commits to termination in accordance with the termination criteria in the Framework.
The EP clearly commits to the quality assurance and quality control items listed in Section 10.11 of the framework.	Section 20 Quality assurance and quality control commits that Santos and the OSM Services Provider will use Section 10.11 of the Joint Industry OSM Framework for QA/QC minimum standards.
The EP includes a clear commitment to use the same description of the roles and responsibilities for key emergency response personnel presented in the framework in Table 10-6.	Section 6 OSM roles and responsibilities commits that Santos and the OSM Services Provider will use the key roles and responsibilities provided in Section 10.13.2 of the Framework.
The EP clearly commits to emergency response personnel having the competencies outlined in Table 11-1. However, Titleholders need to ensure that regardless of the university qualifications that personnel may have, ultimately the monitoring undertaken must be of suitable experimental design, and with personnel who are trained and competent in experimental design and in situ monitoring implementation, irrespective of their qualifications, this may not be achieved.	Section 9.1 Personnel competencies commits that Santos and the OSM Services Provider will use the competencies outlined in Table 11-1 of the Framework.
The EP clearly commits to the minimum standards identified in Appendix A, with the addition of replacing language in the form of "should" and "where possible" with "will". EP's that commit to the standards identified in this appendix without replacing the text described above with more definitive language will likely to be subject to a more comprehensive assessment of the arrangements in accordance with the risk factors particular to the EP and receive requests for clarification from NOPSEMA during the assessment process.	In the activity OPEPs, the Section 'Environmental performance – operational and scientific monitoring' commits that Santos will comply with the minimum standards listed in Appendix A of the Joint Industry OSM Framework. In addition, all of the minimum standards have been reviewed and integrated into this OSM-BIP and/or activity OPEPs.
The EP clearly commits to meet the competencies identified for teams in Appendix D Table D1.	Section 9.1 Personnel competencies commits that Santos and the OSM Services Provider will use the competencies for SMP Field Teams as outlined in Appendix D of the Framework.
The EP clearly commits to an annual review and reviews where all the suggested triggers apply as advised in the template.	Section 11 Document review and in the OPEPs, the Section 'Environmental performance – operational and scientific monitoring' commit to conducting an annual review of the OSM-BIP, providing the criteria for the review.
The EP uses the process described in Sections 2 and 13 of the template to identify the environment that may be affected and the protection and monitoring priorities, including the application of oil concentration thresholds consistent with the exposure values for oil spill modelling presented in NOPSEMA's oil spill modelling bulletin, and fully justifies the outcome.	Section 2 Scientific Monitoring Planning Area and Monitoring Priorities demonstrates that Santos has applied the NOPSEMA oil spill modelling bulletin thresholds for determining the Consolidated Scientific Monitoring Planning Area. This section also outlines Santos' process for identifying monitoring priorities, as required by Section 2 of the BIP Template (step 3). This process incorporates the key elements listed in the BIP Template, including analysis of spill modelling results with receptors of high conservation value (especially receptors predicted to be contacted at higher

RAS Requirement	Relevant Section of Documentation that Addresses the Requirement
	probabilities and a rapid timeframe) and availability of baseline data. This process is then applied in each OPEP (Appendix - Operational and scientific monitoring assessment) to confirm activity-specific monitoring priorities. As noted in Section 2 of the BIP template, the monitoring priorities listed are for planning purposes only and Santos and its OSM Services Provider will follow the process outlined in Section 13 Monitoring priorities when confirming monitoring priorities in the event of a spill.
The EP adheres to the process described in Sections 3 and 4 of the template to undertake baseline data analysis and fully justifies the outcome.	Sections 3 Relevant existing baseline information sources and 4 Baseline data review follow the guidance provided in the BIP Template, with the addition of more information to support continuous improvement in this area. In addition, the OPEP (Appendix - Operational and scientific monitoring assessment) provides a baseline assessment for identified monitoring priorities for that activity. Noting this, Santos is part of a Joint Industry Collaborative Group who are working together to determine the extent, quality and suitability of existing baseline data for the marine environments in the North West Shelf, Browse and Timor Sea Regions of Australia. The Marine Environment Baseline Database includes available data for all receptors relevant to the Joint Industry OSM Framework and has assessed the spatial and temporal relevance of this data and comparison of methods and parameters to those outlined in the Joint Industry SMPs, as recommended in Section 7 and Appendix A of the Framework and Section 4 of the BIP Template.
The EP makes clear, unambiguous commitment that scientific monitoring reports "will be" peer reviewed by an expert panel (Section 4, p10).	In the OPEPs, the Section 'Environmental performance – operational and scientific monitoring' commits that draft OSM data reports will be peer reviewed by an expert panel for data integrity. This is also stated in Section 20 Quality assurance and quality control.
The EP includes clear, unambiguous activation, mobilisation, and implementation timeframes, which are relevant to the predicted time to contact of the pollution with sensitive receptors, baseline data available, sensitivities affected, practicability of implementation and/or other factors. Indicative mobilisation timeframes for OSM activities presented as worked examples in the template, for example, activation timeframes in Table 7-1 and Section 12 and implementation timeframes in Sections 13 and 15, should be revised to reflect each activity's oil pollution scenario(s) and specific response requirements.	Section 12 Mobilisation and activation process provides the mobilisation and activation process and timeframes for the OSRL OSM Supplementary Services Agreement. Section 7 Mobilisation and timing of OMP and SMP implementation provides timeframes for mobilisation and activation that are relevant to Santos' activities, including predicted time to contact to sensitive receptors (from spill modelling), availability of baseline data and practicability of implementation (i.e. remote environments, timeframes for mobilising specialised equipment and personnel). Where receptors may be contacted more rapidly that the quickest deployment timeframes (i.e. aerial surveillance within 24 hours; SCAT within 48 hours), Santos has undertaken an ALARP assessment in Appendix B of each OPEP to determine if any improvements could be made to control measures to address this gap.
Monitoring implementation timeframes consider any time requirements to finalise SMPs prior to implementation being required or take actions to reduce timeframes during the pre-spill (preparedness) phase.	The timeframes for finalising SMPs have been accounted for in the timeframes provided in Part B of the OSM-BIP, in particular, Section 15 Finalising monitoring design.
The EP includes OMPs that are sufficiently developed and/or finalised to ensure that they are ready to implement in the identified timeframes for operational monitoring to provide information to support initial and ongoing response decision-making.	The Joint Industry Framework includes well developed OMPs that have been socialised with the OSM Services Provider and will be finalised in the event of a spill. The timeframe for finalising the OMPs is factored into the implementation timeframes provided in Section 7 Mobilisation and timing of OMP and SMP implementation.
The EP identifies that operational monitoring detailed in the OMPs will be initiated, monitoring teams deployed, and information provided to the incident management team (IMT) in timeframes that match those identified and applied to the oil pollution emergency response planning in the development of the OPEP.	As described in Section 7 Mobilisation and timing of OMP and SMP implementation, the activity OPEPs describe additional operational monitoring and monitor and evaluate activities that may be required to support the implementation of response strategies. This includes SCAT teams to support

