

timor leste



COVA-1 EXPLORATION DRILLING ENVIRONMENTAL IMPACT STATEMENT

TL-HSE-RP-004

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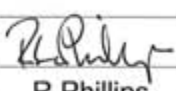


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<p>This Environmental Impact Statement (EIS) for the Cova-1 drilling campaign was prepared in accordance with <i>Regulation 27/1999</i> and the Framework of Reference document submitted to the Direcção Nacional Do Meio Ambient (DNMA). The EIS provides information concerning the drilling of the Cova-1 exploration well and its associated potential environmental and social impacts.</p>					
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ABBREVIATIONS

ADIOS2	Automated Data Inquiry for Oil Spills
ALARP	As Low As Reasonably Practicable
ANP	Autoridade Nacional do Petroleo (National Petroleum Authority)
BBL	Barrel
BOD	Biological Oxygen Demand
BOP	Blow-out Preventer
CAMBA	China-Australia Migratory Bird Agreement
CITES	Convention on International Trade in Endangered Species
CMP	Crisis Management Plan
CMS	Convention on Migratory Species
DNMA	Direcção Nacional do Meio Ambiente (National Directorate of Environment)
DNPA	Direcção Nacional de Pescas e Aquicultura (National Directorate of Fisheries & Aquaculture)
DNPG	Direcção Nacional de Petróleo e Gas (National Directorate of Petroleum & Gas)
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
Eni	Eni Timor Leste S.p.A.
EPBC	Environment Protection and Biodiversity Conservation
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESD	Emergency Shutdown
FoR	Framework of Reference
FPSO	Floating Production Storage and Offloading
GDP	Gross Domestic Product
HSE	Health, Safety and Environment
IMS	Integrated Management System
IUCN	International Union for the Conservation of Nature
JAMBA	Japan- Australia Migratory Bird Agreement
JPDA	Joint Petroleum Development Area
KCl	Potassium Chloride
LAT	Lowest Astronomical Tide
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto
MMO	Marine Mammal Observers
MP	Management Plan
NGO	Non-government Organisation
OBM	Oil Based Mud



ODS	Ozone Depleting Substances
OIW	Oil in Water
OSCP	Oil Spill Contingency Plan
PHG	Prehydrated gel
PHPA	Partially-hydrolyzed polyacrylamide
PSC	Production Sharing Contract
PSV	Platform Supply Vessel
ROV	Remotely Operated Vehicle
SBM	Synthetic Based Mud
SERN	Secretariat for Natural Resources
SOI	Southern Oscillation Index
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
WBM	Water Based Mud



EXECUTIVE SUMMARY

This Environmental Impact Statement (EIS) presents the outcomes of a detailed environmental impact assessment for the Cova-1 exploration well drilling campaign. It addresses the environmental and social impacts and management issues associated with the drilling of the Cova-1 exploration well. This assessment concludes that the drilling can be managed to achieve its objectives, without causing unacceptable environmental and socio-economic effects.

INTRODUCTION

Background

Eni Timor Leste S.p.A. (Eni) proposes to drill the Cova-1 exploration well in deep waters (~1,900m) in permit areas S-06-03 (Contract Area C). The permit is located in the northern Bonaparte Basin in Timor Leste sovereign waters, approximately 100km from the southeast coast of Timor Leste, approximately 125km south of Dili and approximately 725km northwest of Darwin (Figure ES.1).

The campaign will last approximately 45 days, with drilling scheduled to commence in September 2010. Cova-1 will be drilled by the *Saipem 10000* drillship.

The Proponent

The proponent of this proposal is Eni Timor Leste S.p.A (Eni). Eni's contact details are:

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Production Sharing Contract (PSC) S06-03 is a joint venture between Eni (80%), KG Timor Leste Limited (10%) and Galp Exploration and Production (Timor Leste) SA (10%).

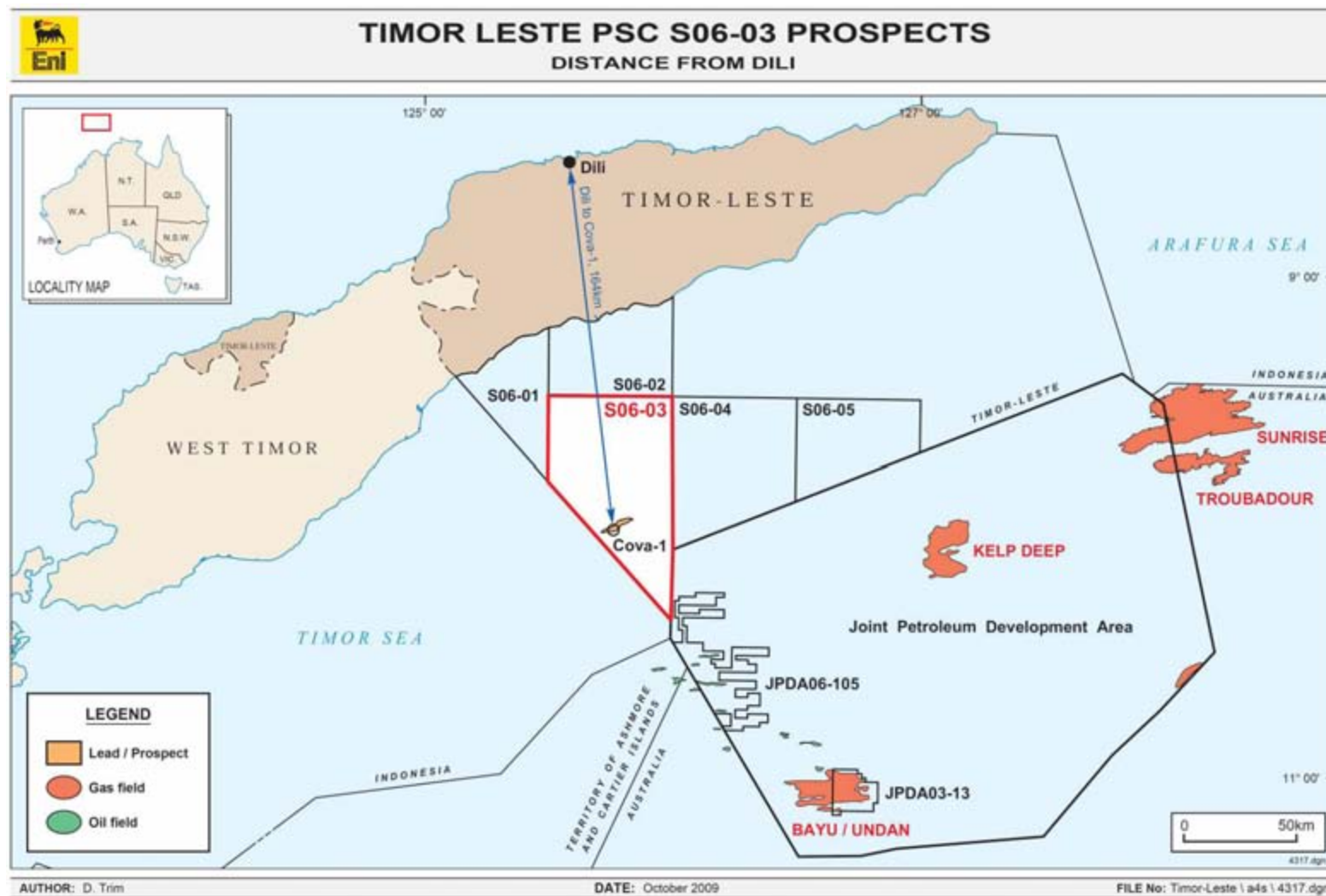


Figure ES.1 Cova-1 Well Location.

THE PROJECT

Proposed Drilling Program

Cova-1 is planned to be drilled in September 2010 as a vertical exploration well. Drilling will be undertaken using the drillship, *Saipem 10000* (Figure ES.2). On arrival at site, the drillship will move into position and remain in position using the Class III Dynamic Positioning system.



Figure ES.2 *Saipem 10000*.

The top sections of the well will use seawater and prehydrated gel (PHG) sweeps. Approximately 150m³ of drill cuttings would be produced and the cuttings will continuously discharged directly on to the surface of the seabed adjacent to the well. The bottom sections of the well will be drilled using WBMs with KCl as the clay stabiliser and weighting agent. A riser will be installed to return cuttings (approximately 250m³) to the drillship where they will be processed to retain the fluids prior to disposing of the cuttings at the sea surface.

ENVIRONMENTAL SETTING

Physical Environment

The climate of the Timor Sea is monsoonal with a wet “summer” and a dry “winter”. The wet season commences between September and November as the southeast trade winds (SE Trades) weaken over Northern Australia and land temperatures rise. Mean annual rainfall in the region is 1,700mm. Almost all rainfall occurs between November and April, the greatest falls being in January and February. Mean air temperature ranges between a mean of 26.9°C in July and 28.4°C in December and vary little during the year. Regional sea surface temperatures range from 26°C to 31°C.

Wind direction is predominantly northeast to southeast in winter months and southwest to west in summer months. A tropical cyclone period prevails over the region from November to April. Surface currents reflect seasonal wind regimes, with summer easterly to north-easterly currents, and winter westerly to south-westerly currents. The Timor Sea region is influenced by the Pacific-Indian Ocean Throughflow which contributes to the westward-flowing South Equatorial Current.

The proposed Cova-1 exploration well is located on the continental slope in an area of uniformly smooth seabed ranging in depth 1,900m to 1,950m. To the north the continental slope continues to decline steadily reaching depths in excess of 2,500m in the Timor Trough.

A system of shoals occurs to the south and southwest of the Cova-1 location (Figure ES.3). The system stretches for approximately 60km in a northeast/southwest direction along the outer edge of the Sahul Shelf and comprises 11 major shoals ranging in size from 0.05km² to 40km², with an average size of 4.6km². The nearest of these shoals, Big Bank Shoals, is located approximately 85km to the south of the Cova-1 well.

The nearest emergent reefs, Ashmore, Cartier and Hibernia, are located on the southwest end of Sahul Shelf. The nearest, Hibernia reef, is more than 300km to the southwest of Cova-1. The nearest shoreline is the southern coastline of Timor-Leste, located approximately 90km to the northwest.

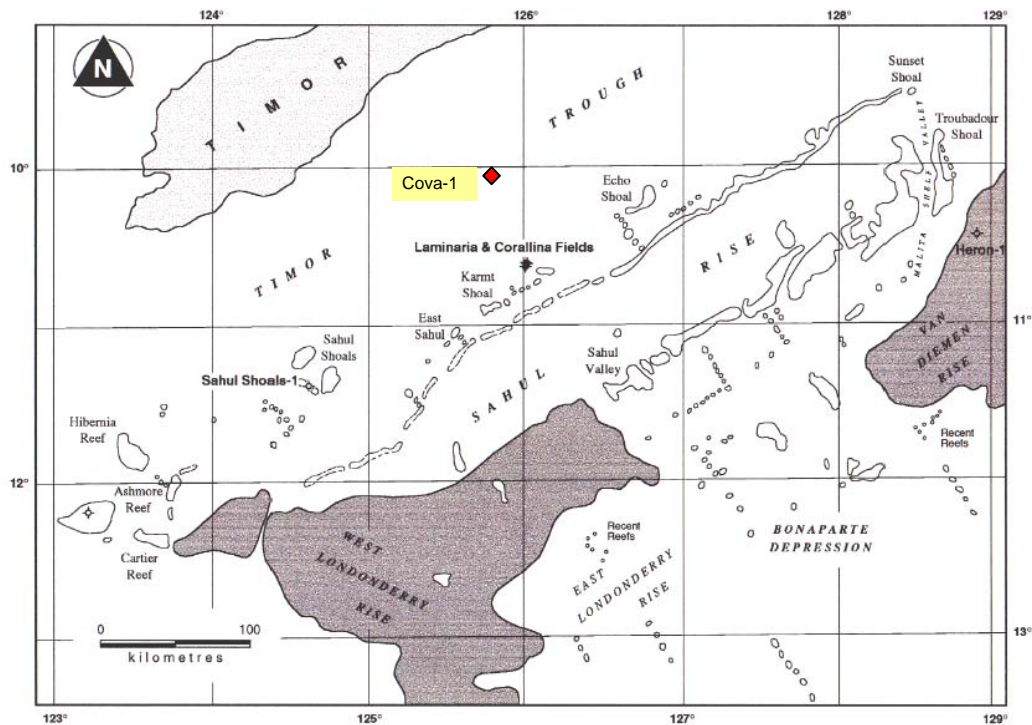


Figure ES.3 Regional Bathymetry.

Biological Environment

The Cova-1 well is situated in approximately 1,900m of water in the Timor Trough. The Timor Trough, in which Cova-1 is located, is classified as the bathypelagic zone (defined as between 1,000m and 4,000m deep). Sunlight does not penetrate the bathypelagic zone and bioluminescence is the only light. Despite the lack of light, the biota of the bathypelagic zone is diverse and sperm whales (*Physeter macrocephalus*) are capable of diving to the bathypelagic zone to feed on deep sea cephalopods and other megafauna.

As no plants can grow in the bathypelagic zone because of lack of light, the fauna are carnivorous, catching in their wide jaws the falling debris of the organisms which exist above them. Fish are common in the bathypelagic zone, typically feeding by ambushing prey or by attracting prey using bioluminescent lures. Due to the relatively small changes in pressure with depth, fish inhabiting the bathypelagic zone can move freely over wide depth changes without being affected by pressure changes. As such, fish species occurring in the bathypelagic zone would be expected to occur over wide depth and geographical ranges.

Benthic invertebrates inhabiting the seabed would be expected to exhibit high diversity though low abundance and productivity due to the water depth, lack of light and reliance on detrital "rain" to drive deep sea ecosystems. Infaunal assemblages would be expected to be dominated by polychaete worms and crustaceans as is typical of marine infaunal assemblages elsewhere including those of continental shelf and slope habitats of the Timor Sea.

A number of whale, dolphin and porpoise species are likely to be encountered during the Cova-1 drilling program, with the Timor Trench providing an important flow-through of species connecting the Pacific and Indian Oceans. The Australian Environment Protection and Biodiversity Conservation (EPBC) Protected Matters Database was searched to determine whether species listed for protection under the Australian *EPBC Act 1999* (EPBC Act) potentially occurred in the Timor Sea and in particular in the region in which the proposed Cova-1 well is located. The EPBC Protected Matters Database search indicated that twenty-two whale and dolphin species could potentially occur in the Timor Sea near the Cova-1 well. Of these, the Pygmy Killer Whale (*Feresa attenuata*), Killer Whale (*Orcinus orca*), False Killer Whale (*Pseudorca crassidens*), Common Dolphin (*Delphinus delphis*) and the Bottlenose Dolphin (*Tursiops truncatus*) are likely to occur near Cova-1.

Five species of sea turtle may be expected to occur in Timor Sea waters either feeding or migrating between feeding and nesting grounds. These are the Flatback (*Natator depressus*), Hawksbill (*Eretmochelys imbricata*), Green (*Chelonia mydas*) and Leatherback (*Dermochelys coriacea*) and Loggerhead turtles. Fifteen species of seasnake are recorded from the Timor Sea and it is possible that some species inhabit shoals in the vicinity of the Kitan Development. The number and variety of fish species present in the region has not been quantified, although studies have identified a large variety of demersal fish which are common to the area.

A variety of seabirds are expected to pass near or use the Timor Sea waters as part of their main habitat. The bird species utilising the area most frequently are offshore species such as shearwaters, petrels and terns.

Socio-economic environment

Timor Leste is situated approximately 100km north of the proposed drilling location. In mid-2008, the population of Timor Leste was estimated to be 1.1 million. The capital, Dili, on the north coast of Timor-Leste, is serviced by a harbour capable of taking medium sized cargo ships. The airport at Dili is capable of taking medium to large passenger and cargo aircraft. The southern coastal area of Timor-Leste, adjacent to the Cova-1 well, includes the districts of Cova Lima, Ainaro and Manufahi. The two largest population centres on the coast adjacent to the drilling area are Suai (population 23,000), capital of Cova Lima district, and Betano, a coastal village in Manufahi.

Timor Leste is an agricultural based economy, primarily focused on subsistence farming. Traditionally, the East Timorese are not fishing people. Most fishing is from canoes or small boats with outboard motors that remain close to shore. However, the Government sees great potential to increase income from fishing in the future both in deepwater and near coastal areas. Currently, commercial fishing is not conducted in the area around the Cova-1 well location. The oil and gas industry is an emerging industry of major significance for the economy and people of Timor-Leste.

ENVIRONMENTAL IMPACTS AND MANAGEMENT

A high level risk assessment of the Cova-1 drilling campaign found that of fourteen broad hazard categories, one was considered to be high inherent risk and the remainder were considered low inherent risk. The high risk event was loss of well control resulting in a blowout. When the mitigation measures to prevent this occurring were taken into consideration the residual risk was reduced to a medium.

Oil Spills

Oil spills are the most significant potential threat to the environment from drilling. Oil spills can potentially occur from a number of sources ranging from major spills such as from a well blow-out, which is an extremely rare event, down to smaller leaks and spills from equipment and piping. The drilling campaign will be managed to avoid or minimise the potential for accidental releases of all substances, nevertheless, the potential exists for either Cova crude oil or diesel to be spilled at some time during the project.

Eni's safeguards to be implemented for the minimisation of environmental impacts associated with non-routine (accidental) discharges include:

- procedures to reduce the likelihood of oil spills occurring;
- procedures to minimise the volumes spilled; and
- actions to be taken minimise the environmental consequences in the event of a spill occurring, i.e. spill response.

Cova crude is expected to be similar to Kitan crude i.e. a light oil that evaporates readily. Oil weathering studies have indicated that 70-75% would evaporate within the first 24 hours of release to the marine environment, with the residual 25-30% remaining as a thin sheen on the sea surface. Fate and trajectory modelling predicted that oil would spread predominantly in a westerly direction, reflecting the predominant oceanic circulation and wind direction during the drilling program, with a very low (1-5%) probability of making contact with the Timorese coastline. The predicted minimum time to exposure was predicted to be two days by which time 75% of the original spill volume would have evaporated.

Diesel is classified as a light persistent oil. Diesels are expected to undergo a rapid spreading with moderate evaporative loss in tropical waters and, consequently, slicks are likely to break up. Oil weathering studies have indicated that 50% would evaporate within 24 hours of release to the marine environment, with the residual 50% becoming entrained into the water column. Fate and trajectory modelling predicted that diesel would spread predominantly in a westerly direction, reflecting the predominant oceanic circulation and wind direction during the drilling program, with a very low (<1%) probability of making contact with the Timorese coastline. The predicted minimum time to exposure was predicted to be two days by which time 50% of the original spill volume would have evaporated.



Eni and its contractors will have appropriate oil spill response procedures in place. The oil spill response procedures would be tested regularly to ensure their adequacy in responding to credible oil spill scenarios. Any release of crude oil or diesel into the marine environment would be recorded as an environmental incident and treated accordingly by Eni's incident investigation and corrective and preventative action processes.

Solid and Hazardous Wastes

Unintentional discharge of solid or hazardous wastes was determined to be a medium risk and the effects on the marine environment would vary depending on the nature of the material involved. For example, solid wastes such as plastics are persistent in the environment and have been implicated in the deaths of a number of marine species including marine mammals and turtles. This is due to ingestion, inhalation or physical entanglement. Hazardous wastes such as waste solvents, excess or waste chemicals, oil contaminated materials (e.g. sorbents, filters and rags), and batteries would expect to have localised toxicity effects. Eni's management of solid and hazardous wastes is to return it onshore for recycling or disposal. Any release of solid and hazardous wastes into the marine environment would be recorded as an environmental incident and treated accordingly by Eni's incident investigation and corrective and preventative action processes.

Drilling Discharges

Discharges to sea of drill cuttings and drilling mud was considered to pose a low risk, most likely resulting in localised short- to medium-term environmental effects. These are mainly turbidity plumes generated in the water column, localised smothering of seafloor habitats, alteration of sediment characteristics, and depletion of oxygen in surface sediments.

The nature of effects on seafloor animals will relate to the toxicity, persistence and biodegradability of synthetic-based drilling mud. Drill cuttings and associated drilling mud are expected to settle on the seafloor within a distance of 700m from the discharge point and at very low concentrations. The highest concentration of drill cuttings is expected to occur within 20m of the well as a result of drilling the riserless top section. Consequently, the concentration of drill cuttings and drilling mud on the seafloor at any point beyond a distance of approximately 20m of the discharge point is expected to be low, and insufficient to cause alteration to sediment characteristics to any extent that would affect sediment fauna composition and abundance.

Atmospheric Emissions

Atmospheric emissions from the Cova-1 drilling campaign are considered unlikely to have a significant impact on air quality at the local and regional scales as they are expected to be quickly dissipated into the surrounding atmosphere. Furthermore, the project area is remote from any land mass and far from sensitive receptors. Therefore, air emissions are not expected to contribute significantly to pollution and the deterioration in air quality.

SOCIO-ECONOMIC IMPACTS AND MANAGEMENT

Timor-Leste faces considerable challenges in rebuilding its infrastructure and creating employment opportunities for young people entering the workforce. The development of oil and gas resources in offshore waters has begun to supplement government revenues resulting in the creation of jobs. In general, the oil and gas industry may be expected to provide the following benefits to Timor-Leste:

- expansion of the economy due to increased service and supply requirements of the oil and gas industry;
- employment opportunities for a large proportion of the population;
- potential funding by the operators for community projects that the government is unable to fund and that donors have not funded;
- vocational education and training opportunities to develop a skilled workforce; and
- gas resources for domestic and industrial use in Timor Leste.

Article 5.4 of PSC S-06-03 includes clear obligations for Eni to provide a real opportunity to suppliers based in Timor-Leste and give preference in employment to Timor-Leste nationals and permanent residents. There is limited opportunity to incorporate significant local content into the Cova-1 drilling program due to the nature of the work and the short duration of the program. However, Eni endeavours to incorporate local content wherever feasible. For example, crew changes for the Cova-1 well will be conducted via helicopter based in Dili. Eni will continue to liaise with Timor-Leste stakeholders to identify and develop local content opportunities, particularly if development of the Cova field proves to be economically viable.

SUMMARY OF MANAGEMENT MEASURES AND COMMITMENTS

Eni is committed to undertaking its petroleum exploration and production activities in a manner that is consistent with the principle of sustainable development. Eni aspires to the goals of zero harm to its people, its host communities and the environment. In keeping with these goals and aspirations, Eni is committed to drilling the Cova-1 well in a manner that minimises impacts on the surrounding biophysical and social environments. Eni's commitments for drilling the Cova-1 well are presented in Table ES1, which are based on Eni's experience of drilling other wells in the Timor Sea.

STAKEHOLDER CONSULTATION

External consultation was initiated by Eni's consultation with DNMA and submission of the draft Framework of Reference (FoR) on 24 November 2009. The purpose of this consultation was to inform DNMA on the scale and nature of the Cova-1 drilling program, clarify the environmental approvals process and present Eni's draft Framework of Reference for the EIA. Subsequently, Eni arranged a forum in Timor-Leste on Tuesday 23rd February, to explain the details of the drilling program and answer questions. Further consultation will be undertaken as appropriate.



Since this early consultation, planning for the Cova-1 drilling program has progressed and this draft EIS has been developed. Eni will incorporate the feedback into the EMP for the project.

CONCLUSION

The Cova-1 well will be drilled in deep offshore waters. The environmental setting is deemed conducive to petroleum related activities given that no sensitive resources are located in the vicinity of the project area or will be impacted upon. Eni believes that by implementing the management strategies and commitments detailed in this EIS, the drilling of the Cova-1 exploration well can be undertaken without compromising the environmental values of the area, in particular the marine biota inhabiting the surrounding pelagic and benthic continental shelf habitats.



Table ES.1 Summary of Eni's Management Measures and Commitments

No.	Topic	Objective(s)	Management Action	Timing
1.	Integrated Management System	Provide a risk-based management system for the identification and control of impacts.	<ul style="list-style-type: none"> Implement Eni's HSE Integrated Management System for the Cova-1 well that embraces the ISO 14001 standards. 	Throughout the drilling program
2.	Environmental Management Plans	Provide operational control documentation for the management of environmental impacts associated with drilling.	<ul style="list-style-type: none"> Develop an EMP for the Cova-1 drilling program The EMP will incorporate environmental and social management measures detailed in Chapter 5 of this EIS where relevant. The EMP will be developed in consultation with DNMA. 	Prior to Drilling
3.	Risk assessment	Ensure project risks are fully identified and understood and management measures and controls are implemented accordingly.	<ul style="list-style-type: none"> Conduct a detailed environmental and social risk assessment for the Cova-1 drilling program. Maintain the findings of the risk assessment in a project Risk Register. Incorporate any additional management measures identified during the detailed risk assessment into the EMP. 	Prior to Drilling
4.	Marine Environmental Monitoring Program.	Ensure that Eni's management measures for the Cova-1 drilling program are effective in minimising environmental harm.	<ul style="list-style-type: none"> Conduct an ROV survey of the seabed prior to drilling and after drilling. Provide a report to DNMA describing the findings of the pre- and post-drilling ROV surveys. 	Before and after drilling
5.	Operational Monitoring Program	<p>Ensure that Eni's management measures for the Cova-1 drilling program are effective in minimising environmental harm.</p> <p>Ensure that the Cova-1 drilling program complies with applicable legislation and regulations.</p> <p>Enable the implementation of contingency measures, if required.</p>	<ul style="list-style-type: none"> Develop an Operational Monitoring Program for the Cova-1 drilling program in consultation with DNMA. Implement the Operational Monitoring Program and provide a report to DNMA upon completion of the program. 	<p>Prior to Drilling</p> <p>Throughout the drilling program</p>



No.	Topic	Objective(s)	Management Action	Timing
6.	Socio-economic development	Ensure that opportunities for Timor-Leste businesses and communities are maximised in line with Eni's resource requirements for the Cova-1 drilling program.	<ul style="list-style-type: none"> Conduct ongoing stakeholder consultation to identify opportunities and build capacity to source goods, materials, services and labour from Timor-Leste. 	Throughout the drilling program
7.	Emergency Planning and Response	Ensure that adequate emergency response procedures and resources are in place to minimise the environmental impacts of an incident e.g. oil spill.	<ul style="list-style-type: none"> Develop and implement an Emergency Management Plan (MP) and an OSCP for the Cova-1 drilling program. The Emergency MP and OSCP will be developed in consultation with the DNMA, Eni's contractors and appropriate emergency response authorities and resource centres. The Emergency MP and OSCP will be tested and reviewed at least once during the drilling program. 	<p>Prior to Drilling</p> <p>During the drilling program</p>
8.	Training and awareness	Ensure that all personnel are aware of their responsibilities towards the management of environmental and social impacts.	<ul style="list-style-type: none"> Provide training to all Eni and contractor personnel on the requirements of Eni's Environmental Management Plan, specifically <ul style="list-style-type: none"> the environmental and social sensitivities of the project; Eni's management objectives and commitments; and obligations of all personnel towards the management of impacts in their areas of responsibility. Provide training to all Eni and contractor personnel on Eni's OSCP. 	Prior to Drilling
9.	Auditing	Ensure that Eni's environmental and social performance objectives for the Cova-1 drilling program are met.	<ul style="list-style-type: none"> Conduct an environmental compliance audit against the drilling EMP. 	During the drilling program
10.	Stakeholder consultation	To maintain open and transparent communication between Eni and its stakeholders.	<ul style="list-style-type: none"> Deliver a presentation on the proposed drilling program to the key stakeholders. Incorporate stakeholder feedback and comments into the EMP for the proposed drilling program. 	Prior to Drilling



1.0 INTRODUCTION

1.1 OVERVIEW OF PROJECT

Eni Timor Leste S.p.A. (Eni) proposes to drill the Cova-1 exploration well in Permit Area S-06-03 (Contract Area C). The permit is located in the northern Bonaparte Basin in Timor-Leste sovereign waters, approximately 100km from the southeast coast of Timor Leste, approximately 125km south of Dili and approximately 725km northwest of Darwin.

The drilling campaign will take approximately 45 days with drilling due to commence in September 2010. Cova-1 will be drilled by the *Saipem 10000* drillship. Cova-1 will be drilled as an exploration well.

1.2 PROJECT PROPONENT

The proponent of this proposal is Eni Timor Leste S.p.A (Eni). Eni's contact details are:

Eni Timor Leste S.p.A
Rua D. Luis dos Reis Noronha no. 56,
Vila Verde, Dili, Timor-Leste
PO Box 52, Dili, Timor-Leste

Tel: +670 331 0847

Eni is the Operator of the Production Sharing Contract (PSC) covering the Cova field and is also Operator of the Project on behalf of the Joint Venture Partners (JVPs):

- Eni Timor Leste S.p.A. (80%);
- KG Timor Leste Ltd (10%); and
- Galp Exploration and Production (Timor Leste) SA (10%).

The nominated proponent contact for this proposal is:

Rob Phillips
Senior Environmental Advisor
Eni Australia Ltd
Tel: +61 (0)8 9320 1541
E-Mail: rob.phillips@eniaustralia.com.au

Eni is one of the world's major integrated energy companies. In the Timor Sea, Eni has activities in the Joint Petroleum Development Area (JPDA) as well as five PSCs in Timor-Leste's sovereign area. Eni is committed to achieving the highest practicable standard of environmental protection and this commitment is documented in the Eni Health, Safety and Environment (HSE) Policy (Appendix A).

In January 2008, Eni's HSE Integrated Management System (IMS) achieved certification with ISO14001:2004 Environmental Management Systems for its drilling and seismic survey activities. This certification provides audited assurance of a best-practice environmental management system based on continual improvement.

1.3 SCOPE AND OBJECTIVES OF THIS EIS

The scope of this Environmental Impact Statement (EIS) is all operational activities relating to the drilling of the Cova-1 exploration well. The overall aim of the EIS is to demonstrate to the Direcção Nacional do Meio Ambiente (DNMA) (National Directorate of Environment) that Eni has a sound understanding of how its operations interact with the environment and that it has implemented environmental safeguards to reduce the risks to as low as reasonably practicable (ALARP).

As operator of the PSC and in line with international industry best practice Eni has prepared this EIS with the following objectives:

- to provide information from which interested individuals and groups can gain an understanding of the Project, its environmental and social setting, potential environmental and social effects of the project and proposed measures to mitigate and control any impacts;
- to provide a forum for stakeholder consultation and informed comment about the proposal; and
- to provide a framework within which decision makers may consider the environmental hazards and effects of the proposed development in parallel with economic, technical and other factors.

In line with the objectives above, technical detail has been kept to a minimum, wherever possible, in the EIS. The reader is referred to the source documents cited throughout the document for detailed accounts of particular environmental features.

1.4 RELEVANT LEGISLATIVE FRAMEWORK AND ENVIRONMENTAL APPROVAL PROCESS

1.4.1 Environmental Legislative Framework

Contract Area C is regulated by the Direcção Nacional de Petróleo e Gas (DNPG) (National Directorate of Petroleum & Gas) under PSC S06-03 between Eni and the government of Timor-Leste. Environmental approval of petroleum exploration and production proposals in Timor-Leste is regulated by DNMA.

