



## **Environmental Impact Assessment for Exploration Drilling in Block AD-3**

***Environmental Impact Assessment***

20 December 2016

**Environmental Resources Management**

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# Environmental Impact Assessment for Exploration Drilling in Block AD-3




## Environmental Impact Assessment

Document Code: *Ophir Block AD-3 Drilling ESIA\_ EIA\_v0.doc*

### Environmental Resources Management

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Client: Ophir Myanmar (Block AD-3) Limited		Project No: 0353877			
Summary:  This document presents the Environmental Impact Assessment for Exploration Drilling in Block AD-3.		Date: 20 December 2016			
		Approved by:   Craig A. Reid Partner			
0	Draft Final	RS	CAR	CAR	20/12/2016
Revision	Description	By	Checked	Approved	Date
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## Acronyms and Abbreviations

Acronym	Definition
%	Percentage
3D	Three dimensional
ALGAS	Asia Least Cost Greenhouse Gas Abatement Strategy
API	American Petroleum Institute
ASEAN	Association of South-East Asia Nations
BANCA	Biodiversity and Nature Conservation Association
bbL	Barrels
BML	Below Mud Line
dB	Decibels
DoF	Department of Fisheries
DST	Drill Stem Test
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EPBC	Environment Protection and Biodiversity Conservation
ERM	Environmental Resources Management
EMP	Environmental Management Plan
ESMP	Environmental and Social Management Plan
FLO	Fisheries Liaison Officer
ft	Feet
HSE	Health, Safety and Environment
Hz	Hertz
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IMO	International Maritime Organisation
IOGP	International Association of Oil and Gas Producers
IPIECA	International Petroleum Industry Environmental Conservation Association
IUCN	International Union for the Conservation of Nature
km	Kilometres
km <sup>2</sup>	Square kilometres
LWD	Logging Whilst Drilling
m	Metres
m <sup>3</sup>	Cubic metres
MARPOL	International Convention for the Prevention of Pollution from Ships
MIC	Myanmar Investment Commission
MODU	Mobile Offshore Drilling Unit
MOEE	Ministry of Electricity and Energy
MOGE	Myanma Oil and Gas Enterprise
MONREC	Ministry of Natural Resources and Environmental Conservation

Acronym	Definition
NABF	Non Aqueous Base Fluid
NADF	Non-Aqueous Drilling Fluid
OOO	Oil on Cuttings
Pa	Pascal
PHB	Pre-hydrated Bentonite
ppg	Pounds per gallon
PSC	Production Sharing Contract
PSV	Platform Supply Vessel
SEP	Stakeholder Engagement Plan
SOPEP	Shipboard Oil Pollution Emergency Plan
TCC	Thermomechanical Cuttings Cleaning
TVD	Total Vertical Depth
USEPA	United States Environmental Protection Agency
UNEP	United Nations Environment Programme
VSP	Vertical Seismic Profiling
WBDF	Water Based Drilling Fluid

# 1 EXECUTIVE SUMMARY

## 1.1 INTRODUCTION

**Ophir Myanmar (Block AD-3) Limited** (Ophir Myanmar) is currently proposing to drill one exploration well (Aung Sakyar) during 2017 in Block AD-3 (*Figure 1.1*). As per the Myanmar Environmental Impact Assessment (EIA) Procedure, this Project requires an EIA and an Environmental Management Plan (EMP) to be prepared and submitted to the Ministry of Natural Resources and Environmental Conservation (MONREC).

Ophir Myanmar signed the Production Sharing Contract (PSC) with the Myanmar Oil and Gas Enterprise (MOGE) in December 2014 and undertook a three-dimensional (3D) seismic survey of the Block in summer 2015; which was subject to the submission and approval of an Initial Environmental Examination (IEE).

This EIA Study has been undertaken in compliance with the Myanmar EIA Procedure. The first stage of the Project was screening which included the submission of the Project Proposal Report to MOGE (for onward submission to MONREC) which was prepared and submitted in April 2016. Following this, the Environmental Conservation Department (ECD) of MONREC advised Ophir Myanmar that the Project would require an EIA assessment. Ophir then prepared and submitted a Scoping Report which included the Terms of Reference for the EIA Study. This was submitted to MOGE in May 2016.

Ophir Myanmar has commissioned ERM Myanmar Company Limited (ERM), along with Myanmar national environmental consultant E Guard Environmental Services Co. Ltd (E Guard), to undertake the EIA for the Project.

This document is the EIA Report for the proposed Project in Block AD-3 (the "Project"). A separate Environmental Management Plan (EMP) has also been prepared alongside this report for submission to, and approval, by MONREC.



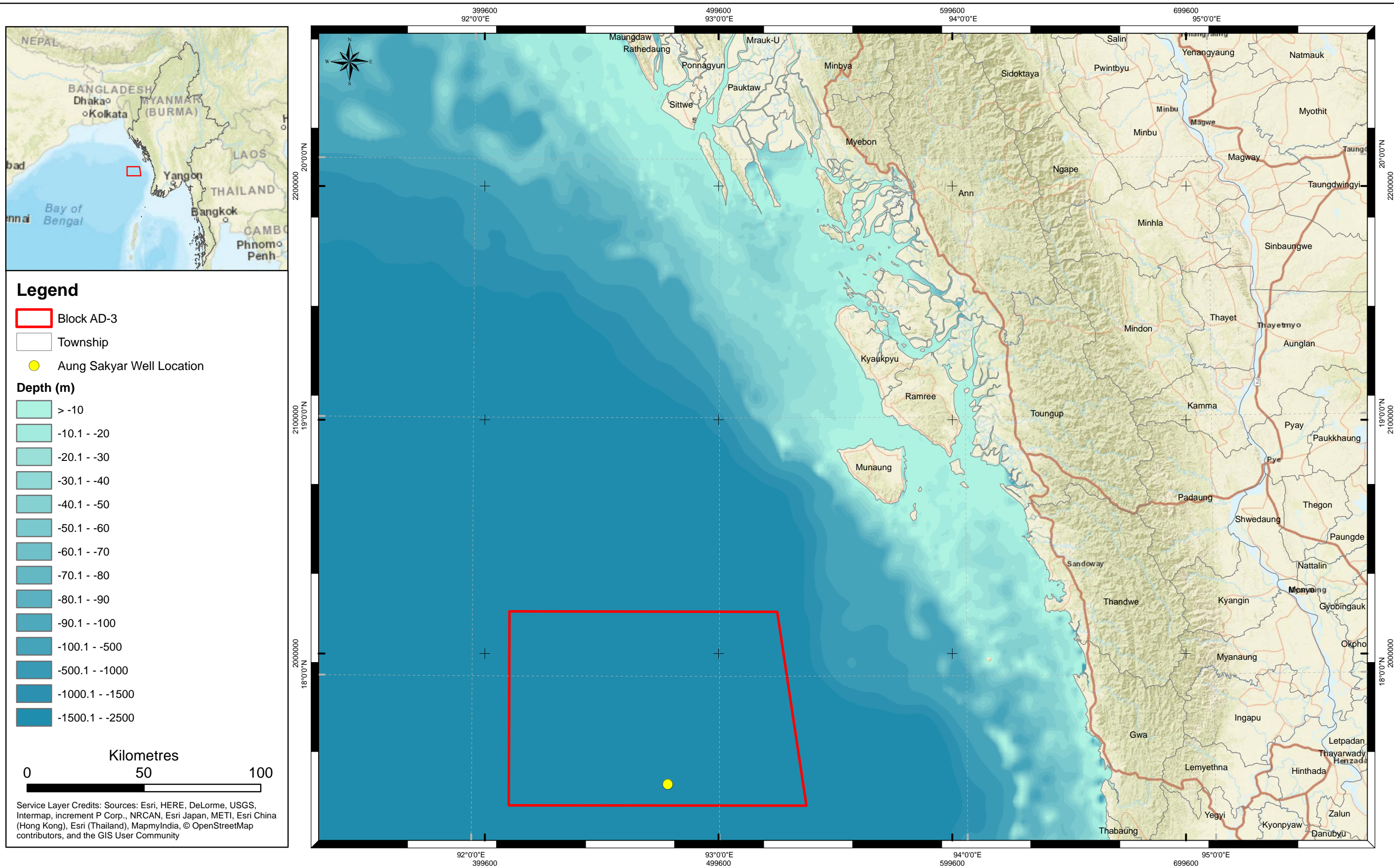


Figure 1.1

Location of Block AD-3

## 1.2 *POLICY AND REGULATORY FRAMEWORK*

Under *Section 7* of the *Environmental Conservation Law* and *Articles 52* and *53* of the *Environmental Conservation Rules* of the Republic of the Union of Myanmar, Ophir Myanmar is required to undertake an EIA to obtain an Environmental Compliance Certificate (ECC) for the proposed exploration activities.

The Project will be undertaken in line with a number of national and local standards and laws. Local laws relating to EIA include: Environmental Conservation Law (2012); Environmental Conservation Rules (2014); National Environmental Quality (Emission) Guidelines (2015); and Environmental Impact Assessment Procedure (2015). A full list of laws and their relevance to the Project is provided in *Section 3*.

With the release of the final Myanmar EIA Procedure in December 2015, the National Environmental Quality (Emissions) Guidelines were also released. These Guidelines provide the basis for regulation and control of noise and air emissions and effluent discharges from projects in order to prevent pollution and protect the environment and public health. These standards are noted to be based on the standards as recommended by the IFC General EHS Guidelines (2007).

## 1.3 *PROJECT DESCRIPTION AND ALTERNATIVES*

Ophir Myanmar proposes to drill one exploration well in Block AD-3, which would be located in water depths of over 2,400 m (7,800 ft.) and at a minimum of 150 km (93 miles) from the nearest coastline (Manaung Island) (the "Project"). Drilling in the offshore environment involves the mobile offshore drilling unit (MODU) lowering a drill bit to the seabed to drill a 36" hole in the seabed. The well is drilled down to a target in order to establish whether there is oil or gas under the seabed. The Project will use seawater and sweeps for drilling the shallowest sections and either non-aqueous drilling fluid (NADF) or water based drilling fluid (WBDF) thereafter. Whilst drilling with seawater and sweeps, cuttings will be discharged at the seabed. Cuttings containing NADF will be returned to the drill rig and treated on-board to reduce the oil on cuttings before being discharge overboard.

As part of the Project design phase, consideration was given to potential alternatives; such as the use of different types of drilling fluids, treatment options and disposal methods. Four (4) alternative well locations were originally considered during Scoping; however one location has been selected for this EIA. This well is located 150 km (93 miles) from the nearest coastline (Manaung Island)

The option to not go ahead with the Project was also considered, however, should the Project be successful and gas be found in a significant quantity to

be commercially viable, the Project could have beneficial impacts for Myanmar and the local communities.

#### **1.4** ***BASELINE CONDITIONS***

The Area of Influence encompasses the waters of Block AD-3 and the surrounding waters offshore southern Rakhine State. As the well is located around 175 km (108 miles) from the mainland and 150 km (93 miles) from the nearest coast (Manaung Island), the focus of the baseline information is on open, deep water habitats. The physical environment within the Project's Area of Influence is not considered to be particularly sensitive and would be expected to be relatively homogenous in nature. The seabed is expected to be characterised by soft mud with relatively low biodiversity, ecological value or significance.

Larger boat fishermen consulted in Rakhine tend to operate trawlers and purse seine boats. These fishermen were consulted during the EIA process and stated that they work up to 100 km (60 miles) from the coast, but mostly stay within 50 km (30 miles) from the coast and they fish within waters up to 490 ft. (150 m) deep. Given the Project Area is 150 km (93 miles) from the nearest land there is no overlap with local fishing activity.

There are no sensitive habitats or protected areas within Block AD-3. The majority of fish species recorded in Rakhine waters are generally not considered of conservation concern. However, there are a number of marine mammals and turtle species in Rakhine waters that are globally and/or nationally protected species.

#### **1.5** ***IMPACT ASSESSMENT AND PROPOSED MITIGATION***

The EIA has assessed the potential impacts and proposed mitigation to reduce the level of the impact. The EIA concluded, from previous experience in the industry that potential impacts are typically short term and are well understood, with little or no evidence of adverse consequences on the majority of environmental or social receptors. These potential impacts and the associated mitigation measures are summarized in *Table 1.1*.



**Table 1.1 Potential Impacts and Proposed Mitigation Measures**

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impact
Drill Cuttings	<ul style="list-style-type: none"> <li>• Drill cuttings with non-aqueous drilling fluid (NADF) will be recycled and treated prior to discharge. The oil content for discharge of cuttings with residual NADF will not exceed 5% by weight of wet cuttings.</li> <li>• Cuttings will be discharged below the water line.</li> <li>• All chemicals discharged selected for low toxicity where possible.</li> <li>• NADF shall only be used where seawater and sweeps or water based drilling fluid (WBDF) cannot provide the required technical specifications.</li> <li>• No bulk discharge of NADF drilling fluids is permitted.</li> <li>• The average oil content for discharge of NADF pit cleaning slops will be limited to 1% by volume.</li> </ul>	Negligible (sediment quality)
		Negligible (sediment quality)
		Minor (water quality)
		Negligible (fish and pelagic species)
		Minor (fish)
Impacts from underwater sound on marine fauna	<ul style="list-style-type: none"> <li>• Visual check for marine fauna within 1 km (observation zone) of the mobile offshore drilling unit (MODU) or vessel for 20 minutes prior to commencing vertical seismic profiling (VSP) operations.</li> <li>• Soft start - build up power for VSP slowly to give adequate time for marine fauna to leave the area (20 minutes at minimum).</li> <li>• Soft start procedures should only resume when fauna have moved outside the shutdown zone (500 m) or when 30 minutes have lapsed since the last sighting.</li> <li>• Visual observations of the observation zone (1 km) must be maintained continuously to identify if there are any mammals or turtles present.</li> <li>• During the pre-start meeting, alert all crews to immediately report to the trained observer when they observe any marine mammals or turtles during and prior to the activity.</li> <li>• A trained observer will be utilised during VSP operations to monitor and record marine mammal and turtle observations.</li> <li>• All records will be reported to the Ministry of Natural Resources and Environmental Conservation (MONREC) following completion of the activity.</li> <li>• Given the potential for whale sharks to be present in the Bay of Bengal, the shutdown procedure will also be observed for whale sharks.</li> </ul>	Moderate (marine mammals and turtles)
Impacts from unplanned spills on marine fauna	<ul style="list-style-type: none"> <li>• Preparation and implementation of vessel standard operating procedures.</li> <li>• Adherence to the international convention for the prevention of pollution from ships (MARPOL 73/78) Annex I.</li> <li>• Chemicals and/or hydrocarbons will be</li> </ul>	Negligible

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impact
	<p>handled and stored in compliance with the Material Safety Data Sheet (MSDS).</p> <ul style="list-style-type: none"> <li>• Spill response kits will be available and kept stocked.</li> <li>• Standard maritime safety/navigation procedures will be implemented</li> <li>• Establishment of a 500 m radius safety exclusion zone around the MODU.</li> <li>• In the event of a vessel collision, the shipboard oil pollution emergency plan (SOPEP) will be implemented, if required</li> </ul>	
Short-term disruption to commercial fishing activities.	<ul style="list-style-type: none"> <li>• A 500 m radius safety exclusion zone around the MODU.</li> <li>• MODU and support vessels will comply with international regulations for collision avoidance, navigation and maintenance.</li> </ul>	<b>Minor</b> (shipping, fishing activities) and livelihoods)
Risk of collisions with fishing vessels and other marine users.	<ul style="list-style-type: none"> <li>• Myanmar speaking (crew members) available on board the MODU.</li> <li>• Timely sharing of information (in the form of a Notice to Mariners).</li> <li>• Disclosure and implementation of the Feedback grievance mechanism.</li> </ul>	<b>Negligible</b> (shipping, fishing activities) and livelihoods)

## 1.6

### *PUBLIC CONSULTATION AND DISCLOSURE*

During the EIA, stakeholder engagement has been conducted with various relevant stakeholders at the regional (Rakhine) level in Sittwe and Thandwe and at the national level in Yangon and Naypyidaw. Fishermen were targeted from large boat communities known to occur along the Rakhine coast such as Thabyugyaing and Gyeitaw and invited to meetings for the Project. These fishermen are also known to use camps on Manaung Island which is the closest land to the Project.

ERM's previous experience of stakeholder engagement in the region was utilised to inform the stakeholder selection the results of this engagement are provided in *Table 1.2*. This information is based on discussions with GAD and DOF representatives and historic village level meetings in 2015 and 2016 for various Projects in the region.

**Table 1.2 Understanding of Fishing from Previous Engagement in Rakhine State**

Township	Understanding of baseline	Potentially affected communities / peoples?
Manaung	People from Thandwe use Fishing Camps on Manaung Island from November to April. 10 miles (16 km) from Manaung, mostly within 5 miles (8 km) from Manaung.	<b>No</b> , the Project Area is >90 miles from Manaung.
Kyaukphyu	Up to 10 miles (16 km) from coast. Not fishing within deeper offshore waters.	<b>No</b> , the Project Area is >150 miles from Kyaukphyu
Gwa	Large boats fish out to 5-20 miles (8-32 km) from Manaung and up to 60 miles (100 km) from the main land.	<b>No</b> , the Project Area is >100 miles from Gwa.
Ramree	Usually 10 miles (16 km) from the coast. Some fishermen found out to 60 miles (100 km) from the coast.	<b>No</b> , the Project Area is >100 miles from Ramree.
Thandwe	Large boats fish out to 5-20 miles (8-32 km) from Manaung and up to 60 miles (100 km) from the main land.	<b>No</b> , the Project Area is >100 miles from Thandwe. However, there is a large port in Thabyugyaing which large offshore vessels (from other parts of Myanmar) may use.
Outside Rakhine State	Large fishing boats (>90 ft. length) from throughout Myanmar are known to fish in the water of Rakhine State.	<b>Yes</b> , boats could come from Tanintharyi, Mon, Yangon or Ayeyarwady.

The meetings helped the Project to gather information on potential data gaps and informed the impact assessment in the EIA Report. Consultation involved face-to-face meetings with a range of stakeholders including the Environmental Conservation Department, Department of Fisheries, the Rakhine Chief Minister, and the General Administrative Department in Sittwe and the Department of Fisheries and Myanmar Fisheries Federation in Yangon as well as a larger town hall meeting held in Thandwe for the public to express views and ask questions. The date, time, location, stakeholder and purpose of each meeting is provided in *Table 1.3*.

**Table 1.3 Consultation Activities Undertaken Throughout EIA Process**

Date, time, location	Stakeholder	Purpose of Engagement
National (Yangon and Nay Pyi Taw)		
5 <sup>th</sup> May, 2016, ECD office,	Environmental Conservation Department (ECD)	Present information on Project. Discuss technical information regarding well drilling. Inform ECD of stakeholder consultation plan.
12 <sup>th</sup> May 2016, 10am, MFF Office	Department of Fisheries (DoF)	Present information on Project. Discuss potential national level fishing activity in Block AD-3.
12 <sup>th</sup> May, 2016, 11am, DoF Office	Myanmar Fisheries Federation (MFF)	Present information on Project. Discuss potential national level fishing activity in Block AD-3.
Regional (Sittwe, Rakhine State)		

Date, time, location	Stakeholder	Purpose of Engagement
9 <sup>th</sup> May, 10am, 2016, DoF offices	Regional Department of Fisheries (DoF)	Present information on Project. Obtain regional level data and information. Confirm that local fishermen are unlikely to be fishing in Block AD-3.
9 <sup>th</sup> May, 1pm, Chief Minister office	Chief Minister	Present information on Project. Seek permissions and approvals required to conduct engagement in Rakhine State.
9 <sup>th</sup> May, 2pm, GAD Offices	State General Administrative Department (GAD)	Present information on Project. Seek an understanding of the requirements and plan for government presence/participation in the consultation process.
10 <sup>th</sup> May, 10am, ECD State Office	MONREC regional office	Present information on Project. Seek an understanding of the requirements and plan for government presence/participation in the consultation process.
Township (Thandwe, Rakhine State)		
16 <sup>th</sup> June, 10am, GAD offices	District GAD	Present information on Project. Seek permissions and approvals required to conduct engagement in Township level.
16 <sup>th</sup> June, 11am, GAD offices	Thandwe town hall meeting (public)	Present information on Project. Obtain township level data and information.

The meetings were undertaken to disclose information on the Project at the regional and national level and to confirm our baseline understanding of the Project Area. A summary of the outcomes of the meetings is presented below:

- For larger vessels that might be within the Project Area, the Yangon and Sittwe DoF and Sittwe ECD confirmed these come from throughout Myanmar but mostly Tanintharyi (Dawei), Ayeyarwady and Yangon.
- The offshore fishermen from Thabyugyaing and Gyietaw confirmed that they fish up to a maximum of 100 km (60 miles) from the mainland coast and in waters of up to 490 ft. depth. Mostly they fish within 50 km (30 miles) from the coast.
- Trawlers and purse seiners are the two types of offshore vessels in Rakhine. All fishermen in the meeting were trawlers and mentioned that they use GPS to navigate offshore.

The main questions related to:

- Local Benefits and social investment: It was noted that in Myanmar, Ophir are at an early stage of the Project and they do not know whether they will find any gas. However, a CSR program is part of the commitment in the PSC with MOGE if the Project goes to the Development and Production Stage.
- Compensation from Incidents: The fishermen in Thandwe asked about compensation if an incident were to occur as they have historic experience with companies in the area paying compensation. It was noted that Block



AD-3 is further offshore than the Block which had the interactions with fishermen. It was also explained that this is drilling of one well, not a seismic survey in whole Block, so the area for potential interaction is much smaller.

- Disclosure of Information: There were question on how the information would be disclosed and suggested that it should be distributed through village leaders. It is noted that the Notice to Mariners would be announced to the public one month prior to the commencement of the Project activities.

## 1.7 CONCLUSIONS AND RECOMMENDATIONS

The EIA Study for the proposed exploration drilling in Block AD-3 was conducted to comply with the requirements of the Myanmar EIA Procedure. The EIA demonstrates that Ophir Myanmar understands the environment and social setting in which they are operating and has properly assessed the key potential environmental and social impacts associated with the proposed Project. A project-specific, dedicated Environmental Management Plan (EMP) has been developed separately to this EIA Report and presented as a tool to manage impacts associated with the Project and ensure legislative compliance and standards of good practice during the exploration drilling in Block AD-3. Provided that the recommended mitigation measures are properly implemented, it is expected that the environmental and social impacts of the proposed Project would be managed by Ophir Myanmar in a professional and acceptable manner. As such, the EIA concludes that **no Major impacts** on the environment and people are anticipated from this Project and all impacts have been properly mitigated to be as low as reasonably practical.

The EIA Report will also be disclosed on Ophir's website as well as the executive summary of the EIA Report in Myanmar and English. Hard copies will be provided upon request at Ophir Myanmar's offices in Yangon as well as in Thandwe GAD and Manaung GAD offices.

The engagement activities thus far, were undertaken as part of the EIA process. However, stakeholder engagement is understood to be a continuous process to be undertaken throughout the life of the Project, in this case during the duration of the exploration drilling. Ophir Myanmar will further develop the Stakeholder Engagement Plan to manage ongoing consultation and respond to stakeholder concerns that may be reported in relation to the implementation of the Project.

## စီမံကိန်းအကျဉ်းချုပ်

### ၁.၁ နိဒါန်း

Ophir Myanmar (Block AD-3) Limited (Ophir Myanmar) သည် ပုံ(၁.၁)တွင် ဖော်ပြပါရှိသော ရေနံလုပ်ကွက်အမှတ်- အေဒီ-၃ ၌ ရေနံအစမ်းတွင်းတစ်တွင်း (အောင်စကြာ) တူးဖော်ခြင်းလုပ်ငန်းကို ၂၀၁၇ ခုနှစ်အတွင်း ဆောင်ရွက်ရန် ရည်ရွယ်ထားရှိပါသည်။ မြန်မာ နိုင်ငံ၏ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း လုပ်ထုံးလုပ်နည်းအရ အဆိုပြုစီမံကိန်းသည် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း(EIA)နှင့် ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှုအစီအစဉ် (EMP) ဆောင်ရွက် ရန်လိုအပ်ပြီး သဘာဝသယံဇာတနှင့်ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဝန်ကြီးဌာနသို့ တင်ပြရမည် ဖြစ်ပါသည်။

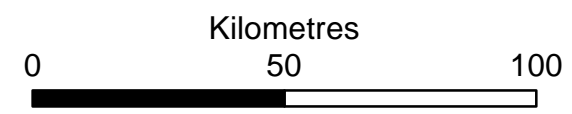
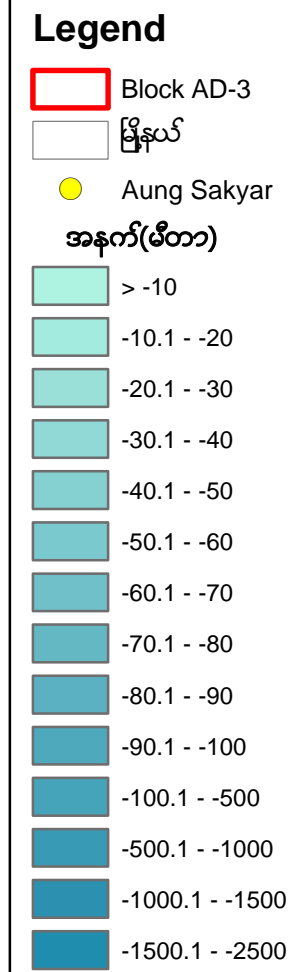
Ophir Myanmar သည် ၂၀၁၄ခုနှစ်၊ ဒီဇင်ဘာလတွင် မြန်မာ့ရေနံနှင့် သဘာဝဓါတ်ငွေ့လုပ်ငန်း (MOGE) နှင့် ထုတ်လုပ်မှုအပေါ်မျှဝေခံစားခြင်းစာချုပ် (PSC) အားလက်မှတ်ရေးထိုးခဲ့ပြီး ၂၀၁၅ခုနှစ်၊ ဇွန်လတွင် အဆိုပါ ရေနံလုပ်ကွက်အတွင်း ဆောင်ရွက်ခဲ့သည့် သုံးဘက်မြင် ဆိုက်စမစ်လေ့လာခြင်းဆိုင်ရာ ကနဦးပတ်ဝန်းကျင် ဆန်းစစ်ခြင်း (IEE) အား အတည်ပြုချက် ရယူရန် အစီရင်ခံစာ တင်ပြခဲ့ပြီးဖြစ်ပါသည်။

ယခု ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လေ့လာမှုအား မြန်မာနိုင်ငံ၏ ပတ်ဝန်းကျင် ထိခိုက်မှု ဆန်းစစ်ခြင်းလုပ်ထုံးလုပ်နည်းနှင့်အညီ ဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ စီမံကိန်း၏ ပထမအဆင့် အဆိုပြုလွှာ စိစစ်ခြင်း(Screening) အားဆောင်ရွက်ရန် ၂၀၁၆ခုနှစ်၊ ဧပြီလတွင် စီမံကိန်းအဆိုပြုလွှာအား မြန်မာ့ရေနံနှင့် သဘာဝဓါတ်ငွေ့လုပ်ငန်းမှတစ်ဆင့် သဘာဝသယံဇာတနှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ တင်ပြ ခဲ့ရာ သဘာဝသယံဇာတနှင့်ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနလက်အောက်ရှိ ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဦးစီးဌာနမှ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအကဲဖြတ်ခြင်းအတွက် လိုအပ်ချက်များအား Ophir Myanmar အား အကြံပြု ပေးပို့ခဲ့ပါသဖြင့် ၂၀၁၆ခုနှစ်၊ မေလတွင် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း လေ့လာမှုတွင် ဆောင်ရွက်မည့်လုပ်ငန်းတာဝန်များပါဝင်သည့် နယ်ပယ်တိုင်းတာသတ်မှတ်ခြင်းအစီရင်ခံစာ (Scoping report) အား မြန်မာ့ရေနံနှင့်သဘာဝဓါတ်ငွေ့လုပ်ငန်းသို့ တင်ပြခဲ့ပြီးဖြစ်ပါသည်။

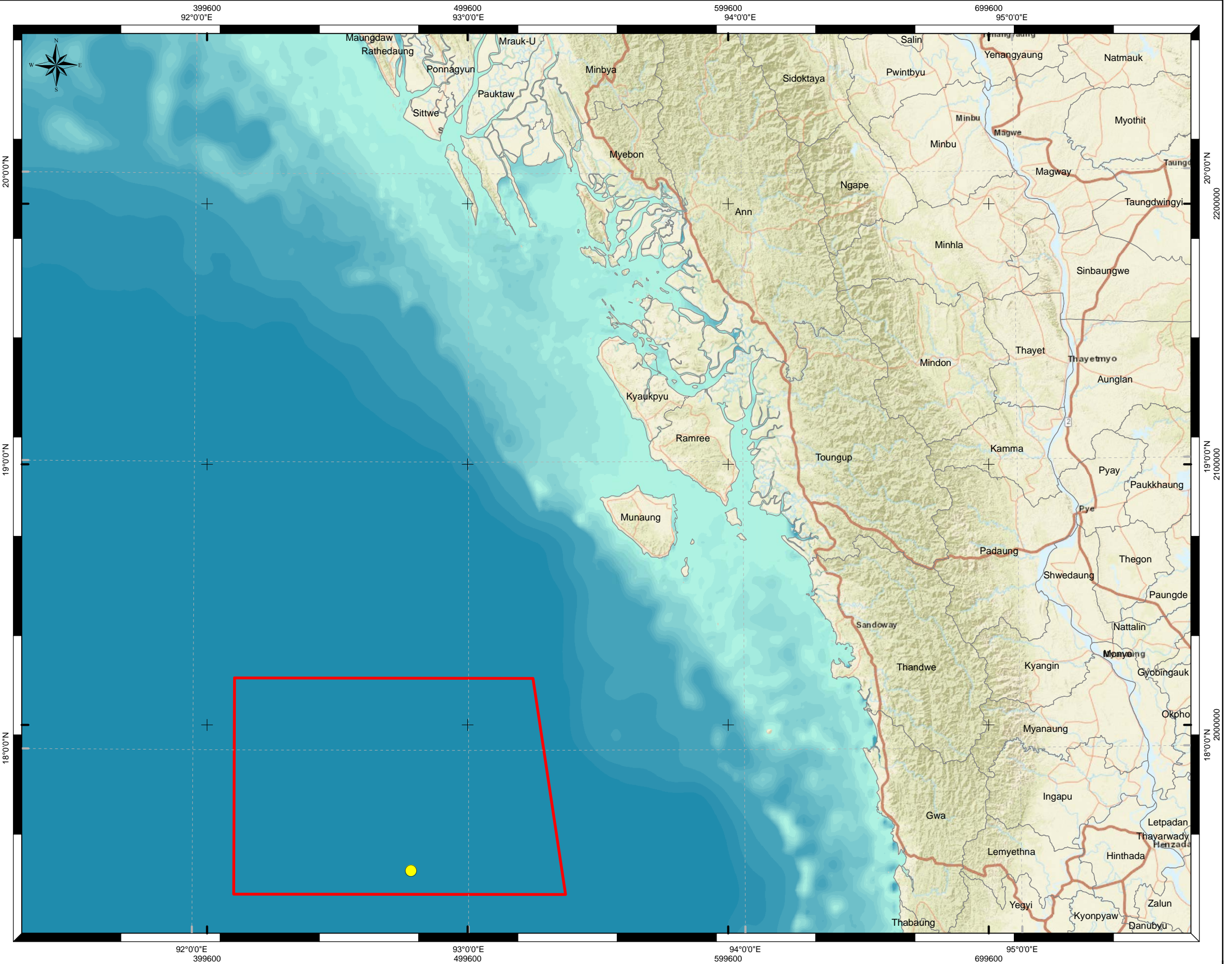
Ophir Myanmar မှ ယခု ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းလေ့လာမှုအား ERM Myanmar Company Limited (ERM) နှင့် မြန်မာနိုင်ငံ၏ ဒေသတွင်း ပတ်ဝန်းကျင်ဆိုင်ရာ အတိုင်ပင်ခံ ကုမ္ပဏီဖြစ်သည့် E Guard Environmental Services Co., Ltd နှင့်အတူ ဆောင်ရွက်ခဲ့ပါသည်။

ဤစာတမ်းသည် ရေနံလုပ်ကွက်အမှတ် အေဒီ-၃ စီမံကိန်း (ရှေ့တွင် "စီမံကိန်း"ဟုဖော်ပြမည့်) ဆိုင်ရာ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာအတွက်ဖြစ်ပြီး ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ် (EMP) အား သီးခြားစာတမ်းတစ်စောင်အဖြစ် သဘာဝသယံဇာတနှင့်ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနမှ အတည်ပြု ချက်ရယူရန် ဤအစီရင်ခံစာနှင့်အတူ တင်ပြသွားမည် ဖြစ်ပါသည်။





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Block AD-3

**Environmental Resources Management**

**၁.၂။ မူဝါဒနှင့် အဖွဲ့အစည်း ကန့်သတ်ချက်**

ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ၊ အပိုဒ်(၇)နှင့် ပြည်ထောင်စုမြန်မာနိုင်ငံတော်မှ ပြဌာန်းထား သည့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးနည်းဥပဒေ၊ ပိုဒ်ခွဲ (၅၂)နှင့် (၅၃) အရ Ophir Myanmar သည် အဆိုပါ ဆောင်ရွက်ရန်ရည်ရွယ်ထားရှိသည့် ရေနံအစမ်းတွင်းတူးဖော်ခြင်းလုပ်ငန်းအတွက် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဆိုင်ရာ လိုက်နာဆောင်ရွက်မှု သက်သေခံလက်မှတ်(ECC) ရရှိရေး အတွက် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း (EIA) အားဆောင်ရွက်ရမည်ဖြစ်ပါသည်။

ထိုသို့ဆောင်ရွက်ရာတွင် အဆိုပြု စီမံကိန်းကို အမျိုးသားအဆင့်နှင့် ဒေသတွင်းရှိ စံချိန်စံညွှန်းများ၊ ဥပဒေများနှင့်အညီ တာဝန်ယူဆောင်ရွက်သွားမည်ဖြစ်ပါသည်။ ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်းနှင့် သက်ဆိုင်သည့် ဒေသဆိုင်ရာ ဥပဒေများဖြစ်သော ပတ်ဝန်းကျင် ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၂)၊ ပတ်ဝန်းကျင် ထိန်းသိမ်းရေးနည်းဥပဒေများ(၂၀၁၃)၊ အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေး(ထုတ်လွှင့်မှု)လမ်းညွှန် ချက်များ(၂၀၁၅)နှင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းလုပ်ထုံးလုပ်နည်း (၂၀၁၅)များအရ လိုက်နာ ဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ စီမံကိန်းနှင့်သက်ဆိုင်သည့် လိုက်နာဆောင်ရွက်မည့် ဥပဒေများ၏ အပြည့်အစုံစာရင်းကို အပိုဒ် (၃)တွင် ဖော်ပြထားပါသည်။

၂၀၁၅ ခုနှစ်၊ ဒီဇင်ဘာလတွင် နောက်ဆုံးထုတ်ပြန်ထားရှိသော ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း လုပ်ထုံးလုပ်နည်း(၂၀၁၅)အရ အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာအရည်အသွေး (ထုတ်လွှင့်မှု) လမ်းညွှန်ချက် များကိုလည်း လိုက်နာဆောင်ရွက်မည်ဖြစ်ပါသည်။ အဆိုပါ လမ်းညွှန်ချက်များတွင် ပတ်ဝန်းကျင်ညစ်ညမ်းမှုအား တားဆီးရန်နှင့် ပတ်ဝန်းကျင်နှင့် ပြည်သူ့ကျန်းမာရေးအားကာကွယ်ရန် စီမံကိန်းကြောင့် ဖြစ်ပေါ်လာသည့် ဆူညံသံ၊ လေထုညစ်ညမ်းမှုနှင့် အညစ်အကြေးထုတ်လွှတ်မှုများအား ထိန်းချုပ်မှုဆိုင်ရာ အခြေခံစည်းမျဉ်းများ အား ပံ့ပိုးထားရှိပါသည်။ အဆိုပါစံချိန်စံညွှန်းများသည် နိုင်ငံတကာ ဘဏ္ဍာရေးပူးပေါင်းဆောင်ရွက်မှုအဖွဲ့ (IFC)၏ ပတ်ဝန်းကျင်ကျန်းမာရေးနှင့်လုံခြုံရေးဆိုင်ရာစံချိန်စံညွှန်းများ(၂၀၀၇) <sup>1</sup> အားအခြေခံ၍ ရေးဆွဲထား ခြင်း ဖြစ်ပါသည်။

**၁.၃။ စီမံကိန်းဖော်ပြချက်နှင့် အခြားနည်းလမ်းများ**

Ophir Myanmar မှ အဆိုပြုဆောင်ရွက်မည့် ရေနံအစမ်းတွင်း တစ်တွင်းတူးဖော်ခြင်းမည့် ရေနံလုပ်ကွက် အေဒီ-၃သည် ရေအနက် ၂,၄၀၀ မီတာ (၇,၈၀၀ပေ)ကျော်နှင့် အနီးဆုံး ကမ်းရိုးတန်းဖြစ်သော (မာန်အောင်ကျွန်း) မှ ၁၅၀ ကီလိုမီတာ (၉၃မိုင်)အကွာတွင် တည်ရှိ ပါသည်။ ကမ်းလွန်ရေနံအစမ်းတွင်း တူးဖော်မည့်ပတ်ဝန်းကျင်အခြေအနေအား ဖော်ပြရမည့် ဆိုလျင် ရွေ့လျားကမ်းလွန်ရေနံတွင်းတူးယူနစ် (MODU)နှင့် ပင်လယ်ကြမ်းပြင် အောက်သို့ ၃ပေအချင်းထက်မပိုသော သေးငယ်သည့် တွင်းတစ်တွင်း တူးဖော်ခြင်း စသည်ဖြင့် ပါဝင်ပါသည်။ တွင်းတူးဖော်ခြင်းအား ပင်လယ်ကြမ်းပြင်အောက်ရှိ ရေနံ (သို့မဟုတ်) ဓါတ်ငွေ့ထုတ်ယူမည့် ရည်မှန်းချက်ရရှိသည်အထိ အောက်ဘက်သို့ ဆက်လက်တူးဖော်သွားမည်ဖြစ်ပါသည်။



စီမံကိန်းတွင် ရေနံတွင်းတူးရည်အဖြစ် ပင်လယ်ရေနှင့် သန့်စင်ပြီးရေ (သို့မဟုတ်) ရေကို အခြေမခံသည့် တွင်းတူးရည် (NADF) အား အသုံးပြုသွားမည်ဖြစ်သည်။ ပင်လယ်ရေနှင့် သန့်စင်ပြီးရေကို အသုံးပြု၍ ရေနံတွင်းတူးဖော်စဉ် ထွက်ရှိလာသည့် ဖြတ်စများကို ပင်လယ်ကြမ်းပြင်သို့ စွန့်ပစ်သွားမည်ဖြစ်သော်လည်း ရေကိုအခြေမခံသည့်တွင်းတူးရည် ပါဝင်သည့် ဖြတ်စများကိုမူ ရေနံတွင်းတူးစင်သို့ ပြန်လည်သယ်ဆောင်၍ ဖြတ်စအတွင်းရှိ ဆီပါဝင်မှုအား လျော့ချပြီးမှသာ ပင်လယ်ပြင်သို့ စွန့်ထုတ်သွားမည်ဖြစ်ပါသည်။

စီမံကိန်းရေးဆွဲသည့် ဒီဇိုင်းအဆင့်၏ ကဏ္ဍတစ်ရပ်အဖြစ် အလားအလာရှိသော အခြားနည်းလမ်း များအနေဖြင့် ကွဲပြားခြားနားသော တွင်းတူးရည် အမျိုးအစားများအား အသုံးပြုခြင်း၊ ပြုပြင်စီရင်သည့်နည်းလမ်းများနှင့် စွန့်ပစ်သည့်နည်းလမ်းများရွေးချယ်ခြင်း စသည်ဖြင့် ထည့်သွင်း စဉ်းစားခြင်းအား ဆောင်ရွက်ခဲ့ပါသည်။ နယ်ပယ်တိုင်းတာသတ်မှတ်ခြင်းတွင် အခြားနည်းလမ်း အဖြစ် တွင်းနေရာအား (၄)နေရာ သတ်မှတ်ခဲ့သော်လည်း ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းတွင် တွင်းနေရာတစ်နေရာသာ ရွေးချယ်ခဲ့ပါသည်။ အဆိုပါရေနံတွင်း တည်နေရာသည် အနီးဆုံး ကမ်းရိုးတန်း (မာန်အောင်ကျွန်း) မှ ၁၅၀ ကီလိုမီတာ (၉၃မိုင်) အကွာတွင် တည်ရှိပါသည်။

ထို့ပြင် စီမံကိန်းမရှိသည့်အခြေအနေအား ထည့်သွင်းစဉ်းစားခဲ့သော်လည်း စီးပွားဖြစ်ဓါတ်ငွေ့ တွေ့ရှိနိုင်မှုအပြင် မြန်မာနိုင်ငံနှင့် ဒေသခံများအပေါ် ထိရောက်သော အကျိုးသက်ရောက်မှု များကြောင့် စီမံကိန်းအနေဖြင့် အောင်မြင်စွာဆောင်ရွက်သင့်ပါသည်။

**၁.၄။ လက်ရှိအခြေအနေများ**

စီမံကိန်း၏သက်ရောက်ရေးဇယားတွင် ရခိုင်ပြည်နယ် ကမ်းလွန်တောင်ပိုင်းနှင့်ရေနံလုပ်ကွက် အေဒီ-၃ ရှိ ရေပြင် ပါဝင်ပါသည်။ ရေနံတွင်းတည်နေရာသည် ကုန်းမြေမှ ၁၀၈ ကီလိုမီတာ (၁၇၅ မိုင်) ပတ်ဝန်းကျင်နှင့် အနီးဆုံးကမ်းရိုးတန်း (မာန်အောင်ကျွန်း) မှ ၁၅၀ ကီလိုမီတာ (၉၃မိုင်)တွင် တည်ရှိသည့်အားလျော်စွာ ရေနက်ပိုင်းတွင် ကျက်စားလေ့ရှိသည့် ရေနေသတ္တဝါများနှင့် ပတ်သက်သည့် အခြေခံအချက်အလက်များအား ဗဟိုပြုလေ့လာရန်ဖြစ်ပါသည်။ စီမံကိန်း၏ သက်ရောက်ရေးဇယားအတွင်းရှိ ရုပ်ပိုင်းဆိုင်ရာပတ်ဝန်းကျင်အနေဖြင့် ကာကွယ်ထိန်းသိမ်းရမည့် သီးခြားလက္ခဏာဆောင်သည့် သဘာဝရှိ မျိုးနွယ်တူများအား နှိုင်းယှဉ် လေ့လာခြင်းအား ထည့်သွင်းစဉ်းစားသွားမည် မဟုတ်ပါ။ ပင်လယ်ကြမ်းပြင်သက်ရောက်မှုအနေဖြင့် ရွှံ့ရည်ကြောင့် ဇီဝဗေဒနှင့် ဂေဟတန်ဆိုး အနည်းငယ်(သို့မဟုတ်) သိသာထင်ရှားစွာဖြင့် ထူးခြားသည့် သွင်ပြင်လက္ခဏာ ပြောင်းလဲခြင်းအား မျှော်လင့်ထားရှိပါသည်။

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းဆိုင်ရာ လုပ်ငန်းစဉ်အတွင်း ဆွဲပိုက်နှင့် ပိုင်းကြီးချုပ် စသည့် ငါးဖမ်းခြင်းလုပ်ငန်းဖြင့် အသက်မွေးသူများနှင့်တွေ့ဆုံဆွေးနွေးရာတွင် ကမ်းရိုးတန်းမှ ၁၀၀ ကီလိုမီတာ (မိုင်၆၀) အကွာထိ ငါးဖမ်းကြသော်လည်း အများစုမှာ ကမ်းရိုးတန်းမှ ၅၀ ကီလိုမီတာ (မိုင်၃၀)အကွာ ရေအနက် ၁၅၀ မီတာ (ပေ ၄၉၀) အတွင်း ငါးဖမ်းကြကြောင်း သိရှိရပါသည်။ စီမံကိန်းဆောင်ရွက်မည့် တည်နေရာ အကွာအဝေးနှင့်ရေပြင်အနက်အရ ဒေသခံငါးဖမ်းလုပ်ငန်း များအား သိသိသာသာ ထိခိုက်နိုင်မည် မဟုတ်ပါ။ ထိုနည်းတူစွာ ရေလမ်းကြောင်း အများအပြားအား အသုံးပြုရန် မျှော်လင့်ထားခြင်းမရှိပါ။

ရေနံလုပ်ကွက် အေဒီ-၃ အတွင်းတွင် ကာကွယ်ထားသော ဧရိယာများ (သို့မဟုတ်) ကာကွယ်ထိန်းသိမ်းရမည့် သက်ရှိသတ္တဝါများမရှိပါ။ ရခိုင်ကမ်းလွန်ရေပြင်တွင် မှတ်တမ်းတင် ထားရှိသော အဓိကငါးမျိုးစိတ်များမှာလည်း ယေဘုယျအားဖြင့် ပတ်ဝန်းကျင်ထိန်းသိမ်း စောင့်ရှောက်ရမည့် ရှုထောင့်အရ ထည့်သွင်းစဉ်းစားရန် မလိုအပ်ပါ။ သို့ရာတွင် ရခိုင်ပင်လယ်ပြင်တွင် ကမ္ဘာတစ်ဝှမ်းလုံးအရသော်လည်းကောင်း အမျိုးသားရေးအရ သော်လည်းကောင်း ကာကွယ်စောင့်ရှောက်ရမည့် အဏ္ဏဝါနို့တိုက်သတ္တဝါနှင့် ပင်လယ်လိပ် မျိုးစိတ်အရေအတွက် တစ်ခု တည်ရှိပါသည်။

**၁.၅ ထိခိုက်မှုအားဆန်းစစ်ခြင်းနှင့် ထိခိုက်မှုအားလျော့ချမည့်အဆိုပြုနည်းလမ်းများ**

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းသည် အလားအလာရှိသော ထိခိုက်မှုများအား ဆန်းစစ်ခြင်းနှင့် ထိခိုက်မှုအားလျော့ချမည့်နည်းလမ်းများအား အဆိုပြုခြင်းလုပ်ငန်းစဉ်ဖြစ်ပါသည်။ ယခင်တွေ့ကြုံ ခဲ့ဘူးသော အတွေ့အကြုံများနှင့် ယခု ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအရ အလားအလာရှိသော ထိခိုက်သက်ရောက်မှု များမှာ ခေတ္တယာယီသာဖြစ်ခြင်း၊ ကောင်းစွာနားလည်မှုပေးနိုင်သည့် အခြေအနေရှိခြင်းစသည့်တို့အပြင် ပတ်ဝန်းကျင်နှင့် လူမှုရေးရာအရ ထည့်သွင်းစဉ်းစားရမည့် အဓိကအားဖြင့် ဆိုးကျိုးပေးနိုင်သည့်ကွင်းဆက် အနည်းငယ် (သို့မဟုတ်) လုံးဝမရှိပါ။ ဖြစ်နိုင်ချေရှိသော အဓိကထိခိုက်မှုများနှင့် ဆက်စပ်လျက်ရှိသော ထိခိုက်မှုအား လျော့နည်း စေနိုင်သည့်အချက်များကို ဇယား ၁.၁ တွင် ဖော်ပြထားပါသည်။

**ဇယား ၁.၁ အလားအလာရှိသောထိခိုက်မှုများနှင့်အဆိုပြုသည့် ထိခိုက်မှုအားလျော့ချစေနိုင်သည့် နည်းလမ်းများ**

ဖြစ်နိုင်ချေရှိသော ထိခိုက်မှုများ	ထိခိုက်မှုအား လျော့ချစေနိုင်သည့်နည်းလမ်းများ	သိသာထင်ရှားသော ထိခိုက်မှုအကြွေးကျန်
တွင်းတူးဖြတ်စ	<ul style="list-style-type: none"> <li>• ရေကိုအခြေမခံသည့်တွင်းတူးရည်ပါဝင်သည့် ဖြတ်စများ အား ပြန်လည်အသုံးပြုခြင်း၊ စွန့်ပစ်နိုင်သည့်အခြေအနေ သို့ ရောက်ရှိရန် ပြုပြင်စီရင်ခြင်း၊ရေကိုအခြေမခံသည့် တွင်းတူးရည်သုံးဖြတ်စများတွင် လက်ကျန် ဆီပါဝင်မှုသည် အလေးချိန်အားဖြင့် ၅% ထက်မပိုစေခြင်း၊</li> <li>• ဖြတ်စအား ပင်လယ်ရေမှတ်အောက်ထိ စွန့်ပစ်ခြင်း၊</li> <li>• စွန့်ပစ်ရာတွင် အဆိပ်သင့်မှု အနည်းဆုံးဖြစ်သော ဓါတုပစ္စည်းများအားရွေးချယ်အသုံးပြုရန်၊</li> <li>• ရေကိုအခြေမခံသည့်တွင်းတူးရည်အား လိုအပ်သော နည်းပညာသတ်မှတ်ချက်အရ ပင်လယ်ရေနှင့် သန့်စင်ပြီး ရေ အသုံးပြုရန်မဖြစ်နိုင်သည့် အခြေအနေတွင်သာ အသုံးပြုရန်၊</li> <li>• ရေကိုအခြေမခံသည့်တွင်းတူးရည် အား ထုထည်ကြီးမားစွာ အသုံးပြုခြင်းအား ခွင့်မပြုရန်၊</li> </ul>	<p>လစ်လျူရှုနိုင်သည့်အဆင့် (နှုန်းအရည်အသွေး)</p> <hr/> <p>လစ်လျူရှုနိုင်သည့်အဆင့် (နှုန်းအရည်အသွေး)</p> <p><b>အနည်းငယ်</b> (ရေအရည်အသွေး)</p> <hr/> <p>လစ်လျူရှုနိုင်သည့်အဆင့် (ငါးနှင့်ပင်လယ်ရေပေါ်လွှာ နေငါးမျိုးစိပ်)</p>
ရေအောက်အသံလှိုင်း ထုတ်လွှတ်ခြင်းကြောင့် ပင်လယ်ရေနေသတ္တဝါများအား ထိခိုက်မှု	<ul style="list-style-type: none"> <li>• ရေအောက်အသံလှိုင်းထုတ်လွှတ်မှုမစတင်မီ ရွေ့လျားရေနံတွင်းတူးစင် (သို့) ထောက်ပံ့ရေးသင်္ဘောမှ သတ်မှတ် လေ့လာရေးဇုန် ဖြစ်သော ၁ ကီလိုမီတာအတွင်း ပင်လယ်ရေနေ သတ္တဝါများရှိမရှိ</li> </ul>	<p><b>အနည်းငယ်</b> (ငါးမျိုးစိပ်)</p>

- မျက်မြင်အရ မိနစ်(၂၀)ခန့် စစ်ဆေးခြင်း၊
- ဖြေးညှင်းစွာစတင်ခြင်း- ပင်လယ် ရေနေ သတ္တဝါများထွက်ခွာသွားနိုင်မည့် လုံလောက် သော အချိန် (အနည်းဆုံး မိနစ် ၂၀ခန့်) ပေးရန် ရေအောက်အသံလှိုင်းလွှင့်ထုတ် သည့်စွမ်းအင်အား ဖြည်းညှင်းစွာ စတင်ခြင်း၊
- ဖြေးညှင်းစွာစတင်ခြင်း လုပ်ငန်းစဉ်အား ပင်လယ်နေသတ္တဝါများ တားမြစ်ရန် ဧရိယာဖြစ်သော ၅၀၀ မီတာပြင်ပသို့ ထွက်ခွာသွားချိန်(သို့) နောက်ဆုံးမြင်ကွင်းမှ ပျောက်ကွယ်ပြီးချိန်မှ မိနစ် ၃၀ကြာမှသာ ပြန်လည်စတင်ခြင်း၊
- လေ့လာရေးရန် (၁ ကီလိုမီတာ)အတွင်း ရေနေသတ္တဝါများနှင့်ပင်လယ်လိပ်များ ဆက်လက်ရှိနေပါက မျက်မြင်လေ့လာခြင်း အား ဆက်လက်ဆောင်ရွက်၍ ထိန်းသိမ်း ဆောင်ရွက်ခြင်း၊
- လုပ်ငန်းမစတင်မီ နှင့် လုပ်ငန်း ဆောင်ရွက် နေစဉ်အတွင်း ပင်လယ်နေ နို့တိုက်သတ္တဝါ များနှင့် ပင်လယ်လိပ်များအား စတင် တွေ့ရှိသည်နှင့်တပြိုင်နက် လေ့ကျင့် သင်ကြားပေးထားသော အကူပါ လေ့လာရေး ပညာရှင်များအား သဘောထားများမှ ချက်ချင်း
- လေ့ကျင့် သင်ကြားပေးထားသော အကူပါ လေ့လာရေး ပညာရှင်များအား ရေအောက် အသံလှိုင်းလွှင့်ထုတ်စဉ် ပင်လယ်နေ နို့တိုက်သတ္တဝါ များနှင့် ပင်လယ်လိပ် များအား စောင့်ကြည့်စစ်ဆေး ခြင်းနှင့် မှတ်တမ်းရယူခြင်းအား အကျိုးရှိရှိ အသုံးပြုခြင်း၊
- မှတ်တမ်းများအား သဘာဝသံယံဇာတနှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနသို့ ဆက်လက်အစီရင်ခံခြင်းဖြင့် လုပ်ငန်းစဉ် အား ပြီးမြောက်စေခြင်း၊
- မျက်မှောက်ကာလအတွင်း ဘင်္ဂလား ပင်လယ်အော်အတွင်းရှိနေနိုင်သည့် ဝေလငါးမန်းများအတွက် လုပ်ငန်းစဉ် ရပ်ပေးခြင်း၊

အလယ်အလတ် (အကူပါနို့တိုက်သတ္တဝါ များနှင့် ပင်လယ်လိပ်များ)

မျှော်လင့်မထားသော ဆီဖိတ်စင်ခြင်းကြောင့် ပင်လယ်ရေနေသတ္တဝါများအား ထိခိုက်မှု

- ရေယာဉ်များလုပ်ငန်းဆောင်ရွက်ခြင်း လုပ်ထုံးလုပ်နည်းဆိုင်ရာ စံချိန်စံညွှန်းအား ကြိုတင်ပြင်ဆင်ခြင်းနှင့် အကောင်အထည် ဖော်ဆောင်ရွက်ခြင်း၊
- MARPOL ၏ ၇၃/၇၈ နောက်ဆက်တွဲ (၁)အား ထိန်းသိမ်းလိုက်နာခြင်း၊
- ဓါတုပစ္စည်းနှင့် (သို့) ဟိုက်ဒြိုကာဘွန်များအား ကိုင်တွယ်သိုလှောင်ထိန်းသိမ်းရာတွင် Material Safety Data Sheet (MSDS)အရ လေးစားလိုက်နာဆောင်ရွက်ခြင်း၊
- ဆီဖိတ်မှုအားချက်ချင်းအရေးယူ တုံ့ပြန်နိုင်သည့် ပစ္စည်းကိရိယာများအား လက်ဝယ်ထိန်းသိမ်းထားရှိခြင်း၊
- အကူပါ လုံခြုံရေးနှင့် ပင်လယ်ရေကြောင်း

လစ်လျူရှုနိုင်သည့်အဆင့်



ဖြစ်နိုင်ချေရှိသော ထိခိုက်မှုများ	ထိခိုက်မှုအား လျော့ချစေနိုင်သည့်နည်းလမ်းများ	သိသာထင်ရှားသော ထိခိုက်မှုအကြွင်းကျန်
	<p>သွားလာမှုနှင့်သက်ဆိုင်သော စံချိန် စံညွှန်း များအတိုင်း လုပ်ထုံးလုပ်နည်းများအား အကောင်အထည်ဖော် ဆောင်ရွက်ခြင်း၊</p> <ul style="list-style-type: none"> <li>• ရေနံတွင်းတူးစင်မှ အချင်း ၅၀၀ မီတာရှိ လုံခြုံရေးဖန်အား သတ်မှတ်ထားရှိခြင်း၊</li> <li>• သဘောတိုက်မိခြင်းဖြစ်စဉ်များတွင် လိုအပ်ပါက သဘောတော်ပေါ်တွင် ကျင့်သုံးသည့် အရေးပေါ် ဆီယိုဖိတ်မှုကာကွယ်ရေး အစီအစဉ် (SOPEP) အား အကောင် အထည်ဖော်ဆောင်ရွက်ခြင်း၊</li> </ul>	
စီးပွားဖြစ်ငါးဖမ်းလုပ်ငန်းများအား ခေတ္တထိခိုက်မှု	<ul style="list-style-type: none"> <li>• ရေနံတွင်းတူးစင်မှ အချင်း ၅၀၀ မီတာရှိ လုံခြုံရေးဖန်အား သတ်မှတ်ထားရှိခြင်း၊</li> <li>• နိုင်ငံတကာ ရေယာဉ်တိုက်မှု တားဆီးရေး၊ ရေကြောင်းသွားလာခြင်းနှင့် ထိန်းသိမ်းခြင်း အား ရွေ့လျားတွင်းတူးစင်နှင့် ထောက်ပံ့ရေး သဘောတိုက်နာဆောင်ရွက်ခြင်း၊</li> </ul>	<p><b>အနည်းငယ်</b> (သဘောတော်သွားလာခြင်း၊ ငါးဖမ်းလုပ်ငန်းနှင့် အသက်မွေး ဝမ်းကြောင်းလုပ်ငန်း)</p>
ငါးဖမ်းသင်္ဘောများအခြား ပင်လယ်အသုံးပြုသူများနှင့် ထိပ်တိုက်တွေ့ ဆုံမှု	<ul style="list-style-type: none"> <li>• မြန်မာဘာသာစကားကျွမ်းကျင်သည့် သဘောတော်သားများအား ရေနံတွင်းတူးစင်တွင် ထားရှိခြင်း၊</li> <li>• အချိန်နှင့်တပြေးညီ သတင်းအချက်အလက် များထုတ်ပြန်ခြင်း၊ (ရေကြောင်း သတိပေး ချက်ကဲ့သို့)</li> <li>• လူထု၏နစ်နာချက်နှင့်မကျေနပ်ချက်များ နှင့်ပတ်သက်၍ ဆောင်ရွက်ချက်အား ထုတ်ပြန်ခြင်းနှင့် အကောင်အထည် ဖော်ခြင်း၊</li> </ul>	<p><b>လစ်လျူရှုနိုင်သည့်အဆင့်</b> (သဘောတော်သွားလာခြင်း၊ ငါးဖမ်းလုပ်ငန်းနှင့် အသက်မွေး ဝမ်းကြောင်းလုပ်ငန်း)</p>

**၁.၆ စီမံကိန်းနှင့်သက်ဆိုင်သူများနှင့်တွေ့ဆုံညှိနှိုင်းခြင်းနှင့် သတင်းထုတ်ပြန်ခြင်း**

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းနှင့်ပတ်သက်သည့် စီမံကိန်းနှင့်သက်ဆိုင်သူများနှင့် တွေ့ဆုံ ညှိနှိုင်းခြင်းအား စစ်တွေနှင့် သံတွဲမြို့များတွင် ရခိုင်ပြည်နယ်အဆင့်အဖြစ်လည်းကောင်း၊ ရန်ကုန်နှင့်နေပြည်တော်မြို့များတွင် အမျိုးသားအဆင့်အဖြစ်လည်းကောင်း ဆောင်ရွက်ခဲ့ပါသည်။ တွေ့ဆုံဆွေးနွေးပွဲများအား စီမံကိန်းကြောင့် ထိခိုက်ရန် အလားအလာရှိသော သက်ဆိုင်သူများထံမှ သတင်းအချက်အလက်များ စုဆောင်းရန်၊ အချက်အလက်ကွဲပြားမှုများအား သိရှိရန်နှင့် ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာပါ အချက်အလက် များအား အသိပေးရန် ဆောင်ရွက်ခဲ့ပါသည်။ မတူညီသည့် စီမံကိန်းနှင့်သက်ဆိုင်သူများနှင့် မျက်နှာစုံညီ ဆွေးနွေးပွဲများအား ဆောင်ရွက်ရာတွင် စစ်တွေရှိ ငါးလုပ်ငန်းဦးစီးဌာန၊ ရခိုင်ပြည်နယ်ဝန်ကြီးချုပ်နှင့် အထွေထွေအုပ်ချုပ်ရေးဦးစီးဌာန၊ ရန်ကုန်မြို့ရှိ မြန်မာနိုင်ငံငါးလုပ်ငန်းအသင်းတို့မှ တာဝန်ရှိသူများနှင့် လည်းကောင်း တွေ့ဆုံခဲ့သည့်ပြင် ပြည်သူများ၏အမြင်နှင့် မေးခွန်းများသိရှိနိုင်ရန် သံတွဲမြို့တွင် လူထုနှင့် တွေ့ဆုံညှိနှိုင်းခြင်းအား ဆောင်ရွက်ခဲ့ပါသည်။ အဆိုပါ တွေ့ဆုံညှိနှိုင်းမှုဆောင်ရွက်ခဲ့သည့် နေ့ရက်၊ အချိန်၊နေရာ၊ သက်ဆိုင်သူများနှင့် ဆောင်ရွက်သည့် ရည်ရွယ်ချက်များအား ဇယား ၁.၂ တွင် ဖော်ပြထား ပါသည်။

**ဇယား ၁.၂ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းလုပ်ငန်းစဉ်အတွင်း ဆောင်ရွက်ခဲ့သည့် တွေ့ဆုံညှိနှိုင်းမှုများ**

နေ့ရက်၊အချိန်နှင့် နေရာ	သက်ဆိုင်သူများ	တွေ့ဆုံသည့်ရည်ရွယ်ချက်
<b>အမျိုးသားအဆင့် (ရန်ကုန်နှင့်နေပြည်တော်)</b>		
၂၀၁၆ခုနှစ်၊ မေလ (၅)ရက် ၊ ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဦးစီးဌာနရုံး	ပတ်ဝန်းကျင် ထိန်းသိမ်းရေးဦးစီးဌာန	<ul style="list-style-type: none"> <li>လက်ရှိစီမံကိန်းဆိုင်ရာသတင်းအချက်အလက်တင်ပြရန်၊</li> <li>ရေနံတွင်းတူးဖော်ခြင်းဆိုင်ရာနည်းပညာအချက်အလက်များဆွေးနွေးရန်၊</li> <li>ပတ်ဝန်းကျင် ထိန်းသိမ်းရေး ဦးစီးဌာနသို့ လူထုနှင့်တွေ့ဆုံ ဆွေးနွေးခြင်းအစီအစဉ်အား အသိပေးတင်ပြရန်၊</li> </ul>
၂၀၁၆ခုနှစ်၊ မေလ (၁၂)ရက်၊ နံနက် (၁၀)နာရီ၊ ငါးလုပ်ငန်း ဦးစီးဌာနရုံး	ငါးလုပ်ငန်းဦးစီးဌာန	<ul style="list-style-type: none"> <li>လက်ရှိစီမံကိန်းဆိုင်ရာသတင်းအချက်အလက်တင်ပြရန်၊</li> <li>ရေနံလုပ်ကွက် အေဒီ-၃ အတွင်း အမျိုးသားအဆင့် ငါးလုပ်ငန်းဆိုင်ရာအလားအလာနှင့်ပတ်သက်၍ ဆွေးနွေးရန်၊</li> </ul>
၂၀၁၆ခုနှစ်၊ မေလ (၁၂)ရက်၊ နံနက် (၁၁)နာရီ၊ မြန်မာ နိုင်ငံငါးလုပ်ငန်း အသင်းချုပ်ရုံး	မြန်မာနိုင်ငံငါးလုပ်ငန်း အသင်းချုပ်	<ul style="list-style-type: none"> <li>လက်ရှိစီမံကိန်းဆိုင်ရာသတင်းအချက်အလက်တင်ပြရန်၊</li> <li>ရေနံလုပ်ကွက် အေဒီ-၃ အတွင်း အမျိုးသားအဆင့် ငါးလုပ်ငန်းဆိုင်ရာအလားအလာနှင့်ပတ်သက်၍ ဆွေးနွေးရန်၊</li> </ul>
<b>ပြည်နယ်အဆင့် (စစ်တွေ၊ ရခိုင်ပြည်နယ်)</b>		
၂၀၁၆ခုနှစ်၊ မေလ (၉ )ရက်၊ နံနက် (၁၀)နာရီ၊ ငါးလုပ်ငန်း ဦးစီးဌာနရုံး	ပြည်နယ်ငါးလုပ်ငန်းဦးစီးဌာန	<ul style="list-style-type: none"> <li>လက်ရှိစီမံကိန်းဆိုင်ရာသတင်းအချက်အလက်တင်ပြရန်၊</li> <li>ပြည်နယ်အဆင့် သတင်းအချက်အလက်များရယူရန်၊</li> <li>ဒေသခံငါးဖမ်းလုပ်ငန်းများအနေဖြင့် ရေနံလုပ်ကွက် အေဒီ-၃တွင် ဆောင်ရွက်ခြင်းရှိမရှိအား အတည်ပြုချက်ရယူခြင်း၊</li> </ul>
၂၀၁၆ခုနှစ်၊ မေလ (၉ )ရက်၊ နေ့လည် (၁)နာရီ၊ ပြည်နယ် ဝန်ကြီးချုပ်ရုံး	ပြည်နယ်ဝန်ကြီးချုပ်နှင့် ပြည်နယ်အစိုးရ ဝန်ကြီးများ	<ul style="list-style-type: none"> <li>လက်ရှိစီမံကိန်းဆိုင်ရာသတင်းအချက်အလက်တင်ပြရန်၊</li> <li>ရခိုင်ပြည်နယ်အတွင်း စီမံကိန်းနှင့်သက်ဆိုင်သူများနှင့် တွေ့ဆုံညှိနှိုင်းခြင်းဆောင်ရွက်ရန် လိုအပ်သည့် ခွင့်ပြုချက်နှင့် ထောက်ခံချက်တောင်းခံရန်၊</li> </ul>
၂၀၁၆ခုနှစ်၊ မေလ (၉ )ရက်၊ နေ့လည် (၂)နာရီ၊ ပြည်နယ် အထွေထွေအုပ်ချုပ်ရေး ဦးစီးဌာနရုံး	ပြည်နယ် အထွေထွေအုပ်ချုပ်ရေး ဦးစီးဌာန	<ul style="list-style-type: none"> <li>လက်ရှိစီမံကိန်းဆိုင်ရာသတင်းအချက်အလက်တင်ပြရန်၊</li> <li>လူထုနှင့်တွေ့ဆုံညှိနှိုင်းမှုအစီအစဉ်တွင် အစိုးရအဖွဲ့ဝင်များ ပူးပေါင်းပါဝင်ရန်လိုအပ်ချက်များအားနားလည်မှုရရှိရန်နှင့် ဆောင်ရွက်မည့် အစီအစဉ်အား တင်ပြရန်</li> </ul>
၂၀၁၆ခုနှစ်၊ မေလ (၁၀ )ရက်၊ နံနက် (၁၀)နာရီ၊ ပတ်ဝန်းကျင်ထိန်း သိမ်းရေးဦးစီးဌာနရုံး	ပြည်နယ်ညွှန်ကြားရေး မှူးရုံး၊ ပတ်ဝန်းကျင် ထိန်းသိမ်းရေးဦးစီးဌာန	<ul style="list-style-type: none"> <li>လက်ရှိစီမံကိန်းဆိုင်ရာသတင်းအချက်အလက်တင်ပြရန်၊</li> <li>လူထုနှင့်တွေ့ဆုံညှိနှိုင်းမှုအစီအစဉ်တွင် အစိုးရအဖွဲ့ဝင်များ ပူးပေါင်းပါဝင်ရန်လိုအပ်ချက်များအားနားလည်မှုရရှိရန်နှင့် ဆောင်ရွက်မည့် အစီအစဉ်အား တင်ပြရန်</li> </ul>
<b>မြို့နယ်အဆင့်(သံတွဲ၊ ရခိုင်ပြည်နယ်)</b>		
၂၀၁၆ခုနှစ်၊ မေလ (၁၆ )ရက်၊ နံနက်(၁၀)နာရီ၊ ခရိုင်အထွေထွေ အုပ်ချုပ်ရေးဦးစီးဌာနရုံး	ခရိုင်အထွေထွေ အုပ်ချုပ်ရေးဦးစီးဌာန	<ul style="list-style-type: none"> <li>လက်ရှိစီမံကိန်းဆိုင်ရာသတင်းအချက်အလက်တင်ပြရန်၊</li> <li>မြို့နယ်အဆင့် လူထုနှင့်တွေ့ဆုံညှိနှိုင်းဆွေးနွေးပွဲ ဆောင်ရွက်နိုင်ရေးအတွက် ခွင့်ပြုချက်တောင်းခံရန်၊</li> </ul>
၂၀၁၆ခုနှစ်၊ မေလ (၁၆ )ရက်၊ နံနက်(၁၁)နာရီ၊ မြို့နယ်အထွေထွေ အုပ်ချုပ်ရေးဦးစီးဌာနရုံး	သံတွဲလူထုတွေ့ဆုံဆွေးနွေး ပွဲ	<ul style="list-style-type: none"> <li>လက်ရှိစီမံကိန်းဆိုင်ရာသတင်းအချက်အလက်တင်ပြရန်၊</li> <li>မြို့နယ်အဆင့်သတင်းအချက်အလက်များရယူရန်၊</li> </ul>