RAS Requirement	Relevant Section of Documentation that Addresses the Requirement
	shoreline protection and clean-up; aerial surveillance to support oiled wildlife activities and marine fauna monitoring; and tier 1 SMART monitoring for surface dispersant application.
The EP identifies monitoring resources in the BIP that match the monitoring and response needs in terms of numbers of personnel, teams, equipment, sites etc. Tables 8-2, 8-3 and 10-1 in the template provide a suitable method of presenting the number of personnel and teams required to resource a monitoring program, however, the content of these tables will be assessed by NOPSEMA in the context of the oil pollution scenario(s), response needs analysis and capacity reasoning presented in the EP.	Section 8 Resourcing requirements presents the spill scenarios most likely to require the greatest initial and on-going capability for Santos on the North West Shelf, which have been used in the capability assessment. As per Section 8 of the BIP Template, Santos has based its resourcing requirements on spill modelling, implementation timeframes and its monitoring priorities. However, in keeping with continuous improvement in this area and alignment to how capability is determined for oil spill response strategies (i.e. shoreline clean-up), Santos has utilised deterministic modelling to help define its capability requirements. In addition, Santos has included the use of 'Monitoring Units' for the reasons stated in Section 8.1 Monitoring units, and also to enable demonstration of how BIAs, KEFs and broadscale features are included in the capability assessment.
The EP adheres to the exercise and testing process described in Section 9.3. Additionally, the BIP should identify the specific objectives of the testing of monitoring arrangements, ensure the frequency of the schedule of testing is consistent with the regulatory requirements and provide information on any aspects of the testing of monitoring that differ to the OPEP testing arrangements described elsewhere in the EP.	Section 9.3 Exercises is aligned to the BIP Template, outlining the types of exercises that shall be conducted by the OSM Services Provider, as per the OSRL OSM Supplementary Services Agreement; and also by Santos.
The EP confirms that the aims and objectives of the OMPs and SMPs are appropriate for a Titleholder's monitoring requirements and address the potential impacts and risks and response activities.	In the OPEPs, the Section 'Operational and Scientific Monitoring' confirms which OMPs and SMPs are relevant to the activity and that the aims and objectives of these monitoring plans are appropriate to the needs of the spill, its risks and response activities.
The EP uses the method provided in the template for Titleholders to ensure special requirements for Matters Protected Under Part 3 of the EPBC Act are met through the proposed monitoring (Section 14). However, the method indicates that this would be done prior to finalisation of OMPs and SMPs, which may not be completed in a Titleholder's EP. Titleholders should ensure that relevant requirements are at least identified in the EP. This process would also be repeated during finalisation of OMPs and SMPs in the event of an oil pollution emergency to ensure any changes to requirements since submission of the EP or the latest review are included.	Santos lists special requirements for Matters Protected Under Part 3 of the EPBC Act in Section 3 of the activity EPs. The process for ensuring all relevant Protected Matters are integrated into the final monitoring design is outlined in Section 14 Protected Matters requirements.
The EP sets environmental performance outcomes, standards and measurement criteria that relate to the environmental impacts and risks and required level of performance of the proposed monitoring arrangements (preparedness and implementation) defined in the BIP.	In the OPEPs, the Section 'Environmental performance – operational and scientific monitoring' outlines a number of environmental performance outcomes, standards and measurement criteria committing Santos to OSM preparedness and implementation performance relevant to this OSM-BIP.

Appendix B Process for assessing new activities against OSM-BIP



Appendix C Background information for key sensitivities

Table C-1: Background information for key sensitivities for locations predicted to be contacted within 7 days, at a probability >5%, and requiring a baseline review

Location	Receptor	Background	Key locations	Seasonality
Beagle Gulf-Darwin Coast	Mangroves	Extensive mangroves in this region (AMOSC 2019).	Along estuaries, inlets and large protected bays in the region- such as Bynoe Harbour (Chatto and Baker 2008).	-
	Cetaceans	BIA for Indo-pacific Humpback Dolphin (*Sousa chinensis*) near Cox Peninsula (DCCEEW 2024).	-	-
	Birds	Shorebirds are widely distributed throughout this area. However as much of the coast is lined with thick mangroves, overall densities of shorebirds is generally not high (Chatto 2003) Fog Bay has historically recorded high numbers of shorebirds (>38,000 February 1995 [Chatto 2003]).	The coast between Lee Point and Tree Point (east of Darwin) Bare Island Fog Bay (southern section) (Chatto 2003)	-
	Crocodile	Saltwater crocodile (*Crocodylus porosus*) (Fukuda and Cuff 2013)	-	-
Darwin Harbour	Cetaceans	Australia Snubfin Dolphin (*Orcaeila heinsohni*) have frequently been observed feeding in turbid shallow areas near river mouths where the water is less than 20 m deep (Parra 2006). The Australian snubfin forages in a variety of habitats, ranging from mangrove communities to seagrass beds, sandy bottom communities and open coastal areas with rocky shores and coral reefs. With the exception of seagrass beds, all of these habitats occur widely in Darwin Harbour (Northern Territory Government, 2011). Spotted Bottlenose Dolphin (*Tursiops aduncus*) – known to inhabit naturally turbid environments (Northern Territory Government, 2011). Indo-pacific Humpback Dolphin (*Sousa chinensis*) – tend to inhabit slightly deeper areas than Australian snubfins, including dredged channels. (Parra. 2006) The Indo-pacific humpback dolphin forages in a variety of habitats, ranging from mangrove communities to seagrass beds, sandy bottom communities and open coastal areas with rocky shores and coral reefs. With the exception of seagrass beds, all of these habitats occur widely in Darwin Harbour (Northern Territory Government 2011).	-	-
	Dugong	Dugong (Dugong dugon) – The waters of Darwin Harbour are a naturally turbid environment, indicating that dugongs inhabiting Darwin harbour are at least tolerant of turbid water. Feeding in concentrated in areas such as the rocky reefs at Weed Reef, Channel Island and sea grass beds (Whiting 2001). However, it is not the most important dugong habitat in the region due to limited seagrass communities (Inpex Browse 2009), with the most extensive being located at Casuarina Beach, and are not known to occur further south than Fannie Bay (Northern Territory Government 2011).	Weed Reef Channel Island Casuarina Beach Fannie Bay	-