DNMA Guideline No. 6 *Environmental Screening* defines the requirement for an Environmental Impact Assessment (EIA) for development proposals. Proposals are screened on the basis of (i) location; (ii) type of development; and (iii) scale to determine the level of environmental assessment required.

Development proposals may be screened as:

- Type A – EIA required;
- Type B – Site suitability and Environmental Management Plan (EMP) required; and
- Type C – no environmental requirements.

According to Table 2 in Annex 1 of Guideline No. 6, all petroleum exploration and production proposals are Type A proposals and therefore require an EIA. By inference, all seismic surveys and exploration drilling programs are Type A proposals and therefore require an EIA.

Under the Timor-Leste constitution, Indonesian laws which were in effect on 25 October 1999 are applicable in matters where there is an absence of comparable Timor-Leste laws. As such, the Indonesian *Regulation 27/1999* defines the process and requirements for conducting EIA in Timor-Leste. According to Article 3 of *Regulation 27/1999*, “environment” encompasses the natural environmental, artificial (or built) environment, and social and cultural environment. Thus, EIA in Timor-Leste includes both the biophysical and social aspects of the environment in which the project is situated.

1.4.2 Environmental Assessment Process

The environmental assessment process under *Regulation 27/1999* requires the proponent to first prepare a draft Framework of Reference (FoR) for the analysis of environmental impacts for assessment by DNMA. The purpose of the FoR document is to outline the project, its environmental setting, and potential environmental impacts and to describe the environmental studies to be conducted by the proponent during the EIA. The DNMA evaluates the draft FoR and provides advice to the proponent. The draft FoR is then agreed and finalised between DNMA and the proponent and so establishes the scope and framework for conducting the EIA. Eni submitted its draft FoR to DNMA on the 24 November 2009 and received advice on 21 December 2009.

Eni has prepared this EIS for submission to DNMA in accordance with the requirements of *Regulation 27/1999* and the FoR. The EIS must be approved by DNMA prior to implementation of the project. According to Article 20 of *Regulation 27/1999*, DNMA must issue a decision on the environmental acceptability of the drilling program within 75 days of receipt of the EIS. If no decision is provided within 75 days of receipt of the EIS, the proposal is deemed to be environmentally acceptable.

During the EIA process, in addition to the EIS, an Environmental Management Plan (EMP) must also be developed. DNMA Guideline No. 7 *Preparation of an Environmental Management Plan* defines the requirements for an EMP for development proposals. Annex A of Guideline No. 7 describes the required scope and content of an EMP and Annexes B to G describe the environmental and social aspects that should be considered. The EMP will be submitted prior to the commencement of drilling.

1.4.3 Other Legislative Requirements

As stated in Eni's HSE policy (Appendix A), Eni shall ensure that it conducts its operations in accordance with legislative requirements. To achieve this, Eni maintains a database that describes legislation relevant to the environmental management aspects of its operations. Eni shall ensure that the Cova-1 drilling campaign complies with all relevant Acts and regulations.

Table 1.1 highlights the most significant legislation and licence requirements in respect of the environmental considerations relating to Eni's operations. Eni reviews the environmental legislation database annually or when significant environmental legislation changes occur. The annual review will be confirmed during an annual environmental audit of Eni operations.

Table 1.1 Relevant Legislation, Codes of Practice and International Agreements for the Drilling Campaign.

International Agreements and Legislation
<i>United Nations Convention on the Law of the Sea 1982.</i>
<i>International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (commonly known as MARPOL 73/78) and implemented in Australia through the Protection of the Sea (Prevention of Pollution from Ships) Act 1983).</i>
<i>Protocol to International Convention for the Prevention of Marine Pollution by Dumping of Waste and Other Matter 1972 (commonly known as the 1996 Protocol).</i>
<i>Agreement Between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment 1986 (commonly referred to as CAMBA).</i>
<i>Agreement Between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment 1974 (commonly referred to as JAMBA).</i>
Republic of Timor-Leste Legislation
<i>Maritime Zones Act 2002.</i>
<i>Timor-Leste Petroleum Act 2004.</i>
<i>DNMA Guideline #5 on Public Engagement</i>
<i>DNMA Guideline #6 on Environmental Screening</i>
<i>DNMA Guideline #7 on Preparation of an Environmental Management Plan</i>
Indonesian Legislation and Regulations in effect on 25 October 1999
<i>Law 23/1997 on Environmental Management</i>
<i>Reg. 20/1990 on Control of Water Pollution</i>
<i>Reg. 27/1999 on Analysis of Environmental Impacts</i>

**Industry Codes of Practice and Guidelines**

Australian Petroleum Production and Exploration Association (APPEA) Code of Environmental Practice 1996: This provides guidance on a set of recommended minimum standards for petroleum industry activities offshore. These standards are aimed at minimising adverse impact on the environment, and ensuring public health and safety by using the best practical technologies available.

1.5 STAKEHOLDER CONSULTATION

External consultation was initiated by Eni's consultation with DNMA and submission of the draft Framework of Reference (FoR) on 24 November 2009. The purpose of this consultation was to inform DNMA on the scale and nature of the Cova-1 drilling program, clarify the environmental approvals process and present Eni's draft Framework of Reference for the EIA.

Subsequently, Eni arranged a forum in Timor-Leste on Tuesday 23rd February, to explain the details of the drilling program and to respond to questions. Table 1.3 presents the organisations and representatives invited to the forum.

Table 1.2 Organisations and representatives invited to attend Eni's Cova-1 exploration drilling stakeholder forum.

Organisation/representative	Attendance
DNMA	✓
Autoridade Nacional do Petroleo (ANP)	✓
National Directorate of Oil and Gas (DNPG)/State Secretariat of Mineral Resources (SERN)	—
Secretary of State for Environment	—
Turismo Timor Leste - Ministerio Desenvolmemtu	—
Public Works	✓
Director of Transport	—
Director of Land and Property	—
Director of International Environment	—
Maritime Customs	—
Minister of Economy and Development	—
TradeInvest Timor-Leste	—
Direccao Nacional Industria	—
Direccao Nacional Pesca & Aquacultura	✓
Director of Haburas Foundation	—
Director Luta Hamutuk	✓
Director Lao Hamutuk	✓
Director of NGO Forum	—

Since this early consultation, planning for the Cova-1 drilling program has progressed and this draft EMP has been developed. Eni will incorporate any feedback into the finalised EMP for the project.

2.0 PROJECT DESCRIPTION

2.1 FIELD LOCATION

The Cova-1 exploration well is located in PSC S06-03, situated in the northern Bonaparte Basin within Timor-Leste waters (Figure 2.1). It is located approximately 100km from the southeast coast of Timor Leste, approximately 125km south of Dili and approximately 725km northwest of Darwin. The geographical coordinates of the Cova exploration well are presented in Table 2.1.

Table 2.1 Geographical Coordinates of the Proposed Cova-1 Well.

Well	Latitude	Longitude
Cova-1	10°01'59.24" S	125°45'58.85" E

2.2 PREVIOUS ACTIVITIES IN THE PERMIT AREA

Oil exploration activities in the Timor Sea commenced in the late 1960s. Since this time numerous wells have been drilled throughout the region, resulting in finds for Eni, OMV, BHP Billiton Petroleum, Santos, TCPL Resources, Norcen International, Peko Oil, Western Mining Corporation, BP, Shell and Woodside Energy. Eni's Kitan Development in the JPDA is expected to commence production in 2011. Producing oil and gas fields in the JPDA include Laminaria/Corallina (oil), Elang-Kakatua (oil) and Bayu-Undan (gas).

Searches for new sources of hydrocarbons are actively being pursued in the region. The petroleum exploration and production industry is a significant stakeholder of offshore waters in the region, particularly within and adjacent to the JPDA between Timor Leste and Australia.

No wells have been drilled in PSC S06-03. However, the permit area was covered by an extensive grid of 3D seismic data acquired in June 2007 (ENI 2007b).

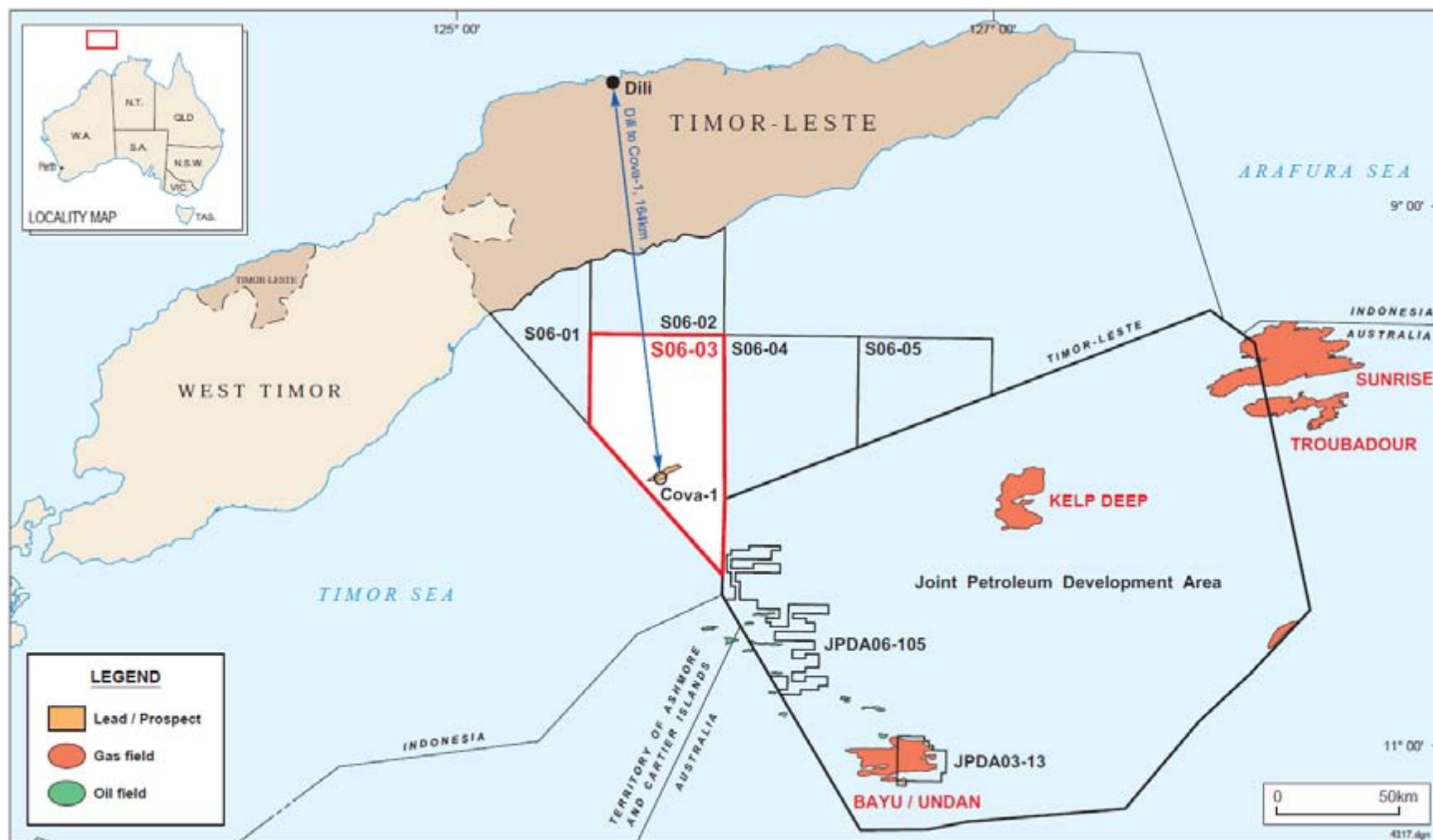


Figure 2.1 Cova-1 Well Location.

2.3 PROPOSED DRILLING PROGRAM

The proposed Cova-1 well will be drilled as a vertical exploration well. Drilling will be undertaken using the drillship, *Saipem 10000* (Figure 2.2). The specifications of the *Saipem 10000* are presented in Appendix B. On arrival at site, the drillship will move into position and remain in position using the Class III Dynamic Positioning system. The well schematic is provided in Figure 2.3

Drilling is scheduled to commence in September 2010 subject to obtaining environmental approval. The drilling program is scheduled to take 45 days to complete.



Figure 2.2 *Saipem 10000*.

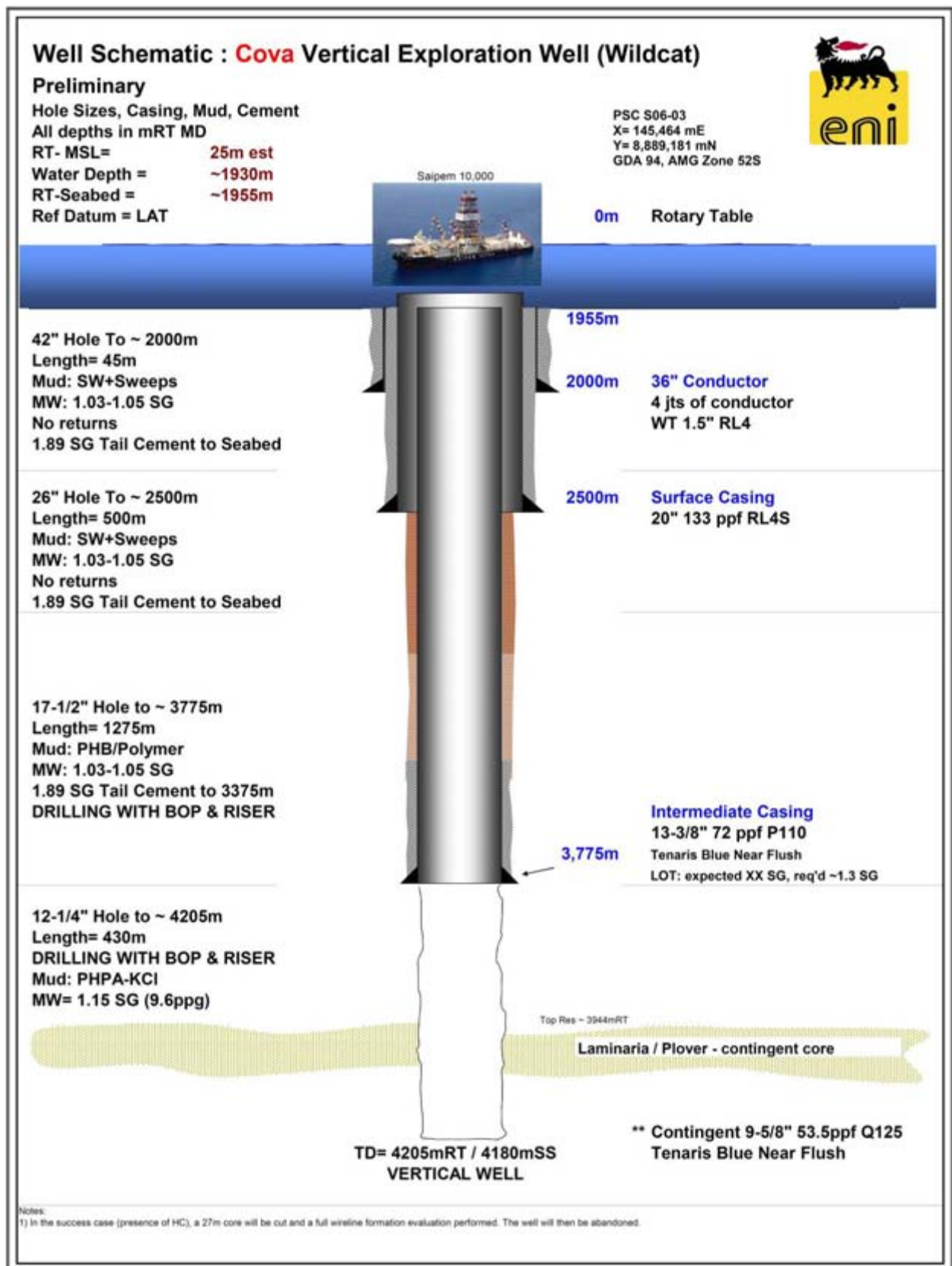


Figure 2.3 Cova-1 Well Schematic.

2.4 DRILLING FLUIDS AND CUTTINGS

The top sections of the well will use seawater and prehydrated gel (PHG) sweeps. Approximately 150m³ of drill cuttings would be produced and the cuttings will be continuously discharged directly on to the surface of the seabed adjacent to the well.

The bottom sections of the well will be drilled using water-based drilling muds (WBM). These have low toxicities, degrade rapidly in the marine environment and are routinely accepted for use by the regulatory authorities (Hinwood *et. al.* 1994). Approximately 250m³ of cuttings will be generated from the bottom section. These cuttings would be brought onboard the drillship and centrifuged to retain the fluids prior to disposing of the cuttings at the sea surface.

2.5 CORE SAMPLE

If hydrocarbons are encountered, a 27m core may be cut.

2.6 WIRELINE EVALUATION

If hydrocarbons are encountered a full wireline formation evaluation will be performed. The well will then be abandoned.

2.7 DRILLING SUPPORT

Drilling support will be provided by one or more platform supply vessel (PSV). The primary PSV is the *Sea Witch*, owned by Deep Sea Supply Pty Ltd and under contract with Eni during the Cova-1 drilling operations. The specifications of the *Sea Witch* are presented in Appendix B. *Sea Witch* will conduct supply services from Darwin to the Cova-1 well site.

Helicopter support will be based at Dili (as will service crew changes). Eni's drilling team will operate from the company's Perth office.

2.8 WELL CONTROL PROCEDURES

Eni's Well Control Procedures are based on three key elements. These include:

- thorough assessment of the geology and formation pressures prevalent in the area;
- design of the drilling fluid programme; and
- well control procedures used by the drilling contractor.

Eni's drilling programme will fully incorporate these three key well control elements to provide an industry 'best practice' approach to well control. This will include training and accreditation of both the drilling contractor's and the operator's site supervisory personnel.

2.9 OPERATIONAL WASTES

Routine drilling operations generate the following types of waste:

- drill cuttings, discharged overboard continuously during drilling after separation of the drilling fluids;
- drilling fluids/muds generally discharged after each hole section;
- the *Saipem 10000* will have containment zones and bunding in all areas where oil products are stored and oily residues will be stored in drums and shipped onshore for disposal at authorised sites. Minor deck spills will be washed with bio-degradable detergents and polluted deck drainage water will be collected in a settling tank for later disposal onshore;
- sewage, grey water and putrescible wastes discharged overboard after treatment;
- cooling waters, discharged overboard continuously during drilling;
- domestic and industrial solid wastes and hazardous solid and liquid wastes, collected and segregated on the drillship for transport to shore for appropriate disposal at intervals during drilling; and
- engine and waste oil, which will be collected and transported to shore for appropriate disposal.

2.10 DRILLING SAFETY

The well will be designed and engineered to approved Eni standards. Most wells within the nearby JPDA show a normal pressure regime down to total depth e.g. Kitan-1 and -2, Capung-1a, Jahul-1, Krill-1, Kuda Tasi-1, -2 and -3. Blow-out preventers (BOPs) will be used prior to the intersection of any hydrocarbon zones.

Casing sizes and lengths and the intervals where the hole is cement sealed around the casing will be selected to maximise well control. Experience gained with previously drilled offset exploration wells will be taken into consideration in the well design.

The positioning and operation of the drillship will be closely supervised by the Drilling Contractor's personnel and the Eni Drilling Supervisor. During the drilling programme, a temporary safety exclusion zone with a radius of 500m around the drillship will be declared and appropriately gazetted. Few vessels are expected to be operating in the area, but those that do will be informed of the location of the drillship and the exclusion zone by radio.

An Emergency Response Plan is contained within the *Saipem 10000* Safety Case Revision. An Oil Spill Contingency Plan (OSCP), detailing actions to be taken in the event of an emergency or an oil spill, will be prepared. Copies of both plans will be introduced in the environmental induction process undertaken by all employees and contractors.

3.0 PROJECT NEED AND ALTERNATIVES CONSIDERED

3.1 PROJECT NEED

The overarching driver for drilling the Cova-1 well is the search for oil to satisfy global demand for hydrocarbon products. The Timor Sea contains known and highly prospective hydrocarbon fields. Previous oil exploration in the Timor Sea, which commenced in the late 1960s, has resulted in several producing fields.

To date, no wells have been drilled in PSC S06-03. A 3D seismic survey conducted in June 2007 indicated the presence of potential hydrocarbon prospects in PSC S06-03. Drilling is the only way more definitive data can be obtained on the presence of hydrocarbons and the economic viability of their production.

Further justification for drilling the Cova-1 well is the benefits the development of Timor-Leste's oil and gas resources can bring to the people of Timor-Leste. Oil and gas revenues underpin the government's routine and development programmes in the absence of any other substantial source of revenue. The oil and gas industry may be expected to provide the following benefits to Timor-Leste:

- expansion of the economy due to increased service and supply requirements of the oil and gas industry;
- employment opportunities for a large proportion of the population;
- potential support towards the development of social development initiatives aimed at improving the quality of life of local communities;
- vocational education and training opportunities to develop a skilled workforce; and
- gas resources for domestic and industrial use in Timor Leste.

Thus, development of Timor-Leste's oil and gas resources can reduce unemployment and poverty, broaden Timor-Leste's economic base and help lift the non-oil economy onto a higher growth path.

3.2 ALTERNATIVES CONSIDERED

Drilling must be undertaken to explore, appraise and develop buried hydrocarbon reserves. No viable alternative to drilling exists.

Obtaining sufficient energy from alternative, renewable energy sources, such as solar, wind, wave, hydro and geothermal are beyond the scope of this EIS and are not discussed here.

4.0 DESCRIPTION OF THE ENVIRONMENT

4.1 PHYSICAL ENVIRONMENT

4.1.1 Climate

Regional Overview

The Timor Sea has two distinct seasons: “winter” from April to September and “summer” from October to March. The short period between the two seasons is termed the transition season. During this period, either winter or summer regimes could dominate.

The “winter” dry season (April to September) is characterised by steady easterly (northeast to southeast) winds of 5 to 13ms^{-1} driven by the South East Trade Winds over Australia. Figure 4.1 shows the general atmospheric circulation pattern over the Timor Sea during winter.

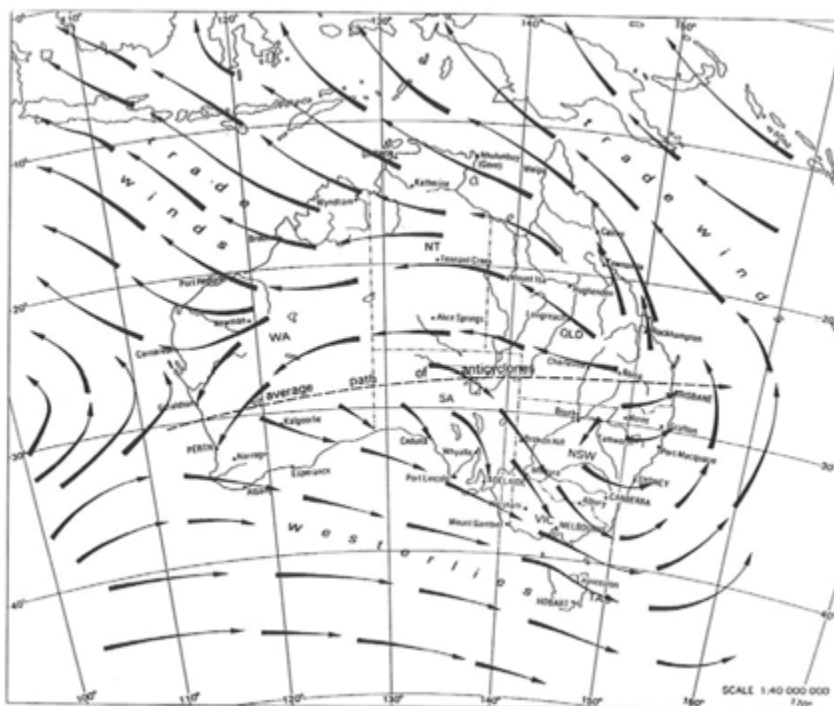


Figure 4.1 Generalised Atmospheric Circulation over Australia in Winter (July)
(from Swan *et. al.* 1994).

The “summer” season (October to March) is the period of the predominant North West Monsoon. It is characterised by mostly westerly (west-southwest) winds of 5ms^{-1} for periods of 5 to 10 days with surges in the airflow of 10ms^{-1} to 18ms^{-1} for the period of 1 to 3 days. Figure 4.2 shows the general atmospheric circulation pattern over the Timor Sea during summer.

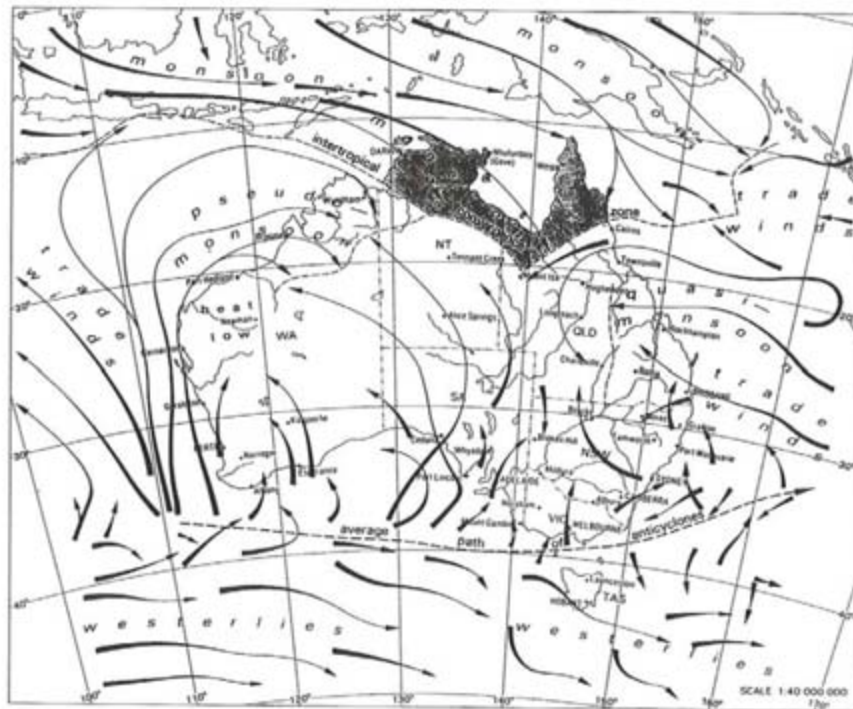


Figure 4.2 Generalised Atmospheric Circulation over Australia in Summer (January) (from Swan *et. al.* 1994).

Tropical cyclones can develop between November and April resulting in short lived, severe storm events often with strong but variable winds. Figure 4.3 shows the cyclone tracks logged over a 36 year period that cross within 200km of the drilling location.

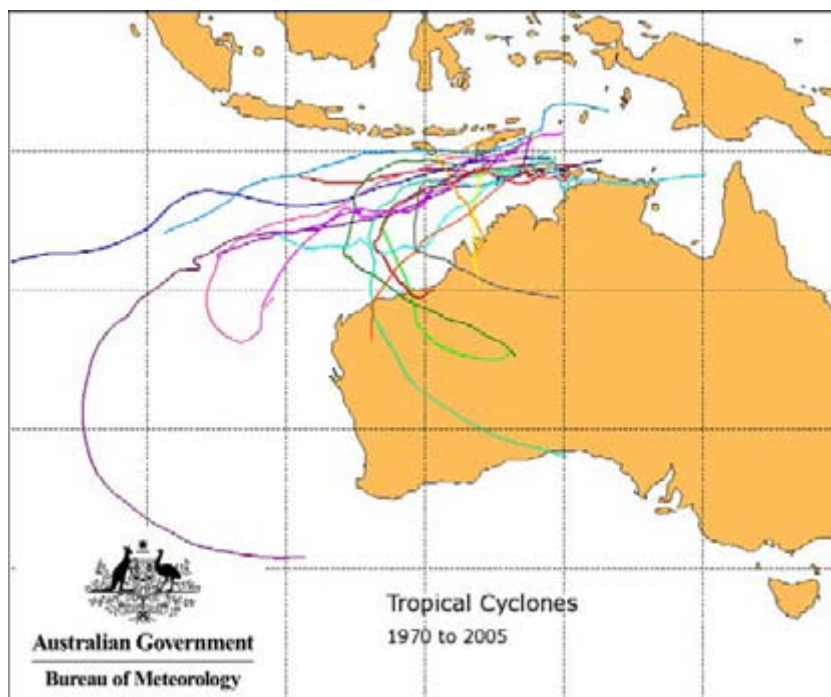


Figure 4.3 Tropical cyclones crossing within 200km of 10° 15' 45.19''S 125° 55' 58.65''E (1970 to 2006) (BOM 2009).

Rainfall and Temperature

Mean annual rainfall in the region is 1,700mm. Almost all rainfall occurs between November and April, the greatest falls being in January and February. The frequency and severity of the thunderstorms produce a large variation in the monthly rainfall. Rainfall during the dry months is sporadic and light.

Mean air temperatures are 26.9°C in July and 28.4°C in December.

Wind Patterns

Joint frequency distributions were calculated from 10 complete years (July 1997 – Jun 2007) of verified NCEP ambient modelled data for the Cova-1 location. Wind roses for the winter, summer and transitional seasons are presented in Figure 4.4. These display the expected seasonal variation in prevailing wind direction, with westerlies (southwest-northwest) persisting from October to March, and a fairly rapid shift to easterlies (northeast – southeast) in late March or early April that then persist until late October or early November before the return to the westerlies.