တွေ့ဆုံဆွေးနွေးပွဲများ၌ ပြည်နယ်နှင့် အမျိုးသားအဆင့်တွင် စီမံကိန်းနှင့်ပတ်သက်သည့် သတင်းအချက်အလက်များအား သတင်းထုတ်ပြန်ရန်နှင့် စီမံကိန်းဧရိယာအတွင်း မိမိတို့မှ အခြေခံ နားလည်မှုများ တည်ဆောက်ရန် ကတိပြုပြောဆိုခဲ့ပြီး တွေ့ဆုံဆွေးနွေးပွဲများမှ ရလဒ်အကျဉ်းချုပ် မှာ အောက်ပါအတိုင်း ဖြစ်ပါသည်။

- စီမံကိန်းဧရိယာအတွင်း ထိပ်တိုက်တွေ့ရှိနိုင်မည့် ငါးဖမ်းရေယာဉ်အကြီးစားများမှာ တနင်္သာရီတိုင်း (ထားဝယ်)နှင့် ဧရာဝတီတိုင်းများမှ လာရောက်ခြင်းဖြစ်ကြောင်းအား ငါးလုပ်ငန်းဦးစီးဌာန၊ ရန်ကုန်နှင့် စစ်တွေမြို့နှင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန၊ စစ်တွေမြို့မှ အတည်ပြုခြင်း၊
- သပြေဂျိင်ရွာမှ ကမ်းလွန်ငါးဖမ်းသမားများမှ ကမ်းရိုးတမ်းမှ အများဆုံး ၁၀၀ကီလိုမီတာ (မိုင် ၆၀) အကွာ၊ ရေပြင်အနက် ပေ ၄၉၀တွင်သာ ငါးဖမ်းလေ့ရှိကြောင်းနှင့် အများစုမှာ ကမ်းရိုးတမ်းမှ ၅၀ ကီလိုမီတာ (မိုင် ၃၀) အကွာတွင်သာ ငါးဖမ်းလေ့ရှိကြောင်း အတည်ပြုခြင်း၊
- ရခိုင်ဒေသတွင် ဆွဲပိုက်နှင့် ဝိုင်းကြီးချုပ်ငါးဖမ်းနည်း (၂)နည်းသာ အများဆုံးအသုံးပြုပြီး ဆွေးနွေးပွဲတက်ရောက်ခဲ့သည့် ရေလုပ်သားများမှာ ဆွဲပိုက်အားအသုံးပြုပြီး ရေလမ်းကြောင်းသိရှိရန် ဂျီပီအက်စ် အားအသုံးပြုကြကြောင်း အတည်ပြုခြင်း၊

အဓိကမေးခွန်းများအပေါ် အောက်ပါအတိုင်းအရေးယူဆောင်ရွက်ခဲ့ပါသည်-

- **ဒေသတွင်းအကျိုးစီးပွားနှင့် လူမှုရေးဆိုင်ရာရင်းနှီးမြှုပ်နှံမှု-** Ophir အနေဖြင့် မြန်မာနိုင်ငံ တွင် စီမံကိန်းစတင်သည့် အစောပိုင်းကာလအတွင်းသာ ဆောင်ရွက်နေရခြင်း ဖြစ်သည့်ပြင် ဓါတ်ငွေ့ တွေ့ရှိမှုမှာလည်း သေချာမှုမရှိသေးပါသဖြင့် စီမံကိန်းတိုးတက်မှုမှ ထုတ်လုပ်မှု အဆင့်သို့ ရောက်ရှိပါက မြန်မာ့ရေနံနှင့်သဘာဝဓါတ်ငွေ့လုပ်ငန်းနှင့် ချုပ်ဆိုထားသည့် ထုတ်လုပ်မှုအပေါ်မျှဝေခံစားခြင်းစာချုပ် (PSC)အရ လူမှုရေးဆိုင်ရာတာဝန်ယူပူးပေါင်း ဆောင်ရွက်မှုအစီအစဉ် (CSR program) အား တာဝန်ယူ ဆောင်ရွက်သွားမည်ဖြစ်ကြောင်း ပြန်လည်ဖြေကြားခဲ့ပါသည်။
- **မတော်တဆထိခိုက်မှုဆိုင်ရာလျော်ကြေးငွေ-** အခြားကုမ္ပဏီများ၏ မတော်တဆထိခိုက်မှုအတွက် လျော်ကြေးငွေ ပေးဆောင်သည့် သမိုင်းအတွေ့အကြုံအရ မတော်တဆ ထိခိုက်မှု ရှိပါက လျော်ကြေးငွေ ပေးဆောင်မှုရှိမရှိ သံတွဲမြို့မှ ရေလုပ်သားတစ်ဦးမှ သိလို၍ မေးမြန်းရာ- အေဒီ-၃ ရေနံလုပ်ကွက်မှာ အဆိုပါ ငါးဖမ်းလုပ်ငန်းများနှင့် ထိပ်တိုက်တွေ့ဆုံသည့် လုပ်ကွက်များထက် ပိုမိုဝေးကွာသော နေရာတွင် တည်ရှိခြင်းကြောင့်လည်းကောင်း၊ ဆိုက်စမစ်လေ့လာသကဲ့သို့ လုပ်ကွက်တစ်ခုလုံးသို့ လေ့လာရခြင်း ထက် အစမ်းတွင်းတစ်တွင်းသာ တူးဖော်မည်ဖြစ်ပါသဖြင့် ထိပ်တိုက်တွေ့ဆုံမှုအနေဖြင့် အလားအလာ အနည်းငယ်သာရှိနိုင်ပါကြောင်း ဖြေကြားခဲ့ပါသည်။
- **သတင်းအချက်အလက်ထုတ်ပြန်ခြင်း-** သတင်းထုတ်ပြန်မည့်နည်းလမ်းအား မေးမြန်းခဲ့ပြီး ကျေးရွာ ခေါင်းဆောင်များမှတစ်ဆင့် သတင်းအချက်အလက်များအား ဖြန့်ဝေခြင်းသင့်ကြောင်းနှင့် ရေကြောင်း သတိပေးချက်အား လုပ်ငန်းမစတင်မီ တစ်လကြိုတင်၍ ထုတ်ပြန်နိုင်ရန် အကြံပြုခဲ့ကြပါသည်။

၁.၇ သုံးသပ်ချက်နှင့် အကြံပြုချက်

အဆိုပြုစီမံကိန်းဖြစ်သော ရေနံလုပ်ကွက် အေဒီ-၃ တွင် ရေနံအစမ်းတွင်းတစ်တွင်းတူဖော်ခြင်းဆိုင်ရာ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းလေ့လာမှုအား မြန်မာနိုင်ငံမှ ပြဌာန်းထားရှိသည့် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း လုပ်ထုံးလုပ်နည်းအရ ဆောင်ရွက်သွားမည်ဖြစ်ပါသည်။ ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအရ Ophir Myanmar အနေဖြင့် လုပ်ငန်းဆောင်ရွက်စဉ်အတွင်း အဆိုပြုစီမံကိန်းနှင့် ပတ်သက်ဆက်နွယ်သည့် အလားအလာရှိသော အဓိကကျသည့် ပတ်ဝန်းကျင်နှင့် လူမှုရေးဆိုင်ရာ ထိခိုက်မှုများကို ယေဘုယျကျကျ ဆန်းစစ်ရန် နားလည်သည့်အားလျော်စွာ ဆောင်ရွက်ခဲ့ပြီးဖြစ်ပါသည်။ စီမံကိန်းကြောင့် ဖြစ်ပေါ်လာမည့် ထိခိုက်မှုများအား စီမံခန့်ခွဲရန် ကိရိယာတစ်ခုအဖြစ်လည်းကောင်း၊ လေးစားလိုက်နာရမည့် ဥပဒေပြုမှုနှင့် ကောင်းမွန်၍ တိကျသေချာပြီး လက်တွေ့ကျသည့်စံချိန်စံညွှန်းများအားလိုက်နာဆောင်ရွက်ရန်လည်းကောင်း၊ စီမံကိန်း၏သတ်မှတ်ချက်တစ်ခုအဖြစ် ဆောင်ရွက်ရန် ရည်မှန်းထားရှိသည့် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် (EMP)အား သီးခြားအစီရင်ခံစာ တစ်စောင်အဖြစ် ယခု ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ နှင့်အတူ တင်ပြသွားမည်ဖြစ်ပါသည်။

ထောက်ခံတင်ပြထားသည့် ထိခိုက်မှုများအား လျော့ချနိုင်မည့်နည်းလမ်းများကို Ophir Myanmar မှ ကျွမ်းကျင်ပညာရှင်များနှင့် လက်ခံနိုင်သည့် နည်းလမ်းများဖြင့် လက်တွေ့ကျကျ အကောင်အထည်ဖော် ဆောင်ရွက်ပါက အဆိုပြုစီမံကိန်းကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် ပတ်ဝန်းကျင်နှင့်လူမှုရေးဆိုင်ရာ ထိခိုက်မှုများ အား ကောင်းစွာစီမံခန့်ခွဲနိုင်မည်ဖြစ်ပါသည်။ ယခုပတ်ဝန်းကျင်ဆိုင်ရာထိခိုက်မှုဆန်းစစ်ခြင်းလေ့လာမှုမှ စီမံကိန်းကြောင့် ပတ်ဝန်းကျင်နှင့် လူများအား ကြီးမားစွာ ထိခိုက်နိုင်မှုမရှိသည့်ပြင် ထိခိုက်မှုအားလုံးအား အနည်းဆုံးအဆင့် ရောက်ရှိသည်အထိ ကျိုးကြောင်းခိုင်လုံစွာ လက်တွေ့ကျကျလျော့ချနိုင်မည်ဟု သုံးသပ်ရရှိ ပါသည်။

ပတ်ဝန်းကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီအစဉ်အရ သတင်းအချက်အလက်ထုတ်ပြန်ရာတွင် ပတ်ဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း အကျဉ်းချုပ်အစီရင်ခံစာ (မြန်မာဘာသာဖြင့်)အား စစ်တွေနှင့်သံတွဲမြို့များတွင် ထားရှိသွားမည်ဖြစ်ပြီး အစီရင်ခံစာဖြန့်ဝေခြင်းအား သတင်းစာ(၂)ခုတွင် ကြေညာသွားမည်ဖြစ်ပါသည်။ ထို့နည်းတူစွာ စီမံကိန်းနှင့်ပတ်သက်သည့် မကျေနပ်ချက်၊ နစ်နာချက်များနှင့် ပတ်သက်သည့် သတင်း အချက်အလက်များနှင့် ရေနံတွင်းတူးစင်ရွေ့လျားသွားလာမှုဆိုင်ရာ အချက်အလက်များကို စီမံကိန်းနှင့် သက်ဆိုင်သူများအား အသိပေးတင်ပြသွားမည်ဖြစ်ပါသည်။ သတင်းဖြန့်ဝေမည့် အသေးစိတ်အစီအစဉ်အား စီမံကိန်းမစတင်မီ ထုတ်ပြန်သွားမည်ဖြစ်ပါသည်။

ပတ်ဝန်းကျင်ဆန်းစစ်ခြင်းလုပ်ငန်းစဉ်တစ်ခုဖြစ်သော လူထုနှင့် တွေ့ဆုံညှိနှိုင်းခြင်းအား ဆောင်ရွက်ခဲ့ပြီး ဖြစ်ပါသည်။ သို့ရာတွင် လူထုနှင့်တွေ့ဆုံညှိနှိုင်းခြင်းသည် စီမံကိန်းကာလတစ်လျောက် ဆောင်ရွက်သွားရမည့် လုပ်ငန်းစဉ်တစ်ခုဖြစ်သည့်အားလျော်စွာ အစမ်းတွင်းတူးဖော်သည့်ကာလတစ်လျောက် ဆောင်ရွက်ရမည်မှာ နားလည်ပြီးဖြစ်ပါသဖြင့် Ophir Myanmar မှ လူထုနှင့်တွေ့ဆုံညှိနှိုင်းခြင်းအစီအစဉ်အား ဆက်လက် ဆောင်ရွက်ခြင်းဖြင့် စီမံကိန်းအကောင်အထည်ဖော်ဆောင်ရွက်နေမှုအခြေအနေများအား စီမံကိန်းနှင့် သက်ဆိုင်သူများထံသို့ တင်ပြသွားနိုင်မည်ဖြစ်ပါသည်။

**2.1****PROJECT OVERVIEW**

On 4<sup>th</sup> December 2014, **Ophir Myanmar (Block AD-3) Limited** (Ophir Myanmar) signed a Production Sharing Contract (PSC) with the Myanmar Oil and Gas Enterprise (MOGE) for Block AD-3; located in offshore Rakhine State (*Figure 1.1*). In the summer of 2015, a 10,000 square km three-dimensional (3D) seismic survey was conducted over Block AD-3. The execution of the project was subject to the submission and approval of an Initial Environmental Examination (IEE). Ophir Myanmar is currently proposing to drill one exploration well in Block AD-3 during 2017 using a Mobile Offshore Drilling Unit (MODU). More information on the planned Project activities is provided in *Section 4.2*. In accordance with the Myanmar Environmental Impact Assessment (EIA) Procedure, this Project requires an EIA to be conducted and submitted to the Ministry of Natural Resources and Environmental Conservation (MONREC).

Ophir Myanmar has commissioned ERM Myanmar Company Limited (ERM), along with Myanmar national environmental consultant E Guard Environmental Services Co. Ltd (E Guard), to undertake the EIA for the Project.

The first stage of the EIA Process was screening which included the submission of the Project Proposal Report to MOGE (for onward submission to MONREC). This report was prepared and submitted in April 2016. Following this, the Environmental Conservation Department (ECD) of MONREC advised Ophir Myanmar that the Project would require an EIA assessment. Ophir then submitted a Scoping Report which included the Terms of Reference for the EIA Study. This was submitted to MOGE and MONREC in May 2016.

This document is the EIA Report for the proposed Project in Block AD-3 (the "Project"). A separate Environmental Management Plan (EMP) to accompany this EIA Report has also been prepared for submission to, and approval by, MONREC.

**2.2****PROJECT PROPONENT**

Contact details for the Ophir Myanmar Country Manager are provided below.

Name: Mr Andrew Chapman

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Phone: +95 9 4202 20776

Email: [andrew.chapman@ophir-energy.com](mailto:andrew.chapman@ophir-energy.com)

## 2.3 EIA OBJECTIVES

The objective of the EIA Study is to complete a robust environmental and social assessment for the Project in compliance with the Myanmar EIA Procedures (2015). Specifically, the objectives of the EIA are:

- To review the potential interactions between the proposed Project activities and the key environmental and social receptors and resources.
- To identify the potentially sensitive environmental and social components of the baseline.
- To identify and evaluate potential environmental and social Project impacts.
- To recommend mitigation or enhancement measures to remove, reduce or avoid potential adverse impacts.
- To provide a Project specific Environmental Management Plan (EMP). This EMP will also cover social impacts.
- To summarise public consultation and disclosure activities related to the Project.

## 2.4 ENVIRONMENTAL AND SOCIAL CONSULTANTS TEAM

The key ERM and E Guard environmental and social consultants that conducted the EIA Study are presented in *Table 2.1*; curricula vitae (CVs) of key personnel are provided in *Annex 2.1*.

**Table 2.1** *Environmental and Social Consultants for the Project*

Name	Role	Organisation	Academic Experience	Years' Experience	Tasks
Craig A. Reid	Project Director	ERM	BSc	18	Technical review and input to EIA.
Becky Summons	Project Manager	ERM	MSc	7	Technical review and input to EIA. Ecology and Biodiversity.
Piers Touzel	SIA Consultant	ERM	MBA	16	Socio-economics.
Jovy Tam	EIA Specialist	ERM	MSc	10	Ecology and Biodiversity. Physical environment.
Nicci Ng	GIS Specialist	ERM	MSc	8	GIS and maps.
Soe Min	Local Lead	E Guard	B.E	>30	Stakeholder Engagement.
Myat Mon Swe	Local Specialist	E Guard	M.Eng.	>25	Facilitation of meetings.

## 2.5

### *REPORT STRUCTURE*

The remainder of this EIA Report is structured as follows:

- *Section 3*: the institutional framework for the Project.
- *Section 4*: the Project description and alternatives selection.
- *Section 5*: the environmental and social baseline.
- *Section 6*: the impact assessment including the adopted methodology and proposed mitigation measures.
- *Section 7*: the cumulative impact assessment.
- *Section 8*: the Project's public consultation and disclosure activities.
- *Section 9*: the Environmental Management Plan.
- *Section 10*: the conclusions of the EIA Report and recommendations of future actions.



This section provides the relevant legal and policy context in Myanmar including the following:

- Ophir's corporate policies relating to health, safety and the environment.
- Policy and Legal Framework; including:
  - Myanmar EIA legislation, other relevant Myanmar legislation; and
  - International conventions, standards and guidelines relevant to the Project.
- Institutional Framework of the Project Proponent and Myanmar; including the requirements of the Production Sharing Contract (PSC).
- Environmental and/or Health standards related to the Project.

### **3.1 CORPORATE POLICIES**

Ophir Myanmar has adopted comprehensive Health, Safety & Security and Environment & Climate Change Policies, the objectives and principles of which are outlined in *Annex 3.1*.

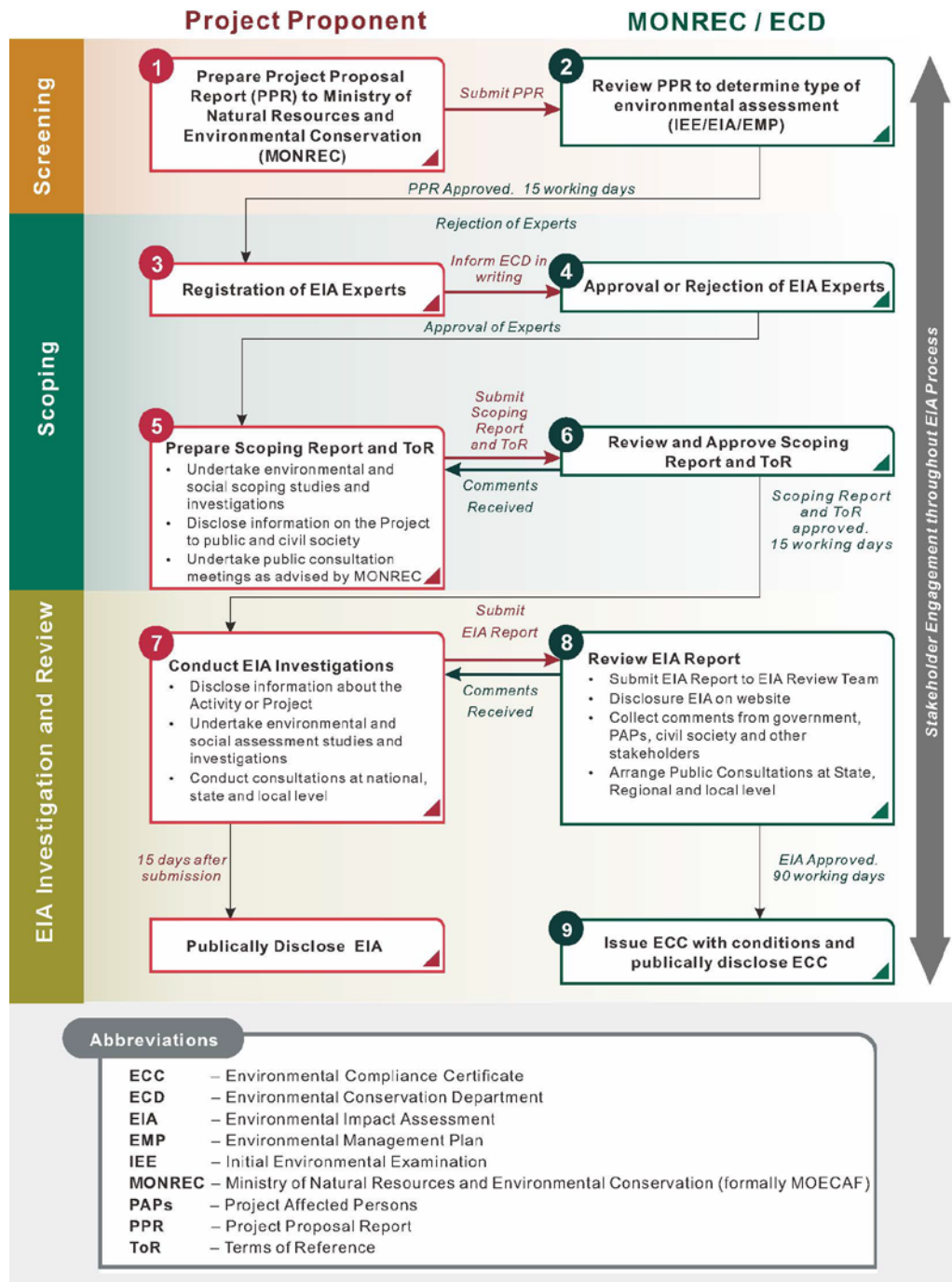
### **3.2 POLICY AND LEGAL FRAMEWORK**

#### **3.2.1 Myanmar EIA Procedure**

The Myanmar EIA Procedure (dated 29 December 2015) set out the requirements for development, assessment and subsequent monitoring of an EIA. The requirements to conduct an EIA are outlined in the Environment Conservation Law (2012) and Environment Conservation Rules (2014). In addition; the EIA Procedures are supported by the draft Administrative Instruction which sets out a proposed format and content for reports.

The full EIA Process undertaken for the Project is shown in *Figure 3.1*. This Project is currently in the EIA Investigation and Reporting Phase which is discussed in detail below.

Figure 3.1 EIA Process in Myanmar



### *EIA Study and Report Preparation*

Ophir Myanmar undertook a systematic assessment of the proposed activities. Screening was conducted as part of the assessment to identify all potential environmental risks. A summary of the screening and the preliminary identified environmental and social impacts was submitted to MONREC and MOGE in the form of a Project Proposal Report. MONREC used this document to decide whether the Project required an IEE or an EIA Study would be required. For this Project, an EIA Study was required in line with Annex I of the EIA Procedure.

After screening, a scoping phase was conducted to further identify the potential impacts of the Project, and likely Project Affected Peoples / Communities and to identify potential mitigation measures. Stakeholder engagement was undertaken during this process to collect baseline data and allow stakeholders to express views and concerns which would be considered during the EIA Phase. The Scoping Report contained the Terms of Reference for the EIA Report which outlined the scope and studies necessary as part of the EIA Phase. This Scoping Report and Terms of Reference were also submitted to the MOGE and MONREC.

The subsequent EIA Report (this Report) has been prepared to address all potential adverse environmental and social impacts and propose appropriate mitigation measures. The report includes the results of public consultations and addresses public concerns when assessing impacts, designing mitigation measures and selecting monitoring parameters. The EIA report will be submitted to MONREC and MOGE.

The EIA Procedure states that operators should disclose the EIA Report to civil society, Project Affected Peoples (PAPs), concerned government organisations and other interested stakeholders. This EIA Report will be disclosed to the public by distributing an executive summary in Myanmar to the township administration office in Sittwe and in Thandwe, advertising the availability of the report for review in a national newspaper and providing access to the translated executive summary and full report on Ophir's website.

#### **3.2.2 Myanmar Legislation Relevant to the Project**

Laws relating to environmental and social issues within the Oil and Gas Sector and hence their relevance to the Environmental Impact Assessment (EIA) Study for the proposed Project are included in *Table 3.1*.

**Table 3.1 Myanmar Legislation Relating to the Oil and Gas Sector and Relevance to Project**

Laws and Regulations	Description
<b>Constitution of the Republic of the Union of Myanmar, 2008</b>	
The Constitution of the Union of Myanmar is the supreme law of the country and has provisions regarding the protection of the environment in Myanmar. Articles in the Constitution relevant to environmental protection are Articles 37, 42 and 390. They are quoted below:	
Article 37	<ul style="list-style-type: none"> <li>(a) The Union is the ultimate owner of all lands and all natural resources above and below the ground, above and beneath the water and in the atmosphere in the Union;</li> <li>(b) The Union shall enact necessary law to supervise extraction and utilization of State owned natural resources by economics forces;</li> </ul>
Article 42	The Union shall protect and conserve natural environment.
Article 390	<p>Every citizen has the duty to assist the Union in carrying out the following matters:</p> <ul style="list-style-type: none"> <li>(a) preservation and safeguarding of cultural heritage;</li> <li>(b) environmental conservation;</li> <li>(c) striving for development of human resources;</li> <li>(d) protection and preservation of public property.</li> </ul> <p>These three Articles in the Constitution provide a basis for legalizing and institutionalizing environmental health impact assessment and social impact assessment.</p>
<b>The Environmental Conservation Law, 2012</b>	
<p>The Pyidaungsu Hluttaw enacted this law by Law No. 9 of 2012 on the date of 30 March, 2012. March, 2012. The legal mechanism for ESHIA has been put in this law. This law was enacted with the objectives of:</p> <ul style="list-style-type: none"> <li>(a) To enable to implement the Myanmar National Environmental Policy;</li> <li>(b) To enable to lay down the basic principles and give guidance for systematic integration of the matters of environmental conservation in the sustainable development process;</li> <li>(c) To enable to emerge a healthy and clean environment and to enable to conserve natural and cultural heritage for the benefit of present and future generations;</li> <li>(d) To reclaim ecosystems as may be possible which are starting to degenerate and disappear;</li> <li>(e) To enable to manage and implement for decrease and loss of natural resources and for enabling the sustainable use beneficially;</li> <li>(f) To enable to implement for promoting public awareness and cooperation in educational for dissemination of environmental perception;</li> <li>(g) To enable to promote international, regional and bilateral cooperation in the matters of environmental conservation;</li> <li>(h) To enable to cooperate with Government Departments, Government Organizations, International Organizations, non-government organizations and individuals in matters of environmental conservation.</li> </ul>	
<b>The Environmental Conservation Rules, 2014</b>	
The Ministry of Natural Resources and Environmental Conservation, in exercise of power conferred under sub-section (a) of section 42 of the Environmental Conservation Law, issues this rules by No. 50 of 2014 on the date of 5 June, 2014.	

Laws and Regulations	Description
Rule 51	The Ministry shall assign duty to the Department for enabling to adopt and carry out the environmental impact assessment system.
Rule 52	The Ministry shall determine the categories of plan, business or activity which shall carry out environmental impact assessment
Rule 53	The Ministry shall to scrutinize whether or not it is necessary to conduct environmental impact assessment, determine the proposed plans, businesses or activities which do not include in stipulation under rule 52
Rule 56	The person who carries out any project, business or activity shall arrange and carry out for conducting the environmental impact assessment for any project, business or activity by a qualified third person or organization accepted by the Ministry.
Rule 58	The Ministry shall form the Environmental Impact Assessment Report Review Body with the experts from the relevant Government departments, Government organizations.
Rule 61	The Ministry may approve and reply on the EIA report or IEE or EMP with the guidance of the Committee
Rule 69	<ul style="list-style-type: none"> <li>i. Any person shall not emit, cause to emit, dispose, cause to dispose, pile and cause to pile, by any means, the pollutants and the hazardous waste or hazardous material stipulated by notification under the Law and any of these rules at any place which may affect the public directly or indirectly.</li> <li>ii. Any person shall not carry out to damage the ecosystem and the natural environment which is changing due to such system, except for carrying out with the permission of the Ministry for the interest of the people.</li> </ul>
<b>EIA Procedure(2015)</b>	
The EIA Procedure sets out the procedures for completing an IEE, EIA and/or EMP in Myanmar. This includes information on project categorisation, responsibilities of project developers and ministries, EIA review, monitoring and auditing, among other issues.	
<b>NEQ Guidelines (2015)</b>	
The NEQ sets out emission standards for air, noise and effluent discharges for oil and gas operations. The project shall consider emissions standards in its environment impact assessment and environmental management plan.	
<b>The Conservation of Water Resources and Rivers Law, 2006</b>	
<p>The State Peace and Development Council Law enacted this law by Law No. 8/ 2006 on the date of 2 October, 2006. This law covers for all water sources above and underground within boundaries of rivers, creeks, banks and water fronts. Under this law, Ministry of Transport has power to direct for carrying out waterways conservation work, to notify the land boundary as waterfront boundary for bank protection, river-creek improvement and to navigate the vessels in the rivers and creeks with the objectives of:</p> <ul style="list-style-type: none"> <li>a) To conserve and protect the water resources and rivers system for beneficial utilization by the public;</li> </ul>	

Laws and Regulations	Description
	<ul style="list-style-type: none"> <li>b) To smooth and safety waterways navigation along rivers and creeks;</li> <li>c) To contribute to the development of State economy through improving water resources and river system;</li> <li>d) To protect environmental impact.</li> </ul>
<b>The Protection and Preservation of Cultural Heritage Regions Law, 1998</b>	
	<p>The State Peace and Development Council Law enacted this law by Law No. 9/ 98 on the date of 10 September, 1998. The Ministry of Culture may, with the approval of the Government issue notification for the protection of cultural heritage areas are categorized as following kinds of zones / region:</p> <ul style="list-style-type: none"> <li>a) Ancient monumental zone;</li> <li>b) Ancient site zone.</li> </ul> <p><b>Objectives:</b></p> <ul style="list-style-type: none"> <li>a) to implement the protection and preservation policy with respect to perpetuation of cultural heritage that has existed for many years;</li> <li>b) to protect and preserve the cultural heritage regions and the cultural heritage therein so as not to deteriorate due to natural disaster or man-made destruction;</li> <li>c) to uplift hereditary pride and to cause dynamism of patriotic spirit of citizens by protecting and preserving the cultural heritage regions;</li> <li>d) to promote public awareness and will as to the high value of the protection and preservation of the cultural heritage regions;</li> <li>e) to protect the cultural heritage regions from destruction;</li> <li>f) to carry out protection and preservation of the cultural heritage regions in conformity with the International Convention approved by the State.</li> </ul>
<b>The Conservation of Antique Objects Law 2016</b>	
	<p>The objectives of this law are as follows:</p> <ul style="list-style-type: none"> <li>a) to implement the policy of protection and preservation for the perpetuation of antique objects;</li> <li>b) to protect and preserve antique objects so as not to deteriorate due to natural disaster or man-made destruction;</li> <li>c) to uplift hereditary pride and to cause dynamism of patriotic spirit by protection and preservation of antique objects;</li> <li>d) to have public awareness of the high value of antique objects;</li> <li>e) to carry out in respect of protection and preservation of antique objects in conformity with the International Convention and Regional Agreement ratified by the State.</li> </ul>
<b>The Forest Law, 1992</b>	
	<p>The State Law and Order Restoration Council had enacted the following Law in 3 November, 1992 as Forest Law.</p>
Chapter II: Basic Principles	<p>3. This Law shall be implemented in accordance with the following basic principles:</p> <ul style="list-style-type: none"> <li>a) to implement the forestry policy of the Government;</li> <li>b) to implement the environmental conservation policy of the Government;</li> <li>c) to promote the sector of public co-operation in implementing the forestry policy and the environmental conservation policy of the Government.</li> </ul>
Chapter IV: Management	9. The functions and responsibilities of the Forest Department are

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of Forest Land	<p>as follows:-</p> <ol style="list-style-type: none"> <li>a) implementation of the forestry policy of the Government;</li> <li>b) implementation of the plans relating to conservation of water, bio-diversity and environment, sustained yield of forest produce and protection of forest covered land;</li> <li>c) management of forest land in accordance with the provision of this Law;</li> <li>d) submitting proposals to the Minister for the determination, alteration or cancellation of reserved forest, protected public forest and species of reserved trees;</li> </ol> <p>Whoever, within a forest land and forest covered land at the disposal of the Government:</p> <ol style="list-style-type: none"> <li>a) is desirous of carrying out any development work or economic scheme shall obtain the prior approval of the MONRAEC.</li> </ol>
Chapter XII: Offences and Penalties	<p>40. Whoever commits any of the following acts shall, on conviction be punished with fine which may extend to Kyat 5,000 or with imprisonment for a term which may extend to 6 months or with both:</p> <ol style="list-style-type: none"> <li>a) trespassing and encroaching in a reserved forest;</li> <li>b) pasturing domestic animals or permitting domestic animals to trespass in a reserved forest;</li> <li>c) breaking up any land, clearing, digging or causing damage to the original condition of the land without a permit in a reserved forest;</li> <li>d) causing damage to a water-course, poisoning in the water, using chemicals or explosives in the water in a reserved forest;</li> <li>e) catching animals, hunting or fishing in a reserved forest;</li> <li>f) kindling, keeping, carrying any fire or leaving any fire burning which may set fire to the forests in a reserved forest;</li> <li>h) violating any provision of the rule, procedure, order, directive or notification issued under this Law.</li> </ol>
<b>Rules On Protection Of Wildlife, And Protected Area Conservation Law (2003) And The Protection Of Wildlife, And Wild Plant And Conservation Of Natural Areas Rules (2002)</b>	
Objectives	<p>The objectives of this Law are as follows:-</p> <ol style="list-style-type: none"> <li>a) to implement the Government policy for wildlife protection;</li> <li>b) to implement the Government policy for natural areas conservation;</li> <li>c) to carry out in accordance with the International Conventions acceded by the State in respect of the protection and conservation of wildlife, ecosystems and migratory birds;</li> <li>d) to protect endangered species of wildlife and their natural habitats.</li> </ol>
Protected Wildlife	<p>15. The Director General shall, with the approval of the Minister:</p> <ol style="list-style-type: none"> <li>a) determine and declare endangered species of wild animal which are to be protected according to the following categories: <ol style="list-style-type: none"> <li>i. completely protected species of wild animals;</li> <li>ii. normally protected species of wild animals;</li> </ol> </li> </ol>

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	iii. seasonally protected species of wild animals; b) determine and declare the endangered species of wild plants and their nature habitats thereof; c) lay down and carry out measures for the preservation of protected wildlife species;
Taking Administrative Action	31. A Forest Officer may pass an administrative order causing a fine that may extend to Kyat 10,000 to be paid, on a person who kills, hunts, wounds or raises a seasonally protected wild animal without permission during the closed season.
<b>The Burma Wildlife Protection Act 1936 and The Burma Wildlife Protection Rules 1941 (Burma Act No. Vii Of 1936)</b>	
This legislation makes provision for the establishment of sanctuaries (game sanctuaries) on any land at the disposal of the government or, subject to the consent of the owner, any land which is private property. It also provides for the protection of a number of named species outside sanctuaries and reserved forests.	
<b>The Protection and Preservation of Ancient Monuments Law (2015)</b>	
3. The objectives of this law are as follows: <ol style="list-style-type: none"> <li>a. To implement the protection and preservation policy for the perpetuation of ancient monuments which have existed for many years;</li> <li>b. To protect and preserve cultural heritage regions and ancient monuments so that they are not destroyed by natural disaster or man;</li> <li>c. To uplift hereditary pride and to cause dynamism of patriotic spirit of citizens by protecting and preserving cultural heritage regions;</li> <li>d. To promote public awareness and will as to the high value of the protection and preservation of cultural heritage regions;</li> <li>e. To explore and preserve new ancient monuments;</li> <li>f. To protect cultural heritage regions from destruction;</li> <li>g. To implement protection and preservation of ancient monuments in conformity with international conventions and regional agreements.</li> </ol>	
<b>National Sustainable Development Strategy (2009)</b>	
Sustainable management of natural resources in Myanmar, from environmental perspective comprises 11 areas, in which mining sector development concerned are as follow: <ul style="list-style-type: none"> <li>• Sustainable forest resources management;</li> <li>• Biodiversity conservation;</li> <li>• Sustainable fresh water resources management ;</li> <li>• Environmental quality management and enhancement;</li> <li>• Sustainable management of land resources;</li> <li>• Sustainable management for mineral resources utilization;</li> <li>• Sustainable energy production and consumption; and</li> <li>• Sustainable industrial, transport and communication development.</li> </ul>	
<b>National Environmental Policy (1994)</b>	
Under this policy, the main environmental body was the NCEA. Prior to the establishment of MONREC, environmental conservation was undertaken by various ministries and departments. In 1990, the NCEA was established to advise the government on environmental policy, to act as a focal point and as a coordinating body for environmental affairs and to promote environmentally sound and sustainable development. The NCEA's main mission is to ensure	



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	sustainable use of environmental resources and to promote environmentally sound practices in industry and other economic activities, objectives and mandates.
<b>Public Health Law, 1972</b>	<p>Purpose: to ensure the public health include not only employees but also resident people and cooperation with the authorized person or organization of health department. It is concerned with the protection of peoples' health by controlling the quality and cleanliness of food, drugs, environmental sanitation, epidemic diseases and regulation of private clinics. The project owner will cooperate with the authorized person or organization in line with the section 3 and 5 of said law.</p> <p>Section 3: The project owner will abide by any instruction or stipulation for public health.</p> <p>Section 5: The project owner will accept any inspection, anytime, anywhere if it is needed.</p>
<b>Myanmar Investment Law, 2016</b>	<p>3. The objectives of this Law are as follows:</p> <ul style="list-style-type: none"> <li>(a) To develop responsible investment businesses which do not cause harm to the natural environment and the society for the benefit of the Union and its citizens;</li> <li>(b) To protect the investors and their investments in accordance with the law;</li> <li>(c) To create job opportunities for the people;</li> <li>(d) To develop human resources;</li> <li>(e) To develop high functioning production, service, and trading sectors.</li> <li>(f) To develop technology and the agriculture, livestock and industrial sectors;</li> <li>(g) To develop various professional fields including infrastructure across the Union;</li> <li>(h) To enable the citizens to be able to work alongside with the international community; and</li> <li>(i) To develop businesses and investments that meet international standards.</li> </ul>
<b>Myanmar Fire Force Law, 2015</b>	<p>The objectives of Myanmar Fire Force Law are:</p> <ul style="list-style-type: none"> <li>a) To take precautionary and preventive measure and loss of state own property, private property, cultural heritage and the lives and property of public due to fire and other natural disasters</li> <li>b) To organize fire brigade systemically and to train the fire brigade</li> <li>c) To prevent from fire and to conduct release work when fire disaster, natural disaster, epidemic disease or any kind of certain danger occurs</li> <li>d) To educate, organize an inside extensively so as to achieve public corporation</li> <li>e) To participate if in need for national security, peace for the citizens and law and order</li> </ul> <p>The relevant Government Department or organization shall, for the purpose of precaution and prevention, obtain the approval of the Fire force Department before granting permission for the following cases:</p> <ul style="list-style-type: none"> <li>a) Constructing three-storied and above buildings market and condominium buildings,</li> <li>b) Operating hotel ,motel, guest house enterprise</li> <li>c) Constructing factory, workshop ,storage facilities and warehouse</li> <li>d) Operating business expose to fire hazard by using in inflammable materials or explosive materials</li> <li>e) Producing and selling fire-extinguishing apparatuses</li> </ul> <p>Doing transport business, public utility vehicles train, airplane, helicopter, vessel, ship, etc.</p> <p>The relevant government department or organization shall obtain the opinion of the Fire Services Department for the purpose of fire precaution and prevention, when laying down</p>

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	plans for construction for town, village and downtown or village development plans.
<b>Prevention from Danger of Hazardous Chemical and Associated Material Law (Pyidaungsu Hluttaw Law No 28/2013)</b>	<p>The objectives of this law are:</p> <ul style="list-style-type: none"> <li>f) to prevent damage to environmental resources and living organisms due to chemicals and associated materials</li> <li>g) to provide for the systematic control of businesses using chemicals and associated materials in accordance with government approvals</li> <li>h) to carry out data gathering and to undertake education and research regarding the safe and systematic utilization of chemicals and associated materials</li> <li>i) to achieve continuous improvements in worksite safety, health and environmental conservation</li> </ul> <p>Chapter 7 – “Any person, who wants to do the business of chemical and associated materials, shall apply to the central body for the acquisition of the license, attached with the management plan for the environmental conservation in accord with the stipulations”.</p> <p>Chapter 8 – “20. License holder shall apply to the central supervising body in accord with the stipulation for the relevant chemicals and associated materials using for his chemicals and associated materials business” for a certificate.</p> <p>“22. The registered certificate holder shall abide by the regulations contained in the registered certificate and shall follow the order and directives issued from time to time by the central supervising body”.</p>
<b>The Petroleum Rules (1937) and The Petroleum Act 1934</b>	Production, storage or transportation of oil.
<b>The Settlement of Labour Dispute Law, 2012</b>	The Pyidaungsu Hluttaw hereby had enacted this Law for safeguarding the right of workers or having good relationship between employer and workers and making peaceful workplace or obtaining the rights fairly, rightfully and quickly by settling the dispute of employer and worker justly.
<b>Explosives Act (1887)</b>	The President of the Union make rules consistent with this Act to regulate or prohibit, except under and in accordance with the conditions of a licence granted as provided by those rules, the manufacture, possession, use, sale, transport and importation of explosives, or any specified class of explosives.
<b>Explosive Substances Act (1908)</b>	Any person who unlawfully and maliciously causes, by any explosive substance, an explosion of a nature likely to endanger life or to cause serious injury to property shall, whether any injury to person or property has been actually caused or not, be punished with transportation for life or any shorter term, to which a fine may be added, or with imprisonment for a term which may extend ten years, to which a fine may be added.
<b>Myanmar Agenda 21 (1997)</b>	The Myanmar Agenda 21 makes recommendations for the drafting and promulgation of a framework law which can further promote the integration of environmental and developmental concerns in the decision-making processes of the country.

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	<p>The Myanmar Agenda 21 contains guidelines to address the following issues:</p> <ul style="list-style-type: none"> <li>• increasing energy and material efficiency in production processes;</li> <li>• reducing wastes from production and promoting recycling;</li> <li>• promoting use of new and renewable sources of energy;</li> <li>• using environmentally sound technologies for sustainable production;</li> <li>• reducing wasteful consumption;</li> <li>• increasing awareness for sustainable consumption.</li> </ul>
	<p><b>Myanmar Insurance Law (1993)</b></p>
	<p>The Myanmar Insurance is established under this Law as a legal entity having perpetual succession, capable of suing and being sued in its own name. The rules for establishing insurances in the country are established.</p> <p>The Myanmar Insurance is established with the following aims:</p> <ul style="list-style-type: none"> <li>• to overcome financial difficulties by effecting mutual agreement of insurance against social and economic losses which the people may encounter, due to common perils;</li> <li>• to promote the habit of savings individually by effecting life assurance, thus contributing to the accumulation of resource, of the State;</li> <li>• to win the trust and confidence of the people in the insurance system by providing effective insurance safeguards which may become necessary in view of the social and economic developments.</li> </ul>
	<p><b>The Law On Standardization (2014)</b></p>
	<p>The objectives of Law on Standardization are as follows:</p> <ul style="list-style-type: none"> <li>• to enable to determine Myanmar Standards;</li> <li>• to enable to support export promotion by enhancing quality of production organizations and their products, production processes and services;</li> <li>• to enable to protect the consumers and users by guaranteeing imports and products are not lower than prescribed standard, and safe from health hazards;</li> <li>• to enable to support protection of environment related to products, production processes and services from impact, and conservation of natural resources;</li> <li>• to enable to protect manufacturing, distributing and importing the disqualified goods which do not meet the prescribed standard and those which are not safe and endangered to the environment;</li> <li>• to support on establishing the ASEAN Free Trade Area and to enable to reduce technical barriers to trade.</li> <li>• to facilitate technological transfer and innovation by using the standards for the development of national economic and social activities in accordance with the national development program.</li> </ul>
	<p><b>The Science and Technology Development Law (1994)</b></p>
	<ul style="list-style-type: none"> <li>• To carry out development of Science and Technology for promotion of industrial production contributory towards the National Economic Development Plans;</li> <li>• To carry out Research and Development for the increased extraction and utilization of domestic raw materials and the promotion of industrial production enterprises based on modern Science and Technology;</li> <li>• To effect Technology Transfer for the promotion of production processes and the improvement of the quality of goods;</li> <li>• To nurture luminaries required for the development of Science and Technology and for Research and Development and to improve their qualifications.</li> </ul>
	<p><b>Myanmar Port Authority Law 2015</b></p>
	<p>“Any person who by himself or another so casts or throws any ballast or rubbish or any such</p>

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	<p>other thing or so discharges any oil or water mixed with oil, or the master of any vessel from which the same is so cast, thrown or discharged, shall be punishable with fine not exceeding fifty thousand kyats, and shall pay any reasonable expenses which may be incurred in removing the same”.</p>
	<p><b>Law Amending the Territorial Sea and Maritime Zone Law (2008)</b></p>
	<p>After clause 3 of the annex to the Territorial Sea and Maritime Zone Law, clause 4 and clause 5 have been inserted with new coordinates which have no impact on the Project.</p>
	<p><b>Conservation of Water Resources and Rivers Law (2006)</b></p>
	<p>Section 6 outlines prohibitions for the following activities:</p> <ul style="list-style-type: none"> <li>• “No person shall anchor the vessels where vessels are prohibited from anchoring in the rivers and creeks.</li> <li>• No person shall dispose of engine oil, chemical, poisonous material and other materials which may cause environmental damage, or dispose of explosives from the bank or from a vessel which is plying, vessel which has berthed, anchored, stranded or sunk.</li> <li>• No one shall dispose of any substance into the rivercreek that may cause damage to waterway or change of watercourse from the bank or vessel.”</li> </ul> <p>The aims of this Law are as follows:</p> <ul style="list-style-type: none"> <li>• to conserve and protect the water resources and river systems for beneficial utilization by the public;</li> <li>• to smooth and enhance safety of waterways navigation along rivers and creeks;</li> <li>• to contribute to the development of State economy through improving water resources and river systems;</li> <li>• to protect environmental impact.</li> </ul> <p>The empowerment of this Law is provided to the Ministry of Transport for controlling navigation of vessels in the rivers and creeks as well as communicating with local and foreign government and organizations for conservation of water resources, rivers and creeks. Also, to carry out conservation works for water resources, rivers and creeks, in accordance with the relevant international conventions, regional agreements and bilateral agreements for environmental conservation.</p>
	<p><b>Union of Myanmar Marine Fisheries law (25 April1990, amended 1993)</b></p>
	<p>The relevance of this law to the offshore component of the Project is that it places restriction on pollution: “No person shall dispose of living aquatic creatures or any material into the Myanmar Marine Fisheries Waters to cause pollution of water or to harass fishes and other marine organisms.”</p>
	<p><b>The Law Relating to Aquaculture, 1989</b></p>
	<p>Not directly relevant to project as no aquaculture exists within or near to the Project Area.</p>
	<p><b>The Law Relating to the Fishing Rights of Foreign Fishing Vessels, 1989</b></p>
	<p>Not directly relevant to the project. Relevant to foreign fisheries.</p>
	<p><b>Territorial Sea and Maritime Zones law (1977)</b></p>

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	<p>The Union of Myanmar has exclusive jurisdiction for the construction, maintenance or operation of offshore terminals and exclusive jurisdiction to preserve and protect the marine environment, and to prevent and control marine pollution.</p>
	<p><b>The Petroleum Act (1939) and Rules (1937)</b></p>
	<p>This act refers that the import, transport or store of any petroleum cannot be made save in accordance to the rules that may be defined by the President of the Union.</p> <p>“All receptacles containing dangerous petroleum shall have a stamped, embossed, painted or printed warning, either on the receptacle itself or, where that is impracticable, displayed near the receptacle, exhibiting in conspicuous characters the words “Petrol” or “Motor Spirit”, or an equivalent warning of the dangerous nature of the petroleum”.</p> <p>It also establishes the needs and exemptions from licenses and authorizes the testing of petroleum by the President of the Union and rules that might issue rules on that regard.</p>
	<p><b>The Oilfields Act (1918)</b></p>
	<p>This act provides clarification on activities within the oil and gas industry, and provides the Government with the power to define and alter limits of any notified oilfield. In addition, the Government may make rules for regulating all matters connected with many operations related to the extraction of oil and/or gas. The Act also provides guidance and issues such as preventing oil and gas wastes, reporting of fires, accidents and other occurrences and regulating the collection and disposal of both oil and gas.</p>
	<p><b>The Protection and Prevention of Communicable Disease Law, 1995</b></p>
	<p>Chapter 5 of this law states that all persons are responsible for reporting an outbreak of a communicable disease to the nearest Health Officer.</p>
	<p><b>The Control of Smoking and Consumption of Tobacco Product Law, 2006</b></p>
	<p>3. The objectives of this Law are as follows;</p> <p>(a) to convince the public that health can be adversely affected due to smoking and consumption of tobacco product and to cause refraining from the use of the same;</p> <p>(b) to protect from the danger which affects public health adversely by creating tobacco smoke-free environment;</p> <p>(c) to obtain a healthy living style of the public including child and youth by preventing the habit of smoking and consumption of tobacco product;</p> <p>(d) to uplift the health, economy and social standard of the public through control of smoking and consumption of tobacco product;</p>

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	<p>(e) to implement measures in conformity with the international convention ratified by Myanmar to control smoking and consumption of tobacco product;</p>
	<p><b>The Development of Employees and Expertise (Skill), 2013</b></p>
	<p>5. (a) (1) If the employer has appointed the employee to work for an employment, the employment agreement shall be made within 30 days. But it shall not be related with government department and organization for a permanent employment.</p> <p>(2) If pre training period and probation period are stipulated before the appointment the said trainee shall not be related with the stipulation of sub-section (1).</p> <p>(b) The following particulars shall be included in the employment agreement:</p> <p>(1) the type of employment;</p> <p>(2) the probation period;</p> <p>(3) wage, salary;</p> <p>(4) location of the employment;</p> <p>(5) the term of the agreement;</p> <p>(6) working hour;</p> <p>(7) day off, holiday and leave;</p> <p>(8) overtime;</p> <p>(9) meal arrangement during the work hour;</p> <p>(10) accommodation;</p> <p>(11) medical treatment;</p> <p>(12) ferry arrangement to worksite and travelling;</p> <p>(13) regulations to be followed by the employees;</p> <p>(14) if the employee is sent to attend the training, the limited time agreed by the employee to continue to work after attending the training;</p> <p>(15) resigning and termination of service;</p> <p>(16) termination of agreement;</p> <p>(17) the obligations in accord with the stipulation of the agreement;</p> <p>(18) the cancellation of employment agreement mutually made between employer and employee;</p>



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	<p>(19) other matters;</p> <p>(20) specifying the regulation of the agreement, amending and supplementing;</p> <p>(21) miscellaneous.</p> <p>(c) The worksite regulations contained in the employment agreement shall be in compliance with any existing law and the benefits of the employee shall not be less than those of the any existing law.</p> <p>(d) According to the employment agreement, the Ministry shall issue the notification for paying the stipulated compensation to the employee by the employer, if the work is completed earlier than the stipulated period or the whole work or any part of it have to be terminated due to unexpected condition or the work has to be terminated due to various conditions.</p> <p>(e) The employment agreement made under sub-section (a) shall be related with daily wage workers, piece rate workers who are appointed temporarily in the government department and organization.</p> <p>(f) The worksite regulations and benefits contained in the employment agreement mutually made between the employer and employee or among the employees shall be amended as necessary, in accord with the existing law.</p> <p>(g) The employer shall send a copy of the employment agreement made between the employer and employee, to the relevant employment and labour exchange office within the stipulated period and shall get the approval of it.</p> <p>(h) The employment agreement made before the enforcement of this law shall be confirmed up to the end of the term of the original agreement.</p> <p>14. The employer shall carry out the training program in accord with the work requirement in line with the policy of the skill development team to develop the skill relating to the employment for the workers who are proposed to appoint and working at present.</p> <p>15. The Employer:</p> <p>(a) shall carry out the training for each work or compounding the work individually or group-wise by opening on-job training, training systematically at worksite, sending outside training and training by using information technology system, for arranging the training program to enhance the employment skill of the workers;</p> <p>(b) appointing the youths of 16 years as apprentice, shall arrange the training for technology relating to the employment systematically in accord with the regulations prescribed by the skill development team.</p> <p>30. (a) The employer of the industry and service business shall put in to the fund monthly as put in fees without fail for the total wages of the subordinates and the supervisors' salary for not less than 0.5%;</p> <p>(b) Put in money paid under sub-section (a) shall not be deducted from the wage and salary of the employees.</p>
	<p><b>Labour Organization Law, 2012</b></p>

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	<p>This Law was enacted, to protect the rights of the workers, to have good relations among the workers or between the employer and the worker, and to enable to form and carry out the labour organizations systematically and independently.</p>
<p><b>Minimum Wages Law, 2013</b></p>	
	<p>This Law was enacted to meet with the essential needs of the workers, and their families, who are working at the commercial, production and service, agricultural and livestock breeding businesses and with the purpose of increasing the capacity of the workers and for the development of competitiveness.</p>
<p><b>Leaves and Holidays Act, 1951</b></p>	
	<p>Under the Leave and Holidays Act (1951), every employee shall be granted paid public holidays as announced by the Government in the Myanmar Gazette. On average, Myanmar has 26 public holidays per year, depending on the date of the variable holidays. Myanmar law recognizes various types of leave. Leave is governed by the Leave and Holidays Act (1951), but additional rules may apply in accordance with other laws, such as the Social Security Law (2012) for employees contributing to the Social Security Fund.</p>
<p><b>The Import and Export Law, 2012</b></p>	
	<p>7. A person who obtained any license shall not violate the conditions contained in the license.</p>
<p><b>The Protection of rights of National Race Law, 2015</b></p>	
	<p>Consists of four bills, as submitted to the legislature; Buddhist Women's Special Marriage Bill, Religious Conversion Bill, Monogamy Bill and Population Control Bill.</p>
<p><b>Payment of Wages Law, 2016</b></p>	
	<p>Salaries are to be paid at the end of the month or, depending on the size of the employing enterprise, between 5-10 days before the end of the month. The employer is permitted and required to withhold income tax and social security payments. Other deductions, e.g. for absence, may only be withheld in accordance with the law.</p> <p>Section 3 The employer (a) will pay for salary either Myanmar Kyats or Foreign Cash permitted by National Bank of Myanmar. When delivery the salary (b) If the employer needs to pay the other opportunities or advantages, he can pay cash together with other materials according employee's attitude.</p> <p>Section 4 When the contract finish, employer need to pay the salary (not more than one month) to employees. For the permanent worker, need to pay per monthly. If more than 100 employees, need to pay within the 5 days from the end of month. If fire the employees, need to pay salary within two days after fire. When employee dies due to the accident, need to pay money as an insurance to employee's family within two days.</p> <p>Section 9 When cut the salary due to the employees' absence, total cut salary not more than 50 % of his salary.</p> <p>Section 10 Employer need to approval form the department as a penalty and cannot more than actual ravage rate when cut salary. No cut salary from the employees under 16 age.</p>
<p><b>Social Security Law, 2012</b></p>	

Laws and Regulations	Description
	<p>The Establishments Applied</p> <p>Section 11. (a) The following establishments shall be applied with the provisions for compulsory registration for social security system and benefits contained in this Law if they employ minimum number of workers and above determined by the Ministry of Labour in co-ordination with the Social Security Board:</p> <p>(i) production industries doing business whether or not they utilize mechanical power or a certain kind of power, works of production, repairing or services, or engineering works, mills, warehouses, establishments;</p> <p>(ii) Government departments, Government organizations and regional administrative organizations doing business;</p> <p>(iii) development organizations;</p> <p>(iv) financial organizations,</p> <p>(v) companies, associations, organizations and their subordinate departments and branch offices doing business;</p> <p>(vi) shops, commercial establishments, public entertaining establishments;</p> <p>(vii) Government departments and Government organizations doing business or transport businesses owned by regional administrative body, and transport businesses carried out with the permission of such department, body or in joint venture with such department or body;</p> <p>(viii) construction works carried out for a period of one year and above under employment agreement;</p> <p>(ix) works carried out with foreign investment or citizen investment or joint ventured businesses;</p> <p>(x) works relating to mining and gemstone contained in any existing law;</p> <p>(xi) works relating to petroleum and natural gas contained in any existing law;</p> <p>(xii) ports and out-ports contained in any existing law;</p> <p>(xiii) works and organizations carried out with freight handling workers;</p> <p>(xiv) Ministry of Labour and its subordinate departments and organizations;</p> <p>(xv) establishments determined by the Ministry of Labour from time to time, in co-ordination with the Social Security Board and with the approval of the Union Government; that they shall be applied with the provisions of compulsory registration for Social Security System and benefits contained in this Law.</p> <p>(b) Any establishment which is applied with the provisions of compulsory registration under sub-section (a) shall continue to be applied by this Law even though any of the following situations occurs if it continues to carry out such work:</p> <p>(i) carrying out work by employing under stipulated minimum number of workers but more than one worker;</p> <p>(ii) changing the employer or changing the type of business.</p>

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	<p>Section 48</p> <p>(a) The employer shall effect insurance by registering for employment injury benefit insurance system contained in section 45 at the relevant township social security office and pay contribution to employment injury benefit fund in accord with stipulations in order that workers applied to provisions of compulsory registration may obtain the employment injury benefits.</p> <p>Section 51</p> <p>The employer (a) shall pay contribution monthly to Employment Injury Benefit Fund at the rates stipulated under section 50. Moreover he shall also bear the expenses for paying as such; (b) shall pay defaulting fee stipulated under section 88, in addition to the contribution if fails to contribute after effecting insurance for employment injury benefit.</p> <p>Section 53 (a) The employers and workers shall co-ordinate with the Social Security Board or insurance agency in respect of keeping plans for safety and health in order to prevent employment injury, contracting disease and decease owing to occupation and in addition to safety and educational work of the workers and accident at the establishment;</p> <p>Section 54 -</p> <p>(a) The employer shall report to the relevant township social security office immediately if a serious employment accident occurs to his insured worker. There shall not be any delay without sufficient cause to report as such.</p> <p>(b) A team of officers and other staff who inspect the establishments, if it is found out the employment injury, death, and contracting disease, shall report to the relevant township social security office in accord with the stipulations.</p>
	<p><b>The Welfare of Labours of Oilfield Act, 1951 (After notification)</b></p>
	<p>The act provide for the prevention of waste of oil or gas and also the prevention of environmental pollution by petroleum operations. For the labours' Working hours: Higher physical danger risk establishment (e.g. an oil rig): 8 hours/day or 40 hours/week, Medium physical danger risk establishment (e.g. factory, oilfield, open mine): 8 hours/day or 44 hours/week. If factory work is part of a continuous process (i.e. technical reasons): admissible 48 hours/week, 10 hours a day Max. 6 days/week (i.e. Sunday = weekly holiday). For Overtime: 2x normal pay rate. Work on weekly holiday = alternative day off within a period of 2 months. In Practice: No specific rules for offshore workers except in old law – oilfields act. Workers in industrial zones work around 11 hours a day, 6 days a week. Many in oilfields the same, but more dangerous jobs, 40/ week.</p>
	<p><b>The Workmen Compensation Act, 1923 (amended 2005)</b></p>
	<p>In the Workmen's compensation Act, 1923, the expression " Kyats 2,160 and Kyats 7,200" contained in clause A (i) of sub-section (1) of section 4, the expression "two hundred Kyats" contained in clause A (ii) of sub-section (1) of section 4, the expression "Kyats 3,024and Kyats 10,080" contained in clause B (i) of sub-section (1) of section 4, the expression "twelve hundred Kyats" contained in clause B (ii) of sub-section (1) of section 4, the expression.</p> <ul style="list-style-type: none"> <li>• "one hundred Kyats" contained in the proviso of sub-section (1) of section 8 shall be substituted respectively by the expression "the amount of compensation prescribed by notification by the Ministry of Labour, with the approval of the Government."</li> </ul> <p>The expression "subject to a maximum of thirty Kyats" contained in clause D (ii) of sub-section (1) of section 4 of the Workmen's Compensation Act, 1923 shall be deleted.</p>

Laws and Regulations	Description
	<p>The expression "ten Kyats" contained in sub-section (2) of section 8, the expression "twenty five Kyats" contained in sub-section (4) of section 8, the expression "three hundred Kyats" contained in the first proviso of sub-section (1) of section 30 of the Workmen's Compensation Act, 1923 shall be substituted respectively by the expression "the amount of money prescribed by notification by the Ministry of Labour, with the approval of the Government.</p> <p>The expression "shall be punishable with fine which may extend to one hundred Kyats" contained in sub-section (1) of section 18 A of the Workmen's Compensation Act, 1923 shall be substituted by the expression "shall be punishable with fine which may extend to Kyats 10,000."</p>
	<p><b>Labour Organization Law, 2012</b></p>
	<p>This Law was enacted, to protect the rights of the workers, to have good relations among the workers or between the employer and the worker, and to enable to form and carry out the labour organizations systematically and independently.</p>
	<p><b>Minimum Wages Law, 2013</b></p>
	<p>This Law was enacted to meet with the essential needs of the workers, and their families, who are working at the commercial, production and service, agricultural and livestock breeding businesses and with the purpose of increasing the capacity of the workers and for the development of competitiveness,.</p>

### 3.2.3

#### *International Agreements and Conventions*

Relevant international conventions to which Myanmar is a signatory include those related to waste management, biodiversity conservation and labour conventions. The key international conventions of relevance to the Project are included in *Table 3.2*.

**Table 3.2 International Conventions of Relevance to the Project**

Legislation	Description	Relevance to the Project	Ratification Status
<b>Environmental</b>			
The International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978 relating thereto and by the Protocol of 1997( MARPOL)	Regulates waste, emission and discharges from vessels. Contains the following Annexes: Annex I: Regulations for the Prevention of Pollution by Oil (October 1983) Annex II: Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk (1986) Annex III: Regulations for the Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form (1992) Annex IV: Regulations for the Prevention of Pollution by Sewage from Ships (September 2003) Annex V: Regulations for the Control of Pollution by Garbage from Ships (December 1998) Annex VI: Regulations for the Prevention of Air Pollution from Ships (1997)	The Project vessels will comply with emissions and discharge standards. Annex I, IV, V and VI are of relevance to the Project.	Ratified Annexes I to V
Vienna Convention for the Protection of the Ozone Layer 1988 and Montreal Protocol on Substances that Deplete the Ozone Layer 1989	Aims at the protection of the ozone layer, including requirements for limiting the production and use of ozone depleting substances.	Not relevant to the Project as the Project will not use any ozone depleting substances.	Accession 16 Sep 1998 (Vienna) & Accession 24 Nov 1993 (Montreal)
Convention on Biological Diversity 1992	Aims to promote national policies for the conservation of wild flora, fauna and habitat that needs to be included in planning policies. The three main goals are: (1) the conservation of the biological diversity; (2) the sustainable use of its components; (3) fair and equitable sharing of the benefits.	The Project will be undertaken in offshore habitats.	Ratified 25 Nov 1994
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	The Convention regulates the transboundary movements of hazardous wastes and provides obligations to its Parties to ensure that such wastes are managed and disposed of in an environmentally sound manner.	The Project may generate hazardous wastes.	Entered into force 6 April 2015
United Nations Framework Convention on Climate Change 1992 (UNFCCC) and Paris Accord 2015	Provide a framework for intergovernmental efforts to tackle climate change. Recognises that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases.	The Project will form part of Myanmar's total emissions output.	Entered in force 23 Feb 1995 (UNFCCC) and 16 Feb 2005 (Kyoto Protocol)
Asia Least Cost Greenhouse Gas (GHG) Abatement Strategy (ALGAS) 1998	Develop national and regional capacity for preparation of GHG inventories. Assist in identifying GHG abatement options and preparation of a portfolio of abatement projects for each country.	The Project will produce air emissions from the MODU and vessels.	1998



Legislation	Description	Relevance to the Project	Ratification Status
Myanmar Agenda 21	Formed by the National Commission for Environmental Affairs (NCEA) in Myanmar. Provides a framework of programmes and actions for achieving sustainable development in the country. Building on the National Environment Policy of Myanmar, takes into account principles contained in the Global Agenda 21. Myanmar Agenda 21 also aims at strengthening and promoting systematic environmental management in the country.	Not relevant to Project. Relevant to government.	Since 1997
<b>Social</b>			
The International Convention for the Safety of Life at Sea (SOLAS) 1974	Ensures that ships flagged by signatory States comply with minimum safety standards in construction, equipment and operation.	The Project vessels will comply with safety standards.	Entered into Force 11 Feb 1988
Convention on the International Regulations for Preventing Collisions at Sea (COLREG) 1972	Sets out the navigation rules to be followed by ships and other vessels at sea to prevent collisions between two or more vessels.	The Project vessels will comply with navigation rules.	Entered into Force 11 Nov 1987
International Convention on Standards of Training, Certification and Watch-keeping for Seafarers 1978 (STCW)	Sets out requirements for marine environment awareness training and training in leadership and teamwork including new training guidance for personnel operating Dynamic Positioning (DP) Systems.	The Project vessels will comply with training requirements including for DP.	Entered into Force 1988

### 3.2.4

#### *Good International Industry Practice Guidelines*

Ophir Myanmar has undertaken the impact assessment study and will undertake offshore exploration activities in a manner which is guided by good international industry practice.