Location	Receptor	Background	Key locations	Seasonality
	Turtle	The green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), and flatback turtle (*Natator depressus*) are known to utilise Darwin Harbour regularly. The loggerhead turtle (*Caretta caretta*) and olive ridley turtle (*Lepidochelys olivacea*) are likely to be occasional visitors to the harbour (Northern Territory Government 2011; Whiting 2001).	Flatback turtle are known to nest within Darwin Harbour, at Casuarina beach. There are no other known turtle nesting sites in Darwin Harbour as the mangroves and mudflats do not provide suitable nesting grounds (Northern Territory Government 2011).	-
	Crocodile	Saltwater crocodile (*Crocodylus porosus*) (Clancy and Fukuda 2024)	-	-
	Birds	Darwin Harbour regularly supports twenty-six species of migratory shorebird (Lilleyman 2020).	Intertidal mudflats during the low tide (Lilleyman *et al*. 2018).	Shorebirds begin arriving in Darwin in August with peaks in September, October and November and then start departing for their northward migration in February and March (Lilleyman 2016)
Djukbinj NP and Van Diemen Gulf Coast	Birds	Great knot (*Calidris tenuirostris*), greater sand plover (*Charadrius leschenaultia*), bar-tailed godwit (*Limosa lapponica*), lesser sand plover (*Charadrius mongolus*), red-necked stint (*Calidris ruficollis*), little curlew (*Numenius minutus*), sharp-tailed sandpiper (*Calidris acuminata*), various other shorebird Significant numbers of water birds found at Adelaide River floodplain. (AMOSC 2019)	Cape Hotham Adelaide River floodplain Mary River Chambers Bay Finke Bay Coast between South Alligator River and Minimini Creek (Chatto 2003)	-
	Dugong	Dugong (*Dugong dugon*) (vulnerable)	-	-
	Cetaceans	Australian snubfin dolphin (*Orcaella heinsohni*) Indo-Pacific humpback dolphin (*Sousa sahulenis*) Indo-Pacific bottlenose dolphin (Tursiops aduncus)	-	-

Location	Receptor	Background	Key locations	Seasonality
		(Groom *et al*. 2017)		
	Crocodile	Saltwater crocodile (*Crocodylus porosus*) (Fukuda and Cuff 2013)	-	-
	Turtle	The vast majority of the mainland coast of this bioregion has little sandy beach suitable for marine turtle nesting. Apart from the occasional Olive Ridley Turtle, nesting in this bioregion was recorded as dominated by Flatback Turtles (Chatto and Baker 2008).	Nesting islands: Greenhill Island Mogogout Island Wangoindjung Island Field Island Nesting on the mainland: Located between the West Alligator and Widman Rivers along the southern shoreline of Van Diemen Gulf. (Chatto and Baker 2008)	Flatback nesting may be all year round. Olive Ridley nesting January to June. (Chatto and Baker 2008)
Joseph Bonaparte Gulf Marine Park	Cetaceans	Australian snubfin dolphin (*Orcaella heinsohni*) Indo-Pacific humpback dolphin (*Sousa sahulenis*) Risso's dolphin (Grampus griseus) Pantropical spotted dolphin (*Stenella attenuate*)	-	-
	Dugongs	Dugongs are not abundant due to lack of seagrass	Anecdotal sightings near the shallow seagrass patches along the eastern coastal boundary (Przeslawski *et al.* 2011, Kyne *et al.* 2018)	-
	Turtles	Flatback turtle (*Natator depressus*) Olive ridley turtle (*Lepidochelys olivacea*) Hawksbill turtle (*Eretmochelys imbricate*) Loggerhead turtle (*Caretta caretta*) Green turtle (*Chelonia mydas*)	Loggerhead, flatback and hawksbill turtles are known to migrate and/or feed in the reef habitats and around the pinnacles on the mid-shelf of the gulf (Brewer *et al*. 2007, Donovan *et al*. 2008). The mid-shelf is also a BIA foraging area for Olive Ridley and green turtles, in areas foraging depths are less than 14 m (Whiting *et al*. 2007). Flatback turtle use the greater Joseph Bonaparte Gulf region including the adjacent marine park during nesting season (Limpus and Fien 2009; Galaiduk *et al* 2018)	-
	Birds	Seabirds such as tern and booby species, lesser frigate bird (*Fregata areil*), the silver gull (*Larus novaehollandiae*) and the common noddy (*Anous stolidus*) are expected to be observed in the marine park (Chatto 2001).	-	-

Location	Receptor	Background	Key locations	Seasonality
	Fishes and sharks	Limited information is available about the fish and sharks of the Joseph Bonaparte Gulf region (Galaiduk *et al* 2018). Northern River shark (*Glyphis garricki*) may occur inside the marine park (Kyne *et al* 2018). Green sawfish (*Pristis zijsron*), dwarf sawfish (*P. clavata*) and largetooth sawfish (*P. pristis*) all have distribution ranges which overlap the marine park and may occur inside the park (Kyne *et al* 2018).	The breeding grounds of green sawfish are likely overlapping the southern boundary of the marine park (Galaiduk *et al* 2018).	-
Joseph Bonaparte Gulf	Benthic	Benthic communities are exposed to strong tidal currents, high turbidity, and substantial sediment mobility, with disturbance decreasing offshore. Previous surveys in the Joseph Bonaparte Gulf have returned no seagrass or macroalgae beyond coastal habitats and only isolated hard corals (Przeslawski *et al* 2011).	Seagrass patches in the Eastern Joseph Bonaparte Gulf coast are reported in the following areas: King Shoals, Medusa Banks, Howland Shoals, Emu Reefs (Przeslawski *et al*. 2011; RPS 2009).	-
	Water	Waters are generally turbid due to the dominance of fine terrigenous sands and muds, a large tidal range (to 8m), and wet season sediment input from the numerous rivers in the area (Chatto and Baker 2008).	High turbidity exists in the inner Joseph Bonaparte Gulf, particularly during the wet season, with peak turbidity recorded 3 km from the coast, and much lower levels recorded ~ 30 km offshore (WEL 2004).	-
	Birds	This area has considerable shorebird habitat- there is a large amount of intertidal mudflat, backed by extensive mangroves an open saline wetland in Anson Bay (AMOSC 2019). Regionally important numbers of seabirds occur at Cape Ford and the Peron Islands (Chatto 2001), including up to 15,000 White Winged Terns (AMOSC 2019).	Anson Bay (mostly in the southern section and north of the Daly River Mouth) Perron Islands (Peron Island N- largest pelican colony in BT (Important Bird Area). Birds forage in exposed flats between Peron Islands during spring low tides. Cape Ford Finnis River Mouth Five Mile Beach Bare Sand Island Windirr Island (Chatto and Baker 2008, AMOSC 2019).	White Winged Terns- April to May (AMOSC 2019)
	Turtles	Marine turtle nesting occurs at scattered locations throughout this region. Although most nesting is at low densities on scattered sandy beaches, there are some areas that have significantly dense nesting. The most significant nesting areas in this bioregion are North Peron, Bare Sand and Quail Islands and the mainland coast adjacent and just to the south of the latter two islands (Chatto and Baker 2008).	High abundance of Flatback nesting on Peron Island N (AMOSC 2019)- Mostly occurs on the west and south side of the island (Chatto and Baker 2008). Anson Bay South some unidentified turtle nesting (most likely flatback) (Chatto and Baker 2008). Channel Point to Point Jenny flatback nesting.	Nesting occur from January to October (Chatto and Baker 2008)