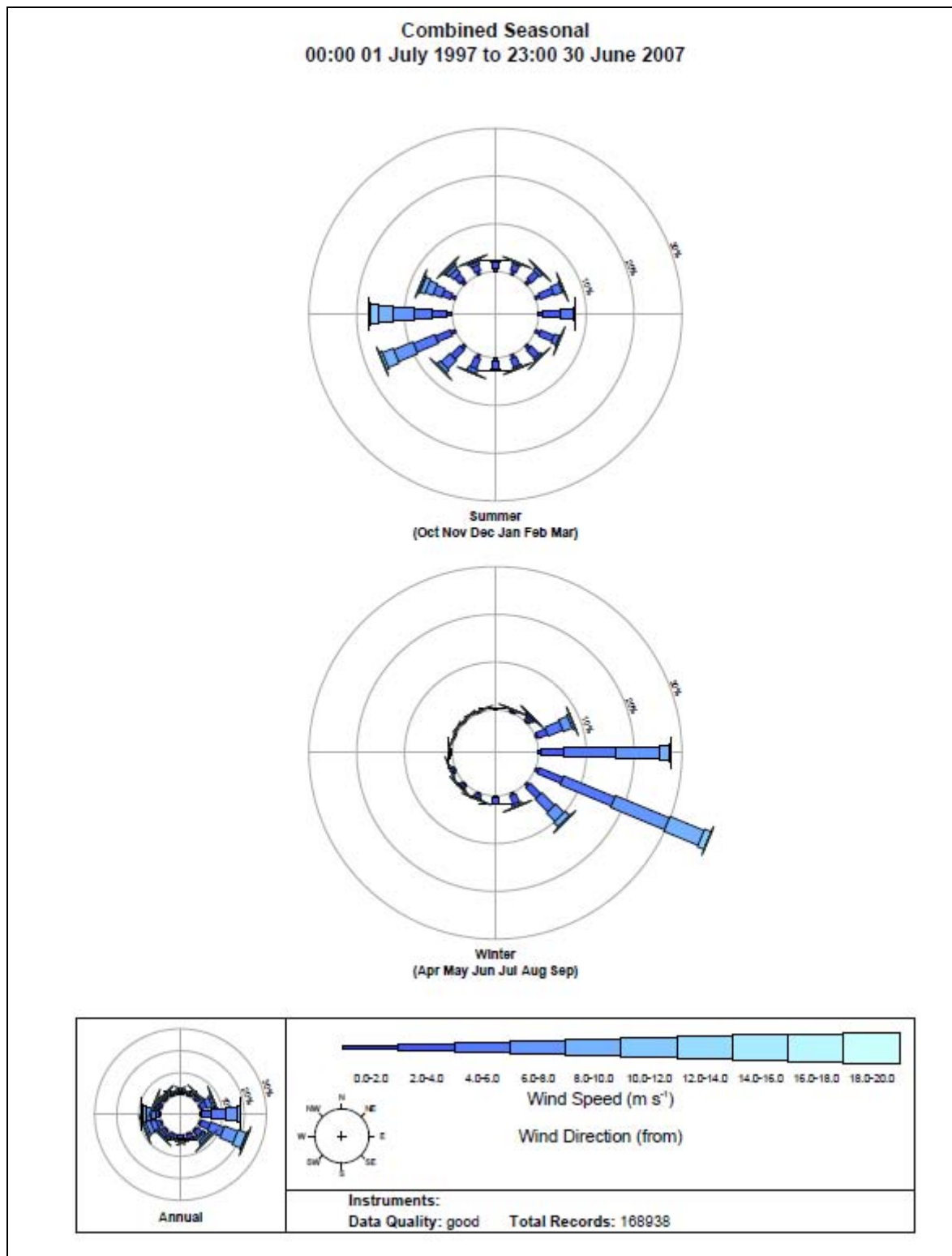


Figure 4.4: Seasonal wind roses for the Timor Sea (Saipem Energy Services, 2009).

4.1.2 Oceanography

Currents and Tides

The main forces contributing to surface water movement at the Cova-1 location are:

- general oceanic circulation;
- astronomical tides; and
- wind stress.

The Pacific – Indian Throughflow flows south through the Indonesian Archipelago and into the Eastern Indian Ocean bathing it in warm, relatively low salinity seawater (Figure 4.5). At the Cova location, this may add a westerly component to the current regime. Current speeds vary depending on the season. Lowest speeds would occur in April at the end of the northwest monsoon when winds blow towards the Pacific whilst highest speeds would occur in September associated with the southeast monsoon (Wijffels et al., 1996).

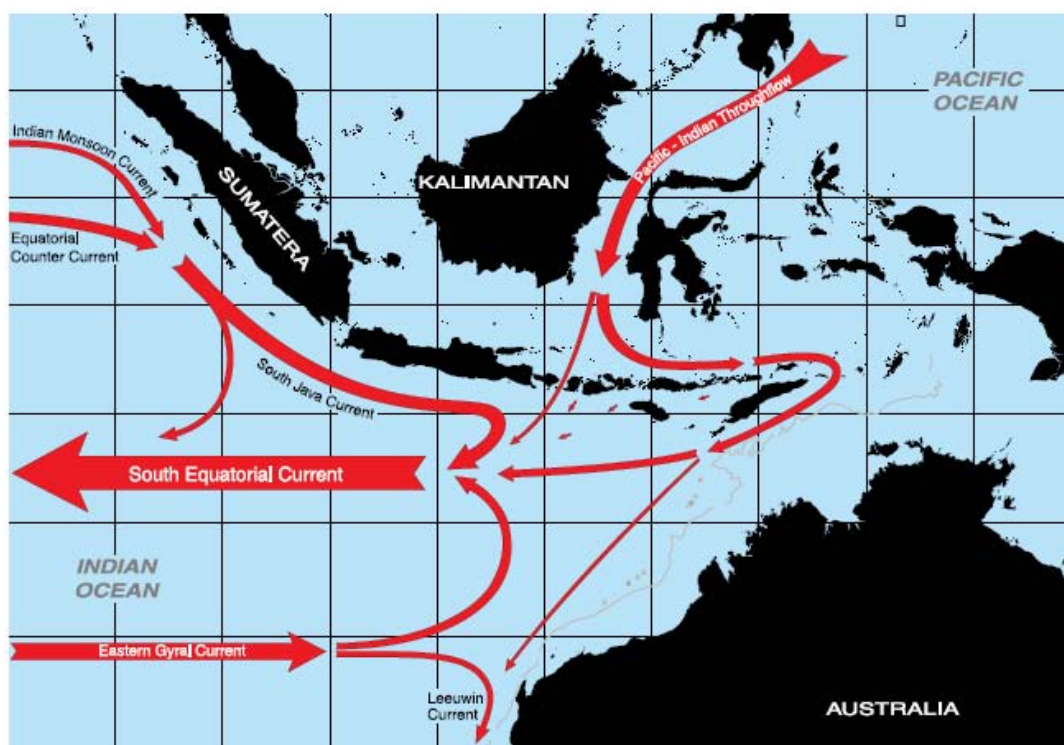


Figure 4.5: Regional Currents (CSIRO, 2004).

Tidal currents in the region are anti-clockwise rotational, commencing flood towards the NE and ebb towards the SW. Speeds will range from about 0.02m/s on neap tides to 0.1m/s on springs.

Surface currents are expected to reflect seasonal wind regimes (Figure 4.4). Local wind-driven surface currents may attain maximum speeds of 0.7m/s during extreme wind surges. More typically speeds would be in the range of 0.2m/s to 0.4m/s.

The tides in the vicinity of the proposed Cova-1 well are semidiurnal (two highs and lows each day) with a slight diurnal inequality (difference in heights between successive highs and low). There is a well defined spring-neap lunar cycle, with spring tides occurring two days after the new and full moon. Table 4.1 provides the standard tidal levels for the Cova-1 Field. Highest Astronomical Tide (HAT) is 3.25m and the mean ranges for spring and neap tides are 2.08m and 0.58m, respectively.

Table 4.1: Standard tide levels for Cova-1 (Fugro, 2009).

Northern Endeavour	Level (m)
Highest Astronomic Tide (HAT)	3.25
Mean High Water Springs (MHWS)	2.65
Mean High Water Neaps (MHWN)	1.90
Mean Sea Level (MSL)	1.61
Mean Low Water Neaps (MLWN)	1.32
Mean Low Water Springs (MLWS)	0.57
Lowest Astronomic tide (LAT)	-0.07

Sea and Swell

Waves at the proposed Cova-1 well location comprise contributions from:

- Southern Ocean swells;
- summer monsoonal swells;
- winter easterly swells; and
- locally generated seas.

The most persistent swell will arrive from the west and southwest with typical heights of 2m in winter and 1m in summer. Since longer period swell suffer less dissipation, periods of long-travelled swell commonly reach 18 seconds and occasionally exceed 20 seconds.

Shorter period swell (6 to 10 seconds), may result from tropical cyclone, winter easterlies over the Arafura Sea and the eastern portions of the Timor Sea, and summer westerlies over the western portions of the Timor Sea.

Local wind generated sea is highly variable but typically ranges in period from 2 seconds to 6 seconds with heights of up to 6m in strong persistent forcing at some locations (Swan *et al*, 1994).

Seawater Temperature and Salinity

Surface sea temperatures in the vicinity of the Cova-1 oilfield are expected to range from about 30°C in summer to 26°C in winter. Table 4.3 presents monthly minimum, maximum and mean temperatures. Seawater temperature and salinity profile data are given in Table 4.3 and Table 4.4 respectively.

Table 4.2 Monthly and All-year Surface Seawater Temperature Statistics (Fugro, 2009).

COMBINED PERIOD (1855 to 2009)	Seawater Temperature at Surface (°C)		
	MIN	MEAN	MAX
January	25.00	29.46	32.10
February	25.00	29.29	32.00
March	26.00	29.71	33.00
April	26.00	29.22	33.00
May	25.00	28.65	32.00
June	24.60	27.83	31.00
July	23.00	26.61	30.00
August	24.50	26.70	29.70
September	23.50	27.34	29.50
October	24.00	28.31	31.00
November	25.00	29.46	32.50
December	25.00	29.69	33.90
All-Year	23.00	28.74	33.90

Table 4.3 All-year Seawater Temperature Profile (Fugro, 2009).

DEPTH (m)	SEAWATER TEMPERATURE		
	MIN (°C)	MEAN (°C)	MAX (°C)
0	25.5	28.8	33.4
10	25.5	28.4	31.5
20	25.4	28.1	30.6
30	24.2	27.7	30.1
50	22.2	26.9	29.1
75	20.4	25.7	28.7
100	18.3	23.9	28.5
125	16.3	21.7	28.2
150	14.9	19.3	23.1
200	12.6	15.8	19.2
250	10.9	13.2	16.1
300	9.6	11.5	13.5
400	8.1	9.3	10.3
500	7.2	7.9	8.9
600	6.5	7.0	7.8
700	6.0	6.3	6.9
800	5.5	5.8	6.1
900	4.9	5.2	5.6
1000	4.5	4.8	5.1
1100	4.2	4.5	4.8
1200	3.9	4.2	4.5
1300	3.7	4.0	4.2
1400	3.5	3.8	3.9
1500	3.3	3.6	3.7

Table 4.4 All-year Seawater Salinity Profile (Fugro, 2009).

DEPTH (m)	SALINITY		
	MIN (PSU)	MEAN (PSU)	MAX (PSU)
0	33.95	34.49	34.94
10	33.95	34.49	34.81
20	33.98	34.49	34.77
30	34.06	34.50	34.75
50	34.20	34.53	34.74
75	34.33	34.56	34.77
100	34.32	34.62	34.80
125	34.38	34.70	34.83
150	34.51	34.74	34.85
200	34.57	34.69	34.81
250	34.47	34.60	34.70
300	34.44	34.55	34.64
400	34.48	34.54	34.58
500	34.52	34.55	34.59
600	34.54	34.56	34.58
700	34.55	34.56	34.57
800	34.56	34.56	34.57
900	34.57	34.57	34.57
1000	34.57	34.58	34.58
1100	34.58	34.58	34.59
1200	34.58	34.59	34.61
1300	34.59	34.61	34.62
1400	34.61	34.63	34.64

Bathymetry

The proposed Cova-1 exploration well is located on the continental slope in an area of uniformly smooth seabed ranging in depth 1,900m to 1,950m (Figure 4.6). To the north the continental slope continues to decline steadily reaching depths in excess of 2,500m in the Timor Trough.

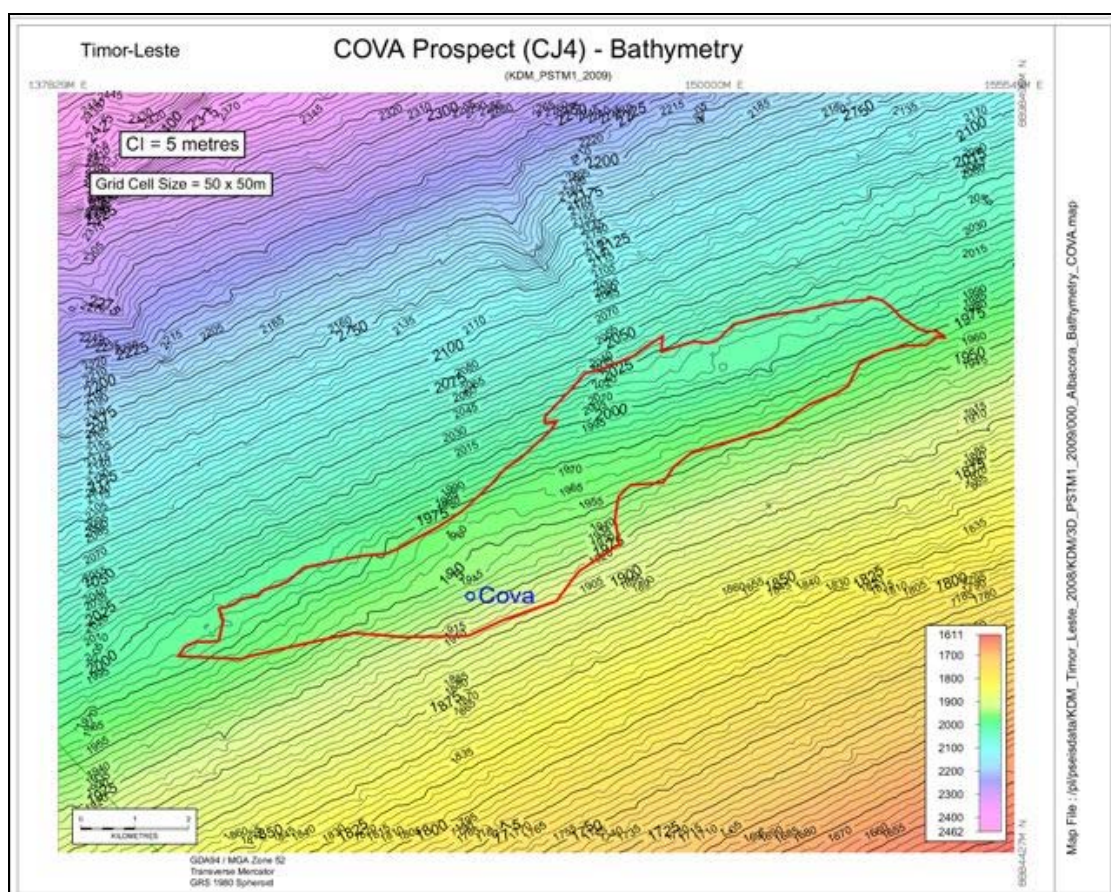


Figure 4.6 Bathymetry of the Cova well location.

Approximately 80km to the south of the proposed Cova-1 well, the Sahul Shelf extends approximately 300km out from and runs parallel to the northern Australian coastline. It is bounded to the northeast by the Van Diemen Rise, to the southwest by the Londonderry Rise and to the north by a series of seven shoals described by Edgerley (1974) as a "broken barrier reef" (Figure 4.7).

A system of shoals occur to the south and southwest of the Cova-1 location (Figure 4.7). The system stretches for approximately 60km in a northeast/southwest direction along the outer edge of the Sahul Shelf and comprises 11 major shoals ranging in size from 0.05km² to 40km², with an average size of 4.6km² (Heyward *et al.* 1997). The banks rise sharply above the continental slope from more than 300m to between 16m to 30m below the sea surface. The nearest, Big Bank Shoals, is located approximately 80km southwest of Cova-1 and rises to within 21m lowest astronomical tide (LAT).

The nearest emergent reefs, Ashmore, Cartier and Hibernia, are located on the southwest end of Sahul Shelf. The nearest, Hibernia reef, is more than 300km to the southwest of Cova-1. The nearest shoreline is the southern coastline of Timor-Leste, located approximately 90km to the northwest.

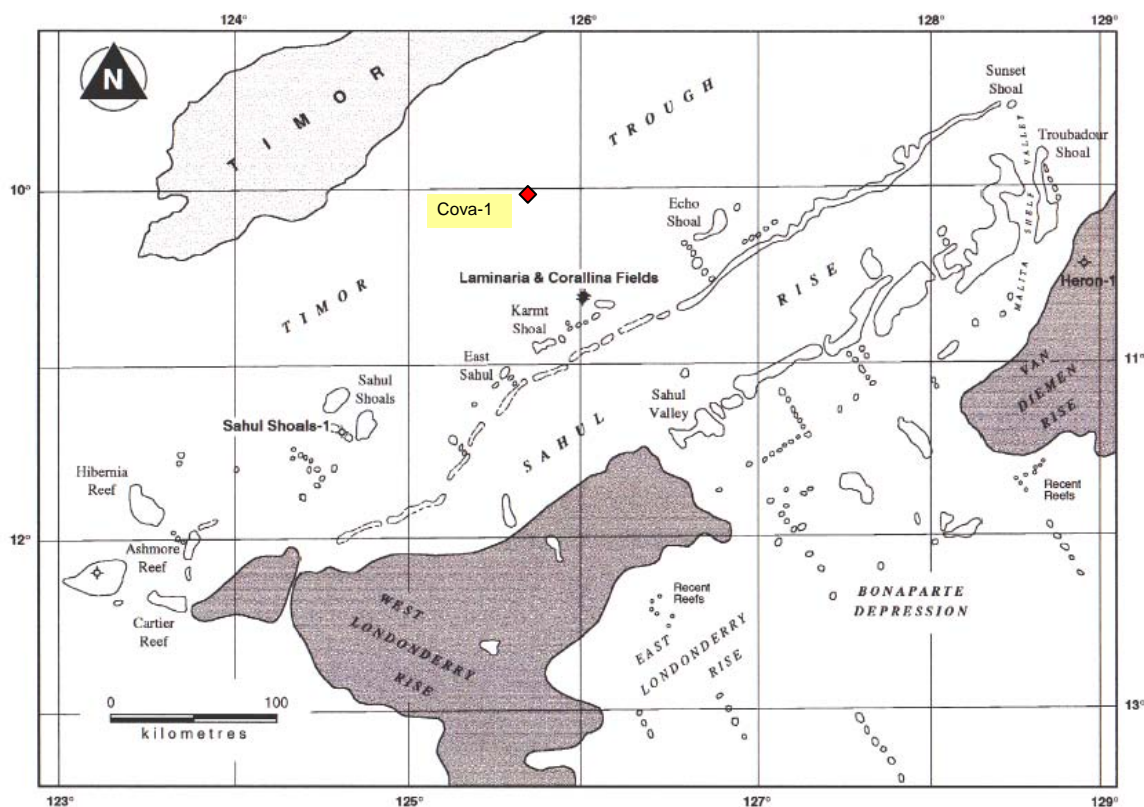


Figure 4.7 Regional bathymetry.

4.1.3 Seismicity and Tsunamis

The Timor Sea has been tectonically active for at least the past six million years where the Australian and Eurasian continental plates converge. Since the mid 1970s, hundreds of earthquakes have been recorded in the region. Many of the earthquakes in the Australian sector of the Timor Sea are of relatively low magnitude occurring around the edges of the Cartier and Timor Troughs.

Subduction earthquakes, caused by one edge of a crustal plate being forced below the edge of another, associated with the Timor Trough dominate the earthquakes of the area. Earthquake activity within the central Timor Trough and the island of Timor is a lot more intense, more frequent and generally of a magnitude greater than seven on the Richter scale (AUSGEO 2003).

The proposed Cova well is located in the southern part of the Timor Trough on the Australian continental plate, which is subducting to the north under Timor. The subduction zone is steeply dipping with the rate of activity along the subduction zone appearing to be greatest to the east (towards the Banda Sea) than to the west (towards Sumbawa). There appears to be an absence of seismicity to the northwest of the Cova well, although this may not be a long-term feature of the seismicity of the area.

At the Timor Trough, subduction-zone earthquakes are shallow at the offshore trench and are deepest to the north, with most subduction earthquakes occurring at depths down to approximately 200km. Few events occur between 300km and 500km depth, although some events do occur at depths exceeding 600km. Events deeper than 300km are too deep to create damage at the surface for major engineered structures.

4.2 BIOLOGICAL ENVIRONMENT

4.2.1 Regional Overview

Physical, biological and environmental data for the marine and coastal environment in Timor-Leste is very scarce (Sandlund *et. al.* 2001) hence referral has to be made to isolated or more general studies. The marine fauna of the Timor Sea is part of the Indo-West Pacific biogeographical province (Figure 4.8). The majority of species are widely distributed in this region (Wilson & Allen 1987). Timor-Leste has been identified as part of the Wallacea region (relating mainly to the terrestrial environment) in Southeast Asia which has been identified as a biodiversity “hotspot” (CI 2007). The most ecologically important marine habitats in the Timor Sea region, in terms of biodiversity and productivity can be grouped into:

- various submerged banks or shoals on the northern Australian continental shelf and shelf slope;
- coastal intertidal coral reefs and shallow (20m to 30m) reefs; and
- mangrove and seagrass areas located along the Timor-Leste and northern Australian coast and islands (Sandlund *et. al.* 2001; SKM 2001).



Figure 4.8 Indo-West Pacific biogeographical province.

4.2.2 Bathypelagic Zone

The Cova-1 well is situated in approximately 1,900m of water in the Timor Trough. The Timor Trough, in which the drilling program is located, is classified as the bathypelagic zone (defined as between 1,000m and 4,000m deep). Sunlight does not penetrate the bathypelagic zone and bioluminescence is the only light. Despite the lack of light, the biota of the bathypelagic zone is diverse and sperm whales (*Physeter macrocephalus*) are capable of diving to the bathypelagic zone to feed on deep sea cephalopods and other megafauna.

As no plants can grow in the bathypelagic zone because of lack of light, the fauna are carnivorous, catching in their wide jaws the falling debris of the organisms which exist above them. Fish are common in the bathypelagic zone, typically feeding by ambushing prey or by attracting prey using bioluminescent lures. Due to the relatively small changes in pressure with depth, fish inhabiting the bathypelagic zone can move freely over wide depth changes without being affected by pressure changes. As such, fish species occurring in the bathypelagic zone would be expected to occur over wide depth and geographical ranges.

Benthic invertebrates inhabiting the seabed would be expected to exhibit high diversity though low abundance and productivity due to the water depth, lack of light and reliance on detrital "rain" to drive deep sea ecosystems. Infaunal assemblages would be expected to be dominated by polychaete worms and crustaceans as is typical of marine infaunal assemblages elsewhere including those of continental shelf and slope habitats of the Timor Sea.

4.2.3 Continental Shelf

Across the northern continental shelf, the predominant animals living within seabed sediments (infauna) are polychaetes (burrowing worms) and crustaceans (e.g. prawns, shrimp and crabs). These two groups comprise 84% of the total species in sediment samples with a high diversity of species but a low abundance of each individual species (Heyward *et al.* 1997). The remaining 16% of species include echinoderms (e.g. sea stars, sea urchins, feather stars), molluscs (both gastropods and bivalves), nemerteans (ribbon worms), sponges and fish.

Epibenthic communities (animals living on the seabed) in deeper waters are generally low in fauna abundance and diversity. Heyward *et al.* (1997) noted that with little sea floor topography and hard substrate, such areas offered minimal habitat diversity or niches for animals to occupy. The main taxa found in these areas include sponges and gorgonians (sea whips and sea fans). The absence of hard substrate is considered a limiting factor for the recruitment of epibenthic organisms (Heyward & Smith 1996).

Whilst the abundance may be low, the diversity of shelf slope invertebrates may, however, be high. A wide variety of crustaceans including scampi, prawns, carids, bugs and crabs are regularly recorded from commercial deepwater trawl catches in the North West Shelf Trawl Fishery and that the additional non commercial crustacean captures included hundreds of species (Caton & McLoughlin 1999). The continental slope of the Timor Sea can be expected to support similar crustacean diversity.

4.2.4 Sea Mounts and Shoals

The proposed Cova-1 program occurs to the north of a number of mostly unnamed sea mounts and the Sahul Shoals. On shoals in less than 50m water depth (where adequate light may penetrate), epibenthic fauna can be abundant and diverse. These areas are of ecological significance due to their regional uniqueness and their patchy distribution in an otherwise broad area of featureless seafloor.

The major shoals and banks in the region include:

- Karmt Shoals (approximately 110km to the south-southeast of the proposed Cova-1 exploration well);
- Big Bank Shoals (approximately 85km to the south-southeast of the proposed Cova-1 exploration well); and
- Echo Shoals (approximately 160km to the east-southeast of the proposed Cova-1 exploration well).

The nearest shoals to the Cova well, Big Bank Shoals were surveyed extensively by Heyward *et al.* (1997). The Big Bank Shoals comprise thirteen banks which vary in their habitat and species composition, but are generally characterised by mixed Halimeda algae, sponge and soft coral communities with some hard corals on the more consolidated sediments. Halimeda or coral dominate ecosystems on the shallower banks and filter-feeding ecosystems dominate the deeper banks. It is not clear why some of these banks are coral-dominated while others are Halimeda-dominated. However, depth and light attenuation seem to play key roles.

South of the Sahul Shelf system lies extensive shelf flats of depths varying from 70m to about 100m. These soft sand-silty seafloors are generally flat and undulating with a sparse assemblage of species. Species present are mainly polychaetes and crustaceans, with sponges, ascidians, echinoderm, gorgonians or soft corals depending on depth and local sediment characteristics (Lavering 1993; Marsh & Marshall 1983).

4.2.5 Coral reefs

Timor-Leste is near the centre of the global region with the highest coral species diversity and there may be in excess of 500 species of coral occurring in Timor-Leste waters (Veron & Stafford-Smith 2000). A series of surveys conducted in Indonesian waters between 1990 and 1998 (Burke *et. al.* 2002) determined that the percentage of coral reefs in good or excellent condition (live coral cover of more than 50%) in eastern Indonesia were 45% compared to only 23% in western Indonesia. Burke *et. al.* (2002) also identified a number of coral reefs along the Timor-Leste coast, including five distinct communities along the south coast of Timor-Leste, that were considered to be at Medium to High risk of impact from the combined effects of coastal development, marine-based pollution, sedimentation, overfishing and destructive fishing.

Intertidal reefs and islands occur along the south coast of Timor-Leste. Wyatt (2004) surveyed a small area of the nearshore coastal marine environment on the south coast. Brittle stars (ophiuroids) and other mobile organisms as well as a total of 27 taxa of sessile organisms were identified as inhabiting the reef platform. Of the sessile organisms, 18 taxa were algae (a brown alga *Ascidium* sp. and a green alga *Caulerpa* sp.), three sponges (poriferans), two hard corals (scleractinians), two ascidians, one anemone (cnidarian) and one foraminifer.

Most of the coastline adjacent to the Cova-1 well site area is identified as "sand", with two coral reef communities present:

- a coral reef zone extending 10km east from Betano; and
- reef immediately around the point at Suai.

Aerial observations of the south coast coral reefs, during helicopter transfers as part of Eni's Albacora 3D survey indicate that the fringing reefs do not extend further than 100m from shore (Eni 2008).

The nearest emergent offshore coral reefs, Ashmore, Cartier and Hibernia, are located on the southwest end of Sahul Shelf. The nearest, Hibernia reef, is more than 380km to the southwest of Cova-1.

4.2.6 Zooplankton

The seas around Australia contain a relatively low biomass of zooplankton, which reach a maximum in an up-welling area between the northwest coast of Australia and Indonesia (generally during the July-August period related to the southeast Monsoonal winds) (Tranter 1962). Zooplankton, which feeds on phytoplankton, provides an important food source to larger animals such as whales, fish and crustacea.

Zooplankton biomass was found to be in the range of 65–155mg/m³ (Heyward *et. al.* 1997). Plankton samples taken from the Big Bank Shoals revealed diverse and abundant assemblages. Samples indicated a population of an average of 31,000 individuals representing 20 to 30 taxa, while abundance at sites away from the bank averaged approximately 17,000 individuals. Planktonic crustaceans that feed on phytoplankton were the most prevalent taxa. A copepod (Crustacean) from the Family Paracalanidae was the most abundant zooplankton encountered. These results are consistent with those of extensive surveys conducted by Tranter (1962). The higher abundance of zooplankton in samples over the Big Bank Shoals appears to be a feature of these ecosystems. Given its deep water location, remote from any seamounts or shoals, the zooplanktonic assemblage of the Cova-1 well location is expected to be considerably lower than that recorded at the Big Bank Shoals.

4.2.7 Marine Mammals

A number of whale, dolphin and porpoise species are likely to be encountered during the Cova-1 drilling program, with the Timor Trench providing an important flow-through of species connecting the Pacific and Indian Oceans. The Australian Environment Protection and Biodiversity Conservation (EPBC) Protected Matters Database was searched to determine whether species listed for protection under the Australian *EPBC Act 1999* (EPBC Act) potentially occurred in the Timor Sea and in particular in the region in which the proposed Cova-1 well is located. The EPBC Protected Matters Database search indicated that twenty-two whale and dolphin species could potentially occur in the Timor Sea near the Cova-1 well. Of these, the Pygmy Killer Whale (*Feresa attenuata*), Killer Whale (*Orcinus orca*), False Killer Whale (*Pseudorca crassidens*), Common Dolphin (*Delphinus delphis*) and the Bottlenose Dolphin (*Tursiops truncatus*) are likely to occur near Cova-1.

Humpback Whales (*Megaptera novaeangliae*) are not expected to occur close to Cova-1 but are known to occur near the Australian mainland coast during their migratory cycle. Calving grounds for humpback whales were identified in Camden Sound, near the Kimberley coast, by Jenner *et. al.* (2001). The Humpback Whale migration path along the western coast of Australia terminates at a known breeding area in the coastal waters of the Bonaparte Archipelago and bays of the Kimberley coast over 300km to the south of Cova. During their northern migration, during late July to early August, Humpback Whales may migrate through waters up to several hundred kilometres offshore but are not likely to be encountered as far north as the Cova-1 well.

Marine mammal observations from Eni's Albacora 3D seismic survey by dedicated Marine Mammal Observers (MMO) provided an insight into the distribution of whales and dolphins in the Timor Sea. In September 2007, observations were made over 22 days, recording a total of 23 sightings of cetaceans comprising approximately 96 individuals (Western Whale Research 2007). These included 13 pods of Pygmy blue whales, *Balaenoptera musculus brevicauda*, and 8 pods of unidentified large whales (most likely to be Pygmy blue whales). Two pods of unidentified dolphins totalling 70 individuals were also observed. Given the large survey coverage over deep water (up to 2,500m) and short observation duration of 22 days (with excellent weather) this number of sightings is considered to be high and of very high importance to marine science.

In contrast, the MMO effort for the 3D Seismic Survey in December 2007 observed relatively low numbers of sightings in the Timor Sea (Eni 2008). Over 13 days, a total of four sightings of cetaceans comprising 16 individuals were recorded. These included one unidentified whale, one sighting of two Fraser's dolphins and two pods of unidentified dolphins. An explanation of the low numbers may be the different seasonal conditions (from Winter/Spring to Spring/Summer) and a change in surveying area from predominantly deep to shallower water (500m).

Dugongs (*Dugong dugon*) occur within Timor-Leste waters, in protected areas coinciding with sizeable seagrass beds. Given its distance offshore and water depth, dugongs are unlikely to be encountered at the Cova-1 well site.

4.2.8 Reptiles

Turtles

The tropical Indo-Pacific region supports marine turtles and sea snakes. Marine turtles include the threatened Flatback Turtle (*Natator depressus*), Green Turtle (*Chelonia mydas*), Hawksbill Turtle (*Eretmochelys imbricata*) and Leatherback Turtle (*Dermochelys coriacea*). The Loggerhead Turtle (*Caretta caretta*) and Olive Ridley Turtle (*Lepidochelys olivacea*) also occur in the region and are listed as endangered.