Applicable guidelines which Ophir Myanmar will consider in preparing its approach include:

- IFC Performance Standards (IFC PS) (2012): The IFC PS's represent the 'policy framework' for the EIA and sustainable social and environmental management for the Project, whereas the World Bank Group's Environmental, Health, and Safety (EHS) Guidelines provide guidance on general and industry best practice as well as recommended numerical limits for emissions to the atmosphere, noise, liquid and solid wastes, hazardous wastes, health and safety, and other aspects of industrial facilities and other types of development projects.
- World Bank Group (WBG) EHS General Guidelines (2007): The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs.
- IFC Environmental, Health, and Safety Guidelines for Offshore Oil and Gas Development (2007): The EHS Guidelines for Offshore Oil and Gas Development include information relevant to seismic exploration, exploratory and production drilling, development and production activities, offshore pipeline operations, offshore transportation, tanker loading and unloading, ancillary and support operations, and decommissioning. The guidelines also address potential onshore impacts that may result from offshore oil and gas activities.
- WBG EHS Guidelines for Offshore Oil and Gas Development (2007 & updated 2015): These latest guidelines for offshore oil and gas development (June 2015) consider industry-specific impacts and management relevant to the environment, occupational health and safety and community health and safety, as well as the development of performance indicators and monitoring programs. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project on the basis of the results of the environmental assessment.
- United Nations Environment Program (UNEP) Guidelines on Environmental Management for Oil and gas Exploration and Production (1997): This document provides an overview of the environmental issues and the technical

and management approaches to achieving high environmental performance in the activities necessary for oil and gas exploration and production.

- Other good international industry practice guidelines from organisations such as the International Maritime Organisation (IMO), American Petroleum Institute (API), International Petroleum Industry Environmental Conservation Association (IPIECA) and International Association of Oil and Gas Producers (IOGP). These include:
  - International Petroleum Industry environment and Conservation Association (IPIECA) the Oil Gas Industry: Operating in Sensitive Environments (2003).
  - International Association of Oil and Gas Producers (IOGP) Environmental management in oil and gas exploration and production (1997).
  - International Association of Oil and Gas Producers (IOGP). Environmental Fates and Effects of Ocean Discharge of Drill Cuttings and Associated Drilling Fluids from Offshore Oil and Gas Operations (2016).

### 3.3 *INSTITUTIONAL FRAMEWORK OF THE PROJECT PROPONENT AND THE MYANMAR GOVERNMENT*

#### 3.3.1 *Myanmar Regulatory Authorities*

Matters pertaining to HSE requirements are generally under the jurisdiction of the ministries and state-owned enterprises in the oil and gas sector. Key ministries, agencies and state-owned enterprises that have jurisdiction over HSE matters in oil and gas operations are included in *Table 3.3*.

**Table 3.3** *Key Ministries, Agencies and State-Owned Enterprises Involved in HSE*

Ministry/Agency	Responsibility
Ministry of Natural Resources and Environmental Conservation (MONREC)	The Environmental Conservation Department (ECD) of MONREC has ultimate responsibility for the review and approval, or otherwise, of submissions under the IEE/EIA process.
Myanma Oil and Gas Enterprise (MOGE)	MOGE is the state-owned enterprise responsible for working together with oil and gas companies (local and international) in Myanmar and oversees the PSCs in cooperation with foreign oil companies. MOGE is involved in direct communication and coordination with various levels of different government agencies for HSE related issues.

Ministry/Agency	Responsibility
Ministry of Electricity and Energy (MOEE)	MOEE jointly works with MOGE in managing HSE issues of oil and gas operators in Myanmar, in which MOEE encourages operators to establish a HSE Management System and prepare their own EIA for their project.
Myanmar Investment Commission (MIC)	MIC is a government agency responsible for coordinating with ministries (such as the MOEE) and other state entities to facilitate foreign investment in Myanmar. The MIC is also responsible for granting MIC permits which enable foreign investors to carry out business activities under the Myanmar Investment Law (2016). The Law specifies MIC shall “take consideration on the facts such as financial credibility, economic justification of the business, appropriateness of technology and protection and conservation of environment in scrutinizing the proposals of investment”.

### *Fisheries Organizations*

Given the offshore location of the well (approximately 150 km (93 miles) from the nearest coastline), fisheries organisations are considered to be of relevance. The key organisations involved in the governance of the fisheries sector are discussed in the section below.

### Department of Fisheries

The Department of Fisheries (DoF), under the Ministry of Agriculture, Livestock and Irrigation, is the main institutional body which governs fishing grounds, methods and catches. The DoF is responsible for the development of the fisheries sector and management of commercial fisheries including exports. There are also fisheries administrations within the States and Divisions of Myanmar, including Rakhine.

The DoF is responsible for:

- Issuing fisheries licenses for gear/vessels/sites and aquaculture sites/ventures.
- Advising the Ministry of Agriculture, Livestock and Irrigation and the Divisional and State Government on fisheries and aquaculture matters.
- Acting as regulatory body for the correct and proper conduct of fisheries and aquaculture.
- Facilitating the technical needs and equipment of the marine sector.
- Undertaking research and development activities.

### Myanmar Fisheries Federation

The Myanmar Fisheries Federation (MFF) was formed in 1998 from the Myanmar Fishery Association, as part of the Association of South-East Asia Nations (ASEAN) Fisheries Federation. It is a non-governmental organisation (NGO) that deals with the fisheries industries.

The MFF operates at a local and national level and is governed by a Central Executive Committee. The Central Executive Committee plays a coordinating role and is supported by office holders. The role of the MFF is to:

- Support applications made by its members to DoF for the fisheries and aquaculture licenses.
- Support applications to the Livestock and Fisheries Bank for loans.
- Raise issues of importance to their members with the DoF.
- Assist in the negotiation of selling and harvesting.
- Assist in the transferring of technology to farmers.
- Assist in the communication and cooperation with trans-boundary organizations.

### 3.3.2 *Production Sharing Contract Requirements*

The Production Sharing Agreement between MOGE and Ophir Myanmar notes that the Project shall be undertaken in accordance with the laws, regulations and directives of Myanmar:

*“Art. 17.2e: The CONTRACTOR shall be responsible for execution of work programme which shall be implemented in a work-man like manner and CONTRACTOR shall take such precautions for protection of navigation and fishing and CONTRACTOR shall be responsible to conduct Petroleum Operations in accordance with the applicable provisions of the International Finance Corporation Performance Standards (2012), the World Bank Environmental, Health and Safety Guidelines for Offshore Oil & Gas Development (2007), good international petroleum industry practises and the laws, regulations and directives of the Republic of the Union of Myanmar with respect to environmental and social protection. The steps to carry out these obligations shall be instituted into the work programme. It is also understood that the execution of the work programme shall be exercised as not to conflict with the laws of the Republic of the Union of Myanmar as they exist as of the effective date.”*

### 3.4

### ENVIRONMENTAL AND SOCIAL STANDARDS

With the release of the final EIA Procedures in December 2015, the National Environmental Quality (Emissions) Guidelines were also released. These Guidelines provide the basis for regulation and control of noise and air emissions and effluent discharges from projects in order to prevent pollution and protect the environment and public health. These standards are noted to be the same as that recommended by the IFC General EHS Guidelines (IFC 2007).

A summary of Myanmar national environmental standards that are relevant to the Project (offshore oil and gas) for effluent discharges are shown in *Table 3.4*.

**Table 3.4** *National Environmental Quality (Emissions) Guidelines on Effluent Discharge Levels*

Parameter	Guideline
Drilling fluids and cuttings (non-aqueous drilling fluid)	<p>Non-aqueous drilling fluid, re-inject or ship-to-shore; no discharge to sea</p> <p>Drilled cuttings, re-inject or ship-to-shore; no discharge except:</p> <p>Oil concentration lower than 1% by weight on dry cuttings</p> <p>Mercury maximum 1 mg/kg dry weight in stock barite</p> <p>Cadmium maximum 3 mg/kg dry weight in stock barite</p> <p>Discharge via a caisson at least 15 metres below sea surface</p> <p><b>2015 change (oil on cuttings):</b></p> <ul style="list-style-type: none"> <li>- For existing facilities (as per the 2015 IFC offshore oil and gas guidelines), c: Use of Group III non-aqueous base fluids and treatment in cutting dryers. Maximum residual Non Aqueous Phase Drilling Fluid d (NAF) 6.9% (C16 -C18 internal olefins) or 9.4% (C12-C14 ester or C8 esters) on wet cuttings.</li> </ul>
Drilling fluids and cuttings (water-based drilling fluid)	<p>Water-based drilling fluid, re-inject or ship-to- shore; no discharge to sea</p> <p>Water-based drilling fluids and cuttings, re-inject or ship-to-shore; no discharge to sea except:</p> <ul style="list-style-type: none"> <li>- Mercury 1 mg/kg dry weight in stock barite</li> <li>- Cadmium 3 mg/kg dry weight in stock barite</li> <li>- Maximum chloride concentration must be less than four time's ambient concentration of fresh or brackish receiving water</li> <li>- Discharge via a caisson at least 15 meters below sea surface</li> </ul>
Produced water	<p>Re-inject, discharge to sea maximum one day oil and grease discharge should not exceed 42 mg/l; 30 day average should not exceed 29 mg/l</p>



Parameter	Guideline
Completion and well work-over fluids	Ship-to-shore or re-inject, no discharge to sea except: <ul style="list-style-type: none"> <li>- Maximum one day oil and grease discharge should not exceed 42 mg/l; 30 day average should not exceed 29 mg/l</li> <li>- Neutralize to attain a pH of 5<sup>a</sup> or more</li> </ul>
Produced sand	Ship-to-shore or re-inject, no discharge to sea except when oil concentration lower than 1% by weight on dry sand
Hydrotest water	<ul style="list-style-type: none"> <li>- Send to shore for treatment and disposal</li> <li>- Discharge offshore following environmental risk analysis, careful selection of chemicals</li> <li>- Reduce use of chemicals</li> </ul>
Cooling water	The effluent should result in a temperature increase of no more than 3°C at edge of the zone where initial mixing and dilution take place; where the zone is not defined, use 100 meters from point of discharge
Desalination brine	Mix with other discharge waste streams if feasible <sup>b</sup>
Sewage	Compliance with MARPOL 73/78 <sup>b</sup>
Food waste	Compliance with MARPOL 73/78 <sup>b</sup>
Storage displacement water	Compliance with MARPOL 73/78 <sup>b</sup>
Bilgewater	Compliance with MARPOL 73/78 <sup>b</sup>
Deck drainage	Compliance with MARPOL 73/78b

a Standard unit,

b In nearshore waters, carefully select discharge location based on environmental sensitivities and assimilative capacity of receiving waters

The standards for Oil on Cuttings in Myanmar are further elaborated in the National Environmental Quality (Emission) Guideline 2015. *Section 2.4.1 Oil and Gas Development, Effluent Levels* of the guidelines refers to the offshore discharge of NADF oil concentration on drilled cuttings and states that the oil concentration limit is 1% by weight on dry cuttings.

The EQEG *Scope of Application* (paragraph 3) states:

*“These Guidelines have been primarily excerpted from the International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines, which provide technical guidance on good international industry pollution prevention practice for application in developing countries. The Guidelines are generally considered to be achievable in **new** facilities by existing technology at reasonable costs. Application of these Guidelines to **existing** facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them.”* (emphasis added)

The International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines *Section 2.1.1 Emissions and Effluent Guidelines*, Table 1 state:

- For **new** facilities <sup>(1)</sup>: Organic Phase Drilling Fluid <sup>(2)</sup> concentration lower than 1% by weight on dry cuttings;
- For **existing** facilities <sup>(3)</sup>: Use of Group III non-aqueous base fluids and treatment in cutting dryers. Maximum residual Non Aqueous Phase Drilling Fluid (NADF) 6.9% (C16 -C18 internal olefins) or 9.4% (C12-C14 ester or C8 esters) by weight on wet cuttings.

It is important to note that for existing facilities to meet the guidelines for **new** facilities, technically and financially feasible techniques (including installation of thermo-mechanical cuttings cleaning systems as mentioned in *Section 4.1.3*), should be considered in relation to the number of wells to be drilled, and/or to potential impacts on critical habitats. As this Project is for drilling one exploration well only and will not impact any critical habitats, the installation of the system is not considered to be a financially and technically viable option for this Project.

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(1) New facilities include offshore drilling rigs which have been newly designed or structurally modified for the project

(2) As defined by OSPAR (2000) Decision 2000/3

(3) Applicable to existing offshore drilling rigs deployed for development well drilling programs. Applicable to exploratory well drilling programs

## ***PROJECT DESCRIPTION AND ALTERNATIVES***

This section provides a brief overview of the alternatives considered and details of the proposed Project activities to be conducted within Block AD-3.

### ***4.1 PROJECT ALTERNATIVES***

Alternatives to the proposed Project were considered in the early stages of Project design which included different options available that may avoid or reduce any adverse environmental and/or social impacts. The different options considered are presented in the following sections.

#### ***4.1.1 No Project Alternative***

The 'No Project' alternative would result in no further exploration activity in Block AD-3 and, in turn, no further oil and gas development. The exploration and production of oil and gas stimulates the Myanmar economy and 'No Project' would result in fewer potential opportunities for gas supply to the domestic market and could lead to fewer employment opportunities and less economic growth. In addition, given the operators obligations in the PSC regarding Block AD-3, the 'No Project' alternative is not considered commercially, contractually or technically practicable.

#### ***4.1.2 Drill Cuttings Disposal***

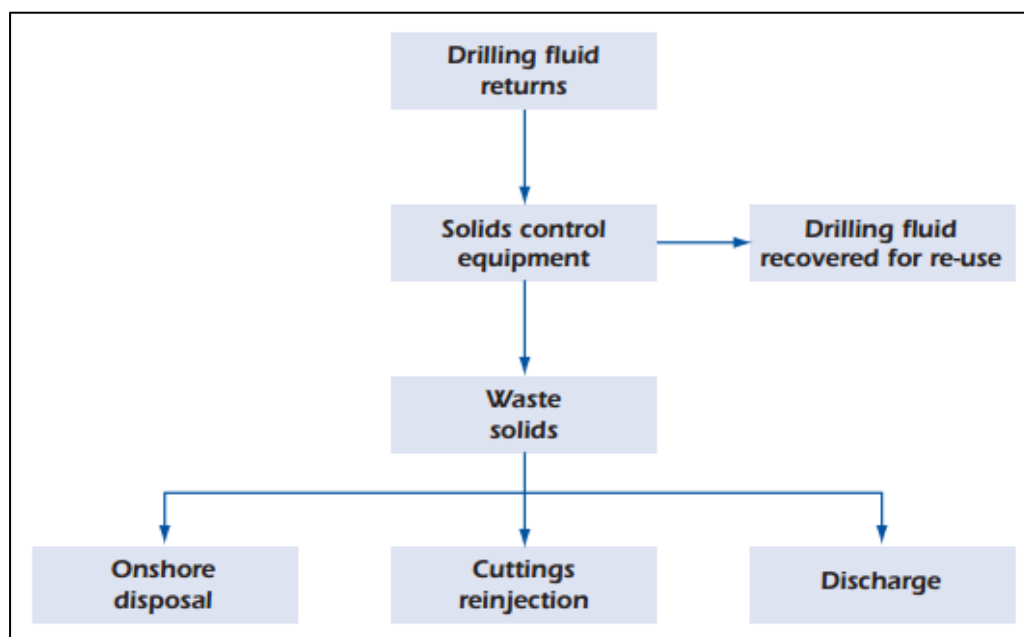
Disposal options for the drilled solids comprise offshore discharge, offshore re-injection, and onshore disposal (*Figure 4.1*). These options are discussed in more detail below.

##### *Onshore Disposal*

This option involves shipping all the cuttings generated from the well to shore for subsequent onshore processing followed by disposal in a land fill. This option is not realistic for Myanmar for a number of technical reasons:

- Myanmar does not have a deep water port with sufficient draft to accommodate Platform Supply Vessels (PSV) likely to be chartered for this project, and as such, there are limited options to get cuttings transferred from the PSV to shore; and
- The energy, carbon dioxide (CO<sub>2</sub>), nitrous oxide (NO<sub>x</sub>) and sulphur oxide (SO<sub>x</sub>) emissions and environmental issues regarding onshore disposal are considered to far outweigh any detrimental effects that may arise from the discharge of cuttings in a deepwater environment a considerable distance from the shore.

Figure 4.1 Options for Drill Cuttings Disposal



#### *Offshore Cutting Injection*

This option involves the injection of cuttings into a dedicated cuttings injection well which has already been drilled in the field or an existing, uncemented annulus with a means of pumping into the annulus. Neither of these options exists for the proposed Project.

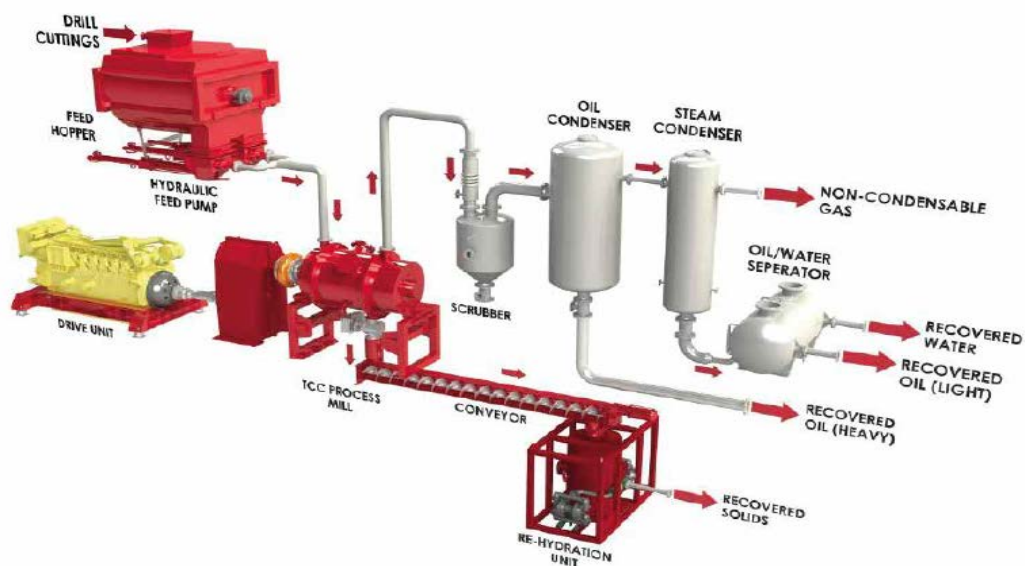
#### *Offshore Discharge*

The MODU has a system for processing non-aqueous drilling fluids (NADF) cuttings. The NADF is processed and returned to the system for reuse. The treated cuttings are discharged overboard. The options for systems to process the cuttings are discussed in the following sections.

#### Thermomechanical Cuttings Cleaning (TCC) System

This option will require the MODU to have a Thermomechanical Cuttings Cleaning (TCC) System installed; as shown in *Figure 4.2*. The TCC processes the cuttings by frictional heat generated and crushes the cuttings to reduce the residual Non Aqueous Base Fluid (NABF) oil on cuttings (OOC) to less than 1%. The liquid phase of the cuttings is then vaporised, condensed and separated into dedicated effluent streams.

Figure 4.2 Typical TCC System Arrangement

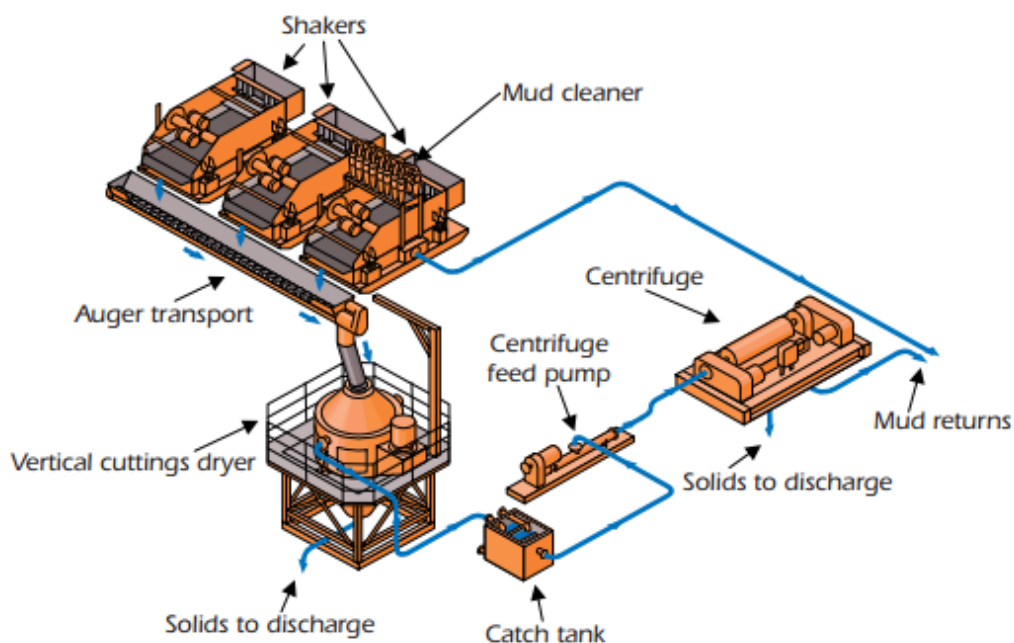


None of the MODU's which are available to drill the proposed well have this system. To install the TCC system on the MODU would require significant modification and incur heavy time and cost penalties. It is estimated that 15 days would be required to install the system at a cost of between US \$7-8 million. As such, this makes the TCC installation impractical and not commercially viable for Ophir Myanmar for an exploration well with a 40 day drilling duration and limited amount of generated cuttings.

#### Centrifugal Cuttings Dryers

Another system for processing cuttings involves using centrifugal cuttings dryers, augers and centrifuges. These systems are already in place or can be easily retrofitted on all the MODUs proposed for this Project. Figure 4.3 shows a schematic of the typical equipment involved. This processing limits the OOC to <5% by weight of wet cuttings. This type of installation is much simpler and less complicated to maintain than an offshore TCC and Ophir Myanmar believes this approach is more suitable for an exploration well with a 40 day drilling duration and limited amount of generated cuttings.

Figure 4.3 Typical Schematic of Centrifugal Cuttings Dryers



#### 4.1.3 Types of Drilling Fluid

The function of the drilling fluid is to provide circulation to remove cuttings from the hole, to cool the drill bit and to maintain well control (by exerting a greater hydrostatic pressure than that expected from any formation). NADF, WBDF, and/or seawater and sweeps will be used for the Project. Seawater and sweeps will be used in the upper sections of the well.

##### *Use of Non-Aqueous Drilling Fluids (NADF) vs. Water Based Drilling Fluids*

For deep water exploration, there are many advantages to drilling with NADF. The advantages include many technical factors such as improved hole stability, minimal fluid invasion and formation damage, and increased penetration rates (quicker drilling). NADFs are also less sensitive to temperature changes, which is particularly applicable to deep-water drilling (as water temperatures at depth can be significantly colder than sea surface temperatures). NADF also aids in corrosion control and suppresses bacteria growth. NADF is particularly beneficial for drilling exploration wells as it is able to neutralise H<sub>2</sub>S easily with simple lime additions making for a safer working environment.

In the extremely unlikely event of a well control situation, where hydrocarbon gas enters the wellbore, using NADF's provides a significantly lower risk of forming gas hydrates – freezing- compared to WBDF's. The formation of natural gas hydrates has several adverse consequences that could impact safety of the well, as they can potentially plug the choke and kill-line, preventing well circulation. Hydrate formation can also preclude well-pressure monitoring below the BOP, prevent drill-string movement, and/or



prevent the BOP from fully opening or closing due to hydrates forming around the BOP, casing or drill string.

The use of water based drilling fluids (WBDF) for deep-water exploration has a number of disadvantages. For example, for best performance, WBDFs need to be correctly formulated based on the chemical (mineral content) and physical (temperature) characteristics of the formations into which the well will be drilled. If the WBDF is not correctly formulated, it can be particularly problematic where water sensitive clay/shale are present as interactions with the clay and water can cause the drill pipe to become stuck or the wall of the wellbore to slough (shed).

When planning an exploration well, relevant information from nearby wells is often limited, making it difficult to correctly formulate a WBDF system. For this Project, the closest well is Aung Pyi Hein-1 (drilled in 2015 with NADF) which is located 143 km (88 miles) to the north. Ophir Myanmar has performed an extensive review of wells in the region and has held discussions with other operators and service companies. In this region, there are cases reported of difficulties with tight hole, tripping problems and wellbore instability which can add significantly to the time and cost of the operation.

#### *Environmental Impacts of Drilling Fluids*

The rationale for limiting the amount of OOC is to reduce the potential for impacts to the marine environment from discharge. Seabed effects are the main environmental concern related to ocean discharge of drilled cuttings with residual NADF. The biological effects are mainly restricted to the benthic (seabed) environment where cuttings may eventually settle. For the Project, the well will be drilled in over 2,400 m (7,800 ft.) water depth. As such, the seabed (benthic) communities at these depths are typically of very low productivity and biodiversity, hence unlikely to be sensitive to discharges, unlike the more sensitive biodiverse habitats found in shallow waters.

Marine water column organisms are at a lower risk of harm from drill cuttings discharge due to the rapid dilution and dispersal. In deep-water (>600m), cuttings are generally scattered and deposited in isolated thin layers over a large horizontal distance of 500-1,000 m from the discharge point, with concentration decreasing over distance.

There are three types of Non Aqueous Base Fluid NABF (IOGP (2016). Environmental Fates and Effects of Ocean Discharge of Drill Cuttings and Associated Drilling Fluids from Offshore Oil and Gas Operations; Report 543)):

- Grade I which includes crude oil and diesel fuel with more than 5% by weight of aromatic hydrocarbons;

- Grade II which are produced by further refining crude oil and contain 0.5-5% by weight of aromatic hydrocarbons; and
- Grade III which are produced by more extensive refining, reducing the concentration of aromatic hydrocarbons to <0.5% by weight.

Grade III NABF will be used for the Project. Most of the organic chemicals in NADF are biodegradable and break down over time due to microbes within the cutting layer. If a NADF containing Group III NABF is used in deepwater projects, the effects of treated cuttings which may accumulate in sediments are usually minor and biological recovery often is well underway within a year of completion of discharge (Balcom et al, 2012).

A significant level of effort has been conducted within the industry to develop NABFs with minimal environmental impacts. These efforts include field studies which have shown that for deep water wells:

- Cuttings are dispersed during transit to the seabed and no cuttings piles are formed when treated NADF concentrations on cuttings are below 5%; and
- Cuttings discharged from cuttings dryers (with retention values under 5%) in combination with a sea water flush, hydrate very quickly and disperse like water-based cuttings.

Furthermore, internationally accepted studies have shown that impacts associated with the discharge of cuttings and synthetic based fluid (a type of Group III NADF) in a deep water setting, are minimal (Balcom et al, 2012).

The US Environmental Protection Agency (EPA, 2001), with the assistance of American Petroleum Institute (API), also concluded that there are other factors to consider with the selection of drilling fluids namely:

- WBDF drilling operations lead to increases in air emissions and fuel usage by drilling rigs and equipment as WBDF drilling operations generally take longer than NADF drilling operations;
- WBDF drilling operations lead to an increase in pollutants discharged per well as WBDF operations require more washout of the well wall than NADF; and
- Supplements (e.g., glycols, shale inhibitors) can be added to WBDF that increase the aquatic toxicity of the drilling fluid. These supplements are added for the purpose of making the WBDF technical capabilities (e.g., lubricity, shale suppression) similar to Group III NADF's. The USEPA estimates that these WBDFs would exhibit greater aquatic toxicity than Group III NADF's.

#### **4.1.4** *Well Location*

Ophir Myanmar identified a number of potential locations for the exploration well. Locations of the wells ranged from 100-150 km offshore. All of the potential wells were in waters depths of over 2,000 m (6,500 ft.). One location has been selected for the well; known as Aung Sakyar. Details of the selected location are below.

## **4.2** *PROPOSED PROJECT ACTIVITIES*

### **4.2.1** *Location and Size of Project*

The Project will cover the drilling of one exploration well (Aung Sakyar). The well location is shown in *Figure 1.1* and is located in waters over 2,400 m (7,800 ft.) deep and at least 150 km (93 miles) from the nearest coastline (Manaung Island) and over 175 km (108 miles) from mainland coastline. The well will be drilled using a Mobile Offshore Drilling Unit (MODU) which will have a safety, or exclusion area, of 500 m radius. The total area temporarily excluded from other marine users will be approximately one (1) square km.

### **4.2.2** *Schedule for Exploration Drilling*

The drilling of the exploration well (Aung Sakyar) is scheduled to commence in Q3 2017, and is estimated to last for approximately 40 days. Operations will run 24 hours a day. The breakdown of operations is expected to be as follows:

- 5 days: Conductor and surface casing installation with seawater and sweeps;
- 4 days: Blow Out Preventer (BOP) and Marine Riser deployment;
- 26 days: Drilling of intermediate and reservoir hole sections with NADF or WBDF; and
- 4 days: Well Abandonment.

The timing is planned to coincide with the northeast monsoon so as to avoid the cyclone season and take place in more favourable meteorological conditions.

### **4.2.3** *Project Activities*

#### *Exploration Drilling Activities*

The primary objective of the well is to test the hydrocarbon potential within the block by acquiring Logging While Drilling (LWD) data and analysing surface samples while drilling. The expected petroleum system relies on biogenic gas charge, proven at the Shwe field. In the success case a full suite

of wireline logs will be deployed along with a vertical seismic profiler (VSP). There are no plans to perform a drill stem test (DST).

The well will be drilled vertically to a total well depth of 5,700m total vertical depth (TVD) (3,300 m below mud line (BML)). The well schematic is provided in *Figure 4.4* and a summary of the well information is provided in *Table 4.2*.

**Table 4.1** *Well Information Summary*

Well Section	Mud Type	Section Length (m)	Location of Discharge	Estimated Cuttings Discharged (MT)
36"	Seawater and sweeps	75	Seabed	192
26"		825		1,102
17 ½"	NADF or WBDF	900	Sent back to MODU for processing and discharge to sea	400
12 ¼"		900		196
8 ½"		600		63

In addition to the cuttings, there will be around 6,000 bbls of viscous water based sweeps (made from polymer or pre-hydrated bentonite (PHB)) and 5,000 bbls of 16 ppg water based mud that will be used as kill mud in case shallow gas is encountered.

The top-hole section (36" and 26" sections) will be drilled riser-less using seawater and sweeps (circulation of fluids to clear the borehole) to approximately 825 m below the seabed. The cuttings from this section will be discharged at the seabed. The open hole section will then be displaced to a weighted fluid and the 20" casing will be run in the hole.

Occasionally it becomes necessary to drill with a weighted water based fluid to keep the wellbore open; if this is the case weighted fluid will be pumped down the drill-string with returns to the sea-bed.

After completion of the top-hole section casing, a blow-out preventer (BOP) and marine riser will be run and installed, connecting the wellhead to the MODU. The BOP is required to control and monitor the well during exploration drilling. The riser enables a closed circulation drilling fluid system to be maintained whereby drilling fluids and cuttings from the well can be returned back to the MODU for separation and/or re-use.

Once the riser is in place, the bottom-hole sections will be drilled using NADF in a closed circulation system enabling the re-use of drilling fluids. If the

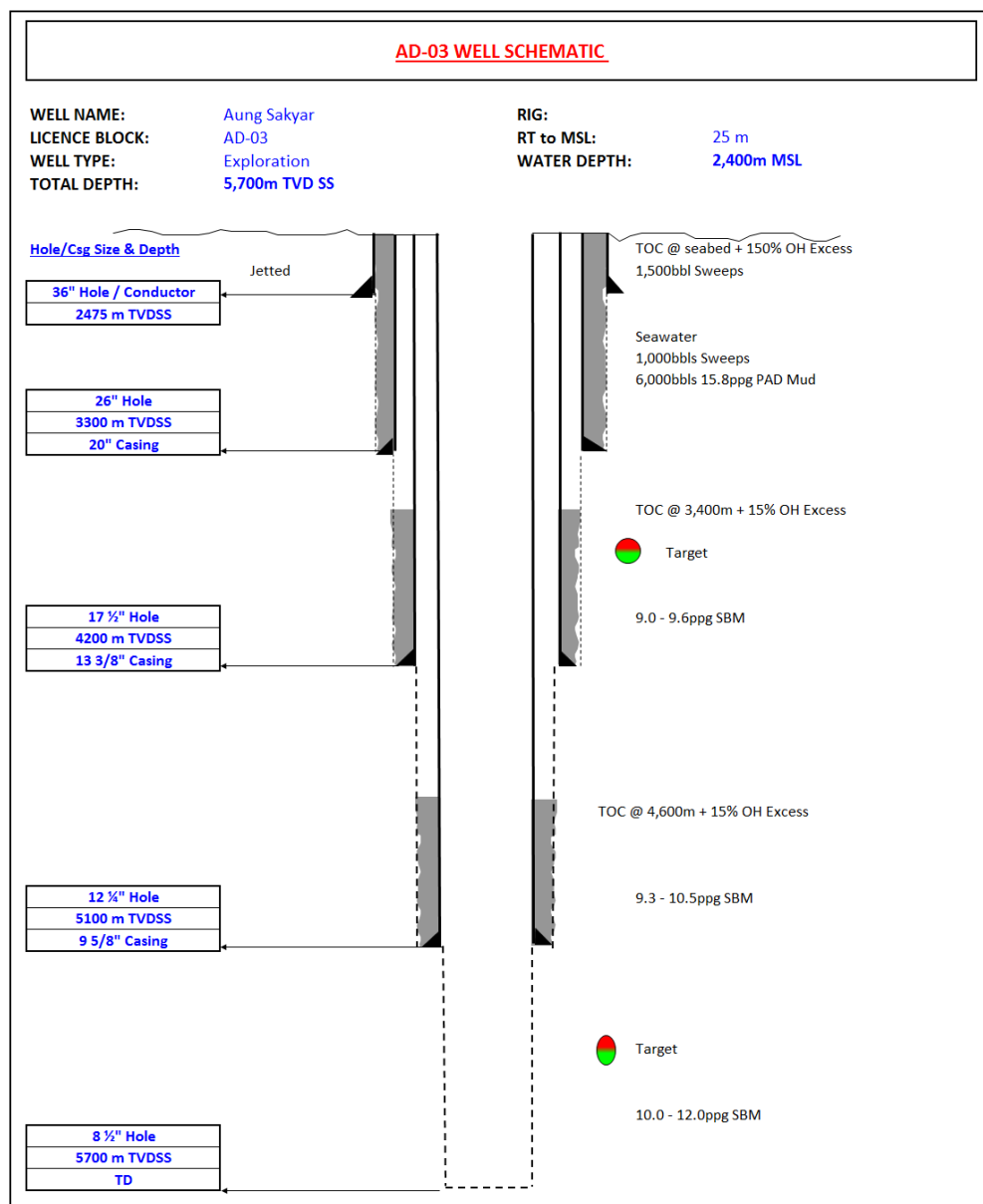
decision is taken to use WBDF in place of NADF then the cuttings will be discharged overboard directly from the shale shakers.

At the end of NADF operations it will be necessary to displace out the NADF from the upper wellbore and riser. The process of displacing out the NADF with seawater will be designed to ensure an efficient displacement takes place. Sweeps containing thinners, surfactants and solvents will be pumped followed by a viscous heavy pill to ensure efficient NADF removal. The interface fluid prior to the arrival of the seawater will be captured and returned to shore along with the NADF, thereafter seawater returns will be discharged overboard provided the average oil content is below 1% by volume.

All NADF fluids and Base Oil will be returned to shore for re-use on other projects. Tanks containing NADF will be circulated and jetted prior to offloading to ensure the fluid is easily moveable and this will be pumped back to the supply vessel. Any remaining NADF in the pits will be sucked out using a diaphragm or similar pump; a surfactant/solvent mixture will then be circulated through the pits and lines to remove any remaining NADF, if the oil content of this fluid is below 1% this will be discharged overboard, if above it will be sent onshore for processing. Finally the tanks will be flushed with seawater which will be discharged overboard.

More information on the drilling fluids and cuttings generated by the Project is provided in *Section 4.2.5*.

Figure 4.4 Schematic for Exploratory Drilling Well Aung Sakyar



#### Vertical Seismic Profile (VSP)

Once the required depth is reached, the formation (seabed and subsea structures) will be evaluated by taking a series of measurements from inside the wellbore. These measurements are used to provide further detail on the subsurface characteristics and to detect and quantify hydrocarbon presence in the rock adjacent to the well. Depending on the results of exploration drilling, these measurements may include extracting small cores, wireline logging and vertical seismic profiling (VSP) as required.

VSP is an optional tool that is used to generate a high-resolution seismic image of the geology in the well's immediate vicinity. VSP uses a small airgun array, typically comprising either a system of three 250 inch<sup>3</sup> airguns

with a total volume of 750 inch<sup>3</sup> of compressed nitrogen at approximately 2,000 pounds per square inch (psi). During VSP operations, four to five receivers are positioned in a section of the wellbore and the airgun array is discharged approximately five times at 20 second intervals. The generated sound pulses are reflected through the seabed and are recorded by the receivers to generate a profile along a section of the wellbore. This process is repeated as required for different stations in the wellbore and will involve approximately 18 hours of source release, within a 24 hour period.

#### *End of Well Activities (Well Abandonment)*

On the completion of exploration drilling and running of any downhole measurements such as VSP, the well will be plugged and abandoned in accordance with established industry procedures. This includes installing barriers and cement plugs to prevent any potential release from the well, as well as pressure testing of installed barriers through a prescribed program. Following abandonment, the marine riser and BOP will be removed and the MODU will demobilise from the well site.

#### **4.2.4 Vessel Requirements**

##### *Mobile Offshore Drilling Unit (MODU)*

A mobile offshore drilling unit (MODU) will be used which will be dynamically positioned <sup>(4)</sup>, therefore there will be no seabed disturbance from anchoring. A 500 m exclusion zone will be implemented around the MODU once on site for the duration of exploration drilling in order to prevent any interactions with other marine users (i.e. shipping or fishing activities). The Project footprint on the sea surface will only cover a small area (less than one square km).

The specific MODU has not yet been confirmed. The following data provided in *Table 4.2* is characteristic for the type of vessel that will be used. A photo of a typical MODU is provided in *Figure 4.5*.

---

(4) A computer-controlled system to automatically maintain a vessel's position by using its own propellers and thrusters



**Figure 4.5** *Photo of Typical MODU*



**Table 4.2** *Typical MODU Details*

Component	Specification
Rig type/design/class	6 <sup>th</sup> generation Drill Ship
Accommodation	200 people
Station keeping	Dynamic Positioning
Max drill depth/water depth	12,000m / 3,600 m
Length	250 m
Operating draft	11 -17 m
Transit draft	9 - 13 m
Bulk mud and cement storage capacity	35,000 cubic feet (cu.ft)
Liquid mud storage capacity	12,000 barrels (bbls)
Fuel oil storage capacity	47,000 bbls
Drill water storage capacity	18,000 bbls

### *Support Vessels and Equipment*

The drilling will be supported by up to three Platform Supply Vessels (PSVs) and one support vessel that will be used to transport equipment, fuel, materials and waste between the MODU and the onshore supply base. The onshore base will most likely be located in Ranong (Thailand) and Singapore.

The support vessels will also transfer drilling fluids, cements, and drill water as required and collect waste materials, drilling fluids and waste oil from the MODU for appropriate reuse, recycling or disposal via a suitable port and handling facility.

Crew changes will be undertaken via helicopter, most likely from Yangon or Sittwe. Helicopters and other equipment may be re-fuelled on the MODU as required.

A submersible remotely operated vehicle (ROV) is required to conduct activities close to the seabed whilst drilling. These activities include pre-spud visual checks and maintenance on subsea equipment.

#### **4.2.5** *Drilling Fluids and Chemicals*

NADF is the fluid of preference for the deeper sections of the well with WBM as an alternative. The NADF is discharged on drilled cuttings following their return to the MODU for separation using shakers, cutting dryers and centrifuges to reduce the residual level of NADF. All chemicals that may be discharged to the marine environment during the exploration drilling activity are required to be selected and approved in line with all National laws and regulations and low toxicity chemicals will be selected where practicable. Chemicals considered for use are also assessed in terms of their application, discharge and potential risk to the marine environment.

The United States Environmental Protection Agency (USEPA) states that Group III NADF associated drill cuttings are permitted for ocean discharge if the concentration of the NADF base oil retention on cuttings does not exceed 6.9 % by weight for *internal olefin* base oil or 9.4 % by weight for *ester* base oil. USEPA has rejected the zero discharge option for NADF cuttings wastes because it would result in unacceptable increases in non-water quality environmental impacts (IOGP, 2016).

#### **4.2.6** *Oil on Cuttings*

Ophir Myanmar will use an existing MODU for the exploration drilling activity which will not be newly designed or modified for this project. Ophir Myanmar proposes to use a low toxicity, paraffin Group III NABF (non-aqueous base fluid) and limit residual NABF oil on cuttings (OOC) to 5% by weight by of wet cuttings using efficient cuttings dryer equipment. NADF will be utilised for approximately 26 operations days of which cuttings will be

generated and processed for approximately 8 days with an estimated total of 1,300 MT of wet cuttings discharged overboard.

#### *Ophir's Experience with Oil on Cuttings (OOC)*

In November 2015, Ophir Myanmar performed a review of the company's residual oil on cuttings (OOC) performance for wells drilled in 2013 and 2014. *Table 4.3* provides performance data for 10 exploration wells drilled with NADF which shows that in all cases, the well-averaged OOC was less than 5% by weight of wet cuttings.

**Table 4.3** *Ophir Experience with Oil on Cuttings*

Drilling Campaign / Well	Target Residual Oil on Cuttings (OOC) (%)	Well-averaged OOC (%)
<b>Ghana 2013</b>		
Starfish	<3.0	2.69
<b>Tanzania 2013</b>		
Minzi Mbeli	<6.9	3.50
<b>Tanzania 2014</b>		
Tende	<6.9	3.50
Mkuki	<6.9	2.30
<b>Gabon 2014</b>		
Padouk Deep	<5.0	3.10
Affanga Deep	<5.0	3.60
Okala	<5.0	3.70
<b>Equatorial Guinea 2014</b>		
Fortuna 2	<5.0	3.51
Silenus East-1	<5.0	4.51
Tonel North-1	<5.0	2.36

#### **4.2.7** *Emissions, Discharges & Wastes*

Atmospheric emissions will arise from internal combustion engines on the MODU, PSVs and machinery engines resulting in the release of SO<sub>2</sub>, NO<sub>x</sub>, greenhouse gases (GHG), CO<sub>2</sub>, particulates and Volatile Organic Compounds (VOCs). An extensive analysis of the GHG emission of shipping is presented in the Third IMO Greenhouse Gas Study 2014 (IMO 2014) where a number of factors were developed for the emission of GHGs based on the mass of fuel consumed. It should be noted that both NO<sub>2</sub> and methane (CH<sub>4</sub>) are GHGs emitted in relatively trace amounts by ships. For the purposes of this project they can be considered to make a negligible contribution. The principal GHG emitted by internal combustion engines is carbon dioxide (CO<sub>2</sub>). Factors for the generation of carbon dioxide from various fuels are presented in *Table 4.4*.

**Table 4.4** *Specific Emission Rates of CO<sub>2</sub> for Various Shipping Fuels*

Fuel Type	CO <sub>2</sub> Emissions (g/g fuel)
Residual fuel oil (RFO)	3.114
Low sulphur fuel oil (LSFO)	3.114
Marine gas oil (a distillate product) (MGO)	3.206
Liquid natural gas (LNG)	2.750

Thus estimated GHG emissions in tons of CO<sub>2</sub> equivalent for the Project are set out in *Table 4.5*.

**Table 4.5** *Greenhouse Gas Calculation*

Vessel	Fuel* Consumed (tonnes)	CO <sub>2</sub> Emission (Tonnes)
MODU	1,600	5,130

\*fuel estimated as Marine gas oil

The wastewater generated by the MODU and support vessels includes domestic and sanitary wastewater, deck drainage and bilge water that will be treated and monitored onboard before discharge into the surrounding environment. These wastewater releases will strictly comply with International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 Annex I requirements.

A variety of non-hazardous solid wastes will be generated during the exploration drilling activity such as glass, paper, plastic and wood. No solid wastes will be disposed of into the marine environment; they will be collected and shipped to shore. Vessels shall be operated in compliance with MARPOL regulations whereby the discharge of comminuted and disinfected sewage and food waste ground to particle size <25 millimetre (mm) is permitted >3 nautical mile (nm) from the nearest land. Hazardous wastes such as lubricants, filters, chemical containers, used equipment or batteries will be stored and consolidated for onshore processing and/or disposal.

**5.1****INTRODUCTION & SETTING THE STUDY LIMITS**

The following section describes the physical, biological and human system (mainly fishing) within the waters of offshore Myanmar and the potential Area of Influence. In terms of environment, the Area of Influence encompasses the waters of Block AD-3 and the surrounding waters offshore southern Rakhine State. As the Project is located over 175 km (108 miles) from the mainland and 150 km (93 miles) from the nearest coast (Manaung Island), information on shallow water and coastal habitats and species is provided to support a general baseline description only; the focus of the baseline information is on open, deep water habitats. For the social assessment, the closest land to the Project is located within Rakhine State. However, as the Project will be located at least 150 km (93 miles) from the nearest land, information relating to the human environment will be limited and focused on the offshore fishing, shipping and other activities which could overlap with the Project activities.

The information provided in this section is based on a desktop review of published information, supplemented with information provided by Ophir Myanmar and through review of available ERM and E Guard in house literature.

Where possible, environmental and social information collected as part of the 3D seismic campaign run by Ophir Myanmar during 2015 has also been incorporated. Primary data collected during scoping consultations and during a visit to Sittwe in April 2016 and Thandwe in June 2016 have also been used to supplement the known information. More details on the engagement activities undertaken for scoping are provided in *Section 8.3*.

**5.2****PHYSICAL CHARACTERISTICS****5.2.1*****Climate and Meteorology***

The weather and climate of Myanmar is primarily influenced by the Northeast and the Southwest Monsoons and the short transitional periods between them. A high level study of the meteorological and oceanographic conditions in Myanmar has been performed. This study found that the majority of time winds blow from the north from October to February, and from the west and south west for the remainder of the year. This coincides with general climate information on Myanmar which shows a pattern of the southwest monsoon (June to September) is characterised by extensive cloud cover, light rain almost daily, interspersed with rain squalls or thunderstorms.

The northeast monsoon (December to April) brings less cloud, scant rainfall, mild temperatures and lower humidity during winter.

The spring and autumn transition periods between the monsoons (April and May, October and November) are generally hot with very variable weather and heavy squalls. The transition periods are governed by the Inter-Tropical Convergence Zone (ITCZ) which separates the main wind streams of the northern and southern hemispheres. The ITCZ moves seasonally over the area (northwards in spring and southwards in autumn), with no well-defined weather pattern.

### 5.2.2 *Storms and Cyclones*

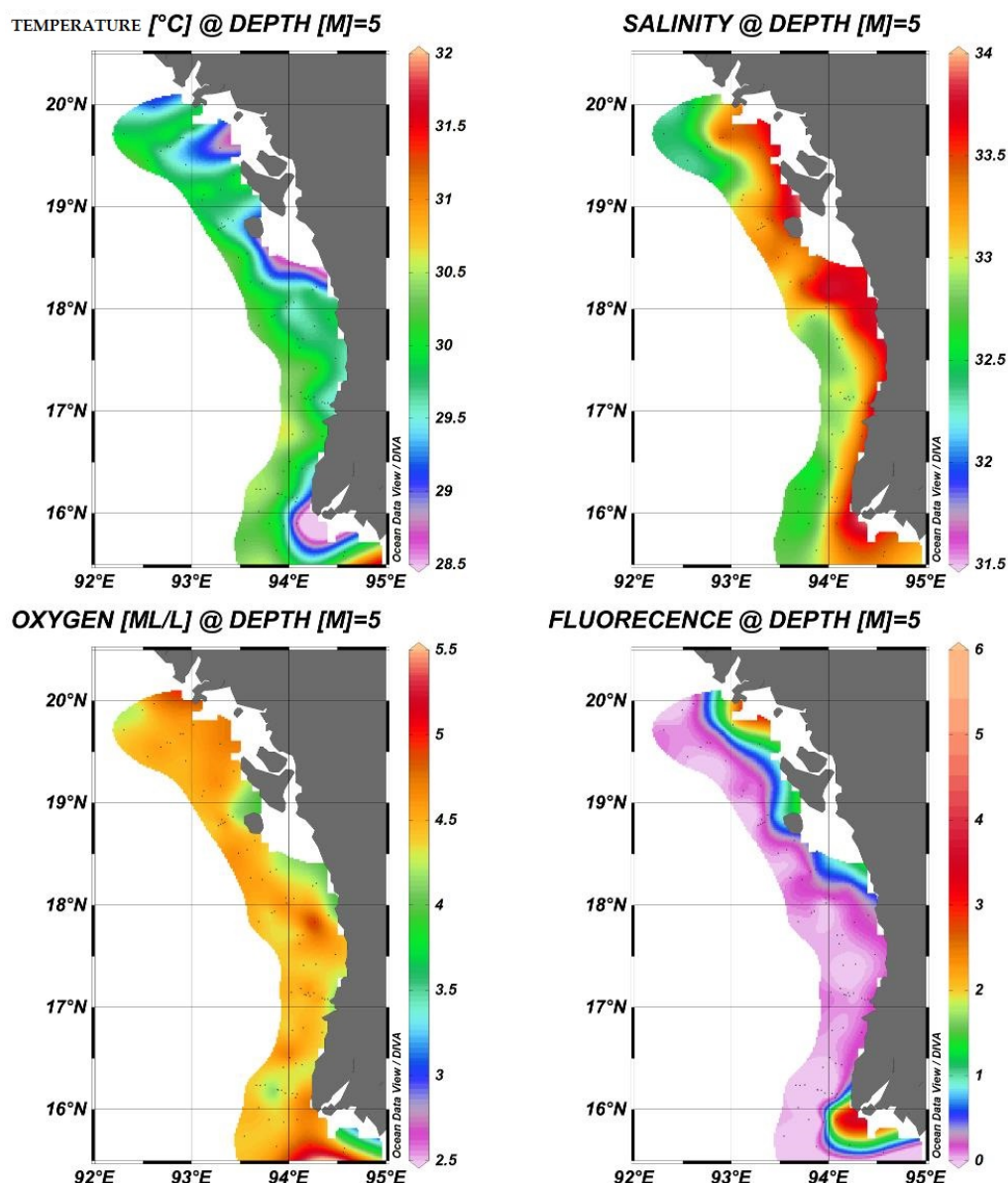
Gale force winds ( $17.2 \text{ ms}^{-1}$  or over) are mainly associated with local rain squalls and with severe tropical storms or cyclones. The central region of the Bay of Bengal receives the worst buffeting during the summer monsoon. The threat of cyclones with winds above  $32.7 \text{ m s}^{-1}$  affects different areas at different times of the year, affecting all areas though the major tracks do not pass over the Andaman Sea. They are most frequent from mid-May to early December.

### 5.2.3 *Oceanography and Hydrology*

The surface circulation of the Bay of Bengal moves generally clockwise from January to July and counter-clockwise from August to December, in accordance with the reversible monsoon wind systems. The flow is not constant and depends on the strength and duration of the winds. The effects of a strong wind blowing for a few consecutive days are reflected in the rate of flow. Currents to the northeast generally persist longer and flow at greater speed because of the stronger southwest monsoons. An important vertical circulation in the Bay of Bengal is a surge very similar to up-welling. In this process, sub-surface water is brought toward the surface. In Myanmar, the highest astronomical tide is recorded as 1.32 m above sea level and the lowest is 1.26 m below sea level.

An oceanographic survey of the waters of Rakhine State was conducted in April 2015 as part of the 'Dr. Fridtjof Nansen' survey (Myanmar Ecosystem Survey, 2015). The near surface (5m depth) water temperature ranged from  $29^{\circ}\text{C}$  to  $30.5^{\circ}\text{C}$ . Water plumes near the coast of the border to Bangladesh, around Manaung Island, the waters off Thandwe showed the lowest temperatures (*Figure 5.1*). Salinity measurements at 5m depth ranged between 32-34 parts per thousand (ppt), with the lowest values found the further offshore. Oxygen levels in surface waters were generally high ( $\sim 4 - 5 \text{ ml/l}$ ), and showed relatively high variability. The lowest oxygen concentrations were associated with the coldest water. Information collected on temperature, salinity, fluorescence and oxygen levels is presented visually in *Figure 5.1*.

**Figure 5.1** Horizontal near-surface (5m depth) distributions of temperature, salinity, oxygen and fluorescence along the Rakhine coastal region.

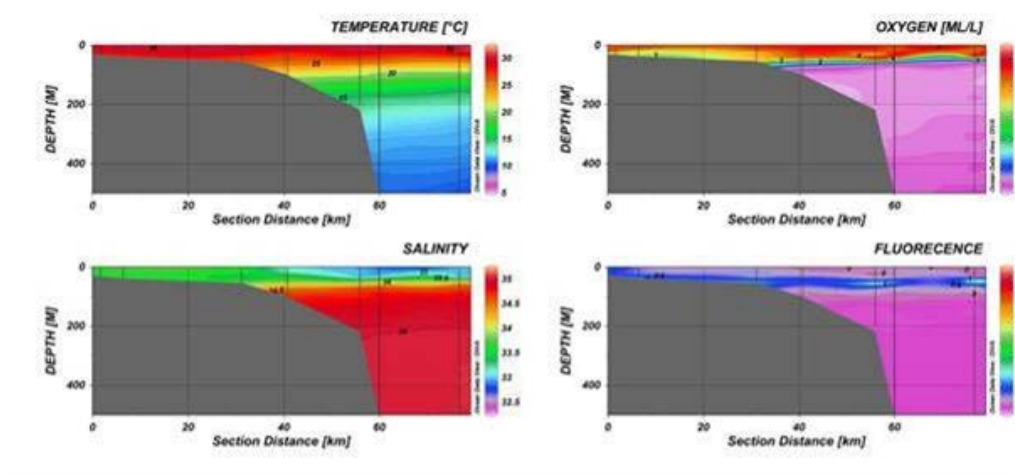


Station positions indicated as black dots. Note variable colour scales for the different figures

Surveys of temperature, oxygen levels, salinity and fluorescence were also taken along transects to show variation with depth. The closest transect to Block AD-3 is located offshore Thandwe and is shown in Figure 5.2. The strongest temperature, oxygen and salinity clines (i.e. changes) were associated with the shelf edge. The coldest water was typically <10°C in the 400-500 m depths, increasing to 15°C around 200 m. The depth of the strongest salinity- and oxy -clines seem strongly correlated at around 70-100 m depth. Below this, the water masses were typically of highest salinity and with hypoxic O<sub>2</sub> levels <0.25 to more than 500 m depth.



**Figure 5.2** *Cross-shelf distributions of temperature, salinity, oxygen and fluorescence in Transect No. 3 (Andrew Bay) Offshore Thandwe*



#### 5.2.4 *Seabed Topography and Sediments*

The seabed topography along the coast of Myanmar falls under two distinct types with the narrow continental shelf and deep water in the north, which is typical of the Bay of Bengal, and the wide continental shelf and shallow waters in the south, which is typical of the Andaman Sea and the Gulf of Martaban. The continental slope is not a uniform slope, instead being incised by steep gulleys and canyons.

Block AD-3 is situated over abyssal plain with water depths exceeding 2,400 m (7,800 ft.). The seabed at the well location is expected to be characterized by soft mud due to heavy sedimentation of the area (Kader et al, 2013).

#### 5.2.5 *Natural Hazards*

##### *Earthquakes*

A review of available literature has shown that Myanmar is seismologically unstable and vulnerable to earthquakes due to its location in the active Alpidic seismotectonic belt and the young Alpine-Himalayan-Sumatran orogenic belt (Theilen and Pararas-Carayannis, 2009). Historic records show that at least 15 major earthquakes with magnitudes  $M \geq 7.0$  RS have occurred in Myanmar in the last hundred years. Earthquakes occurred within the Ayeyarwady Delta in the last century, at Bago (5 May 1930), at Yangon (27 March, 16 May and 21 May 1931), at Sagaing (16 July 1956) and at Bagan (8 July 1976) (Union of Myanmar, 2009). Historical records of earthquakes are noted within and nearby Block AD-3 and the magnitudes of the earthquakes were less than 6.0 (Union of Myanmar, 2009) (Figure 5.3). An assessment of hazards during drilling (including earthquakes) was commissioned by Ophir for this Project (RPS, undated).

## *Tsunami*

Myanmar is an earthquake-prone country and at moderate risk for tsunamis. Tsunamis have been recorded in the Myanmar coastal areas. The 2004 tsunami generated by the Sumatra earthquake caused moderate damage to the Rakhine Coast, Ayeyarwady Delta and the Tanintharyi Coast with more than 60 lives and hundreds of boats lost (Union of Myanmar, 2009). The southern Rakhine Coast, including Thandwe and Gwa, is generally rocky and sandy without mangrove protection. As such, it is considered that this area is comparatively more vulnerable to a potential tsunami.

## **5.3 BIOLOGICAL CHARACTERISTICS**

### **5.3.1 Coastal Habitats**

Although the Project is located over 150 km (93 miles) from the nearest land (Manaung Island), the following sections provide a brief overview of the coastal habitats neighbouring Block AD-3. Given the distance between habitats and Project activities, it is unlikely that there will be any impact on these coastal receptors. The locations of coastal habitats taken from secondary baseline data sources are shown in *Figure 5.4*.

#### *Coral Habitats*

In shallow waters, United Nations Environment Programme (UNEP) satellite analyses show coral habitats (usually fringing or patch reefs in Myanmar) occur along the coast of Rakhine State. Potential coral reef and coral habitat areas in the Area of Influence are shown in *Figure 5.4*. Hard and soft corals are known to occur in near shore waters in the Area of Influence and the prevalence of rocky substrate in shallow waters indicates favourable conditions for the growth of coral communities are likely (Spalding et al, 2001). Coral habitat around Manaung is estimated to be up to water depths of around 20 m based on existing secondary data. This is the closest potential coral habitat to Block AD-3; however, this is located over 100 km (60 miles) away.

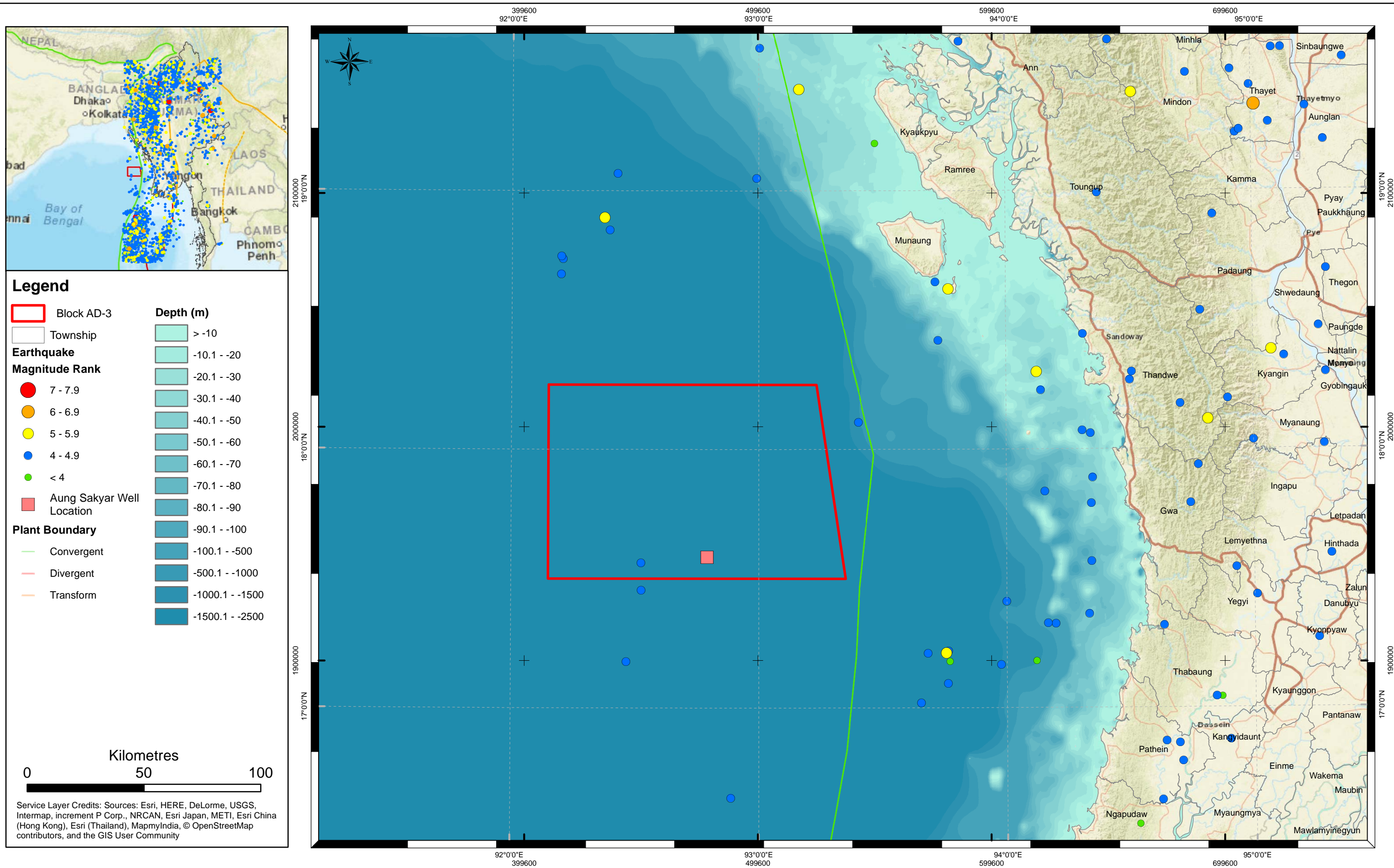
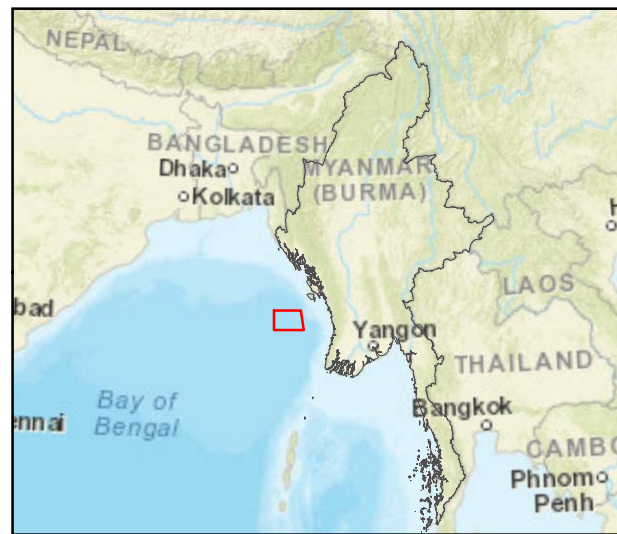























Figure 5.3

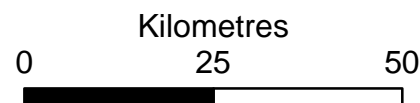
Historical Records of Locations of Earthquake in Myanmar





**Legend**

- |   |                           |   |                 |
|---|---------------------------|---|-----------------|
|  | Block AD-3                |    | Depth (m)       |
|  | Township                  |    | > -10           |
|  | Aung Sakyar Well Location |    | -10.1 - -20     |
|  | Coral Reefs               |    | -20.1 - -30     |
|  | Mangrove                  |    | -30.1 - -40     |
|  | Seagrass                  |    | -40.1 - -50     |
|   |                           |  | -50.1 - -60     |
|   |                           |  | -60.1 - -70     |
|   |                           |  | -70.1 - -80     |
|   |                           |  | -80.1 - -90     |
|   |                           |  | -90.1 - -100    |
|   |                           |  | -100.1 - -500   |
|   |                           |  | -500.1 - -1000  |
|   |                           |  | -1000.1 - -1500 |
|   |                           |  | -1500.1 - -2500 |



Service Layer Credits: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

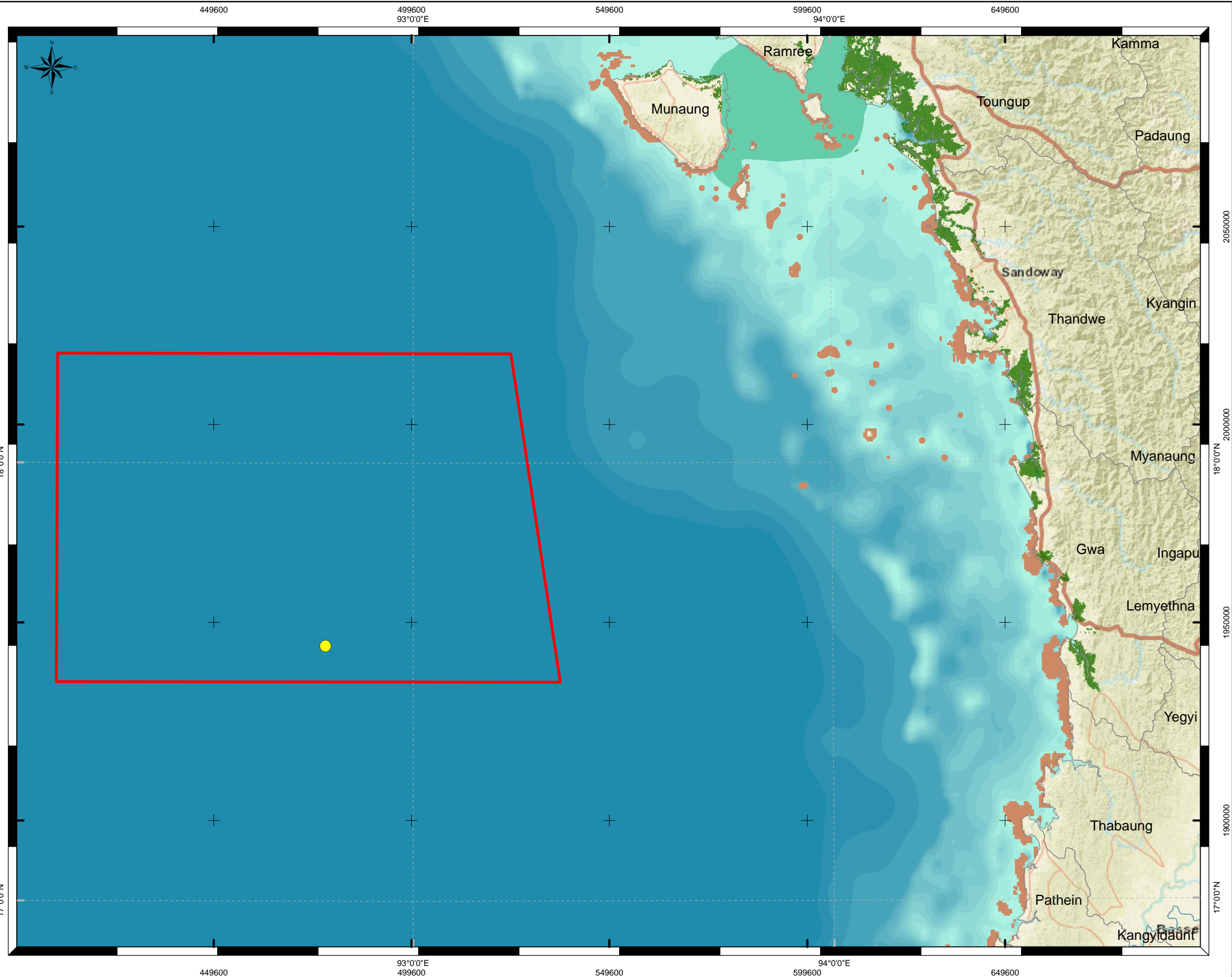


Figure 5.4

Coastal Habitats in Area of Influence

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Date: 4/7/2016

Environmental  
Resources  
Management



Given the distance between coral habitats and the Block, corals are not expected to be impacted by Project activities.