Location	Receptor	Background	Key locations	Seasonality
			Native Point to Five Mile Beach- flatback nesting (Chatto and Baker 2008) Bare Sand Island- flatback turtle nesting (Chatto and Baker 2008) Quail Island- Flatback turtle nesting (Chatto and Baker 2008) Indian Island North End- flatback turtle nesting (Chatto and Baker 2008)	
Tiwi Islands	Turtles	Significant flatback turtle (*Natator depressus*), Olive ridley turtle (*Lepidochelys olivacea*) and green turtle (*Chelonia mydas*) nesting (AMOSC 2019), (Pendoley Environmental 2023)	East of Cape Gambier to Shoal Bay SW coast of Melville Island Buchanan Island West Bathurst Island Gordon Bay to Dudwell Creek Seagull Island NW tip Melville Island Johnson Point to Lethbridge Bay Lethridge Bay to Brenton Bay Point Jahleel Biradu Bay to Puloloo Bay	-
	Birds	Shorebirds: great knot (*Calidris tenuirostris*), red-necked stint (*C. ruficollis*) (near threatened), great sand plover (*Charadrius leschenaultii*) least concern), bar-tailed godwit (*Limosa lapponica*) (near threatened), lesser sand plover (*Charadrius mongolus*) (least concern), various other shorebirds Seagull Island has the largest crested tern (*Thalasseus bergii*) colony (>30,000) in the NT (AMOSC 2019)	Puwanapi Seagull Island Lethbridge Bay Quanipiri Bay	-
	Crocodile	Saltwater crocodile (*Crocodylus porosus*) (Fukuda and Cuff 2013)	-	-
Kimberley Marine Park	Cetaceans	The marine park is on the migration route of the humpback whale (*Megaptera novaeangilae*) and possibly the pygmy blue whale (*Balaenoptera musculus brevicauda*) (Puotinen *et al*. 2018)	-	Humpback migration occurring in dry season from April to October.
	Dugong		Dugong have been observed in south-eastern parts of the park where shallow water (<20 m) extends into the park (Bayliss and Hutton 2017; Puotinen *et al*. 2018).	-
	Turtle	Flatback turtle (*Natator depressus*)	Green turtle nest along the North-West Shelf and at Scott Reef are known to disperse	-

Location	Receptor	Background	Key locations	Seasonality
		Olive ridley turtle (*Lepidochelys olivacea*) Hawksbill turtle (*Eretmochelys imbricate*) Loggerhead turtle (*Caretta caretta*) Green turtle (*Chelonia mydas*) Leatherback turtle (*Dermochelys coriacea*)	throughout the park while foraging and migrating (Commonwealth of Australia 2017). Nesting areas identified as critical to their survival include the Lacepede Islands located near the park (Puotinen *et al*. 2018). Loggerhead that nest within Western Australia have been tracked throughout the park (Commonwealth of Australia 2017). Olive Ridley that nest in Indonesia may track within the northernmost parts of the park (Commonwealth of Australia 2017). Leatherback that nest in Indonesia may track within the northernmost parts of the park (Commonwealth of Australia 2017). Hawksbill have not been observed to track within the park even though the park may fall within their home range (Commonwealth of Australia 2017). Flatback have nesting areas identified as critical to their survival include the Lacepede Islands located within but excluded from the park. The area that they use during the inter-nesting period is contained within the park (Puotinen *et al*. 2018).	
	Seabirds	-	The tidal flat systems surrounding Adele Island and the Lacepede Islands, which are located in close proximity to the marine park, are also important for some shorebird species, such as Pacific golden plover (*Pluvialis fulva*), Grey plover (*Pluvialis squatarola*), Lesser sand plover (*Charadrius mongolus*), Grey-tailed tattler (*Tringa brevipes*), Ruddy turnstone (*Arenaria interpres*) and Sanderling (*Calidris alba*) (Rogers *et al*. 2011). Adele Island is also an important nesting site for a number of seabirds including Brown booby (*Sula leucogaster*), Lesser frigatebird (*Fregata ariel*), Red-footed booby (*Sula sula*), Masked booby (*Sula dactylatra*), and Lesser crested tern (*Thalasseus bengalensis*) (DEWHA 2008).	-

Location	Receptor	Background	Key locations	Seasonality
	Whale shark	Whale sharks (*Rhincodon typus*) sometimes pass through the marine park (Puotinen *et al*. 2018).	-	-
	Benthic	The known benthic fauna of the Kimberley Marine Park is characteristic of the offshore, sandy and turbid habitats in the Indo-Pacific region. There are few hard-substrate features within the park that might typically be associated with diverse assemblages (Puotinen *et al*. 2018). The banks and terraces within the park may support diverse benthic assemblages (Puotinen *et al*. 2018). A survey of Lynher Bank identified 197 species of crustacean, 86 species of mollusc, 14 hard corals, 54 soft corals, 195 sponges, 19 asteroids, and eight echinoids (Heyward *et al*. 2018).	Lynher Bank	-
Oceanic Shoals Marine Park	Benthic	The banks in the Oceanic Shoals are biodiversity hotspots for sponges, with more species and different communities than the surrounding seafloor (species richness and endemism of sponges in the western sector may not be as high as those in the eastern sector) (Nichol *et al*. 2013).	-	-
	Fish	A wide variety of high-order pelagic fish species occur in these waters (Nichol *et al*. 2013).	-	-
	Turtle	Includes biologically important foraging areas for flatback turtle (*Natator depressus*), loggerhead turtle (*Caretta caretta*) and olive ridley turtle (*Lepidochelys olivacea*), and interesting areas for flatback.	Flatback turtle prefer foraging in waters 60 to 90 m deep in association with complex, benthic geomorphology (banks, shoals, terraces, deep holes and valleys) thought to support a high abundance of sessile invertebrates (Thums *et al*. 2017).	- ,
Vernon Islands	Birds	Low abundance for shorebirds and seabirds as largely covered in mangroves (AMOSC 2019)	-	-
	Dugong	Important dugong (*Dugong dugon*) habitat (Northern Territory Government 2011)	-	-
	Cetaceans	Australian snubfin dolphin (*Orcaella heinsohni*) Indo-Pacific humpback dolphin (*Sousa sahulenis*) Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) (Groom *et al*. 2017)	-	-

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Appendix D OSM baseline data sources

Table D-1: Baseline data sources

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
Water Quality	RPS (2023) Pipeline Benthic Survey Report – Barossa DPD. Prepared for Santos	Santos	Along the Barossa Darwin Pipeline Duplication Darwin Harbour
	Proposed Browse to North West Shelf Project, Appendix D.1: Browse to NWS Project Trunkline Route Surveys (2019) Environmental Survey Report. Neptune Document J11200-1-RR-006	Advisian/Neptune	Kimberley Marine Park Continental Slope Demersal Fish KEF Agro-Rowley Terrace Marine Park Ancient Coastline at 125 m Depth Contour KEF
Sediment quality	Radke L, Majid M, Mummery A, Lambrinidis D, Logan M, Wyatt J (2020) Sediment quality assessment of Outer Darwin Harbour (2020): Survey record and data report. Technical Report No. 38/2020, Department of Environment	Northern Territory Government	Shoal Bay
	Radke L, Majid M, Wyatt J, Lambrinidis D, Logan M, Fortune J, Nicholas T (2021) Benthic sediment sampling campaign of Middle Arm and West Arm, Darwin Harbour (2020): Survey record and data report. Technical Report No. 11/2021, Department of Environment and Natural Resources, Northern Territory Government, Darwin, Northern Territory.	Northern Territory Government	Middle Arm (Darwin Harbour) West Arm (Darwin Harbour)
	Benthic Sediment Monitoring for Darwin Harbour. Darwin Harbour Integrated Marine Monitoring and Research Program	Northern Territory Department of Environment, Parks and Water Security	Darwin Harbour
	Radke L, Majid M, Wyatt J, Lambrinidis D, Logan M, Fortune J, Nicholas T (2021) Benthic sediment sampling campaign of Middle Arm and West Arm, Darwin Harbour (2020): Survey record and data report. Technical Report No. 11/2021, Department of Environment and Natural Resources, Northern Territory Government, Darwin, Northern Territory.	Department of Environment and Natural Resources, Northern Territory Government	Darwin Harbour
	RPS (2023) Pipeline Benthic Survey Report – Barossa DPD. Prepared for Santos	Santos	Along the Barossa Darwin Pipeline Duplication Darwin Harbour