There are no turtle nesting sites or other critical habitat (e.g. breeding or feeding sites) identified within the Timor-Leste coastline adjacent to the Cova-1 well (UNEP-WCMC 2006). However, Jaco Island and Tutuala beach have been identified as turtle nesting sites (Nunes 2001) and other breeding sites may exist on the south coast of Timor-Leste where the appropriate conditions exist.

Saltwater Crocodiles

The distribution of the saltwater crocodile, *Crocodylus porosus*, encompasses Timor-Leste and the islands and coasts surrounding the Timor Sea. The animals usually inhabit territories within tidal river systems and estuaries, sometimes around coastal areas and in freshwater rivers or water bodies (Ross 1998). The saltwater crocodile is unlikely to be encountered during the drilling of the Cova-1 well.

Sea Snakes

Sea snakes are very common in subtropical and tropical waters where they occupy a wide range of habitats and water depths, extending from the coast to the reefs and banks further offshore. Sea snakes are expected in the Timor Sea region, with as many as 15 species known to occur in northern Australian waters (Storr *et. al.* 1986). Sea snakes are unlikely to be encountered during the drilling of the Cova-1 well.

4.2.9 Fish

FishBase (2006) lists 144 marine fish species in 38 families for Timor-Leste waters, with one species, the Bigeye Tuna (*Thunnus obesus*) listed as Threatened, 18 of the species as being pelagic and 10 of the species as being deep water. Many of the species listed for Timor-Leste are found throughout the tropics and are important commercial species, such as the tunas, mackerels and snappers.

Fish densities in the region of the drilling programme are likely to be low, with some pelagic species traversing the area. However waters with greater fish abundance are likely to occur in the shallow, coastal fringe and around reefs and shoals on the edge of the continental shelf (CSIRO 1999a). The broader area of the Timor Sea region supports pelagic fish species that are utilised in traditional and commercial fisheries.

The region supports large populations of cartilaginous fishes such as sharks and rays. The most prolific of the sharks are the whalers, represented by at least twelve species in the region. They are common in all environments and the oceanic white tipped sharks (*Carcharhinus longimanus*) occur in the deeper offshore areas. Whale sharks may occur occasionally in the permit area, although little is known of their movements through the region.

4.2.10 Birds

Timor-Leste has approximately 224 species of birds of which 23 are endemic to the Timor island group (World Bank 2005). Of the known species that occur in Timor-Leste, two are listed as critically endangered and three are listed as endangered under the IUCN Red List. Of these birds, only the Christmas Island Frigatebird, *Fregata andrews* is a seabird.

Birdlife at the Cova well location is expected to be limited given the oceanic environment. A large variety of seabird species are expected to migrate across the region or forage within the coastal waters of the Timor Sea. Shoreline species may pass through these areas during migrations or enter for short periods during foraging. Seabirds that may occur in the Cova-1 well area includes various tern species, the silver gull (*Larus novaehollandiae*), the lesser frigate bird (*Fregata ariel*), the common noddy (*Anous stolidus*) and the migratory seabird, the streaked shearwater (*Calonectris leucomelas*).

In a systematic survey of seabird distribution in the eastern Indian Ocean carried out in 1995 (Dunlop *et. al.* 1995) it was found that seabird distributions were generally very patchy except near islands where shelter and anomalies in surface water

concentrated food seasonally. For example, Ashmore Reef (located over 380km to the southwest of Cova-1) is a significant staging point for wading birds migrating between Australia and the northern hemisphere, including forty-three species listed on one or both of CAMBA and JAMBA.

Ashmore Reef supports extremely high concentrations of breeding seabirds, many of which are nomadic and typically breed on small isolated islands. CSIRO (1999b) recorded over 10,000 seabirds of nine species on Ashmore Reef and at sea within the Timor MOU74 (Memorandum of Understanding) Box during a survey between September and October, 1998. These species are listed in Table 4.5.

Table 4.5 Seabirds species on Ashmore Reef and at sea within the Timor MOU74 Box during a survey between September and October, 1998 (CSIRO 1999b).

Common name	Scientific name
Crested Tern	<i>Sterna bergii</i>
Sooty Tern	<i>Sterna fuscata</i>
Roseate Tern	<i>Sterna dougalli</i>
Common Noddy	<i>Anous stolidus</i>
Brown Booby	<i>Sula leucogaster</i>
Masked Booby	<i>Sula dactylatra</i>
Bulwer's Petrel	<i>Bulweria bulwerii</i>
Matsudaira's Storm-Petrel	<i>Oceanodroma matsudairae</i>
Leach's Storm-Petrel	<i>Oceanodroma leucorhoa</i>

4.2.11 Mangroves

Mangroves occupy approximately 7,500 acres along the coastline of Timor-Leste. On the south coast, they tend to form small communities at the mouths of streams and in marshy or swampy terrain (timorNET, 2007).

The mangroves species that occur along the coast of Timor-Leste include, *Bruguiera parvifolia*, *Sonneratia alba*, *Rhizophora conjugata*, *Excoecaria agallocha*, *Avicennia marina*, *Aegiceras corniculatum*, *Acanthus ilicifolius*, *Lumnitzera racemosa*, *Heritiera littoralis*, *Acanthus ilicifolius*, *Achrosticum aureum*, *Xylocarpus granatum*, *Corypha utan*, *Pandanus odoratissimus*, *Cycas circinalis*, *Dolichandrone spathacea* and *Melaleuca leucadendron* (timorNET, 2007).

4.2.12 Conservation Significant Biological Resources

There are a number of threatened and/or migratory species listed under the EPBC Act that regularly use the Timor Sea. A search of Australia's Department of the Environment, Water, Heritage and the Arts' Protected Matters Database

(<http://www.environment.gov.au/erin/ert/epbc>) indicated that there may be as many as 74 species listed under the EPBC occurring within a 100km radius of the proposed Cova well, including two endangered six vulnerable and fourteen migratory species (Table 4.6). Many of these species are also listed under international conventions such as the *Convention on International Trade in Endangered Species* (CITES), *Convention on Migratory Species* (CMS), JAMBA, CAMBA, the *International Union for the Conservation of Nature* (IUCN) Red List or the *United Nations Convention on the Law of the Sea* (UNCLOS).

The fourteen migratory species are widely distributed oceanic species and hence are listed for this region on the EPBC Act database. There are no particular natural seabed, oceanographic or topographic features that would attract any of these wide ranging species to the proximity of the drilling location. The proposal is not likely to affect the movement of any of these species through the area during their migration.

Similarly, the eight threatened species are widely distributed oceanic species and hence are listed for this region on the EPBC Act database. While some of the whale and shark species may breed or feed in the region, there are no known features that would make the area particularly attractive to these species and the conditions are widely represented on the tropical continental shelf of Australia and elsewhere in the tropics. Although turtles may occur in the area during their oceanic migrations, the drilling campaign is not likely to affect any local populations of these species. There is no suitable habitat for turtle nesting for hundreds of kilometres. The Cova well does not involve any processes that may threaten the breeding, feeding or general migration of any of the listed threatened species.

The remaining listed species are widely distributed marine pipefish, seahorse, turtles and seasnake species. Many of the pipefish and seasnake species may occur, feed and breed in the Timor Sea where there are appropriate habitats e.g. in shallow, coastal fringes and around reefs and shoals on the edge of the continental shelf.

Table 4 6 Protected marine species listed under EPBC Act potentially occurring within a 100km radius of the proposed Cova well location (EPBC Protected Matters Database Search).

Common name	Scientific name	Distribution	Conservation status
Threatened Species			
Mammals			
Blue whale	<i>Balaenoptera musculus</i>	Open ocean, world-wide distribution. Considered to be endangered. Occasional visitor to region.	Endangered* (EPBC Act) Migratory*** (CMS)
Humpback whale	<i>Megaptera novaeangliae</i>	Considered to be endangered. Known migration path not near proposed development site.	Vulnerable** (EPBC Act), (CITES) Migratory*** (CMS)
Reptiles			
Loggerhead turtle	<i>Caretta caretta</i>	Global distribution in tropical, subtropical and temperate waters.	Endangered* (EPBC Act), (CITES) Migratory*** (CMS)
Leatherback turtle	<i>Dermochelys coriacea</i>	Global tropical and temperate distribution, largest populations in Atlantic, Pacific and Indian Oceans and Caribbean Sea.	Endangered* (EPBC Act), (CITES) Critically endangered (IUCN) Migratory*** (CMS)
Green turtle	<i>Chelonia mydas</i>	Global distribution including tropical waters of Northern Australia.	Vulnerable** (EPBC Act), (CITES) Migratory*** (CMS)
Hawksbill turtle	<i>Eretmochelys imbricata</i>	Global distribution in tropical, subtropical and temperate waters, largest populations occur in Australian waters.	Vulnerable** (EPBC Act), (CITES) Migratory (CMS)
Flatback turtle	<i>Natator depressus</i>	Restricted to Australian and Indonesian waters, all known nesting beaches occur in Australia.	Vulnerable** (EPBC Act), (CITES) Migratory*** (CMS)
Fish			
Whale sharks	<i>Rhincodon typus</i>	Broad distribution between latitudes 30° N and 35° S in tropical and warm temperate seas, both oceanic and coastal settings. Circum-Australia but most common in waters off northern Western Australia, Northern Territory and Queensland.	Vulnerable** (EPBC Act) (IUCN) Migratory*** (CMS) (UNCLOS)

Common name	Scientific name	Distribution	Conservation status
Migratory Species			
Birds			
Streaked shearwater	<i>Calonectris leucomelas</i>	Northern Territory and eastern coastline of Australia.	Migratory*** (EPBC Act) (JAMBA/CAMBA) Marine species (EPBC Act)
Marine Species			
Cetaceans			
Antarctic Minke Whale, Dark-shoulder Minke Whale	<i>Balaenoptera bonaerensis</i>	Throughout the Southern Hemisphere. Recorded in all Australian states except Northern Territory.	Migratory*** / marine species (EPBC Act) No category assigned, but possibly secure
Bryde's Whale	<i>Balaenoptera edeni</i>	Temperate to tropical waters, both oceanic and inshore.	Migratory*** (EPBC Act) (CMS) (CITES) Marine species (EPBC Act)
Killer Whale	<i>Orcinus orca</i>	Global and circum-Australia.	Migratory*** (EPBC Act) (CMS) (CITES) Marine species (EPBC Act) No category assigned but probably secure
Sperm Whale	<i>Physeter macrocephalus</i>	Global in deep waters in all oceans and confluent seas. Circum-Australia.	Vulnerable** (EPBC Act) (IUCN) Migratory*** (EPBC Act) (CMS) (CITES) Marine species (EPBC Act)
Spotted Bottlenose Dolphin	<i>Tursiops aduncus</i>	Tropical and sub-tropical coastal and shallow offshore waters of the Indian Ocean, Indo-Pacific Region and the western Pacific Ocean. Circum-Australia.	Migratory*** (EPBC Act) (CMS) (CITES)
Pygmy Killer Whale	<i>Feresa attenuata</i>	Global in tropical and subtropical oceanic waters. Circum-Australia.	Migratory*** (CMS)
False Killer Whale	<i>Pseudorca crassidens</i>	Global in deep tropical and temperate waters. Circum-Australia.	Migratory*** (CMS)
Dwarf Sperm Whale	<i>Kogia simus</i>	Primarily occurs over the continental shelf and slope off tropical and temperate coasts of all oceans. Circum-Australia.	Cetacean (EPBC Act) (CITES)

Common name	Scientific name	Distribution	Conservation status
Pygmy Sperm Whale	<i>Kogia breviceps</i>	Global tropical and temperate oceans, mostly beyond the edge of the continental shelf. Circum-Australia.	Cetacean (EPBC Act) (CITES)
Short-finned Pilot Whale	<i>Globicephala macrorhynchus</i>	Tropical and warm-temperate waters world-wide. Circum-Australia.	Cetacean (EPBC Act) (CITES)
Minke Whale	<i>Balaenoptera acutorostrata</i>	Tropical and warm-temperate waters of the Southern Hemisphere. Western, southern and eastern Australian waters.	Cetacean (EPBC Act)
Melon-headed Whale	<i>Peponocephala electra</i>	All deep oceanic waters between 35° N and 35° S. Australian temperate and tropical waters.	Cetacean (EPBC Act) (CITES)
Risso's Dolphin	<i>Grampus griseus</i>	Tropical, subtropical, temperate and subantarctic waters between 60° N and 60° S. Circum-Australia	Cetacean (EPBC Act) (CITES)
Bottlenose Dolphin	<i>Tursiops truncatus</i>	Global temperate and tropical waters. Circum-Australia	Migratory*** (CMS) (CITES)
Spinner Dolphin	<i>Stenella longirostris</i>	Pelagic zone of tropical, subtropical and, less frequently, in warm temperate waters in the Indian, Pacific and Atlantic Oceans. South-western Australia northwards to south-eastern Australia.	Migratory*** (CMS) (CITES)
Striped Dolphin	<i>Stenella coeruleoalba</i>	Temperate to tropical species. South-western Australia northwards to south-eastern Australia.	Cetacean (EPBC Act) (CITES)
Spotted Dolphin	<i>Stenella attenuata</i>	Pantropical oceanic tropical zones between about 40° N and 40° S. South-western Australia northwards to south-eastern Australia.	Cetacean (EPBC Act) (CITES)
Common Dolphin	<i>Delphinus delphis</i>	Tropical, subtropical and temperate in offshore waters of the Atlantic, Pacific and Indian Oceans. All Australian states and territories though less common in northern Australia.	Migratory*** (CMS) (CITES)
Rough-toothed Dolphin	<i>Steno bredanensis</i>	Deep oceanic tropical to subtropical waters. Recorded off Western Australia, Northern Territory, Queensland and New South Wales.	Cetacean (EPBC Act) (CITES)

Common name	Scientific name	Distribution	Conservation status
Cuvier's Beaked Whale, Goose-beaked Whale	<i>Ziphius cavirostris</i>	Worldwide distribution in all temperate and tropical waters. Circum-Australia	Cetacean (EPBC Act) (CITES)
Reptiles			
Horned Seasnake	<i>Acalyptophis peronii</i>	Tropical northern Australia, Coral Sea Islands, New Caledonia, Papua New Guinea, Thailand and Hong Kong.	Marine species (EPBC Act)
Dubois' Seasnake	<i>Aipysurus duboisii</i>	Indo-Pacific: from Australia to New Guinea and New Caledonia. Tropical northern Australia.	Marine species (EPBC Act)
Leaf-scaled Seasnake	<i>Aipysurus foliosquama</i>	East Indian Ocean; West Central Pacific; Southwest Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Olive Seasnake	<i>Aipysurus laevis</i>	Indo-Pacific, Northwest Atlantic and the Mediterranean. Tropical northern Australia.	Marine species (EPBC Act)
Stokes' Seasnake	<i>Astrotia stokesii</i>	Indo-Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Spectacled Seasnake	<i>Disteira kingii</i>	Indo-West Pacific. Western and northern Australia.	Marine species (EPBC Act)
Olive-headed Seasnake	<i>Disteira major</i>	Indo-West Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Turtle-headed Seasnake	<i>Emydocephalus annulatus</i>	Indo-West Pacific, Northwest Atlantic and the Mediterranean. North western and north eastern Australia	Marine species (EPBC Act)
Beaked Seasnake	<i>Enhydrina schistosa</i>	Indo-West Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Black-headed Seasnake	<i>Hydrophis atriceps</i>	Indo-West Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Slender-necked Seasnake	<i>Hydrophis coggeri</i>	Northeast Atlantic, Mediterranean and Indo-West Pacific. North western Australia	Marine species (EPBC Act)
Elegant Seasnake	<i>Hydrophis elegans</i>	Indo-West Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Plain seasnake	<i>Hydrophis ornatus</i>	Northeast Atlantic, Mediterranean and Indo-Pacific. Tropical northern Australia.	Marine species (EPBC Act)

Common name	Scientific name	Distribution	Conservation status
Spine-bellied Seasnake	<i>Lapemis hardwickii</i>	Indo-West Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Yellow-bellied Seasnake	<i>Pelamis platurus</i>	Global tropical waters. South-western Australia northwards to south-eastern Australia.	Marine species (EPBC Act)
Ray Finned Fishes			
Corrugated Pipefish, Barbed Pipefish	<i>Bhanotia fasciolata</i>	Eastern Indian Ocean and Western Pacific. North western Australian waters.	Marine species (EPBC Act)
Three-keel Pipefish	<i>Campichthys tricarinatus</i>	Western Central Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Pacific Short-bodied Pipefish, Short-bodied Pipefish	<i>Choeroichthys brachysoma</i>	Indo-Pacific: Red Sea and East Africa to the Society Islands, north to the Philippines and Guam, south to northern Australia.	Marine species (EPBC Act)
Pig-snouted Pipefish	<i>Choeroichthys suillus</i>	Western Central Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Fijian Banded Pipefish, Brown-banded Pipefish	<i>Corythoichthys amplexus</i>	Indo-West Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Yellow-banded Pipefish, Network Pipefish	<i>Corythoichthys flavofasciatus</i>	Indo-Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Australian Messmate Pipefish, Banded Pipefish	<i>Corythoichthys intestinalis</i>	Western Central Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Schultz's Pipefish	<i>Corythoichthys schultzi</i>	Indo-Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Roughridge Pipefish	<i>Cosmocampus banneri</i>	Indo-West Pacific. North western Australian waters.	Marine species (EPBC Act)
Ringed Pipefish	<i>Doryrhamphus dactyliophorus</i>	Indo-Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Indian Blue-stripe Pipefish, Blue-stripe Pipefish	<i>Doryrhamphus excisus</i>	Indo-Pacific and Eastern Pacific. Tropical northern Australia.	Marine species (EPBC Act)

Common name	Scientific name	Distribution	Conservation status
Cleaner Pipefish, Janss' Pipefish	<i>Doryrhamphus janssi</i>	Western Central Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Tiger Pipefish	<i>Filicampus tigris</i>	Eastern Indian Ocean and Western Pacific. Northwestern, eastern and southern Australian waters.	Marine species (EPBC Act)
Brock's Pipefish	<i>Halicampus brocki</i>	Western Pacific. Western and northern Australian waters.	Marine species (EPBC Act)
Red-hair Pipefish, Duncker's Pipefish	<i>Halicampus dunckeri</i>	Indo-West Pacific Tropical northern Australia.	Marine species (EPBC Act)
Mud Pipefish, Gray's Pipefish	<i>Halicampus grayi</i>	Indo-West Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Spiny-snout Pipefish	<i>Halicampus spinirostris</i>	Indo-Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Ribboned Seadragon, Ribboned Pipefish	<i>Haliichthys taeniophorus</i>	Indo-Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Beady Pipefish, Steep-nosed Pipefish	<i>Hippichthys penicillus</i>	Indo-West Pacific. Northwestern, northern and eastern Australian waters.	Marine species (EPBC Act)
Spiny Seahorse	<i>Hippocampus histrix</i>	Indo-Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Spotted Seahorse, Yellow Seahorse	<i>Hippocampus kuda</i>	Indo-Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Flat-face Seahorse	<i>Hippocampus planifrons</i>	Indo-Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Hedgehog Seahorse	<i>Hippocampus spinosissimus</i>	Indo-Pacific. Tropical northern Australia.	Marine species (EPBC Act)
Tidepool Pipefish	<i>Micrognathus micronotus</i>	Western Pacific. Northwestern Australian waters.	Marine species (EPBC Act)
Pipehorse	<i>Solegnathus hardwickii</i>	Western Indian Ocean. Tropical northern Australia.	Marine species (EPBC Act)
Indonesian Pipefish, Gunther's Pipehorse	<i>Solegnathus lettiensis</i>	Eastern Indian Ocean. Western Australian waters.	Marine species (EPBC Act)

Common name	Scientific name	Distribution	Conservation status
Blue-finned Ghost Pipefish, Robust Ghost Pipefish	<i>Solenostomus cyanopterus</i>	Indo-Pacific. Northwestern, northern and eastern Australian waters.	Marine species (EPBC Act)
Double-ended Pipehorse, Alligator Pipefish	<i>Syngnathoides biaculeatus</i>	Indo-Pacific. Western, northern and eastern Australian waters.	Marine species (EPBC Act)
Bend Stick Pipefish, Short-tailed Pipefish	<i>Trachyrhamphus bicoarctatus</i>	Indo-West Pacific. Northwestern, northern and eastern Australian waters.	Marine species (EPBC Act)
Long-nosed Pipefish, Straight Stick Pipefish	<i>Trachyrhamphus longirostris</i>	Indo-West Pacific. Tropical northern Australia.	Marine species (EPBC Act)
<p>*Endangered = An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:</p> <ul style="list-style-type: none"> lead to a long-term decrease in the size of a population, or reduce the area of occupancy of the species, or fragment an existing population into two or more populations, or adversely affect habitat critical to the survival of a species, or disrupt the breeding cycle of a population, or modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or interfere with the recovery of the species. 			
<p>**Vulnerable = An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:</p> <ul style="list-style-type: none"> lead to a long-term decrease in the size of an important population of a species, or reduce the area of occupancy of an important population, or fragment an existing important population into two or more populations, or adversely affect habitat critical to the survival of a species, or disrupt the breeding cycle of an important population, or modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat*, or interferes substantially with the recovery of the species. 			
<p>***Migratory = Listed migratory species include species listed in:</p> <ul style="list-style-type: none"> appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention; CAMBA; and JAMBA. 			

4.2.13 Conservation Areas

The nearest currently declared marine conservation zones or marine protected areas to Cova-1 well are: Jaco Island Marine Park, at the eastern end of Timor-Leste (approximately 130km northeast); the Australian Ashmore Reef National Nature Reserve (approximately 380km south-west); and the Indonesian Teluk Kupang/Pulau Kera Marine Recreation Park (approximately 220km west) (SKM 2001). All are considered to be too far away to be impacted by the drilling activities.

The coastal waters surrounding Timor-Leste are considered to be included in the Coral Triangle which is a geographical term referring to the tropical marine waters of Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste that according to the World Wildlife Fund harbours 75% of all known coral species, more than half of the world's reefs, 40% of the world's coral reef fish species, and six of the world's seven species of marine turtle.

4.3 SOCIAL ENVIRONMENT

4.3.1 Socio-economic Profile

Timor Leste became independent in May 2002 following nearly two years under United Nations Transitional Administration in East Timor. In mid-2008, the population of Timor Leste was estimated to be 1.1 million. The current annual GDP in 2008 was estimated to be US\$2.526 billion with an annual growth rate of 12.8%. Per capita GDP adjusted for purchasing power parity is estimated at US\$2,300. Unemployment in 2006 was estimated to be 20% in rural areas and 40% in urban areas (CIA 2009).

The capital, Dili, on the north coast of Timor-Leste, is serviced by a harbour capable of taking medium sized cargo ships. The airport at Dili is capable of taking medium to large passenger and cargo aircraft (e.g. Boeing 737). The only other airstrip capable of taking similar sized aircraft is that near the town of Baucau, some 100km to the east of Dili. Baucau airport is capable of taking large passenger and cargo aircraft and has been used for military purposes.

Timor Leste has an agricultural based economy, primarily focused on subsistence farming. In 2008, 90% of the population was dependent on agriculture as a livelihood (CIA 2009). Traditionally, the East Timorese are not fishing people. Most fishing is from canoes or small boats with outboard motors that remain close to shore. Fishing is likely to be seasonal and is frequently undertaken at night or early in the morning. The Government sees great potential to increase income from fishing in the future aiming to increase fishing grounds to about 33 times that of the past. This could increase fishing activities and sea traffic both in deepwater and near coastal areas. Government plans are to increase investment in national fishing capacity and licence foreign vessels. The Government's strategy identified several key fishing areas:

- the inshore reef;
- coastal and Timor Leste shelf fisheries for demersal and small pelagic species;

- the pelagic fishery for tunas including Yellow Fin and Big Eye;
- reef fish species of the Sahul Bank in the southern region;
- deepwater trawl resources well off the south coast; and
- aquaculture including hatchery and pond production.

Although 90% of the workforce is employed in agriculture, it contributes only 32% to GDP, whereas industry and services account for 13% and 55% of GDP respectively (CIA 2009). The construction industry, and the sector which provides its supplies, is the largest employer in the private wage paying sector. The large contractors are expatriate firms and local contractors are currently only able to pre-qualify for work under US\$50,000. The only sector of potential and major significance to Timor-Leste is the oil and gas industry.

Oil and gas revenues will underpin the government's routine and development programmes in the absence of any other substantial source of revenue. The oil and gas industry may be expected to provide the following benefits to Timor-Leste:

- expansion of the economy due to increased service and supply requirements of the oil and gas industry;
- employment opportunities for a large proportion of the population;
- potential support towards the development of social development initiatives aimed at improving the quality of life of local communities;
- vocational education and training opportunities to develop a skilled workforce; and
- gas resources for domestic and industrial use in Timor Leste.

Despite significant increases in revenue due to receipts from petroleum and coffee exports, it is still the poorest country in the Asia-Pacific region and has been ranked 150 of 177 countries in the 2007 UN Human Development Index. Despite this, the country has made significant progress in building an institutional framework to support economic development and promote macroeconomic stability.

The underlying economic policy challenge the country faces remains how best to use oil-and-gas wealth to lift the non-oil economy onto a higher growth path and to reduce poverty. In June 2005, the National Parliament approved the creation of a Petroleum Fund to serve as a repository for all petroleum revenues and preserve the value of Timor-Leste's petroleum wealth for future generations.

4.3.2 Communities Adjacent to the Drilling Area

The southern coastal areas of Timor-Leste adjacent to the Cova-1 well borders includes the districts of Cova Lima (population 53,000), Ainaro (52,500) and Manufahi (45,000). Within these districts, there are seven sub-districts and around seventeen sucos along the coast.

Small towns and villages are spread throughout these sucos, usually located a few kilometres inland from the coast. The two largest population centres on the coast

adjacent to the drilling area are Suai (population 23,000), capital of Cova Lima district, and Betano, a coastal village in Manufahi.

4.3.3 Petroleum Activities

Several offshore petroleum production facilities are located within a 200km radius of the Cova-1 field:

- the Elang-Kakatua Kakatua-North Floating Production, Storage and Offloading (FPSO) facility, producing export condensate;
- the Northern Endeavour FPSO, producing export oil from the Laminaria-Coralina condensate field;
- the Jabiru Venture FPSO, producing export oil; and
- the Challis Venture FPSO, producing export oil.

In addition, Eni's proposed Kitan Development is located approximately 80km south-southeast of the Cova-1 well. The Kitan Development is expected to commence production in 2011.

4.3.4 Shipping

The major commercial shipping routes through the Timor Sea pass well to the north and south of the permit areas. Vessels utilising these routes include bauxite carriers servicing terminals at Gove (Northern Territory) and Weipa (Cape York Peninsula), and coal carriers and container vessels departing Queensland ports for destinations in the Middle East, Europe and South Africa (LeProvost Dames & Moore 1997).

Vessel movements routinely operating in waters of the JPDA to the south of Contract Area C include those servicing the Challis/Jabiru, Corallina/Laminaria oilfields and Bayu Undan gas field. Fisheries

4.3.5 Commercial Fishing

The Government of Timor-Leste issued four commercial fishing licences for the Timor Sea in 2006. These were operated in 2007, but the Direcção Nacional de Pescas e Aquicultura (DNPA) (National Directorate of Fisheries & Aquaculture) have advised that these were not operated in 2008. Illegal fishing is also known to occur in the waters south of Timor-Leste.

Traditional and Subsistence Fisheries

Coastal communities along the 600km of Timor-Leste's coastline rely on a wide range of fish, including the large tunas, flying fish, coral reef fish and deepwater snappers for their livelihoods. The DNPA estimates that for over half the 20,000 fishermen of Timor-Leste, fishing is the main source of food and income. United Nations (UN) support since 1999 has helped re-establish the nation's fishing capacity, with the fish catch estimated to be 1,600 tonne in 2002 (Jasarevic, 2002).

The main vessel for traditional fishing is the pirogue, a small, flat-bottomed boat often propelled by paddles, although outboard motors are becoming increasingly common. Traditional fishing uses both gill net and handlines, and fishing activities usually do not extend more than 2 nautical miles (<4km) from the coast.

Recreational Fishing

The project is located in a very remote area and the deep waters and flat bottom of the project area are unlikely to be of interest to recreational fishing. No known tourist or recreational fishing occurs in the area. Apart from the possibility of occasional passing private motor vessels or yachts, there are no known tourism interests in the area.

4.3.6 Shipwrecks and Heritage Sites

There are no known significant marine heritage or archaeological sites in the vicinity of the proposed Cova-1 well.

5.0 POTENTIAL IMPACTS AND MANAGEMENT

5.1 INTRODUCTION

This chapter describes the potential environmental impacts associated with the drilling of the Cova-1 exploration well. Section 5.2 describes Eni's risk assessment procedure and Section 5.3 provides a high-level summary of the risks posed by the drilling to the biophysical environment. Sections 5.4 to 5.10 provide detailed discussions of the risks in terms of their source, characteristics, the potential environmental effect and their management.

Section 5.11 provides detailed discussions of the risks in terms of the socio-economic impacts and their management.

5.2 ENVIRONMENTAL RISK ASSESSMENT

Eni's philosophy to managing environmental risks is to remove or mitigate the risk during the design phase. Managing risks through design is contingent upon identifying, at an early stage in the project, the sources and pathways by which environmental impacts can occur and the sensitivities of the receiving environment in which the project is situated.

Eni's risk assessment procedure was implemented in order to assess the expected or potential impacts associated with the drilling of Cova-1. Eni's risk assessment methodology provides a systematic process for:

1. identifying each project activity and its associated environmental aspects;
2. identifying the environmental values/attributes at risk within and adjacent to the area;
3. defining the potential environmental effects of aspects identified in Step 1 on those values/attributes at risk identified in Step 2 above;
4. identifying the likelihood of occurrence;
5. identifying the consequences of potential environmental aspects; and
6. evaluating overall environmental risk levels using a likelihood and consequence matrix.

Figure 5.1 provides a generic representation of Eni's risk assessment methodology. Table 5.1 presents Eni's risk matrix showing likelihood, consequence and risk ranking classifications and Table 5.2 presents the environmental consequence descriptors.