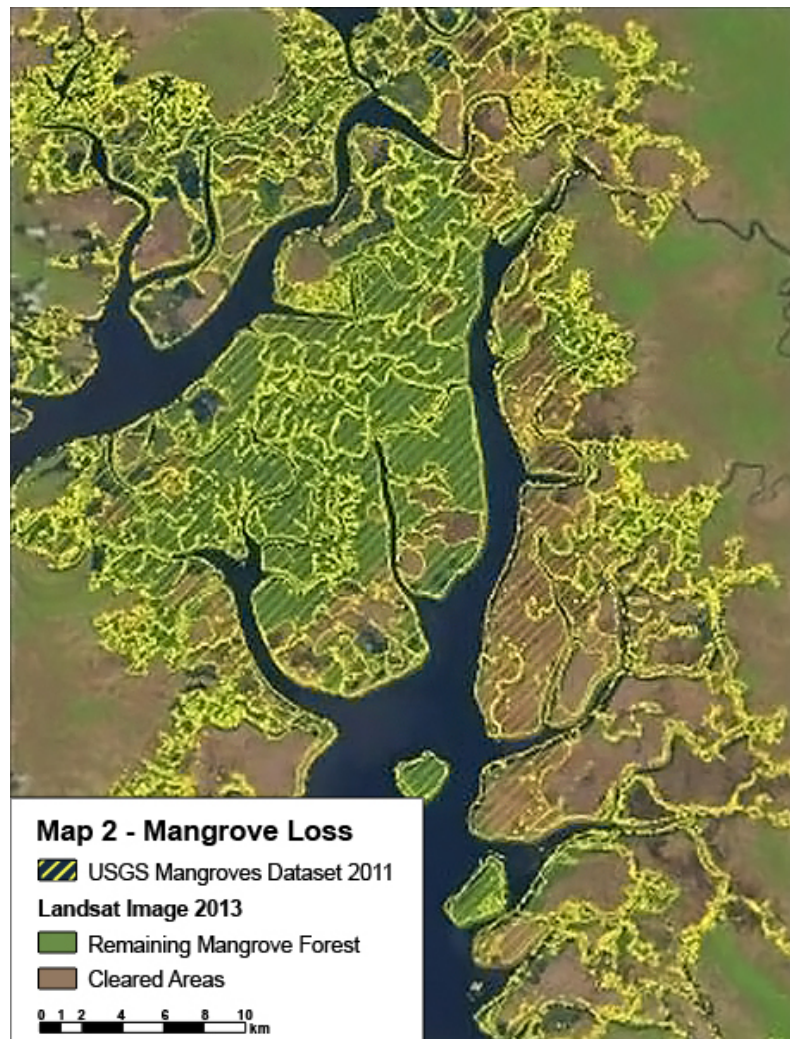
### *Mangroves*

Within Myanmar, Rakhine State along with the Ayeyarwady Delta and Tanintharyi Region are the most important area for mangroves. There are well developed mangrove areas within the Area of Influence with extensive mangrove areas occurring along the shores surrounding the sheltered lee side of Ramree Island and river mouths and inland areas fringing the tidal creeks of rivers. Sheltered areas along the coast also support stands of mangrove (UNEP-WCMC 2011). These areas do not face Block AD-3. The closest areas of mangroves to Block AD-3 are located 150 km (93 miles) away.

Mangroves recorded from Rakhine State coast include *Rhizophora*, *Xylocarpus*, *Avicennia*, *Bruguiera*, *Sonneratia*, *Heritiera*, *Finlaysonia*, *Ceriops*, *Lumnitzera*, *Excoecaria*, *Nypa* and *Aegiceras*.

Reclamation of mangrove areas is a well recorded phenomenon in the Area of Influence. The use of mangrove forest for agricultural land and firewood in Rakhine State, Ayeyarwady Delta and Tanintharyi regions, has seen a reduction in the recorded 85,533 ha of mangroves at the beginning of the 1990s by approximately 50 percent in 2002 (U Tin Tun, *undated*). Mangroves in Rakhine state are also reportedly being lost to shrimp farming (*Figure 5.5*).

Figure 5.5 Example of Extent of Mangrove Habitat Loss due to Farming in Rakhine State



Source: Zöckler, et al, 2013.

### Seagrass

Seagrass beds typically occur in shallow (usually < 20 m (65 feet) of water depth), sheltered intertidal or sub-tidal areas and are recognised as areas of high biological productivity and support more diverse invertebrate communities (Short, et al, 2001). Sheltered nearshore waters surrounding Manaung Island provide suitable conditions and are expected locations for seagrass habitat and growth (U. Soe-Htun, et al, 2001). The potential seagrass habitats are shown on *Figure 5.4*. The closest areas of seagrass to Block AD-3 are located over 150 km (93 miles) away.

In waters around the Rakhine State, seagrass beds are expected to serve as nurseries and habitats for fish and invertebrates, and may also provide a food source for grazing animals including green turtles (*Chelonia mydas*), hawksbill turtles (*Eretmochelys imbricata*) and dugongs (*Dugong dugon*), which are species of international conservation interest.



In Thandwe (the closest township on the mainland coast to Block AD-3), seagrass species *Halophila decipiens*, *Halodule pinifolia*, *Cymodocea serrulata* and *Syringodium isoetifolium* have been observed (U. Soe-Htun, et al, 2001). All four of these species are classified as Least Concern on the International Union for the Conservation of Nature (IUCN) 2015 Red List of Threatened Species which means in terms of survival of individual seagrass species, they are not recognized as a species of conservation concern. However, Block AD-3 is located in over 2,400 m (7,800 ft.) water depth and seagrass is not expected to be impacted by Project activities.

### 5.3.2

#### *Plankton*

Block AD-3 spans deep open ocean waters. Moderate Resolution Imaging Spectrometer (MODIS) Aqua satellite datasets (NOAA 2015) from the area within and surrounding Block AD-3 show that chlorophyll *a* concentrations and inferred phytoplankton standing crop levels in the surface layer are higher in the Northeast season (November to March) than in Southwest (June to September). As is typical, highest chlorophyll levels ranging up to 10 mg/m<sup>3</sup> occur closest to the coast likely due to nutrient inputs from the land such as from rivers.

There are limited data on the species composition, abundance and distribution of plankton within the Study Area. Some studies have been undertaken in the wider Bay of Bengal with for instance; phytoplankton communities found to be dominated by diatoms (Bacillariophyceae) followed by dinoflagellates (Dinoflagellata) in terms of abundance in different survey areas (north, west and east). The composition, abundance and distribution of phytoplankton species was recorded in November 2007 (Booonyapiwat, et al, 2007) during the northeast monsoon period (the period in which the exploration drilling will be undertaken). During this survey, the northern part of the Bay of Bengal (located offshore of the waters of Myanmar between Myanmar and India) was found to be the most productive area with high phytoplankton densities recorded, likely associated with nutrient-rich discharges from large rivers on the north coast. Phytoplankton in this northern area were found to be dominated by the diatoms *Pseudonitzschia pseudodelicatissima* <sup>(5)</sup> and *Chaetoceros messanensis* which were the main contributors to 'massive' phytoplankton blooms of this area at the time of sampling.

Given the limited scope to impact plankton concentrations or abundance, plankton is not particularly sensitive to the Project activities.

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(5) This diatom species is a potentially harmful species that can produce a neurotoxin (domoic acid) linked to amnesic shellfish poisoning.



### 5.3.3 *Benthic Invertebrates*

Given the lack of data on the deep water habitats (e.g. continental slope and abyssal plain) within the Area of Influence and the wider Bay and Bengal, the composition of benthic invertebrates is not known, however, common deep water species from typical family groups of polychaetes, sponges, molluscs and echinoderms are likely to be present. As the exploration drilling is to be conducted in water depths exceeding 2,400 m (7,800 ft.); the deep sea benthic community is expected to be of low productivity and biodiversity, and thus unlikely to be sensitive to Project activities.

### 5.3.4 *Fish*

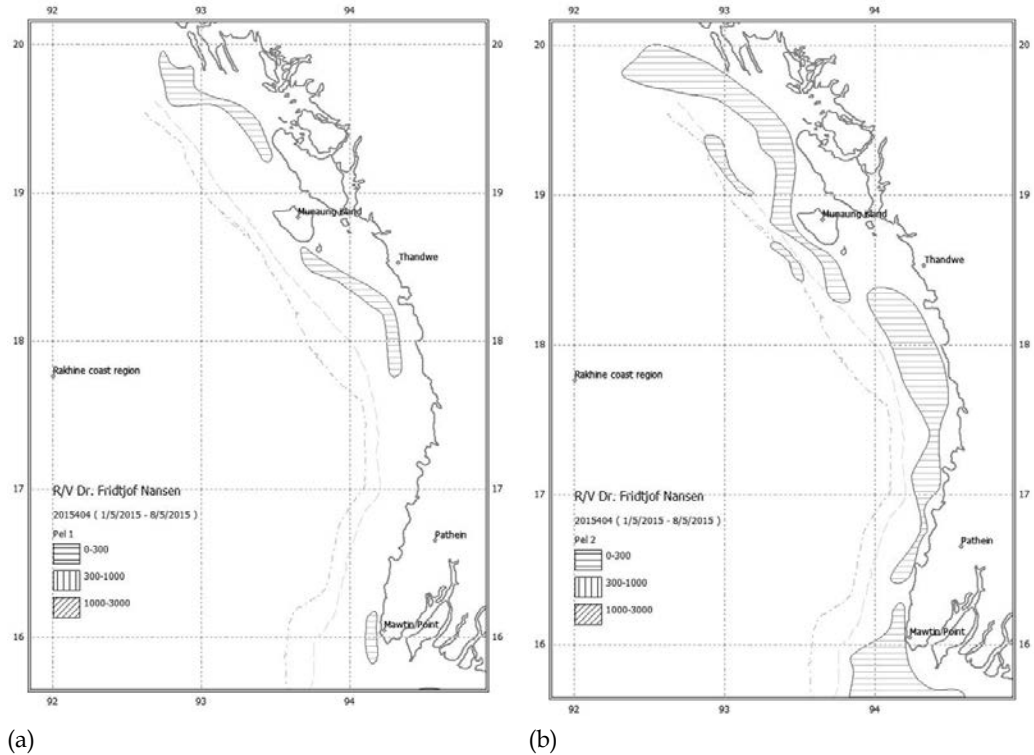
Fish communities in the Area of Influence occupy a range of habitats from coral and rocky reefs and seagrass habitat in shallow waters to deep-water habitats below the sun-lit euphotic zone (>200 m or 650 feet) in open ocean, and the open water pelagic zone. As the Project is located in water depths of over 2,400 m (7,800 ft.), the focus of this section will be on fish species that inhabit this area. Pelagic species are those that inhabit open water areas (such as Block AD-3) and generally undertake large migrations between feeding grounds and spawning areas throughout the year.

Recent trawl surveys to look at fisheries composition were conducted by the R.V. Dr. Fridtjof Nansen in 2013 and covered 41 fishing stations in Rakhine State and west coast of the Ayeyarwady Division, as well as other parts of Myanmar waters. The findings were summarised as showing that pelagic marine fishery resources have significantly decreased, tenfold for this sample example, in Rakhine between 1980 and 2013, which was attributed to exploitation by fisheries. An "Ecosystem Survey" as an extension to the trawl surveys was carried out between April and June 2015 by the Institute of Marine Research, Norway and Myanmar's Department of Fisheries (Myanmar Ecosystem Survey, 2015). This survey used two methods to assess the number of fish species in Myanmar waters; an acoustic survey and a catch survey. Information from this report is summarised below.

Acoustic distribution and abundance was estimated for two species groups during the survey; 1. Clupeidae and Engraulididae and 2. Carangidae, Scombridae, Barracuda and Hairtails. The Group 1 species were separated from the Group 2 species based on their presence in catches, and the fact that Clupeidae and Engraulididae has a much stronger backscattering signal than Carangidae and other Group 2 species. The most common Group 1 species on the Rakhine coast was the Engraulidae *Stolephorus indicus*, no other clupeids were frequent in the catches. This species was mostly present in low density concentrations close to the coast, mainly shallower than 50 m. A total acoustic abundance index of 21,000 tonnes of fish was estimated based on a set (average) total length of 10 cm, which was about double the 2013

estimate of 10 000 tonnes. However, this is considered to be well within the range these species can fluctuate in abundance (Figure 5.6).

**Figure 5.6** Distributions of acoustic backscattering of Group 1 (a) and Group 2 (b) species along the Rakhine Coast



The most common Group 2 species found in the region was the Hairtails; *Trichiurus lepturus* and *Lepturacanthus savala* and the Carangids; *Selar crumenophthalmus* and *Decapterus russelli*. The species composition of pelagic species during this survey was considerably different from the November-December 2013 survey. During that survey *Lepturacanthus savala*, the Carangid *Megalaspis cordyla*, *Carangoides malabaricus* and the Scombrid *Scomberomorus guttatus* and *Rastrelliger kanagaruta* dominated. The total acoustic abundance index was 19,000 tonnes compared to 23 000 tonnes in 2013.

The abundance and composition of fish species in Rakhine was also assessed by catch surveys. Trawls were conducted offshore Rakhine at 49 different stations; 16 between 20 -50 m depth, 14 between 50 - 100 m depth, 13 between 100 - 200 m depth, 5 between 200 - 500 m depth and 1 > 500 m. The survey found a mixed group of species at the lowest depth surveyed (i.e. 200-500m depth) during the Rakhine coast survey, including Sharks, Ophidiidae, Muraenesocidae, Jellyfish, Shrimps, Triglidae, Cephalopoda, and Brachyura. There is a visible difference in the species composition compared to the survey conducted in 2013 where the brotulas (cask eels) was the most important caught species.

A total of 372 different species were caught in the Rakhine coast stations, with 48 of these recorded over 200 m water depth. The greatest number of species was recorded in 20-50 m water depth (200 species). Biomass estimates of this depth in Rakhine coast are 23,000 in 2015, up from 2013 estimates of 5,200. The results of the analysis by region showed that the most common species (groups) in the Rakhine coastal zone were *Trichiurus lepturus*, *Priacanthus hamrur*, Jellyfish, *Saurida tumbil*, *Gazza minuta*, *Nemipterus japonicus*, *Benthoosema fibulatum*, *Decapterus sp.*, and *Stolephorus indicus*.

The main commercial fish species in Rakhine waters are shown in Table 5.1 This list was compiled from information from the Myanmar National Report (Myint Pe, *undated*) and the 2015 survey discussed above.

**Table 5.1** *Main Pelagic Commercially Important Fish Species Reported to occur in Rakhine Waters*

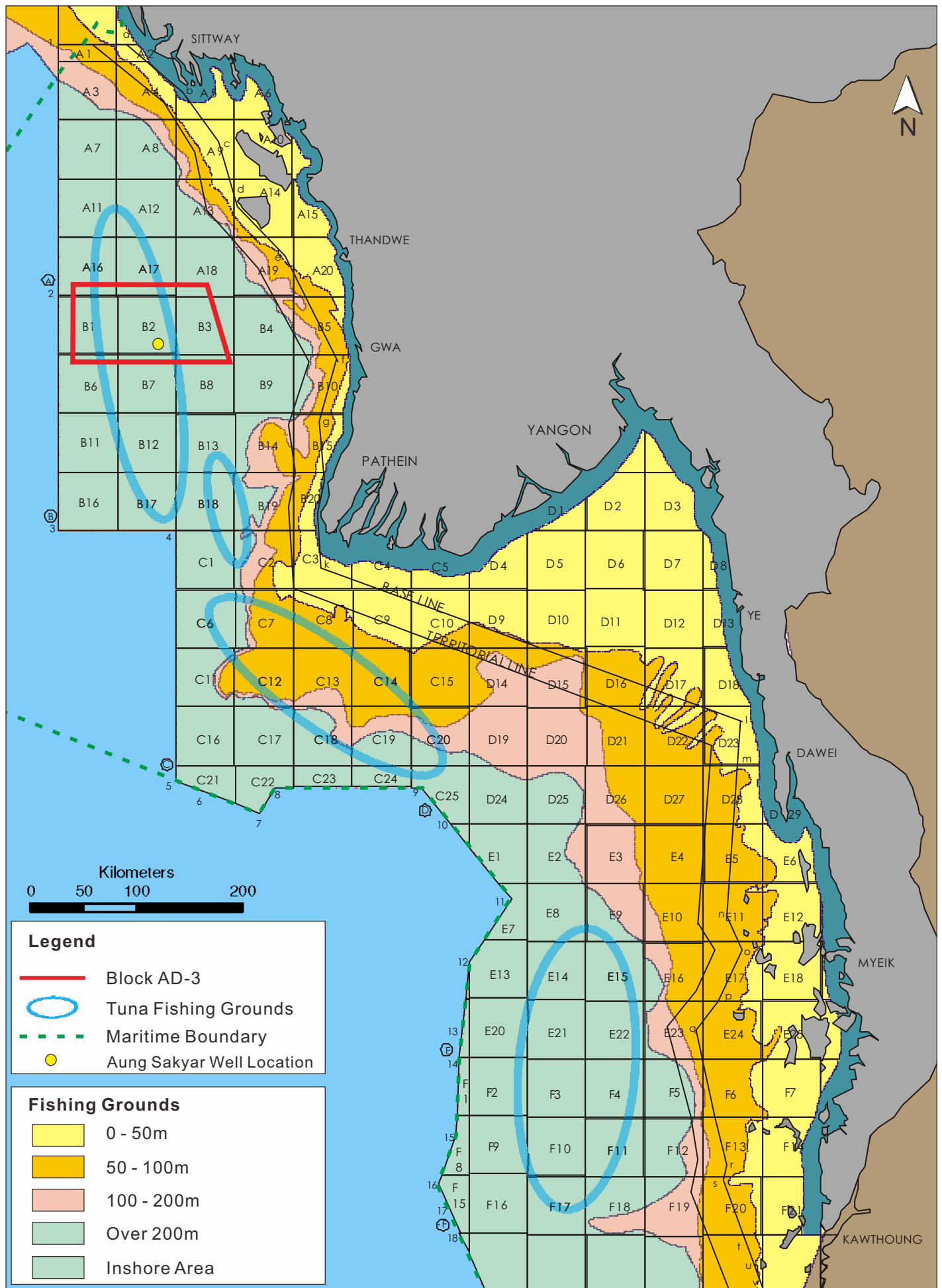
Latin name	Common Name	IUCN Status*
<b>CARANGIDAE</b>	<b>Jacks</b>	
<i>Carangoides malabaricus</i>	Malabar trevally	Not yet assessed
<i>Decapterus sp.</i>	Scads / mackerel scads / horse mackerel	-
<i>Megalaspis cordyla</i>	Torpedo scad	Not yet assessed
<i>Selar crumenophthalmus</i>	Bigeye scad	Least Concern
<b>CLUPEIDAE</b>	<b>Herring/Shad/Sardine</b>	
<i>Anodontostoma chacunda</i>	Chacunda gizzard shad	Not yet assessed
<i>Dussumieria acuta</i>	Rainbow sardine	Not yet assessed
<i>Encrasicholina heteroloba</i>	Shorthead anchovy	Not yet assessed
<i>Hilsa ilisha</i>	Elongate ilisha	Not yet assessed
<i>Opisthopterus tardoore</i>	Tardoore	Not yet assessed
<i>Sardinella gibbosa</i>	Gold stripe sardinella	Not yet assessed
<i>Tenuulosa ilisha</i>	Hilsa shad	Least Concern
<b>ENGRAULIDAE</b>	<b>Anchovy</b>	
<i>Stolephorus indicus</i>	Indian anchovy	Not yet assessed
<b>EXOCOETIDAE</b>	<b>Flying Fish</b>	
<i>Exocoetidae sp.</i>	Flying fish	-
<b>LATIDAE</b>	<b>Perch</b>	
<i>Lates calcarifer</i>	Barramundi	Not yet assessed
<b>LEIOGNATHIDAE</b>	<b>Ponyfish</b>	
<i>Gazza minuta</i>	Toothed ponyfish	Least Concern
<b>MYCTOPHIDAE</b>	<b>Lantern fish</b>	
<i>Benthoosema fibulatum</i>	Spinycheek lantern fish	Not yet assessed
<b>NEMIPTERIDAE</b>	<b>Threadfin breams</b>	
<i>Nemipterus japonicus</i>	Japanese threadfin bream	Not yet assessed
<b>PRIACANTHIDAE</b>	<b>Bigeyes</b>	
<i>Priacanthus hamrur</i>	Lunar-tailed bigeye	Not yet assessed
<b>SCOMBRIDAE</b>	<b>Mackerels</b>	
<i>Katsuwonus pelamis</i>	Stripped tuna (skipjack)	Least Concern

Latin name	Common Name	IUCN Status*
<i>Rastrelliger brachysoma</i>	short bodied mackerel	Data Deficient
<i>Rastrelliger kanagurta</i>	Indian mackerel	Data Deficient
<i>Scomberomorus guttatus</i>	Indo-pacific Spanish mackerel	Data Deficient
<i>Scomberomorus lineolatus</i>	Streaked Spanish mackerel	Least Concern
<i>Scomberomorus commerson</i>	Narrow barred Spanish mackerel	Near Threatened
<i>Scomberomorus maculatus</i>	Spanish mackerel	Least Concern
<b>SYNODONTIDAE</b>		
<i>Saurida tumbil</i>	Greater lizardfish	Not yet assessed
<b>TRICHIURIDAE</b>		
<b>Hair tail / Ribbon fish</b>		
<i>Lepturacanthus savala</i>	Savalai hairtail	Not yet assessed
<i>Trichiurus lepturus</i>	Largehead hairtail	Not yet assessed

\* The IUCN Red List of Threatened Species. Version 2015-4 ("IUCN 2015 Red List"). [www.iucnredlist.org](http://www.iucnredlist.org)

Of the pelagic species most commonly caught in Myanmar waters (Myint Pe, *undated*), one is considered as species of conservation concern on the IUCN 2015 Red List; Narrow barred Spanish mackerel (*Scomberomorus commerson*). Mackerel are caught in open water areas and could potentially be found within Block AD-3.

Block AD-3 is located in the middle of a known Yellowfin Tuna (*Thunnus albacares*) fishing ground (see *Figure 5.7*). These grounds are expected to be utilized by Myanmar licensed long line vessels (given foreign fishing vessels are banned from Myanmar waters). In 2011, nearly 200 tonnes of Yellowfin tuna were caught in Myanmar mainly for export, with the number of licensed long line vessels increasing significantly to 109 in the same year.



**Legend**

- Block AD-3
- Tuna Fishing Grounds
- Maritime Boundary
- Aung Sakyar Well Location

**Fishing Grounds**

- 0 - 50m
- 50 - 100m
- 100 - 200m
- Over 200m
- Inshore Area

Figure 5.7

Fishing Blocks in Rakhine Waters

Swordfish (*Xiphias gladius*), Striped marlin (*Tetrapturus audax*) and Sailfish (*Istiophorus platypterus*) also inhabit Myanmar offshore waters, with Swordfish being the most abundant species and the potential to be a future commercial fish. These and other species, such as Pelagic Thresher (*Alopias pelagicus*), Oceanic Whit-tipped shark (*Carcharhinus longimanus*), Escolar (*Lepidocybium flavobrunneum*), Pelagic stingray (*Dasyatis sp.*), and Snake mackerel (*Gempylus serpens*) were also found in a survey reported by Julius Kyaw of Myanmar's Department of Fisheries (2011) (Julius Kyaw, 2011).

**Table 5.2** *Status of Other Fish Species Reported in Myanmar's Offshore Fisheries*

Latin name	Common Name	IUCN Status*
<i>Alopias pelagicus</i>	Pelagic Thresher	Vulnerable
<i>Carcharhinus longimanus</i>	Oceanic Whitetip Shark	Vulnerable
<i>Thunnus albacares</i>	Yellowfin tuna	Near threatened
<i>Xiphias gladius</i>	Swordfish	Least concern
<i>Istiophorus platypterus</i>	Sailfish	Least concern
<i>Lepidocybium flavobrunneum</i>	Escolar	Least concern
<i>Gempylus serpens</i>	Snake mackerel	Least concern
<i>Tetrapturus audax</i>	Striped marlin	Not yet assessed

\* The IUCN Red List of Threatened Species. Version 2015-4 ("IUCN 2015 Red List") [www.iucnredlist.org](http://www.iucnredlist.org)  
Source: Julius Kyaw, 2011

Whale sharks (*Rhincodon typus*) are listed as vulnerable on the IUCN 2015 Red List. This species is highly migratory occurring in both tropical and temperate waters, though there is a general lack of knowledge on many aspects of whale shark biology, including definitive migration patterns (Colman, 1997). The species normally has an oceanic distribution but can occur in coastal waters. In the Bay of Bengal, whale sharks have been recorded in the northern area of Bengal (off the Bangladesh coast) from December to March (Rowat, D., 2007).

Data on other sharks found within the Bay of Bengal are limited, Scalloped Hammerhead (*Sphyrna lewini*) and Great Hammerhead (*Sphyrna mokarran*), both listed as Endangered on the IUCN 2015 Red List are found within Myanmar's domestic waters, predominantly as by-catch. Other sharks reported in the Bay of Bengal include the vulnerable Smooth hammerhead (*Sphyrna zygaena*); and various other shark species (CITES, 2014).

### 5.3.5 *Marine Mammals*

A total of 21 cetaceans (whale and dolphin) and 1 sirenian species have been reported from Myanmar waters (Figure 5.8). Two marine mammals, the Irrawaddy dolphin (*Orcaella brevirostris*) and dugong (*Dugong dugon*), have been protected under the Myanmar Protection of Wildlife and Conservation of Natural Areas Law since 1994 under the category "completely protected".

### *Cetacean (Whales and Dolphins)*

Of the whale and dolphin species potentially present in Myanmar waters, most are far-ranging migratory oceanic species while several others are coastal species with closer affinities to shallow water habitat areas and estuarine areas. IUCN-listed threatened cetacean species in Myanmar waters are oceanic species that typically inhabit deep offshore open waters, namely the blue whale (*Balaenoptera musculus*) (Endangered), fin whale (*Balaenoptera physalus*) (Endangered) and sperm whale (*Physeter macrocephalus*) (Vulnerable). The blue whale and the fin whale are also listed as endangered species recognized as of prime importance to the Region and deserving special attention under the ASEAN Agreement on the Conservation of Nature and Natural Resources (ASEAN, 1985). Other common deeper water species such as humpback whale (*Megaptera novaeangliae*) and bryde's whale (*Balaenoptera edeni*) are known to occur in offshore waters in Myanmar; however these are listed as Least Concern and Data Deficient on IUCN Red List, respectively.

There are limited data on distribution, abundance, habitat utilization and seasonality of marine mammals in Myanmar due to only a handful of scientific surveys conducted and stranding information. Marine mammal sightings data was collected by Ophir Myanmar during the seismic surveys conducted in Block AD-3 from March to June 2015 (*Table 5.3*). During this period Byrde's whales were found to be the most commonly sighted cetacean. Of the species recorded, none are listed as species of conservational concern by the IUCN Red List. Historic sightings of marine mammals in Rakhine waters are also shown in *Figure 5.9*.



Common Name	Latin Name	IUCN Red List
<b>Baleen Whales</b>		
Bryde's whale	<i>Balaenoptera edeni</i>	Data Deficient
Blue whale	<i>Balaenoptera musculus</i>	Endangered
Fin whale	<i>Balaenoptera physalus</i>	Endangered
Humpback whale	<i>Megaptera novaeangliae</i>	Least Concern
<b>Toothed Whales</b>		
Blainville's beaked whale	<i>Mesoplodon densirostris</i>	Data Deficient
Dwarf sperm whale	<i>Kogia sima</i>	Data Deficient
False killer whale	<i>Pseudorca crassidens</i>	Data Deficient
Killer whale	<i>Orcinus orca</i>	Data Deficient
Melon-headed Whale	<i>Peponocephala electra</i>	Least Concern
Pygmy killer whale	<i>Feresa attenuata</i>	Data Deficient
Pygmy sperm whale	<i>Kogia breviceps</i>	Data Deficient
Short-finned pilot whale	<i>Globicephala macrorhynchus</i>	Data Deficient
Sperm Whale	<i>Physeter macrocephalus</i>	Vulnerable
<b>Porpoise and Dolphins</b>		
Dwarf Spinner Dolphin	<i>Stenella longirostris roseiventris</i>	Data Deficient
Indo-pacific bottlenose dolphin	<i>Tursiops aduncus</i>	Data Deficient
Indo-pacific finless porpoise	<i>Neophocaena phocaenoides</i>	Vulnerable
Indo-pacific humpbacked dolphin	<i>Sousa chinensis</i>	Near Threatened
Irrawaddy dolphin	<i>Orcaella brevirostris</i>	Vulnerable
Pantropical spotted dolphin	<i>Stenella attenuata</i>	Least Concern
Rissos dolphin	<i>Grampus griseus</i>	Least Concern
Spinner dolphin	<i>Stenella longirostris</i>	Data Deficient
Striped dolphin	<i>Stenella coeruleoalba</i>	Least Concern
<b>Sirenian</b>		
Dugong	<i>Dugong dugon</i>	Vulnerable



Photo by Amila Tennakoon



Photo by Amila Tennakoon



Photo by Adam Li



Photo by NOAA



Photo by Keith Mullin.



Photo by Amila Tennakoon



Photo by Aude Steiner



Photo by Dan Keohl

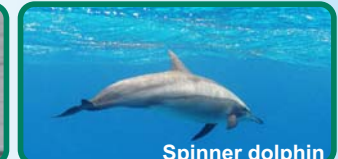


Photo by Alexander Vasenin



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Photo by Julien Willem

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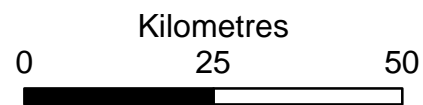
Figure 5.8

Marine Mammals Species in Rakhine Waters



**Legend**

- |   |                  |
|---|------------------|
| Block AD-3                              | <b>Depth (m)</b> |
| Township                                | > -10            |
| Aung Sakyar Well Location               | -10.1 - -20      |
| <b>Marine Mammal Sightings</b>          | -20.1 - -30      |
| Dugong (Dugong dugon)                   | -30.1 - -40      |
| Bottlenose dolphin (Tursiops truncatus) | -40.1 - -50      |
| Spinner dolphin (Stenella longirostris) | -50.1 - -60      |
| Bryde's whale (Balaenoptera edeni)      | -60.1 - -70      |
| <b>Turtle Nesting Sites</b>             | -70.1 - -80      |
| Green                                   | -80.1 - -90      |
| Hawksbill                               | -90.1 - -100     |
| Olive Ridley                            | -100.1 - -500    |
|   | -500.1 - -1000   |
|   | -1000.1 - -1500  |
|   | -1500.1 - -2500  |



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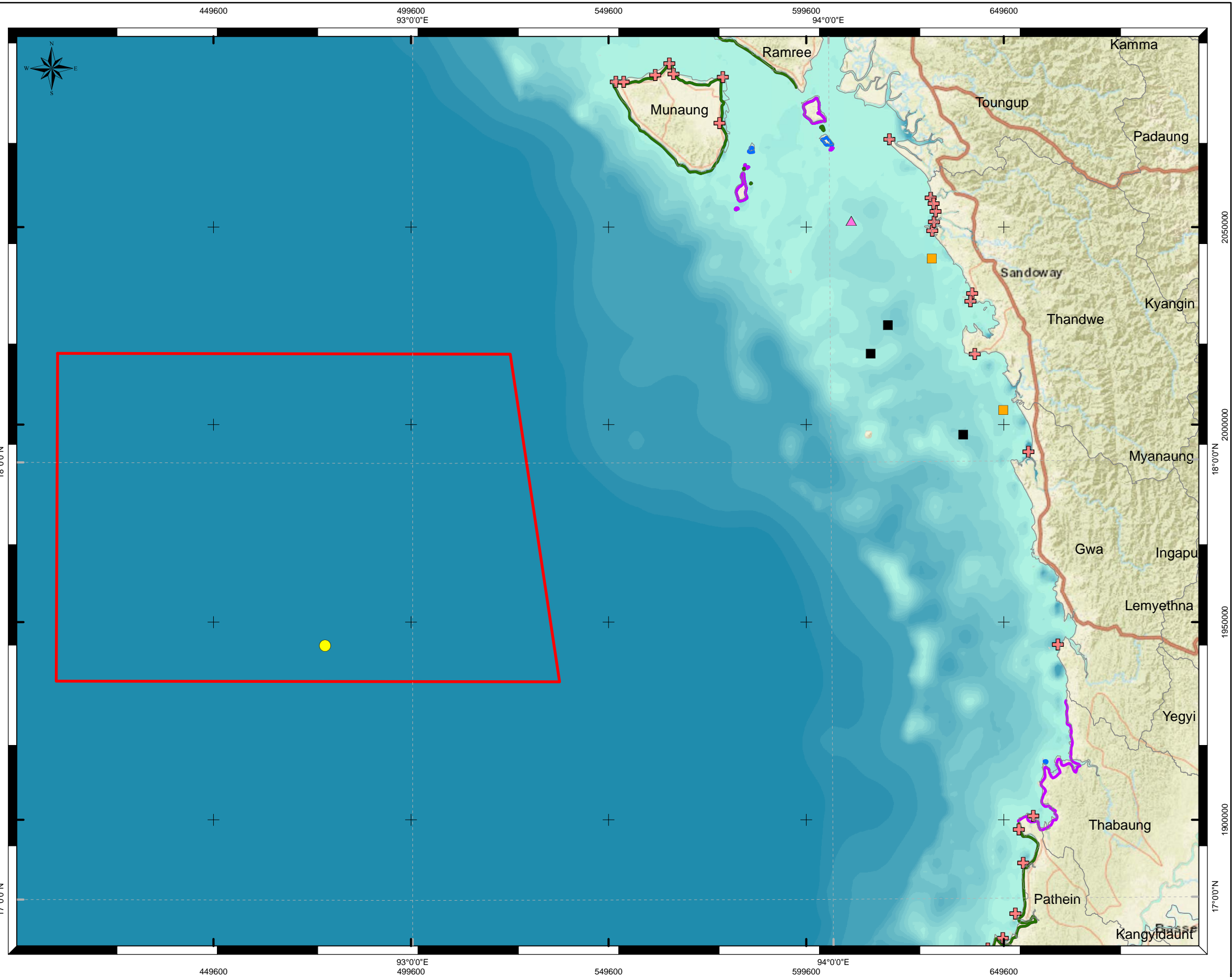


Figure 5.9

Marine Mammal Sightings and Turtle Nesting Beaches in Area of Influence

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Date: 4/7/2016

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Management**



**Table 5.3** *List of Marine Mammals Observed during Seismic Survey in Block AD-3 (March to June 2015)*

Marine Fauna Species	Number of Sightings
<b>Dolphins</b>	<b>96</b>
Common Bottlenose Dolphin [ <i>Tursiops truncatus</i> ]	1
Dwarf Spinner Dolphin [ <i>Stenella longirostris roseiventris</i> ]	31
Pantropical Spotted Dolphin [ <i>Stenella attenuata</i> ]	1
Risso's Dolphin [ <i>Grampus griseus</i> ]	4
Spinner Dolphin [ <i>Stenella longirostris</i> ]	10
Unidentifiable Dolphin [n/a]	49
<b>Whales</b>	<b>80</b>
Bryde's Whale [ <i>Balaenoptera edeni</i> ]	53
False Killer Whale [ <i>Pseudorca crassidens</i> ]	2
Humpback Whale [ <i>Megaptera novaeangliae</i> ]	2
Short-finned Pilot Whale [ <i>Globicephala macrorhynchus</i> ]	2
Sperm Whale [ <i>Physeter macrocephalus</i> ]	3
Unidentifiable Baleen Whale [n/a]	7
Unidentifiable Beaked Whale [n/a]	3
Unidentifiable Cetacean [n/a]	1
Unidentifiable Large Whale [n/a]	4
Unidentifiable Small Whale [n/a]	1
Unidentifiable Toothed Whale [n/a]	2

Based on the above historical information and the sightings recorded by Ophir Myanmar during the seismic campaign in 2015 in the same Block, it is considered likely that marine mammals will be present or pass through Block AD-3 during the proposed exploration drilling programme.

#### *Sirenians (Dugongs)*

Dugongs (*Dugong dugon*) are migratory species with factors governing movements including food availability. Dugongs rely on seagrass for nutrition and therefore typically inhabit shallow and sheltered coastal waters, though individuals occasionally may occur many kilometres from the coast. In Myanmar, these herbivorous mammals are rare and their distribution mainly extends in areas to the west of the Ayeyarwady Delta and northwards along the Rakhine State coast as far north as Bangladesh (Tint Tun and Anouk D. Ilangakoon, 2007). Dugongs inhabit shallow and sheltered coastal waters. Along with the Irrawaddy dolphin (*Orcaella brevirostris*); dugong are also protected under the Myanmar Protection of Wildlife and Conservation of Natural Areas Law since 1994 under the category “completely protected”.



Given their preference for nearshore/coastal areas, dugongs are not expected to be present in Block AD-3.

### 5.3.6 Marine Turtles

Myanmar waters host five species of marine turtles, all of which are IUCN-listed threatened species; olive ridley turtle (*Lepidochelys olivacea*), loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricate*), and leatherback turtle (*Dermochelys coriacea*) (Figure 5.10). UNEP data suggest sandy shore habitat along Ramree Island, Manaung Island and adjacent small coastal islands are nesting sites for green, olive ridley and hawksbill turtles.

All five species share similar life cycle characteristics, which include migration from foraging areas to mating (inter-nesting) and nesting areas (Miller JD, 1997). In general, mature adult turtles (approximately 30 to 50 years old) undertake the migration from their coastal shallow benthic foraging areas to shallow water inter-nesting areas waters near nesting beaches every two to eight years. On arrival, turtles mate and females may nest multiple times at about 2 week intervals before returning to foraging areas. Eggs hatch after 8 to 10 weeks of incubation with hatchlings dispersing into the open ocean surface waters where they forage for the next 5 to 20 years.

As with marine mammals, Ophir Myanmar have collected marine turtle sightings data within Block AD-3 during the seismic surveys conducted in 2015. 25 marine turtles were observed from March to June 2015; however, most were not identified to species level (Table 5.2).

**Table 5.4 List of Marine Turtles Observed during Seismic Survey in Block AD-3 (March to June 2015)**

Marine Fauna Species	Number of Sightings
Turtles	25
Green Turtle [ <i>Chelonia mydas</i> ]	1
Loggerhead Turtle [ <i>Caretta caretta</i> ]	2
Olive Ridley Turtle [ <i>Lepidochelys olivacea</i> ]	2
Unidentifiable Turtle [n/a]	20

Latin Name	Common Name	Myanmar Name	IUCN Status	Potential Presence in Block AD-3
<i>Lepidochely olivacea</i>	Olive ridley turtle	<i>Leik Lyaung</i>	Endangered	Known to be nesting in Rakhine State and likely to be present in Block AD-3.
<i>Caretta caretta</i>	Loggerhead turtle	<i>Leik Khway</i>	Endangered	Not known to nest on the Rakhine Coast.
<i>Chelonia mydas</i>	Green turtle	<i>Pyin Tha Leik</i>	Vulnerable	Reported to be nesting in Rakhine State and likely to be present in Block AD-3 .
<i>Eretmochelys imbricata</i>	Hawksbill turtle	<i>Leik Kyet Tu Yway</i>	Critically Endangered	Known to be nesting in Rakhine State and likely to be present in Block AD-3.
<i>Dermochelys coriacea</i>	Leatherback turtle	<i>Leik Zaung Lyar</i>	Endangered	Have historically been recorded in Rakhine waters but are now considered rare.

**Olive Ridley Turtle**



Photo by Bernard Gagnon

**Loggerhead Turtle**



Photo by NOAA

**Green Turtle**



Photo by P. Lindgren

**Hawksbill Turtle**



Photo by US Fish and Wildlife Service Southeast Region

**Leatherback Turtle**



Photo by US Fish and Wildlife Service Southeast Region

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Figure 5.10

Marine Turtles in Rakhine Waters

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DATE: 30/10/2015

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Annual turtle nesting activity in Rakhine waters is reported to occur between September and March with the peak period of activity occurring from December to January. Reported turtle nesting locations are shown in *Figure 5.9*.

A review of available data on the numbers of turtles nesting annually was undertaken for Rakhine and neighbouring States / Regions. Anecdotal information from fishermen consulted in Rakhine suggests that low numbers of nests (<10) are encountered at certain beaches annually. There is also information available from the Ministry of Livestock and Fisheries on turtle nesting from Diamond Island (Thameehla) in the Ayeyarwady Region around 200 km to the south of Block AD-3. This data was collected from 1986 to 2004 and demonstrates a positive relationship between number of eggs laid and number of hatchlings released (Maung Maung Lwin, *undated*). The number of nests, eggs laid and the total number of unhatched, damaged and hatched eggs is presented in *Table 5.5*. Diamond Island is the largest recorded concentration of nesting in Myanmar where approximately 20,000-30,000 green turtle eggs and 7,000-15,000 loggerhead turtle eggs are laid annually according to the DoF (Thorbjarnarson, et al, 2000).

**Table 5.5** *Turtle Nesting Data from Ayeyarwady Region (1986 to 2004)*

Year	No of Nests	Eggs Laid	Unhatched Eggs	Damaged Eggs	Hatchlings Released	Hatching Rate (%)
1986	106	5,200	-	4,230	970	18.65
1987	528	16,073	5,890	2,114	8,069	50.2
1988	297	27,900	2,650	15,161	10,089	36.16
1989	549	66,908	27,294	4,583	35,031	52.36
1990	537	52,300	7,321	-	44,979	86
1991	359	34,334	7,395	-	26,939	78.46
1992	369	36,900	7,558	7,413	21,929	59.43
1993	540	47,902	3,143	10,036	34,723	72.49
1994	387	34,461	3,987	-	30,474	88.43
1995	419	39,613	4,516	3,533	31,564	79.68
1996	463	45,928	3,767	5,317	36,844	80.22
1997	456	47,312	5,138	1,689	40,485	85.57
1998	306	30,679	3,664	2,065	24,950	81.33
1999	136	13,651	1,888	-	11,763	86.17
2000	231	45,673	2,201	-	43,472	95.18
2001	402	46,680	3,090	-	43,590	93.38
2002	122	11,549	1,821	595	9,133	79.09
2003	251	21,016	4,711	5,221	11,084	52.74
2004	165	14,347	3,162	7,764	3,421	23.84
<b>Total</b>	<b>6,623</b>	<b>638,426</b>	<b>99,196</b>	<b>69,721</b>	<b>469,509</b>	<b>-</b>
<b>Average</b>	<b>349</b>	<b>33,601</b>	<b>5,511</b>	<b>5,363</b>	<b>24,711</b>	<b>68</b>

Turtle nesting is well known on the Islands around the Bogale River in the Ayeyarwady Region (over 250 km from Block AD-3). In 2003, the Department of Fisheries suggested that the annual number of nests is 300. Most nesting in the Ayeyarwady Region is performed by olive ridley (70%), loggerhead (20%) and green turtle (10%) (Thorbjarnarson, et al, 2000). Like other countries, Myanmar has a long tradition of turtle egg collection for human consumption, which is one of the main threats to turtle populations in the region (Shanker K and Pilcher NJ 2003).

Despite the absence of specific data, it can be assumed that the numbers of turtles nesting in the coastline neighbouring the Block will most likely be less than the Ayeyarwady Delta and Islands, which is a well-known turtle nesting site area in Myanmar (ASEAN, 2003). Given the location of Block AD-3 in relation to known nesting beaches, the presence of marine turtles within the Block is likely.

### 5.3.7 *Seabirds*

The most abundant group of seabirds in offshore Myanmar are the terns, of which 13 species regularly occur. Other seabirds which may use these waters include gulls, storm petrels, Jaegers (also known as Skuas), tropic birds, boobies, noddies and frigatebirds. Seabird species tend to be highly migratory, far ranging and widely distributed away from breeding areas. Offshore Myanmar waters are used by seabirds for foraging and loafing (resting). Islands and islets can also be used for roosting, resting and moulting. Only two species, the Little Tern (*Sterna albifrons*) and the Brown Booby (*Sula leucogaster*), are reported to have breeding colonies in Myanmar. Isolated islets in the Area of Influence, such as those in waters depths of less than 50 m to the south of Manaung Island, are expected to be potential suitable nesting sites for individuals of these species. However, no Important Bird and or Key Biodiversity Areas which are designated for birds<sup>(6)</sup> are reported from the Area of Influence (refer to *Section 5.3.8*).

The distribution range of one IUCN-listed threatened seabird species, the Christmas Island Frigatebird (*Fregata andrewsi*) (Critically Endangered) extends as far as Myanmar waters. However, Myanmar waters are at the outer limit of its range. Given this and its rarity, the potential for the occurrence of this seabird in the block is considered low.

Of the seabird species that occur in the Study Area, only species of seabird that spend large quantities of time underwater while foraging for food, either underwater swimmers or aerial divers, are considered potentially vulnerable to underwater sound impacts. Feeding by seabirds involves snatching prey

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(6) An Important Bird and Biodiversity Area (IBA) is an area recognized by Birdlife International as being globally important habitat for the conservation of birds populations



items from or below the water surface (terns, noddies, tropic birds, frigate birds, gulls), by paddling (petrels) and mainly kleptoparasitism (i.e. taking from others) (jaeger). Of the species potentially present, only boobies feed by aerial diving.

Although detailed data on distribution, abundance, habitat utilisation and seasonality of seabirds specific to the Area of Influence are limited at present, noting the above it can be conservatively assumed that seabirds may be expected to occasionally pass within or close by Block AD-3.

### 5.3.8 *Protected & Environmentally Sensitive Areas*

There are a total of 43 designated or proposed protected areas with IUCN categories existing in Myanmar (Wildlife Conservation Society, 2013). It should be noted that some of the locations are proposed as protected area without authorized designation (i.e. “soft” designation). None of these protected or environmentally sensitive areas lie within Block AD-3.

There are two restricted fishing areas within the Area of Influence which are based on the Department of Fisheries (DoF) Fishing Blocks A10 and A20. The Sittwe DoF stated that these Blocks were restricted for fishing activity for the conservation of species (fish, dugong, turtles, dolphin, shark, whale and coral) during the rainy season (June to August). The following gears are prohibited; trawl, surrounding net, stow net and long line as well as small engine boats. Although this ban is in place the level of enforcement is unknown.

Limited data are available on the designations of these protected areas. There are no protected areas in the Area of Influence but there are a number of Key Biodiversity Areas (KBAs) (Wildlife Conservation Society, 2013) as shown in *Figure 5.11*. Information on the size of the KBAs and key species for their designation in the Area of Influence is presented in *Table 5.6*.

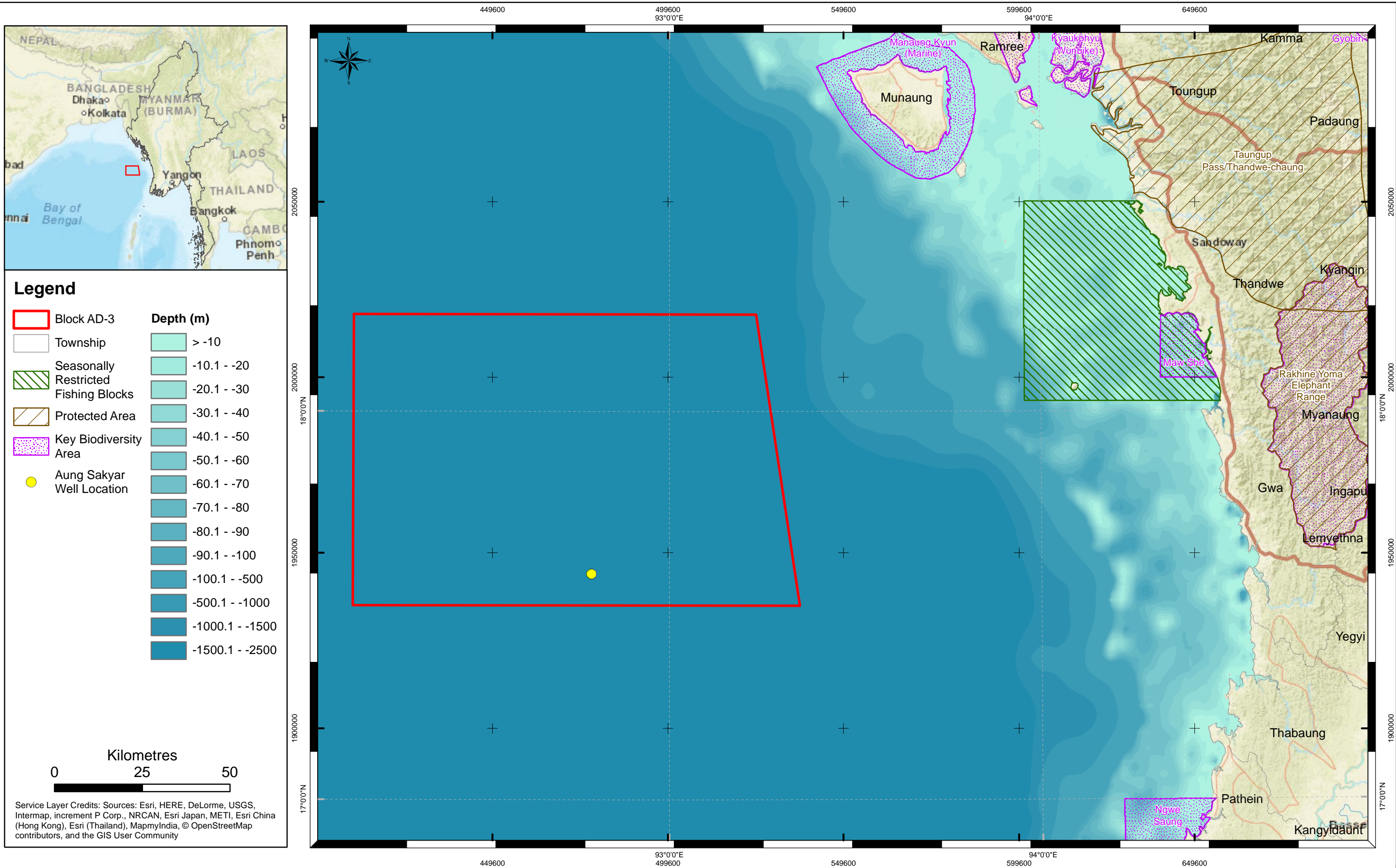


Figure 5.11

Protected Areas and Key Biodiversity Areas in the Area of Influence

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Date: 4/7/2016

**Environmental  
Resources  
Management**



**Table 5.6** *Key Biodiversity Areas (KBAs) in Area of Influence*

Name	Area (km <sup>2</sup> )	Key species	Distance from Block AD-3
Manaung Kyun (marine)	766	Hawksbill turtle, green turtle, loggerhead turtle, olive ridley turtle.	57 km (35 miles)
Kyaukphyu (Wunbike)	2,591	Hawksbill turtle, mangrove terrapin, green turtle, olive ridley turtle and mangrove species.	97 km (60 miles)
Maw Swe	222	Hawksbill turtle, green turtle, loggerhead turtle, olive ridley turtle.	115 km (71 miles)
Ngwe Saung	733	Hawksbill turtle, green turtle, and mangrove species.	120 km (74 miles)

## 5.4 *SOCIO-ECONOMIC CHARACTERISTICS*

### 5.4.1 *Physical Characteristics and Land Use*

Rakhine (formerly known as Arakan) State is located in Western Myanmar, and is bordered by the Chin State in the North, Magway, Bago and Ayeyarwady Division in the east, the Bay of Bengal in the west and Chittagong Division of Bangladesh in the Northwest. It is the eighth largest region in the country, and has a total land area of 36,780 km<sup>2</sup>. The area is characterised by a long coastline along the Bay of Bengal, with a number of islands being located within the state’s boundaries. It is also a mountainous territory which is difficult to access and separated from the rest of Myanmar by the Arakan Yoma Mountain range (UNICEF).

The land use in the region is characterised by a dominance of forests, with approximately 44 percent of the total land area being covered by evergreen forest, while 7 percent of the area is covered by deciduous forest. The eastern boundary of the state is mostly covered by deciduous forest (UNDP, 2011). Apart from forest cover, the main land use in the region is agriculture, with twenty-eight percent of the land being categorised as agriculture land. Agricultural land is an important resource for the local community for livelihood purposes. The area occupied by settlements is only one percent of the total land area. The settlement area density is higher in the northern part of the state, than in the south. The capital, Sittwe, situated in the north, covers approximately 10 percent of the total land classified as settlements (UNDP, 2011).

## 5.4.2

### *Administration and Demographics*

#### *Administrative Structure*

Rakhine State is divided into four districts and 17 townships of which five are located entirely on islands and several more have parts of their territory on islands (UNDP, 2011). The number of townships and village tracts within the Districts closest to the Project area shown in *Table 5.7*.

**Table 5.7** *Administrative Structure of Kyaukphyu and Thandwe District*

District	Township	Number of Village Tracts
Kyaukphyu	Ann	30
	Kyaukphyu	54
	Manaung	37
	Ramree	52
Thandwe	Gwa	34
	Thandwe	64
	Toungup	55

*Source: UNDP Multi Hazard Risk Assessment in the Rakhine State of Myanmar: Final Report, 2011*

#### *Demographics*

Rakhine State is the eighth largest and the second most populous state, 3,188,807 total individuals; 1,526,402 males and 1,662,405 females (Myanmar Census, 2014a). Since the last Census in 1973, the population of Rakhine State has increased from by 56 %.

The population density is 86.7 people per square kilometre (Myanmar Census, 2014). Most of the population is concentrated around the coast and in the northern townships; the populations in the eastern, hilly forests of the State having particularly small populations. Among the 17 townships, Sittwe is the most densely populated (UNDP, 2011). The 2014 Census results show that the majority of people live in “rural” areas; 83 out of every 100 (areas as classified by the GAD) (Myanmar Census, 2014a).

An overview of demographics for the state is provided in *Table 5.4* with a population data for the Sittwe provided in *Table 5.5* both highlight that the vast majority of the population resides in rural areas – a reflection of the dependency on agricultural livelihoods.



**Table 5.8** *Demographic Profile of the Rakhine State*

Attribute	Rakhine
Total Population	3,188,807
Area (sq. km)	36,780 sq. km
Population Density (persons per sq. km)	87
Population between 0-14 years	1,039,134
Sex Ratio	1,114 females per 1,000 males
Rural Population %	84.2%
Urban Population %	15.8%

Source: The Union of Myanmar Population and Housing Census, 2014; Final Rakhine Report & UNDP Myanmar (2011): Local Governance Mapping: The State of Local Governance: Trends in Rakhine and Republic of Myanmar

**Table 5.9** *Overview of the Demographics in Thandwe*

District	Population Figures			Sex Ratio
	Total	Male	Female	
Kyaukphyu	439,923	207,308	232,615	89.1
Thandwe	357,840	174,959	182,881	95.7

Source: The Union of Myanmar Population and Housing Census, 2014; Final Rakhine Report

Like many parts of Myanmar, the state has a diverse ethnic population. The majority of the state's population (60 percent) is comprised of Rakhine, followed by Muslims who comprise 30 to 35 percent of the population. The other main ethnic groups in the region are Chin, Mro, Bamar, Khami (UNDP, 2011).

### 5.4.3 *Livelihood and Economy*

Rakhine State is rich in natural resources including the scenic beauty of coastal beaches with high potential for tourism, unexplored potential for oil and natural gas, coastline to support fisheries, and lands supporting rice production and plantation. The main sources of livelihood are agriculture, fisheries and livestock holdings, small businesses and the service industry. More than 50 percent of the population is dependent upon agriculture for their livelihood, while 13 percent engage in fishing, and 10 percent in livestock farming. The remaining 25 percent of the population is dependent upon the service industry, small businesses and other activities (UNDP, 2011).

The 2014 Census Report – Occupation and Industry (Myanmar Census, 2014b) highlighted that the unemployment rate in Rakhine is the highest out of all states / regions in the country (10.4%). Small amounts of inferior-grade crude oil are produced from basic, shallow, hand dug wells. In recent years there has been significant investment in the tourism sector. However, issues such as poor infrastructure, particularly road infrastructure, weak connectivity to the rest of the country, lack of electricity, poor communication facilities, the mountainous terrain and social conflict amongst ethnic groups have resulted in major challenges for the state’s socio-economic development (UNDP, 2011).

The coastal areas in Rakhine are characterised by fishing and agriculture as the two main livelihood opportunities, followed by tourism and sale of timber. The main crop produced is paddy, which is cultivated across approximately 85 percent of the total cultivated land in the region. Apart from paddy, the main crops are rubber, pepper, pigeon pea, beans, sunflower, mustard and oil seeds. Fishing constitutes a quarter of Rakhine’s estimated economic value with several studies by independent organisations (Oliver *et.al.* 2014) indicating that around 43 percent of the population in the state relies either on fishing or a combination of fishing/agriculture. The fishing sector also employs a number of landless coastal households (Joffery & Moe Aung, 2014).

The fisheries sector plays a critical role in terms of employment (Oxfam, 2014); it is estimated that in the Rakhine region, almost 600,000 individuals are involved in capture fisheries and/or aquaculture, while 150,000 individuals are involved in other stages of the value chain, including processing, wholesale and export (this figure however only includes 489 registered fish traders and more traders may be involved on an informal basis). The fisheries sector is also important for casual labour, with 24 percent of the casual labour workforce in Myanmar reporting the fisheries sector as the first source of income.

Fishing and related activities are present all along the coastline. Key species captured in the Area of Interest include tiger prawn and pomfret (the most valuable catch), small and large prawns, small and large tuna, groupers, mackerel, mullet, red snapper, catfish, squid, anchovy, sardines, shark, eel, lobsters, mahi mahi, scad, and sea bass. In deep-water, herring is also part of the catch.

Agricultural activities (predominantly paddy cultivation and groundnut with minor proportion of maize, pulses, wheat and soybean (FAO website) are observed in the coastal areas in Kyaukphyu, Ramree and Manaung. Agricultural activity varies in coastal communities depending on access to land. Some coastal communities have limited access to land and are highly dependent on fishing for income and subsistence.

#### 5.4.4 *Social Indicators*

UNICEF (2013) reports that Rakhine State is characterised by high malnutrition, generally low enrolment and completion in primary education, and poor access to clean water and sanitation. It is also prone to natural hazards such as storms and floods increasing the vulnerability at the community level. It is reported that the inter-community violence in 2012 led to a worsening of social indicators with thousands displaced, suffering from food insecurity, interrupted livelihoods and education, as well as a lack of access to markets.

Literacy levels and access to educational infrastructure in Rakhine State are reported to be significantly lower than the national averages. Rakhine State has the lowest pre-school attendance among children aged three to five years in the country at five percent, in comparison to the national average of twenty-three percent. Only about a third of children enrolled at primary school complete their education on time.

A World Bank analysis of 2014 household survey data suggests that Rakhine State, with a poverty rate of 78 percent (national average is 38 percent) may be the poorest region in the country. This is of particular concern given the high level of poverty at the national level and suggests that the population of Rakhine State may be particularly vulnerable.

#### 5.4.5 *Fishing Operations and Resources*

The Department of Fisheries (DoF) at the national level controls offshore fishing activities and licenses, while inshore licenses are granted at the state level. The DoF has established a legal framework with strategies and policies for sustainable development and management of marine fisheries. These include licensing, prescription of exploitable species, designation of environmental friendly fishing gears and methods, and the imposition of closed areas and seasons. The DoF fishing license blocks are shown in *Figure 5.7*.

The DoF has instituted two fishing zones which provide a restriction on fishing activities and a degree of protection to fisheries resources. Fishing Zone 1, for traditional coastal fisheries, extends from the shoreline to 5 nautical miles in the northern area including Rakhine coastal areas, and to 10 nautical miles from the shore in southern coastal areas. Fishing Zone 2 extends from the outer limit of Fishing Zone 1 to the 200 nautical mile Exclusive Economic Zone (EEZ) limit.

Fishing vessels are classified as commercial or traditional. Commercial offshore fishing vessels use trawl nets, purse seines, drift nets and gill nets. Traditional inshore fishing vessels use methods such as hook-and-line, cast net, bag net, gill net, lift net and traps. In 2012 - 13, approximately 1,900 licensed offshore commercial vessels and 24,500 licensed inshore traditional



vessels operated in Myanmar waters. Total fisheries production for human consumption was 1.9 million tonnes in 2012.

The peak season for fishing is from November to April as this is outside of the monsoon season. Fishing is still conducted during the monsoon season but this is generally within the nearshore fishing area; within 16 km (10 miles) from the coast.

Information collected from previous consultations in Rakhine State is provided in *Table 5.7*.

**Table 5.10** *Baseline Understanding of Fishing Activities offshore Rakhine State*

Parameter	Information
Fishing Locations	Nearshore fishing 0-16 km (0-10 miles) from coast (small boats) Offshore fishing mostly 16-48 km (10-30 miles) from coast (some big boats out to 100 km (60 miles). Fishermen in Manaung fish out to 24 km (15 miles) from the island.
Seasonality	November to April is considered the peak fishing season (in terms of amount and value of catch) for offshore fishermen.
Gear	Offshore fishing gear used, including hook and line, drift nets, and purse seines. Stow nets, cast nets are used in shallow waters.
Boats	Mostly fit into 3 categories: small (<30ft), medium (35-50ft) and large (> 50ft.)
Catch	The most profitable catch is Tuna (in offshore; over 200 m water depth) and Tiger prawn (in shallow; under 200 m water depth).

During scoping, stakeholders were consulted on the type and scale of commercial fishing conducted further offshore (and potentially within the vicinity of the Project.) Stakeholders consulted in Sittwe confirmed that the largest boats from Rakhine can go up to 100 km (60 miles) from the coast, but mostly fish within 50 km (30 miles) from the coast and within 490 ft. (150 m) water depth, therefore, unlikely to be near the proposed well location.

The State Department of Fisheries mentioned that there is the potential for fishermen throughout Myanmar to be fishing in the waters of Block AD-3; specifically from large port areas such as Dawei (Tanintharyi Region), Patheingyi (Ayeyarwady Region) and Yangon.

#### 5.4.6 *Infrastructure and Activities*

With the lifting of international sanctions, licensing has begun on a number of onshore and offshore oil and gas License Blocks in Myanmar. In 2014, the Ministry of Energy announced that 10 shallow water and 10 deep water Blocks had been awarded in Myanmar waters (Oil and gas Journal, online).

The recently awarded license Blocks within Rakhine waters are listed in *Table 5.8*.

**Table 5.11** *Blocks Licensed in 2014 in Rakhine Waters*

Block	Operators
Shallow water	
A-4	BG Group and Woodside Energy (Myanmar)
A-5	Chevron (Unocal Myanmar Offshore Co. Ltd.)
A-7	BG Group and Woodside Energy (Myanmar)
Deep Water	
AD-02	BG Group and Woodside Energy (Myanmar)
AD-3	Ophir Energy PLC
AD-05	BG Group and Woodside Energy (Myanmar)
AD-09	Shell Myanmar Energy and MOECO
AD-10	Statoil and ConocoPhillips
AD-11	Shell Myanmar Energy and MOECO

There are no known infrastructures or manmade seabed hazards within the area of AD-3. In addition, a cable search by the Global Marine Cable Database (GeoCable) did not indicate the presence of any cables within the Block AD-3.