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
	Radke L, Majid M, Low Choy D (2024) Darwin Harbour Integrated Marine Monitoring and Research Program Benthic Sediment Monitoring Report 2023-24. DEPWS Technical Report 008/2024	Northern Territory Government	Darwin Harbour
	Proposed Browse to North West Shelf Project, Appendix D.1: Browse to NWS Project Trunkline Route Surveys (2019) Environmental Survey Report. Neptune Document J11200-1-RR-006	Advisian/Neptune	Kimberley Marine Park Continental Slope Demersal Fish KEF Agro-Rowley Terrace Marine Park Ancient Coastline at 125 m Depth Contour KEF
Intertidal and coastal habitats	Salum R, Staben G, Roach C (2023). Darwin Harbour Integrated Marine Monitoring and Research Program. Mangrove Monitoring Report 2022-2023: Mangrove Health 2022. Technical Report No 5/2023, Department of Environment, Parks and Water Security, Northern Territory Government, Darwin, NT.	Rangelands Division-Northern Territory Department of Environment, Parks and Water Security	Darwin Harbour
	Brocklehurst P, Edmeades B, Munns P (2017) Mangroves of the Darwin Region: Native Point to Adelaide River, Northern Territory, 1996-2016. Technical Report: 3/2017D. Department of Environment and Natural Resources, Darwin, NT.	Northern Territory, Department of Environment, Parks and Water Security	Bynoe Harbour Charles Point Darwin Harbour Shoal Bay Gunn Point Adelaide River
	O2 Marine (2019) Darwin Industrial Processing Facility Benthic Habitat and Communities. Report R190216	O2 Marine for TNG Limited	Darwin Harbour East Channel Island (Darwin harbour) Middle Arm (Darwin harbour) Elizabeth River (Darwin harbour)
	Salum R and Roach C (2024). Darwin Harbour Integrated Marine Monitoring and Research Program. Mangrove Monitoring Report 2023-2024: Mangrove Health 2023. Technical Report No 22/2024, Department of Environment, Parks and Water Security, Northern Territory Government, Darwin, NT.	NT Department of Environment, Parks and Water Security	Darwin Harbour
	Lincoln G, Mathews D, Oades D with the Balanggarra, Bardi Jawi, Dambimangari, Karajarri, Mayala, Nyangumarta, Nyul Nyul, Wunambal Gaambera & Yawuru ISWAG members (2021) The Kimberley Indigenous Turtle & Dugong Initiative 2021-2031. Prepared by Mosaic Environmental for the Kimberley Indigenous Saltwater Advisory Group (ISWAG) Broome 2021	Coordinated by the Kimberley Indigenous Saltwater Advisory Group, implemented by Kimberley saltwater communities, supported	Kimberley

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
		by Western Science partners	
Benthic habitat	O2 Marine (2019) Darwin Industrial Processing Facility Benthic Habitat and Communities. Report R190216	O2 Marine for TNG Limited	Darwin Harbour East Channel Island (Darwin harbour) Middle Arm (Darwin harbour) Elizabeth River (Darwin harbour)
	Galaiduk R, Radford B, Harries S, Case M, Williams D, Low Choy D, Smit N (2019) Technical Report: Darwin – Bynoe Harbours predictive mapping of benthic communities. Australian Institute of Marine Science, Perth. pp 42.	AIMS	Darwin Harbour Bynoe Harbour
	AIMS (2023) Ranger led marine ecological surveys within the Joseph Bonaparte Gulf Marine Park. https://apps.aims.gov.au/metadata/view/e72fea7c-8959-4fcc-b504-54c9b1ba1d88, accessed 22-May-2024.	AIMS	Joseph Bonaparte Gulf Emu Break (Joseph Bonaparte Gulf Marine Park) Emu Reefs (Joseph Bonaparte Gulf Marine Park) Howland Shoals (Joseph Bonaparte Gulf Marine Park) Tchinbilli Reef
	RPS (2023) Pipeline Benthic Survey Report – Barossa DPD. Prepared for Santos	Santos	Along the Barossa Darwin Pipeline Duplication Darwin Harbour
	RPS (2024) DPD Trench Monitoring Pilot Survey Technical Report. Prepared for Santos	Santos	Darwin Harbour Woods Inlet Charles Point Fannie Bay East Point Casuarina Channel Island Wickham Point South Shell Island

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
			Weed Reef Mandorah Santos DPD Pipeline NT
	Proposed Browse to North West Shelf Project, Appendix D.1: Browse to NWS Project Trunkline Route Surveys (2019) Environmental Survey Report. Neptune Document J11200-1-RR-006	Advisian/Neptune	Kimberley Marine Park Continental Slope Demersal Fish KEF Agro-Rowley Terrace Marine Park Ancient Coastline at 125 m Depth Contour KEF
	DBCA Monitoring	DBCA Marine Science	North Kimberley Marine Park Cape Londonderry (North Kimberley Marine Park) Niiwalara (North Kimberley Marine Park) Angel Bay (North Kimberley Marine Park) Rocky Point (North Kimberley Marine Park) Seahorse Island (North Kimberley Marine Park) Cassini Island (North Kimberley Marine Park) Hat Point (North Kimberley Marine Park) Krait Bay (North Kimberley Marine Park) Long Reef Berthier Island (North Kimberley Marine Park) Maret Island Bernouilli Island (North Kimberley Marine Park)