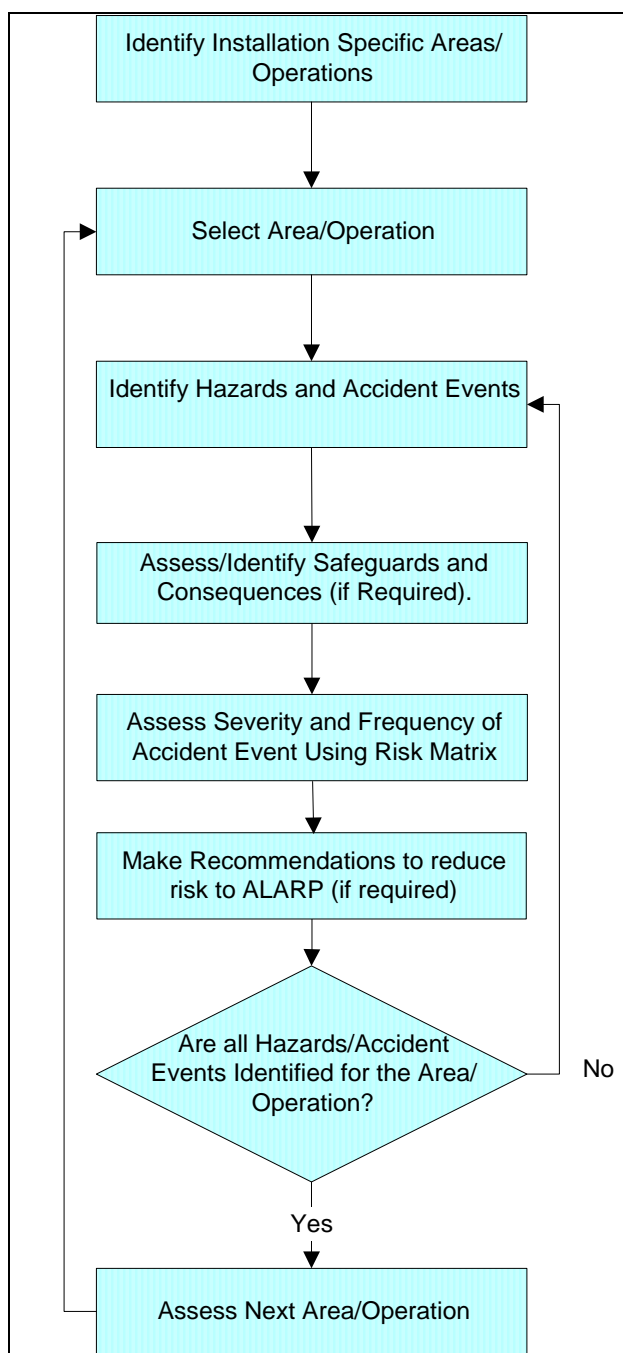


Figure 5.1 Risk Assessment Methodology.

A high-level risk assessment workshop was conducted in January 2010 by Eni's multidisciplinary team of project engineers and environmental scientists. The risk assessment was based Eni's knowledge and understanding of risks and impacts gained through its previous drilling in the Timor Sea. The combined experience of the workshop team ensured that all key environmental issues associated with drilling were identified, their significance assessed and appropriate management measures put in place to ensure that the environmental impacts would be managed appropriately.

Table 5.1 Eni Risk Matrix.

Consequence									Increasing Annual Frequency/Likelihood					
Severity	Reputation		Labour	Community	Health & Safety		Environment	Assets/Activities	0	A	B	C	D	E
	Stakeholder Relation	Company Image			Health	Safety			Practically non-credible occurrence	Rare occurrence	Unlikely occurrence	Credible occurrence	Probable occurrence	Likely/Frequent occurrence
									Could happen in E&P industry	Reported for E&P industry	Has occurred at least once in Company	Has occurred several times in Company	Happens several times/year in Company	Happens several times/year in one location
1	Slight impact	Slight impact	Slight impact	Slight impact	Slight impact	Slight impact	Slight impact	Slight impact	LOW					
2	Minor impact	Minor impact	Minor impact	Minor impact	Minor impact	Minor impact	Minor impact	Minor impact	MEDIUM					
3	Significant impact	Local impact	Medium impact	Local impact	Significant impact	Significant impact	Local impact	Local impact	HIGH					
4	Major impact	National impact	Major impact	Major impact	Major impact	Major impact	Major impact	Major impact	HIGH					
5	Extensive impact	International impact	Extensive impact	Extensive impact	Extensive impact	Extensive impact	Extensive impact	Extensive impact	HIGH					

Table 5.2 Environmental Consequence Descriptors

Descriptor	Description
Slight Impact	<p>Small discharges with confined and temporary impact on the area.</p> <p>No noticeable impact on water/air/soil and biodiversity.</p> <p>Negligible impact due to GHG emissions.</p> <p>Good materials/energy/water selection and use.</p> <p>Negligible financial consequences.</p>
Minor Impact	<p>Sufficiently large discharges to impact the environment but no long lasting effect.</p> <p>Short-term, localised impact on water/air/soil and biodiversity (on a limited no. of non-threatened species).</p> <p><1 week for clean up, 1-2 years for natural recovery.</p> <p>Slight impact due to GHG emissions.</p> <p>Adequate materials/energy/water selection and use.</p> <p>Single breach of statutory or prescribed limit or single complaint.</p>
Local Impact	<p>Limited discharges affecting the neighbourhood and damaging the environment with longer effects.</p> <p>Short term, more widespread impact on water/air/soil and biodiversity (on a higher no. of non-threatened species).</p> <p><1month for clean up, 2-5 years for natural recovery.</p> <p>Limited impact due to GHG emissions.</p> <p>Inadequate materials/energy/water selection and use.</p> <p>Repeated breaches of statutory or prescribed limit or many complaints.</p>
Major Impact	<p>Large discharges with severe and long lasting environmental damage.</p> <p>Medium-term, widespread impact on water/air/soil and biodiversity (on some threatened species and/or ecosystem function).</p> <p>1-5 months for clean up, 5-10 years for natural recovery.</p> <p>Extensive measures (financially significant) required to restore the impacted area.</p> <p>Significant impact due to GHG emissions.</p> <p>Poor materials/energy/water selection and use.</p> <p>Extended breaches of statutory or prescribed limits, or widespread nuisance.</p>
Extensive Impact	<p>Large discharges with severe and persistent environmental damage.</p> <p>Long-term, large-scale impact on water/air/soil and biodiversity (likely permanent species loss and impact on ecosystem function).</p> <p>>5 months for clean up, >10 years for natural recovery.</p> <p>Very poor materials/energy/water selection and use.</p> <p>Major financial consequences for the Company.</p> <p>Ongoing breaches well above statutory or prescribed limits.</p>

5.3 SUMMARY OF RISKS TO THE BIOPHYSICAL ENVIRONMENT

Table 5.3 presents a summary of the inherent risks (in the absence of risk reduction measures) of the project to the biophysical environment.

Table 5.3 Summary of Cova-1 Drilling Inherent Environmental Risks.

Hazard	Source	Inherent Risk
Oil, fuel and chemical spills	Well blow out Vessel collision Fuel or chemical transfers	High
Solid and hazardous wastes	Potential escape of solid and hazardous wastes (e.g. waste oil, chemicals) from operating vessels	Low
Drilling emissions	Discharge of drilling cuttings and associated drilling fluids Discharge of bulk drilling muds at the completion of drilling Use of displacement fluids	Low
Atmospheric emissions (SO _x /NO _x and greenhouse gases)	Exhaust emissions from operating vessels Flaring Potential fugitive emissions of ozone depleting substances	Low
Deck drainage	Deck drainage and associated contaminants from operating vessels	Low
Laboratory wastes	Laboratory wastes generated during oil testing	Low
Cooling water	Discharge of cooling water and associated chemical additives from operating vessels	Low
Desalination brine	Discharge of reject water (brine) from reverse osmosis plants from operating vessels	Low
Sewage, domestic wastewater and putrescible wastes	Discharge of sewage, domestic wastewater and putrescible wastes from operating vessels	Low
Antifouling biocides	Hull antifouling on operating vessels	Low
Marine pests	Ballast water discharge Hull biofouling	Low
Physical disturbance to marine biota	Physical presence of operating vessels	Low
Noise and vibration disturbance to marine biota	Noise and vibration generated Noise from aircraft during crew changes	Low
Disturbance to marine biota from artificial lighting	Lighting from operating vessels	Low

5.4 HYDROCARBON SPILLS

5.4.1 Sources

Oil spills are the most significant potential threat to the environment from drilling projects. Oil spills can potentially occur from a number of sources ranging from a major spill such as from a well blowout down to smaller leaks and spills from equipment and piping.

In total there have been seven well blowouts in Australian waters. The Montara blowout in 2009 is the first since 1984. Since then the industry has drilled around 1,500 offshore wells. A well blowout is, therefore, considered to be a rare event. The proposed drilling will be managed to avoid or minimise the potential for accidental releases of all substances, however, the potential exists for accidental release of hydrocarbons.

5.4.2 Properties of Hydrocarbons

Hydrocarbons usually comprise hundreds of mainly carbon based chemical structures. The relative balance of the constituent substances influences both their chemical and physical properties, which in turn affect their potential or environmental impact on marine biota. In general, hydrocarbons comprise four main groups:

- Alkanes: paraffin (acyclic) saturated hydrocarbons with direct or branched chains of carbon atoms;
- Naphthalene (cycloparaffins): saturated cyclic and polycyclic compounds in which hydrogen atoms may be replaced by alkyl groups;
- Arenes: aromatic unsaturated cyclic compounds from the benzene order where the hydrogen atoms may be also replaced by alkyl groups; and
- Alkenes (olefins): unsaturated acyclic hydrocarbons with direct or branched chains and double carbon connection (the compounds of this group are not part of crude oil but are the main products of its cracking).

Cova Crude Oil

The Cova field is expected to be a part of the reservoir that also supplies the Kitan oilfield so Cova crude is expected to be very similar to Kitan crude. Kitan crude is a light oil with an API of 57° and a specific gravity of 0.75 (Table 5.4). The distillation cuts indicate that about 80% of the oil is volatile or semi-volatile (those boiling off at less than 265°C) meaning that it will evaporate readily. It is classified as a Group 1 oil (ITOPF 2002) and if spilt into the sea, would be expected to spread rapidly on the sea surface, due to its low density, and degrade through evaporation and dispersion into the water column.

Modelling of weathering behaviour (Figure 5.2) using the Automated Data Inquiry for Oil Spills (ADIOS2) model predicts that 70 – 75% of a spill would be removed within the first 24 hours due to evaporation. Intertek (2008) reports a low wax content meaning that stable emulsions are unlikely to form.

Table 5.4 Anticipated properties of Cova Crude.

Parameter		Value	
API (°)		56	
Specific Gravity		0.75	
Kinematic Viscosity @ 20°C (cSt)		1.24	
Pour Point (°C)		< - 40°C	
Distillation Cuts Temp (°C)	Vol %	Distillation Cuts Temp (°C)	Vol %
22	3	180	61
70	12	220	72
100	24	260	80
120	33	330	91
135	42	400	97
160	53		

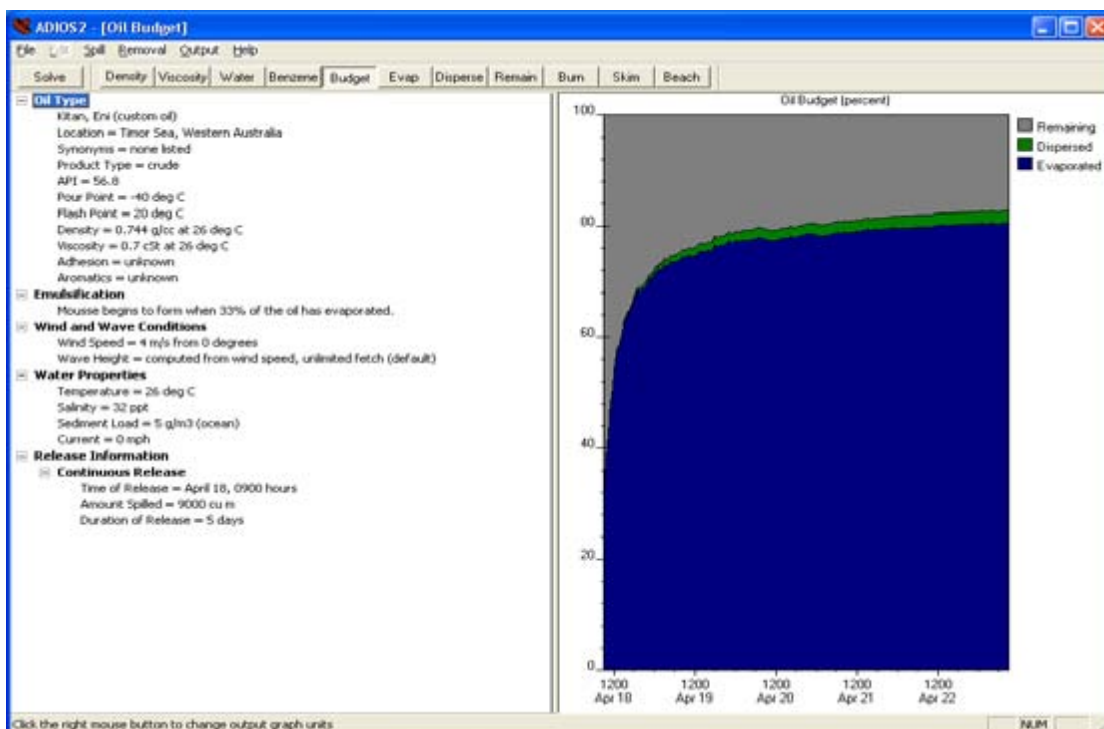


Figure 5.2 Predicted weathering of Kitan oil (based on a continuous release of 9,000m³ spill over 5 days for a 4ms⁻¹ wind).

Diesel fuel

Diesel is a light petroleum distillate with an API of 30°- 32° and a specific gravity in the range 0.84 to 0.88 (Table 5.5). As such they are classed as Group II oils (ITOPF 2002) i.e. light persistent oils. Diesels are expected to undergo a rapid spreading with moderate evaporative loss in tropical waters and, consequently, slicks are likely to break up. Diesel oils tend not to form emulsions at the temperatures likely to be found in the Timor Sea and so these will not inhibit spreading of the slick or evaporation rates.

Weathering and dispersability studies on Australian marine diesel indicate that in the case of a spill approximately 50% of the mass will be evaporated under northwest conditions (Kagi *et al.* 1988). Figure 5.3 shows the predicted weathering behaviour from the ADIOS2 model for a constant wind speed of 4ms⁻¹. Evaporation rates are initially high with just under 50% evaporating within the first 24 hours. Vertical dispersion rates are also high with the majority of diesel being removed from the sea surface within three days.

Table 5.5 Properties of Diesel Fuel Oil (from ADIOS2 database).

Parameter	Heavy Oil
API (°)	30 - 32
Specific Gravity (g/cc)	0.84 to 0.88
Kinematic Viscosity @15°C (cSt)	4
Pour Point (°C)	-14
Distillation Cuts	
Temp	
(°C)	Vol %
160	3
180	6
200	11
250	31
300	63
350	89

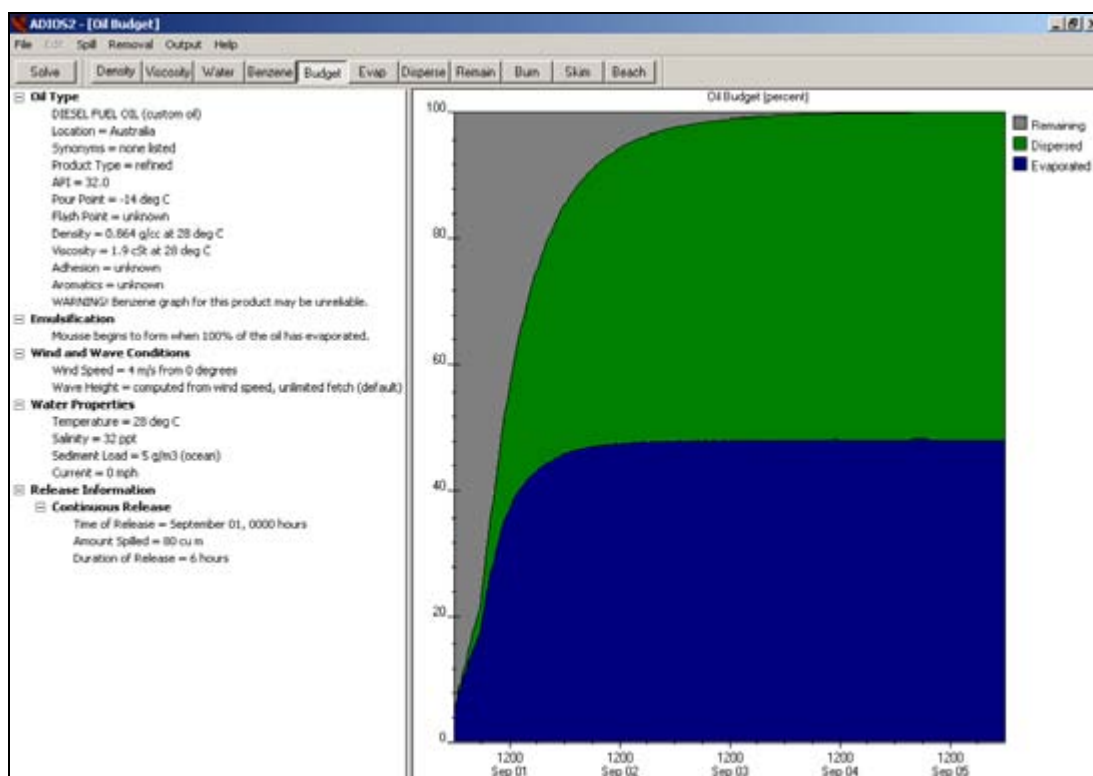


Figure 5.3 Predicted weathering of diesel fuel oil (based on a continuous release of 80m³ over 6 hours for a 4ms⁻¹ wind).

Toxicity of crudes and diesel

Toxicity of crude and refined products is primarily due to the volatile and water soluble aromatic hydrocarbons (benzenes, naphthalenes and phenanthrenes) and the higher molecular weight polycyclic aromatic hydrocarbons. The most toxic components in oil, although having the highest solubility in water, tend to be those that are lost rapidly through evaporation when oil is spilt. As a result, lethal concentrations of toxic components leading to large scale mortalities of marine life are relatively rare, localised and short-lived and only likely to be associated with spills of light refined products or fresh crude. At particular risk are animals and plants living in areas of poor water exchange.

The toxicity of Cova oil has yet to be evaluated. However, it is likely to have similar toxicities to Kitan crude. Toxicity testing of diesel by various organisations has identified it as being toxic to a variety of marine species. The range of reported toxic concentrations varies from 3 – 80 mg/L (CONCAWE 1996).

5.4.3 Fate and Trajectory

Fate of hydrocarbons in water

When oil is spilled into the sea it undergoes a number of physical and chemical changes some of which lead to its removal from the sea surface, others which cause it to persist. Although spilled oil is eventually assimilated by the marine environment, the time taken depends upon factors such as the amount of oil spilled, its initial physical and chemical characteristics, the prevailing climatic and sea conditions and whether the oil remains at sea or is washed ashore.

Oil Spill Modelling

An oil spill trajectory modelling system was developed for the Cova-1 well to predict the fate of oil spills. The modelling system comprises an oil weathering model, a three-dimensional oil spill trajectory model and a detailed hydrodynamic finite element model of the Timor Sea (Sustainability 2010a). The hydrodynamic model simulates the flow of ocean currents generated by astronomical tides, wind stress and incorporates residual oceanic circulation from a global hydrodynamic model.

Table 5.6 summarises the oil spill scenarios modelled. The model was run in stochastic mode in which the model takes into consideration the frequency of occurrence of a range of different current and wind conditions. Multiple spill simulations (200) were undertaken using randomly selected start dates during the wet and dry seasons. Each of the 200 simulations generates a slightly different result due to the unique combination of tides, wind and oceanic circulation which might occur. The results from each simulation were combined to generate contour plots showing the probability of surface exposure to oil and the predicted minimum time to exposure. It is important to note that the plots do not show the total areas where oil will spread but rather the area in which the oil may possibly occur for the given spill scenario.

Table 5.6 Summary of modelled oil spill scenarios.

Scenario	Description	Oil type	Spill Volume (m ³)	Spill Duration
1	Well Blowout	Crude oil	9000 (1800m ³ /day)	5 days
2	Loss of fuel from a storage tank on a refuelling vessel	Diesel	80	6hrs

Fate and trajectory of Crude Oil

The well blowout scenario assumed a continuous crude oil spill of 1,800m³/day (~11,000 bbl/day) over five days (9,000m³ total spill volume). Figure 5.4 shows the probability of surface exposure at day 5 under winter wind and current conditions. The probability envelope extended predominantly in the westerly direction (approximately 150km towards the west and <30km towards the east) reflecting the oceanic circulation and the predominant wind direction during this season. Under this scenario, the modelling predicted a 1-5% probability that oil would reach the Timor coastline. The predicted minimum time to exposure was 2 days (Figure 5.5). By this time 75% of the original spill volume would have evaporated.

Under strong winds, oil droplets of less than 100µm would become entrained rapidly into the water column. As wind strength and surface wave intensity increases, oil droplets of greater than 100µm would also become mixed into the water column. After about 33% of the oil has evaporated and the remaining oil becomes more viscous there is the possibility that a mousse could form leading to an increase in the overall spill volume. Emulsions are more stable and persistent on the sea surface.

For crude oil to reach the Timor coastline, there would have to be prolonged periods of strong south-easterly winds. Under these conditions, evaporative rates and vertical dispersion would be high resulting in low concentrations of oil on impact with the coastline. As is standard procedure in the event of a spill, the slick should be monitored from the air and weather forecast obtained to allow real-time predictive oil spill modelling to be undertaken. If the slick is predicted to remain out at sea, then it should be allowed to degrade naturally.

Fate and trajectory of Diesel

The loss of fuel from a storage tank on a refuelling vessel scenario assumed a spill of 80m³ over a 6 hour period. Figure 5.6 shows the probability of surface exposure at day 5 under winter wind and current conditions. As with the crude oil spill, the probability envelope extended predominantly in the westerly direction (approximately 120km towards the west and <10km towards the east) reflecting the oceanic circulation and the predominant wind direction during this season. Under this scenario, the modelling predicted <1% probability that oil would reach the Timor coastline. The predicted minimum time to exposure was 2 days (Figure 5.7). By this time 50% of the original spill volume would have evaporated and the remainder would have dispersed into the water column.

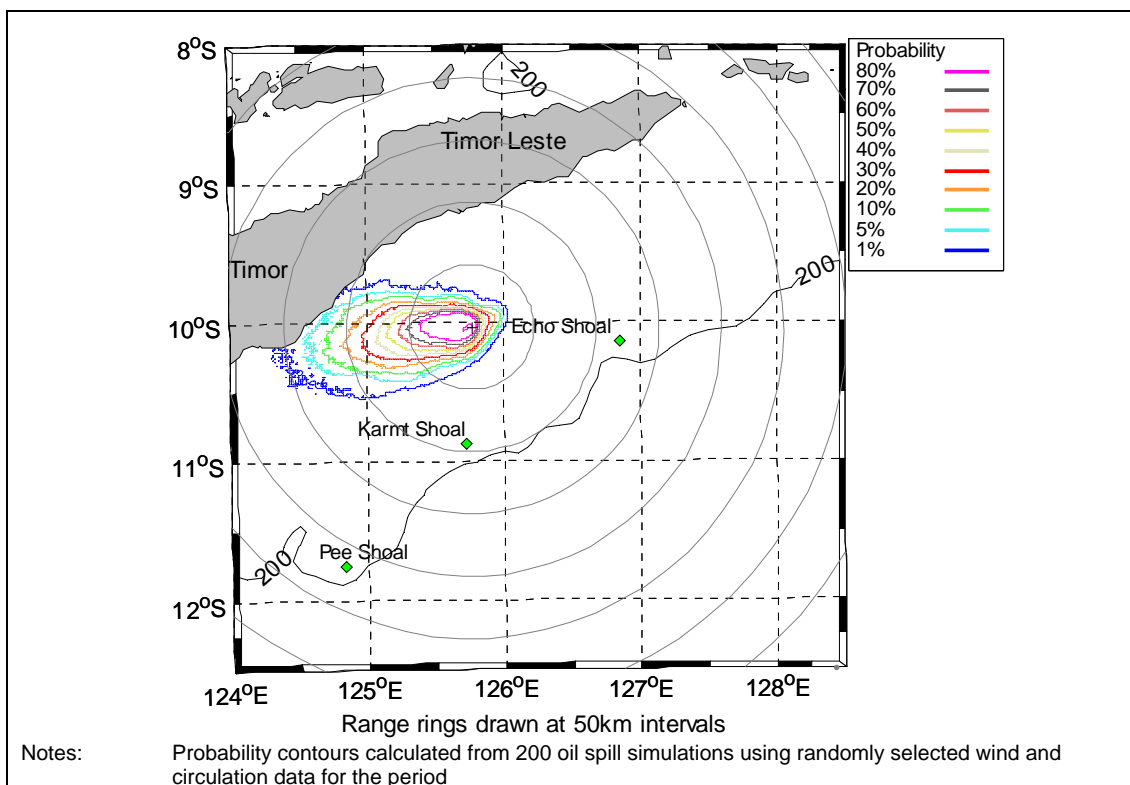


Figure 5.4 Probability of surface exposure at day 5 under winter conditions from a 9000m³ spill of crude oil occurring over a 5 day period.

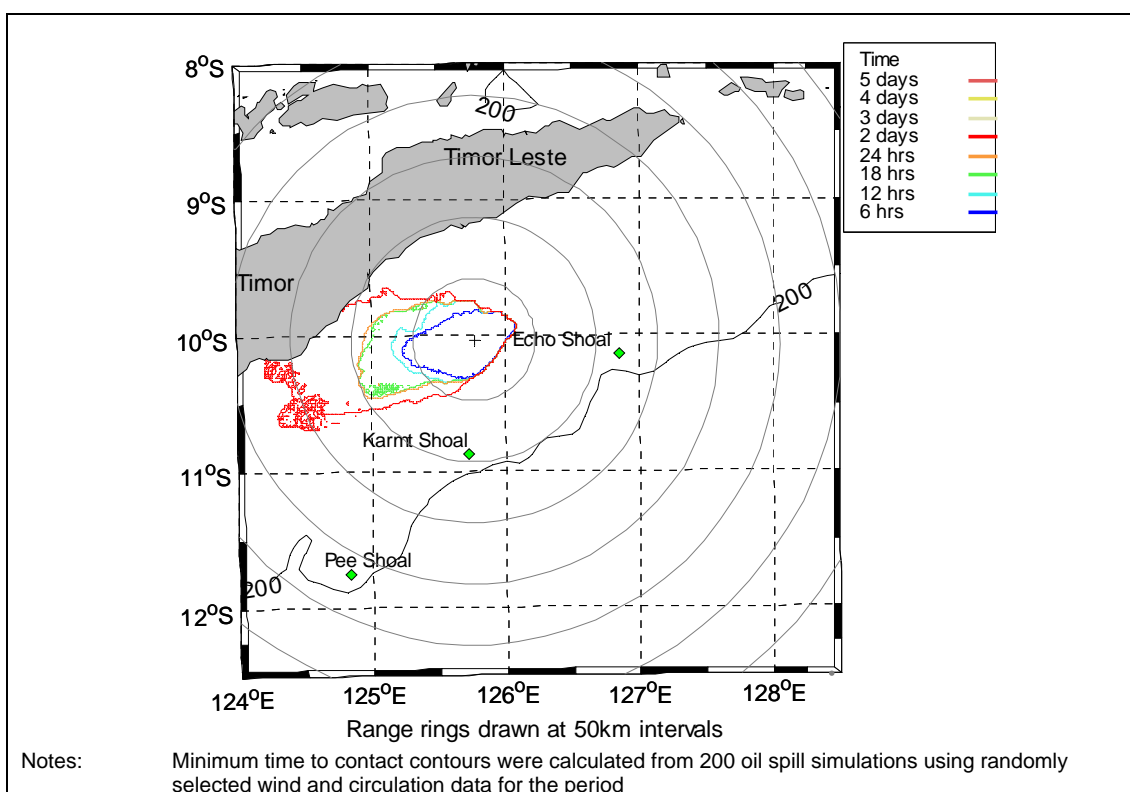


Figure 5.5 Predicted minimum time to exposure under winter conditions from a 9000m³ spill of crude oil occurring over a 5 day period.

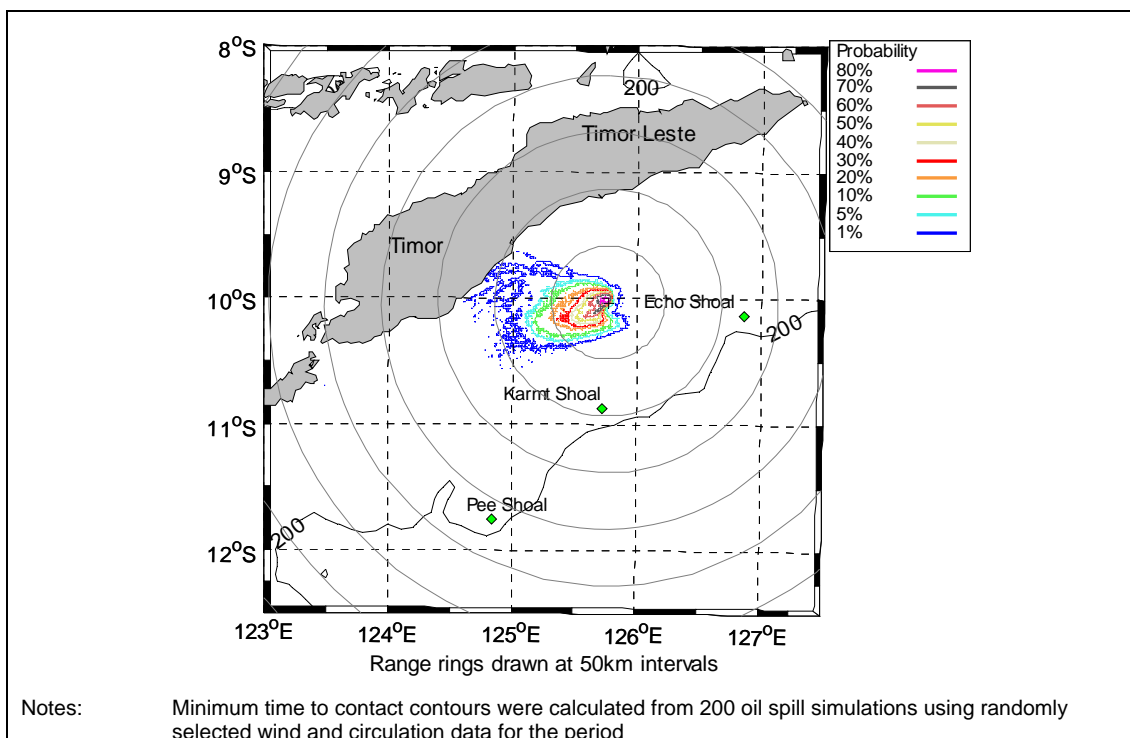


Figure 5.6 Probability of surface exposure at day 5 under winter conditions from a 80m³ spill of diesel occurring over a 6 hour period.