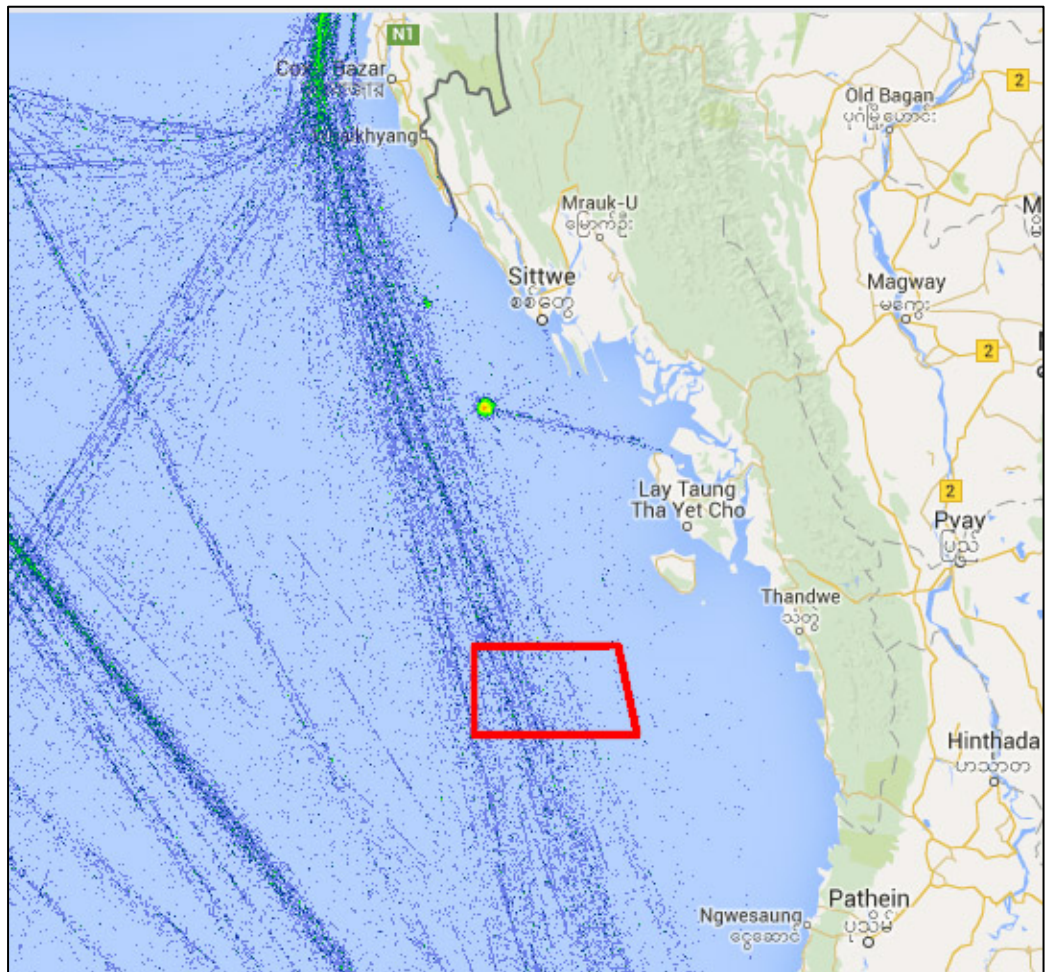
#### 5.4.7 *Shipping and Navigation*

From available ship frequency tracking data, the Bay of Bengal has relatively limited shipping activity with lightly used shipping lanes from ports in the north (Kolkata, Chittagong etc.) heading to the southern tip of India and the Straits of Malacca in the south; shown in *Figure 5.12*. Block AD-3 is located within the shipping route from Chittagong and therefore there is a potential for encounters although the likelihood is low. Of note is that limited shipping activity was observed during the previous seismic survey in 2015.

### 5.5 *CULTURAL AND VISUAL CHARACTERISTICS*

No known offshore sites of culture heritage are identified as within Block AD-3. In addition, given that the Project is located over 150 km (93 miles) from the nearest coastline (Manaung Island), visual impacts are not expected to occur from the Project.

Figure 5.12 Shipping Lanes in Area of Influence



Source: <http://www.marinetraffic.com/> Block AD-3 is shown in Red

This section presents the environmental and social impact assessment methodology and recommended mitigation measures, to reduce or avoid potential impacts, where appropriate.

The impact assessment methodology provides a basis to characterise the potential impacts of the Project and is based on models commonly employed in impact assessment and takes into account international best practices.

Potential impacts arising from both planned (routine and non-routine) activities and unplanned events are assessed. Unplanned events are those not anticipated to occur during the normal course of Project activities, for example a vessel collision resulting in a spill of fuel or damage to a fishing boat.

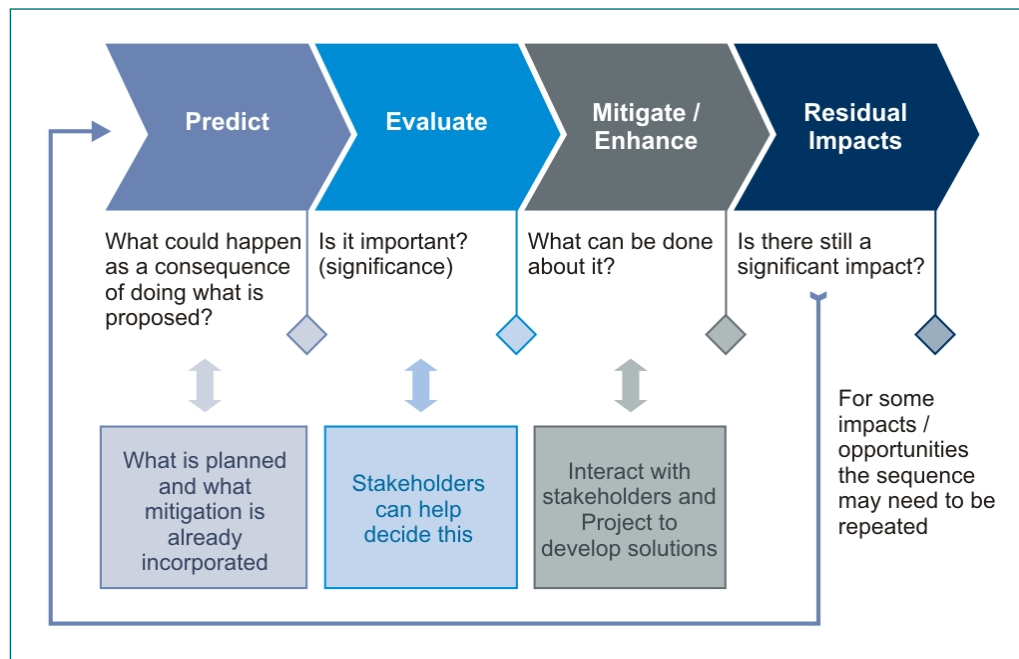
### **6.1**

#### ***IMPACT ASSESSMENT METHODOLOGY AND APPROACH***

The principal impact assessment steps are summarized in *Figure 6.1* and comprise:

- Impact prediction: to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities.
- Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude or likelihood of occurrence (for unplanned events), and the sensitivity, value and/or importance of the affected resource/receptor.
- Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

**Figure 6.1** *Impact Assessment Process*



**6.1.1** *Prediction of Impacts*

Prediction of impacts is an objective exercise to determine what could potentially happen to the sensitive receptors/resources as a consequence of the Project activities. From these potential interactions, the potential impacts to the various resources/receptors are identified and are elaborated to the extent possible. The assessment process typically utilises a wide range of prediction methods including quantitative, semi-quantitative and qualitative techniques.

**6.1.2** *Evaluation of Impacts*

Once the prediction of impacts is complete, each impact is described in terms of its relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is shown in *Table 6.1*.

**Table 6.1** *Impact Characteristic Terminology*

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	Direct, Indirect, Induced
Extent	The “reach” of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.).	Local, Regional, International
Duration	The time period over which a resource / receptor is affected.	Temporary, Short-term, Long-term, Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.).	[no fixed designations; intended to be a numerical value]
Frequency	A measure of the constancy or periodicity of	[no fixed designations;

Characteristic	Definition	Designations
	the impact.	intended to be a numerical value]

The definitions for the *type* designations are shown in *Table 6.2* and definitions for the other designations are resource/receptor-specific and are discussed in *Section 6.4*.

**Table 6.2** *Impact Type Definitions*

Designations (Type, Extent, Duration)	Definition
<b>Type</b>	
Direct	Impacts that result from a direct interaction between the Project and a resource/receptor (e.g. sound from a seismic source such as a VSP leading to behavioural changes in marine fauna).
Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g. reduction in water quality from waste discharges potentially leading to effects in marine fauna).
Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g., influx of camp followers resulting from the importation of a large Project workforce).
<b>Extent</b>	
Local	Impacts are experienced at a localised extent and limited to the vicinity of the well locations. These impacts will not be felt outside of the extent of Block AD-3.
Regional	Impacts are likely to be experienced within the wider region i.e. Rakhine State.
International	Impacts are may potentially extend across International boundaries.
<b>Duration</b>	
Temporary	Impacts that have effects that will occur for less than 1 month
Short-term	Impacts that have effects that will occur for 1-12 months
Long-term	Impacts that have effects that will occur for over a year 5 years
Permanent	Permanent, irreversible impact

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is *likelihood* which is designated using a qualitative scale, as described in *Table 6.3*.



**Table 6.3** *Definitions for Likelihood Designations*

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions.
Possible	The event is likely to occur at some time during normal operating conditions.
Likely	The event will occur during normal operating conditions (i.e., it is essentially inevitable).

**6.1.3** *Impact Magnitude, Receptor/Resource Sensitivity and Impact Significance*

The next step is to assign each impact a ‘magnitude’ which is a function of a combination (depending on the resource/receptor in question) of the following impact characteristics: Extent; Duration; Scale; and Frequency.

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. The magnitude designations are: Positive; Negligible; Small; Medium; and Large.

In the case of a *positive* impact, no magnitude designation (aside from ‘positive’) is assigned.

The definitions for these designations vary on a resource/ receptor basis. The impact magnitude for marine species, marine habitats and water quality impacts is provided in *Table 6.4*, *Table 6.5*, and *Table 6.6* respectively. The impact magnitude criteria for the social impact assessment are provided in *Table 6.7*.

**Table 6.4** *Impact Magnitude for Marine Species*

	Extent / Duration / Scale / Frequency
Large	May affect an entire population or species in sufficient magnitude to cause a decline in abundance and/ or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations.
Medium	May affect a portion of a population and may bring about a change in abundance and/ or distribution over one or more generations, but does not threaten the integrity of that population or any population dependent on it.
Small	May affect specific group of localised individuals within a population over a short time period (one generation or less), but does not affect other trophic levels or the population itself.
Negligible	Immeasurable, undetectable or within the range of normal natural variation.

**Table 6.5** *Impact Magnitude for Marine Habitats*

	Extent / Duration / Scale / Frequency
Large	May affect the integrity of an area or region, by substantially changing, in the long term, its ecological features, structures and functions, across its whole area, that enable it to sustain the habitat, complex of habitats and/or population levels of species that makes it important.
Medium	May affect some, if not all, of the area’s ecological features, structures and functions in the short or medium term. The area or region may be able to recover through natural regeneration and restoration.



Extent / Duration / Scale / Frequency	
Small	May cause some minor impacts of limited extent, or to some elements of the area, are evident but easy to recover through natural regeneration.
Negligible	Immeasurable, undetectable or within the range of normal natural variation.

**Table 6.6** *Impact Magnitude for Water Quality*

Extent / Duration / Scale / Frequency	
Large	Change in water quality over a large area that lasts over the course of several months with quality likely to cause secondary impacts on marine ecology; and/or Routine exceedance of benchmark effluent discharge limits.
Medium	Temporary or localised change in water quality with water quality returning to background levels thereafter and/or occasional exceedance of benchmark effluent discharge limits.
Small	Slight change in water quality expected over a limited area with water quality returning to background levels within a few metres and/or discharges are well within benchmark effluent discharge limits.
Negligible	Immeasurable, undetectable or within the range of normal natural variation.

**Table 6.7** *Impact Magnitude for Local Communities, Fishermen and Other Marine Users*

Extent / Duration / Scale / Frequency	
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the area of influence and/or persists over many years. The impact may be experienced over a regional or national area.
Medium	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may potentially be regional in scale.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.
Negligible	Change remains within the range commonly experienced within the household or community.

The other principal impact evaluation step is definition of the sensitivity (including vulnerability and importance) of the impacted resource/receptor. Other factors may also be considered, such as legal protection, government policy, stakeholder views and economic value.

As in the case of magnitude, the sensitivity designations themselves are universally consistent, however, the definitions for these designations vary on a resource/receptor basis. The universal sensitivity/ vulnerability/ importance designations are: Low; Medium; and High.

The receptor sensitivities for marine species, marine habitats and water quality are provided in *Table 6.8*, *Table 6.9*, and *Table 6.10*, respectively. The receptor sensitivity criteria for the social assessment are provided in *Table 6.11*.

**Table 6.8** *Receptor Sensitivity for Marine Habitat*

Category	Designation / Importance / Vulnerability
High	A habitat that has designated conservation status at an international scale (e.g. IUCN). Areas of particular biodiversity importance that may support populations of restricted range, endemic or endangered species, or is in itself unique or threatened.
Medium	A habitat that has designated conservation status at a national or regional scale. Areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.
Low	A habitat not protected by law. Areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition.

**Table 6.9** *Receptor Sensitivity for Marine Species*

Category	Designation / Importance / Vulnerability
High	A species population that has designated conservation status at an international scale (e.g. IUCN).  A species that is globally rare. A keystone species fundamental to the functioning of the ecosystem.
Medium	A species population that has designated conservation status at a national or regional scale.  A species common globally but rare locally. Important to ecosystem functions or under threat or population in decline.
Low	A species not protected by law.  Not critical to other ecosystem functions (e.g. as prey to other species or as predator to potential pest species) or common / abundant locally.

**Table 6.10** *Receptor Sensitivity for Marine Water Quality*

Category	Designation / Importance / Vulnerability
High	Existing water quality is already under stress and/ or the ecological resources it supports are very sensitive to change (secondary ecological or health impacts are likely).
Medium	Existing water quality already shows some signs of stress and/ or supports ecological resources that could be sensitive to change in water quality.
Low	Existing water quality is good and the ecological resources that it supports are not sensitive to a change in water quality.

**Table 6.11** *Receptor Sensitivity for Local Communities, Fishermen and Other Marine Users*

Category	Designation / Importance / Vulnerability
High	Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the Project.
Medium	Some but few areas of vulnerability; but still retaining an ability to at least in part adapt to change brought by the Project.
Low	Minimal vulnerability; consequently with a high ability to adapt to changes brought by the Project and opportunities associated with it.

Once impact magnitude and resource/receptor sensitivity have been characterised, the significance can be assigned for each impact. Impact significance is designated using the matrix shown in *Table 6.12*.

**Table 6.12** *Impact Significances*

		Resource/Receptor Sensitivity		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors as well as all impacts, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity designations that enter into the matrix. *Box 6.1* provides context for what the impact significance ratings signify.

**Box 6.1** *Context of Impact Significances*

An impact of **negligible** significance is one where a resource/receptor will essentially not be affected or the predicted effect is deemed to be ‘imperceptible’ or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity. In either case, the magnitude should be well within applicable standards.

An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. These impacts are a priority for mitigation in order to avoid or reduce the significance of the impact. This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly sensitive resource/receptors. An aim of impact assessment is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual

impacts after all practicable mitigation options have been exhausted. An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

It is important to note that impact prediction and evaluation take into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the impact assessment process). An example of an embedded control is a standard acoustic enclosure that is designed to be installed around a piece of major equipment. This avoids the situation where an impact is assigned a magnitude based on a hypothetical version of the Project that would not happen in a real world situation.

#### **6.1.4** *Identification of Mitigation and Enhancement Measures*

Once the significance of an impact has been characterised, the next step is to evaluate what control measures can be applied to eliminate, control or mitigate the risk and to determine if the risk level is acceptable.

The assessment process is intended to identify impacts and benefits associated with project activities and ways of dealing with them during the planning and design stage of the project. Planned mitigation measures will be described, and additional measures or controls will be recommended where impacts are still considered to be unacceptable. These mitigation measures have been utilised to develop the EMP. Note that, in accordance with the EIA Procedures, the EMP for this Project is presented as a separate document.

Many mitigation or control measures will require a degree of management to ensure their success in reducing potential impacts to the residual level that is expected through the EIA process. Most of these residual outcomes are likely to require a degree of monitoring through project implementation to ensure that the mitigation management process is effective. It is these management and monitoring efforts that report to the EMP as part of the EIA process.

#### **6.1.5** *Residual Impact Evaluation*

Once mitigation and enhancement measures are declared, the residual impact significance is identified (i.e. a repeat of the impact assessment steps discussed above). In some cases, it may only be possible to reduce the impact to a certain degree such as where an impact could not be completely avoided. All residual significant impacts are described in this report with commentary on why further mitigation is not feasible.

The degree of significance attributed to residual impacts is related to the weight that should be given to them in reaching a decision on the Project:

- Residual impacts of **Major** significance are considered to warrant substantial weight in the Project decision making process. Conditions should be imposed to ensure adverse impacts are strictly controlled and monitored;
- Residual impacts of **Moderate** significance are considered to be of reducing importance to decision-making, however, still warrant careful attention to ensure best available techniques are used to keep adverse impacts to as low as is technically and financially feasible;
- Residual impacts of **Minor** significance should be brought to the attention of the decision-maker but are identified as warranting little if any weight in the decision; and
- Not significant residual impacts are those that, after assessment, are found not to be significant to the decision making about the Project.

### 6.1.6 *Management and Monitoring*

The final stage in the impact assessment process is defining the management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards; and b) mitigation measures are effectively addressing.

A summary of all actions which the Project Proponent has committed to are included in the separate EMP. The EMP includes mitigation measures, management and monitoring activities.

## 6.2 *IDENTIFICATION OF IMPACTS*

Project risks and potential impacts have been identified through a systematic process whereby the activities associated with the Project have been considered with respect to their potential to interact with resources or receptors. Following screening, a scoping exercise is undertaken in order to clearly show the potential interactions between project activities and physical, biological and social receptors. This was presented in detailed in the Scoping Report submitted to MONREC in May 2016. The scoping matrix is presented in *Table 6.13*.

## 6.3 *KEY POTENTIAL IMPACTS*

The Scoping Report stated that the majority of identified potential impacts are not expected to be significant (i.e. those scoped out in *Table 6.13*). For activities predicted to have no significant impact, no detailed quantification or further assessment will be conducted in this EIA Report.

For activities where possible significant effects could occur, these interactions will be assessed in more detail within this EIA Report. Those interactions include:

- Short-term disturbance to large commercial fishing activities (from outside of Rakhine State) and shipping/navigation within Block AD-3.
- Increases in ambient underwater sound and generation of sound pressure levels from short-duration VSP causing disturbance to marine mammals, marine turtles and fish that may be present within Block AD-3.
- Potential impacts from drill cuttings and drilling mud discharge on water quality, sediment quality and pelagic and benthic communities.
- Potential water contamination and potentially secondary impacts to biodiversity and fishing from accidental spills (e.g. vessel collision, or deck spills).

*Section 6.4* presents the detailed assessment of the key potential environmental and social impacts associated with the exploration drilling.

A summary of the impacts that were scoped out during the Scoping Phase and are not considered in this EIA Report is provided in *Table 6.14*.



**Table 6.13 Scoping Matrix**

Project Activity/ Hazards	Physical				Biological							Socio-economic			
	Sediment Quality	Seabed Features/ Profile	Air Quality	Marine Water Quality	Fish and Pelagic Communities	Planktonic Communities	Offshore Benthic Habitats and Communities	Nearshore Habitats and Communities	Marine Mammals	Marine Turtles	Seabirds and Shorebirds	Subsea Infrastructure	Public Health and Safety	Fisheries	Navigation/ Traffic and Transport
Planned Events															
Emissions from MODU, support vessel(s) and machinery engines															
Presence of MODU and support vessels															
Routine offshore discharges / waste generation and disposal															
Drilling cuttings and mud discharges															
Sound from vertical seismic profiling (VSP), drilling, support vessel movements and equipment.															
Unplanned Events															
Spills/ Leaks															
Invasive Species															
Dropped Objects/ Lost Equipment															
Fires and explosions															
Well blowout															

**Colour coding:** an interaction is not reasonably expected (white); an interaction is reasonably possible but none of the resulting impacts are likely to lead to significant effects and are therefore scoped out of the EIA with justification (grey); or an interaction is reasonably possible and at least one of the resulting impacts may lead to a significant effect and are therefore taken forward for assessment in the EIA (black).

**Table 6.14** *Scoped Out Impacts and Rationale for Exploration Drilling*

Impact	Rationale for scoping out of Assessment
<b>Environmental</b>	
Impacts from presence of MODU and support vessels on marine habitats and species	<p>A MODU and associated support vessels will be present in AD-3 during the 40 day exploration drilling campaign. Given the MODU will be dynamically positioned there is limited potential for impacts on marine benthic habitats.</p> <p>The potential for the vessels to collide with marine fauna (especially marine mammals) is unlikely given the small number of vessels movements and the short duration of the drilling campaign. Additionally, during operations, vessels will implement a number of controls to reduce the potential for interactions between vessels and marine fauna. These include maintaining a watch for marine mammal sightings, vessels not approaching closer than 100 m of a whale and limiting vessel speeds to no greater than 6 knots within 300 m of a whale. With controls in place, no significant impacts to marine habitats and species are expected from the presence of the MODU and associated support vessels.</p>
Impacts from exhaust emissions on ambient air quality	<p>Atmospheric emissions generated during the drilling campaign may arise from internal combustion engines on the MODU, support vessels and machinery engines resulting in the release of SO<sub>2</sub>, NO<sub>x</sub>, particulates and Volatile Organic Compounds (VOCs). These emissions may result in a localised reduction in air quality in the area. The exhaust emissions are expected to disperse rapidly in the offshore location and will be temporary and small in volume, given the short duration (~ 40 days). Therefore, significant impacts to air quality are not considered likely. In addition, the MODU and vessels will be in compliance with MARPOL 73/78 Regulations for the prevention of air pollution from ships (Annex VI), and no significant impacts on ambient air quality are anticipated.</p>
Impacts from unplanned venting of gas during drilling (well kick)	<p>During drilling of the well, a kick may occur. A kick is a sudden undesirable influx of formation fluid into the wellbore. The resultant effect could be the release of a small volume of gas via the degasser to the atmosphere during well control operations and may result in a temporary decrease in local air quality. To mitigate any risks, Ophir Myanmar will verify that relevant contractor procedures align with Ophir Myanmar requirements for well control. Given the minor volumes and the offshore location no significant impacts on ambient air quality are expected.</p>
Impacts from routine MODU and vessel discharges on marine habitats	<p>The MODU and support vessels will routinely discharge sewage, grey water, putrescible (food) waste, bilge water and deck drainage. Sensitive marine habitats are generally found in shallow waters, typically less than 20 m water depth. Given the water depth of approximately 2,400 m at the proposed well location within AD-3, there is no potential for vessel discharges to impact shallow water habitats.</p> <p>Localised impacts at the point of discharge may include temporary eutrophication of the water column with potential adverse effects to marine biota. However, given the short duration (~ 40 days) and the rapid dilution and dispersion of routine discharges in the open ocean environment, no long term impacts are expected. In addition, discharges from the MODU and support vessels will comply with relevant MARPOL 73/78 Regulations and no significant impacts are expected to occur.</p>

Impact	Rationale for scoping out of Assessment
Impacts from underwater sound generated by the MODU and support vessels	<p>Drilling noise is generally low level, low frequency and continuous with most energy concentrated below 1 kHz. Reported continuous sound produced by drilling activities may produce received sound levels of 110 to 130 dB re 1 <math>\mu</math>Pa @ 1 m. Supply vessels peak frequency or band ranges from 1-500 Hz at a peak source level of 170-190 dB re 1 <math>\mu</math>Pa @ 1 m.</p> <p>Given the low level emissions of sound, routine operations from drilling and vessel movements do not have the intensity and characteristics likely to cause physiological damage and behavioural change to marine fauna.</p>
Impacts from accidental loss of solid hazardous or non-hazardous wastes to the marine environment (excludes sewerage, grey water, putrescible waste and bilge water).	<p>The MODU and support vessels will generate a variety of solid wastes including packaging and domestic wastes. The accidental discharge or loss of material overboard may result in pollution and contamination of the marine environment, and secondary toxicity and physical effects on marine fauna through ingestion or entanglement. Given that the well will be located around 150 km (93 miles) from sensitive habitats and the short duration of the drilling (~ 40 days) any potential impact would be minor. All solid wastes will be managed under a Waste Management Plan specifying the segregation (as required) and appropriate storage, transfer and transport of wastes to reduce the risk of accidental loss of wastes to the marine environment.</p> <p>All non-hazardous and hazardous solid wastes generated offshore are to be returned to shore for disposal by a licensed waste management contractor and therefore no significant impacts are expected to occur.</p>
Introduction of invasive marine species associated with ballast water transfer and transportation of invasive marine species via MODU/ vessel hulls, internal niches or in-water equipment.	<p>Invasive marine species present within the water column may be collected with the intake of seawater and survive within ballast tanks. Marine species may then be relocated and discharged with the ballast water at the drilling location in AD-3. There is also potential for the introduction and establishment of invasive species from biofoul present on the hull of the MODU and support vessels. This can lead to the introduction of IMS which can become invasive if the environmental conditions at the point of release are suitable.</p> <p>During the Project, the MODU will remain offshore and is not planned to enter nearshore waters in Myanmar therefore reducing the potential to introduce marine species into sensitive areas where the proliferation of non-native species may occur. It is also likely that vessels and MODU will come from the wider region thereby limiting the potential for uncommon marine species to be introduced. On this basis, no significant impacts are expected to occur.</p>
Impacts from dropped objects on marine habitats	<p>There is potential for objects to be dropped from the MODU and/or support vessels overboard resulting in the localised disturbance of benthic habitats. Dropped objects refer to larger drill equipment such as drill pipes and do not include smaller objects such as Personal Protective Equipment (PPE). Benthic habitats within Block AD-3 are considered to be of low sensitivity consisting of fine sediments dominated by silts and muds, typically associated with low levels of biodiversity.</p> <p>Operations will be undertaken in accordance with approved plans and procedures to prevent dropped objects. Given the adopted controls in place and the low sensitivity of the seabed communities, any dropped objects are expected to result in a temporary disruption to a small area of the seabed, limited to a small proportion of the benthic population. Therefore, no significant impacts are expected to occur.</p>

Impact	Rationale for scoping out of Assessment
Impacts from lighting on marine fauna	Lighting from MODU and other vessels can cause behavioural responses in which animals (turtles, seabirds, fish and dolphins) can alter their foraging and breeding activity. In addition, it is possible that seabirds may fly over Block AD-3. However, as the well will be located 150 km (93 miles) from the nearest coastline and lighting will only impact a small area; there is unlikely to be a significant impact on marine fauna and seabirds. The drilling activity will also be temporary; reducing the potential for impact.
<b>Social</b>	
Impacts on shipping vessels from presence of MODU and support vessels	There is the potential for the presence of the MODU and support vessels to interact and cause disruption to shipping operations in the area. Block AD-3 is traversed by a moderately used shipping lane that covers a wide area. The area of potential interaction is localised to the vicinity of the MODU with a 500 m radius safety/exclusion zone. Any vessel displacement due to the temporary presence of the MODU and support vessels within the wider area is not anticipated to cause any negative impacts. Through implementation of pre-mobilisation notifications to relevant parties and adherence to navigational lighting and communication requirements, any disruption or interference is expected to be minimal and not significant.
Impacts on local artisanal fishing activities from presence of MODU and support vessels	During consultations in May and June 2016, stakeholders in Sittwe and Thandwe were consulted on the area in which they fish. All stakeholders consulted suggested that local artisanal fishing is conducted out to a maximum of 100 km (60 miles) from the coast. In addition, no fishing was observed in Block AD-3 during the 2015 seismic survey. As such, there are unlikely to be any local artisanal fishing vessels in or near Block AD-3 and no impacts are anticipated. Potential impacts to deep water commercial fishing activities which may be present within AD-3 (i.e. larger scale trawling and purse seine operations) are further assessed in the EIA Report.

## 6.4 DETERMINATION OF IMPACT SIGNIFICANCE, MITIGATION MEASURES AND RESIDUAL IMPACT SIGNIFICANCE

### 6.4.1 Impacts from Drill Cuttings and Drilling Fluid Discharges to Sediment, Benthic Communities, Water Quality, Fish and Pelagic Communities

#### *Source of Impact*

The cuttings and fluid volumes for each hole section are shown in *Table 4.2*. It is anticipated that approximately 1,294 MT of cuttings using seawater and sweeps will be discharged to the marine environment at the seabed from the drilling of the two top-hole sections. Once the riser and blow out preventer are in place, the remaining sections will be drilled using NADF in a closed circulation system enabling the re-use of drilling fluids. Cuttings using NADF will be discharged to surface waters around 2,400 m (7,800 ft.) above the seabed.

A low toxicity, Paraffin Group III NABF (non-aqueous base fluid) will be used in the NADF drilling fluid system and residual NABF oil on cuttings (OOC) will be limited to 5% by weight of wet cuttings by using efficient cuttings

dryer equipment on-board the MODU. NADF will be utilised for approximately 26 operations days of which cuttings will be generated and processed for approximately 8 days with an estimated total of 1,300 MT of wet cuttings discharged overboard (refer to *Section 4.2.3*). Coarser particles (sand and gravel), which comprise the majority of cuttings will rapidly settle albeit subject to dispersion by currents during their descent <sup>(7)</sup>, while fine particles (fine silt and clay) will tend to remain in suspension being dispersed and diluted to lower concentrations down current of the discharge pipe.

### Drilling Fluid Characteristics

Drilling fluids consist of a mixture of additives such as bentonite clay, barite, lignite, lignosulphate, lime, brine, gellents and emulsifiers which are suspended in a base fluid. The base fluid is water for WBDF or paraffin Group III NABF for NADF.

WBDF consists of approximately around 70-98% fresh or saline water, with the remaining 2-30% comprising of drilling fluid additives that are generally inert or readily biodegradable organic polymers.

A Grade III NABF (40 to 65% by volume) is used in NADF. NADF are designed by the industry to be of low toxicity with faster biodegradability than traditionally-used fluids (Neff, J. M., 2005). The treatment system on the MODU will limit oil on cuttings to 5% by weight of wet cuttings.

Drilling fluids to be used are non-toxic or have low toxicity upon discharge to receiving waters. Chemical selection for drilling fluids will conform to Offshore Chemical Notification Scheme (OCNS) rating of additives (GESAMP, 1993), with priority given to using additives rated as PLONOR (Pose Little or No Risk), Group E and F or Gold rating (OSPAR, 2004). Products that are not on the OCNS rating will be risk assessed for offshore use.

### Drill Cuttings Characteristics

Drill cuttings, which are the rock fragments removed from the well, will primarily consist of claystone, siltstone, sandstone and shale, and will range from very fine (4.5 to 6 microns) to very coarse (>1 cm) particles with a thin film of drilling fluids. Where NADF are used, drill cuttings tend to clump together to make larger particle sizes (Neff JM, et al, 2000).

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(7) Coarse particles may take several hours to settle 2,400 m (7,800 ft.) to the seabed. For instance, based on settling velocity, a 1mm diameter sand particle would take in the order of 4.3 hours to settle this distance.

### Impacts to Sediment Quality

The direct discharge of cuttings to the seabed from drilling the top-hole sections will represent the most pronounced source of potential environmental impacts to sediment quality from the Project. This discharge of the anticipated 350 m<sup>3</sup> of cuttings at the seabed is expected to result in the formation of a small cuttings pile immediately around the well site (Neff, J. M., 2005). The characteristics and size of the pile will depend on a number of factors including particle size of the cuttings and tidal and current forces (Hinwood JB, et al., 1994). For deeper hole sections using NADF, where cuttings are discharged in surface waters at approximately 2,400m above the seabed, these cuttings are highly unlikely to form a cuttings pile on the seabed and are not expected to do so. Piles of drill cuttings rarely occur in deepwater environments (Neff JM, et al, 2000). Even though NADF drill cuttings do tend to clump together which would increase their settling velocity, they will be laterally dispersed by currents on their descent through the around 2,400 m (7,800 ft.) deep water column before they eventually settle forming scattered and isolated thin veneer patches of fine particles on the seabed (Hinwood, JB., et al, 1994, & IOGP, 2016). Of the fraction that settle, settling may typically occur over a distance of in the order of 500 to 1,000 m from the discharge point, possibly further depending on the current speed and movement, with concentration decreasing over distance.

Upon completion of drilling, concentrations of most contaminants would be expected to gradually return to within the range of background conditions, through mechanisms including dissolution, biodegradation and resuspension and transport by bottom currents. An exception is likely to be barium contained in barium sulphate (barite) present in drilling fluids, which is insoluble and relatively persistent in the marine environment. Concentrations of barite (a non-toxic PLONOR substance) will be relatively low and will not pose an environmental concern as it is insoluble.

Potential oxygen reduction can occur in the sediment of cuttings piles particularly where NADF is used due to microbial biodegradation of the adhered synthetic base organic fluid. Given the cutting pile will be derived from the top-hole sections where seawater and sweeps is used, the potential for oxygen reduction effects in sediment will be limited and is not expected to have lasting adverse impacts to the surrounding ecology.

### Impact to Benthic Communities

The well will be drilled in over 2,400 m (7,800 ft.) water depth. The deep sea communities inhabiting the soft sediment seabed at the potential well site (where temperatures are low and which are permanently in darkness) are expected to comprise of a low density of isolated individuals of common organisms such as polychaetes, foraminifera, hydrozoa, sponges, crustaceans,



molluscs and echinoderms. These species are likely to be well-represented in the region and are considered a low sensitivity receptor.

Potential impacts to benthic communities from the discharge of drill cuttings and fluids include:

- Sediment depositional impacts to benthic communities and potential alteration of the sediment particle size characteristics of the seabed;
- Toxicity and bioaccumulation effects; and,
- Deoxygenation effects to infauna due to microbial process on organically enriched sediments.

Sessile benthic marine organisms may become buried or their feeding and respiratory apparatus could become clogged. However effects would be confined to the immediate surrounds of the well where sediment deposition exceeds 1 kg/m<sup>2</sup> and thus would be limited to a local scale. Given the small anticipated volume of bottom-hole cuttings (350 m<sup>3</sup>) and dispersion in the deep water of the well location (<2,400m; 7,800 ft.), NADF cuttings that will be discharged near the sea surface are expected to disperse over a wide area and result in extremely low sedimentation rates, which will represent a minor increase compared to natural erosion and accretion. The deposition will be localised to the well site and will occur in scattered and isolated thin veneer patches of fine-sized particles.

Given Group III NABF will be selected for the Project, which is the least toxic compared to Groups I and II, the potential for toxicity effects to seabed communities will be minor. Group III NABF is either sufficiently water soluble such that they typically do not bio accumulate in the lipids of marine organisms or are insoluble making them not biologically available (IOGP, 2016). Most of the organic compounds in NADF are biodegradable and are broken down over time by microbes. In addition, metals present in drill cuttings and fluids are strongly bound to particles which make them insoluble. Hence they are not biologically available even when digested by a marine organism (USEPA, 2000). As cuttings and adhered NABF will be dispersed on their long descent to the seabed, any potential for toxicity effects to occur to benthic organisms is substantially reduced. The area in the immediate vicinity of wellhead where the cutting pile has formed will comprise cuttings overridingly derived from cuttings from the top-hole sections where seawater and sweeps are used. Any potential for toxicity and bioaccumulation effect are expected to be very minor and short-lived.

Reduction in oxygen levels in sediment have the potential to cause secondary impacts to benthic in-faunal communities if oxygen concentrations decline to levels where anoxic or hypoxic conditions form. This effect is typically associated with biodegradation of the organic content of NADF and can be the

main factor in determining potential impacts to infauna. Species sensitive to anoxic environments are eliminated and replaced by tolerant and opportunistic species, so species diversity decreases, but the number of individuals often increases (Neff JM, et al, 2000). Given that the cuttings pile is likely to be formed by the seawater from the top-hole sections, the potential for oxygen reduction effects in sediment is assessed to be small and short-term such that indirect impacts to infauna will be negligible and these species are considered to be of low sensitivity to the Project activities. The thin veneer of fine-sized particles from deposition of NADF drill cutting particles is expected to be rapidly reworked in the surficial sediment by natural processes such as bioturbation (USEPA, 2000).

Overall, any effects to benthic species or habitats will be highly localised to around the well head and recovery by recruitment of new colonising organisms and migration from adjacent undisturbed seabed area is expected to commence shortly after drilling finishes (Neff, J. M., 2005, IOGP, 2016). Recolonization is typically well advanced within a year, though processes are likely to take longer in deepwater environment with a peak community reached in the order of more than two years. In a study on the impacts to the benthic environment resulting from the discharge of drill cuttings and NADF in deep water, it was concluded that environmental impacts were minimal and highly localised to well sites (Balcom et al, 2012).

#### Impacts to Water Quality

The main potential source of impact to water quality will be the discharge of cuttings coated with NADF at the sea surface after treatment onboard the MODU. Fine particles (fine silt and clay) within the cuttings will tend to remain in suspension to form a turbid plume being dispersed and diluted to lower concentrations down current of the discharge pipe. However this potential for turbidity in the water column may be reduced due to NADF drill cuttings tendency to clump together, which increases the rate of settling. Plume dilutions by a factor of 10,000 within a downstream current distance of 100 m have been reported (Hinwood JB, et al, 1994), with dilution to ambient concentrations (based on suspended solid concentrations and light transmittance) within 350 to 1,500 m downstream from the discharge location (UNEP, 1985). Given the short duration of the exploration activities (40 days), impacts to water quality are expected to be localized and temporary in nature. The plume is expected to dissipate rapidly given the plume will move with current.

#### Impacts to Fish and Pelagic Communities

Marine water column organisms are at a lower risk of harm from drill cuttings discharge due to the rapid dilution and dispersal downstream of the well site by prevailing currents. Mobile organisms, such as fish and larger

crustaceans usually avoid or move away from plumes of suspended drill cuttings, which reduces the potential for impact (IOGP, 2016).

After discharge of the cuttings with NADF in the upper water column, rapid dilution and dispersion will occur and aid in the reduction of the concentration of NADF fluid to below levels that could elicit a toxic response. Given that fish and pelagic organisms are mobile and would have a temporary, transient exposure to the plume, the potential for toxicity effects to occur is considered negligible and this biota are considered to be of low sensitivity to the Project activities.

#### *Existing/In Place Controls*

The following controls will also be implemented:

- The NADF will be recycled and cuttings will be treated on-board to MODU prior to discharge. The oil content for discharge of NADF will be equal or less than 5% by weight of wet cuttings.
- Where cuttings are discharged overboard, they will be discharged below the water line.
- All chemicals that are discharged to the marine environment are selected for low toxicity where possible and subject to internal justification including environmental consideration with reference to OCNS rating of additives.
- NADF shall only be used where seawater and sweeps or WBDF cannot provide the required technical specifications.
- All residual NADF must be returned to a shore for reconditioning, re-use or disposal or alternatively contaminated muds may be left in situ in the well behind suitable barriers. No bulk discharge of NADF drilling fluids will take place.
- The average oil content for discharge of NADF pit cleaning slops will be limited to 1% by volume.

#### *Significance of Impact*

With the implementation of the existing / in place controls, and given the short duration of the drilling activity (approximately 40 days), the temporary or short-term duration of impacts and localized scale of impacts to medium to low sensitivity receptors, the significance of impacts due to operational discharges of drill cuttings and drilling fluids is considered be **Minor** significance for water quality and **Negligible** significance for sediment quality, fish & pelagic communities and benthic communities (*Table 6.15 to Table 6.18*).

**Table 6.15** *Assessment of Impacts from Operational Discharge of Drill Cuttings and Drilling Fluids on Sediment Quality*

<b>Impact</b>	Deposition of cuttings on seabed sediments and change in sediment quality			
<b>Impact Type</b>	Direct	Indirect	Induced	
<b>Impact Duration</b>	Temporary	Short-term	Long-term	Permanent
<b>Impact Extent</b>	Local	Regional	International	
<b>Impact Scale</b>	Drill cutting pile formation around the well site (typically <200 m radius) and minor increase in sedimentation rate in wider area.			
<b>Frequency</b>	Operational discharges and formation of the cuttings pile will occur over the duration of drilling (approximately 40 days).			
<b>Impact Magnitude</b>	Positive	Negligible	Small	Medium
<b>Resource Sensitivity</b>	Low	Medium	High	
<b>Impact Significance</b>	Negligible	Minor	Moderate	Major

**Table 6.16** *Assessment of Impacts from Operational Discharge of Drill Cuttings and Drilling Fluids on Benthic Communities*

<b>Impact</b>	Sediment deposition on benthic communities			
<b>Impact Type</b>	Direct	Indirect	Induced	
<b>Impact Duration</b>	Temporary	Short-term	Long-term	Permanent
<b>Impact Extent</b>	Local	Regional	International	
<b>Impact Scale</b>	Impacts to benthic community under the cutting pile limited to the immediate surrounds of the well site (typically <200m)			
<b>Frequency</b>	Operational discharges and deposition of cuttings will occur over the duration of drilling activity (approximately 40 days).			
<b>Impact Magnitude</b>	Positive	Negligible	Small	Medium
<b>Resource Sensitivity</b>	Low	Medium	High	
<b>Impact Significance</b>	Negligible	Minor	Moderate	Major

**Table 6.17** *Assessment of Impacts from Operational Discharge of Drill Cuttings and Drilling Fluids on Water Quality*

<b>Impact</b>	Reduction in water quality			
<b>Impact Type</b>	Direct	Indirect	Induced	
<b>Impact Duration</b>	Temporary	Short-term	Long-term	Permanent
<b>Impact Extent</b>	Local	Regional	International	
<b>Impact Scale</b>	Localised and temporary impacts to water quality are expected within the plume.			
<b>Frequency</b>	Operational discharges will occur over the duration of drilling (approximately 40 days).			
<b>Impact Magnitude</b>	Positive	Negligible	Small	Medium
<b>Resource Sensitivity</b>	Low	Medium	High	
<b>Impact Significance</b>	Negligible	Minor	Moderate	Major

**Table 6.18** *Assessment of Impacts from Operational Discharge of Drill Cuttings and Drilling Fluids on Fish and Pelagic Communities*

<b>Impact</b>	Exposure of fish and pelagic communities to sediment plume			
<b>Impact Type</b>	Direct	Indirect	Induced	
<b>Impact Duration</b>	Temporary	Short-term	Long-term	Permanent
<b>Impact Extent</b>	Local	Regional		International
<b>Impact Scale</b>	Localised potential for change in behaviour – avoidance.			
<b>Frequency</b>	Operational discharges will occur over the duration of drilling (approximately 40 days).			
<b>Impact Magnitude</b>	Positive	Negligible	Small	Medium
<b>Resource Sensitivity</b>	Low	Medium		High
<b>Impact Significance</b>	Negligible	Minor	Moderate	Major

*Additional Mitigation, Management and Monitoring*

Given the **Minor** and **Negligible** significance, no additional mitigation is considered necessary provided the existing controls are appropriately implemented.

*Significance of Residual Impacts*

The residual impact from operational discharges would be of **Negligible** to **Minor** significance for sediment, benthic communities, water quality and fish and pelagic communities.

**6.4.2** *Impacts from Underwater Sound Generation on Marine Fauna*

*Source of Impact*

The use of vertical seismic profiling (VSP) has the potential to generate elevated underwater sound in the vicinity of the well. VSP uses a small airgun array, typically comprising either a system of three 250 inch<sup>3</sup> airguns with a total volume of 750 inch<sup>3</sup> of compressed nitrogen at approximately 2,000 pounds per square inch (psi). During VSP operations, four to five receivers are positioned in a section of the wellbore and the airgun array is discharged approximately five times at 20 second intervals. The generated sound pulses are reflected through the seabed and are recorded by the receivers to generate a profile along a section of the wellbore. This process is repeated as required for different stations in the wellbore and will involve approximately 18 hours of source release, within a 24 hour period.

Acoustic modelling undertaken for VSP for similar drilling activities indicates that sound pressure levels generated at source (1 m) are equivalent to 216 dB re 1µPa (Chevron, 2008). Applying a spherical loss propagation approach, sound levels are predicted to attenuate to approximately 160 dB re 1µPa within 600 m of the source.

Depending on received sound levels and the sensitivity of the specific marine fauna, exposure to underwater sound has the potential to affect receptors in four main ways:

- **Physical Injury.** Direct physical injury of the fauna due to rupture or damage of body tissue, which may lead to mortality in extreme cases.
- **Auditory Injury.** Permanent injury to hearing organs (known as a Permanent Threshold Shift (PTS)).
- **Physiological and Behavioural Changes.** Physiological changes include temporary auditory fatigue (known as Temporary Threshold Shift (TTS)). Temporary behavioural changes include changes in swimming behaviour or direction of fauna.
- **Masking or interfering with other biologically important sounds.** This includes vocal communication, echolocation signals and sounds produced by predators or prey.

The effects of the above in relation to different key sensitive receptors within Rakhine waters are discussed below.

#### Marine Mammals

Marine mammals are considered the receptor most susceptible to impacts from anthropogenic underwater sound sources. Whales and dolphins in particular utilise sound for communication, socialising, breeding and (for dolphins) foraging and feeding.

Low frequency mammals (baleen whales such as humpback, blue and Bryde's whales) are considered to be most sensitive to the frequency levels generated by VSP (<500 Hz) (Southall, et al, 2007). These species are known to be present in the waters off Rakhine State.

Mid and high frequency mammals (toothed whales such as dolphins and sperm whales) are considered to be most sensitive to sound greater than 1 kHz and are therefore less sensitive to the low frequency sound from VSP. These species are also known to be present in Rakhine waters.

Little information is available on sensitivity of dugongs to sound; however, similar to dolphins, they are understood to be most sensitive to sound frequencies greater than 1 kHz (Anderson and Barclay, 1995), and therefore are not anticipated to be affected significantly by sounds generated by the VSP source. However, suitable dugong habitat is located 150 km (93 miles) away and therefore will not be impacted.

## Marine Turtles

Only a few studies have looked into hearing capabilities of marine turtles which have shown that turtles respond to low frequency sound, with highest hearing sensitivity in the frequency range 100-700 Hz (Bartol and Musick, 2003). This coincides with the frequency range for VSP (<500 Hz). There is limited information about the sound levels and associated frequencies that will cause physical injury or temporary hearing loss in turtles. Turtles are considered to be less sensitive to sound than marine mammals.

## Fish

Fish hearing abilities can vary widely even within families, but generally fish hear best at low frequencies below 1 kHz (Ladich, F., 2000). Hearing sensitivity in bony fish is a function of the inner ear, specialised auditory structures and, if present, the swim bladder, which provides an indirect route for sound to reach the inner ear (Finneran and Hastings, 2000). Some fish have a special connection between the swim bladder and the inner ear, providing an enhanced indirect route. These fish are considered to be 'hearing specialists' as they are capable of detecting less intense and higher frequency sound waves compared to non-specialised fish 'hearing generalists'. Underwater sound can cause a change in fish swimming behaviour or direction.

### *Existing/ In Place Controls*

Measures to control/ minimise adverse impacts from an increase in underwater sound levels as based on the Australian Environment Protection and Biodiversity Conservation (EPBC) Act Policy Statement 2.1 (EPBC, 2008) and will include:

- Visual check for marine mammals or turtles within 1 km (observation zone) of the MODU or vessel for 20 minutes prior to commencing VSP operations.
- Soft start - build up power for VSP slowly to give adequate time for marine mammals or turtles to leave the area (20 minutes at minimum). If a whale or marine turtle is sighted within the shut-down zone (500 m), the acoustic source should be shut down completely.
- Soft start procedures should only resume after the whale(s) or turtle(s) has been observed to move outside the shutdown zone (500 m) or when 30 minutes have lapsed since the last sighting.
- Visual observations of the observation zone (1 km) will be maintained continuously during VSP to identify if there are any whales or turtles present.
- During the pre-start meeting, all crews will be alerted to immediately report to the trained observer when they observe any marine mammals or turtles



during and prior to the activity. The pre-start meeting will cover the likelihood of whale observations and required actions if they are sighted.

- A trained observer will be utilised during VSP operations to monitor and record marine mammal and turtle observations and all records will be reported to MONREC following completion of the activity.

#### *Significance of Impact*

VSP will be undertaken within an 18 hour period. Behavioural effects on the most sensitive fauna (marine mammals) are only likely within a radius of 600 m of the sound source. Therefore, effects from underwater sound will be localised and temporary and any resulting significant impacts to marine fauna are therefore considered unlikely.

Based on secondary data in literature and previous studies for similar operations, VSP sound levels will not be sufficient to result in injury or mortality; the injury criteria for marine mammals potentially present in Rakhine waters ranges from 179 – 230 dB re 1 $\mu$ Pa (Southall, et al, 2007). US National Marine Fisheries Service (NMFS) and National Oceanographic and Atmospheric Administration (NOAA) agencies have also provided an SPL threshold of 160 dB re 1 $\mu$ Pa (rms) whereby behavioural avoidance may be detected in noise sensitive fauna (NOAA, 1995).

As mentioned above, underwater sound levels have been predicted to attenuate to around 160 dB within 600 m of the source, so only marine fauna in relatively small radius from the sound source could experience potential behavioural changes for a short duration (18 hours). Marine fauna is expected to return to their normal behaviour once sound levels have attenuated to below 160 dB re 1 $\mu$ Pa, with no lasting effects for individuals and no impacts at population level expected.

The magnitude of impact from increased sound levels associated with VSP operations is therefore **small**.

Marine mammals and turtles are considered highly sensitive receptors as some of the species present in Rakhine waters are considered international and national species of conservation concern and their sensitivity to underwater sound. Based on the **high** ranking for receptor sensitivity attributed to marine mammals and turtles, it is anticipated that, with all the existing control measures in place, the impact will be of **moderate** significance for marine mammals and turtles. Although, given the duration and scale of the potential impact, the impact with the associate mitigation is unlikely to have a significant impact.

As fish are not considered to be as sensitive to underwater sounds as marine mammals and turtles (**Medium** sensitivity ranking acknowledging the presence of hearing specialist species), it is anticipated that, with all the

existing control measures in place, the impact will be of **Minor** significance for fish (Table 6.19 and 6.20).

**Table 6.19** *Summary of Impact Assessment of Ambient Underwater Sound on Marine Mammals and Turtles*

<b>Impact</b>	Increase in underwater sound leading to behavioural changes on marine mammals			
<b>Impact Type</b>	Direct	Indirect	Induced	
<b>Impact Duration</b>	Temporary	Short-term	Long-term	Permanent
<b>Impact Extent</b>	Local	Regional		International
<b>Impact Scale</b>	Localised behavioural changes to a small number of individuals.			
<b>Frequency</b>	Once for approximately 18 hours over the duration of drilling operations			
<b>Impact Magnitude</b>	Positive	Negligible	Small	Medium
<b>Resource Sensitivity</b>	Low	Medium	High	
<b>Impact Significance</b>	Negligible	Minor	Moderate	Major

**Table 6.20** *Summary of Impact Assessment of Ambient Underwater Sound on Fish*

<b>Impact</b>	Increase in underwater sound leading to behavioural changes or physical impact on fish			
<b>Impact Type</b>	Direct	Indirect	Induced	
<b>Impact Duration</b>	Temporary	Short-term	Long-term	Permanent
<b>Impact Extent</b>	Local	Regional		International
<b>Impact Scale</b>	Localised behavioural changes to a small number of individuals.			
<b>Frequency</b>	Once for approximately 18 hours over the duration of drilling operations			
<b>Impact Magnitude</b>	Positive	Negligible	Small	Medium
<b>Resource Sensitivity</b>	Low	Medium	High	
<b>Impact Significance</b>	Negligible	Minor	Moderate	Major

#### *Additional Mitigation, Management and Monitoring*

The control measures adopted by the Project are considered international good practice for reducing the impact of underwater sound from VSP operations on marine organisms. However, given the potential for whale sharks to be present in the Bay of Bengal, the shutdown procedure will also be observed for whale sharks.

Although this does not affect the overall impact significance rating, all information collected on marine species sightings will be reported to MONREC at the end of the activity in the Environmental Monitoring Report.

#### *Significance of Residual Impacts*

The residual impact from an increase in underwater sound levels associated with VSP would be of **Moderate** significance for marine mammals and turtles and of **Minor** significance for fish. The Moderate significance rating applied to marine mammals and turtles corresponds to the highly sensitivity nature of these species.

### 6.4.3

#### *Impacts from Unplanned Hydrocarbon Spills to Marine Fauna and Habitats*

##### *Source of Impact*

There is the inherent potential for unplanned releases of hydrocarbons with offshore oil and gas operations. Spills are not predicted to occur during normal operating conditions, but rather represent unlikely and exceptional incidents. For the Project, these potential spills scenarios have been identified:

- Accidental fuel spills including deck spills.
- Vessel collision during drilling activities or transit or with third party/other Project vessels.
- Loss of well integrity/control.

Minor spills on the deck of the vessels can occur due to accidental releases from stored hydrocarbons/harmful chemicals or equipment present on the deck such as small quantities of lubricating oils, hydraulic fluid or other chemicals.

In rare cases, vessel collision can lead to rupture of the fuel tank leading to a release of fuel to the marine environment. For this to occur, the collision must be of sufficient force to penetrate the vessel hull in the location of the fuel tank; which is unlikely. The volumes spilled would be potential spill volume is expected to be approximately 100-200 m<sup>3</sup> of MGO.

The target for Block AD-3 is dry gas based on data collected in seismic surveys in 2015. Therefore, no oil spill will occur from a potential loss of well control. Loss of well control situations are rare in offshore oil and gas drilling. If this did occur, a gas plume could be generated but will have a limited, localised impact on the marine environment such as the physical displacement of transient and/or mobile fauna. The extent of the plume is expected to be relatively small in comparison to the surrounding offshore, deep water environment.

Potential impacts from unplanned hydrocarbon spills may include:

- Toxic effects to marine biota.
- Decline in water quality.
- Oiling of marine megafauna and avifauna.

Impacts to marine mammals, marine turtles, fishes and seabirds which may be found within the offshore area are discussed below.

##### Marine Mammals

Marine mammals are mobile and a number of field and experimental observations indicate whales and dolphins may be able to detect and avoid surface slicks from fuel spills (Smith et al, 1983). Nevertheless, observed instances have occurred where whales and dolphins have swum into oiled areas without seeming to detect the slicks, or because the slicks were unavoidable. Marine mammals exposed to surface slicks in the event of a spill, are at risk of lethal and sub lethal effects from inhalation of volatile components, as well as skin contact and/or ingestion of hydrocarbons (Etkins, D.S., 1997, IPIECA, 1995). Fouling of whale baleen may disrupt feeding by reducing the ability to take in prey, while toothed whales including dolphins, which are gulp feeders, may be less susceptible. Given that significant numbers of marine mammals are not expected to be present in the area potentially affected by a spill and may exhibit avoidance behaviour, the relatively small volumes of hydrocarbons released and the tendency for fuel spills to evaporate rapidly, the potential for environmental impact to marine mammals from a surface spill of hydrocarbons is considered unlikely and will reduce with increased distance away from the spill source.

### Seabirds

Offshore waters can be potential foraging grounds for seabirds that are vulnerable when coming into contact with surface slicks during feeding or resting on the sea surface and typically do not exhibit avoidance behaviour. Physical contact of seabirds with surface slicks may result in fouling of feathers causing them to matt and lose their insulating, buoyancy and water-repelling properties. This may also lead to mortality as birds sink and drown, due to hypothermia (loss of thermoregulation) or as they lose the ability to fly leading to starvation. Physical contact with slick or vapours can also cause irritation and injury to a bird's eyes, skin and mouth cavities. Ingestion and inhalation of hydrocarbons from preening can damage internal organs, suppress immune system and reduce reproductive success (AMSA, 2012, IPIECA, 1995).

Seabirds are not expected to be encountered in significant numbers at the well location as it will be over 93 miles (150 km) from the coast. In addition, no large slicks are expected since the release would be fuel or hydrocarbons (as this is not an oil well). Given that, the relatively small volumes of hydrocarbons potentially released and the tendency for fuel spills to evaporate rapidly, the potential for environmental impact to seabirds from a surface spill of hydrocarbons is considered to affect relatively few individuals and will reduce with increased distance away from the spill source.

### Marine Turtles

Marine turtles are not known to exhibit avoidance behaviour when they encounter an oil slick (Odell, DK. and MacMurray, C., 1986) although contact with slicks can result in hydrocarbon adherence to body surfaces (Gagnon,

MM and Rawson CA., 2010) causing irritation leading to inflammation and infection and damage to the salt gland (Etkins, D.S., 1997). Oiling can also irritate and injure skin which is most evident on pliable areas such as the neck and flippers (Lutcavage, et al, 1995). On contact with surface slicks, turtles may also experience irritation and injury to airways and lungs, eyes and mucous membranes of the nose and mouth. Ingested oil such as tarballs can cause buoyancy problems due to build-up of fermentation gases in the gut.

As discussed previously, the potential exposure to a slick would be highly localised. While marine turtles (adults, hatchlings and juveniles) may be present in the area affected by a spill, they are not expected to be present in significant numbers. Given the limited extent of exposure and its rapid dilution and dispersion, impacts to marine turtles are not expected to have any population-wide effects and will be localised.

### Fish

It is rare for fish mortality to occur from oil spills, especially in open water environments (ITOPF, 2011) such as those found in Block AD-3. It is suggested that pelagic fish species (like those present in Block AD-3) can detect and avoid oil spills by swimming into deeper water or away from the affected areas. As such, fish are unlikely to be impacted.

### *Existing/ In Place Controls*

Standard measures to control or minimise the potential adverse impacts from unplanned spills will include:

- Preparation and implementation of vessel standard operating procedures.
- Adherence to MARPOL 73/78 Annex I:
  - Vessels will hold a valid International Oil Pollution Prevention (IOPP) Certificate (Regulation 7).
  - Vessels will maintain an oil record book (Regulation 17).
  - Shipboard Oil Pollution Emergency Plans (SOPEPs) will be developed and kept on-board vessels (Regulation 37).
- Chemicals and/or hydrocarbons will be handled and stored in compliance with the Material Safety Data Sheet (MSDS).
- All chemical and/or hydrocarbon wastes will be segregated into clearly marked containers prior to onshore disposal by a licensed waste management contractor, as per the relevant MSDSs.

- Spill response kits will be located in proximity to hydrocarbon storage/bunkering areas and appropriately stocked/replenished as required.
- Standard maritime safety/navigation procedures will be implemented including:
  - Adhere to steering and sailing rules including maintaining look-outs (e.g. visual, hearing, radar etc.), proceeding at safe speeds, assessing risk of collision and taking action to avoid collision (monitoring radar).
  - Adhere to navigation light display requirements, including visibility, light position/shape appropriate to activity.
  - Adhere to navigation noise signals as required.
  - Adherence to minimum safe manning levels.
  - Maintenance of navigation equipment in efficient working order (compass/radar).
  - Navigational systems and equipment required are those specified in Safety of Life at Sea (SOLAS) Chapter V (Regulation 19).
  - Automatic Identification System (AIS) installed as required by vessel class in accordance with SOLAS Chapter V (Regulation 19).
- Establishment of a 500 m radius safety exclusion zone around the MODU.
- In the event of a vessel collision, the SOPEP will be implemented if required.

*Significance of Impact*

The above controls will help reduce the likelihood of a spill. If a fuel spill does occur, it will be highly localised and will evaporate and disperse rapidly in the offshore waters of Block AD-3.

As discussed above, spills are unlikely to have significant effects on the marine environment or species. Given only small volumes are likely in the event of a spill, the considerable distance of Block AD-3 (over 150 km (93 miles)) from coastal habitats, and the highly dispersible nature of the fuel, a spill would only affect water quality and marine fauna in close proximity to the spill release location. In addition, large marine fauna (fish, turtles and mammals) may exhibit avoidance behaviour and move away from the spill-affected area.

Therefore, a spill to the marine environment will result in a negligible magnitude impact. Marine fauna and habitats that may be impacted by an

oil spill have varying degrees of sensitivity. However, the impact would be of **Negligible** significance overall.

**Table 6.21** *Assessment of Impacts from Accidental Spills on Marine Fauna and Habitats*

<b>Impact</b>	Water contamination and secondary impacts to biodiversity from accidental spills				
<b>Impact Type</b>	Direct	Indirect		Induced	
<b>Impact Duration</b>	Temporary	Short-term	Long-term	Permanent	
<b>Impact Extent</b>	Local	Regional		International	
<b>Impact Scale</b>	Localised potential to a small number of individuals.				
<b>Frequency</b>	Infrequent.				
<b>Likelihood</b>	Rare				
<b>Impact Magnitude</b>	Positive	Negligible	Small	Medium	Large
<b>Resource Sensitivity</b>	Low	Medium		High	
<b>Impact Significance</b>	Negligible	Minor	Moderate	Major	

*Additional Mitigation, Management and Monitoring*

Provided that the control measures are in place, the likelihood of a spill occurring is unlikely and no additional mitigation is required. Preventative controls designed to avoid spills, or contain and prevent spills from reaching the marine environment will be implemented via compliance with legislative requirements and Ophir Myanmar procedures.

*Significance of Residual Impacts*

The residual impact from an unplanned spill would be of **Negligible** significance for all marine fauna and habitats (Table 6.21).

**6.4.4** *Impacts on Fishing Activity from Physical Presence of MODU and Vessels*

*Source of Impact*

The following section assesses the impacts to fisheries from potential physical disturbance due to the presence of the MODU and support vessels based on the areas / locations in which they fish as defined in Section 5.4. The assessment excludes the local Rakhine fishermen who fish in waters up to 50 km (30 miles) from the coast in 490 ft. (150 m) water depth. The assessment focuses on commercial trawlers and purse seine fishermen from through Myanmar that could potentially be fishing in the waters of Block AD-3.

Temporary disturbance of fishing activities may occur due to the presence of the MODU and support vessels and implementation of the 500 m safety exclusion zone. Some fishermen may therefore have to move outside of the exclusion zone in order to catch fish.

It was mentioned that during consultation in Rakhine, November to May is the key fishing season however; large commercial trawlers can fish



throughout the year. Fishing boats likely to be in offshore waters are large (>90 ft. in length) and have navigational systems such as GPS.

#### *Existing / In Place Controls*

In order to ensure potential impacts from the exploration drilling on the fishers and the fishing community are avoided or reduced as far as practicable, the following control measures as mentioned in *Section 6.4.3* are planned:

- A 500 m radius safety exclusion zone and 2.5 nautical mile (nm) cautionary zone will be maintained around the MODU as required. The Vessel Master will endeavour to manage vessel access and activities within this zone.
- MODU and support vessels will comply with international regulations for collision avoidance, navigation and maintenance.
- Myanmar speaking crew members will be available on board the MODU.
- Timely sharing of information on the details of the Project in order to inform stakeholders (in the form of a Notice to Mariners).
- Disclosure and implementation of the grievance mechanism for the Project and timely investigation of any grievances.

A grievance mechanism will be developed and implemented to provide an avenue for stakeholders, including those in fishing communities, to raise concerns with the Project and provide a process for timely resolution of grievances. Although this measure does not affect the impact significance, it has been included as an important component of Ophir Myanmar's responsibilities to ensure impacts are avoided or reduced as far as possible.

#### *Significance of Impacts*

The communication of timely information will help to raise awareness of exploration drilling and potential disturbance to fishing activity to help fishers to avoid the MODU and support vessels, and the exclusion zone. In addition, the Project will have support vessels which will communicate with fishing vessels they encounter whilst at sea. Once the MODU and support vessels leave the area, fishing vessels will be able to return to the area minimising the overall time that fishing is restricted.

The fishing activity likely to be in Block AD-3 consists of large commercial fishing vessels from throughout Myanmar. These vessels, however, tend to have larger fishing grounds with highly developed navigational and communication systems which will be able to easily avoid the exclusion zone around the vessels and equipment. In addition, the actual area of potential

exclusion is small; limited to 500 m radius zone around the MODU. Therefore, impacts will be of minor magnitude.

With the existing control measures in place, it is expected that the impacts on fishing activities are likely to be **minor** and impacts on livelihoods should be **minor** (Table 6.22).

**Table 6.22** *Assessment of Impacts on Fishermen*

<b>Impact</b>	Fisheries Activity and Livelihoods			
<b>Impact Type</b>	Direct	Indirect	Induced	
<b>Impact Duration</b>	Temporary	Short-term	Long-term	Permanent
<b>Impact Extent</b>	Local	Regional		International
<b>Impact Scale</b>	Impact scale will be limited to a relatively small number of vessels (compared to the overall number of vessels engaged in fishing) in the deep water.			
<b>Frequency</b>	Duration of the drilling (40 days)			
<b>Impact Magnitude</b>	Positive	Negligible	Small	Medium
<b>Resource Sensitivity</b>	Low	Medium		High
<b>Impact Significance</b>	Negligible	Minor	Moderate	Major

*Additional Mitigation, Management and Monitoring*

Given the controls in place; no additional mitigation is required. A number of factors will be tracked to monitor the effectiveness of mitigation measures. These will include the following:

- Number of interactions between support vessels and fishing boats.
- Feedback from ongoing stakeholder engagement.
- Tracking of grievances raised and response actions.

*Significance of Residual Impacts*

It is anticipated that there may be a **minor** residual impact caused by disturbance to fishers.

**6.4.5** *Impacts from Unplanned Collisions on Fishing Vessel and Other Marine Users*

*Source of Impact*

Potential unplanned collisions between fishing vessels / other shipping may result in damage to fishing gear (e.g. nets/lines damaged), damage to vessels or sinking of vessels. Additional concerns associated with interactions with other vessels include potential for fuel oil spillage. The potential impacts from an accidental release of fuel are provided in Section 6.4.3.

Any damages to fishing gear may adversely impact the fishermen who would have to pay for replacement equipment and may not be able to fish until the

damage is fixed. This could lead to secondary effects on livelihoods of fishing communities.