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
			Hedley Island (North Kimberley Marine Park) Keraudren Island (North Kimberley Marine Park)
Marine fish and elasmobranchs	Kyne PM, Brooke B, Davies CL, Ferreira L, Finucci B, Lymburner L, Phillips C, Thums M, Tulloch V (2018). Final Report. Scoping a Seascape Approach to Managing and Recovering Northern Australian Threatened and Migratory Marine Species. Report to the National Environmental Science Programme, Marine Biodiversity Hub. Charles Darwin University, Darwin.	Darwin University	Northern Territory Coastline
	AIMS (2023) Ranger led marine ecological surveys within the Joseph Bonaparte Gulf Marine Park. https://apps.aims.gov.au/metadata/view/e72fea7c-8959-4fcc-b504-54c9b1ba1d88, accessed 22-May-2024.	AIMS	Joseph Bonaparte Gulf Emu Break (Joseph Bonaparte Gulf Marine Park) Emu Reefs (Joseph Bonaparte Gulf Marine Park) Howland Shoals (Joseph Bonaparte Gulf Marine Park) Tchinbilli Reef
	Conservation and management of dugongs, cetaceans and threatened marine matters of national environmental significance in the Top End (including green sawfish and freshwater sawfish)	The offset program commenced in 2021 and is implemented through a collaborative effort between INPEX, on behalf of the Ichthys Joint Venture partners, and the Northern Territory Department of Environment, Parks and Water Security	Northern Territory Coastline
	Australian Institute of Marine Science (AIMS). (2023). Understanding bio-cultural values of Moonjaniid jina baaliboor (Brue Reef) in the Kimberley Marine Park: Co-designing a project between Traditional Owners, the Australian Institute of Marine Science and Parks Australia. https://apps.aims.gov.au/metadata/view/2dcee86e-3bc3-43af-be7c-7d6d51065725, accessed 07-Oct-2024.	AIMS	Kimberley Marine Park Brue Reef
	West K, Harry A, Payet S, Harvey E, Dambimangari Rangers, Bardi-Jawi Rangers, Karajarri Rangers, Yawuru Country Managers, Travers M (2023): Comparative assessment of eDNA metabarcoding and longline deployments for elasmobranch surveying across a large tropical marine park network. v1. CSIRO. Data Collection. https://doi.org/10.25919/8wvd-e269	CSIRO DPIRD Curtin University	Kimberley Marine Park Roebuck Marine Park

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
	Feutry P, Laird A, Davies CL, Devloo-Delva F, Fry G, Johnson G, Gunasekara RM, Marthick J, Kyne PM (2021) Population structure of Narrow Sawfish Anoxypristis cuspidata across northern Australia. Report to the National Environmental Science Program Marine Biodiversity Hub. CSIRO, Charles Darwin University, and NPF Industry Pty Ltd.	CSIRO	Kimberley Northern Territory coastline
	West K, Travers MJ, Stat M, Harvey ES, Richards ZT, DiBattista JD, Newman SJ, Harry A, Skepper CL, Heydenrych M, Bunce M (2021) Large-scale eDNA metabarcoding survey reveals marine biogeographic break and transitions	Trace and Environmental DNA (TrDNA) Laboratory, Curtin University	Kimberley
	DBCA Monitoring	DBCA Marine Science	Lalang-gaddam Marine Park Iron Islands (Lalang-gaddam Marine Park) Sister Islands (Lalang-gaddam Marine Park) King fisher Islands (Lalang-gaddam Marine Park) Montgomery Reef Okenia Reef (Lalang-gaddam Marine Park) Big Lucas Island (Lalang-gaddam Marine Park) Degerando Island (Lalang-gaddam Marine Park) Champagny Reef (Lalang-gaddam Marine Park)
Fisheries	Meteyard B (2024) Northern Prawn Fishery Data Summary 2023. NPF Industry Pty Ltd, Australia	Northern Prawn Fishery PTY Ltd	Northern Territory Kimberley Queensland
	Lynch TP, Smallwood CB, Ochwada-Doyle FA, Lyle J, Williams J, Ryan KL, Devine C, Gibson B, Jordan A (2020) A cross continental scale comparison of Australian offshore recreational fisheries research and its applications to Marine Park and fisheries management. – ICES Journal of Marine Science, 77 (3): 1190–1205.	CSIRO	Australia wide
	Errity C, Penny SS, Steffe A (2022) A Survey of Recreational Fishing in the Greater Darwin area 2016. Northern Territory Government, Australia. Fishery Report No 124.	Department of Industry Tourism and Trade,	Darwin Harbour Bynoe Harbour

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
		Northern Territory Government	Shoal Bay
	Knuckey I, Koopman M (2022). Survey of Tropical Snapper in Northern Territory Fisheries — 2021.	Department of Industry Tourism and Trade, Northern Territory Government	Northern Territory
	Errity C, Penny, SS, Steffe A (2022) A Survey of Recreational Fishing in the Greater Darwin area 2017. Northern Territory Government, Australia. Fishery Report No 125	Department of Industry Tourism and Trade, Northern Territory Government	Darwin Harbour Bynoe Harbour Shoal Bay
	West LD, Stark KE, Dysart K, Lyle JM (2022) Survey of recreational fishing in the Northern Territory: 2018 to 2019. Northern Territory Government, Australia	Department of Industry Tourism and Trade, Northern Territory Government	Northern Territory
	Northern Territory Government (2019) Status of Key Northern Territory Fish Stocks Report 2017. Northern Territory Government Department of Primary Industry and Resources. Fishery Report No. 121.	Department of Primary Industry and Resources, Northern Territory Government	Northern Territory
Reptiles	Ferreira LC, Thums M, Whiting S, Meekan M, Andrews-Goff V, Attard CRM, Bilgmann K, Davenport A, Double M, Falchi F, Guinea M, Hickey SM, Jenner C, Jenner M, Loewenthal G, McFarlane G, Möller LM, Norman B, Peel L, Pendoley K, Radford B, Reynolds S, Rossendell J, Tucker A, Waayers D, Whittock P, Wilson P and Fossette S (2023) Exposure of marine megafauna to cumulative anthropogenic threats in north-west Australia. Front. Ecol. Evol. 11:1229803. doi: 10.3389/fevo.2023.1229803	AIMS	Pilbara Coast Kimberley Northern Territory coastline
	Udyawer V, D'Anastasi B, McAuley R, Heupel M (2016) Exploring the status of Western Australia's sea snakes. National Environmental Science Programme	AIMS	Shark Bay Ningaloo Coast World Heritage Area Port Hedland Rowley Shoals Oceanic Shoals
	Kyne PM, Brooke B, Davies CL, Ferreira L, Finucci B, Lymburner L, Phillips C, Thums M, Tulloch V (2018). Final Report. Scoping a Seascape Approach to Managing and Recovering Northern Australian Threatened and Migratory Marine Species. Report to the National Environmental Science Programme, Marine Biodiversity Hub. Charles Darwin University, Darwin.	Darwin University	Northern Territory Coastline
	Field Island (Gardangarl) - sea turtle monitoring	Gardangarl (Field Island) flatback turtle monitoring	Field Island
	New project to look at climate impacts on Northern Australia's turtle population	AIMS	Northern Territory Coastline

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
		Charles Darwin University Indigenous ranger groups	Tiwi Islands
	New protect 'how sea turtles are helping us unlock the secrets of Australia's remote seas'	AIMS	Tiwi Islands North West Crocodile Island
	Management Program for the Saltwater Crocodile (*Crocodylus porosus*) in the Northern Territory of Australia, 2016-2020	Department of Environment, Parks and Water Security, Northern Territory Government	Adelaide River Blyth River Cadell River Daly River Glyde River Liverpool River Mary River Tomkinson Rivers East Alligator River West Alligator River South Alligator River Wildman Rivers
	Conservation and management of dugongs, cetaceans and threatened marine matters of national environmental significance in the Top End	The offset program commenced in 2021 and is implemented through a collaborative effort between INPEX, on behalf of the Ichthys Joint Venture partners, and the Northern Territory Department of Environment, Parks and Water	Northern Territory Coastline
	Lincoln G, Mathews D, Oades D with the Balanggarra, Bardi Jawi, Dambimangari, Karajarri, Mayala, Nyangumarta, Nyul Nyul, Wunambal Gaambera & Yawuru ISWAG members (2021) The Kimberley Indigenous Turtle & Dugong Initiative 2021-2031. Prepared by Mosaic Environmental for the Kimberley Indigenous Saltwater Advisory Group (ISWAG) Broome 2021	Coordinated by the Kimberley Indigenous Saltwater Advisory Group, implemented by Kimberley saltwater communities, supported by Western Science partners	Kimberley