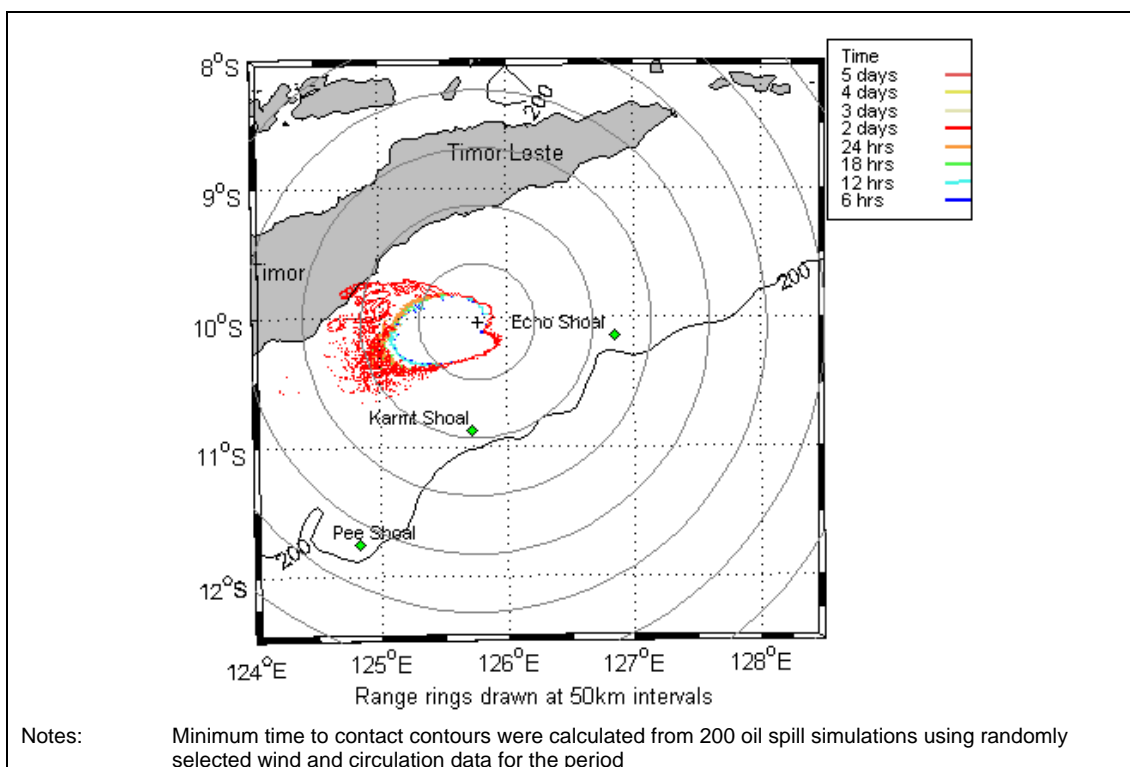


Figure 5.7 Predicted minimum time to exposure under winter conditions from a 80m³ spill of diesel occurring over a 6 hour period.

5.4.4 Potential Environmental Effects

Oil spill trajectory modelling has shown that any spill of either Cova crude oil or diesel from the proposed drilling area is most likely to degrade before it could make contact with a shoreline. Thus, nearshore marine communities and habitats of the Timor-Leste and Indonesian coastlines (e.g. corals, seagrasses, mangroves, turtle nesting beaches, intertidal and subtidal communities) are not considered to be a significant risk from the Cova-1 drilling program. Given Cova's oceanic environment, the resources considered to be most at risk are considered to be pelagic phyto- and zooplankton, pelagic fish, cetaceans, marine turtles and surface-feeding seabirds.

Oil can affect marine biota in a variety of ways through acute toxicity, and sub-lethal chronic effects on morphology, physiology and behaviour, some of which may ultimately lead to mortality. Weathering influences the toxicity of oil and its constituents. Weathering processes include spreading, evaporation, dissolution, dispersion into the water column, formation of oil-in-water emulsions, photochemical oxidation, microbial degradation, absorption to suspended particulate matter and stranding on the shore or sedimentation to the sea floor. Relatively lighter, more volatile, mobile and water-soluble compounds will tend to evaporate fairly quickly into the atmosphere. The lighter components of oil are usually the most toxic but are also those most readily lost through evaporation and the rate of evaporative loss increases with temperature. Consequently, weathered oil is generally less toxic than fresh oil (Swan *et al.* 1994) and so lethal concentrations of toxic components that could lead to death of marine organisms are relatively rare, localised and short-lived.

Swan *et al.* (1994) reviewed the environmental effects of oil spills across a broad spectrum of marine organisms and communities. Their review indicated that the response of phyto- and zooplankton to oil varied between species. However, phyto- and zooplankton could be generally characterised as having a high tolerance and rapid recovery (no long-term effects). Thus, the risk of an oil spill occurring and persisting at toxic concentrations for a sufficient period of time to have long-term effects on phyto- and zooplankton is considered to be negligible.

Organisms inhabiting the water column such as cetaceans, marine turtles and fish may be exposed to oil in the event of an oil spill. Pelagic fish are highly mobile and capable of diving to avoid exposure to oil so the threat of significant effects is considered low. Cetaceans and marine turtles would be more likely to come into contact with oil as they return to the surface to breathe. The effects of oil on cetaceans and marine turtles would include oiling of parts of the body, irritation of the eyes, inhalation of volatile oil components and ingestion. Inhalation and ingestion are likely to have a more significant effect on individuals that come into contact with oil than surface contact (Swan *et al.* 1994). Being mobile, however, these organisms would be expected to be able to move away from heavily oiled areas. It is difficult to predict with certainty the number of cetaceans or turtles that would be likely to be exposed in the event of an oil spill. However, in the open ocean environment of Cova-1, it is probable that only a small number of individuals would be exposed. In the event of an oil spill, Eni's priority would be to protect breeding and feeding areas to avoid impacts on populations.

Swan *et. al.* (1994) identify seabirds as being the most vulnerable organisms to an oil spill in oceanic environments. Oil spills can have a variety of effects including fouling of the plumage, ingestion of oil, effects on reproduction and physical disturbance. Many of the species that occur offshore are surface-feeding or plunge-diving pelagic birds, so that oil slicks would potentially interfere with feeding and increase exposure risk. Preening to remove oil would also expose the birds to direct ingestion of oil. Given the open oceanic location of Cova-1, remote from any land mass, the number of seabirds likely to be exposed in the event of an oil spill is expected to be low.

5.4.5 Management of Hydrocarbons

Eni's safeguards to be implemented for the minimisation of environmental impacts associated with oil spills comprise:

- procedures to reduce the likelihood of oil and chemical spills occurring;
- procedures to minimise the volumes spilled; and
- actions to be taken to minimise the environmental consequences in the event of a spill occurring, i.e. spill response.

These safeguards are described in Table 5.7. In addition, Eni will develop an OSCP which will be submitted for approval to DNMA. It details the practices and standards to be implemented in the event of an accidental hydrocarbon discharge.

Table 5.7 Summary of Safeguards to Manage Hydrocarbons.

Scenario	Description of Safeguards
Well Blow-out	<ul style="list-style-type: none"> • Comprehensive understanding of the nature of hydrocarbon formations at Cova including reservoir pressures and oil characteristics. • Use of industry standard drilling practices and equipment. • Installation of safety valves to shut in well in the event of release - BOPs. • Pressure testing the casing string. • Adoption of industry standard operational and maintenance practices and procedures. • Continuously monitoring for abnormal pressure parameters during drilling.
Leak from fittings and connections	<ul style="list-style-type: none"> • Pressure tested equipment. • Planned maintenance is undertaken and recorded. • Emergency shut-down (ESD) valves limit the size of the release.

Scenario	Description of Safeguards
Vessel collision	<ul style="list-style-type: none"> Exclusion zone established around the drillship. DNMA notified of location of the drillship. Drillship not located in commercial shipping lanes.
Hydraulic fluid leaks	<ul style="list-style-type: none"> Planned maintenance undertaken and recorded. Low toxicity hydraulic fluids used. Manned operation (visual detection of release). Drip pans/bunds.

5.4.6 Spill Response

In the unlikely event of an oil spill, the environmental impacts of the spill will be mitigated by various oil spill response activities to be detailed in the OSCP for the Cova-1 drilling campaign. The OSCP will assign responsibilities, specify procedures and identify resources available in the event of an oil spill. Trained and experienced personnel, extensive dispersant, materials and equipment stockpiles, and external agencies in the region will support the OSCP. No activities will be undertaken without the approved OSCP in place.

Key elements of the spill response are summarised below:

- all hydrocarbon spills to the ocean will be reported in accordance with the OSCP;
- procedures for oil and fuel spill intervention and response, as detailed in the approved OSCP, will be followed;
- spills in Timor-Leste sovereign waters will be reported to DNMA and other relevant parties; and
- pre-agreement for dispersant application procedures will be sought from DNMA, AMSA and other relevant agencies such that rapid response is possible.

Stocks of absorbent material and spill response equipment, including stocks of dispersants will be located on-site. The offshore support vessel will maintain oil spill procedures in accordance with the requirements of MARPOL 73/78 and also have oil spill response capability.

5.5 SOLID AND HAZARDOUS WASTES

5.5.1 Source and Characteristics

Solid and hazardous wastes generated during drilling of the Cova-1 well will include:

- general non-hazardous wastes;
- hazardous wastes; and

- maintenance wastes.

General non-hazardous wastes include scrap materials, packaging, wood and paper and empty containers. These non-hazardous waste materials will be stored on board the drillship in suitable containers (segregated from hazardous waste materials) ahead of transport back to shore for disposal/recycling in accordance with local regulations.

Hazardous wastes are defined as being waste materials that are harmful to health or the environment. Hazardous wastes generated include recovered solvents, excess or spent chemicals, oil contaminated materials (e.g. absorbents, filters and rags) and batteries. All hazardous waste materials generated will be documented and tracked, segregated from other waste streams and stored in suitable containers. Recyclable hazardous wastes, such as oils and batteries, will be stored separately from non-recyclable materials. All hazardous waste materials will be transported to shore for disposal or recycled at an approved and licensed facility.

Maintenance wastes include used chemicals, lubricating oils, paint, solvents, rags and other cleaning items. Maintenance wastes will not be discharged to the marine environment but will be stored in appropriate containers until the materials are transported onshore for recycling or disposal at approved and licensed facilities.

5.5.2 Potential Environmental Effects

The effects of discharges of solid or hazardous wastes to the marine environment would vary depending on the nature of the material involved. For example, solid wastes such as plastics are persistent in the environment and have been implicated in the deaths of a number of marine species including marine mammals and turtles. This is due to ingestion, inhalation or physical entanglement.

Solid and hazardous wastes would be transferred to the Australian mainland for onshore recycling or disposal. Any release of solid and hazardous wastes into the marine environment would be recorded as an environmental incident and treated accordingly by Eni's incident investigation and corrective and preventative action processes.

With the effective implementation of Eni's policy to transfer solid and hazardous wastes onshore for recycling or disposal, these wastes are not expected to have any impact on the marine environment.

5.5.3 Management of Solid and Hazardous Wastes

Safeguards to protect the environment from the potential impacts of solid and hazardous wastes entail:

- A Waste Management Plan will be prepared by Saipem.
- All personnel will be trained in the correct waste management procedures through the induction process.
- Solid and hazardous wastes will not be discharged from any vessel.

- All hazardous wastes will be segregated into clearly marked containers and stored in a bunded area capable of containing leakage or spillage, prior to onshore disposal.
- Solid wastes will be segregated and stored in enclosed areas prior to transfer onshore for recycling or disposal at approved facilities.
- Equipment and procedures will be in place to respond to any releases of hazardous wastes.
- Records will be maintained of solid and hazardous waste volumes generated and transferred onshore for recycling or disposal.

5.6 DRILLING DISCHARGES

5.6.1 Source and Characteristics

Drill Cuttings

Drill cuttings are crushed rock generated by the drill bit as it penetrates into the seafloor. The composition of the cuttings is determined by the nature of the formation being drilled. The cuttings retrieved are expected to range in size from very fine to very coarse particles, with a mean size no larger than one centimetre. The cuttings may contain up to 10% by weight of drilling muds. Drill cuttings produced are either:

- discharged directly onto the surface of the seabed during riserless drilling; or
- brought to the drillship by the drill fluids during closed drilling (with a riser), passed through a set of vibrating screens, hydrocyclones and centrifuges, to separate the muds for recirculation, before being disposed of near the sea surface.

Drill Fluids

There are three different broad classes of drilling fluid systems:

- water based muds (WBMs), where the continuous fluid phase is water;
- synthetic based muds (SBMs), where the continuous fluid phase is a well-characterised synthetic organic compound; and
- oil-based muds (OBMs), where the continuous fluid phase is oil.

Different drill fluids are used during different stages of drilling due to variations in water depth, geological formation and drillhole deviation. WBMs will be used during drilling of the Cova-1 exploration well. Neither SBMs nor OBMs will be used at any time.

Water Based Muds

WBMs use fresh or sea water as the continuous phase and the most common systems include bentonite, KCl, polymers and PHPA. They may also contain a range of additives such as biocides, weighting agents, alkaline chemicals, various salts, defoamers, corrosion inhibitors, scale inhibitors, drilling lubricants, lost circulation materials and pipe release agents. A typical formulation of a water-based fluid system is shown in Table 5.8.

Table 5.8 Typical Water Based Drilling Fluid System Formulation.

Component	Function	Concentration
Drill water	-	As required
KOH (Potassium hydroxide)	pH Control	0.5 lb/bbl
NaCO ₃ (Sodium carbonate)	pH Control	0.5 lb/bbl
KCl (8%)	Clay stabilisation and weighting agent	41 lb/bbl
PHPA (solid)	Cutting's encapsulation and stabilisation	1 lb/bbl
Polyanionic cellulose	Viscosifier and fluid loss control	0.5–1 lb/bbl
Bentonite (Clay)	Viscosity control	3 lb/bbl
Xanthum gum polymer	Viscosifier	1 lb/bbl
Polyglycol	Shale stabiliser	3% /bbl
Barite	Weighting agent	As required

WBMs deliver acceptable performance for drilling non-challenging wells (e.g. vertical wells with generally unreactive lithologies). They provide the least environmental impact due to their non-toxic nature and ability to disperse and biodegrade rapidly.

There are three main pathways for drilling muds to enter the marine environment during drilling activities:

- discharge of whole drilling muds to the ocean at the end of drilling;
- residual mud coating on drill cuttings that are discharged to the ocean; and
- unintentional spills.

WBMs are routinely discharged to the ocean at the end of drilling, or when the mud property requirements change.

The drilling fluids are released to the environment with the drill cuttings, either onto the seabed when drilling riser-less, or at sea surface, after centrifuging, when drilling with a riser. The amount of residual drilling mud that is discharged to the marine environment on cuttings varies depending on the viscosity, mud weight and water repellent nature of the drilling mud.

Drilling mud would be shipped in bulk containers then mixed aboard the drillship. Transfer of drilling mud components between the support vessel and drillship has a very low potential for material to be spilled overboard. For a spill to occur there would first have to be an accident involving loss of the container overboard and the container would have to rupture to release the contents. The volume of a spill will be limited by the size of the container being transferred and will usually be in the order of 200L drums to 1,500L bulk containers.

5.6.2 Potential Environmental Effects

The potential environmental effects associated with the discharge of drill cuttings and muds relate primarily to:

- the toxicity of the drilling fluids;
- increases in water column turbidity;
- smothering and alteration of sediment characteristics;
- seabed oxygen depletion if smothered by cuttings; and
- leaching of materials from cuttings.

Toxicity

Drilling muds contain a variety of special purpose additives. A number of reviews have been carried out to identify common drilling mud additives, their uses, application concentrations and ecotoxicities (Swan *et.al.*, 1994). Acute ecotoxicity from drilling mud additive contamination is highly unlikely and can only occur where the drilling mud is present in very high concentrations, far in excess of that which would occur in field situations.

Barite, a weighting agent, and bentonite, a viscofier, are some of the least toxic components of drilling fluids (Hinwood *et.al.*, 1944). Bentonite, barite and cement are all on the Oslo-Paris Commission (OSPAR) list of substances/preparations used and discharged offshore which are considered to Pose Little or No Risk to the environment (PLONOR list) (OSPAR 2003). WBM's have low ecotoxicity, high biodegradability and low bioaccumulation/bioconcentration potential. They are routinely accepted for discharge in open waters by international regulatory authorities. All of the additives of the WBM proposed for use in drilling the wells are on the PLONOR list.

Turbidity

When drill cuttings and adhered muds are discharged into the sea, a turbid patch of water develops and gradually dilutes as it disperses down current, and through the water column. Any increase in water turbidity resulting from the discharge of drill cuttings would be expected to be spatially localised and temporary. This was confirmed during Remotely Operated Vessel (ROV) surveys undertaken within days of completion of the exploration drilling of Kitan-1 and Kitan-2 wells (Sustainability, 2008a, 2008b). These surveys revealed that the water turbidity was low (i.e. a high water clarity) near the seabed throughout the length of each 50m transect emanating from the well.

Field tests and general observations indicate that discharged drilling fluids settle rapidly and that only a minor proportion remains in suspension (BHPP 1998). This is due to the fact that the thinners added to the muds are rapidly diluted by seawater causing the clays to agglomerate. These larger particles sink rapidly.

Although prolonged high levels of turbidity can affect photosynthetic activity, drilling the Cova-1 well is not expected to cause major, lasting effects because of the temporary nature of the discharge, the limited area affected, the low biological abundance in the area and the significant water depth and consequently the absence of benthic organisms directly reliant on photosynthesis for survival.

Smothering and Alteration of Sediment Characteristics

There is a high likelihood that there will be some localised smothering of the benthic invertebrate communities, particularly during the drilling of the top-hole section when cuttings are discharged directly to the seabed in the immediate vicinity of the drill hole. Smothering of benthos is likely to occur close to the discharge point for drilling of the wells, mainly along the axis of the predominant current. Some habitat disturbance is likely to occur due to the difference in particle characteristics, such as size and abrasiveness, to the existing sediment. However, the severity of this impact will be slight, due to the low toxicity of the seawater and bentonite mud, the short time period, small area potentially affected and the action of water currents in dispersing this material.

To predict the fate of drill cuttings in the environment at the Cova-1 well, Eni modelled a 486m³ discharge of drill cuttings comprising 232m³ released at the seabed during riser-less drilling and 254m³ released at the sea surface from drilling using a riser (Sustainability 2010b). The modelling predicted that the majority of cuttings would settle on the seabed within 700m of the well at an average concentration of 0.24kg/m² – 1kg/m² and an average thickness of <1mm (Figure 5.8). The modelling predicted that the highest concentration of cuttings would occur within 20m of the well at a concentration of 1200kg/m² – 2400kg/m² and a thickness of 1m – 2m. These Cova-1 modelling results are consistent with Eni's modelling of cuttings dispersal at the Kitan-1 and Kitan-2 wells (located in the JPDA), which predicted that cuttings would settle within several hundred metres of the wells and at low concentrations.



ROV surveys undertaken at the conclusion of the Kitan-1 and Kitan-2 drilling programs (Sustainability 2008a, 2008b) observed isolated drill cuttings mounds of between two and 10m high within 50m of the well parallel to the predominant water current direction. Elsewhere, cuttings were not detected. The Kitan ROV survey findings supported the modelling predictions that impacts on benthic organisms from smothering by drilling cuttings would be localised. Thus, Eni expects the effects of drilling cuttings from the Cova-1 well to be similarly localised.

Oxygen Depletion

The use of WBMs reduces the likelihood of oxygen depletion in the sediments because of their greater hydrophilic properties, ability to disperse in the water column and lower toxicity to benthic fauna that re-work the sediments.

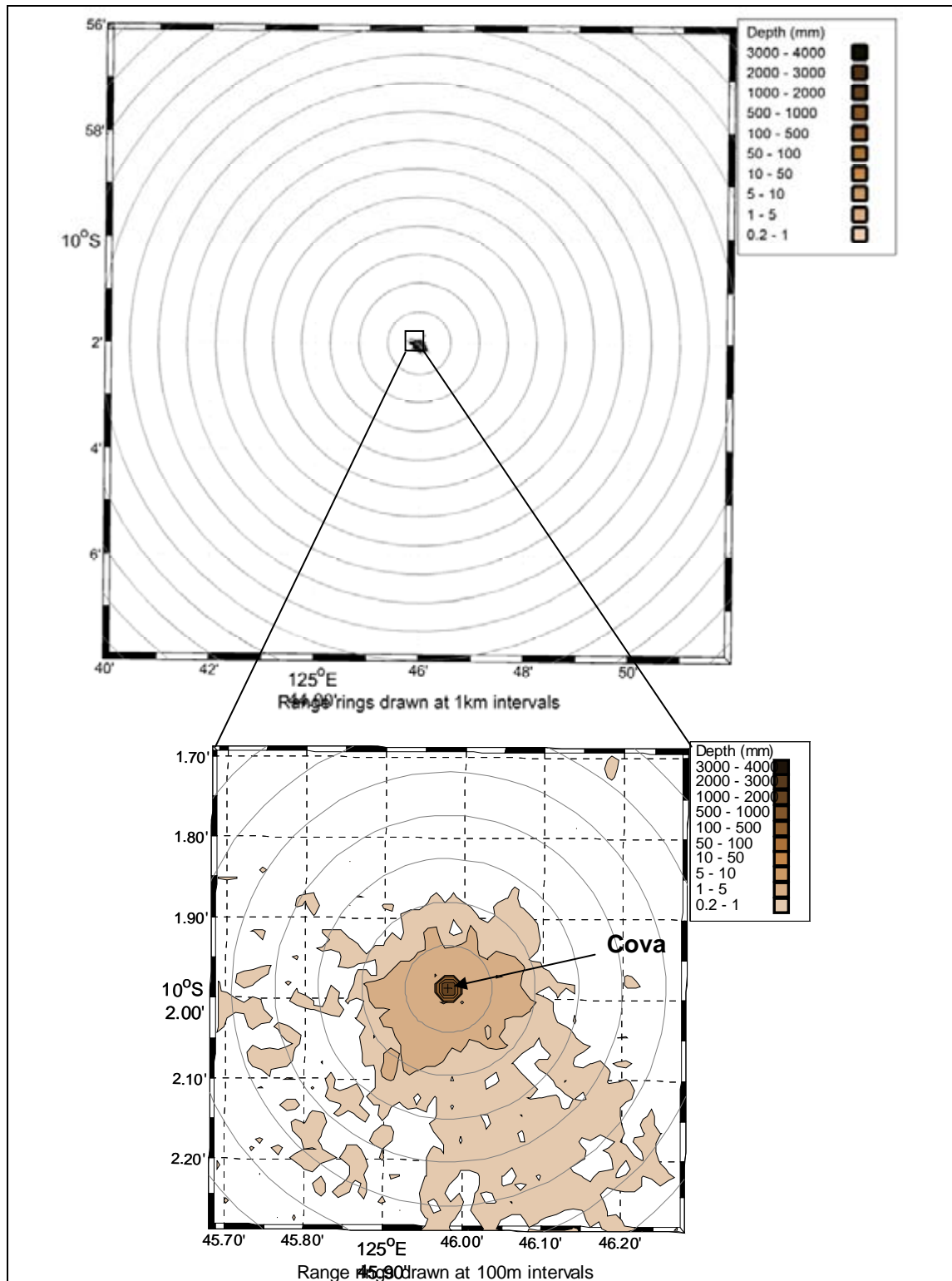


Figure 5.8 Predicted distribution of drill cuttings during the Cova-1 drilling campaign (Sustainability 2010b).

Leaching of Materials from Cuttings

The heavy metal content of cuttings from individual wells varies considerably based on the characteristics of the host rock and it is therefore difficult to make generalised predictions of metal leaching and its effects (Swan *et. al.* 1994). The analysis of drill cuttings in other fields (ESSO 1993) has shown that the concentration of metals contained within cuttings is generally within the range of concentrations of typical marine sediments and it is not anticipated that any significant leachable compounds will be found at Cova-1.

Metals in residual drilling mud on cuttings would be transported to the seabed. However, the potential leachate in these muds (i.e. metals) are biologically unavailable or are not in soluble form (with the exception of very minor quantities of formation fluids which may be circulated), and therefore do not constitute a pollution threat (Neff *et. al.* 2000). Barite and bentonite may contain some heavy metal concentrations but not in a readily bioavailable form. Hydrocarbons may also be present in the cuttings but the volumes of hydrocarbons that may be transported to the seabed via drill cuttings is relatively minor and unlikely to cause any significant environmental effects (APPEA 1994).

5.6.3 Management of Drilling Discharges

Eni's safeguards to protect the environment from the potential impacts of the drilling discharges comprise:

- An Environmental Management Plan (EMP) for the drilling of the Cova-1 exploration well. Eni would consult with DNMA during the development of the EMP and seek acceptance of the EMP prior to conducting drilling.
- The EMP would include a detailed risk assessment and development of risk registers specific to the Cova-1 drilling campaign.
- Use of WBMs, comprising seawater and prehydrated gel sweeps for the riserless section of the hole and a PHPA water based gel with KCl for the riser section of the hole.
- Onboard recovery of muds to minimise discharge of residues on cuttings.
- Transfer and handling procedures would be in place to ensure that the potential for concentrated mud components being spilled on the drillship or during transfer to enter the sea is low.
- Transfer and drainage systems on board the drillship. In the event of a spill of drilling materials on board the drillship, liquid material would be diverted to the drainage sump or slops tank. Dry material would be contained on deck until it can be cleaned up.
- Water column turbidity caused by the drilling cuttings/fluids plume will be minimised by maintaining the cuttings shakers equipment aboard the drillship at optimum efficiency.
- Routine checks will be made of the cuttings shakers and other solids control equipment, to ensure that cuttings are not contaminated with oil prior to discharge.

- Drillship procedures will ensure that any overboard discharges meet the legislative standards for oil-in-water (OIW).

5.7 ATMOSPHERIC EMISSIONS

5.7.1 Source and Characteristics

There are three identified sources of atmospheric emissions, which are:

- flared gas;
- exhaust gas; and
- ozone depleting substances (ODS).

The flaring of well test formation gases releases combustion gases into the atmosphere. Most of these gaseous emissions are in the form of CO₂, although smaller quantities of other gases, such as nitrogen oxides (NO_x) and carbon monoxide (CO) are generated, with only minimal quantities of sulphur dioxide (SO₂), generated owing to the low sulphur content of the oil.

Exhaust gases are produced from running the power plant and machinery on board the drillship and are ultimately released into the atmosphere. The composition of exhaust gases is similar to those produced from flaring.

ODSs (halon) will be present on helicopters but avoided elsewhere if possible. There will be no planned discharge of ODS. However as the halon is used in fire suppression systems a small volume would be released in the event of a fire.

Table 5.9 summarises the potential air emission types and sources and their significance in terms of greenhouse gas emissions, pollution or ozone depletion.

Table 5.9 Potential Air Emissions and Sources.

Gas	Sources			Significance		
	Flaring	Exhaust Gases	Refrigerants, Air Conditioning, Fire Suppression	Greenhouse Gas	Air Pollutant / Toxicant	Ozone Depleting Substance
Methane	✓	✓		✓ (21x CO ₂ -e)		
VOCs	✓	✓			✓	
H ₂ S					✓	
CO ₂	✓	✓		✓ (1x CO ₂ -e)		
NO _x (NO, NO ₂)	✓	✓				
N ₂ O	✓	✓		✓ (310x CO ₂ -e)		

Gas	Sources			Significance		
	Flaring	Exhaust Gases	Refrigerants, Air Conditioning, Fire Suppression	Greenhouse Gas	Air Pollutant / Toxicant	Ozone Depleting Substance
SO _x (SO ₂ , SO ₃)	✓	✓			✓	
CO	✓	✓			✓	
Particulates/ smoke	✓	✓			✓	
Fluorocarbons (CFCs, HFCs, HCFCs, SF, CF)			✓	✓ (560x – 23,900x CO ₂ -e)		✓

5.7.2 Potential Environmental Effects

Air emissions from the Cova-1 drilling campaign are considered unlikely to have a significant impact on air quality at the local and regional scales as they are expected to be quickly dissipated into the surrounding atmosphere. Furthermore, the project area is remote from any land mass, far from sensitive receptors and the drilling campaign is of a short duration. Therefore, air emissions are not expected to contribute significantly to pollution and the deterioration in air quality.

5.7.3 Management of Atmospheric Emissions

Safeguards that will be adopted to protect the environment from the potential impacts of the atmospheric emissions entail:

- Equipment and machinery will undergo planned maintenance to manufacturer's specifications to ensure that it is operating at its optimal efficiency.
- Green burners will be used on flare, i.e. small droplets that promote complete combustion and consequently low NO_x emissions;
- Fire and gas detection and shutdown systems will be installed to ensure any unexpected significant leaks of fugitive emissions are quickly detected and rectified.
- There will be no discharge of ozone-depleting substances, except in the case of an emergency.
- Records of flared gas will be maintained.

5.8 LIQUID WASTE STREAMS

5.8.1 Source and Characteristics

Deck Drainage

Deck drainage consists primarily of rainwater and deck wash-down water. It may include small amounts of detergents, oil and grease, spilt chemicals, used machinery chemicals and dirt from the decks. The volume of drainage likely to be generated is difficult to determine with accuracy as it depends on the rainfall and frequency of deck washing.

Spills on the drillship deck will be contained and diverted to the slops tank, sump or mopped up to prevent overboard discharge. To achieve this, the drillship will have scupper plugs available to block overboard drains, as well as absorbent booms and clean-up materials at the ready so that any spill on deck can be rapidly contained. Deck drainage water on the drillship will be directed to a sump (or similar) which is connected to an oil-water separator. Once separated, the oil and grease will be stored in suitable containers ahead of transfer ashore for recycling, and the treated water will be discharged to sea. This discharge will be monitored for OIW content.

Laboratory Wastes

Laboratory facilities on the drillship enable operating personnel to carry out analytical checks on samples taken from the various process and utility systems.

Cooling and Reject (Brine) Water

Cooling water is usually once-through seawater that does not come in direct contact with production streams. It is used as a heat exchange medium for the purpose of cooling machinery and may contain biocides to control biofouling on the inside of conduction pipelines. The cooling water is then discharged at a temperature higher than that of the ambient seawater (Swan *et. al.* 1994).

Reject water is seawater that is extracted from the ocean, and is then passed through a reverse osmosis or steam system to obtain freshwater. The residual water is then discharged to the ocean. Reject water is anticipated to be discharged with about 50% higher salinity than ambient seawater.

Sewage, Grey Water and Putrescible Wastes

Sewage, grey water and putrescible wastes (those wastes that are liable to decay, i.e. kitchen wastes) will only be released to the sea after the material has passed through a comminuter or grinder such that the material to be released is capable of passing through a screen with openings no greater than 25mm in accordance with the MARPOL 73/78.

5.8.2 Potential Environmental Effects

Deck Drainage

The volume of deck drainage water that is likely to be discharged at any given time is expected to be low. Furthermore, the concentrations of oil, grease and trace metals and other contaminants that could potentially enter the marine environment as a result of deck wash activities are expected to be low. There is unlikely to be a detectable environmental effect due to the expected low volumes of deck drainage in relation to the high dilution rates afforded by the open ocean environment of Cova-1.

Laboratory Wastes

The procedures and design of the facility will be such that the risk of discharge of laboratory wastes is very low. The concentrations of chemicals likely to enter the marine environment, as a result of laboratory activities, are unlikely to cause any detectable environmental effect because of the minor quantities involved. No significant environmental effects are anticipated from this source.