A moderately used shipping lane exists between ports in Bangladesh connecting to Malaysia and beyond. The issues associated with other marine users are the same as those mentioned above for fishing except for damage to fishing gear.

#### *Existing/In Place Controls*

The existing controls for fisheries and other marine users from unplanned collisions will be the same as those mentioned for impacts on fishing activity from the physical presence of the MODU and support vessels in *Section 6.4.4*.

#### *Significance of Impacts*

During the entire Project, the MODU will be accompanied by the support vessels that act as fishing liaison as well as look out for the presence of other marine users. In addition, there is unlikely to be any local artisanal fishing vessels from Rakhine State in Block AD-3; these vessels have lower navigational abilities than the larger trawlers and purse seiners. The fishing vessels potentially present in Block AD-3 have fishing grounds that cover a wide area (*Figure 5.7*) and also have on-board advance navigational and communication systems to warn them of the presence of the MODU. It should be noted that as the Project Area offshore is relatively small, the potential for encountering fishing vessels is low.

The shipping lane between ports in the north (in Bangladesh) connecting to Malaysia is not busy and covers an area larger than Block AD-3 (refer to *Figure 5.12*). Shipping vessels in transit with a good standard of navigational equipment can easily avoid the Project activities without disruption.

Given the measures in place, the low risk of collision, and the small area to be impacted by the exclusion zone, the impact from collision is of **Negligible** significance.

**Table 6.23** *Assessment of Impacts from Unplanned Collisions on Fishing Vessels and Other Marine Users*

<b>Impact</b>	Unplanned Collisions				
<b>Impact Type</b>	Direct	Indirect	Induced		
<b>Impact Duration</b>	Temporary	Short-term	Long-term	Permanent	
<b>Impact Extent</b>	Local	Regional	International		
<b>Impact Scale</b>	Affect the vessels using Block AD-3.				
<b>Frequency</b>	Duration of the exploration drilling activities (40 days).				
<b>Likelihood</b>	Unlikely.				
<b>Impact Magnitude</b>	Positive	Negligible	Small	Medium	Large
<b>Resource Sensitivity</b>	Low	Medium (Fishing vessels)		High (livelihoods)	
<b>Impact Significance</b>	Negligible	Minor	Moderate	Major	

*Additional Mitigation, Management and Monitoring*

With the existing controls in place, no additional mitigation measures are required.

*Significance of Residual Impacts*

The impacts on fishing vessels and other marine users are likely to be **Negligible** (Table 6.23).

**6.5 SUMMARY OF IMPACTS**

The key potential impacts associated with the project and required mitigation measures are summarised below and in Table 6.24:

- Potential impacts to sediment, benthic communities, water quality, fish and pelagic communities from drill cuttings discharge.
- Increases in underwater sound from the operation of VSP leading to potential disturbance to marine mammals, marine turtles and fish.
- Potential water contamination and related secondary impacts to biodiversity and fishing from accidental spills (e.g. during offshore re-fuelling).
- Potential short-term disruption to commercial fishing activities.
- Potential risk of collisions with fishing vessels and other marine users.

**Table 6.24 Summary of Potential Impacts and Residual Impact Significance**

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impact
Drill Cuttings	• Drill cuttings with NADF will be recycled and treated prior to discharge. The oil content for discharge of cuttings with residual NADF will not exceed 5% by weight of wet cuttings.	<b>Negligible</b> (sediment quality)
	• Cuttings will be discharged below the water line.	<b>Negligible</b> (benthic quality)
	• All chemicals discharged selected for low toxicity where possible.	<b>Minor</b> (water quality)
	• NADF shall only be used where seawater and sweeps or WBDF cannot provide the required technical specifications.	<b>Negligible</b> (fish and pelagic species)
• No bulk discharge of NADF drilling fluids is permitted.		
	• The average oil content for discharge of NADF pit cleaning slops will be limited to 1% by volume.	

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impact
Impacts from underwater sound on marine fauna	<ul style="list-style-type: none"> <li>• Visual check for marine fauna within 1 km (observation zone) of the MODU or vessel for 20 minutes prior to commencing VSP operations.</li> <li>• Soft start - build up power for VSP slowly to give adequate time for marine fauna to leave the area (20 minutes at minimum).</li> <li>• Soft start procedures should only resume when fauna have moved outside the shutdown zone (500 m) or when 30 minutes have lapsed since the last sighting.</li> <li>• Visual observations of the observation zone (1 km) must be maintained continuously to identify if there are any mammals or turtles present.</li> <li>• During the pre-start meeting, alert all crews to immediately report to the trained observer when they observe any marine mammals or turtles during and prior to the activity.</li> <li>• A trained observer will be utilised during VSP operations to monitor and record marine mammal and turtle observations.</li> <li>• All records will be reported to MONREC following completion of the activity.</li> <li>• Given the potential for whale sharks to be present in the Bay of Bengal, the shutdown procedure will also be observed for whale sharks.</li> </ul>	<p><b>Minor</b> (fish)</p>
		<p><b>Moderate</b> (marine mammals and turtles)</p>
Impacts from unplanned spills on marine fauna	<ul style="list-style-type: none"> <li>• Preparation and implementation of vessel standard operating procedures.</li> <li>• Adherence to MARPOL 73/78 Annex I:</li> <li>• Chemicals and/or hydrocarbons will be handled and stored in compliance with the Material Safety Data Sheet (MSDS).</li> <li>• Spill response kits will be available and kept stocked.</li> <li>• Standard maritime safety/navigation procedures will be implemented</li> <li>• Establishment of a 500 m radius safety exclusion zone around the MODU.</li> <li>• In the event of a vessel collision, the SOPEP will be implemented, if required</li> </ul>	<p><b>Negligible</b></p>
Short-term disruption to commercial fishing activities.	<ul style="list-style-type: none"> <li>• A 500 m radius safety exclusion zone around the MODU.</li> <li>• MODU and support vessels will comply with international regulations for collision avoidance, navigation and maintenance.</li> <li>• Myanmar speaking (crew members) available on board the MODU.</li> </ul>	<p><b>Minor</b> (shipping, fishing activities) and livelihoods)</p>
Risk of collisions with fishing vessels and other marine users.	<ul style="list-style-type: none"> <li>• Timely sharing of information (in the form of a Notice to Mariners).</li> <li>• Disclosure and implementation of the Feedback grievance mechanism.</li> </ul>	<p><b>Negligible</b> (shipping, fishing activities) and livelihoods)</p>

This section presents the Cumulative Impact Assessment (CIA) which includes identification of existing and/or potential Projects or activities which could cause cumulative impacts, the impact assessment methodology, and, recommendations for the mitigation measures, if required.

Cumulative impacts refer to the additional impacts that may be generated by other developments or activities in the vicinity of Block AD-3 that when added to the impacts of the proposed Project combine to cause a greater impact. Such impacts may arise due to spatial overlap (e.g. overlap in spatial extent of water quality changes) or temporal overlap (e.g. underwater sound impacts caused by VSP activities at the same time from different sources).

### **7.1 IMPACT ASSESSMENT METHODOLOGY**

The methodology adopted for the CIA is the same as the methodology presented in *Section 6*. Receptors are given the same sensitivity; however, impact magnitude will consider the cumulative effect from the Project and the other projects / activities under consideration. The Methodology adopted is presented in *Section 6.1*.

A CIA considers the residual impacts reported for the Project and evaluates these alongside potential impacts from other projects/activities that may affect common resources and receptors. The ultimate goal of this analysis is to capture the total effects of many actions over time that would be missed by evaluating each action individually.

The CIA will also define the geographic and temporal boundaries to identify other relevant projects or activities, which could interact with the Project. The cumulative assessment will be the same as the impact assessment process and once the initial impact assessment is performed, mitigation and management measures will be developed for all significant impacts and the residual impact will be calculated for each relevant receptor.

### **7.2 EXISTING OR PROPOSED PROJECTS AND ACTIVITIES IN THE AREA OF INFLUENCE**

AD-3 is surrounded by other offshore oil and gas blocks: AD-2, AD-4, AD-9, AD-10, and AD-13 (shown in *Figure 6.2*). It is also bordered to the east by the shallower water Blocks A-4, A-5, and A-6. There are no planned activities in Block AD-4 or AD-13. Seismic surveys were conducted in 2015 and early 2016 in Blocks, A-4, A-5, AD-2, AD-9, AD-10, as well as exploration drilling undertaken in A-6.

Some of these Blocks, such as A-6, may undertake further exploration drilling at the same time as Project activities. Activities in Block A-6 are likely to be similar to the activities proposed in Block AD-3. Block A-6 is located at least 50 km (31 miles) from the proposed well location. Other Blocks could be undertaking seismic surveys at the same time.

Possible cumulative environmental impacts could therefore arise from the generation of underwater sound that could lead to disturbance of marine fauna and the physical presence of seismic equipment which could pose an entanglement risk. Possible social impacts arise from the temporary displacement of fishing activity, specifically fishermen that fish near the continental shelf area where the Project Area overlaps with potential commercial fishing grounds.

### 7.3 *POTENTIAL IMPACTS AND MITIGATION MEASURES*

Any increases in vessel movements will be negligible and are unlikely to have an impact on commercial fishing or shipping in the area. In addition, only a small number of fishers are expected to fish in or in the vicinity of Block AD-3. It is expected that the social impacts from the seismic surveys, if properly mitigated, will be localised and the impact will be of **Negligible** significance overall to shipping and fishing activities. Potential impacts could also arise from potential fuel spills occurring at the same time and the increased vessel presence. The potential for cumulative spills of fuel from the vessels is extremely unlikely to occur, and as vessels generally use light fuels which are readily diluted and dispersed and implement standard mitigation measures, impacts would be expected to be of **Minor** significance. There is the potential impact from cumulative sound generation, however; given that the area of impact for the Project activities is small (limited to 600 m around the MODU), and of a very short duration (18 hours), the resulting cumulative impacts is considered to be of **Negligible** significance.



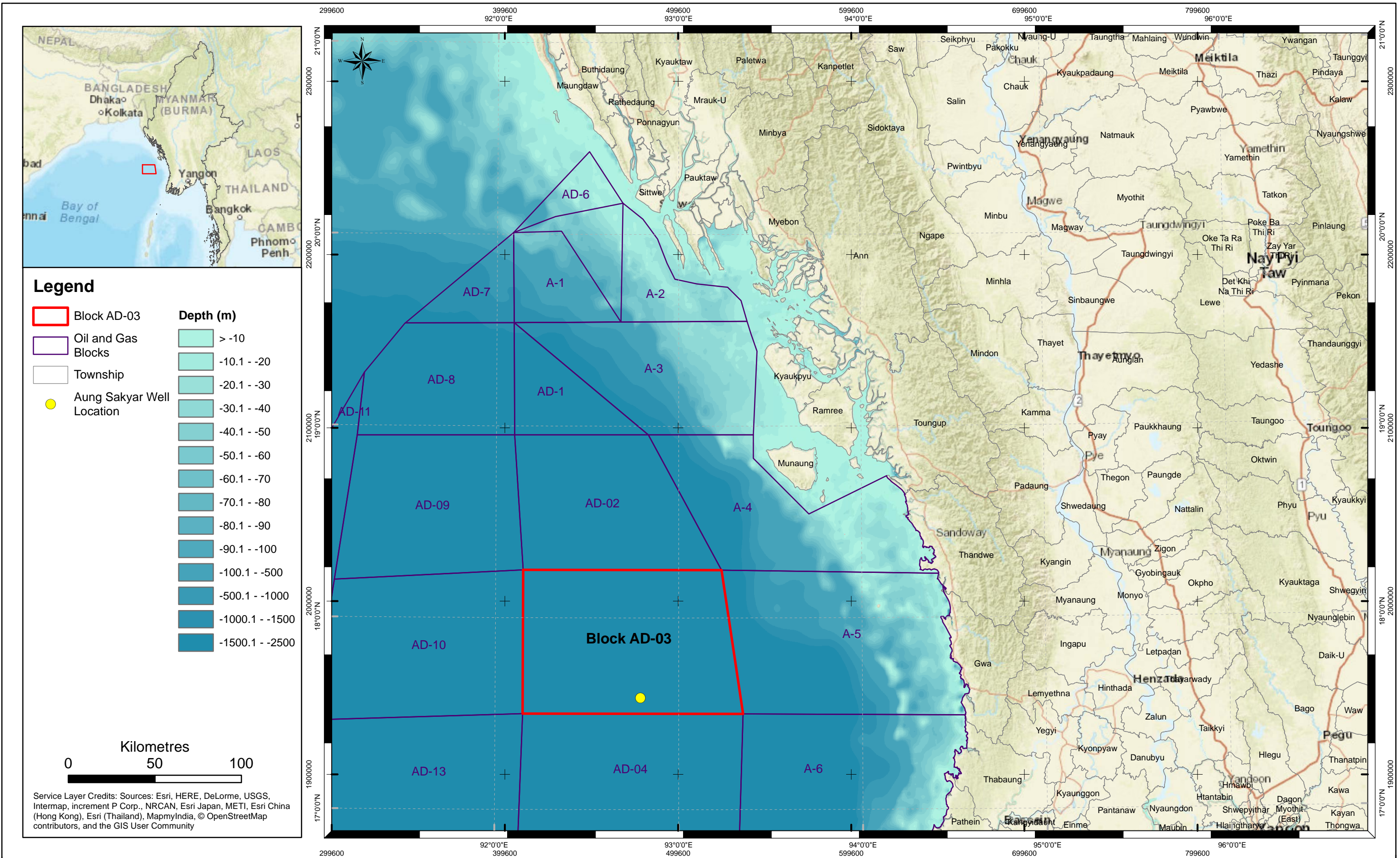


Figure 7.1

Offshore Oil and Gas Blocks in Rakhine

Environmental  
Resources  
Management



## ***PUBLIC CONSULTATION AND DISCLOSURE***

This section presents a summary of the consultation undertaken in the development of the EIA, including description of:

- Regulatory and corporate requirements
- Objectives of consultation
- Approach and scope of engagement for the impact assessment
- Format and content of consultation meetings
- Key issues raised during consultation
- Further disclosure and consultation
- Approach for developing a grievance mechanism.

### ***8.1 PURPOSE OF THE CONSULTATION***

The specific objectives for stakeholder engagement were to:

- Inform relevant stakeholders about Ophir Myanmar and its planned Project activities;
- Identify stakeholders and communities potentially affected by Project activities;
- Gather baseline information on the social and biological environment; and,
- Engage with potentially affected groups to understand the scope of fishing activities, potential Project impacts, perceptions and concerns and discuss appropriate mitigation measures.

### ***8.2 METHODOLOGY AND APPROACH***

#### ***8.2.1 Identification of Relevant Stakeholders and Potential Issues***

The process of identifying potentially affected stakeholders started with scoping which was conducted for the PPR submitted to MOGE and MONREC in April 2016. The purpose of scoping was to identify relevant issues and the townships and villages potentially impacted. The scoping exercise involved both desk-based and preliminary consultation with a number of stakeholders including government authorities.



The scoping process concluded that those fishers active in and around Block AD-3 would likely be from Thandwe District as these are the closest townships to Block AD-3, as well as Yangon, Ayeyarwady, Mon State and Tanintharyi Region. The process informed planning of the stakeholder engagement process for the assessment and fed into the Stakeholder Engagement Plan (SEP) submitted to MOGE in April 2016.

ERM's previous experience of stakeholder engagement in the region was utilised to inform the stakeholder selection the results of this engagement are provided in *Table 8.1*. This information is based on discussions with GAD and DOF representatives and historic village level meetings in 2015 and 2016 for various Projects in the region.

**Table 8.1** *Understanding of Fishing from Previous Engagement in Rakhine State*

Township	Understanding of baseline	Potentially affected communities / peoples?
Manaung	People from Thandwe use Fishing Camps on Manaung Island from November to April. 10 miles (16 km) from Manaung, mostly within 5 miles (8 km) from Manaung.	<b>No</b> , the Project Area is >90 miles from Manaung.
Kyaukphyu	Up to 10 miles (16 km) from coast. Not fishing within deeper offshore waters.	<b>No</b> , the Project Area is >150 miles from Kyaukphyu
Gwa	Large boats fish out to 5-20 miles (8-32 km) from Manaung and up to 60 miles (100 km) from the main land.	<b>No</b> , the Project Area is >100 miles from Gwa.
Ramree	Usually 10 miles (16 km) from the coast. Some fishermen found out to 60 miles (100 km) from the coast.	<b>No</b> , the Project Area is >100 miles from Ramree.
Thandwe	Large boats fish out to 5-20 miles (8-32 km) from Manaung and up to 60 miles (100 km) from the main land.	<b>No</b> , the Project Area is >100 miles from Thandwe. However, there is a large port in Thabyugyaing which large offshore vessels (from other parts of Myanmar) may use.
Outside Rakhine State	Large fishing boats (>90 ft. length) from throughout Myanmar are known to fish in the water of Rakhine State.	<b>Yes</b> , boats could come from Tanintharyi, Mon, Yangon or Ayeyarwady.

*Figure 8.1* shows the location of the township visited for the public consultation. Stakeholder engagement is an ongoing process and as such new stakeholders may emerge as the Project progresses. This will be captured and inform ongoing stakeholder engagement activity that will be undertaken for the Project.

## 8.2.2

### *Overall Approach and Scope of Engagement for the Impact Assessment*

Stakeholder engagement was conducted across administrative levels, subject to permissions of responsible authorities <sup>(8)</sup>. *Figure 7.2* provides an overview of the levels engaged including: National Government, Rakhine State, district and township levels, supported by representative discussion with the village tract leader in the town hall meeting.

Engagement was undertaken in two phases in April and June 2016. A consultation team consisting of ERM and E Guard, accompanied by Ophir Myanmar and Parami representatives conducted meetings and consultations at the three administrative levels. The team was also accompanied by a MOGE representative.

#### *National Level*

Stakeholder engagement at the national level was focused on government agencies with regulatory and policy making responsibility. The purpose of early engagement was to introduce the Project and Ophir Myanmar, to seek clarity on the EIA process and expectations on stakeholder engagement and disclosure. The opportunity was also used to obtain required permissions for engagement with agencies at state and township level and get access to data and information for the EIA Study.

In subsequent stages, engagement covered identification of relevant stakeholders at the state, township and village tract level. At the national level, consultation included MOGE and MONREC.

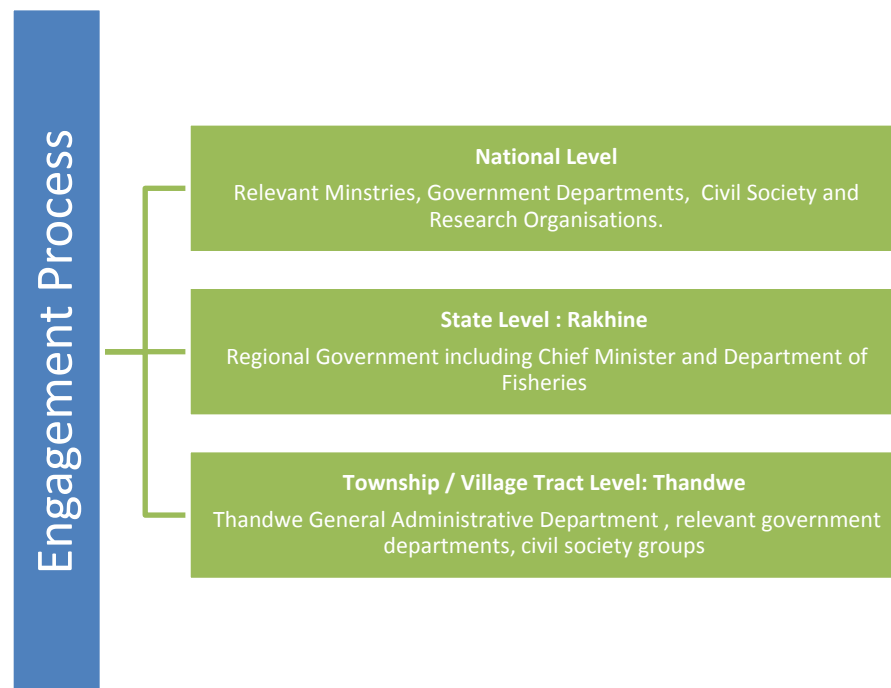
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(8) Prior to any public consultation in Rakhine, a meeting was held between Ophir Myanmar, the environmental consultants and the Chief Minister of Rakhine to discuss the proposed Stakeholder Engagement Plan and receive permission on visiting the townships.





**Figure 7.2** *Engagement at Three levels with Key Stakeholders*



*State Level*

Stakeholder engagement at the state level focused on obtaining required permission for engagement activities at the township level and get access to information on offshore and inshore fishing activities in the state. At the State level the Project met with the Chief Minister of Rakhine State and delegates.

*Township / Village Tract Level*

Engagement for the EIA was focused on Thandwe District in Rakhine State which was considered to be relevant to the Project. The town hall meeting was conducted in the GAD office in Thandwe town. The necessity for this meeting and the participation was also discussed during the Chief Minister’s meeting in Sittwe undertaken during the Scoping Phase. It was agreed that Thandwe included communities with some of the greatest reliance on fishing as well as potential presence in or nearby Block AD-3. The purpose of engagement was to make the community aware of the Project, seek an understanding of specific issues and stakeholder concerns, discuss potential impacts and mitigation measures and obtain district and township level social and environmental data.

The key stakeholders engaged with included;

- GAD (District and Township)
- Department of Fisheries

- Forestry Department
- Offshore fishermen / boat owners from Thabyugyaing and Thandwe
- Myanmar Women's Association; and
- Red Cross.

### 8.2.3 *Format and Content of Consultation Meetings*

#### *Key Principles*

The consultation process was guided by the following key principles:

- **Inclusive:** The consultations were organised to ensure representation of potentially affected and interested stakeholders. Separate focus group discussions (FGDs) were undertaken with fishermen and boat owners.
- **Sharing of information:** At the township and village level consultations, special emphasis was given to build community level understanding of the Project and all the information was provided in Myanmar language.
- **Participatory:** Stakeholders were encouraged to actively participate in the consultations and were always given the opportunity to ask questions.

The approach to consultation, informed by these principles, is described below.

#### *Consultation Approach*

The stakeholder consultation meetings were structured as followed:

- **Introductions and information disclosure:** Introduce Ophir Myanmar, the Project, the EIA, the proposed stakeholder engagement process, the potential environmental and social impacts and mitigation to help the stakeholders understand the Project and Ophir Myanmar's intentions for engagement.
- **Question and answer session** for all stakeholders in the town hall meeting to raise concerns, comments or ask questions to which Ophir Myanmar can directly respond.
- **Data collection:** Collection of more in-depth information through FGDs with key stakeholder groups in the town hall meeting.

In order to inform stakeholders about the Project and share information on the activities, a two page flyer was produced which contained Project information and details on how to feedback into the Project. All information was communicated through use of visual media (including posters and power point presentations) and was provided in local Myanmar language.



To gather more environmental and social baseline data and to identify potentially affected communities, FGDs were undertaken with village leaders, and were guided by questionnaires covering information relating to:

- Generic village profile: Collected information on demographic patterns, communities, occupations, and communication and grievance systems.
- Fishing Methods: Collected information on number / type of boats, fishing season, fishing locations, fishing camps, trip duration and fishing gear used.
- Environment: Collected information on type of fish caught, sighting of marine mammals and turtles, locations of sensitive habitats (coral reefs, seagrass beds, and mangroves), locations of turtle nesting beaches, timing of turtle nesting, fish / invertebrate spawning areas, and protected areas.

Visual tools, such as pictures of fishing gear, maps and pictures of marine species, and hands-on activities, such as drawing fishing areas on hard copies of maps, were utilised in order to increase the involvement of the communities in the stakeholder consultation process. All information collected was summarised and confirmed with stakeholders at the end of the discussion. Stakeholders were also given time to share their concerns and views and any further clarifications they required at the end of the meetings.

Any queries raised by the stakeholders were responded to, and also noted to feed into the impact assessment process for the EIA.

## **8.3 SUMMARY OF CONSULTATION ACTIVITIES UNDERTAKEN FOR THE EIA PROCESS**

### **8.3.1 Scoping Phase**

During scoping, consultation meetings were held with various relevant stakeholders at the regional (Rakhine) level in Sittwe and at the national level in Yangon. The purpose of the scoping consultations was to present information on the Project, gather information on potentially affected people, and gather information on the potential data gaps and how these can be closed for the EIA Report. Scoping consultation involved face-to-face meetings with a range of stakeholders. A summary of the outcomes of the meetings is presented below:

- Stakeholders in Sittwe confirmed that local artisanal fishermen usually fish no further than 48 km (30 miles) from the coast. Only larger fishing vessels are likely to be present in the Project Area.
- For larger vessels that might be within the Project Area, the Yangon and Sittwe DoF and Sittwe ECD confirmed these come from throughout Myanmar but mostly Tanintharyi (Dawei), Ayeyarwady and Yangon.

- The Chief Minister gave his verbal approval for EIA public consultations in Thandwe.
- The main concern raised was regarding social investment in Rakhine. It was explained to stakeholders that for oil and gas operations; social investment usually occurs at a later stage i.e. during production and field development. Stakeholders were familiar with this point and appreciated Ophir Myanmar's transparency.

As per the requirements of the EIA Procedure, Ophir Myanmar disclosed information on the Project in local and national newspapers during Scoping.

### 8.3.2

#### *EIA Phase*

During EIA, a town hall public consultation meeting was conducted in Thandwe, Rakhine State. The meeting location was selected based on previous visits for the Seismic Survey (and IEE Report) and as it is the closest township to the Block with a presence of a large offshore fishing fleet. The meetings were conducted at the Thandwe District General Administrative Department (GAD) office in Thandwe town. The District GAD was met briefly prior to a larger town hall meeting in the main meeting room of the GAD office. The meeting was attended by around 25-30 people consisted of; offshore fishermen, GAD, DOF, Rakhine Women's Association (NGO). In total, around 6 fishermen were present. The majority of people were either GAD (local government), or DOF; although invited, no media attended. A summary of the outcomes of the meetings is presented below:

- The general consensus from the meeting was that the Project activities would be unlikely to interact with local fishing which is conducted closer to shore. However, fishermen have experience with interactions with seismic surveys in this area and were keen to know what would happen if interactions did occur. They did however state that they understood that this Block was further offshore than the other Block they were referring to.
- The offshore fishermen from Thabyugyaing and Gyeitaw confirmed that they fish up to 100 km (60 miles) from the mainland coast and in waters of up to 490 ft. (150 m) depth.
- Trawlers and purse seiners are the two types of offshore vessels in Rakhine. All fishermen in the meeting were trawlers and mentioned that they use GPS to navigate offshore.
- The main questions related to (1) social investment, (2) Ophir's activities including H&S training offshore and permissions to use helicopters and (3) the compensation for fishing interactions. No questions were raised relating to environmental impacts.

### 8.3.3

### Summary

The minutes of the meetings and photos from the consultation are provided in *Annex 8.1*; some photos of the meeting are also provided in *Figure 8.3*.

The date, time, location, stakeholder and purpose of each meeting is provided in *Table 8.1*.

**Table 8.2** *Consultation Activities Undertaken*

Date, time, location	Stakeholder	Purpose of Engagement
<b>National (Yangon and Nay Pyi Taw)</b>		
5 <sup>th</sup> May, 2016, ECD office,	Environmental Conservation Department (ECD)	Present information on Project. Discuss technical information regarding well drilling. Inform ECD of stakeholder consultation plan.
12 <sup>th</sup> May 2016, 10am, MFF Office	Myanmar Fisheries Federation (MFF)	Present information on Project. Discuss potential national level fishing activity in Block AD-3.
12 <sup>th</sup> May, 2016, 11am, DoF Office	Department of Fisheries (DoF)	Present information on Project. Discuss potential national level fishing activity in Block AD-3.
<b>Regional (Sittwe, Rakhine State)</b>		
9 <sup>th</sup> May, 10am, 2016, DoF offices	Regional Department of Fisheries (DoF)	Present information on Project. Obtain regional level data and information. Confirm that local fishermen unlikely to be fishing in Block AD-3.
9 <sup>th</sup> May, 1pm, Chief Minister office	Chief Minister	Present information on Project. Seek permissions and approvals required to conduct engagement in Rakhine State.
9 <sup>th</sup> May, 2pm, GAD Offices	State General Administrative Department (GAD)	Present information on Project. Seek an understanding of the requirements and plan for government presence/participation in the consultation process.
10 <sup>th</sup> May, 10am, ECD State Office	MONREC regional office	Present information on Project. Seek an understanding of the requirements and plan for government presence/participation in the consultation process.
<b>Township (Thandwe, Rakhine State)</b>		
16 <sup>th</sup> June, 10am, GAD offices	District GAD	Present information on Project. Seek permissions and approvals required to conduct engagement in Township level.
16 <sup>th</sup> June, 11am, GAD offices	Thandwe town hall meeting (public)	Present information on Project. Obtain township level data and information.

Figure 8.3 Photos from the Consultation Meetings Undertaken for the EIA Process



Meeting with District GAD in Thandwe



E Guard presenting during Town hall meeting in Thandwe



Chief Minister Meeting in Sittwe



Fishermen asking question during town hall meeting in Thandwe



Meeting with the Regional Environmental Conservation Department in Sittwe



Meeting with the Myanmar Fisheries Federation in Yangon

### 8.3.4

#### *Key Questions Raised during Public Consultation*

##### *Compensation from Incidents*

The fishermen asked about compensation if an incident were to occur. *Note: this in the reference to a 2015 seismic survey where there were cases of nets becoming entangled in seismic lines and fishing gear needed to be cut.* It was noted that they had visited Thandwe and villages before (fisherman asking the question was from Thabyugyaing) and that during these visits fishermen said they wouldn't be fishing that far offshore (in Block AD-3). It was explained, that AD-3 is further offshore than the Block which had the interactions with fishermen. It was also explained that this is drilling of one well, not a seismic survey in the whole Block, so the area for potential interaction is much smaller.

##### *Questions on Project Information*

The GAD asked questions on the Project including permissions from navy, port use in Rakhine, & helicopter use. Also, a member of District Red-cross asked for the Health and Safety training for workers such as First-Aid training. MOGE responded that all contractors will have the required training to work offshore (including health and safety).

##### *Disclosure of Information*

The District GAD asked about the way of disclosure for Notice to Mariners and suggested that it should be distributed through village leaders. MOGE responded that it will be announced to the public one month prior to the commencement of the Project activities.

##### *Local Benefits*

The district GAD asked about social investment and the proposed CSR program. Ophir responded that CSR is very important to Ophir and that wherever Ophir operate; they consider supporting CSR an essential part of the operation. In Myanmar, Ophir are at an early stage of the Project and they do not know whether they will find any gas. However, a CSR program is part of the commitment in the PSC with MOGE if the Project goes to the Production Stage.

### 8.3.5

#### *Disclosure of the EIA*

Information disclosure is one of the most important aspects of any engagement process. The process of disclosure involves the provisioning of information in an accessible manner (a manner which allows for easy understanding, such as in the local language) to the various stakeholders in a Project. This disclosure not only allows for trust to be built amongst the stakeholders through the sharing of information but also allows for more

constructive participation in the other processes of consultation and resolution of grievances due to availability of accurate and timely information.

The EIA Report will also be disclosed on Ophir's website as well as the executive summary of the EIA Report in Myanmar and English. Hard copies will be provided upon request at Ophir Myanmar's offices in Yangon as well as in Thandwe GAD and Manaung GAD offices.



## 9.1 EXECUTIVE SUMMARY

**Ophir Myanmar (Block AD-3) Limited** (Ophir Myanmar) is currently proposing to drill one exploration well in late 2017 in Block AD-3. As per the Myanmar Environmental Impact Assessment (EIA) Procedure, this Project requires an EIA and an Environmental Management Plan (EMP) to be prepared and submitted to the Ministry of Natural Resources and Environmental Conservation (MONREC).

The proposed well will be located in water depths of over 2,400 m and over 93 miles (150 km) from the mainland (the "Project"). Offshore drilling involves the mobile offshore drilling unit (MODU) lowering a drill bit to the seabed to drill a 36" hole in the seabed. The well extends down to a target in order to find out if there is oil or gas under the seabed.

This document is the EMP for the Project and cover both environmental and social impacts and management. As such, this document will be referred to as the Environmental and Social Management Plan (ESMP).

The EIA study identified and developed the following key potential impacts and associated mitigation measures as listed in *Table 9.1*.

**Table 9.1** *Summary of Potential Impacts and Mitigation Measures*

Potential Impact/Issue	Control / Mitigation Measures
Drill Cuttings	<ul style="list-style-type: none"> <li>The non-aqueous drilling fluid (NADF) will be recycled and treated prior to discharge. The oil content for discharge of cuttings with residual NADF will be 5% by weight of wet cuttings.</li> <li>Where cuttings discharged overboard, they will be discharged below the water line.</li> <li>All chemicals discharged will be selected for low toxicity where possible.</li> <li>NADF shall only be used where seawater and sweeps cannot provide the required technical specifications.</li> <li>No bulk discharge of NADF drilling fluids is permitted.</li> <li>If the decision is taken to use water based drilling fluid (WBDF) in place of NADF then the cuttings will be discharged overboard directly from the shale shakers.</li> <li>The average oil content for discharge of NADF pit cleaning slops will be limited to 1% by volume.</li> </ul>



Potential Impact/Issue	Control / Mitigation Measures
Impacts from underwater sound on marine fauna	<ul style="list-style-type: none"> <li>• Visual check for marine mammals or turtles within 1 km (observation zone) of the mobile offshore drilling unit (MODU) or vessel for 20 minutes prior to commencing vertical seismic profiling (VSP) operations.</li> <li>• Soft start - build up power for VSP slowly to give adequate time for marine fauna to leave the area (20 minutes at minimum).</li> <li>• Soft start procedures should only resume when marine mammals or turtles are outside the shutdown zone (500 m) or when 30 minutes have lapsed since the last sighting.</li> <li>• Visual observations must be maintained continuously during VSP to identify if there are any marine mammals or turtles present.</li> <li>• During the pre-start meeting, all crews will be alerted to immediately report to the trained observer when they observe any marine mammals or turtles during and prior to the activity.</li> <li>• A trained observer will be utilised during VSP operations to monitor and record marine mammal and turtle observations.</li> <li>• All records will be reported to Ministry of Natural Resources and Environmental Conservation (MONREC) following completion of the activity.</li> </ul>
Impacts from unplanned spills on marine fauna	<ul style="list-style-type: none"> <li>• Preparation and implementation of vessel standard operating procedures.</li> <li>• Adherence to the international convention for the prevention of pollution from ships (MARPOL 73/78) Annex I.</li> <li>• Chemicals and/or hydrocarbons will be handled and stored in compliance with the Material Safety Data Sheet (MSDS).</li> <li>• Spill response kits will be available and kept stocked.</li> <li>• Standard maritime safety/navigation procedures will be implemented</li> <li>• Establishment of a 500 m radius safety exclusion zone around the MODU.</li> <li>• In the event of a vessel collision, the shipboard oil pollution emergency plan (SOPEP) will be implemented if required.</li> </ul>
Short-term disruption to commercial fishing activities.	<ul style="list-style-type: none"> <li>• A 500 m radius safety exclusion zone around the MODU and support vessels will comply with international regulations for collision avoidance, navigation and maintenance.</li> <li>• Myanmar speaking (crew members) will be available on board the MODU.</li> </ul>
Risk of collisions with fishing vessels and other marine users.	<ul style="list-style-type: none"> <li>• Timely sharing of information (in the form of a Notice to Mariners).</li> <li>• Disclosure and implementation of the Feedback grievance mechanism.</li> </ul>

The EIA Study for the proposed exploration drilling in Block AD-3 was conducted to comply with the requirements of the Myanmar EIA Procedure. The EIA demonstrates that Ophir Myanmar understands the environment and social setting in which they are operating and has properly assessed the key potential environmental and social impacts associated with the proposed Project. Provided that the recommended mitigation measures (as specified in this ESMP) are properly implemented, it is expected that the environmental and social impacts of the proposed Project would be managed by Ophir Myanmar in a professional and acceptable manner. As such, the EIA concludes that **no Major** impacts on the environment and people are anticipated from this Project and all impacts have been properly mitigated to be as low as reasonably practical.

## 9.2 *INTRODUCTION*

This document provides the standalone Environmental and Social Management Plan (ESMP) for the planning and operation of the Project. The Project is the proposed offshore exploration drilling in Block AD-3, offshore Rakhine State, Myanmar. It aims to provide an environmental and social management framework by outlining the compliance requirements, mitigation measures and monitoring programmes to be undertaken throughout the offshore exploration activities.

### 9.2.1 *Scope of the ESMP*

The ESMP covers the operations/execution phase implementation of:

- Environmental Management.
- Social Management.
- Stakeholder Engagement.

This ESMP is the means by which the findings of the environmental assessment are implemented during the execution of the offshore exploration activities. The scope of the ESMP covers all of the marine activities as described in *Section 4* of the EIA, with the objective of demonstrating compliance with the relevant national and international legislation and Ophir Myanmar HSE Policy and Management System.

The ESMP lists the obligations and responsibilities of each party involved in the project; stipulates methods and procedures that will be followed; as well as outlining the environmental and social management actions that will be implemented.

## 9.2.2

### *Purpose and Objectives of the ESMP*

This ESMP has been prepared based on the findings of the EIA Report and describes management measures designed to mitigate potential environmental and social impacts of proposed offshore exploration activities. Mitigation strategies have been considered according to a series of responses that address impacts (in descending order of preference) to avoid, prevent or reduce any potential impact on the identified sensitive receptors.

The overarching purpose of this ESMP is to:

- Integrate management and mitigation measures into the exploration drilling activities in order to reduce or mitigate any potential adverse impacts on natural and socio-economic environments.
- Consider and address the concerns and interests of stakeholders who will potentially be engaged or impacted during execution of the offshore exploration activities.
- Establish systems and processes for delivery and implementation of environmental and social requirements in order to meet statutory and compliance standards.

The objectives of the ESMP are to:

- Demonstrate continuing compliance with the relevant Myanmar environmental legislation, Ophir Myanmar HSE Policy and Management System and good international industry practices.
- Describe the mechanism for implementing identified control, monitoring and management measures to mitigate potentially adverse impacts.
- Provide a framework for mitigating impacts that may be unforeseen or unidentified until offshore exploration activities are underway.
- Provide assurance to regulators and stakeholders that requirements with respect to environmental and social performance will be met.
- Undertake monitoring to provide assurance that the control and management measures are being implemented.
- Combine all of the above in a systematic framework of monitoring, reporting and management that will measure the successful implementation of the project in accordance with Ophir Myanmar's standards for social and environmental performance, and respond as needed to maintain those objectives.

### 9.3

#### *DESCRIPTION OF THE PROJECT*

Ophir Myanmar proposes to drill an exploration well in Block AD-3, which will be located in water depths of over 2,400 m and over 90 miles (150 km) from the mainland (the "Project"). Offshore drilling involves the mobile offshore drilling unit (MODU) lowering a drill bit to the seabed to drill a 36" hole in the seabed. The well extends down to a target in order establish whether there is oil or gas under the seabed. The well will use Seawater and Sweeps, Pre-hydrated Bentonite (PHB) and a non- aqueous drilling fluid (NADF) or water based drilling fluid (WBDF) for exploration drilling. The drilled cuttings from the top hole sections will be discharged at the seabed. Cuttings containing NADF will be returned to the drill rig and treated on-board to reduce the oil on cuttings before discharge overboard. As part of the Project design phase, consideration was given to potential alternatives; such as the use of different types of drilling fluids, treatment options and disposal methods. Four (4) alternative well locations were originally considered during Scoping; however one location has been selected for this EIA. This well is located 150 km (93 miles) from the nearest coastline (Manaung Island). The option to not go ahead with the Project was also considered, however, should the Project be successful and gas be found in a significant quantity to be commercially viable, the Project could have beneficial impacts for Myanmar and the local communities.

Detailed information on the Project is provided in *Section 4* the EIA Report.

### 9.4

#### *POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK*

Under *Section 7* of the *Environmental Conservation Law* and *Articles 52 and 53* of the *Environmental Conservation Rules* of the Republic of the Union of Myanmar, Ophir Myanmar is required to undertake an EIA to obtain an Environmental Compliance Certificate (ECC) for the proposed exploration activities.

The Project will be undertaken in line with a number of national and local standards and laws. Local laws relating to EIA include: Environmental Conservation Law (2012); Environmental Conservation Rules (2014); National Environmental Quality (Emission) Guidelines (2015); and Environmental Impact Assessment Procedure (2015). A full list of laws and their relevance to the Project is provided in *Section 3*.

With the release of the final Myanmar EIA Procedure in December 2015, the National Environmental Quality (Emissions) Guidelines were also released. These Guidelines provide the basis for regulation and control of noise and air emissions and effluent discharges from projects in order to prevent pollution and protect the environment and public health. These standards are noted to be based on the standards as recommended by the IFC General EHS Guidelines (2007 & 2015) (IFC, 2007 & IFC, 2015).

The Project is also being conducted in line with Ophir Myanmar’s internal requirements and considering the requirements of the Production Sharing Contract (PSC). The policy and legislative framework is discussed in more detail in *Section 3* of the EIA Report.

## 9.5 GOVERNING PARAMETERS

### 9.5.1 National Parameters

A summary of Myanmar national environmental standards that are relevant to the Project (offshore oil and gas) for effluent discharges are shown in *Table 3.4*.

### 9.5.2 International Parameters

The specific emission limit values and environmental quality standards that are relevant to the Project are shown in *Table 9.2*.

**Table 9.2 Environmental Standards of Relevance to the Project**

Environmental Parameter	Standard	Details
Air emissions	MARPOL Annex VI	The MODU and vessels will comply with applicable MARPOL requirements, for the prevention of air pollution from ships, including Vessels will hold a valid International Air Pollution Prevention (IAPP) Certificate, comply with allowable NOx emission from diesel engines, the sulphur content of any fuel oil used on board ships shall not exceed 3.5% m/m and regulation of shipboard incineration.
Waste discharges	MARPOL Annex I, IV & V	The support vessels will comply with applicable MARPOL requirements, including: discharge of untreated sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than 3 nm from the nearest land. Sewage which is not comminuted or disinfected has to be discharged at a distance of more than 12 nm from the nearest land. The support vessels will operate in compliance with MARPOL Annex I: any oil-in-water content of discharges should not exceed 15 ppm. General waste (excluding food) will not be disposed of to sea in line with MARPOL Annex V requirements. Combustible wastes will be segregated and disposed by incinerator on-board, should an incinerator be available on the selected vessel. Non-combustible and recyclable wastes will be stored in containers and returned to the shore base for disposal. Food waste will be macerated into smaller pieces (25 mm) prior to discharge overboard (if discharged <12 nm from shore).  Hazardous wastes will be stored on the vessels in

Environmental Parameter	Standard	Details
		appropriate containers with labels. Hazardous waste storage will be designated in accordance with their SDS. Hazardous wastes will be returned to the vessels' selected shore base and sent to a licensed disposal facility by a licensed waste contractor).
		Visual check for marine mammals and turtles within 1 km (observation zone) of the MODU or vessel for 20 minutes prior to commencing VSP operations.
		Soft start - build up power for VSP slowly to give adequate time for marine fauna to leave the area (20 minutes at minimum). If a whale or marine turtle is sighted within the shut-down zone (500 m), the acoustic source should be shut down completely.
		Soft start procedures should only resume after the whale(s) or turtle(s) has been observed to move outside the shutdown zone (500 m) or when 30 minutes have lapsed since the last sighting.
Underwater noise generation	International good practise	Visual observations of the observation zone (1 km) must be maintained continuously to identify if there are any marine mammals or turtles present.
		During the pre-start meeting, alert all crews to immediately report to the trained observer when they observe any marine mammals or turtles during and prior to the activity. The pre-start meeting will cover the likelihood of whale observations and required actions if they are sighted.
		All information on marine fauna sightings will be reported to MONREC following completion of the drilling campaign.
Spills	MARPOL Annex I	Support vessel standard operating procedures to be prepared and implemented. Contingency plans will be prepared and implemented, e.g. vessel SOPEPs and Ophir Myanmar OPEP.

## 9.6

### SUMMARY OF IMPACTS

The EIA has assessed the potential impacts and proposed mitigation to reduce the level of the impact. The EIA concluded, from previous experience in the industry that potential impacts are typically short term and are well understood, with little or no evidence of adverse consequences on the majority of environmental or social receptors. These potential impacts and the associated mitigation measures are summarized in *Table 6.24*.

## 9.7

### *DESCRIPTION OF PROPOSED MITIGATION MEASURES*

Through the Project development and the EIA process, Ophir Myanmar has made commitments to ensure appropriate environmental and social performance. A summary of the Project impacts and the committed measures designed to manage and mitigate those impacts is presented in *Table 6.24*. The schedule and responsibility for implementation of these mitigation measures are identified as necessary.

The EIA has assessed the potential impacts and proposed mitigation to reduce the level of the impact. The EIA concluded that potential impacts are typically short term and are well understood, with little or no evidence of adverse consequences on the majority of environmental or social receptors from previous experience in the industry. These potential impacts and the associated mitigation measures are summarized in *Table 9.3*.



Table 9.3 Summary of Mitigation Measures and Reporting

Potential Impact/Issue		Control / Mitigation Measures		Significance of Residual Impacts	Specific Action		Responsible Project Team Member	Schedule	Reporting
SS1	Impacts from exhaust emissions on ambient air quality	SS1.1	Use of low sulphur fuel (sulphur content not to exceed 3.5% m/m) when it is available.	Scoped out of assessment	SS1.1.1	Contractor to provide specifications of fuel to be used by MODU and vessels.	Contractor	Pre-mobilisation and during drilling campaign	Copy of marine fuel specifications.
			Vessels will be in compliance with applicable MARPOL 73/78 Regulations for the prevention of air pollution from ships (Annex VI).		SS1.1.2	Contractor to provide MARPOL certification for the MODU and vessels.		Pre-mobilisation	MARPOL certification.
SS2	Impacts of sewage and grey water on marine water quality and localised adverse impacts to marine biota	SS2.1	The MODU and support vessels will comply with applicable MARPOL 73/78 Annex IV requirements (Reg 4 and 8), including: <ul style="list-style-type: none"> <li>vessels will have valid International Sewage Pollution Prevention (ISPP) Certificate;</li> <li>discharge of sewage into the sea is prohibited, except when the vessel has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than 3 nm from the nearest land; and</li> <li>sewage which is not comminuted or disinfected has to be discharged at a distance of more than 12 nm from the nearest land.</li> </ul>	Scoped out of assessment	SS2.1.1	Contractor to provide MARPOL and ISPP certification and maintain vessel discharge log book for MODU and vessels.	Contractor	Pre-mobilisation and during drilling campaign	MARPOL certification, ISPP certificate and vessel discharges log book
SS3	Impacts of putrescible (food) wastes on marine water quality and localised adverse impacts to marine biota	SS3.1	The MODU and support vessels will comply with applicable MARPOL 73/78 Annex V requirements (Reg 3), including: <ul style="list-style-type: none"> <li>Waste discharged by the MODU is passed through a grinder so that it is capable of passing through a screen with no opening wider than 25 millimetres: this applies to support vessels within the 500 m safety exclusion zone.</li> </ul>	Scoped out of assessment	SS3.1	Contractor to provide MARPOL certification and maintain vessel discharge log book for MODU and vessels.	Contractor	Pre-mobilisation and during drilling campaign	MARPOL certification and vessel discharges log book
SS4	Impacts of bilge water and deck drainage on marine water quality and localised adverse impacts to marine biota	SS4.1	The MODU and support vessels will comply with applicable MARPOL 73/78 Annex I requirements (Reg 7, 14 and 17) including: <ul style="list-style-type: none"> <li>vessels will have valid International Oil Pollution Prevention (IOPP) certificate, as appropriate to vessel class.</li> <li>bilge water contaminated with hydrocarbons must be contained and disposed of onshore, unless the oil in water (OIW) content is within 15 ppm and an IMO approved oil/water separator (OWS) (as required by vessel class) is used to treat the bilge water.</li> <li>vessels will maintain an oil record book</li> <li>no direct overboard drainage from sludge/drain/dirty oil/bilge water collecting tanks.</li> </ul>	Scoped out of assessment	SS4.1.1	Contractor to provide MARPOL certification and maintain vessel discharge log/oil record book for MODU and vessels.	Contractor	Pre-mobilisation and during drilling campaign	MARPOL certification, (IOPP) Certificate and vessel discharges log book (oil record book)

Potential Impact/Issue		Control / Mitigation Measures		Significance of Residual Impacts	Specific Action		Responsible Project Team Member	Schedule	Reporting
SS5	Impacts of drill cuttings and drilling muds on marine water quality	SS5.1	The NADF will be recycled and cuttings will be treated on-board to MODU prior to discharge. The oil content for discharge of cuttings with residual NADF will be 5% by weight of wet cuttings.	Minor	SS5.1.1	Contractor to ensure cuttings treated on board MODU and discharges are recorded are 5% by weight of wet cuttings. Cuttings will be discharged below water line.	Ophir Myanmar/ Contractor	Pre-mobilisation and during drilling campaign	Chemical use and approval records.
		SS5.2	Where cuttings are discharged overboard, they will be discharged below the water line. All chemicals that are discharged to the marine environment are selected for low toxicity where possible and subject to internal justification including environmental consideration with reference to OCNS rating of additives. All residual NADF must be returned to a shore for reconditioning, re-use or disposal or alternatively contaminated muds may be disposed of down well prior to plug and abandonment. No bulk discharge of NADF drilling fluids is permitted.		SS5.2.1	Selection of chemicals undertaken for low toxicity where possible and subject to internal justification including environmental consideration with reference to OCNS rating of additives.	Ophir Myanmar	Pre-mobilisation and during drilling campaign	Chemical use and approval records.
		SS5.3	The average oil content for discharge of NADF pit cleaning slops will be limited to 1% by volume.		SS5.3.1	Contractor to ensure no residual NADF is discharged overboard. All mud use and discharge to be recorded.	Ophir Myanmar	Pre-mobilisation and during drilling campaign	Chemical use and approval records.
		SS5.4			SS5.4.1	The average oil content of NADF pit cleaning slops discharged to sea will be limited to less than 1% by volume.	Ophir Myanmar / Contractor	During the drilling program	MODU log book
SS6	Impacts due to non-hazardous and hazardous waste generation and disposal from vessels.	SS6.1	<p>The MODU and support vessels will comply with applicable MARPOL 73/78 Annex V requirements (Reg 10.2 and 10.3) including:</p> <ul style="list-style-type: none"> <li>Vessel Waste Management Plan (or equivalent) must contain as a minimum: <ul style="list-style-type: none"> <li>Waste handling equipment, waste storage containers, and spill response equipment appropriate to the type and volume of waste will be provided at waste storage areas.</li> <li>All hazardous wastes will be segregated prior to onshore disposal.</li> </ul> </li> <li>General waste (excluding food) will not be disposed of to sea.</li> <li>Vessels &gt;400 tonnes (or certified for &gt;15 persons on-board) will have a garbage record book.</li> <li>Where safe and practicable to do so, lost objects will be recovered</li> <li>Any accidental release of foreign material to the marine environment that does not meet MARPOL discharge standards will be reported if required to relevant Authorities.</li> </ul>	Scoped out of assessment	SS6.1.1	<p>Contractor Waste Management plan and contractor to maintain garbage record book for MODU and vessels.</p> <p>Reporting of any accidental release of wastes to the marine environment</p>	Contractor	Pre-mobilisation and during drilling campaign	<p>Contractor Waste Management Plan, garbage record book.</p> <p>Report of any accidental release of wastes</p>
SS7	Introduction of invasive marine species to the marine environment	SS7.1	<p>MODU and vessels to have valid Fouling Coating Certificates.</p> <p>MODU will not enter nearshore waters in Myanmar.</p>	Scoped out of assessment	SS7.1.1	MODU and vessels maintain valid Fouling Coating Certificates.	Ophir Myanmar and Contractor	Pre-mobilisation	MODU/ Vessel FCC certification
						Vessels to maintain records of ballast water uptake and discharge locations.		Pre-mobilisation and during the drilling campaign	Contractor ballast water log book
						MODU not to enter nearshore waters		During the drilling campaign	MODU log book

Potential Impact/Issue		Control / Mitigation Measures		Significance of Residual Impacts	Specific Action		Responsible Project Team Member	Schedule	Reporting
SS8	Impacts on Fishing Activity from Physical Presence of MODU and Vessels	SS8.1	A 500 m radius safety exclusion zone and 2.5 nautical mile (nm) cautionary zone will be maintained around the MODU as required. The Vessel Master will endeavour to manage vessel access and activities within this zone.	Minor	SS8.1.1	Implementation of 500 m safety exclusion zone.	Contractor	During drilling campaign	Vessel communications log
			MODU and support vessels will comply with the following: <ul style="list-style-type: none"> <li>international regulations for collision avoidance (COLREGs 1972) including maintaining look-outs (e.g. visual, hearing, radar etc.), proceeding at safe speeds, assessing risk of collision and taking action to avoid collision (monitoring radar).</li> <li>Navigation light display requirements, including visibility, light position/shape appropriate to activity.</li> <li>Maintenance of minimum safe manning levels.</li> <li>Maintenance of navigation equipment in efficient working order (compass/radar / communications).</li> <li>Navigational systems and equipment as specified in Regulation 19 of Chapter V of SOLAS.</li> <li>AIS installed as required by vessel class in accordance with Regulation 19 of Chapter V of SOLAS.</li> </ul>			Ophir Myanmar inspection to confirm implementation of relevant navigational and communication requirements for MODU and support vessels operating at sea.	Contractor	Pre-mobilisation and during drilling campaign	MODU/vessel certification and vessel log books. Ophir Myanmar inspection report.
		SS8.2	Myanmar speaking (crew members) available on board the MODU.		SS8.2.1	Contractor to ensure the provision of Myanmar speaking crew on board the MODU.	Contractor	During drilling campaign	-
		SS8.3	Disclosure and implementation of the Grievance Mechanism for the Project and timely investigation of any grievances.		SS8.3.1	Ophir Myanmar to disclose Grievance Mechanism to maritime authorities, fisheries authorities, fishing communities and other marine users.	Ophir Myanmar	Pre-mobilisation and during drilling campaign	Ophir Myanmar's notice released to relevant stakeholders.
SS8	Impacts from underwater noise generation on marine fauna.	SS8.1	Trained observer utilised during VSP operations to monitor and record marine mammal observations.	Moderate (marine mammals and turtles)	SS8.1.1	Trained observer on board maintaining watch during daylight hours	Contractor	During VSP operations	Copy of personnel training records for marine mammal observation requirements.
		SS8.2	Visual check for marine mammals and turtles within 1 km (observation zone) of the MODU or vessel for 20 minutes prior to commencing VSP operations.  Visual observations of the observation zone (1 km) must be maintained continuously during VSP to identify if there are any marine mammals or turtles present.		SS8.2.1	Contractor to ensure that visual inspection is undertake prior to VSP operation. Visual inspection undertaken with 1km radius.	Contractor	During VSP operations	Marine mammal observation report
		SS8.3	Undertake a 20 minute soft-start before testing of all airguns at full power.  Ensure shut down if marine mammal, or turtle within 500 m of the array and only continue 30 minutes after last sighting and if mammals outside the 500 m zone.		SS8.3.1	Soft start - build up power for VSP slowly to give adequate time for marine fauna to leave the area (20 minutes at minimum). If a whale or marine turtle is sighted within the shut-down zone (500 m), the acoustic source should be shut down completely.  Soft start procedures should only resume after the whale(s) or turtle(s) has been observed to move outside the shutdown zone (500 m) or when 30 minutes have lapsed since the last sighting.			

Potential Impact/Issue		Control / Mitigation Measures		Significance of Residual Impacts	Specific Action		Responsible Project Team Member	Schedule	Reporting
		SS8.4	During the pre-start meeting, alert all crews to immediately report to the trained observer when they observe any marine mammals or turtles during and prior to the activity. The pre-start meeting will cover the likelihood of whale observations and required actions if they are sighted.		SS8.4.1	Contractor to ensure crew instructed to report any marine mammal, whale shark or turtle sighting to the trained observer.			
		SS8.3	All sightings of marine mammals / turtles should be recorded and reported to MONREC following completion of the drilling campaign.		SS8.3.1	All sightings of marine fauna shall be recorded during the VSP. Details to be recorded shall include the estimated distance to the animal, and where possible, the species, number of animals, direction of movement (if any) and behavioural activity.	Contractor	During VSP operations	Marine mammal observation Report/ Monitoring Report
					SS8.3.2	All information on marine fauna sightings will be reported to MONREC following completion of the drilling campaign.	Ophir Myanmar	After completion of the drilling campaign	
SS9	Impacts from unplanned spills on marine fauna and habitats	SS9.1	MODU and support vessels operate in compliance with MARPOL 73/78 Annex I (Reg 7, 17 and 37) including: - vessels will hold a valid International Oil Pollution Prevention (IOPP) certificate. - vessels will maintain an oil record book. SOPEP to be developed as appropriate to class	Negligible	SS9.1.1	Contractor to provide MARPOL certification and maintain oil record book for MODU and vessels. SOPEP available.	Contractor	Pre-mobilisation	MARPOL certification, (IOPP) Certificate and vessel discharges log book (oil record book). SOPEP
		SS9.2	Implement procedures for chemical handling and storage on board MODU and vessels including: Chemicals and/or hydrocarbons will be handled and stored in compliance with the SDSs and to prevent release to the marine environment.		SS9.2.1	Appropriate storage and handling of chemicals.	Contractor	Pre-mobilisation and during drilling campaign	Any spills to be reported and response measures implemented where appropriate.
		SS9.4	Spill response kits located in proximity to chemical and hydrocarbon storage/bunkering areas and appropriately stocked/replenished as required.		SS9.4.1	Contractor to provide and replenish spill response kits adjacent to chemical and hydrocarbon storage/bunkering areas.	Contractor	During drilling campaign	N/A
		SS9.5	Crew trained in spill prevention and use of spill response equipment.		SS9.5.1	Crew induction to include spill prevention and use of spill response equipment.	Contractor	During drilling campaign	Crew induction training records
		SS9.6	Any unplanned hydrocarbon spills from vessel collision to be reported to MOGE to notify relevant third parties.		SS9.6.1	Any spills to be reported including details of any spill response measures implemented.	Ophir Myanmar	During drilling campaign	Spill reporting
		SS9.7	Ophir Myanmar OPEP developed and implemented in the event of a spill resulting from a vessel collision beyond the capability of the SOPEP		SS9.7.1	OPEP available on board MODU.	Ophir Myanmar	Pre-mobilisation and during drilling campaign	OPEP
		SS9.8	A 500 m radius safety exclusion zone and 2.5 nm cautionary zone will be maintained around the MODU as required. The Vessel Master will endeavour to manage vessel access and activities within this zone.		SS9.8.1	Implementation of 500 m safety exclusion zone.	Contractor	During drilling campaign	Vessel communications log
		SS9.9	MODU and support vessels will comply with the international regulations for collision avoidance.		SS9.9.1	Ophir Myanmar inspection to confirm implementation of relevant navigational and communication requirements for MODU and support vessels operating at sea.	Contractor	Pre-mobilisation and during drilling campaign	MODU/vessel certification and vessel log books.
		S9.10	Myanmar speaking (crew members) available on board the MODU		SS9.10.1	Contractor to ensure the provision of Myanmar speaking crew on board the MODU.	Contractor	During drilling campaign	



## 9.8 *MONITORING PROGRAM*

Monitoring will be required in order to demonstrate compliance with both regulatory and Ophir Myanmar’s Project requirements (compliance monitoring), and will also provide verification of the overall design and effectiveness of the implemented control measures.

Compliance will be monitored to ensure that subcontractors meet contractual obligations with respect to work practices and design specifications (e.g. Project emission standards). This monitoring will be carried out by Ophir Myanmar and/or by an appointed third party.

In developing the monitoring measures, the following considerations and strategies have been applied:

- Consistency with internationally and locally acceptable practices.
- Logistically practical.
- Cost effectiveness.

### 9.8.1 *Environmental and Social Management Organisation*

Ophir Myanmar is committed to providing resources essential to the implementation and control of the ESMP. The internal reporting requirements for each mitigation measure are specified in *Table 9.3*.

Resources include the appropriate human resources and specialised skills. The structure for the organisation responsible for environmental and social management and implementation of the ESMP is depicted in *Table 9.4*.

**Table 9.4** *Environmental & Social Management Organisation Roles and Responsibilities*

Position	Responsibility
<b>Office-based Personnel</b>	
Ophir Myanmar Drilling Operations Manager	<ul style="list-style-type: none"> <li>• Ensure drilling operations are undertaken as per this ESMP.</li> <li>• Provide sufficient resources to implement the management measures in this ESMP.</li> <li>• Ensure the MODU and support vessel personnel are provided with an Environmental Induction at the start of the exploration drilling activity. Mitigation measures as detailed in this ESMP are actioned, as required, before drilling commences.</li> <li>• Ensure the MODU start-up meets the requirements of the Ophir Myanmar Campaign Management Procedures (CaMP) .</li> </ul>

Position	Responsibility
Ophir Myanmar Drilling Superintendent	<ul style="list-style-type: none"> <li>• Ensure that the drilling program meets the requirements detailed in this ESMP.</li> <li>• Ensure the changes to the drilling program are communicated to the Myanmar Drilling HSE Advisor.</li> <li>• Ensure that Reporting of environmental incidents meets external reporting requirements and Ophir Myanmar's internal reporting requirements.</li> <li>• Ensure that corrective actions raised from environmental inspections are tracked and closed out.</li> </ul>
Ophir Myanmar Drilling Engineers	<ul style="list-style-type: none"> <li>• Ensure that changes to the drilling program are communicated to the Myanmar Drilling HSE Advisor.</li> <li>• Ensure that all drill and completions fluid chemical components and other fluids that are used downhole have been reviewed by the Myanmar Drilling HSE Advisor.</li> </ul>
Ophir Myanmar Drilling HSE Advisor	<ul style="list-style-type: none"> <li>• Prepare environmental component of relevant Induction Package.</li> <li>• Assist with the review, investigation and reporting of environmental incidents. Ensure environmental monitoring and inspections/audits are undertaken as per the requirements of this ESMP. Liaise with relevant regulatory authorities as required.</li> <li>• Assist in preparation of external regulatory reports required, in line with environmental approval requirements and Ophir Myanmar incident reporting procedures. Monitor and close out corrective actions identified during environmental monitoring or inspections.</li> <li>• Provide advice to the Senior Drilling Supervisor and Drilling Superintendent and copies of this ESMP to assist them to understand their responsibilities.</li> </ul>
Ophir Myanmar Country Manager	<ul style="list-style-type: none"> <li>• Implement the SEP.</li> <li>• Report on stakeholder consultation.</li> <li>• Ongoing liaison as required.</li> </ul>
MODU-based Personnel	
MODU Offshore Installation Manager	<ul style="list-style-type: none"> <li>• Ensure that the MODU's management system and procedures are implemented.</li> <li>• Ensure that personnel starting work on the MODU receive an environmental induction and are competent to undertake the work they have been assigned.</li> <li>• Ensure that emergency drills are conducted as per the MODU's schedule.</li> <li>• Ensure that the MODU's Emergency Response Team has been given sufficient training to implement the MODU's SOPEP.</li> <li>• Ensure that any environmental incidents are reported immediately to the Ophir Senior Drilling Supervisor.</li> </ul>
Ophir Senior Drilling Supervisor	<ul style="list-style-type: none"> <li>• Ensure that the drilling / completions programs are undertaken as detailed in this ESMP.</li> <li>• Ensure that the management measures detailed in this ESMP are implemented on the MODU. Ensure that Environmental incidents are reported to the Drilling Superintendent and periodic environmental inspections are completed.</li> </ul>
Ophir HSE Adviser Offshore	<ul style="list-style-type: none"> <li>• Ensure that the activities are undertaken as outlined in this ESMP</li> <li>• Support the Senior Drilling Supervisor to ensure the monitoring requirements are met and the ESMP is implemented on the MODU</li> <li>• Ensure environmental incidents are reported.</li> <li>• Ensure periodic environmental inspections are completed</li> </ul>

Position	Responsibility
<b>Vessel-based Personnel</b>	
Vessel Master	<ul style="list-style-type: none"> <li>• <b>Ensure that the vessel management system and procedures are implemented.</b></li> <li>• Ensure that personnel commencing work on the vessel receive an environmental induction and that personnel are competent to undertake the work they have been assigned.</li> <li>• Ensure that SOPEP drills are conducted as per the vessel's schedule. Ensure that the vessel Emergency Response Team has been given sufficient training to implement the SOPEP.</li> <li>• Ensure that any environmental incidents or breaches of this ESMP are reported immediately to the Ophir Myanmar Senior Drilling Supervisor</li> </ul>

Supervision of subcontractor activities will be conducted by the drilling contractor and be monitored by the Ophir Myanmar Drilling HSE Team Lead who will establish management controls over aspects of the Project and will interact with subcontractor staff where Project activities take place.

### 9.8.2 *Contractor Management*

Ophir Myanmar will work with and influence the contractors to ensure that all contractors are aware of and competent with respect to:

- Environmental and social impacts that could potentially arise from their activities.
- Necessity of conforming to the requirements of the EIA and ESMP (i.e. implementing the control and mitigation measures) in order to avoid or reduce those impacts.
- Roles and responsibilities to achieve that conformity, including with regard to change management and emergency response.
- Documentation and reporting requirements and other ESMP compliance requirements.

The Project will require that contractors have implemented training programmes for their personnel and each contractor is responsible for HSE awareness training for personnel working on the Project. The contractors are also responsible for identification of any additional training requirements to maintain required competency levels.

### 9.8.3 *Inspection*

The Ophir Myanmar Drilling HSE Team Lead on-board will ensure environmental monitoring and inspections/audits are undertaken as per the requirements of this ESMP.



## 9.9

### REPORTING REQUIREMENTS

Ophir Myanmar will submit an Environmental Monitoring Report to Myanmar Oil and Gas Enterprise (MOGE) and the Ministry of Natural Resources and Environmental Conservation (MONREC) after the completion of the Project. The report will include the following information collated during the Project:

- Environment Record.
- Waste Record.

A summary of the monitoring and record keeping is provided in *Table 9.5*.