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
	Tucker AD, Pendoley KL, Murray K, Loewenthal G, Barber C, Denda J, Lincoln G, Mathews D, Oades D, Whiting SD, et al. (2021) Regional Ranking of Marine Turtle Nesting in Remote Western Australia by Integrating Traditional Ecological	DBCA WAMSI	Kimberley
Marine megafauna (whale shark, dugong and cetaceans)	Brooks L, Palmer C, Griffiths AD, Pollock KH (2017) Monitoring variation in Small Coastal dolphin populations: An example from Darwin, Northern Territory, Australia, Frontiers in Marine Science, 4(APR), pp. 1–16.	Southern Cross University	Bynoe Harbour Darwin Harbour Shoal Bay
	Griffiths AD, Groom RA, Low Choy D, Mackarous K, Brooks L (2020) Darwin Region Coastal Dolphin Monitoring Program: Final Report – 2011 to 2019. Department of Environment, Parks and Water Security, Northern Territory Government.	Northern Territory Flora and fauna Division, Department of Environment, Parks and Water Security	Darwin Harbour Bynoe Harbour Shoal Bay
	Groom RA, Dunshea GJ, Griffiths AD, Mackarous K (2017) The distribution and abundance of dugong and other marine megafauna in the Northern Territory. Department of Environment and Natural Resources, Darwin.	Northern Territory Government	Northern Territory Coastline
	Palmer C, Brooks L, Fegan M, Griffiths T (2017) Conservation Status of Coastal Dolphins in the Northern Territory: Final Report. Marine Ecosystems Group, Flora and Fauna Division, Department of Environment and Natural Resources. Darwin.	Northern Territory Government	Northern Territory Coastline
	Kyne PM, Brooke B, Davies CL, Ferreira L, Finucci B, Lymburner L, Phillips C, Thums M, Tulloch V (2018) Final Report. Scoping a Seascape Approach to Managing and Recovering Northern Australian Threatened and Migratory Marine Species. Report to the National Environmental Science Programme, Marine Biodiversity Hub. Charles Darwin University, Darwin.	Darwin University	Northern Territory Coastline
	Conservation and management of dugongs, cetaceans and threatened marine matters of national environmental significance in the Top End	The offset program commenced in 2021 and is implemented through a collaborative effort between INPEX, on behalf of the Ichthys Joint Venture partners, and the Northern Territory Department of Environment, Parks and Water	Northern Territory Coastline
	von Takach B, Woolley L-A, Banks S (2020) Population Viability Analysis for Three Species of Coastal Dolphin in Darwin Harbour. Research Institute for the Environmental and Livelihoods, Charles Darwin University	Charles Darwin University	Darwin Harbour
	Ferreira LC, Thums M, Whiting S, Meekan M, Andrews-Goff V, Attard CRM, Bilgmann K, Davenport A, Double M, Falchi F, Guinea M, Hickey SM, Jenner C, Jenner M, Loewenthal G, McFarlane G, Möller LM, Norman B, Peel L, Pendoley K, Radford B, Reynolds S, Rossendell J, Tucker A, Waayers D, Whittock P,	AIMS	Shark Bay Ningaloo Coast World Heritage Area

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
	Wilson P and Fossette S (2023) Exposure of marine megafauna to cumulative anthropogenic threats in north-west Australia. Front. Ecol. Evol. 11:1229803. doi: 10.3389/fevo.2023.1229803		Kimberley
	Bouchet PJ, Thiele D, Marley SA, Waples K, Weisenberger F, Balanggarra Rangers, Bardi Jawi Rangers, Dambimangari Rangers, Nyamba Buru Yawuru Rangers, Nyul Nyul Rangers, Uunguu rangers, Raudino H (2021) Regional Assessment of the Conservation Status of Snubfin Dolphins (*Orcaella heinsohni*) in the Kimberley Region , Western Australia, Frontiers in Marine Science, 7(January), pp. 1–20.	University of St Andrews	Kimberley Roebuck Bay Cygnet Bay Prince Regent River Cambridge Gulf
	Lincoln G, Mathews D, Oades D with the Balanggarra, Bardi Jawi, Dambimangari, Karajarri, Mayala, Nyangumarta, Nyul Nyul, Wunambal Gaambera & Yawuru ISWAG members (2021) The Kimberley Indigenous Turtle & Dugong Initiative 2021-2031. Prepared by Mosaic Environmental for the Kimberley Indigenous Saltwater Advisory Group (ISWAG) Broome 2021	Coordinated by the Kimberley Indigenous Saltwater Advisory Group, implemented by Kimberley saltwater communities, supported by Western Science partners	Kimberley
Seabirds and shorebirds	Kyne PM, Brooke B, Davies CL, Ferreira L, Finucci B, Lymburner L, Phillips C, Thums M, Tulloch V (2018) Final Report. Scoping a Seascape Approach to Managing and Recovering Northern Australian Threatened and Migratory Marine Species. Report to the National Environmental Science Programme, Marine Biodiversity Hub. Charles Darwin University, Darwin.	Darwin University	Northern Territory Coastline
	Lilleyman A, Maglio G, Bush R, Jessop R, Wright P, Minton CDT (2018) Darwin Shorebird Catching: Expedition Report 2018	Charles Darwin University	Darwin Harbour Finniss Beach East Arm Wharf (Darwin Harbour) Sandy Creek Lee Point-Buffalo Creek Tree Point
	Lilleyman A, Alley A, Jackson D, O'Brien G, Garnett ST (2018) Distribution and abundance of migratory shorebirds in Darwin Harbour, Northern Territory, Australia. Northern Territory Naturalist 28: 30-42	Charles Darwin University	Darwin Harbour East Arm Wharf (Darwin Harbour)
	SLR Consulting (2024) Preliminary Migratory Shorebird Survey. Undertaken for Aurizon Operations Ltd	Aurizon Operations Limited	Darwin Harbour
	Lilleyman A (2020) Constraints to migratory shorebird populations at a tropical non-breeding site in northern Australia. PhD Thesis	Charles Darwin University	Darwin Harbour East Arm Wharf (Darwin Harbour) Spot on Marine (Darwin Harbour)

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent
			Nightcliff Rocks (Darwin Harbour) Sandy Creek Lee Point-Buffalo Creek East Point (Darwin Harbour)
	Ecological and Heritage Partners (2023) Shorebird monitoring plan: Lee Point, Darwin, Northern Territory. Prepared for Defence Housing Australia	Ecology and Heritage Partners	Sandy Creek Lee Point-Buffalo Creek East Point (Darwin Harbour) Nightcliff Rocks (Darwin Harbour) Spot on Marine (Darwin Harbour)
	Conservation and management of dugongs, cetaceans and threatened marine matters of national environmental significance in the Top End (including great knot, great sand plover, lesser sand plover)	The offset program commenced in 2021 and is implemented through a collaborative effort between INPEX, on behalf of the Ichthys Joint Venture partners, and the Northern Territory Department of Environment, Parks and Water	Northern Territory Coastline

Appendix E Initial oil characterisation sampling

Oil sampling and analysis

Oil sampling kits are held by Santos for the purposes of taking initial spilled oil/ oily water samples. Santos also maintains procedures to guide untrained personnel in the collection of these initial samples, which may be taken by vessel crew. Trained personnel may be deployed to the field via the OSM Services Provider to continue sampling as required as part of ongoing operational monitoring.