Cooling and Reject (Brine) Water

Once discharged into the ocean, the cooling water will initially be subject to mixing due to ocean turbulence and some heat will be transferred to the surrounding waters. The plume would then disperse and rise to the ocean surface, where further loss of heat and dilution would occur.

The volume of discharge from the drillship will be small compared to the receiving waters and so the environmental effects of the elevated temperature of discharged waters is therefore predicted to be insignificant due to the large buffering capacity of the ocean. The plume will quickly lose heat and water in only a small area around the outfall will have a substantially elevated temperature (Swan *et. al.* 1994).

Upon discharge of brine to the sea, the brine is of greater density than seawater and would be expected to sink and disperse in the currents. It is expected that most pelagic species that would occur at the proposed drilling location would be able to tolerate short-term exposure to the slight increase in salinity caused by discharge of the brine. Both potassium and chloride are common in seawater and so the effect on the marine environment is considered slight.

Sewage, Grey Water and Putrescible Wastes

The primary concerns relating to sewage discharge are increases in nutrient availability and biological oxygen demand (BOD). In the open oceanic environment of Cova-1, the effect of the BOD of the effluent on seawater oxygen concentrations around the drillship is predicted to be undetectable (Swan *et. al.* 1994).

Increased nutrient availability may result in the biostimulation of marine organisms and a slight increase in algal growth in a small area near the outlet. The mass of nutrients to be discharged in sewage on a daily basis is likely to be small and, given the Cova-1's open ocean environment, rapid dilution of the effluent is expected to result in a highly localised influence. This is not considered to lead to any adverse impacts. The discharge of sewage, grey water and putrescible wastes is not considered to have any potential adverse effects on the marine environment.

5.8.3 Management of Liquid Wastes

Deck Drainage

The primary mitigation measure is the avoidance of spills through the initial design integrity built into process and utility equipment, materials handling and dropped object studies, and operating and maintenance procedures. Safeguards to protect the environment from the potential impacts of deck drainage include:

- Operational areas will be segregated for drainage collection and to restrict contamination of stormwater run-off.
- Routine maintenance and visual monitoring will allow for early detection of leaks, ensuring a quick response to repair leaks on clean up spills.
- Absorbents and containers would be available on the drillship and support vessels to clean up small accumulations of oil and grease around work areas and decks.
- Deck drains on all vessels will be routed to an oil-water separator and monitored for OIW content prior to discharge. Oily water from the drillship machinery space bilges would be captured and directed to a sludge tank, which in turn drains into a slops tank.
- The discharge of oily water from the drillship is regulated by MARPOL 73/78 and requires the OIW content to be less than 15ppm.

Laboratory Wastes

The procedures of the drillship will be such that the risk of discharge of laboratory wastes is very low. No further management is likely to be required.

Cooling and Reject (Brine) Water

The discharge of cooling water and reject water is not likely to have a deleterious effect on the surrounding marine environment due to the small volumes involved compared to the open oceanic environment in which Cova-1 is situated. No management measures are expected to be necessary.

Sewage, Grey Water and Putrescible Wastes

Safeguards to protect the environment from the potential impacts of sewage, grey water and putrescible wastes entail:

- Sewage, grey water and other putrescible wastes such as food scraps from the drillship and support vessels would be disposed of in accordance with MARPOL 73/78 Annex IV.
- Sewage effluent on the drillship will be treated in an extended aeration system and comminuted to pass through a screen of less than 25mm diameter prior to discharge, in accordance with the MARPOL 73/78.
- The support vessel would be required to have either a certified sewage treatment plant or sewage treatment facilities. As a minimum, sewage will be macerated to a diameter of less than 25mm and disinfected prior to disposal in accordance with the MARPOL 73/78.
- Sewage, food scraps or putrescible wastes would not be discharged within 12 nautical miles of land.

5.9 MARINE PESTS

5.9.1 Source and Characteristics

Marine pest species may potentially be transported to the proposed drilling location as a component of ballast water (and associated sediments) or as marine fouling on the supply vessels and drillship. Ballast water inevitably will contain organisms such as fish, invertebrate larvae and phytoplankton from the location from which the ballast was taken onboard. Similarly, despite the use of antifouling systems, there will inevitably be some degree of hull fouling on the drillship and supply vessel.

5.9.2 Potential Environmental Effects

The successful establishment of an exotic species transported via either ballast or hull-fouling depends primarily on three factors:

- colonisation and establishment of the marine pest on a vector (vessel, equipment or structure) in a donor region (e.g. a home port, harbour or coastal project site where a marine pest is established);
- survival of the marine pests on the vector during the voyage from the donor to the recipient region; and
- colonisation (for example by reproduction or dislodgement) of the recipient region by the marine pest, followed by successful establishment of a viable new local population.

In terms of the potential introduction of marine pests from ballast water, the Cova-1 drilling campaign would not pose any such risk because the proposed well is located in oceanic waters with a water depth of over 2,000m and does not provide a habitat for ballast water organisms to colonise. Thus, the risk of introducing marine pests to the oceanic environment of Cova-1 is negligible.

In relation to hull biofouling, should organisms be dislodged from a vessel the Cova-1 location does not provide a habitat for organisms to colonise. Neither the drill ship nor the supply vessel will enter Timor-Leste coastal waters during the drilling program so there is no conceivable risk of introduced marine species becomes established, either from ballast water discharge or hull fouling.

5.9.3 Management of Marine Pests

Safeguards to protect the environment from the potential impacts of marine pests would entail

- Application of Eni's HSE Management Standard for Marine Pests and Quarantine Management (Document No.: ENI-HSE-ST-034) to all vessels used throughout each phase of the project.

5.10 NOISE AND LIGHT DISTURBANCE

5.10.1 Source and Characteristics

Noise

During drilling there will be noise emissions from the drillship, support vessel and helicopters. Noise will be generated above and below the water surface.

At the drillship, noise will be emitted from the drill pipes and onboard machinery. McCauley (1998) measured the underwater noise emitted from a drilling rig in the Timor Sea and found the broadband noise level to be approximately 146dB re 1µPa when not actively drilling and 169dB re 1µPa during drilling operations.

Under normal operating conditions, when idle or moving between sites, the support vessel noise would be detectable only over a short distance. Working support vessels usually maintain position during loading and unloading supplies or during installation activities which means strong forward and reverse thrusts from the engines and bow thrusters for short periods of time. McCauley (1998) measured underwater broadband noise of approximately 182dB re 1µPa from a rig support vessel holding station in the Timor Sea.

Noise emissions can affect marine fauna in the following ways:

- attraction;
- increased stress levels;
- disruption to underwater acoustic cues;
- behavioural avoidance;
- hearing impairment and pathological damage; and
- secondary ecological effect may occur as a result of one or more species influencing another species, e.g. by alteration of a predator/prey relationship.

The frequency of whale, other marine mammals and turtle visitations to the Cova-1 location is perceived to be low although whales, turtles and dolphins are known to occur within the wider region. Cetaceans are sensitive to sounds below the water surface. For some offshore developments, there is the potential that severe sound waves created from drilling activities could induce stress, and any pulsating or modulating effects may cause abandonment of important habitats, such as calving and nursery sites (McCauley, 1998). However, the nearest known whale calving ground to the project, is that of the Humpback Whale over 300km away from Cova-1. Therefore any effect on important habitats, such as calving and nursery sites, is highly unlikely. Similarly, turtles would be expected to avoid areas where sound was at such levels long before it caused them any physical harm.

Disturbance to fish is likely to be minimal as fish will be expected to avoid acoustical emissions which attain levels that may cause pathological effects. The degree of observed effect weakens with depth, with fish below about 200m depth being only mildly affected and the effect is temporary with normal schooling patterns resuming shortly after the noise source has passed. Surface and mid-water dwelling fishes may theoretically be adversely affected by noise generated during vessel movements.

Light

Lighting would be used by drillship and support vessel for safe illumination. Light would also occur from flaring activity during well testing. However, as the nearest coastline is approximately 90km from the proposed well location drillship lighting and flaring will not be visible at sea level from any mainland or island beaches. Lights on the drillship are likely to attract marine life and seabirds in the immediate vicinity but the impacts are expected to be slight. It is highly unlikely that there will be any impact on breeding turtles, nesting areas or hatchlings.

5.10.2 Potential Environmental Effects

Noise and light emissions from the proposed development would be localised and so the effects on marine mammals, turtles and fish is expected to be minimal. Further to this, it is important to note that whales, turtles and fish are highly mobile and will temporarily avoid the project area, if disturbed, as a result of drilling operations.

It is also unlikely that seabirds will be affected in any way from light or noise generated by the proposed development. Due to the distance of the proposed development from seabird rookeries, the potential for impacts due to airborne noises from the proposed development is extremely remote.

5.10.3 Management of Noise and Light Disturbance

Safeguards to protect the environment from the potential impacts of noise and light disturbance would entail:

- Helicopter flights would be carried out during daylight hours only, except if required during emergencies and training purposes.
- Flight paths would be routed to avoid any sensitive areas, such as shoals or known nesting sites.
- The drillship and supply vessel would consider minimising light spill from the as much as practical whilst maintaining safety requirements.

5.11 SOCIO-ECONOMIC IMPACTS

5.11.1 Socio-Economic Development

Timor-Leste faces considerable challenges in rebuilding its infrastructure and creating employment opportunities for young people entering the workforce. The development of oil and gas resources in offshore waters has begun to supplement government revenues resulting in the creation of jobs.

Article 5.4 of PSC S-06-03 includes clear obligations for Eni to provide a real opportunity to suppliers based in Timor-Leste and give preference in employment to Timor-Leste nationals and permanent residents. There is limited opportunity to incorporate significant local content into the Cova-1 drilling program due to the nature of the work and the short duration of the program. However, Eni endeavours to incorporate local content wherever feasible. For example, crew changes for the Cova-1 well will be conducted via helicopter based in Dili. Eni will continue to liaise with Timor-Leste stakeholders to identify and develop local content opportunities, particularly if development of the Cova field proves to be economically viable.

5.11.2 Fisheries

Traditional fishing boats are often observed fishing on Big Bank Shoals around the well head platform of the Buffalo Field in the nearby JPDA. Regular observations of Indonesian and Timor-Leste line fishing vessels are made from the Northern Endeavour. However, there are no known fishing activities in the deep waters of the Cova-1 well site. An impact on traditional fishing activities is highly unlikely and the risk may be considered to be low.

In terms of the open sea commercial fisheries, the region is only lightly exploited by longline fishermen, although the level of exploitation is increasing. Shark is the main target species. The shark fin fishery is increasing, with *Charedon* spp. and *Carcharhinus* spp. being the most valued species. Other species likely to be targeted are tuna and mackerel. As the area is not extensively used by fisheries and the drilling program is of a short duration (45 days) impacts on commercial fisheries are considered to be negligible.

5.11.3 Tourism

No known tourist or recreational fishing occurs in the area. Apart from the possibility of occasional passing private motor vessels or yachts, there are no known tourism interests in the area. Thus, impacts on tourism activities are not expected to occur.

5.11.4 Shipping

Shipping in the area is light, and there are no designated shipping lanes near the Cova-1 well. The major commercial shipping routes through the Timor Sea pass well to the north and south of the permit area. Vessels utilising these routes include bauxite carriers servicing terminals at Gove (Northern Territory) and Weipa (Cape York Peninsula), and coal carriers and container vessels departing Queensland ports for destinations in the Middle East, Europe and South Africa (Le Provost, Dames & Moore 1997).

Vessel movements in closer proximity to the Cova-1 well include those servicing the Challis/Jabiru, Corallina/Laminaria oilfields and Bayu Undan gas field. These fields are well to the south of the Cova field. Communication will be established with these vessels prior to installation activities and during the life of the project with the intention of planning vessel routes to avoid any potential interference. Strict adherence to marine navigation, communication and safety procedures will be maintained to ensure no risk is presented during all activities.

As shipping in the area is not significant, it is not expected that the drilling program will cause any disruption to shipping activity in the region. Marine safety notices will be issued through AMSA prior to the installation activities commencing and radio contact will be maintained with any vessels in the area. Measures taken to minimise the risk of collisions from shipping will include the designation of a 500m radius safety zone. The impact to shipping from the loss of access to the safety exclusion zone around the proposed well is mitigated by the relatively small size of the exclusion zone and the short duration of the program.

5.11.5 Amenity, National Parks and Conservation Reserves

There are no national parks (Ramsar) listed areas or other special conservation areas near the proposed well. Similarly, there are no marine protected areas, areas listed on the Register of the National Estate, shipwrecks or heritage sites. Due to its remote offshore location, there are no known heritage or archaeological sites of significance, shipwrecks or heritage sites in the vicinity of Permit Area PSC S-06-03.

6.0 MANAGEMENT MEASURES AND COMMITMENTS

6.1 ENVIRONMENTAL MANAGEMENT FRAMEWORK

6.1.1 Guiding Principles

Environmental management of the Cova-1 drilling program will be conducted within a framework comprising:

- currently accepted best practice approaches to environmental impact assessment;
- a systematic hazard management process, with defined procedures for identifying, assessing, controlling and mitigating hazards and effects; and
- an EMP to be developed and implemented in compliance with applicable legislation.

These guiding principles will drive improvements in environmental performance during the design phase of the program. Drilling will be conducted in line with good oilfield practice and opportunities for improving environmental performance will be pursued in accordance with business requirements.

6.1.2 HSE Integrated Management System

The environmental management framework is underpinned by Eni's HSE IMS, which incorporates systematic environmental management and controls as part of its standard business processes. Eni's HSE IMS is certified to the ISO14001 standard and is applied throughout all Eni operations and projects. Eni's management of the Cova-1 drilling program would be modelled on its successful implementation of management measures and procedures at its various drilling sites in the JPDA.

6.1.3 HSE Policy

Eni's HSE Policy (Appendix A) has the following general objectives:

- setting health, safety and environmental objectives as an integral part of business activities and decision making;
- promoting best HSE practice throughout Eni's activities;
- setting objectives and targets, implemented through appropriate programmes, thus ensuring the continual improvement in overall HSE performance;
- implementing safe working and fitness to work programmes to pursue the goals of zero harm to the health of, or injury to, people and protects the environment and business assets;
- complying with relevant legislation and other requirements to which Eni subscribes or applies company standards where laws and regulations do not exist;



- assessing and managing HSE risks across each life cycle for all business activities;
- maintaining a documented HSE IMS certified to ISO14001, which enables comprehensive reporting and review of performance;
- including HSE performance in appraisal of staff and contractors;
- preventing pollution and minimising greenhouse gas emissions, effluents, discharges and other impacts on the environment while safeguarding our resources; and
- fulfilling Eni's commitment to sustainable development and the welfare of its host communities.

6.2 ENVIRONMENTAL MANAGEMENT PLAN

Environmental aspects of the Cova-1 drilling campaign will be managed primarily through the development and implementation of an EMP. The EMP will:

- define Eni's environmental and social performance objectives for the drilling campaign;
- describe the standards that Eni will adopt to meet its objectives and the criteria by which Eni will measure its performance;
- present Eni's management measures and commitments by which it will fulfil its stated environmental and social performance objectives;
- describe Eni systems and procedures for implementing its management measures and commitments;
- describe the roles and responsibilities of Eni personnel and its contractors in management of the Cova-1 drilling program and related operations;
- detail Eni's emergency management and contingency planning in place in the event of an unplanned incident or activity;
- describe Eni's training and competency standards and procedures that ensure that Eni personnel and its contractors are qualified and competent to fulfil their roles and responsibilities;
- detail Eni monitoring and auditing procedures that are intended to reduce environmental risk to ALARP and to ensure that environmental performance objectives are met; and
- describe Eni reporting obligations to both internal and external stakeholders.

6.3 MONITORING PROGRAM

A pre-drill ROV survey will provide baseline images of the seabed surrounding the proposed well. During the drilling program, further ROV surveys will be undertaken. The ROV survey images will be reviewed to ascertain suitability and performance of the drilling operations in respect to the deposition of drill cuttings on the seabed and the effects of turbidity on marine fauna. A report on the findings of the ROV surveys will be provided to the DNMA within one month of well completion.

The discharge of domestic wastes will be periodically monitored by the Eni representative to ensure that the performance standards in place for the activity will be met. All solid and hazardous wastes stored onboard and transferred onshore for disposal will be recorded in a waste manifest. Volumes of fuel used and crude consumed during operations will also be recorded on daily logs. Table 6.1 presents the operational monitoring program to be implanted during the Cova-1 well drilling program. Eni will submit a compliance report to DNMA, as required, outlining the results of its monitoring program.

Table 6.1 Operational Monitoring Program.

Environmental Risk	Criteria to be Monitored during Drilling Campaign	Inspection
Drilling chemicals	Chemical characteristics: <ul style="list-style-type: none"> ecotoxicity; biodegradability; potential for bioaccumulation. 	Prior to drilling
	Volume on board, volume used and volume discharged	Daily recorded in the operational log inspection
Drill floor drainage	All drainage directed to sumps ahead of oil-in-water separators	Prior to drilling and once during campaign.
Laboratory wastes	Type, usage and toxicity	Prior to and on completion of drilling
Chemicals and hazardous materials	Volume stored and volume consumed	Daily operational inspection of the storage area, management and transfer procedures and log sheet update
Sewage discharges	Correct operation of sewage treatment system	At start and once during campaign
General rubbish disposal	Volume of waste generated and volume transferred for onshore disposal	Prior to waste transfers to supply vessels
Hazardous waste disposal	Volume of waste generated and volume transferred for onshore disposal	Prior to waste transfers to supply vessels
Flared well fluids emission	Volume flared	Ongoing during flaring
Diesel usage	Volume on board and volume consumed	Daily operational log inspection and fuel transfer log sheet

All environmental incidents or deviations from the EMP will be reported in accordance with Eni's Procedure: *Hazard and Incident Reporting and Investigation* (Eni, 2007c). Additionally, all incidents arising out of operations for the activity that are not within the parameters of the environmental performance standards in the EMP shall be reported.

6.4 SUMMARY OF MANAGEMENT COMMITMENTS

Eni is committed to undertaking its petroleum exploration and production activities in a manner that is consistent with the principle of sustainable development. Eni aspires to the goals of zero harm to its people, its host communities and the environment. In keeping with these goals and aspirations, Eni is committed to drilling the Cova-1 well in a manner that minimises impacts on the surrounding biophysical and social environments.

Eni's commitments for drilling the Cova-1 well are presented in Table 6.2, which are based on Eni's experience of drilling other wells in the Timor Sea. Eni's commitments will be reviewed and revised, if required, as the drilling program details and planning advance.

Table 6.2 Summary of Commitments for the Cova-1 drilling program.

No.	Topic	Objective(s)	Management Action	Timing
1.	Integrated Management System	Provide a risk-based management system for the identification and control of impacts.	<ul style="list-style-type: none"> Implement Eni's HSE Integrated Management System for the Cova-1 well that embraces the ISO 14001 standards. 	Throughout the drilling program
2.	Environmental Management Plans	Provide operational control documentation for the management of environmental impacts associated with drilling.	<ul style="list-style-type: none"> Develop an EMP for the Cova-1 drilling program The EMP will incorporate environmental and social management measures detailed in Chapter 5 of this EIS where relevant. The EMP will be developed in consultation with DNMA. 	Prior to Drilling
3.	Risk assessment	Ensure project risks are fully identified and understood and management measures and controls are implemented accordingly.	<ul style="list-style-type: none"> Conduct a detailed environmental and social risk assessment for the Cova-1 drilling program. Maintain the findings of the risk assessment in a project Risk Register. Incorporate any additional management measures identified during the detailed risk assessment into the EMP. 	Prior to Drilling



No.	Topic	Objective(s)	Management Action	Timing
4.	Marine Environmental Monitoring Program.	Ensure that Eni's management measures for the Cova-1 drilling program are effective in minimising environmental harm.	<ul style="list-style-type: none"> Conduct an ROV survey of the seabed prior to drilling and after drilling. Provide a report to DNMA describing the findings of the pre- and post-drilling ROV surveys. 	Before and after drilling
5.	Operational Monitoring Program	<p>Ensure that Eni's management measures for the Cova-1 drilling program are effective in minimising environmental harm.</p> <p>Ensure that the Cova-1 drilling program complies with applicable legislation and regulations.</p> <p>Enable the implementation of contingency measures, if required.</p>	<ul style="list-style-type: none"> Develop an Operational Monitoring Program for the Cova-1 drilling program in consultation with DNMA. Implement the Operational Monitoring Program and provide a report to DNMA upon completion of the program. 	<p>Prior to Drilling</p> <p>Throughout the drilling program</p>
6.	Socio-economic development	Ensure that opportunities for Timor-Leste businesses and communities are maximised in line with Eni's resource requirements for the Cova-1 drilling program.	<ul style="list-style-type: none"> Conduct ongoing stakeholder consultation to identify opportunities and build capacity to source goods, materials, services and labour from Timor-Leste. 	Throughout the drilling program
7.	Emergency Planning and Response	Ensure that adequate emergency response procedures and resources are in place to minimise the environmental impacts of an incident e.g. oil spill.	<ul style="list-style-type: none"> Develop and implement a Emergency Management Plan (Emergency MP) and an OSCP for the Cova-1 drilling program. The Emergency MP and OSCP will be developed in consultation with the DNMA, Eni's contractors, and appropriate emergency response authorities and resource centres. The Emergency MP and OSCP will be tested and reviewed at least once during the drilling program. 	<p>Prior to Drilling</p> <p>During the drilling program</p>
8.	Training and awareness	Ensure that all personnel are aware of their responsibilities towards the management of environmental and social impacts.	<ul style="list-style-type: none"> Provide training to all Eni and contractor personnel on the requirements of Eni's Environmental Management Plan, specifically <ul style="list-style-type: none"> the environmental and social sensitivities of the project; Eni's management objectives and commitments; and obligations of all personnel towards the management of impacts in their areas of responsibility. Provide training to all Eni and contractor personnel on Eni's OSCP. 	Prior to Drilling



No.	Topic	Objective(s)	Management Action	Timing
9.	Auditing	Ensure that Eni's environmental and social performance objectives for the Cova-1 drilling program are met.	<ul style="list-style-type: none">• Conduct an environmental compliance audit against the drilling EMP.	During the drilling program
10	Stakeholder consultation	To maintain open and transparent communication between Eni and its stakeholders.	<ul style="list-style-type: none">• Deliver a presentation on the proposed drilling program to the key stakeholders.• Incorporate stakeholder feedback and comments into the EMP for the proposed drilling program.	Prior to Drilling

7.0 REFERENCES

- APPEA. (1994). *Environmental Implications of Offshore Oil and Gas Development in Australia*. Prepared by Australian Petroleum Production and Exploration Association. Canberra, Australia.
- AUSGEO. (2003). Issue No. 69 Timor Sea Activity, March 2003.
- Australian Hydrographic Services. (2003). *Australian National Tide Tables*. Australian Hydrographic Publication.
- BHPP. (1998). *EKKN Development Final Environmental Assessment Report*. Report by BHP Petroleum.
- BOM. (2009). Bureau of Meteorology. Commonwealth of Australia. Website: <http://www.bom.gov.au>
- Burke, L, Selig, L and Spalding, M. (2002). *Reefs at Risk in Southeast Asia*. World Resources Institute.
- Caton A. and McLoughlin K. (1999). *Resource assessments of Australian commercial fisheries, Fishery Status Reports 1999*. Bureau of Rural Sciences.
- CI. (2007). Biodiversity Hotspots. Center for Applied Biodiversity Science, Conservation International.
- CIA. (2009). *Central Intelligence Agency – The World Factbook*. Website: www.cia.gov/library/publications/the-world-factbook
- CONCAWE. (1996). *Gas Oils (Diesel Fuels and Heating Oils)*. Product Dossier No. 95/107, CONCAWE, Brussels.
- Cresswell G, Frifche A, Peterson J and Quadfapel D. (1993). *Circulation in the Timor Sea*, Journal of Geophysical Research, 98:369-379.
- CSIRO. (1999a). *Survey And Stock Size Estimates Of The Shallow Reef (0-15m Deep) And Shoal Area (15-50m Deep) Marine Resources And Habitat Mapping Within The Timor Sea Mou74 Box Volume 1: Stock Estimates And Stock Status*. CSIRO.
- CSIRO. (1999b). *Survey And Stock Size Estimates Of The Shallow Reef (0-1m Deep) And Shoal Area (15-50m Deep) Marine Resources And Habitat Mapping Within The Timor Sea Mou74 Box Volume 3: Seabirds And Shorebirds Of Ashmore Reef*. CSIRO.
- Dunlop, N.J., Surman, C.A. and Wooller, R.D. (1995). *Distribution and abundance of seabirds in the Eastern Indian Ocean: an analysis of potential interactions with the offshore petroleum industry*. A report to the Australian Petroleum Production and Exploration Association.
- Edgerley DW. (1974). *Fossil Reefs of the Sahul Shelf*. Proceedings of the Second International Coral Reef Symposium, Brisbane.

- Eni (2007a). *External Relations and Stakeholder Management Plan*. Document reference ENI-000-PG-0014. Eni Australia Limited, Perth, Western Australia.
- Eni (2007b). *3D Seismic Survey Environmental Management Plan*. Document reference ENI-0000-BN-0001. Eni Timor Leste S.p.A, Perth, Western Australia.
- Eni (2007c). *HSE-PR-03 Hazard & Incident Report & Investigation Procedure*. Document reference ENI-0000-PF-0507. Eni Australia Limited, Perth, Western Australia.
- ESSO. (1993). *West Tuna Offshore Oil and Gas Development Environmental Plan*. ESSO Australia Pty Ltd and BHP Petroleum Pty Ltd.
- FishBase. (2006). *FishBase*. World Wide Web electronic publication. Froese, R. and D. Pauly. Eds., www.fishbase.org, version (10/2006).
- Heyward, A. J. and Smith, I. D. (1996). *Analysis of Timor Sea Macrobenthos from ROV Video – Bayu-Undan*. Produced at the request of BHP Petroleum Pty. Ltd. By the Australian Institute of Marine Science, Dampier, Western Australia: in Leprovost Dames and Moore (1997), Appendix C.
- Heyward, A., Pinceratto, E. and Smith L. (1997). *Big Bank Shoals of the Timor Sea: an Environmental Resource Atlas*. Brisbane.
- Hinwood, J. B., Potts A.E., Dennis, I. R., Carey, J. M., Houridis, H., Bell, R. J., Thompson, J. R., Boudreau, P. & Ayling, D.M. (1994). *Environmental Implications of Offshore Oil and Gas Development in Australia – Drilling Activities*. In Swan, J. M., Neff, J. M. & Young, P. C. (eds). *Environmental Implications of Offshore Oil and Gas Development in Australia – the Findings of an Independent Scientific Review*. Australian Petroleum Production and Exploration Association (APPEA) and Energy Research and Development Corporation (ERDC). Sydney.
- Intertek. (2008). *Kitan-1 oil assay*. Unpublished report for Eni Australia Limited
- ITOPF (2002). *Technical Information Paper. Fate of Marine Oil Spills*. www.itopf.com
- Jasarevic, T. (2002). *Reviving fisheries in East Timor – Casting nets for development*. UN Volunteers, UNV News, #93, August 2002.
- Kagi, R.I., Fisher, S.J. and Alexander, R. (1988). *Behaviour of Petroleum in Northern Australian Waters*. In: Purcell, P.G. and R.R. (eds). *Proceedings North West Shelf Symposium* Perth, WA.
- Jenner, C., Jenner, M N. And McCabe, K. (2001). *Geographical and Temporal Movements of Humpback Whales in Western Australian Waters – a Preliminary Report and Description of a Computer Assisted Matching System*. Centre for Whale Research (Western Australia) Inc., Fremantle.

- Lavering, I. H. (1993). *Quaternary and Modern Environment of the Van Diemen Rise, Timor Sea and the Potential Effects of Additional Petroleum Exploration Activities*. Journal of Australian Geology and Geophysics 13: 281-292.
- LeProvost Dames & Moore. (1997). *Bayu-Undan Infield Development – Preliminary Environmental Report (PER)*. Report produced for BHP Petroleum Pty Ltd and Phillips Petroleum Company by LeProvost Dames & Moore, Perth, Western Australia.
- Marsh, I.M and Marshall, J. I. (1983). *Some Aspects of the Zoogeography of North-Western Australian Echinoderms*. Bulletin of Marine Science 33(3):671:687.
- McCauley, R. (1998). *Radiated Underwater Noise Measured from the Drilling Rig Ocean General, Rig Tenders Pacific Ariki and Pacific Frontier, Fishing Vessel Reef Venture and Natural Sources in the Timor Sea, Northern Australia*. Report prepared for Shell Australia, Melbourne, July 1998.
- Neff, J.M., S. McKelvie and R.C. Ayers, Jr. (2000). *Environmental impacts of synthetic based drilling fluids*. Report prepared for MMS by Robert Ayers and Associates, Inc. August 2000. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2000-064. 118 pp.
- Nunes, MN. (2001). *The Natural Resources of East Timor. A physical, geographical and ecological review*. Sustainable Development and the Environment in East Timor: Proceedings of the Conference on Sustainable Development in East Timor, 2001, Anderson, R & Deutsch, C Eds. Timor Aid, Dili, Timor-Leste.
- OSPAR (2003). *List of Substances/Preparations used and discharged Offshore Which are Considered to Pose Little or No Risk to the Environment (PLONOR)*. Reference No. 2003-3. Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic.
- Ross, JP (ed.). (1998). *Crocodiles. Status Survey and Conservation Action Plan* [Online]. 2nd Edition. IUCN/SSC Crocodile Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.
(<http://www.flmnh.ufl.edu/natsci/herpetology/act-plan/plan1998a.htm>).
- Sandlund, OT, Bryceson, I, de Carvalho, D, Rio, N, da Silva, J, Silva, MI. (2001). *Assessing Environmental Needs and Priorities in East Timor*. Final Report. UNDP Dili and Norwegian Institute for Nature Research, Trondheim, Norway.
- SKM (2001). *Sunrise Gas Project Draft Environmental Impact Statement*. Prepared by Sinclair Knight Merz for Woodside Energy Ltd, Perth, Australia.
- Storr, GM, Smith, LA & Johnstone, RE. (1986). *Snakes of Western Australia*. WA Museum, Perth, Australia.
- Sustainability (2008a). *Kitan-1 Exploration Drilling ROV Environmental Survey*. Unpublished report prepared by Sustainability Pty Ltd for Eni JPDA 06-105 Pty Ltd, Perth, Western Australia.