**Table 9.5** *Summary of the Monitoring and Record-keeping for the AD-3 Exploration Drilling*

Project Activity/ Environmental Aspect	Monitoring Measures	Reporting	Responsibility
	Quantities of waste discharged		
Waste Generation	Quantities of any fluids discharged and hydrocarbon content if measured	Environmental Discharge Report	Ophir Myanmar
Marine Mammal Observations	Marine mammals	Sighting report forms	Ophir Myanmar
Commercial Fishery Interaction	Recording of community grievances	Records of grievance in accordance with the community grievance mechanism	Ophir Myanmar
Training	Details of vessel crew inductions	Induction record sheet	Ophir Myanmar
Incident reporting	Details of any environment or social incidents	Incident report forms	Ophir Myanmar
Compliance Reporting	Compliance with ESMP	Inspection check sheets Final Environmental Discharge Report	Ophir Myanmar
Accidental Releases and Leaks	Safety Record	Safety record included in Project Environmental Monitoring report	Ophir Myanmar

The Project will adopt MARPOL requirements and a SOPEP will be prepared and implemented. Should spills occur, they will be reported in the SOPEP Report.

## 9.10

### *EMERGENCY PLAN*

Ophir Myanmar, through the drilling contractor's HSE Plan, will develop plans and procedures to identify the potential for and response to environmental accidents and health and safety emergency situations and for preventing and mitigating any potentially adverse environmental and social impacts that may arise. The plans include but are not limited to: notification procedures; an emergency response organization with personnel properly trained on their roles and responsibilities; having adequate and appropriate emergency response equipment readily available to respond to minor incidents; and having the capability to quickly request additional assistance. The plans will include, at a minimum:

- Vessel emergency procedures (SOPEP will be implemented for minor vessel-based spills).
- Ophir Myanmar OPEP (Implemented in the event of a spill beyond the capability of the SOPEP).
- Medical emergencies including medevac procedures.
- Search and rescue – includes man-overboard procedures.
- Heavy weather/cyclone plan.
- Hazardous material, oil, and fuel spill response plans.
- Any other emergency response plan required by the Republic of the Union of Myanmar authorities.

In the event of an emergency of any type, the Offshore Installation Manager will act as the Incident Commander (IC) and personnel will assist in implementing the vessels emergency response procedures as directed by the IC. Additional emergency response support can be provided by Ophir Myanmar if requested. The MODU and support vessels will have appropriate emergency equipment on board including, but not limited to, medical equipment, fire-fighting equipment, and oil spill response equipment capable of responding to minor incidents. Emergency preparedness and response will be continually reviewed by the drilling contractor and Ophir Myanmar representative during the operations and after the occurrence of any accidents or emergency situations to ensure that lessons learnt inform continuous improvement. Emergency exercises will be undertaken prior to operations and on an ongoing regular basis to confirm adequacy of response strategies and investigations of accidents or incidents will follow formal documented procedures.

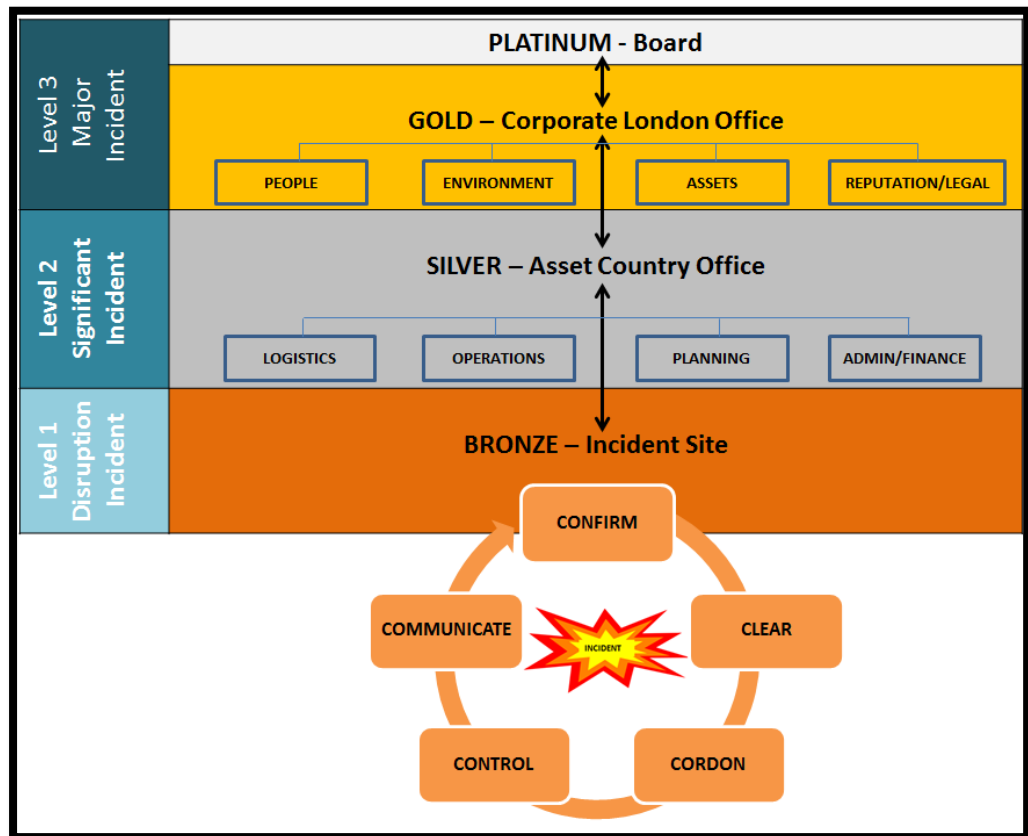
### 9.10.1

#### *Ophir Incident Management and Escalation Levels*

Respecting best practice guidelines and the requirement for a simple incident leadership system, Ophir has adopted Platinum, Gold, Silver and Bronze levels in its incident management structure. This approach assigns responsibilities and authorities to each level in order to respond and recover as quickly as possible. Following IPIECA guidance, Ophir has adopted the functional framework of Operations, Planning, Logistics and Finance/Administration at Silver and Bronze levels. It is normal that during drilling and seismic operations, Bronze level will be managed by a third party service company (at the incident site) and the response structure will be covered in the associated Bridging document (where incident management primacy is outlined); this must show how the third party system connects with Ophir's system. At Gold level the strategic imperatives of People, Environment, Assets and Reputation (PEAR) and Legal have been assigned as lead functional areas. The diagram below illustrates how Bronze directly manages the incident site and depending on the severity of the incident (Level 1 (Disruption), 2 (Significant) or 3 (Major)), how they notify Silver, Gold and Platinum for additional support as required.

Incidents are classified into one of three severity categories: Disruption, Significant and Major (*Figure 9.1*). Ophir's response levels highlight the priorities at Bronze, where the incident is being directly controlled. Silver, Gold and Platinum provide resources and support if and when required.

Figure 9.1 Incident Classification



Clarity, consistency, simplicity and preparedness are the bedrock of effective Incident Management. The following incident classification table (Table 9.6) should be used to identify the severity level of an incident and hence determine the escalation route for incidents. Should staff be in doubt they are advised to escalate rather than not. The criteria in this table are taken directly from the Ophir Incident Notification Chart and Risk Matrix which are referenced on the home page of the Intranet. If a decision to escalate is made it must be made person-to-person and not by email or messaging.

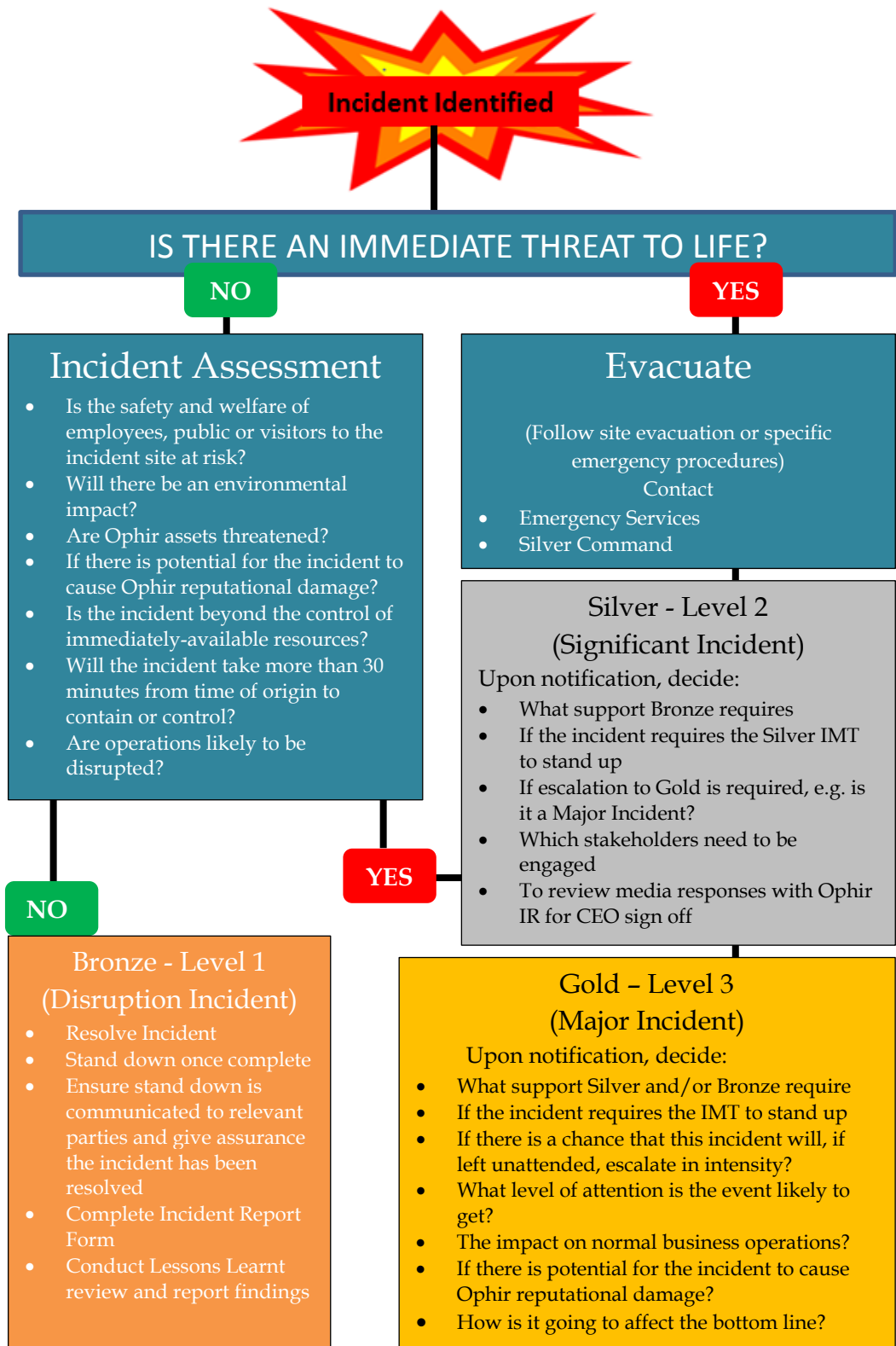
Table 9.6 Incident Classification Table

<p style="text-align: center;"><b>Level 3</b></p> <p style="text-align: center;">-</p> <p style="text-align: center;"><b>MAJOR INCIDENT</b></p>	<p><b>People:</b> ≥ Single Fatality or Permanent Total Disability  <b>Environment:</b> Loss of containment ≥ 1,000bbls, 1-5 year impact  <b>Asset:</b> Financial Loss ≥ US\$ 100MM  <b>Reputation:</b> Drop in Group value. &gt; 1 year to recover</p>	<ul style="list-style-type: none"> <li>Gold Leader decision point on whether to activate Gold IMT (if Gold is activated, Platinum level is informed and stand up to a level agreed by Chairman, CEO and COO)</li> </ul>	
		<p><b>YES</b> Gold Incident Management Team activated and supports Silver. Decision on whether to inform Platinum level</p>	<p><b>NO</b> Country-specific Silver continues to manage incident</p>
<p style="text-align: center;"><b>Level 2</b></p> <p style="text-align: center;">-</p> <p style="text-align: center;"><b>SIGNIFICANT INCIDENT</b></p>	<p><b>People:</b> ≤ Lost Time Incident (&gt;5days) or Permanent Partial Disability  <b>Environment:</b> ≤Loss of containment 100bbls, &lt;1 year impact  <b>Asset:</b> Financial Loss ≤US\$ 100MM  <b>Reputation:</b> Temporary drop in Group value. Impact for c. 1 year</p>	<ul style="list-style-type: none"> <li>Country-Specific – Silver Leader informed by Bronze of incident</li> <li>Decision to activate Local IMT</li> </ul>	
		<p><b>YES</b> Country-specific – Silver Leader activates LIMT and supports Bronze Leader. Decides whether escalation to Gold Leader is required</p>	<p><b>NO</b> Bronze site continues to control incident</p>
<p style="text-align: center;"><b>Level 1</b></p> <p style="text-align: center;">-</p> <p style="text-align: center;"><b>DISRUPTION INCIDENT</b></p>	<p><b>People:</b> ≤ Medical Treatment Case  <b>Environment:</b> ≤ Loss of containment 10bbls  <b>Asset:</b> Financial Loss ≤US\$ 25 million  <b>Reputation:</b> Prolonged local media coverage. Local impact for 1-6 months</p>	<ul style="list-style-type: none"> <li>Site Bronze Leader to assume control, or make decision to escalate to Silver?</li> </ul>	
		<p><b>YES</b> Bronze Leader assumes control and decides whether escalation is required to Silver Leader</p>	<p><b>NO</b> Normal procedures apply</p>

9.10.2 *Ophir Escalation Tree*

The Escalation Tree is pivotal to the early notification of an incident and will assist with an effective response. When in doubt about the severity of the incident, it should be escalated to the next level.

Figure 9.2 *Ophir Escalation Tree*



## 9.11 CAPACITY DEVELOPMENT AND TRAINING

Employee training, provided by the contractor, will include awareness and competency with respect to:

- Environmental and social impacts that could potentially arise from their activities.
- Necessity of conforming to the requirements of the EIA and ESMP, in order to avoid or reduce those impacts.
- Roles and responsibilities to achieve that conformity, including with regard to change management and emergency response.

The Ophir Myanmar Senior Drilling Supervisor is responsible for coordinating training, maintaining employee-training records, and ensuring that these are monitored and reviewed on a regular basis. Ophir Myanmar will be responsible for the management of contractors to ensure that training needs are met for personnel whose work may have a significant adverse impact upon the environment or social conditions.

## 9.12 PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

During the EIA, stakeholder engagement has been conducted with various relevant stakeholders at the regional (Rakhine) level in Sittwe and Thandwe and at the national level in Yangon and Naypyidaw. The meetings helped the Project to gather information on potentially affected people and on potential data gaps and informed the impact assessment in the EIA Report. Consultation involved face-to-face meetings with a range of stakeholders including the Department of Fisheries, the Rakhine Chief Minister, and the General Administrative Department in Sittwe and the Department of Fisheries and Myanmar Fisheries Federation in Yangon as well as a larger town hall meeting held in Thandwe for the public to express views and ask questions. The date, time, location, stakeholder and purpose of each meeting is provided in *Table 8.2*.

The meetings were undertaken to disclose information on the Project at the regional and national level and to confirm our baseline understanding of the Project Area. A summary of the outcomes of the meetings is presented below:

- For larger vessels that might be within the Project Area, the Yangon and Sittwe DoF and Sittwe ECD confirmed these come from throughout Myanmar but mostly Tanintharyi (Dawei), Ayeyarwady and Yangon.



- The offshore fishermen from Thabyugyaing confirmed that they fish up to a maximum of 100 km (60 miles) from the mainland coast and in waters of up to 490 ft. depth. Mostly they fish within 50 km (30 miles) from the coast.
- Trawlers and purse seiners are the two types of offshore vessels in Rakhine. All fishermen in the meeting were trawlers and mentioned that they use GPS to navigate offshore.

The main questions related to:

- Local Benefits and social investment: It was noted that in Myanmar, Ophir are at an early stage of the Project and they do not know whether they will find any gas. However, a CSR program is part of the commitment in the PSC with MOGE if the Project goes to the Development and Production Stage.
- Compensation from Incidents: The fishermen in Thandwe asked about compensation if an incident were to occur as they have historic experience with companies in the area paying compensation. It was noted that Block AD-3 is further offshore than the Block which had the interactions with fishermen. It was also explained that this is drilling of one well, not a seismic survey in whole Block, so the area for potential interaction is much smaller.
- Disclosure of Information: There were question on how the information would be disclosed and suggested that it should be distributed through village leaders. It is noted that the Notice to Mariners would be announced to the public one month prior to the commencement of the Project activities.

## 9.13

### *WORK PLAN AND IMPLEMENTATION SCHEDULE*

Through the Project development and the EIA process, Ophir Myanmar has made commitments to ensure appropriate environmental and social performance. A summary of the Project impacts and the committed measures designed to manage and mitigate those impacts is presented in *Table 6.1*. The schedule and responsibility for implementation of these mitigation measures are identified as necessary.

Ophir Myanmar plan to commence the exploration drilling in Q3, 2017 and for it to run for approximately 40 days. The work plan and commitments of the ESMP is provided in *Table 7.1*. The overall estimated budget for the implementation of the mitigation measures is around \$ 800,000 US.

**10.1***CONCLUSIONS*

The EIA Study for the exploration drilling in AD-3 was conducted in line with the EIA Procedure (2015). The EIA demonstrates that Ophir Myanmar understands the environment and social setting in which they are operating and has properly assessed the key potential environmental and social impacts associated with the proposed Project. A project-specific, dedicated EMP has been developed to manage impacts associated with the Project and ensure legislative compliance and standards of good practice. Provided that the recommended mitigation measures are properly implemented, it is expected that the environmental and social impacts of the proposed exploration drilling in Block AD-3 would be managed by Ophir Myanmar in an acceptable manner.

Impacts are likely to be temporary (40 days maximum) and localised to around the MODU. From a social perspective, the Project will be located over 150 km (93 miles) from Manaung and further from the mainland coastline. As such, it was concluded that the Project is not likely to have an impact on local communities in Rakhine State. In addition, the Project has no significant onshore activities. Crew changes may be undertaken in Yangon or Sittwe port; this is still to be confirmed. However, there is unlikely to be any adverse impact on the local communities or livelihoods. For environmental impacts, the Project is located in water depths in excess of 2,400 m (7,800 ft.) and therefore unlikely to impact the sensitive habitats and species in the region which are found closer to the coast in much shallower water depths. The seabed where the drilling will be located is unlikely to be sensitive and the potential impact is small scale. The generation of underwater sound is limited to operational activities of the vessels and drilling and a very short duration VSP (18 hours).

The EIA concludes that **no Major** impacts are anticipated from this Project and all impacts have been properly mitigated to be as low as reasonably practical.

**10.2***RECOMMENDATIONS*

The Project will have an EMP which will detail the required mitigation measures and all reporting and monitoring requirements. Ophir Myanmar will also have a representative on board the MODU to monitor the contractors' activities and ensure compliance with the stated mitigation measures. The EIA Report will also be disclosed on Ophir's website as well as the executive summary of the EIA Report in Myanmar and English. Hard copies will be provided upon request at Ophir Myanmar's offices in Yangon as well as in Thandwe GAD and Manaung GAD offices.

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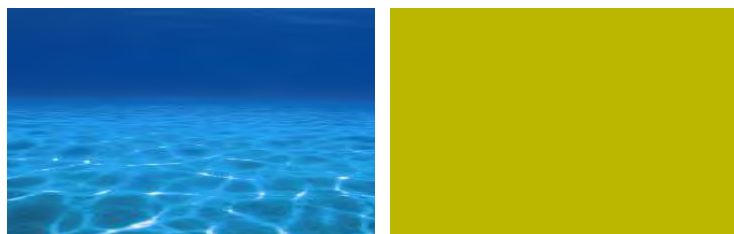
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## **Annex 2.1 CVs of the Environmental and Social Experts**

# Craig A Reid

Partner



Craig A. Reid is a Partner with ERM and Manager of the Hong Kong based ESHIA Management, Marine Sciences and Water Group.

With over 18 years' experience Mr Reid specialises in the environmental and social assessment of major resource development projects, many of which require compliance with either Corporate Standards or internationally recognised standards and guidelines, such as the Equator Principles and the policies and procedures of the World Bank Group. He also contributes to the environmental and social management of these projects, including the development and implementation of environmental and social action plans (ESAP). These plans are used to translate project sponsor commitments into realistic and verifiable environmental and social management programs during project construction and operations.

Mr Reid has specific experience in servicing ERM's key industry sectors, namely Oil and Gas and Power as well as a strong background in Government regulatory and management services. Mr Reid has worked on oil and gas infrastructure, LNG terminals, FPSOs, FSRUs, seismic surveys, exploratory and production drilling, decommissioning, onshore and offshore power generation (coal, gas, diesel), offshore wind farms, dredging, disposal and reclamation, mud disposal facilities, port management, airports, incinerators, fuel storage facilities, theme parks, highways, railways and submarine cables. The results of these studies have been used to present information on baseline conditions of sensitive habitats and biodiversity, to assess acceptability of installations, developments or facilities, or to develop and implement mitigation, management and marine conservation programmes.

Since 2013 Mr Reid has also acted as ERM's Country Manager for Myanmar. Under this role Mr Reid has been responsible for leading business development, opening the Yangon office, securing contracts with new and existing clients and overseeing health and safety on in-country work. Mr Reid has also acted as the Project Director for numerous projects in the country including those for IFC, ADB, JICA, BG, Chevron, Statoil, Woodside, eni and PTTEP.

Based in Hong Kong, Mr Reid has worked extensively internationally, having undertaken studies in Africa (Angola, Benin, Egypt, Gabon, Ghana, Liberia, Nigeria, Sierra Leone and Togo), Middle East (Abu Dhabi, Iran, Bahrain, Qatar and Saudi Arabia) South East Asia (Singapore, Thailand, Philippines, Malaysia, Vietnam, Brunei and Myanmar) East Asia (China, Hong Kong, Japan and South Korea) and the Pacific Rim (Australia, New Zealand and Fiji).

## EDUCATION

- BSc (Hons), Marine Biology, University of Stirling, Scotland, United Kingdom, 1997

## PROFESSIONAL AFFILIATIONS & REGISTRATIONS

- Member of the International Association for Impact Assessment
- Member of the Society of Petroleum Engineers
- Member of the Marine Biological Association of Hong Kong
- Member of the Hong Kong Institute for Environmental Impact Assessment

## FIELDS OF COMPETENCE

- Marine Biology, Ecology and Water Quality
- Environmental Impact Assessment (EIA)
- Environmental Monitoring
- Site selection and route assessment
- Natural Resource Management

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## OIL AND GAS PROJECTS

### MARINE SEISMIC SURVEYS

- ESIA for Marine Seismic Survey of Blocks 17/03 & 04/20 in South China Sea, China, SK Innovation, 2015-ongoing. *Project Director.*
- ESIA for Seismic Exploration of Block AD-07, Myanmar, Daewoo, 2015-ongoing. *Project Director.*
- ESIA for Seismic Exploration of Offshore Block AD-10, Myanmar, Statoil, Myanmar, 2014-ongoing. *Partner-in-Charge.*
- ESIA for Marine Seismic Survey in Block M-10, Tap Oil, Myanmar, 2015. *Project Director.*
- ESIA for Seismic Exploration of Offshore Blocks A-5, for Chevron, Myanmar, 2015. *Partner-in-Charge.*
- ESIA for Seismic Exploration of Offshore Blocks A-04 and AD-02, Myanmar, BG, Myanmar, 2014. *Partner-in-Charge.*
- ESIA for Onshore Seismic Exploration of Block IOR-4 and Block IOR-6, Myanmar, MPRL E&P, Myanmar, 2014-ongoing. *Partner-in-Charge.*
- EIA for Enhanced Oil Recovery of the Mann Oil Field, Myanmar, for MPRL E&P, Myanmar, 2014-ongoing. *Partner-in-Charge.*
- ESIA for Onshore Seismic Exploration of Block C-1 and Block H, Myanmar, for Pacific Hunt Energy Corp, Myanmar, 2014-ongoing. *Partner-in-Charge.*
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- Environmental Risk Assessment for Offshore Exploration, for BG, Myanmar, 2013. *Technical Advisor.*
- Screening and Scoping Study for 3D Seismic Survey of three Blocks in the South China Sea, Shell, 2012. *Partner in Charge.*
- Environmental Scoping and Management Plan for 3D Seismic Survey of Blocks 64/18 and 53/30 in the South China Sea, China, Chevron, 2010. *Project Manager.*
- Environmental Risk Assessment of a 3D Marine Seismic Survey in Southern Chinese Waters, BG, 2008. *Marine Ecology Specialist.*
- Survey on Environmental Impact of Marine Seismic Operations, Japanese Oil, Gas and Metals Corp, 2008 - 2009. *Project Manager.*
- ESHIA for Block G4/50 Seismic Survey, Gulf of Thailand, Chevron, 2008 - 2009. *Marine Ecology Specialist.*
- Monitoring Impacts of 3D Marine Seismic Surveys for Browse Field Development, Woodside Energy Limited,

Australia, 2007 – 2009. *Lead Scientist.*

- Environmental Review for 2D Marine Seismic Survey in Southern Chinese Waters, BG, 2007. *Project Manager.*
- Environmental Protection Statement for Maxima 3D Marine Seismic Survey at Scott Reef, Woodside Energy Limited, 2007. *Lead Scientist.*
- Marine Seismic Survey Integrated Impact Assessments, Offshore Brunei Darussalam, Brunei Shell Petroleum Sdn Bhd, 2004 – 2006. *Lead Scientist.*

### EXPLORATORY/PRODUCTION DRILLING OPERATIONS

- ESIA for Exploration Drilling in Block AD-03, Ophir, Myanmar, 2016. *Project Director.*
- ESIA for Multi Well / Multi Year Exploration Drilling in Block AD-7, Woodside, Myanmar, 2016. *Project Director.*
- ESIA for Exploration Drilling in Block AD-7, Woodside, Myanmar, 2015. *Project Director.*
- ESIA for Exploration of Blocks AD6 and AD8, Chinnery Assets Limited (CNPC), Myanmar, 2013. *Project Director.*
- Myanmar HSE Regulatory Framework Study, for RocOil, Myanmar, 2013. *Project Director.*
- ESHIA for Seismic Exploration of Blocks 15/10 & 15/27 in South China Sea, Chevron, 2013. *Project Director.*
- ESHIA for Exploration Drilling of Block 42/05 in South China Sea, Chevron, 2013. *Project Director.*
- ESIA for Exploration Drilling of a Deepwater Well in the Sea of Japan, JX Nippon Oil, Japan, 2012. *ESIA Advisor.*
- ESHIA for Exploration Drilling of Block 64/11, 53/30 and 42/05 in South China Sea, Chevron, 2011. *Project Director.*
- ESHIA for Block B Gas Development, Vietnam, for Chevron Vietnam, 2010. *Lead Marine Scientist.*
- ESHIA for Pandora Offshore Gas Development, Talisman, Papua New Guinea, 2010 ongoing. *Lead Marine Scientist.*
- ESHIA for Shore Base for Offshore Operations, Thailand, for Chevron Pattani Thailand, 2008 – 2009. *Project Manager.*
- Air Dispersion Modelling for Shwe Gas Development, for Daewoo International Corporation (Myanmar E&P), Myanmar, 2013. *Project Director.*
- EIA for the Shwe Gas Field Shore Base for Shwe Gas Field Development, for Daewoo International Corporation (Myanmar E&P), Myanmar, 2010. *Project Manager.*
- EIA for the Midstream Pipeline and Gas Metering Station for Shwe Gas Field Development, for Daewoo International Corporation (Myanmar E&P), Myanmar, 2009. *Project Manager.*

- Terrestrial Environmental Baseline Study for Onshore Midstream Facilities and Pipeline Landing Site, for Daewoo International Corporation (Myanmar E&P), Myanmar, 2008. *Project Manager.*
- Marine Environmental Baseline Survey for Midstream Pipeline, for Daewoo International Corporation (Myanmar E&P), Myanmar, 2008. *Project Manager.*
- Impact Identification Study for the Alternative Midstream Pipelines and Associated Onshore Facilities, for Daewoo International Corporation (Myanmar E&P), Myanmar, 2008. *Project Manager.*
- Drill Cuttings Modelling Study for Offshore Production Platform, for Daewoo International Corporation (Myanmar E&P), Myanmar, 2007. *Project Manager.*
- EIA for Upstream Facilities in Offshore Myanmar, for Daewoo International Corporation (Myanmar E&P), Myanmar, 2007. *Project Manager.*
- Marine Environmental Baseline Survey for the Development of Upstream Facilities in Offshore Myanmar, for Daewoo International Corporation (Myanmar E&P), Myanmar, 2006. *Project Manager.*
- Impact Identification Study for the Development of Upstream Facilities in Offshore Myanmar, for Daewoo International Corporation (Myanmar E&P), Myanmar, 2005. *Project Manager.*
- EIA for a Medium Compression Platform, Myanmar (Hyundai Heavy Industries & Total E&P Myanmar), Myanmar, 2007. *Project Manager.*
- Preliminary Environmental and Social Scoping Study for the Development of an Offshore Gas Field, for Daewoo International Corporation (Myanmar E&P), Myanmar, 2004. *Project Manager.*
- ESHIA for Block G4/48(c) Production Facility, Gulf of Thailand, Chevron, 2007 - 2008. *Lead Marine Scientist.*
- Status and Trends of HSE Issues in the Oil and Gas Industry, Japanese Oil, Gas and Metals Corp, 2007, 2008 and 2010. *Project Manager.*
- EIA of Mampak Block 4 Field Development, Brunei Shell Petroleum Sdn Bhd, 2006 - 2009. *Lead Marine Scientist.*
- Main Oil Line Replacement Study, Brunei Shell Petroleum Sdn Bhd, 2007 - 2008. *Lead Marine Scientist.*
- Impact Assessment of Bagan Field Development, Brunei Shell Petroleum Sdn Bhd, 2006 - 2009. *Lead Marine Scientist.*
- Pipeline Replacement Project, Brunei Shell Petroleum Sdn Bhd, 2007. *Lead Marine Scientist.*
- EIA of Seria North Flank Development, Brunei Shell Petroleum Sdn Bhd, 2006 - 2007. *Lead Marine Scientist.*
- Bagan Phase II ROV Field Survey, Brunei Shell Petroleum Sdn Bhd, 2006. *Lead Marine Scientist.*
- Integrated Impact Assessment of the Jetty Relocation Project, Brunei Shell Petroleum Sdn Bhd, 2004. *Lead Marine Scientist.*

#### **DRILL CUTTINGS AND PRODUCED WATER DISPOSAL**

- Drill Cuttings Study for Block D12 in Offshore Sarawak, for Shell Sarawak Berhad, Malaysia, 2012. *Project Director.*
- Drill Cuttings Modelling for Well SH-05 in Abu Dhabi, for Wintershall, Abu Dhabi, UAE, 2011. *Technical Lead.*
- Drill Cuttings and Oil Spill Modelling for Hair Dalma HD-09 Well in Abu Dhabi, for ADMA-OPCO, Abu Dhabi, UAE, 2011. *Project Manager.*
- Drill Cuttings and Oil Spill Modelling for Block 64/11, 53/30 and 42/05 in South China Sea, Chevron, 2011. *Project Director.*
- Drill Cuttings Modelling Study Bagan Field Development (Brunei Shell Petroleum Sdn Bhd), Brunei, 2008. *Project Manager.*
- Drill Cuttings Modelling Study Bubut Field Development (Brunei Shell Petroleum Sdn Bhd), Brunei, 2007. *Project Manager.*
- Peragam Exploration Well Drill Cuttings Modelling, Brunei Shell Petroleum Sdn Bhd, 2006 - 2007. *Project Manager.*
- BSP CP127ST1 Well CPDP-12, Champion South-East Development Project, for Brunei Shell Petroleum Sdn Bhd, Brunei, 2007. *Project Manager.*
- Oil Spill Modelling Study for Offshore Production Platform, TOTAL, 2007 - 2008. *Project Manager.*
- Oil Spill Modelling Study for Offshore Production Platform, Shell Australia, 2007 - 2008. *Project Manager.*

#### **FLOATING PRODUCTION STORAGE AND OFFLOADING (FPSO) VESSELS**

- Fishing/Fisheries Scoping/Baseline Study for Offshore Developments, Ghana, for Tullow Ghana Ltd, 2010 - ongoing. *Technical Specialist.*
- Integrated Impact Assessment of the Development of Cendor Field, Petrofac, 2005 - 2006. *Lead Marine Scientist.*

#### **LNG TERMINALS (EXPORT AND RECEIVING)**

- Hong Kong Offshore LNG Terminal - Preliminary Environmental Site and Risk Assessment, Hong Kong, Confidential Client, 2015 - ongoing. *Marine Specialist.*
- Environmental Social Health Impact Assessment for a Floating Liquefied Natural Gas Facility in Offshore Waters, Northwest Australia, Confidential, 2008 - 2009. *Marine Ecology Specialist.*
- Manzanillo LNG Terminal, Korea, Samsung Engineering Company Ltd (SECL), 2008. *Lead Marine Scientist.*

- Environmental Impact Assessment (EIA) of Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities, CAPCO, 2005 – 2007. *Project Coordinator.*
- Adequacy Review of Environmental Assessment for Proposed Taranaki LNG (New Plymouth Council), 2008. *Lead Marine Scientist.*
- Environmental and Risk Assessments for two Natural Gas Facilities in Southeast Asia, CAPCO, 2004 – 2005. *Project Coordinator.*
- Detailed EIA and FEED Study for Submarine Gas Pipelines from Shenzhen LNG Terminal to Tai Po Gas Production Plant, Hong Kong & China Gas Company, 2002 – 2003. *Lead Marine Scientist.*
- Study of Potential Land-based Sites for Natural Gas Facilities in Southeast Asia, CAPCO, 2002 – 2003. *Project Coordinator.*
- Site Selection and Scoping Study for an LNG Terminal in Thailand, Confidential Client, 2005 – 2006. *Lead Marine Scientist.*
- Marine Biodiversity Study for Shoaiba Power Plant Stage III, HSBC, Saudi Arabia, 2012. *Marine Expert.*
- EM&A Team for Installation of Offshore Wind Farm in Southwest Lamma Waters, Hong Kong, for The Hongkong Electric Co., Ltd., 2011 – ongoing. *Project Director.*
- Investigation into Fish Ingress at Hong Kong Electric Power Station, Lamma Island, Hong Kong, 2010 – 2011. *Project Manager.*
- ESHIA Update for Mong Duong 2 Power Plant, Vietnam, AES, 2010 – 2011. *Marine Ecology Specialist.*
- Cooling Mist Dispersion Study at Sabyia Combined Cycle Gas Turbine Power Station, Kuwait, HHI, 2009 – 2010. *Project Manager.*
- EIA for an Offshore Wind Farm Development in Hong Kong, for The Hongkong Electric Co Ltd, 2007 - 2009. *Project Manager.*
- Environmental, Health and Safety Impact Assessment (ESHIA) for Vung Ang II Thermal Power, for One Energy, Vietnam. 2008 - 2010. *Marine Ecology Specialist.*

#### DECOMMISSIONING

- Options Assessment Update for Lufeng 22-1 Oil Field Decommissioning Project, Statoil, 2008-2009. *Project Manager.*
- Options Assessment for Lufeng 22-1 Oil Field Decommissioning Project, Statoil, 2004. *Lead Marine Scientist.*
- Platforms Decommissioning Campaign, Offshore Brunei Darussalam, Brunei Shell Petroleum Sdn Bhd, 2004. *Lead Marine Scientist.*
- Environmental Impact Study of Temsah NW Platform Disposal, Eni E&P, 2005. *Lead Marine Scientist.*
- Consultation on Decommissioning of Overseas Offshore Platforms, CNOOC, 2006. *Project Manager.*
- Environmental Impact Assessment of the Development of a 2,750MW Power Station and Desalination Plant in Jubail Industrial City, Marafiq IWPP, Kingdom of Saudi Arabia, for WSP Environmental Middle East, 2007. *Marine Ecology Specialist.*
- Seawater Recirculation Study, Al Dur IWPP, for Hyundai Heavy Industries Co. Ltd, Bahrain, 2008. *Project Manager.*
- Seawater Recirculation Study, Marafiq IWPP, Hyundai Heavy Industries Co. Ltd., Kingdom of Saudi Arabia, 2006 – 2007. *Project Manager.*
- Baseline Water Quality Survey, Marafiq IWPP, Hyundai Heavy Industries Co. Ltd., 2006, Kingdom of Saudi Arabia. *Project Manager.*
- Thermal Plume Dispersion Study, Ma'aden Phosphate Company, Kingdom of Saudi Arabia, 2009. *Project Manager.*
- Kwang Yang Combined Cycle Power Plant Cooling Water Review, BP, South Korea, 2005.
- Emissions Control Project at the Castle Peak Power Station "B" Units, CAPCO, Hong Kong, 2006. *Marine Ecology Specialist.*
- Cooling Water Culvert Improvement Works, CLP Power, Hong Kong, 2002. *Marine Ecology Specialist.*
- EIA for an 1800 MW Gas-Fired Power Station at Lamma Extension, The Hongkong Electric Co., Ltd., Hong Kong, 1998 – 1999. *Marine Ecology Specialist.*
- Identification of Constraints to the Routing of HEC New Gas Pipeline - Desktop Study, The Hongkong Electric Co., Ltd., 1998. *Project Manager.*

#### DOWNSTREAM PROJECTS

- ESHIA for a Greenfield Refinery in Mandji Free Trade Zone, Samsung C&T, Gabon, 2012 - ongoing. *Project Director.*

#### POWER SECTOR PROJECTS

- Environmental and Social Consulting Services in Support of Transaction Advisory Services for the Mingyan IPP Project, IFC, Myanmar, 2014-2015. *Project Director.*
- ESIA for Combined Cycle Power Plant, GMS Power, Myanmar, 2014. *Technical Advisor.*
- Seawater Recirculation Study for Jeddah South Power Plant Stage I, HHI, Saudi Arabia, 2012. *Partner in Charge.*



## PORT RELATED PROJECTS

- ESIA of a Greenfield Port, APM Terminals, Nigeria, 2012. *Project Director*.
- Contaminated Sediment Disposal Facility at South of Brothers - EIA Update, Civil Engineering and Development Department, Hong Kong Government, Hong Kong, 2009 - 2010. *Project Manager*.
- EM&A for Contaminated Mud Pit IV at East of Sha Chau, CEDD, Hong Kong Government, 2009 - 2013. *Deputy Environmental Team Leader*.
- EM&A for Contaminated Mud Pit IV at East of Sha Chau, CEDD, Hong Kong Government, 2005 - 2009. *Deputy Project Manager*.
- EM&A for Contaminated Mud Pit IV at East of Sha Chau, CEDD, Hong Kong Government, 1997 - 2002. *Project Coordinator*.
- Ecological Monitoring for Uncontaminated Mud Disposal, CEDD, Hong Kong Government, 1999 - 2002. *Project Manager*.
- Review of the Contaminated Mud Disposal Strategy and the need for an Intermediate Contaminated Mud Disposal Facility, CEDD, Hong Kong Government, 2002 - 2003. *Project Manager*
- Ecological, Fisheries and Water Quality Impact Assessment Study for the Proposed Port Development at Northwest Lantau, EDLB, Hong Kong Government, 2005 - 2007. *Water Quality Specialist*.
- Environmental Impact Assessment of Savusavu Port, Rural and Outer Islands Project, Asian Development Bank, Fiji, 2006 - 2007. *Environmental Team Lead*.
- EIA of the Development of a Container Terminal, Vietnam, SPCT/P&O Ports, Vietnam, 2006 - 2008. *Lead Marine Scientist*.
- Permanent Aviation Fuel Facility, Leighton Contractors Asia Limited, Hong Kong, 2003 - 2009. *Environmental Team Leader*.
- Strategic Assessment and Site Selection Study for Contaminated Mud Disposal, CEDD, Hong Kong Government, 1999. *Marine Ecology Specialist*.
- Site Specific Feasibility of Sludge Management Strategy and Sludge Disposal Plan, EPD, Hong Kong Government, 1998 - 2000. *Marine Ecology Specialist*.
- Focussed Cumulative Water Quality Impact Assessment for the West Po Toi Sand Borrow Area, HAM Dredging & Marine Contractors, 2001. *Marine Ecology Specialist*.
- Baseline Survey at East Tung Lung Chau, CEDD, Hong Kong Government, 1999. Non-Statutory Marine Environmental Monitoring Update, Airport Authority Hong Kong, 2002 - 2003. *Marine Ecology Specialist*.
- Performance Verification of Stanley and Shek O Outfalls, EPD, Hong Kong Government, 1999 - 2001. *Marine Ecology Specialist*.
- Sustainable Development for the 21st Century,

Supplementary Agreement for Undertaking Baseline Surveys - Monitoring of Toxics in Marine Sediment and Biota, PlanD, Hong Kong, 2000. *Marine Ecology Specialist*.

## MINING PROJECTS

- Marampa Mine ESHIA, London Mining PLC, Sierra Leone, 2012. *Aquatic Specialist*
- ESHIA of Weda Bay Nickel Mine, ERAMET, Indonesia, 2011. *Marine Specialist*.

## TRANSPORT

- Environmental Permit Consultancy for the Third Runway System Project at Hong Kong International Airport, Hong Kong, 2015. *Project Director*.
- EIA Review Consultancy for Hong Kong Airport Third Runway Project, Airport Authority Hong Kong, Hong Kong, 2012-2013. *Project Manager*
- EIA Review for Area 54 Road Network, Transport Department, Hong Kong, 2012-2013. *Project Director*.

## SEWAGE INFRASTRUCTURE AND DRAINAGE

- Agreement No. CE 55/2009 (DS) - Outlying Islands Sewerage Stage 2 - South Lantau Sewerage Works - Investigation EIA, Hong Kong, for DSD, 2010 - 2014. *EIA Manager*.
- Agreement No. CE 6/2002 (DS) - Drainage Improvement in Northern New Territories - Package C - Investigation, Design and Construction - EIA for TKL05, Hong Kong, for DSD, 2010 - 2012. *EIA Manager*.
- Agreement No. CE 6/2010 (DS) - Improvement of Yuen Long Town Nullah (Town Centre Section) - Investigation EIA, Hong Kong, for DSD, 2010 - 2012. *EIA Manager*.
- Environmental Impact Assessment of Regulation of Shenzhen River Stage IV EIA Study, Hong Kong, for DSD, 2009 - 2011. *Water Quality Specialist*.
- Hong Kong Sewage Harbour Area Treatment Scheme (HATS) Stage 2 - Supplementary Water Quality Monitoring, EPD, Hong Kong Government, Hong Kong, 2007 - 2011. *Project Manager*.

## NATURAL RESOURCE MANAGEMENT

- Total Water Management for Hong Kong - Feasibility Study, DSD, Hong Kong Government, 2005 - 2008. *Project Manager (Environmental)*.
- Study in Terrestrial Habitat Mapping Based on

Conservation Value, SDU, Hong Kong Government, 2002 – 2003. *Project Manager*.

- Artificial Reef Deployment Study, AFCD, Hong Kong Government, 1998 – 1999. *Marine Ecology Specialist*.
- Fisheries Resources and Fishing Operations in Hong Kong Waters, AFCD, Hong Kong Government, 1998. *Marine Ecology Specialist*.
- Seabed Ecology Studies, AFCD, Hong Kong Government, 1998 – 1999. *Marine Ecology Specialist*.

## ROUTE SELECTION AND ENVIRONMENTAL PERMITTING

- FLAG North Asian Loop, International Submarine Cable System, Hong Kong to Taiwan, (FLAG Telecom), Hong Kong, 2001 - 2002. *Marine Ecology Specialist*
- New T&T Hong Kong Limited, Domestic Cable System (New T&T), Hong Kong, 2000 - 2001. *Marine Ecology Specialist*
- C2C International Submarine Cable System – Hong Kong Section (SingTel and GB21), Hong Kong, 2000 – 2001. *Marine Ecology Specialist*
- East Asian Crossing (EAC1) International Submarine Cable System (Asia Global Crossing and KDD SCS), Hong Kong, 2001. *Marine Ecology Specialist*
- East Asian Crossing (EAC2) International Submarine Cable System (Global Crossing Development Co. and NEC Networks), Hong Kong, 2001. *Marine Ecology Specialist*
- Telecommunications Installation at Lot 591SA in DD 328, Tong Fuk, South Lantau Coast and Associated Cable Landing Work in Tong Fuk, South Lantau for the North Asia Cable (NAC) Fibre Optic Submarine Cable System (Level(3)), Hong Kong, 2000. *Marine Ecology Specialist*
- 132kV Submarine Cable Installation for Wong Chuk Hang – Chung Hom Kok 132kV Circuits (The Hongkong Electric Co. Ltd), Hong Kong, 2001 - 2002. *Marine Ecology Specialist*
- 132kV Submarine Cable Circuits from A Kung Wan to Sai Kung Pier (CLP Power), Hong Kong, 1999. *Marine Ecology Specialist*
- Seabed Survey Work for the Proposed 11kV Cable Circuits from Tai Mong Tsai to Kiu Tsui (CLP Power ), Hong Kong, 1999. *Marine Ecology Specialist*
- Seabed Survey Work for the Proposed 11kV Cable Circuit between Pak Lap and Fu Tau Fan Chau (CLP Power), Hong Kong, 1999. *Marine Ecology Specialist*

## SELECTED PUBLICATIONS

- Grebe, C.C, Smith, L. & **Reid, C.A** (2009) The Effects of Marine Seismic Acquisition in a Coral Reef Environment: Results from a Multi-Disciplinary Monitoring Program at Scott Reef, Western Australia. APPEA Conference 2009.
- Grebe CC, Smith L, **Reid CA**, Hearn RL and Colman JG (2008) *The Effects of Marine Seismic Acquisition in a Coral Reef Environment: A Synthesis of Results from a Multi-Disciplinary Monitoring Program at Scott Reef, Western Australia*. APPEA 08.
- Hastings M, **Reid CA**, Hearn R, Grebe C and Coleman J (2008) *The Effects of Seismic Airgun Noise on the Hearing Sensitivity of Tropical Reef Fishes at Scott Reef, Western Australia*. Proceedings of the Institute of Acoustics, 2008.
- C.C. Grebe, J.G. Colman & **C.A. Reid** (2008) *Practical application of an adaptive management approach for a marine seismic survey*. IAIA08 Paper.
- Qui JW, **Reid CA**, Kennish R and Qian PY (2003) *Recolonisation of Benthic Infauna Subsequent to Capping of Contaminated Mud Pits with Uncontaminated Sediments in East Sha Chau, Hong Kong*. Estuarine and Coastal Shelf Science 56 (2003) 819-831.
- Germano JG, **Reid CA**, Whiteside P and Kennish R (2002) *Field Verification of Computer Models Predicting Plume Dispersion in Hong Kong*. Dredging 02 - Proceedings of American Society of Engineers.
- Kennish R, Lui PH, Chan A, Allery SC, Leung KF and **Reid CA** (2002) *Sewage Outfall Performance Verification in Hong Kong: The results of an integrated modeling and monitoring approach*. Proceedings of the International Conference Wastewater Management & Technologies for Highly Urbanized Coastal Cities 2002, pp 295-301.
- Nicholson S, Clarke SC, Word JQ, Kennish R, Barlow KL & **Reid CA** (2000) *Quality Assurance in the Toxicological Assessment of Hong Kong Dredged Sediments: The Potential Influence of Confounding Factors on Bioassay Results*. ISWA Conference Proceedings, October 2000, Hong Kong



# Becky Summons

Consultant



Becky Summons is a Consultant with ERM based in the Myanmar Office. Miss Summons has over 7 years' experience in Environmental and Social Impact Assessments and has worked on a number of projects in the oil and gas, renewables and marine cable industries. She has particular experience in undertaking environmental and social impact assessment to lender requirements (such as IFC, EBRD, Equator Principles and JBIC).

Becky has significant experience in the preparation and management of a variety of Environmental, Health and Social Impact Assessments (ESIAs/EIAs/ESHAs), Environmental Statements (ESs), Habitat Regulations Assessments (HRAs), Appropriate Assessment (AAs) and Strategic Environmental Assessments (SEAs). As part of these works, Becky has managed a range of projects for clients in the oil and gas industry including BP, BG Group, Tap Oil, Statoil, EnQuest, Petrofac, PA Resources, GDF Suez, Ophir Energy, Woodside, RWE, South Stream Transport B.V. and Wintershall.

Since February 2015, Becky has been working exclusively in Myanmar on projects for Tap Oil, Woodside, BG Group, and Statoil related to offshore exploration. She has taken part in numerous public consultations for ESIA studies in Rakhine State, Yangon and in Nay Pyi Taw and has built up good relationships with governing bodies such as MOECF and MOGE.

Becky has also lead or supported stakeholder engagement, ensuring all consultation was conducted to IFC requirements. Becky's engagement experience includes: setting up and running workshops; preparing engagement plans, consultation databases, meeting minutes and presentation materials and participating in focus group discussions and stakeholder consultation. This engagement has included liaison and meetings with local potentially affected communities and fishing communities, fishing organizations, governing bodies and local academic institutions.

## EDUCATION

- MSc, Marine Environmental Protection, Bangor University, Wales, United Kingdom, 2009
- BSc (Hons), Marine Biology, University of Swansea, Wales, United Kingdom, 2003

## PROFESSIONAL AFFILIATIONS & REGISTRATIONS

- Member of the Institute of Environmental Management & Assessment (IEMA)
- DECC Level 2 Corporate Manager (Oil Spill Response): Oil Spill Response (September 2011)

## FIELDS OF COMPETENCE

- Marine Biology and Ecology
- Environmental Impact Assessment (EIA)
- Environmental Monitoring
- Oil and Gas Specialist
- Environmental Planning and Regulations
- Stakeholder Engagement

## CONTACT DETAILS

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## SELECTED PROJECT EXPERIENCE

### MYANMAR

- **Exploration Drilling, Offshore Myanmar, Ophir Myanmar, 2016-Ongoing.** Becky is the Project Manager for an exploration drilling campaign in Block AD-03 in the waters offshore Rakhine State in Myanmar. The role includes client liaison, marine environmental baseline and impact assessment and preparation of the EIA Report to local Myanmar requirements. The work involves stakeholder engagement in the Sittwe, Rakhine State.
- **ESIA for Phase 2 Development of MIP Port, Yangon, MAS, 2016-ongoing.** Becky is the Project Coordinator for an environmental and social impact assessment for an expansion to an existing port in Yangon. The work involves scoping study, baseline data collection, stakeholder engagement and development of an EIA and EMP report.
- **3D Seismic Survey and Exploration Drilling, Offshore Myanmar, Woodside, 2015-Ongoing.** Becky is the Project Manager for a 2D and 3D exploration campaign (including seismic surveys and exploration drilling) in Block AD-07 in the waters offshore Rakhine State in Myanmar. The role includes client liaison, marine environmental baseline and impact assessment and preparation of the IEE Report to local Myanmar requirements. The work also involved stakeholder engagement in the Sittwe, Rakhine State to participate in focus group discussions on fishing and the environment. The engagement has also involved discussion with key stakeholders such as universities, NGOs, government authorities and Myanmar fishing associations.
- **2D and 3D Seismic Survey, Offshore Myanmar, Tap Oil, 2015-Ongoing.** Becky is the Project Manager for 2D and 3D seismic surveys in Block M-7 in the waters offshore Mon State and Tanintharyi Region in Myanmar. The role includes client liaison, marine environmental baseline and impact assessment and preparation of the IEE Report to local Myanmar requirements.
- **2D and 3D Seismic Survey, Offshore Myanmar, BG Group, 2015-Ongoing.** Becky is the Project Manager for a 2D and 3D exploration campaign (including seismic surveys, gravity & magnetic surveys and seabed sampling) in Blocks A-4 and Ad-02 in the waters offshore Rakhine State in Myanmar. The role includes client liaison, marine environmental baseline and impact assessment and preparation of the IEE Report to local Myanmar requirements. The work also involved stakeholder engagement in the Rakhine State in 4 townships to participate in focus group discussions on fishing and the environment. The

engagement has also involved discussion with key stakeholders such as universities, NGOs, government authorities and Myanmar fishing associations.

- **2D Seismic Survey, Offshore Myanmar, Statoil, 2015-ongoing.** Becky is the Project Manager for a 2D seismic survey in Block AD-10 in the waters offshore Rakhine State in Myanmar. The role includes client liaison, marine environmental baseline and impact assessment and preparation of the IEE Report to local Myanmar requirements. The work also involved stakeholder engagement in the Rakhine State in 2 townships to participate in focus group discussions on fishing and the environment.

### OIL AND GAS – SEISMIC SURVEYS

- **Seismic Survey ESIA, Honduras, BG Group, 2014-2015.** Becky was the part of the marine ecological project team for an ESIA required for a seismic survey in Honduran Caribbean waters. Work involved the development of the marine ecological impact methodology and criteria, the preparation of the baseline and impacts assessment and development of mitigation measures and monitoring requirements.
- **Seismic Survey Application and ES, PA Resources, Greenland, 2010.** Becky was involved in the preparation of applications with an associated ES for proposed 3D seismic activity in Disko Bay (West Coast of Greenland). Work involved liaison with local authorities, review and assessment of baseline environmental data and environmental impact assessment.
- **Offshore oil and gas permitting, BP, RWE, GDF Suez, EnQuest, Wintershall, UK 2009-11.** Becky has undertaken over 15 applications for seismic surveys within the North Sea. These have included underwater noise modelling analysis, baseline creation and impact assessment to meet permitting requirements.

### OIL AND GAS - MIDSTREAM (PIPELINES)

- **South Stream Offshore Pipeline Project, South Stream Transport B.V., 2012-2014.** The SSOPP was a major development scheme to bring gas from the Russian gas fields to Europe via a pipeline under the Black Sea. Becky was the country manager for the Turkish EIA and ESIA process and was responsible for the delivery of all reports from scoping to final ESIA related to Turkish permitting requirements and international standards such as Equator Principles, World Bank and IFC Performance Standards. She was also responsible for delivering the marine ecology Chapters for all three countries (Russia, Bulgaria and Turkey). Becky also managed the stakeholder

engagement aspects of the project within Turkey which included liaison with ministries, NGOs and academic organisations to support the national approval process. She also assisted with the stakeholder consultation primarily focused on fishing communities and organisations as the Project was located >100km from the coastline. Becky's responsibilities in the marine ecology aspects include: sole author of the scope of work for Turkish, Russian and Bulgarian marine survey. The survey included benthic, mammal and seabird surveys in the Black Sea and was undertaken to meet international standards, development of impact assessment criteria for marine receptors, preparation of the marine ecology chapters for the ESIA and assistance with the planning of HRA/Appropriate Assessment for Bulgaria and other required documents for permitting requirements.

#### *EXPLORATION AND DRILLING*

- **Conrie Field Development Environmental Statement (ES), EnQuest, UKCS 2011-2012.** Becky was project manager, lead author and focal point to deliver the ES for the Conrie Field Development in the Northern North Sea including 8 new wells and a tie-back to the existing Don Platform. This work included the preparation of an ES detailing impacts from construction of and production from the Conrie Field in the Northern North Sea. Work included liaison with statutory bodies, chemical, noise, air and other environmental impacts associated with oil and gas developments based on baseline surveys.
- **Don SW and West Don and Exploration offshore oil and gas permitting, EnQuest, 2010-2011.** Becky was project manager and focal point for environmental permitting work for EnQuest in their Don Field. Work involved the preparation of a variety of environmental permits (PONs/ OPPCs/ OPEPs) for drilling and intervening wells, seismic surveys and installing pipelines and platforms and liaison with regulatory bodies. Impact assessments were carried out for the following; Don SW and West Don, Heather and Ivy, Crathes and Knightsbridge.
- **BP Secondment, Aberdeen, BP, 2010 - 2011 (6 months).** Becky was seconded into the BP offices in Aberdeen to assist the wells and subsea environmental advisor with permitting regulations of all BP upstream activities in the UKCS. Work involved liaison with statutory bodies and preparation, tracking and submission of E&P permits for the UKCS.
- **Offshore oil and gas permitting, BP, RWE, GDF Suez, EnQuest, Wintershall, UK 2009-11.** Becky was project manager and focal point for environmental permitting work for EnQuest exploration drilling

within the UKCS. Becky was also involved in the preparation and management of environmental assessments and permits of a number of well drilling and intervention programs for a variety of companies operating within the UKCS. Work included; preparation of ESs, seismic surveys applications, drilling and intervention permits for wells, permits for installation of pipelines, platforms and subsea templates.

- **Exploration drilling Oil Pollution Emergency Plans (OPEPs), EnQuest, Wintershall, BP, 2010-2011.** Becky was the lead author for a number of Oil Pollution Emergency Plans (OPEPs) for BP, Wintershall and EnQuest and undertook frequent liaison with governmental departments on the requirements of new legislation into oil spill response. This work involved assessment of oil spill models and key sensitivities in the area. The OPEP was prepared in accordance with new government guidelines.
- **Seaward License Round (R26) Applications, RWE and GDF Suez, 2010.** Becky authored the environmental appendix for RWE and GDF Suez to support their 26th round license applications. This involved identification of key sensitivities and assessment of any potential impacts.

#### *RENEWABLES – WINDFARMS*

- **GTI and BWII Windfarms due diligence, Germany, 2009-10.** Becky was involved in the due diligence work for two large German windfarm developments in the North Sea. Work involved managing the translation of documents from German and overall document management for all key reports. Becky also prepared the environmental and permitting sections of a due diligence report to focus on any key issues that could arise from the proposed wind farms.

#### *DUE DILIGENCE/RISK*

- **TAP / TANAP ESIA Commitments Risk Assessment, BP, 2014.** Becky was the Project Manager for a risk assessment of ESIA commitments contained within the commitment registers for two gas pipelines (TAP and TANAP). This work involved a review, categorisation and pre-screening of the ESIA commitments in order to undertake a risk assessment. The risk assessment focused on business, HSE and financial risks (associated with the inaction of commitments) and highlights those with the greatest risk to the Project.

## *POWER*

- **Power Cable Constraints Mapping, Transelec, Chile, 2011.** Becky was involved in constraints mapping for a proposed marine cable in Chile. The project aimed to link a new hydroelectric energy dam with the existing infrastructure. The work was mainly GIS based and involved analysis of baseline data and data from the local authorities on key sensitivities in the region.
- **Habitats Regulations Assessments (HRA) for siting of a nuclear power station, DECC, 2010.** Becky assisted in the preparation of HRAs for two locations within the UK identified as potential sites for nuclear power stations. This work involved assessing potential impacts from the power plants in terms of the impact on neighbouring protected areas.
- **EriGrid cable (England -Ireland Interconnector) ES, Ireland, 2009-2010.** Becky assisted in the preparation an ES for a power cable between Ireland and Wales. This involved analysis of baseline data in terms of key sensitivities observed along the cable route. The work also involved constraint mapping using GIS.



# Jovy Tam

Senior Consultant



Mr Jovy Tam is a Senior Consultant with Environmental Resources Management in Hong Kong. He is a trained marine ecologist with over 10 years experience in environmental management.

Mr Tam has extensive experience in undertaking environmental impact assessment for large-scale projects in accordance with the ADB and IFC requirements. He has worked on projects related to port developments, upstream and midstream oil and gas developments, offshore wind farms, power stations, submarine gas pipelines, submarine cables, sewage infrastructure, marine disposal facilities, LNG terminals and mining.

Mr Tam has involved in projects throughout the Asia Pacific region and elsewhere included the following:

- **Australia:** Provided water quality and marine biological input to assessments of exploration and production activities, including leading state of the art investigations into seismic impacts on coral reef ecosystems.
- **Brunei:** Managed coral surveys, marine biological baseline studies and water quality survey for exploration and production activities.
- **Indonesia:** Involved in the marine ecological baseline studies and impact assessment for a nickel mining, processing plant and associated port in accordance with the IFC standards.
- **Mainland China:** Involved in ESHIAs for industrial projects including gas pipelines, offshore platforms, marine seismic surveys and exploratory drilling.
- **Maldives:** Involved as an independent expert for IFC to review the ESHIA for a proposed waste management system and facilities in accordance with the IFC Performance Standards and guidelines;
- **Middle East (Saudi Arabia):** Involved in the marine ecological impact assessment for desalination plant;
- **Vietnam:** Provided technical fishery and marine ecology inputs to an ESHIA for a Coal Fired Power Plant in order to comply with ADB and IFC requirements.

In Myanmar, Mr Tam has been deployed in various oil and gas projects for which he is mainly responsible for leading the ESIA Study both as a Project Manager and as an EIA specialist. Key projects include:

- *Environmental and Social Impact Assessment (ESIA) for Offshore Seismic Exploration of Block M-7, 2015 – ongoing.*
- *ESIA for Geophysical Data Acquisition Programs of Offshore Block A-5, 2015.*
- *ESIA for Offshore Seismic Exploration of Block M-8, 2014 – ongoing.*
- *ESIA for Onshore Seismic Exploration of Block MOGE-4, 2014 – ongoing.*
- *ESIA for Onshore Seismic Exploration of Block C-1 and Block H, 2014 – ongoing.*
- *ESIA for Onshore Seismic Exploration of Block IOR-4 and Block IOR-6, 2014 - ongoing.*
- *EIA for Enhanced Oil Recovery of the Mann Oil Field, 2014 - ongoing.*
- *ESIA for the Exploratory Drilling Programme in Block AD-1, Block AD-6 and Block AD-8 at the Rakhine Basin, Offshore Myanmar, 2013.*
- *Myanmar Health, Safety and Environment Regulatory Framework Study, 2013.*
- *Block A-1, A-3 Gas Development – Marine Environmental Impact Assessment for Supply Base, Myanmar, 2009 – 2010.*
- *Block A-1, A-3 Gas Development – Marine Environmental Baseline Study for Offshore Midstream Pipeline, 2008–2009.*
- *Block A-1, A-3 Gas Development, Terrestrial Environmental Baseline Study for Onshore Midstream Facilities and Pipeline Landing, 2008–2009.*

## Fields of Competence

- Environmental Impact Assessment
- Best Practicable Option Assessment
- Site Selection and Route Assessment

## Education

- BSc (Hons) Environmental Science, The Chinese University of Hong Kong, 2002.
- M.Phil Environmental Science, The Chinese University of Hong Kong, 2006.

## Academic Achievement

- Outstanding Young Scientist Award 2005, granted by Organizing Committee of the 5th Conference on

## Key Projects

### Myanmar Projects

**Environmental and Social Impact Assessment for offshore Seismic Exploration of Block M-7, Tap Energy (M-7) Pte. Ltd., 2015 - ongoing.** ERM have been commissioned to undertake an ESIA for a planned offshore seismic exploration of Block M-7 of Myanmar. As part of the Study, a Project Proposal Report, an IEE Report and an Environmental Management Plan will be prepared for approval by the Myanmar authorities. Mr Tam is being deployed as the Project Manager for the Study.

**Environmental and Social Impact Assessment for Geophysical Data Acquisition Programs of Offshore Block A-5, Chevron, 2015.** ERM have been commissioned to undertake an ESIA for the geophysical acquisition programs of offshore Block A-5 of Myanmar. As part of the Study, a Project Proposal Report, an IEE Report and an Environmental Management Plan were prepared for approval by the Myanmar authorities. Mr Tam is being deployed as the Project Manager for the Study.

**Environmental and Social Impact Assessment for Onshore Seismic Exploration of Block MOGE-4, CAOG Pte. Ltd., 2014 - ongoing.** ERM have been commissioned to undertake an ESIA for a planned onshore seismic exploration of Block MOGE-4 of Myanmar. As part of the Study, a Project Proposal Report, an IEE Report and an Environmental Management Plan were prepared for approval by the Myanmar authorities. Mr Tam is being deployed as the Project Manager for the Study.

**Environmental and Social Impact Assessment for offshore Seismic Exploration of Block M-8, Berlanga Myanmar Pte. Ltd., 2014 - ongoing.** ERM have been commissioned to undertake an ESIA for a planned offshore seismic exploration of Block M-8 of Myanmar. As part of the Study, a Project Proposal Report, an IEE Report and an Environmental Management Plan were prepared for approval by the Myanmar authorities. Mr Tam is being deployed as the Project Manager for the Study.

**Environmental and Social Impact Assessment for Onshore Seismic Exploration of Block C-1 and Block H, Pacific Hunt Energy, 2014 - ongoing.** ERM have been commissioned to undertake an ESIA for a planned onshore seismic exploration of Blocks C1 and H of Myanmar. As part of the Study, a Project Proposal Report, an ESIA Report and an

Environmental Management Plan EMP were prepared for approval by the Myanmar authorities. Mr Tam is being deployed as the Project Manager for the Study.

**Environmental and Social Impact Assessment for Onshore Seismic Exploration of Block IOR-4 and Block IOR-6, MPRL E&P, 2014 - ongoing.** ERM have been commissioned to undertake an ESIA for a planned onshore seismic exploration of Blocks IOR-4 and IOR-6 of Myanmar. As part of the Study, a Project Proposal Report, an ESIA Report and an EMP were prepared for approval by the Myanmar authorities. Mr Tam is being deployed as the Project Manager for the Study.

**Environmental Impact Assessment for Enhanced Oil Recovery of the Mann Oil Field, MPRL E&P, 2014 - ongoing.** ERM have been commissioned to undertake an EIA for a planned Enhanced Oil Recovery of the Mann Oil Field of onshore Myanmar. As part of the Study, a Project Proposal Report, an EIA Report and an EMP were prepared for approval by the Myanmar authorities. Mr Tam is being deployed as the Project Manager for the Study.

**Environmental and Social Impact Assessment for the Exploratory Drilling Program in Block AD-1, Block AD-6 and Block AD-8 at the Rakhine Basin, Offshore Myanmar, Chinnery Assets Limited (CAL), 2013.** ERM was commissioned by CAL to undertake an ESIA Study for its proposed offshore exploratory drilling operations in Myanmar, which covers one shallow water and two deep water blocks at the Rakhine Basin. Mr Tam is the Project Manager and is responsible to lead the Screening, Scoping, Impact Assessment and Environmental and Social Management Plan preparation of the Project.

**Myanmar Health, Safety and Environment (HSE) Regulatory Framework Study, Roc Oil, 2013.**

ERM was commissioned by Roc Oil to undertake a HSE regulatory review related to onshore and offshore oil and gas operations in the Union of Myanmar. The purpose of the review has been to present the current status of HSE Regulations and the existing Regulatory Agencies in Myanmar, as well as provide a forecast of potential future legislation that relates to HSE. The intent of this review is to allow Roc Oil to better understand HSE regulatory requirements/ guidelines in Myanmar both at present and in the near future. Mr Tam is responsible for overall project management and was leading the regulatory review.