Sampling kits are positioned at Santos strategic locations (refer to Table 9-2) and will be mobilised to the required locations when needed. The kits contain all necessary equipment and sampling containers for shipping to a laboratory for analysis.

The Santos Oil and Water Sampling Procedures (7710-650-PRO-0008) defines the sampling protocol and procedures, and broad implementation guidance is provided in Table E-1.

Using on-site Vessel of Opportunity (VOOs), oil samples are to be taken daily where possible from fresh oil, and from the weathered oil locations.

Laboratory analysis

Laboratory analysis of the chemical and physical properties of the recovered oil, including gas chromatography/mass spectrometry for the purpose of fingerprinting the oil constituents, is to be undertaken. Fingerprinting of the released hydrocarbon potentially allows contamination to be traced back to the source where this is otherwise unclear or in dispute. The Santos Oil and Water Sampling Procedures (7710-650-PRO-0008) outlines the suite of available oil testing and fingerprinting analyses that can be performed by the preferred laboratories. Details of the testing laboratories can also be found within the document.

Ecotoxicology assessment of the oil is to be conducted at an ecotoxicology capable laboratory following the revised Australian and New Zealand Water Quality Guidelines, if the hydrocarbon is from Santos fields/reservoirs and ecotoxicology testing has not already been done (i.e. pre-spill). The quantity of sample required for analysis will be confirmed by the laboratory but is expected to be in the order of 6 to 10 L. Testing results will provide the concentrations at which toxicity endpoints consistent with revised Australian and New Zealand Water Quality Guidelines are met for each test. Overall species protection concentrations, including 90%, 95% and 99% species protection trigger levels are then to be generated using a species sensitivity distribution fitted to the data (e.g. by using the Burrlioz software program).

Table E-1: Implementation guidance – initial oil characterisation

Action		Consideration	Responsibility	Complete
Initial actions	Source available vessels (on hire or VOO) for oil sampling.	Can be multi-tasked – e.g. for vessel surveillance or tracking buoy deployment.	Operations Section Chief Logistics Section Chief	☐
	Source sampling equipment. Confirm sampling methodology. Confirm laboratory for sample analysis. Develop health and safety requirements/controls.	Refer Table 9-2 for resource availability. The Santos Oil and Water Sampling Procedures (7110-650-PRO-0008) provide the procedures for sampling.	Environment Unit Lead Safety Officer	☐
	Vessel directed to sampling location.	Sampling of oil at thickest part of slick – typically leading edge.	Operations Section Chief	☐
	Vessel crew to undertake sampling and delivery of samples to nearest Port for dispatch to laboratory. Environment Unit Lead to confirm analysis of oil with lab.	Darwin Logistics personnel to assist with logistics of sending oil samples to laboratory for analysis.	Operations Section Chief Environment Unit Lead Logistics Section Chief	☐
Ongoing actions	Continue sample collection post release where oil is available.	Initial monitoring by crew of available vessels – Once mobilised to site OSM Services Provider to continue sampling of oil in conjunction with operational water quality monitoring.	Operations Section Chief Environment Unit Lead Logistics Section Chief	☐

Appendix F OSM Services Provider Call Off Order Form

Operational and Scientific Monitoring (OSM) Services Call-Off Order Form

Please do not hesitate in contacting the Duty Manager at the earliest opportunity in the event of an incident or potential incident. Please ensure you telephone the Duty Manager before e-mailing or faxing this completed form

Oil Spill Response Limited's safety policy requires us to work closely with the mobilising party to ensure all aspects of safety and security are addressed for our personnel.

To	Duty Manager
OSRL Base	Southampton, UK Loyang, Singapore Fort Lauderdale, USA
Telephone	+65 6266 1566
Emergency Fax	+65 6266 2312
Email	dutymanagers@oilspillresponse.com, osm@oilspillresponse.com

Details of Authorised Contact				
Mobilising Company				
Name of Person Authorising OSRL				
Position of Authorising Representative				
Direct Phone Number	Country Code	+	Number	
Email Address				

Operational Monitoring service to be activated (X)		**Scientific Monitoring service to be activated (X)**	
OM1 Hydrocarbon Properties and Weathering Behaviour at Sea		**SM1** Water Quality Impact Assessment	
OM2 Water Quality Assessment		**SM2** Sediment Quality Impact Assessment	
OM3 Sediment Quality Assessment		**SM3** Intertidal and Coastal Habitat Assessment	
OM4a Surface Chemical Dispersant Effectiveness and Fate Assessment		**SM4** Seabirds and Shorebirds	
OM4b Subsea Dispersant Injection Monitoring		**SM5** Marine Mega-fauna Assessment	
OM5 Marine Fauna Surveillance		**SM6** Benthic Habitat Assessment	
OM6 Shoreline Clean-up Assessment		**SM7** Marine Fish and Elasmobranch Assemblages Assessment	
		SM8 Fisheries Impact Assessment	
		SM9 Heritage Features Assessment	
		SM10 Social Impact Assessment	

Location of Port of Staging/ Departure – Port (X)	**Additional Information**

Ashburton		
Barrow Island		
Broome		
Cape Preston		
Dampier		
Darwin		
Derby		
Exmouth		
Onslow		
Port Hedland		
Port Walcott		
Varanus Island		
Wyndham		
Yampi Sound		
Others (*To be Agreed)		

Location of Port of Staging/ Departure – Airport (X)		Additional Information
Barrow Island		
Broome		
Cape Preston		
Darwin		
Derby		
Karratha		
Learmonth		
Lombardina		
Onslow		
Pardoo		
Perth		
Port Hedland		
Roebourne		
Wallal Downs		
Others (*To be Agreed)		

Request for OSM position to IMT/EMT (X)		IMT/EMT Address
OSM Implementation Lead		
OSM Field Operations Manager		
SM Coordinator		
OM Coordinator		

Invoice Address if available	
Purchase Order Number	

I, the above-named Authorising Representative for the Mobilising Company, approve activation of Oil Spill Response Limited and its resources for OSM Services under the terms of the SUPPLEMENTARY SERVICE AGREEMENT FOR OPERATIONAL AND SCIENTIFIC MONITORING (OSM) SERVICES Agreement in place between the above stated Company and Oil Spill Response PTY Limited.

Signature:		Date / Time (UTC+8):		

Please telephone the Duty Manager to confirm receipt the completed form after sending this completed form.