- Sustainability. (2008b). *Kitan-2 Exploration Drilling ROV Environmental Survey*. Unpublished report prepared by Sustainability Pty Ltd for Eni JPDA 06-105 Pty Ltd, Perth, Western Australia.
- Sustainability. (2010a). *Cova Oil Spill Risk Assessment Modelling*. Unpublished report prepared by Sustainability Pty Ltd for Eni Timor Leste S.p.A, Perth, Western Australia.
- Sustainability. (2010b). *Cova Drill Cuttings Dispersion Modelling*. Unpublished report prepared by Sustainability Pty Ltd for Eni Timor Leste S.p.A, Perth, Western Australia.
- Swan, J.M., Neff, J.M. & Young, P.C. (eds.). (1994). *Environmental Implications of Offshore Oil and Gas Development in Australia, the Findings of an Independent Scientific Review*. Australian Petroleum Exploration Association (APPEA), Energy Research and Development Corporation (ERDC), Australia.
- timorNET. (2007). *East Timor, an Information Service on East Timor*. University of Coimbra, Portugal.
- Tranter, D. (1962). *Zooplankton abundance in Australasian Waters*. Australian Journal of Marine and Freshwater Research 13(2):106-142.
- UNEP-WCMC (2006). *Marine Turtle Interactive Mapping system (IMAPS), – Interactive Map Service* (<http://bure.unep-wcmc.org/imaps/indturtles/viewer.htm>) Marine Programme, UNEP World Conservation Monitoring Centre, Cambridge, UK.
- Veron, JEN And Stafford-Smith, M. (2000). *Corals of the World*. AIMS, Cape Ferguson.
- Wijffels, S.E., Bray, N., Hautala, S., Meyers, G. and Morawitz, W.M.L. (1996). *The WOCE Indonesian Throughflow Repeat Hydrography Sections: I10 and IR6*. WOCE, 24.
- Wilson, B.R. & Allen, G. (1987). *Major Components and Distribution of Marine Fauna*. In: Fauna of Australia, Vol 1a - General Articles. Australian Government Publishing Service, Canberra 1987.
- World Bank. (2005). *World Bank Country assistance Strategy for Timor-Leste FY06-08*. Report No. 32700-TP, 18-Aug-05. Timor-Leste Country Management Unit, World Bank.
- Wyatt, ASJ. (2004). *Preliminary survey of the nearshore coastal marine environment of the south coast of East Timor: a baseline for assessing the impacts of a developing nation*. Bachelor of Engineering thesis, University of Western Australia (Nov 2004).



APPENDIX A

ENI HEALTH, SAFETY AND ENVIRONMENT POLICY



timor leste

Health, Safety & Environment Policy

In our hydrocarbon, exploration and production activities, Eni Timor Leste and its associated companies are committed to maintaining a strong and effective culture in Health, Safety and Environment (HSE) for everyone involved in our activities.

This policy applies to all operational and project activities under Eni Timor Leste's control, including activities carried out by contractors.

Eni Timor Leste will:

- ✓ Set Health, Safety and Environment as a core value for all business activities;
- ✓ Play a leading role in promoting best HSE practice throughout our activities;
- ✓ Set objectives and targets, implemented through appropriate programmes, thus ensuring the continual improvement in overall HSE performance;
- ✓ Implement safe working procedures and fitness to work programmes to pursue the goal of zero harm to anyone, anytime in an injury-free workplace;
- ✓ Comply with relevant legislation and other requirements to which Eni Timor Leste subscribes or apply company standards where laws and regulations do not exist;
- ✓ Assess and manage HSE risks across each life cycle for all business activities;
- ✓ Maintain a documented HSE Integrated Management System certified to ISO14001 which enables comprehensive reporting and review of performance;
- ✓ Include HSE performance in appraisal of staff and contractors;
- ✓ Prevent pollution and minimise greenhouse gas emissions, effluents, discharges and other impacts on the environment while safeguarding our resources; and
- ✓ Remain committed to sustainable development and the welfare of our host communities.

Eni Timor Leste expects that everyone recognises their personal responsibility for HSE and their right to report openly any HSE issue or concern. In addition, everyone is obliged to intervene in the case of unsafe acts or conditions.

To ensure we meet these objectives and respect the interests of those who may be affected by our operations, Eni Timor Leste will consult with, listen to and respond openly to all staff, contractors, regulators, customers and host communities.

Country Representative
Eni Timor Leste S.p.A.

Tony Heynen

24 March 2010



APPENDIX B

VESSEL SPECIFICATIONS

Saipem 10000 Drillship

Sea Witch Platform Support Vessel



Saipem

GROUP

Drilling

Saipem 10000



Saipem 10000

The Saipem 10000 ultra-deepwater drillship is the latest vessel to join Saipem's drilling fleet and represents an innovative and advanced addition to oil and gas exploration and production worldwide.

Built by Samsung Heavy Industries in its Koje shipyard in South Korea and completed in 2000, Saipem 10000 is a drillship for the new millennium.

The vessel has been designed and built to Class III Dynamic Positioning specifications making it capable of worldwide, year-round operations.

The main operating areas for Saipem 10000 will be the US Gulf of Mexico, South Atlantic, West Africa and, during the summer weather window, the UK sector of the North Sea and West of Shetlands.

Saipem 10000 has been built to set a new standard in drilling activities. The vessel has been designed and completely outfitted to explore and develop hydrocarbon reservoirs down to 30,000 ft RKB, operating in water depths in excess of 10,000 ft in full DP mode.







Saipem 10000

BRIEF DESCRIPTION

The main operational modes of the vessel in DP are the following:

- drilling activities
(exploration/appraisal/development);
- early production and extensive well
production/testing;
- crude oil storage and offloading;
- well completion activities.

All of the equipment installed onboard the vessel has been designed to meet the most stringent health, safety and environmental standards.

Among the chief benefits gained through operating with the Saipem 10000 are the particular arrangement of drilling facilities, the high pay load capacity and its Extended Well Testing facilities.

The arrangement of the vessel's topsides equipment allows the drilling crew to conduct several activities simultaneously, thereby optimising the sequence of operations and reducing downtime between different phases. The Saipem 10000's pay load, recorded at more than 20,000 t, permits the loading of large quantities of consumables, reducing the necessity of frequent reloading and the number of required supply vessel trips and, consequently, cutting overall operating costs for the client. Saipem 10000 is fitted with Extended Well Testing facilities that allow for the storage of up to 140,000 barrels of crude oil and has offloading capabilities to avoid the need for flaring, thus limiting environmental impact whilst optimising cost.





INTEGRATED MANAGEMENT SYSTEM

The Saipem 10000 holds the ABS and 'ACCU' notation, meaning all vessel automation and instrumentation is in line with the unattended machinery space class requirements. Based on the operating philosophy of DP Class III, the Integrated Automated System (IAS) is fibre optic based and fully integrated with the drilling control system.

A dual data highway will carry signals to and from operator stations located in the bridge, cargo control centre and engine control room.

The main subsystems incorporated in IAS are the following:

- power generation/manoeuvring;
- auxiliary system control and monitoring;
- cargo/ballast;
- riser management system;
- serial interface with the following systems:
 - Drilling Integrated Systems (DIS);
 - gas detection systems;
 - tank level gauging system;
 - fire detection system;
 - emergency shutdown system.

ACCOMMODATION

The accommodation module, built in accordance with ABS regulations, has been designed to accommodate 172 people with a high degree of comfort and includes two recreation rooms, coffee shop, sauna and gymnasium.

Vessel specifications

UNIT TYPE

Ultra deep water drillship, equipped with EWT (Extended Well Testing), designed for exploration and development drilling down to 30,000 ft RKB, operating in water depth in excess of 10,000 ft

UNIT FLAG

Bahamas

UNIT CLASSIFICATION

ABS +A1(E), "Drilling Unit", +FPSO, +AMS, +ACCU, +DPS-3, OMBO, DLA, +CDS

UNIT DESIGN

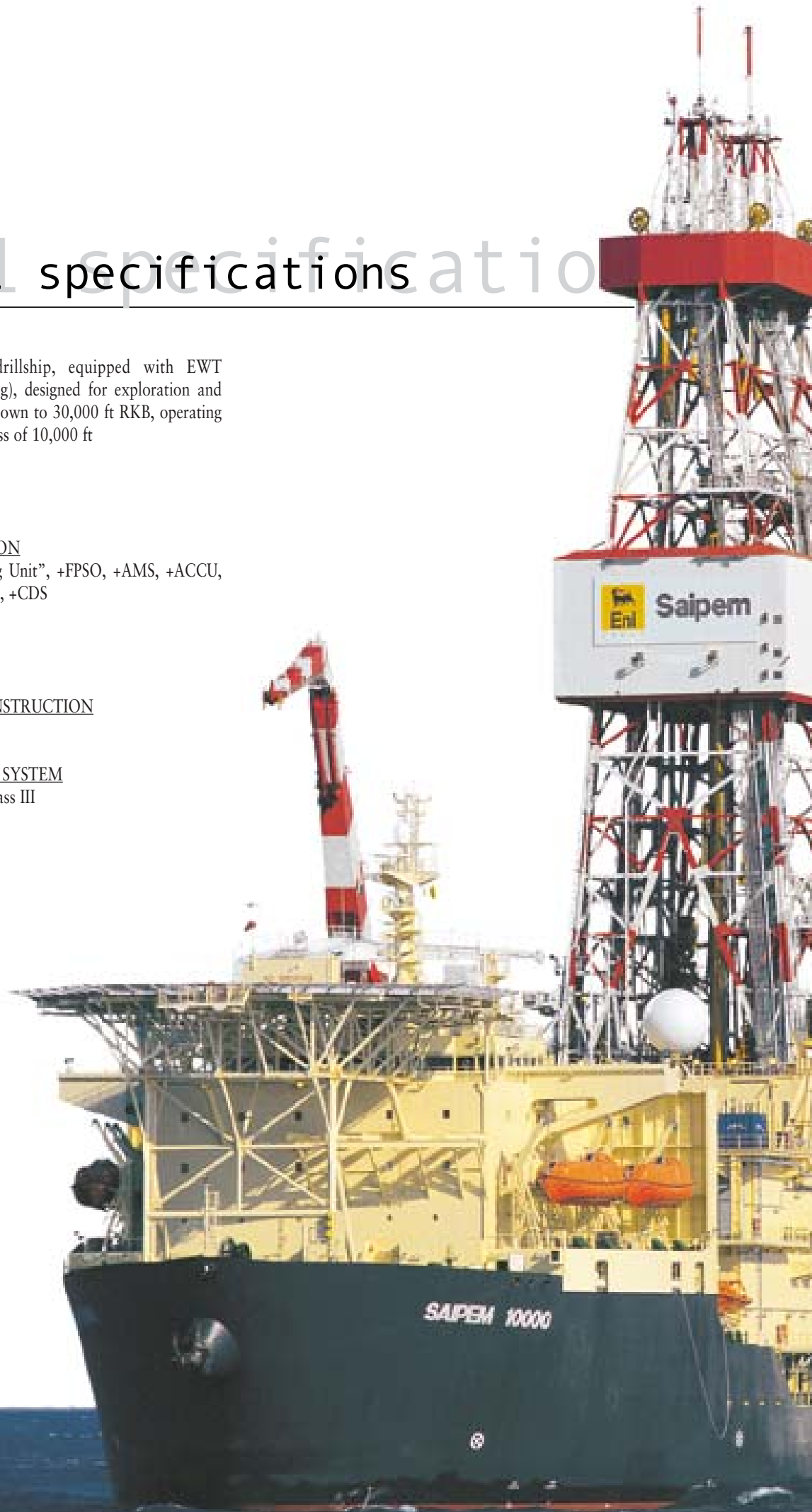
Samsung

YEAR OF UNIT CONSTRUCTION

1999-2000

UNIT POSITIONING SYSTEM

Simrad SDP-32, DP class III



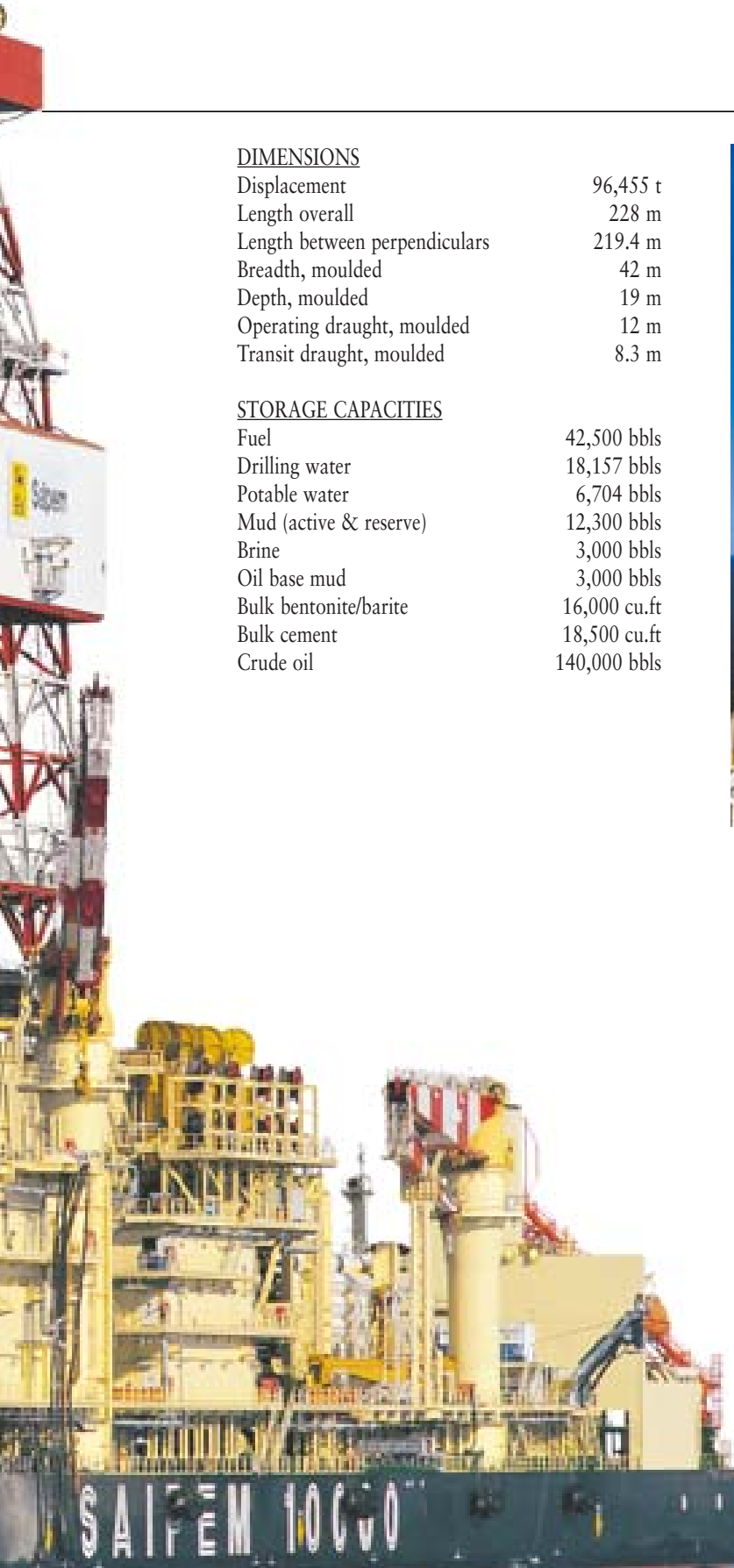
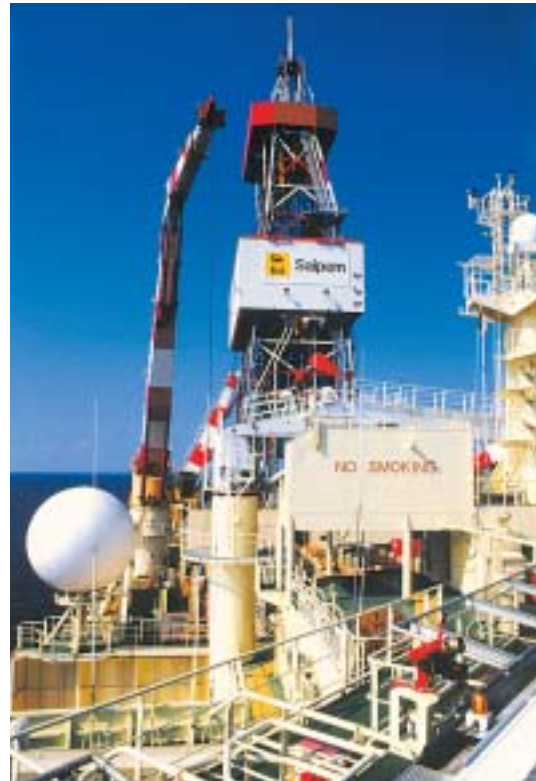


DIMENSIONS

Displacement	96,455 t
Length overall	228 m
Length between perpendiculars	219.4 m
Breadth, moulded	42 m
Depth, moulded	19 m
Operating draught, moulded	12 m
Transit draught, moulded	8.3 m

STORAGE CAPACITIES

Fuel	42,500 bbls
Drilling water	18,157 bbls
Potable water	6,704 bbls
Mud (active & reserve)	12,300 bbls
Brine	3,000 bbls
Oil base mud	3,000 bbls
Bulk bentonite/barite	16,000 cu.ft
Bulk cement	18,500 cu.ft
Crude oil	140,000 bbls





Vessel specifications

OPERATIONAL CAPABILITIES

Water depth capability in excess of 10,000 ft
Drilling depth 30,000 ft RKB

Variable load in transit mode
With crude oil: 20,000 t. Without crude oil: 17,000 t.
Variable load in drilling mode
With crude oil: 18,000 t. Without crude oil: 20,000 t.
Variable load in survival mode
With crude oil: 15,000 t. Without crude oil: 20,000 t.

CRANES

4 Hydralift Knuckle Boom Cranes.
Rated capacity 85 t. at 18.4 m

PIPE RACK OVERHEAD CRANE

1 Hydralift Catwalk machine (loaded by Knuckle Boom Crane)

RISER RACK OVERHEAD CRANE

1 Hydralift Catwalk machine (loaded by Knuckle Boom Crane)

BOP HANDLING SYSTEM

1 Hydralift Overhead Crane. Rated capacity 350 t.

X-TREE HANDLING SYSTEM

1 Hydralift Skidding System + trolley.
Rated capacity 120 t.

ACCOMMODATION

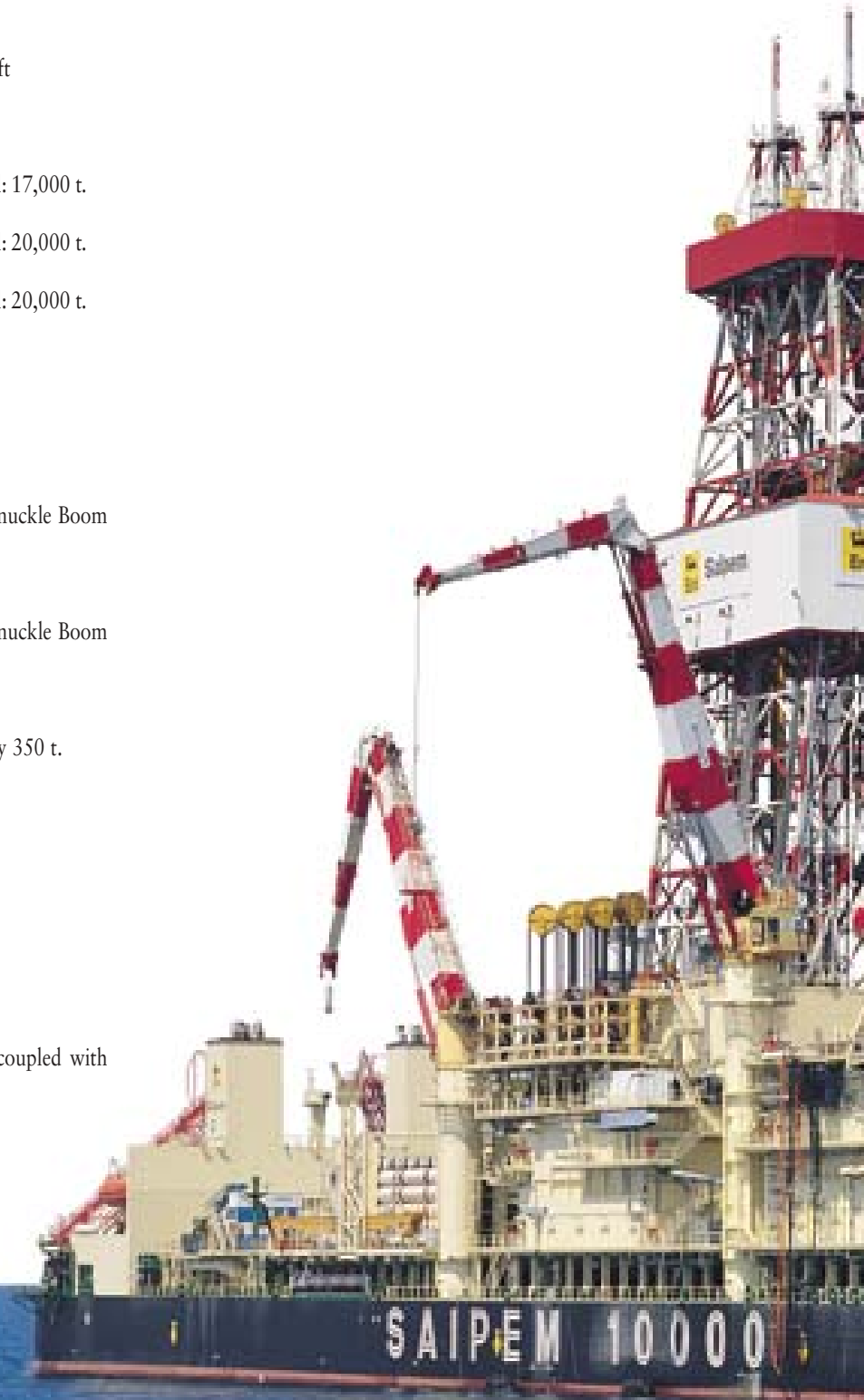
172 people

POWER PLANT

6 Wartsila Nsd Co 18V32LNE 9,910 hp coupled with
ABB HSG900XU10 8,750 kVA.

VFD SYSTEM

18 ABB 600 V (Variable Frequency Drive)





Drilling rig specifications





ons

<u>DERRICK</u>	Bailey	Dynamic	base 80 x 60 ft top 60 x 20 ft height 200 ft Static hook load 2,000,000 lbs
<u>SUBSTRUCTURE/RIG FLOOR RACKING PLATFORM</u>	Simultaneous setback and hook Hydralift	load capacity 2,600,000 lbs 6 7/8" D.P. plus 5" D.P. plus 9 1/2" D.C. plus 8 3/4" D.C. plus 6 3/4" D.C. plus 4 3/4" D.C. 13 3/8" Casing or 9 1/2" Casing or 7" Casing	252 joints Range III 121 joints Range III 6 Stands 12 Stands 6 Stands 10 Stands 80 Stands in triple 105 Stands in triple 105 Stands in triple
<u>AUTOMATIC DRILL PIPE RACKING SYSTEM</u>	Hydralift	Vertical Column Type capable to handle from 3 1/2" D.P. to 13 3/8" Casing	
<u>CASING STABBING BOARD DERRICKMAN PLTF-TV</u>	Hydralift	Hydraulic basket adjustable from rig floor up to 16 m Located on upper and lower finger board with monitors located in the driller's house and TV net. Capable to camera system zoom, pan and tilt.	
<u>DRAWWORKS</u>	Wirth GH 4500 EG 4,500 hp, Re-regenerative Braking + Baylor 7838 + disk brake + back up disk brake. Powered by 3 General Electric GEB 22A1, AC.		
<u>CROWN BLOCK</u>	Hydralift	Rated capacity 907 t Sheaves 8 x 2" drilling line	
<u>TRAVELLING BLOCK</u>	Hydralift	Rated capacity 907 t Sheaves 7 x 2" drilling line	
<u>HOOK BLOCK</u>	Hydralift	Integrated with travelling block	
<u>SWIVEL HEAD</u>	Hydralift	Integrated with Top Drive	
<u>MOTION COMPENSATOR</u>	Hydralift	Crown mounted equipped with Active Heave Compensation System Rated capacity compensated 450 t Rated capacity locked 907 t Stroke 25 ft	
<u>ROTARY TABLE</u>	Wirth RTSS 60 1/2" hydraulic	Maximum opening 60 1/2" Rated capacity 907 t Driven by Hydraulic motor	
<u>TOP DRIVE</u>	Hydralift HPS 750 2E	Rated capacity 680 t Driven by 2 x GEB 752 22 A1AC	
<u>MUD PUMPS</u>	Wirth TPK 2200	4 triplex pumps, 2,200 hp each with 7,500 psi fluid end	
<u>CEMENTING UNIT</u>	BJ Services	SCP 248/RAM Driven by 2 x Caterpillar 3406 B	
<u>SHALE SHAKER</u>	Brandt	6 VMS 300	
<u>DESANDER AND DESILTER</u>	Gann Mekaniske Brandt	2 installed	16 M - 3 x 12" + 16 M - 16 x 8"
<u>DRYER</u>	BRANDT	1 VORTEX FINDER	
<u>DEGASSER</u>	Burgess	1 installed	Magnavac 1500
<u>BOP STACK</u>	Shaffer	18 3/4" - 15,000 Guidelineless with Vetco HD-H4 Bop Connector	
<u>RISER</u>	Abb Vetco Gray	3,000 m w.d. Type HMF 21" o.d. x 90 ft long	
<u>DIVERTER</u>	Abb Vetco Gray	KFDS Type CSO	
<u>RISER TENSIONERS</u>	Hydralift	16 x 200,000 lbs type 65' Line Travel	
<u>BOP CONTROL SYSTEM</u>	Shaffer	Multiplex with 5,000 psi Accumulator Unit	



G R O U P

Saipem

Ideas, as strong as man.

Sea Witch



IMO no: 9392975
 DNV id no: 27353
 MMSI: 212 590 000
 Call sign: 5BLT2

MAIN DESCRIPTION		MEASUREMENT	
Type :	UT 755 L	Lenght oa :	71,90 m
Classification :	DNV +IAI,SF E0 Clean	Lenght bpp :	66,00 m
	Dynpos-Auto	Breath moulded :	16,00 m
Yard :	Cochin Shipyard LTD	Depth moulded :	7,00 m
Place built :	Cochin	Draught max :	5,83 m
Country built :	India	Gross tonnage GT :	2100
Delivered :	Nov '08	Correspondign DWT :	3250 mt
Flag :	Cypros	Net tonnage NT :	1150
Port of registry :	Limasol	Speed svc/max. :	14.3 Knots
Owner :	Dess Cypros LTD	ISM-Responsible :	Thome Management PTE LTD

CARGO CAPACITY		DISCHARGE RATE	
Deck cargo:	1600 t	Fuel discharge rate :	1 off 200 m3/h - 9 bar
Deck area:	680 m2	Mud discharge rate :	2 off 75 m3/h - 18 bar
Deck strength:	5,0 t / m2	Brine discharge rate :	1 off 75 m3/h - 18 bar
Fuel (gasoil) :	1000 m3	Drillwater discharge rate :	1 off 200 m3/h - 9 bar
Liquid Mud :	970 m3	Dry bulk discharge rate :	2 off 27 m3 min 5,6 bar
Brine :	390 m3	Base Oil discharge rate :	1 off 150 m3/h - 9,0 bar
Drillwater/Ballast :	850 m3	Fresh Water discharge rate :	1 off 200 m3/h - 9 bar
Base Oil :	200 m3		
Dry Bulk :	315 m3 (11250 cuft)		
Fresh Water :	840 m3		

MACHINERY / PROPULSION			
Main Engine set :	2x2725 bhp /825 rpm	Stern Thruster :	1 off 590 Kw (800 bhp)
Propellers :	2 off Ulstein CPP		
Rudders :	2 off T1650	Generators :	2 x 1280 kW Shaft
Total BHP :	5450 BHP	Diesel Generators :	2 x 250 kW
Total Kw :		Emergency Generator :	1 x 72 kW
Bow Thrusters:	2 off 590 kW (800bhp)	Shore Connection:	440 v ,60 Hz

Sea Witch



PERFORMANCE / CONSUMPTION

Max Speed/Consumption : 14,3 Knots/ 20 t
 Service Speed/Consumption: 11,0 Knots / 17 t
 Economical Speep/Consumption : 9.0 Knots / 14 t
 Standby Mode : 2-3 knots / 4t
 Port Consumption :

Roll reduction system : 4 off ulstein
 passive roll
 red.tanks

ACCOMODATION

The vessel to have accommodation and equipment for 10 officers / crew and 12 passengers as follows:

Tween deck: 2 off 4-men cabins
 Main deck: 1 off Change / Washroom
 1 off Toilet room/ 1 off Spare room
 F.C.-deck Galley and provision rooms Mess and dayroom
 1 off Laundry/ Drying room, 1 off store room
 A-deck 5 off 1-bed cabins for crew
 1 off 4-men cabin/ 1 off Aircond. room
 B-deck 5 off 1-bed cabins for officers/crew
 Bridge deck Wheelhouse, Toilet room

DECK

Tugger Winch : Brattvaag 2 off 10 t
 Deck Crane : 3t/10-16m TTS-GPT 115
 Windlass: Brattvaag PH SNF 210-40
 Capstans: Brattvaag 2 off 8 t CMX2208

Two off starting air compressors. Sperre HL2 / 105
 Two off starting air bottles.
 One off instrument air drier, one instrument air tank.
 Two off Bilge/fire pumps. All Weiler AEB1E0750-IE
 One off Bilge water separator.
 Four Reefer plugs Two 440V + Two 220V
 CO2 fire fighting system in engine room.

RESCUE EQUIPMENT

Fire Fighting equipment : Wather Mist. External Fire system
 MOB Boats: 1x Viking
 Radar transponders :
 Emergency Beacon: 2 Off JRC.VHF406 MHz

Survival Suits : 22 persons
 Life jackets : 22 persons
 Life rafts: 4 Viking

NAVIGATION AND COMMUNICATION EQUIPMENT

Dynamic Position : AUT (DP1) Kongsberg
 Radar 3 cm: JRC.JMA 9922 SXA
 Radar 10 cm: JRC.JMA 9932 SA
 Radar Slave : One on aft bridge
 Direction Finder : John Lillie & Gillie LTD
 Gyro: Tokimec Inc -TG- 8000
 Autopilot: Tokimec Inc -Pr-6114A-22
 Navtex : JRC.NCR - 333
 Joystick : Poscon(RRM)
 AIS : JRC.JHS - 182
 Echo Sounder : JRC.JFE 585
 Speed log : JRC.JLF 205
 Satellite Navigator (GPS) DGPS.JRC.JRL-77MK2
 Wind Sensors: John Lillie & Gillie LTD

GMDSS Sea Area: A3
 MF/HF Radio : JRC.JSS - 296
 DSC Receiver : JRC.JHS - 32B
 VHF 1 : JRC.JHS - 7
 VHF 2: JRC.JHS - 7
 VHF 3 : JRC.JHS - 7
 Portabel UHF : 4x JRC.JHS - 430
 Mobil Telephone : Yes
 Iridium : Inmarsat Fleet 77
 Mini-M : Inmarsat JRC.JUE 85
 Sat C 1 : JRC.JQE-3A
 Intercom System : Yes

DETAILS PROVIDED HEREIN ARE BELIEVED TO BE ACCURATE HOWEVER ARE WITHOUT WARRANTY.
 INTERESTED PARTIES ARE ENCOURAGED TO INSPECT THE VESSEL TO SATISFY REQUIREMENTS

Sea Witch