**Block A-1, A-3 Gas Development - Marine Environmental Impact Assessment for Supply Base**

**(Confidential Client), Block A-1 and Block A-3 Gas Development, Myanmar, 2009 - 2010.** ERM was commissioned to undertake an EIA for a proposed onshore supply base facilities, which included a supply base, an access road and a jetty, on Ramree Island, Myanmar, to support the construction, operation and maintenance of offshore and onshore facilities as part of the upstream and midstream development of Block A-1 and Block A-3. Mr Tam was deployed as EIA Specialist responsible for the preparation of the EIA Report and Environmental Management and Monitoring Plan (EMMP).

**Block A-1, A-3 Gas Development, Marine Environmental Baseline Study for Offshore Midstream Pipeline, 2008-2009.** ERM has been commissioned to conduct a Marine Environmental Baseline Study for Offshore Midstream Pipeline as part of the Block A-1 and A-3 Gas Development Project. Marine baseline information collected will then be used to conduct an Environmental Impact Assessment for installation and operation of such facilities. Mr Tam is responsible for supervising the offshore coral survey for collection of baseline data of coral assemblages in the Study area and is also involved in the preparation of technical submission.

**Block A-1, A-3 Gas Development, Terrestrial Environmental Baseline Study for Onshore Midstream Facilities and Pipeline Landing, 2008-2009.** This Study is a Terrestrial Environmental Baseline Study for onshore midstream facilities and pipeline landing as part of the Block A-1 and A-3 Gas Development Project. Terrestrial baseline information collected was used to conduct an Environmental Impact Assessment for installation and operation of such facilities. Mr Tam was responsible for planning and supervising the Onshore Terrestrial Field Survey for collection of terrestrial baseline data in both dry (February) and wet (June) seasons and he was also responsible to prepare the terrestrial environmental baseline report.

**Environmental Impact Assessment (EIA) for a Medium Compression Platform, Myanmar (Hyundai Heavy Industries & Total E&P Myanmar), 2007.** ERM undertook a supplementary EIA for additional development works at an operating production field in offshore waters of S Myanmar. Due to a lack of local legislation, the assessment was undertaken to Company HSE Standards supplemented by World Bank and IFC Guidelines. Mr Tam was responsible for preparation of the EIA Report.



## **IFC / ADB Projects**

### **Independent ESHIA Review for Thilafushi Waste Management Facility, Maldives, IFC, 2011 – 2012.**

ERM has been contracted as an independent expert to support IFC in reviewing the ESHIA for a proposed waste management system and facilities (include composting, gasification and landfill) in Maldives. Under the Assignment, Mr Tam had undertaken a site visit, participated in the stakeholders liaison process and was leading the review of the ESHIA Report prepared by a local consultant to ensure that the ESHIA is in compliance with relevant IFC standards.

### **ESHIA Update for Mong Duong 2 Power Plant, Vietnam, AES, 2010 – 2011.**

ERM has been contracted to update the ESHIA for the coal-fired power plant in Vietnam. Mr Tam was leading the marine ecological impact assessment of the Study and was also responsible to assess the baseline fisheries conditions in the area and the impacts to the identified fishing operations and fisheries resources. The ESHIA was undertaken in accordance with the ADB and IFC standards.

### **Managed Biodiversity Impact Assessment for Nickel Mining in Indonesia, confidential client, 2009 – ongoing.**

ERM has been contracted to undertake the Marine Biodiversity Impact Assessment for nickel mining and process facilities in Indonesia. Mr Tam was the marine ecologist for the Study and was responsible for conducting the baseline marine ecological surveys and assessing impacts to the identified marine ecological sensitive receptors. He was also involved in preparing the Environmental Management Plan for the project which detailed the mitigation measures and monitoring requirements to be adopted during the life cycle of the Project.

## **Infrastructure Projects**

**Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities: EIA of two potential locations for a LNG Terminal in Hong Kong, at Black Point and South Soko (CAPCO), Hong Kong, 2005-2007.** Part of the assessment includes examining the impacts associated with the reclamation at Black

Point and South Soko and installation of a 12" submarine water main connecting Shek Pik with South Soko, a 30" submarine gas pipeline and a submarine cable circuit. For the two EIAs, ERM conducted a detailed water quality impact, fisheries and marine ecological assessment of the construction and operation of the LNG terminal options. Mr Tam was responsible for the fisheries and marine issues, including undertaking a comprehensive ichthyoplankton & fish post-larvae surveys in southern Hong Kong waters.

### **Black Point Gas Supply Project – EIA Study, 2009.**

ERM have been commissioned by the Castle Peak Power Company Limited (CAPCO) to conduct an Environmental Impact Assessment (EIA) for the development of the Black Point Gas Supply. Mr Tam was responsible for the contractor training and supervision of the sediment sampling programme within the footprint of the proposed development. Data collected were used to characterise the level of contamination of the marine sediments which will be required to be dredged and disposed as part of the Project. Subtidal dive survey was also conducted to identify coral community, if any, and to characterize its composition and condition. Mr Tam was responsible for supervising the dive survey with the assistance of a commercial diving team. He has also involved in the fisheries impact assessment of the Project.

### **EIA Study of Development of a 100MW Offshore Wind Farm in Hong Kong – EIA Study, 2008-2009.**

ERM was commissioned to undertake an EIA Study of two potential locations for an offshore wind farm in Hong Kong, at Southwest Lamma and Eastern Offshore waters. Key issues for the EIA included impacts of sensitive marine habitats for corals, finless porpoise and seabirds. Mr Tam was the coral specialist for the Project and was responsible for all of the subtidal dive surveys (REA) at Lamma and Eastern Offshore waters in identifying sensitive receivers (coral communities) and to characterize the composition and condition of the coral communities. Mr Tam also assisted the baseline surveys of sediment chemistry and toxicity, water quality and macrobenthos assemblages of the Study area.

### **Ecological, Fisheries and Water Quality Impact Assessment Study for the Proposed Port Development at Northwest Lantau (EDLB), 2006 – 2007.**

ERM was conducting an environmental impact assessment of the various predicted environmental impacts on the site for this project. The study is to determine the nature and extent of water quality

impact, ecological and fisheries impacts, especially the effects and impact on the Chinese White Dolphin arising from the construction and operation of the Project at the Northwest Lantau site. Mr Tam was the fisheries biologist of this EIA. He was also responsible for the intertidal and horse-shoe crab survey in this project.

## **Oil and Gas Projects**

**Environmental, Social and Health Impact Assessment for Exploratory Drilling of Block 15/10 in Pearl River Mouth Basin, South China Sea, China, Chevron, 2014 - ongoing.** ERM were commissioned by Chevron to undertake an ESHIA Study for the proposed Exploratory Drilling at Block 15/10 within the Pearl River Mouth Basin of South China Sea. Mr Tam is the Project Manager and is responsible to lead the Screening, Scoping, Impact Assessment and Environmental and Social Management Plan preparation of the Project.

**Environmental, Social and Health Impact Assessment for Phase 2 Exploratory Drilling in Pearl River Mouth Basin, South China Sea, China, Chevron, 2013.** ERM were commissioned by Chevron to undertake an ESHIA Study for the proposed Phase 2 Exploratory Drilling at Block 42/05 within the Pearl River Mouth Basin of South China Sea. Mr Tam is the Project Manager and is responsible to lead the Screening, Scoping, Impact Assessment and Environmental and Social Management Plan preparation of the Project.

**Environmental, Social and Health Impact Assessment for Marine 3D Seismic survey of Block 15/10 and Block 15/28 in the South China Sea, China, Chevron, 2013.** ERM were commissioned by Chevron to undertake an ESHIA Study for the proposed marine 3D seismic survey of Block 15/10 and Block 15/28 in the South China Sea. Mr Tam is the Project Manager and is responsible to lead the Screening, Scoping and Environmental and Social Management Plan preparation of the Project.

**Waste Management Study for Phase 2 Exploratory Drilling in Pearl River Mouth Basin, South China Sea, China, Chevron, 2013.** ERM were commissioned by Chevron to undertake a waste management study for the proposed Phase 2 Exploratory Drilling at Block 42/05 within the Pearl River Mouth Basin of South China Sea. Under the Study, ERM identified potential waste treatment facilities in Shenzhen, China to handle hazardous wastes generated by the exploratory drilling

operations and conducted an audit of those facilities to determine its suitability for use for the Project. A Waste Management is also developed as part of the Study. Mr Tam is the Project Manager for the Study.

**Environmental, Social and Health Impact Assessment for Phase 1 Exploratory Drilling in Pearl River Mouth Basin, South China Sea, China, Chevron, 2011.** ERM were commissioned by Chevron to undertake an ESHIA Study for the proposed Phase 1 Exploratory Drilling at Blocks 42/05, 53/30 and 64/18 within the Pearl River Mouth Basin of South China Sea. Mr Tam is the Project Manager and is responsible to lead the Screening, Scoping, Impact Assessment and Environmental and Social Management Plan preparation of the Project.

**Environmental Scoping and Management Plan for 3D Seismic Survey of Blocks 64/18 and 53/30 in the South China Sea, China, Chevron, 2010.** ERM were commissioned by Chevron to undertake a Screening / Scoping study for a marine seismic survey in the South China Sea. The survey was to cover two blocks where key issues related to sensitive marine mammal habitat and fishing operations. Mr Tam was responsible for the preparation of the Environmental Scoping and Management Plan for the proposed survey.

# Piers Touzel

Partner

Mr Touzel is the Managing Partner for ERM's Impact Assessment and Planning Practice in the Asia Pacific Region, based in Hong Kong. He has managed or provided technical input to over 50 Environmental and Social Impact Assessments (ESIA) and Resettlement Plans for clients in China, Southeast Asia, Africa and Mongolia. He has undertaken ESIA's across a range of industry sectors according to the following financial institution standards: World Bank, IFC, European Bank for Reconstruction and Development and the Asian Development Bank. He has prepared Resettlement Planning Frameworks and Resettlement Plans in China, Southeast Asia, Africa and Central America.

Mr Touzel has undertaken impact assessments, due diligence and resettlement planning for hydropower and related infrastructure projects.

## Myanmar Experience

Mr Touzel is currently leading two environmental and social reviews in Myanmar. The first is for a controversial (and confidential) extractive industry investment where key issues relate to land use, resettlement and community relations. The second project is an Environmental and Social Impact Assessment of the Mandalay Industrial Park on behalf of a multilateral investment organisation.

## Professional Affiliations & Registrations

- Society of Petroleum Engineers

## Fields of Competence

- International ESIA
- Resettlement Planning
- Stakeholder Engagement

## Education

- Master of Business Administration, Rutgers, State University of New Jersey, 2012
- Bachelor of Science (Chemistry), University of Melbourne, 1999
- Bachelor of Arts (Chinese), University of Melbourne, 1999
- Beijing Language and Culture University, Language Certificates C and B, 1997

## Languages

- English (native)
- Mandarin (fluent)

## Key Industry Sectors

- Infrastructure
- Oil & gas
- Mining
- Chemicals/Petrochemicals

## **Environmental and Social Impact Assessment**

*Environmental and Social Impact Assessment for the Chuandongbei Gas Project, Sichuan, China (Chevron), 2007- 2013.* Mr Touzel was the Partner in Charge of ESHIA preparation for a multi-phase onshore gas development in southern China. The project involves the extraction and purification of high-sulphur natural gas. Residents located close to surface facilities and sour gas pipelines will be relocated to allow for the safe operation of the project.

*Environmental and Social Impact Assessment and Resettlement Planning Framework for an Iron Ore Mine, (Wuhan Iron and Steel Company - 武钢), Liberia, 2011-12.* ESIA referencing IFC Performance Standards submitted for regulatory approvals.

*Regulatory EIA for an Onshore Gas Development, (Total E&P China/Petrochina), 2008-11.* Mr Touzel was the the Partner in Charge of this EIA for regulatory submission to the Ministry of Environmental Protection for an onshore gas development in Inner Mongolia.

*Environmental and Social Impact Assessment for a Proposed 12 Mtpa Coal Mine in Shaanxi Province, China, (Anglo Coal), 2005- 2009. Mr Touzel was the Partner in Charge.* The project involves a 12 Mtpa open pit coal mine, coal gasification and coal to liquids plants in an adjacent chemical park. ERM was retained to undertake an ESHIA, including preliminary consultation with communities that will be displaced by the mine, and to liaise with local government authorities on EHS permitting and land administration issues. The project will require displacement of several thousand local residents and consequently, resettlement (and the capacity of local government to manage this process) was a key issue for the project.

*Regulatory EIA for the Shenzhen to Zhongshan Corridor, China, 2009-2012 (Shenzhen Transportation Bureau).* Mr Touzel was the Partner in Charge of a Regulatory EIA for this major infrastructure project comprising subsea tunnels and roadways totally 51 km in length. The EIA report was review and approved by China's Ministry of Environmental Protection.

*EIAs and Permitting Support for Four Roads in Yunnan Province, China, 2009-11 (Government Client)* Mr Touzel was the Partner in charge of Regulatory EIA and associated permitting support of four road construction projects in Yunnan that were approved

by the Yunnan Provincial Environmental Protection Bureau.

*Bankable ESHIA for a Coal to Liquids Facility (Confidential Client), 2009.* Mr Touzel is the Partner in Charge of a bankable ESHIA for a coal to liquids project in Ningxia, China.

*ESHIA for CBM Appraisal Drilling and Seismic Exploration, (Confidential Client), 2008-2009. Mr Touzel was the Project Director* ERM undertook an ESHIA for a seismic exploration and appraisal drilling programme for a CBM project located in Shanxi Province.

*Regulatory EIA and Bankable ESHIA of a Gold Mine in Inner Mongolia, (Jinshan Gold Mines), 2005-2006. Mr Touzel was the Project Manager.* The project involved an open cut gold mine and leaching plant. ERM partnered with the Inner Mongolian Institute of Environmental Science to undertake an EIA for regulatory submission and a bankable ESIA in accordance with IFC Performance Standards. Key issues for the project included the sustainability of the Project's water demand, the restriction of grazing areas for ethnic Mongolian herdsman and community engagement.

*Environmental and Social Impact Assessment of a Coal to Chemicals Facility in Inner Mongolia, (Xinao Group- IFC): Mr Touzel was the Technical Reviewer for the social component of the ESIA, 2005-2006.* ERM was commissioned to undertake a bankable ESIA for the construction of a chemical plant in Inner Mongolia. Key issues for the project were resettlement and planning issues within the safety buffer distance of the proposed facility and a neighbouring pharmaceutical plant also operated by Xinao Group.

*Environmental and Community Risk Assessment of a Bauxite Mine in central Vietnam, (BHP Billiton), 2005.* Mr Touzel undertook an environmental and community risk assessment for a proposed mining development in the southern central highlands of Vietnam. The proposed mining area and transport corridors are home to over 30 ethnic minorities. Indigenous (and other minority) peoples and resettlement were the key issues.

*Social and Health Impact Assessment (SHIA) for the Hangzhou City Gas Ring Project, (Shell China Gas and Power Ltd), 2003-4. Mr Touzel was the Project Manager.* The SHIA addressed issues associated with the installation and operation of a ring main in Hangzhou City, the capital of eastern China's Zhejiang

Province. Key issues for the project were resettlement to allow pipeline installation and management of the non-local construction workforce.

**BP Zhuhai LPG Phase II Extension ESIA, BP 2003.** Mr Touzel was the principal author responsible for 'upgrading' the EIA produced for Chinese regulatory compliance to a standard consistent with internationally accepted practices. An ESIA was undertaken for the construction and operation of two underground LPG cavern storage facilities which receive gas by sea tanker for distribution throughout the Pearl River Delta. The major issue was related to the storage of surplus spoil material which was planned for use in further reclamation along the foreshore adjacent to the project site.

**ESHIA for the Upstream West to East Pipeline Project (WEPP), Shell China Exploration and Production Co. Ltd, 2002-2003.**

Key issues for the project were waste management associated with drilling cuttings during the construction phase and the disposal of saline produced water during the operational phase. ERM partnered with the Xinjiang Environmental Science Institute, which provided local expertise and field support.

**ESIA of the West to East Pipeline Project (WEPP), Shell China Exploration and Production Co. Ltd, 2002-2003.** Mr Touzel was a principal author of the ESIA. Covering a distance of almost 4,000 km, the WEPP will transport natural gas from the Tarim Basin in Xinjiang for end use by power generators and other industry along China's industrialised eastern seaboard, thereby reducing the reliance on coal-fired power. Key issues for the project were ecological impacts associated with Nature Conservation Areas through which the WEPP passes and cultural heritage management of archaeological relics unearthed during pipeline construction. The United Nations Development Programme undertook a Social Impact Survey of project-affected communities along the pipeline alignment and the findings were incorporated into the ESIA Report.

### **Resettlement Planning & Monitoring**

**Resettlement Planning Framework for the Nicaragua Grand Canal Project, HKND 2013-4.** Mr Touzel was the Partner in Charge of the preparation of the Resettlement Planning Framework for a \$50 billion canal and associated infrastructure.

**Resettlement Planning Framework for Confidential Port development, Nigeria 2013.** Mr Touzel developed a resettlement planning framework following IFC Performance Standards (2012) for a proposed port development in Lagos, Nigeria.

**Land Acquisition and Compensation Audit, Confidential Client, Sichuan, August 2008.** ERM was commissioned by a chemical company to undertake a land acquisition and compensation review against IFC's Performance Standard 5: Land Acquisition and Involuntary Resettlement. The key issue was prolonged transition time and insufficient livelihood restoration strategies.

**Resettlement Planning and Monitoring for the Chuandongbei Gas Project (Chevron), 2008-2013.** Mr Touzel was the Partner in Charge of the preparation of resettlement documentation and implementation support for the CDB Project being jointly developed by Chevron and PetroChina. The project will relocate around 2,000 residents.

ERM was commissioned to develop a Temporary Land Access and Compensation Procedure, to oversee negotiations with Government for temporary land use, and to conduct external review of negotiations and compensation payments. ERM acted as an external Third Party Monitor to oversee the land access processes in compliance with Chinese legal requirements, FCPA requirements, and relevant IFC's performance standards. In addition, ERM drafted the Resettlement Grievance Procedure and provided in-field support for the implementation of the procedure for a period of three years.

**Resettlement Planning Framework for an Open-cast Coal Mine, Anglo American plc, 2007-8.** ERM prepared a preliminary resettlement planning framework for a proposed open cast coal mine that would require resettlement of approximately 3,000 residents. Piers led this work and also calculated expected costs of land acquisition, physical resettlement and livelihood restoration measures.

**Post-resettlement Land Acquisition and Resettlement Review, IFC, 2007** ERM was commissioned by IFC to conduct a land acquisition and resettlement review for two chemical plant sites to identify gaps between current practices and IFC performance standards and recommend action plans to bridge non-compliances.

**Resettlement Monitoring, (Confidential Client), 2006.** Mr Touzel was the technical reviewer for a post-resettlement audit to assess the adequacy of

compensation and livelihood restoration for a client seeking finance from the IFC.

***SIA and Land Acquisition/Resettlement Plan Guangdong Dapeng LNG Co, Ltd (BP/CNOOC joint venture), 2004-2006. Mr Touzel was the Project Manager.*** The project involves the construction of a receiving facility and installation of a 350 km LNG pipeline in southern China. The Project Proponents sought to ensure that land acquisition and resettlement was conducted in a fair and transparent manner. ERM developed procedures that harmonise local standards and procedures with internationally accepted practices, as recommended by the IFC/World Bank.

***Resettlement Review, (Tarmac Materials) 2003.*** Mr Touzel undertook a review of the proposed resettlement procedures to be adopted by local government for a quarry that has been acquired by Tarmac, a wholly owned subsidiary of Anglo American Group. Resettlement and compensation procedures were benchmarked against World Bank Policy and Anglo American Group's corporate policy on involuntary resettlement. Where shortcomings were identified, recommendations were made to bridge these gaps in order to comply with relevant policy guidelines in a Chinese context.

***Resettlement Action Plan (Tarmac Aggregates), 2003-4.*** Mr Touzel was the Project Manager. ERM was commissioned to prepare a RAP that conforms with World Bank Group Resettlement Policy in a Chinese context. As part of the assignment, ERM arranged detailed land surveys to be undertaken as the basis for land acquisition plans and compensation payments by a licensed agency. ERM is working with local government, including resettlement authorities, to address the shortcomings in local resettlement practices with respect to World Bank Policy.

## **Due Diligence and Strategic Assessments**

***Environmental and Social Due Diligence of Five Underground Coal Mines for a confidential Equator Principles Financial Institution, 2010.***

Mr Touzel was the Partner-in charge of a due diligence assignment of five coal mines in Guizhou Province, China. Mr Touzel and his team assisted the lenders to prepare an environmental and social action plan that translated non-compliance issues into loan covenants with the borrower.

***Environmental, Social and Resettlement Due Diligence for an Onshore gas Development, (Confidential Client) 2007. Mr Touzel was the Project Director.*** ERM undertook environmental and social due diligence of an onshore gas development on behalf of a multinational oil company considering entering a joint venture with a Chinese national oil company.

***Strategic Environmental and Social Advice for Proposed Coal to Liquids Facilities in China, (Confidential Client) 2006.*** Strategic advice on Chinese legal requirements for EHS permitting in China and compliance with the IFC's *Social and Environmental Sustainability Standards* in China. Mr Touzel and colleagues presented a 5 day workshop on China EHS issues and IFC requirements.

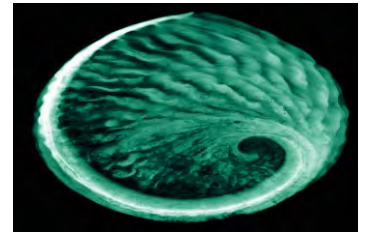
***Lenders' Independent Environmental and Social Review for Oyu Tolgoi Mine, Mongolia, 2011-12.*** Mr Touzel was the independent social specialist responsible for review of resettlement and social performance.

***Environmental and Social Due Diligence of a Nickel Mines Confidential Client, Philippines, 2010-11. Mr Touzel was the Partner in Charge.*** ERM was commissioned to undertake due diligence and prepare the disclosure documentation for an independent technical review of a nickel mine in the Philippines for listing on the Hong Kong Stock Exchange.

***Environmental and Social Due Diligence of four mines in China, Confidential Client, 2010-11. Mr Touzel was the Partner in Charge.*** ERM was commissioned to undertake due diligence and prepare the disclosure documentation for an independent technical review of mines and processing facilities being listed on the Hong Kong Stock Exchange.

# Dr Robin Kennish

ESHIA Project Director



Dr Robin Kennish is a Director and Partner of ERM with responsibility for managing and directing ESHIA and other studies particularly for the Power & Oil & Gas Sectors. Dr Kennish is a Chevron Qualified ESHIA Facilitator (QEF)

Dr Kennish has over fifteen years experience in environmental management with extensive experience in managing large-scale projects. His particular focus has been on the impacts of power and oil and gas projects on the environment including the following:

- **Hydropower Philippines:** Directing the ESHIA for a 150MW hydropower facility on Luzon Island.
- **Coal-Fired Power Plants Southern Philippines:** Directed the EHSS Due Diligence assessments for two separate coal fired plants in the southern Philippines.
- **Oil & Gas Exploration & Production Philippines:** Provided marine biological input to assessments of exploration and production activities. Directed the preparation of EMS procedures and manuals in readiness for an Oil & Gas major's exploratory drilling activities.
- **Oil & Gas Exploration & Production Vietnam:** Directed ESHIAs of marine seismic, exploratory drilling. This includes ESHIA of full scale gas production for Chevron.
- **Oil & Gas Exploration & Production Thailand:** Managed ESHIA assessments of infrastructure projects and exploration and production activities for Chevron.
- **Oil & Gas Exploration & Production Mainland China:** Managed and contributed to ESHIAs for industrial projects including gas pipelines, mining, offshore platforms and marine seismic surveys. This includes work for Chevron in the South China Sea.
- **Nickel Mining Indonesia:** Managed Biodiversity Impact Assessment for nickel mining in Halmahera.
- **Coal-Fired Plant Vietnam:** Directed the ESHIA for a 2 x 660MW coal fired supercritical plant in Vietnam.
- **Oil & Gas Exploration & Production Myanmar:** Directed the ESHIA studies for exploration and production activities.
- **Hydropower Laos:** Provided terrestrial ecology inputs to the ESHIA for a hydropower project in Laos.
- **Integrated Water Power Plant Saudi Arabia:** Managed marine baseline surveys and water recirculation studies.
- **Integrated Water Power Plant Bahrain:** Managed water recirculation studies.
- **Onshore Wind Farm China:** Provided specialist input to bird monitoring manuals and bird baseline studies.
- **Waste to Energy Plants China:** Directed EHSS due diligence of several water to energy facilities across China.
- **Offshore Wind Farm South Hong Kong:** Directed the ESHIA for a 100MW offshore wind in the southern waters of Hong Kong.
- **Offshore Wind Farm East Hong Kong:** Directed the stakeholder engagement activities and the preparation of a fisheries enhancement plan for a 210MW offshore wind farm in the eastern waters of Hong Kong.
- **2,500MW Gas-Fired Power Plant Hong Kong:** Directed and managed a series of studies including air emissions, water modeling and ESHIAs for replacement gas sources.
- **4,108MW Coal-Fired Power Plant Complex Hong Kong:** Directed and managed a series of studies including water modeling, oil spill escape response plans, ESHIAs for retrofitting emission control systems and OHL permitting.
- **Submarine Electricity Circuits Hong Kong:** Numerous permitting exercises (including EIA and Right of Way approvals) for 132kV and 11kV submarine cable circuits.
- **1,800MW Gas Fired Power Plant Hong Kong:** Directed and managed a series of studies including the ESHIA for the plant, additional cooling water studies and specialist fisheries investigations.

In addition to the above, Dr Kennish has also significant experience in the Mining sector throughout the Asia Pacific region. This has included work in the Philippines, Indonesia, China & Vietnam



## **Fields of Competence**

- Environmental, Social, Health Impact Assessments (ESHIA)
- Equator Principle and IFC Performance Standards
- Ecology, Marine Biology and Fisheries
- Water Quality Assessments
- Environmental Permitting
- Stakeholder Negotiations

## **Education**

- BSc (Hons) Marine Biology, University of Liverpool UK, 1991
- PhD Marine Biology, University of Hong Kong, 1995

## **Professional Affiliations**

- Member of the Society of Environmental Toxicology & Chemistry
- Member of the Society of Petroleum Engineers

## **Key Relevant Projects**

### **Philippines Projects**

**Environmental, Social and Health Impact Assessment of a Proposed 150 MW Hydropower Project in Philippines, 2011.** ERM is presently conducting the ESHIA for a hydropower facility in Luzon Province in the Philippines. ERM is also tasked with supervising the local consultants who are responsible for obtaining the Environmental Compliance Certificate. Key issues include dam safety, changes in seasonal flooding patterns and habitat loss. Dr Kennish is the Project Director.

**Environmental and Social Due Diligence of a Proposed Coal-Fired Power Plant Project in Southern Philippines, 2010.** ERM was retained to provide a due diligence report on an operating coal-fired power plant. Dr Kennish was the lead technical reviewer.

**Exploratory Drilling Sulu Sea, Philippines, (Confidential Client), March 2009 - ongoing.** ERM is providing EHS services to an Oil and gas major to support their efforts in exploratory drilling in the Southern Philippines. ERM is preparing the internal management system documents and procedures including regulatory compliance plans, environmental monitoring plans, waste management plans and oil spill contingency plans. ERM is also assisting in conducting strategic advice on how to handle waste management issues and conducting independent

reviews of documents provided by local contractors in support of regulatory permitting activities. Dr Kennish is the project Director.

**ESHIA Study for Refinery in Philippines, for Confidential Client, 2006-2007.** The objective of this study was to assess the impacts of upgrading works for the existing refinery. Dr Kennish was the Marine & Ecology Team Leader.

### **Chevron Projects**

**Environmental Scoping, ESHIA and Management Plan for Exploratory Drilling of Blocks 42/05, 64/18 and 53/30 in the South China Sea, China, Chevron, 2011-ongoing.** ERM was commissioned by Chevron to undertake Screening / Scoping study for exploratory drilling in the South China Sea. An ESHIA is now underway focusing on key issue identified in the screening/scoping such as drill cuttings disposal and spill modelling. Dr Kennish is the ESHIA Subject Matter Expert for the study.

**Environmental Scoping and Management Plan for 3D Seismic Survey of Blocks 64/18 and 53/30 in the South China Sea, China, Chevron, 2010.** ERM was commissioned by Chevron to undertake a Screening / Scoping study for a marine seismic survey in the South China Sea. The survey was to cover two blocks where key issues related to sensitive marine mammal habitat and fishing operations. Dr Kennish is the ESHIA Subject Matter Expert for the study.

**ESHIA for Block B Gas Production Project Western Vietnam (Chevron Vietnam), 2011 - ongoing.** ERM is conducting the ESHIA for an Oil and Gas major to support their project development to extract gas from fields located in western Vietnam waters of the Gulf of Thailand. ERM has supported the local regulatory EIA process and also prepared a supplementary ESHIA to meet corporate requirements. Key issues included drill cuttings modelling. Dr Kennish is the project Director.

**Block G4/50 3D Seismic Survey ESHIA, Gulf of Thailand (Chevron Thailand) 2008.** ERM was commissioned to undertake an ESHIA examining the potential impacts associated with 3D Seismic Surveys of an exploration block in the Gulf of Thailand. Dr Kennish was the Technical Specialist for the project and also lead the Chevron Screening-Scoping assessment.

**Block G4/48(c) Production ESHIA, Gulf of Thailand (Chevron Thailand) 2007.** ERM was commissioned

to undertake an ESHIA examining the potential impacts associated with the development of an offshore oil production block in the Gulf of Thailand. Dr Kennish was the Technical Specialist for the project and also lead the Chevron Screening-Scoping assessment.

### **Power Sector Projects**

**Environmental, Health and Safety Impact Assessment (ESHIA) for Vung Ang II Thermal Power, for One Energy, 2008 - ongoing.** The Project comprises a 2x660MW coal-fired power station, ash disposal facility, coal unloading jetty, and an 8km electricity transmission line. ERM is charged with preparing the local EIA as well as the upgraded ESHIA document for the financiers. ERM conducted all of the technical studies for the project including water, noise and air modeling studies as well as baseline ecological investigations and community consultations. Dr Kennish is the Project Director for the ESHIA.

**Emissions Control Project at the Castle Peak Power Station "B" Units (ExxonMobil CLP Power JV CAPCO), Hong Kong, 2006.** The Castle Peak Power Company Limited (CAPCO) is proposing to retrofit the Castle Peak Power Station "B" Units (CPB) with emissions control facilities to reduce the atmospheric emissions from the operations of these units. ERM has been commissioned to undertake an EIA on the proposed project. Dr Kennish was responsible for the assessment of potential impacts to the marine environment as a result of the proposed construction and operation works.

**Nam Sane 3 HPP Environmental Impact Assessment Study, Laos (Rohas) 2008.** ERM has been commissioned to conduct the EIA for the development of a hydroelectric project in a remote region of Xieng Khouang province in Laos. Dr Kennish was the lead technical reviewer of the Biodiversity Impact Assessment.

**Site Selection Study for a 100MW Offshore Wind Farm (Hongkong Electric Co., Ltd), 2008.** Dr Kennish was responsible for directing the site selection exercise for an offshore wind farm in Hong Kong. The key issues were aviation, marine navigation, bird and marine mammal impacts.

**EIA of Lamma Power Station Units L4 & L5 Flue Gas Desulphurization Plant Retrofit Project, Water Quality Impact Assessment, for Hongkong Electric Co. Ltd, 2005-2006.** This project involved installation

of FGD plants to the two existing coal-fired units and demolition of two existing light oil tanks on formed land. Dr Kennish was the Project Director.

**EIA of a 100MW Offshore Wind Farm (Hongkong Electric Co., Ltd), 2008-2009.** Dr Kennish is the Project Director for the EIA of an offshore wind farm in Hong Kong. Key issues for the EIA include impacts to marine mammals, turtles, fisheries and seabirds. ERM has conducted all of the assessment and baseline survey work.

**Renewable Energy by A Wind Turbine System on Lamma Island, HEC, 2004:** Dr Kennish lead the EIA for a demonstration wind turbine project on an outlying island (Lamma) in Hong Kong.

**EIA of a Commercial Scale Wind Turbine Pilot Demonstration at Hei Ling Chau, for CAPCO, Hong Kong, 2004-2006.** Dr Kennish was responsible for directing the water and ecology inputs of this EIA of a commercial scale wind turbine project in the Lantau region of Hong Kong.

**EIA of a 1,800MW Gas-fired Power Station at Lamma Extension (Hongkong Electric Co., Ltd), 1998-1999.** Dr Kennish was responsible for leading the marine ecological and fisheries assessments for the proposed power station extension including impacts to these resources through reclamation activities, dredging and cooling water discharges. He was responsible for devising the field sampling design for surveying benthic, intertidal and subtidal marine resources including coral habitats. A focus of the assessment performed by Dr Kennish was to determine the acceptability of impacts of cooling water discharges, specifically biocides, on marine ecological sensitive receivers including the finless porpoise *Neophocaena phocaenoides*.

**Seawater Recirculation Study, Al Dur IWPP, for Hyundai Heavy Industries Co. Ltd, Bahrain, 2008.** A seawater recirculation study using detailed water quality modelling was conducted to assess the suitability of siting a new power and desalination plant to the south of EWA's existing Al Dur SWRO plant due to concerns that the present design may result in adverse interactions (ie re-circulation) between the two facilities during operation. This study has investigated the potential changes to temperature, salinity and dissolved oxygen in waters surrounding the Al Dur IWPP as a result of effluent discharge. Dilution of residual chlorine from the facility has also been examined. Dr Kennish was the Project Director for the study.

**Environmental Impact Assessment of the Development of a 2,750MW Power Station and Desalination Plant in Jubail Industrial City, Marafiq IWPP (WSP Environmental Middle East), Saudi Arabia, 2007.** ERM was commissioned by WSP to conduct water quality modelling for the EIA study for the proposed power and desalination plant (IWPP) in Marafiq. The Study involved a water quality assessment to investigate the potential impacts associated with dredging works on corals and seagrass beds. Dr Kennish was the Project Director for the study.

**Seawater Recirculation Study, Marafiq IWPP (Hyundai Heavy Industries Co. Ltd.) Kingdom of Saudi Arabia, 2007.** ERM was commissioned to undertake an assessment of the potential impacts associated with the cooled water discharge through the operation of a 2,600 MW power station and 1MGD desalination plant in the Kingdom of Saudi Arabia. As part of the assessment, ERM conducted detailed water quality modelling to review the potential for recirculation between the seawater intake and outfall and determine the optimum design. Dr Kennish was the Project Director for the study.

**Baseline Water Quality Survey, Marafiq IWPP (Hyundai Heavy Industries Co. Ltd.) Kingdom of Saudi Arabia, 2006.** ERM was commissioned to undertake a baseline water quality survey as part of an assessment of the potential impacts associated with the construction and operation of a 2,600 MW power station and 1MGD desalination plant in the Kingdom of Saudi Arabia. ERM were responsible for designing the survey, coordination with local and international subcontractors and reporting of baseline conditions. The results were used in a seawater recirculation study, as well as providing key data on existing conditions in an EIA study for the Royal Commission. Dr Kennish was the Project Director for the study.

### **Oil & Gas Projects**

**Exploratory Drilling Offshore Danang, Vietnam (Confidential Client), 2010 - ongoing.** ERM is providing EHS services to an Oil and Gas major to support their efforts in exploratory drilling in waters offshore of Danang in Eastern Vietnam. ERM has supported the local regulatory EIA process and also prepared a supplementary EIA to meet corporate requirements. Dr Kennish is the project Director.

**Seismic Exploration, Deepwater Southwestern Vietnam (Confidential Client), 2010 - ongoing.** ERM is providing EHS services to an Oil and Gas

major to support their efforts in marine seismic surveying in deepwater offshore of Southwestern Vietnam. ERM has supported the local regulatory EIA process and also prepared a supplementary EIA to meet corporate requirements. Key issues included the preparation of a marine mammal risk assessment. Dr Kennish is the project Director.

**Black Point Power Station Gas Supply Project, Hong Kong (CLP/ExxonMobil), 2009-2010.** ERM is undertaking the EIA of the installation and operation of submarine gas pipelines between China and Hong Kong. As part of the EIA ERM also completed Quantitative Risk Assessments of the gas Receiving Stations and conducted 3D water quality and hydrodynamic modeling. Dr Kennish was the Project Director.

**Exploratory Drilling Environmental Monitoring Program, Scott Reef, Western Australia, (Woodside Energy Ltd.), March 2008 - ongoing.** Dr Kennish has been involved in the design and planning for the execution of a targeted suite of monitoring programs to assess potential impacts of drilling in a sensitive coral reef environment. Dedicated programs to assess the disposal of drill cuttings, wastewater, rig footprint, underwater noise and artificial light have been implemented through a series of offshore surveys from May - August 2008 resulting in a series of specialised reporting deliverables that fully document the impacts of exploratory drilling on a remote coral reef system.

**Environmental Social Impact Assessment for the West East Pipeline (Shell) 2002.** Dr Kennish provided input to the ESIA report for this 1,400 km pipeline that traverses China from Xinjiang to Shanghai. His key responsibilities included an assessment of operation and construction phase impacts to water quality and biodiversity, and the preparation of management and mitigation measures.

**EIA of LPG - LNG Plant, Peru (Pluspetrol Peru Corporation) 2003.** ERM performed an environmental and social Impact assessment including environmental management and monitoring plan for Camisea Gas Export project facility. The facility includes the gas fractioning plant and a marine loading terminal. Dr Kennish advised the in-country team on installation methods to minimize water quality and ecological impacts to a sensitive nature reserve.

**Huizhou 21-1 Natural Gas Submarine Pipeline, CACT Operators Group, 2002 - 2003.** ERM has been commissioned to provide consulting services and

specialist advice to the project. ERM provides technical assistance and negotiations with various parties and engineering support to the preliminary design of the system. Dr Kennish worked as a technical advisor on the project responsible for government liaisons and pipeline crossing parties.

# Nicci Ng

Consultant  
Geographic Information Systems  
ERM Hong Kong



Nicci Ng is a Consultant within ERM based in Hong Kong who is responsible for all the GIS works and provides GIS services in Hong Kong BU and the NEA region. Nicci has over 9 years of professional experience in Geomatics; her key areas of expertise include database development, data mining, spatial analysis and site selection, 3D modeling and maintenance and using GIS for quantitative analysis. Nicci's project experience focuses on GIS for database, environmental impact assessment (EIA), marine studies, construction and engineering, mapping, and transport information system. She has worked on a variety of projects across the whole of Hong Kong, as well as doing international work, including in America, Brunei, Indonesia, Myanmar, Singapore, Vietnam, Abu Dhabi and projects in Africa (Ghana, Nigeria and Sierra Leone).

On joining ERM, Nicci immediately played an important role in GIS, she has involved into various ESIA and GIS database related projects, e.g. ESIA studies in Myanmar, various EIA studies in Hong Kong and database projects for Brunei Shell Petroleum. Previously worked with AECOM Asia Co. Ltd., Nicci has hands-on experiences in GIS-related construction and engineering projects, e.g. the *Coastal Development at Hideriyyat, Abu Dhabi, UAE*; the *Hung Hom to Admiralty Section and Wong Tai Sin Section of Shatin-to-Central Link (SCL)*; the *Admiralty Section of South Island Line (SIL)*; and the *West Kowloon Terminus of the Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL)*. Environmental projects include *3D EIA for Sludge Treatment Plant in Tuen Mun*, and *Study of Major Industrial Air Pollution Sources in the Pearl River Delta Region*. Besides worked in private sector, Nicci has been also worked for the government sector. She has been involved in various government projects, such as *Transport Information System (TIS)* for the Transport Department, *Hong Kong Map Service (HKMS)* and *Enhanced Map Archived Retrieval Systems (EMARS)* for the Lands Department.

When Nicci was pursuing the post graduate studies in college, she was the GIS Cartographic Specialist of the Grey County Emergency Management System Co-op Project, where the project is offered by the Grey County and Sir Sandford Fleming College when she was in Canada.

## Fields of Competence

- Geographic Information System
- Cartography
- 3D modelling and spatial analysis
- Remote sensing
- Database
- Web design
- Software:
  - Adobe (Illustrator, InDesign, Photoshop)
  - CAD (AutoCAD, MicroStation)
  - GIS (ArcGIS 9.x and up, MapInfo, QGIS)
  - Macromedia (Dreamweaver, Flash)
  - MAPublisher for Adobe Illustrator
  - Microsoft Office (e.g. Access, Excel, SQL, Visio)
  - Programming (VB.NET)
  - Remote sensing (ERDAS, Idrisi, PCI Geomatica)
  - VRML
  - Web programming (e.g. Cold Fusion, PHP)

## Experience

- Environmental Resources Management, Hong Kong  
Consultant - GIS (2011 - Present)
- Lands Department, HKSAR, Hong Kong  
Assistant Cartographer (2009 - 2011)
- AECOM Asia Co. Ltd., Hong Kong  
GIS Programmer (2008 - 2009)
- PCCW Solutions Ltd, Hong Kong  
GIS CAD Draftsman (2007 - 2008)

## Education

- MGIS, Geographic Information Systems  
University of Hong Kong, Hong Kong, 2009
- PGCGIS, Geographic Information System -  
Cartographic Specialist  
Sir Sandford Fleming College, Canada, 2006
- BA (Hons), Geography with Economics  
University of Western Ontario, Canada, 2005

## Languages

- Cantonese, native speaker
- English, fluent
- Mandarin, fluent

# Nicci Ng

Consultant  
Geographic Information Systems  
ERM Hong Kong



## Key Projects

### **GIS in Database and Data Management**

*GIS Database Update for Brunei Shell Petroleum, Brunei (2015).*

#### **Project Manager and GIS Specialist**

To provide service to manipulate and also convert the new survey data to a new database. Update the existing database for the client to fulfil the client's needs. Create data standard document and data dictionary for the database.

*Climate Change Risk Screening Tool for CLP Investments, CLP, Hong Kong (2015).*

#### **GIS Specialist**

To develop a GIS database for identifying the natural hazards and climate change related risks on a global scale. Tasks include develop natural hazard and climate projection dataset and develop the climate change screening tool.

*Provision of Services for the Updating of the Wetland Inventory with Field Verification and Digitization on GIS, Phase 2, Agriculture, Fisheries and Conservation Department, Hong Kong (2014).*

#### **Project Manager and GIS Specialist.**

To provide service to update the records of the existing Wetland Inventory GIS database based on aerial photo images. Nicci is the project manager who is responsible for the updating works and all project management works include coordinate with client and ecological surveyors, data QC and ensure deliverables are submitted on schedule.

*Glass Bottle Collection Study, Environmental Protection Department, Hong Kong (2014).*

#### **GIS Specialist**

A project to GIS technology to present information on waste glass bottles arisings across the 18 districts (based on the District Council geographical boundaries). An interactive map will be produced which allows users to investigate the distribution of waste glass bottles for each district. Data will be overlaid on the GIS system and will take into account variables such as population density, residential property density, locations of food and beverage (F&B) establishments. Nicci is the task manager who

is responsible to design and build the GIS database; she is also responsible to supervise other junior staffs to work on data collection and manipulation for the GIS database.

*Provision of Services for the Updating of the Wetland Inventory with Field Verification and Digitization on GIS, Phase 1, Agriculture, Fisheries and Conservation Department, Hong Kong (2013).*

#### **Project Manager and GIS Specialist**

To provide service to update the records of the existing Wetland Inventory GIS database based on aerial photo images. Nicci is the project manager who is responsible for the updating works and all project management works include coordinate with client and ecological surveyors, data QC and ensure deliverables are submitted on schedule.

*GIS Database Design and Data Conversion for Brunei Shell Petroleum, Brunei (2013).*

#### **Project Manager and GIS Specialist**

To provide service to convert the current survey data for the client and also to design the database for the current and future survey data to fulfil the client's needs. Create data standard document and data dictionary for the database.

### **GIS in Environmental, Social Impact Assessment (ESIA)**

*Exploration Drilling, Offshore Myanmar, Ophir Myanmar (2016-ongoing).*

#### **GIS Specialist**

A project for an exploration drilling campaign in Block AD-03 in the waters offshore Rakhine State in Myanmar. Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*ESIA for Phase 2 Development of MIP Port, Yangon, MAS (2016-ongoing).*

#### **GIS Specialist**

A project for an environmental and social impact assessment for an expansion to an existing port in Yangon. The work involves scoping study, baseline data collection, stakeholder engagement and development of an EIA and EMP report. Nicci is responsible for reviewing, manipulating, processing



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and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*Myanmar Environmental and Social Impact Assessment (ESIA) Block AD-7, JV of Woodside Energy (Myanmar) Pte. Ltd. And Daewoo International Cooperation (2015-ongoing).*

## **GIS Specialist**

The Joint Venture (JV) Partnership of Woodside Energy (Myanmar) Pte. Ltd and Daewoo International Cooperation plans to undertake a 3D marine seismic survey and drilling of one exploration well (Tha Lim A) in Block AD-7, located in the Bay of Bengal, approximately 100km offshore of west coast of Myanmar. Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*Myanmar: Environmental and Social Impact Study for Offshore Bay of Bengal Block A- and AD-02, BG Group (2015).*

## **GIS Specialist**

BG Group is planning to undertake an exploration campaign in the waters offshore of the Rakhine State in Myanmar. This campaign will inform future drilling for hydrocarbons by means of a combination of 2D and 3D seismic surveys, gravity and magnetics surveys and seabed sampling surveys. The Project requires an IEE as the appropriate level of assessment. BG Group has commissioned ERM, supported by local specialists to undertake the IEE Study. Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*2D Seismic Survey in Block AD-10, Statoil (2015).*

## **GIS Specialist**

Statoil is planning to undertake an exploratory campaign by means of 2D seismic surveys in Block AD-10. Block AD-10 is located at the Rakhine Basin, Offshore Myanmar at a distance of about 200 km from the coast, covering an area of 9000 sq. km. The Project requires an IEE as the appropriate level of assessment. BG Group has commissioned ERM, supported by local specialists to undertake the IEE Study. Nicci is

responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*ESIA/ESHIA Study for Geophysical Data Acquisition Programs in Block A-5, Offshore Myanmar, Unocal Myanmar Offshore Co. Ltd. (Chevron Corporation) (2015).*

## **GIS Specialist**

UMOL is planning to undertake geophysical data acquisition programs in Block A-5 during the Study Period. UMOL has commissioned ERM, supported by REM to undertake the IEE Study for the proposed geophysical data acquisition program in Block A-5. The overall purpose of the Study is to complete a robust IEE to meet requirements of the procedures for the IEE to be approved by the Ministry of Environmental Conservation and Forestry. Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*Environmental and Social Impact Assessment (ESIA) for a 500MW Pumped-Storage Hydropower Project (Project Wawa), Olympia Violago Water & Power Inc. (2015-Ongoing).*

## **GIS Specialist**

OVPI requires a comprehensive ESIA to be undertaken, what will satisfy international best practices for a proposed 500 MW pumped-storage hydropower project, located within the City of Antipolo, Municipalities of San mateo and Rodriguez, Rizal Province, Luz on, the Philippines. Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*Marine Seismic Survey for Block M-8, Offshore Myanmar, Berlanga Myanmar Pte Ltd. (2015).*

## **GIS Specialist**

Berlanga Myanmar Pte Ltd. was awarded the offshore Block M-8 in Myanmar, under a Product Sharing Contract (PSC) with local authorities, Ministry of Energy. Berlanga intends to conduct Oil and gas marine seismic exploration activities as part of a program of work. In relation to the above, Berlanga



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has commissioned Environmental Resources Management (ERM), supported by local specialists from Resource and Environment Myanmar (REM), to undertake an IEE Study for the proposed seismic survey in Block M-8 in accordance with the requirements of the Procedure. Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*EIA, SIA and EMP for Seismic Survey of Onshore Block MOGE-4, Myanmar, CAOG Pte. Ltd (CAOG) (2015).*

## **GIS Specialist**

CAOG Pte. Ltd (CAOG) was awarded the onshore Block MOGE-4 to operate on behalf of partner Apex Geo a Production Sharing Contract (PSC) for Myanmar Oil & Gas Enterprise (MOGE). CAOG is planning to conduct 2D seismic exploration activities across the whole Block MOGE-4, and possibly 3D exploration activities over the perceived more prospective northern part of the block. Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*Environmental and Social Impact Assessment for the Seismic Survey and Workover Activities of Myanmar Onshore Block IOR 4 and IOR- 6, MPRL E&P Pte Ltd (MPRL E&P) (2015).*

## **GIS Specialist**

MPRL E&P Pte Ltd (MPRL E&P) was awarded the Exploration Block IOR - 4 and 6 in October 2013 to jointly operate with Myanma Oil & Gas Enterprise (MOGE) under Improved Petroleum Recovery (IPR) Contract. Following the contract award, MPRL E&P is planning to conduct seismic exploration activities, possibly consisting of 2D and 3D surveys, across Block IOR-4 and IOR 6. Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*ESHIA Study for 1280MW USC Coal Fired Power Plant Project, Toyo-Thai Corporation Public Company Limited, Myanmar (2015).*

## **GIS Specialist**

Toyo-Thai is planning to develop a coal fired power

plant in Ye Township, Mon State, Myanmar. Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*EIS and ESIA for a proposed hydropower plant and pumped storage facility, SN Aboitiz Power Generation, The Philippines (2014-Ongoing).*

## **GIS Specialist**

ESIA and local Environmental Impact Statement (EIS) for a 130MW hydroelectric power plant and 250MW pumped storage facility in northern Philippines. As the GIS Specialist, Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*Initial Environmental Examination (IEE) and ESIA for a proposed gas-fired power project, GMS Power and GPSC Group, Myanmar (2014-Ongoing).*

## **GIS Specialist**

A preliminary E&S risk assessment for a 500MW combined cycle gas-fired power project in Kyaitlat, Ayeyarwady Region in Myanmar. Nicci is responsible for reviewing, manipulating, processing and management the survey data. She is also responsible for creating a series of survey maps and processing the survey data and delivering a series of maps for reports.

*Environmental, Social and Health Impact Assessment for Exploratory Drilling of Block 15/10 in the South China Sea, Chevron, China (2014).*

## **GIS Specialist**

ERM is commissioned by Chevron to undertake an ESHIA Study for the proposed exploratory drilling of Block 15/10 in the South China Sea. Nicci is responsible for data processing and data management and delivering a series of maps for reports.

*Environmental, Social and Health Impact Assessment for Phase 2 Exploratory Drilling in Pearl River Mouth Basin, South China Sea, Chevron, China (2013).*

## **GIS Specialist**

ERM were commissioned by Chevron to undertake an ESHIA Study for the proposed Phase 2 Exploratory

# Nicci Ng

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Geographic Information Systems  
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Drilling at Block 42/05 within the Pearl River Mouth Basin of South China Sea. Nicci is responsible for data processing and data management and delivering a series of maps for reports.

*Environmental, Social and Health Impact Assessment for Marine 3D Seismic survey of Block 15/10 and Block 15/28 in the South China Sea, Chevron, China (2013).*

## **GIS Specialist.**

ERM were commissioned by Chevron to undertake an ESHIA Study for the proposed marine 3D seismic survey of Block 15/10 and Block 15/28 in the South China Sea. Nicci is responsible for data processing and data management and delivering a series of maps for reports.

*Coc San Hydropower Project ESIA, Confidential Client, Vietnam (2013)*

## **GIS Specialist**

Nicci is responsible to work on all the maps for the project, tasks include consolidate the survey data (survey location, points, and also habitats) and provide quantitative analysis for the project team.

## **GIS in Environmental Impact Assessment (EIA)**

Cross Island MRT Line (EIA), Land Transport Authority, Singapore (2014-Ongoing).

## **GIS Specialist**

A project to build a major MRT line, the 50 km Cross Island Line (CRL), which will run across the span of Singapore. Nicci is responsible to acquire, manipulate and consolidate the data from different sources, and deliver a series of maps to the surveyors, the Client and also for report submission.

*Tseung Kwan O Desalination Plant, Water Supplies Department, Hong Kong (2013-2014)*

## **GIS Specialist**

A project profile and quantitative risk assessment was required for the application of EIA Study Brief. Nicci is responsible to deliver various maps including Landscape Character Areas (LCA), Landscape Resources (LR), Outline Zoning Plans (OZP), and as well as to create figures for visual impacts by generating visual envelopes for the selected project sites.

*Environmental Impact Assessment (EIA) and Historical Land Use Surveys (HLUS) for North South Expressway – Package B – Ove Arup for Land Transport Authority, Singapore (2013)*

## **GIS Specialist**

The North-South Expressway (NSE) is Singapore's eleventh expressway. It will run parallel to the Central Expressway (CTE) to alleviate the traffic load on the heavily utilized CTE as well as nearby major arterial roads. Nicci is responsible to deliver a series of land use maps with the new alignments.

*Environmental Impact Assessment (EIA) and Historical Land Use Surveys (HLUS) for North South Expressway – Package C – Ove Arup for Land Transport Authority, Singapore (2013)*

## **GIS Specialist**

The North-South Expressway (NSE) is Singapore's eleventh expressway. It will run parallel to the Central Expressway (CTE) to alleviate the traffic load on the heavily utilized CTE as well as nearby major arterial roads. Nicci is responsible to deliver a series of land use maps with the new alignments.

*Agreement No. CE 15/2010 (DS) Upgrading of Cheung Chau and Tai O Sewerage Collection, Treatment and Disposal Facilities – Design and Construction (Ecological Baseline Survey), Hong Kong (2011-2013)*

## **GIS Specialist**

The project is to conduct terrestrial and marine ecological baseline surveys for Project. Nicci is responsible to deliver a series of ecological survey maps of the project areas, which includes habitat, Landscape Character Areas (LCA), Landscape Resources (LR), Outline Zoning Plans (OZP), and as well as to create maps for survey transects and sampling points for terrestrial and freshwater fauna survey for the project sites.

*Agreement No. CE 6/2002 (DS) Drainage Improvement in Northern New Territories – Package C – Investigation, Design and Construction, Drainage Services Department, Hong Kong (2011-2013)*

## **GIS Specialist**

The project is to carry out an Environmental Impact Assessment (EIA) for the Project and identify, assess, resolve and advise on the environmental issues arising from the Project. Nicci is responsible to deliver a series of maps that includes habitat maps, NSR/ASR location maps, Landscape Character Areas (LCA), Landscape Resources (LR), and Outline Zoning Plans

# Nicci Ng

Consultant  
Geographic Information Systems  
ERM Hong Kong



(OZP).

*Environmental Impact Reassessment for the Revised Scheme of South East New Territories Landfill Extension, Environmental Protection Department, Hong Kong (2011-2013)*

## **GIS Specialist**

The objective of the assignment is to review and assess the environmental impacts of the revised scheme of South East New Territories (SENT) Landfill Extension and prepare documents for submission to the Environmental Impact Assessment Authority for variation of the existing Environmental Permit. Nicci is responsible to deliver a series of maps that includes habitat maps, NSR/ASR location maps, Landscape Character Areas (LCA), Landscape Resources (LR), and Outline Zoning Plans (OZP).

*Agreement No. CE 61/207 (CE) North East New Territories New Development Areas Planning and Engineering Study - Investigation, Planning Department, Hong Kong (2011-2013)*

## **GIS Specialist**

An EIA study to provide information on the nature and extent of environmental impacts arising from the construction and operation of the developments proposed under the Project and related works that take place currently. Nicci is responsible to deliver various maps including Landscape Character Areas (LCA), Landscape Resources (LR), Outline Zoning Plans (OZP), and as well as to create figures for visual impacts by generating visual envelopes for the selected project sites.

*Agreement No. CE 33/2011 (CE) Planning and Engineering Study on Future Land Use at Ex-Lamma Quarry Area at Sok Kwu Wan, Lamma Island - Feasibility Study, Ove Arup for CEDD, Hong Kong (2012 - 2013)*

## **GIS Specialist**

The project is to carry out an Environmental Impact Assessment (EIA) for the Project and identify, assess, resolve and advise on the environmental issues arising from the Project. Nicci is responsible to deliver a series of maps that includes habitat maps, Landscape Character Areas (LCA), Landscape Resources (LR), and Outline Zoning Plans (OZP).

*Weda Bay Nickel, Environmental Management and Monitoring Plan for Pre-Construction Minerals Conservation Programme (2011-2012)*

## **GIS Specialist**

Nicci is responsible to process all the survey data and present them in maps, and deliver series habitat maps of the Weda Bay to the client.

*Hong Kong Offshore Wind Farm in Southeastern Waters - Cable Route Desktop Study, CLP, Hong Kong (2011-2012)*

## **GIS Specialist**

Nicci is responsible for delivering series constraint maps of Southeastern waters region in Hong Kong. She has to prepare comprehensive environmental, physical and land use planning maps for the constraints analysis of the potential new cable systems landing in Hong Kong.

*Agreement No. CE 43/2010 (HY) Central Kowloon Route - Design and Construction, Highways Department, Hong Kong (2011-2012)*

## **GIS Specialist**

The project is to construct and operate a dual-3 lane tunnel, across the Kowloon Peninsula linking the West Kowloon Reclamation in the west and the proposed Kai Tak Development in the east. An EIA study is conducted to provide information on the nature and extent of environmental impacts arising from the construction and operation of the Project and related activities taking place concurrently. Nicci is responsible for the data presentation for the landscape visual impact assessment phase. She is responsible to deliver maps of Landscape Character Areas (LCA), Landscape Resources (LR), Outline Zoning Plans (OZP), and visual impacts figures for the affected works areas.

*Agreement No. CE 4/2010 (TP) Planning Study on Future Land Use at Anderson Road Quarry - Feasibility Study, Planning Department, Hong Kong (2011-2012)*

## **GIS Specialist**

The feasibility study aims to identify and assess the potential cumulative environmental impacts arising from the land use proposals and other planned/committed developments within the Study Site and Study Area. Nicci is responsible to deliver various maps including Landscape Character Areas (LCA), Landscape Resources (LR), Outline Zoning Plans (OZP), and as well as to create figures for visual impacts by generating visual envelopes for the project site.

*Agreement No. CE35/2009 (HY) Elevated Walkway System Along Gloucester Road - Investigation, Highways Department, Hong Kong (2011-2012)*



# Nicci Ng

Consultant  
Geographic Information Systems  
ERM Hong Kong



## GIS Specialist

A landscape and visual impact appraisal (LVIA) is conducted to the establishment of the elevated walkway along Gloucester Road, which is one of the busiest areas in Hong Kong. Nicci is responsible to deliver various maps including Landscape Character Areas (LCA), Landscape Resources (LR), Outline Zoning Plans (OZP), and as well as to create figures for visual impacts by generating visual envelopes for the selected project sites.

## GIS in Mapping

*Site Selection for Hong Kong Floating Storage Regasification Unit (FSRU) Project, CLP (2015)*

### GIS Specialist

CLP is currently exploring siting of an FSRU as an additional gas option to meet Hong Kong's future fuel supply needs. With respect to the preliminary advice from EPD and AFCD, it is recommended to submit a Site Selection Report to Government Departments to obtain some initial alignment on the preferred site prior to submitting a Project Profile application for an EIA Study Brief. Nicci is responsible to offer a constraint mapping service for the site selection stage. It is achieved through the use of GIS software through the collation of layers of mapped information showing features, constraints and engineering or planning proposals, to produce a multi-layered constraint map which forms the basis for the identification of unconstrained areas and thereby feasible sites for the FSRU locations.

*Coral Mapping for Sarawak Shell Berhad, Malaysia (2014).*

### GIS Specialist

To obtain survey results from surveyors and create a database for the survey and analysed results; and finally deliver a series of coral maps of the surveyed areas. Nicci is responsible to consolidate and normalize the survey data, apply different interpolation methods to interpolate the coral distributions in order to create coral mapping.

*Coral Mapping for Brunei Shell Petroleum, Brunei (2014).*

### GIS Specialist

To obtain survey results from surveyors and create a database for the survey and analysed results; and finally deliver a series of coral maps of the surveyed areas. Nicci is responsible to consolidate and normalize the survey data, apply different

interpolation methods to interpolate the coral distributions in order to create coral mapping.

*Biodiversity Consultancy Services for the Si Hong 100MW Photovoltaic Power Project, CLP, China (2013).*

### GIS Specialist

An Ecological Baseline Survey to verify the wetland habitat condition and wildlife utilization (especially avian fauna) at the project site and its vicinity. Measures based on the site conditions and potential ecological impacts are recommended. Nicci is responsible to prepare survey maps and process the survey data and deliver a series of maps for reports.

*Ecological Survey for Proposed Muk Wu Sewage Treatment Plant - North District Sewerage Stage 2 (Remainder) and Sewerage to Chuen Lung, Kau Wa Keng Old Village and Lo Wai - Investigation, Design and Construction, Hong Kong (2013)*

### GIS Specialist

A baseline ecological survey is needed for the construction of the proposed Muk Wu Sewage Treatment Plant. Nicci is responsible to prepare survey maps and process the survey data and deliver a series of maps for reports.

*Tai Tam Harbour Environmental Consultancy Services, Confidential Client, Hong Kong (2011-2013)*

### GIS Specialist

Nicci is responsible to deliver series constraint maps of the Tai Tam Harbour site. She has to prepare comprehensive environmental, physical and land use planning constraints analysis for potential new cable systems landing in Hong Kong.

*New Submarine Cable System in Junk Bay, CLP, Hong Kong (2011)*

### GIS Specialist

Nicci is responsible to deliver series constraint maps of the Junk Bay area. She has to prepare comprehensive environmental, physical and land use planning constraints analysis for potential new cable systems landing in Hong Kong.

*Constraint Analysis for Asia Submarine-cable Express (ASE) - Tseung Kwan O, NTT Com Asia, Hong Kong (2010-2011)*

### GIS Specialist

Nicci is responsible to offer a constraint mapping service for the route and landing point planning

# Nicci Ng

Consultant  
Geographic Information Systems  
ERM Hong Kong



exercise. It is achieved through the use of GIS software through the collation of layers of mapped information showing features, constraints and engineering or planning proposals, to produce a multi-layered constraint map which forms the basis for the identification of unconstrained areas and thereby feasible route.

## OTHERS

### GIS in Web Service

*Enhanced Map Archived Retrieval Systems (EMARS), Lands Department, Hong Kong (2010-2011)*

*Hong Kong Map Services (HKMS), Lands Department, Hong Kong (2009-2010)*

### GIS in Construction & Engineering

*Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL) Preliminary Design, Hong Kong, MTR Corporation (2008)*

*Shatin-to-Central Link (Hung Hom to Admiralty Section and Wong Tai Sin Section) Design Phase, MTR Corporation, Hong Kong (2008)*

*South Island Line (East) Preliminary Design, MTR Corporation, Hong Kong (2008)*

*Mubadala – South Hydayriat Islands, Abu Dhabi – Project Management – Design Phase, Abu Dhabi Urban Planning Council, United Arab Emirates, Abu Dhabi (2008)*

*HKHA Agreement No.: CB20070002 – Term Geotechnical Consultancy for Natural Terrain Hazard Study, CEDD, Hong Kong (2007 – 2009)*

*Agreement No. CE 9/2007 (GE) – Natural Terrain Hazard Mitigation Works at North Lantau Expressway & Yu Tung Road Near Tung Chung Eastern Interchange – Design & Construction, CEDD, Hong Kong (2008)*

*Agreement No. CE 41/2007 (GE) – Study of Landslides Occurring in Kowloon and the New Territories in 2008 and 2009 – Feasibility Study, CEDD, Hong Kong (2008)*

### GIS and Remote Sensing

*Study of Major Industrial Air Pollution Sources in the Pearl River Delta Region – Design Phase, China (2008)*

*3D Environmental Impact Assessment for CLP Sludge Treatment Plant – Design Phase, CLP, Hong Kong (2008)*

### GIS in Transportation

*Transport Information System (TIS), GLD Contract No.:C0162/2006, Hong Kong, Transport Department (2007-2008)*

# Curriculum Vitae of Soe Min



## Personal data

Name	SOE MIN
Contact Address/ Email	No. 42 A, Bawdiyeiktha, Shwetaungkyar Quarter no. 2, Bahan, Yangon. Email: <a href="mailto:usoemin@eguardservices.com">usoemin@eguardservices.com</a>
Contact Number	+95-9-797005160, +95-9-448001676
Nationality	Myanmar
Sex	Male
Marital Status	Married
NRC No.	7/PaMaNa (N) 006103
Language Proficiency	Myanmar - Native Speaker English - Proficient in four language skills Thai - Some communicable language

## Educational qualifications

Master of Engineering ( Environmental Technology & Management), 2001.	Asian Institute of Technology (AIT), Bangkok, Thailand.
Bachelor of Engineering (Civil), 1984	Rangoon Institute of Technology (RIT), Yangon, Myanmar

## Attended trainings and workshops

Internal QMS Awareness Training ISO 9001:2008 (On-going training and implementation of QMS for the organization)	18-19 December 2015. SGS Myanmar.
Internal EMS Auditor Training ISO 14001:2004, (Certificate)	21-23 July, 2014. EQS Asia Pte Ltd., Singapore.
MTERM (Modeling Tools for Environmental and Resource Management) Workshop on Modelling of Wastewater Treatment Plants (Certificate)	5-9 Nov 2001. Danish International Development Assistance Asian Institute of Technology, Bangkok, Thailand.
Irrigation and Drainage Engineering Training Course II (Certificate),	Feb-Nov 1992 Tsukuba Int'l Agr. Training Center Tsukuba, Japan.

## Employment records

Position:	Director
Period:	March 2013 – to date
Place:	E Guard Environmental Services, Yangon, Myanmar.
Position:	Director
Period:	Jan 2007 - April 2013
Place:	Myanmar GreenTech Co., Ltd, Yangon, Myanmar.
Position:	Managing Director
Period:	Jan 2006 – Feb 2013
Place:	SK-Lynx Pte Ltd., Singapore
Position:	Director
Period:	Jul 2005 - Nov 2007
Place:	AVA Consultancy and Engineering Co., Ltd., Yangon, Myanmar.
Position:	Water Feature Specialist
Period:	Aug 2002 - May 2005
Place:	Environmental Landscape Pte Ltd., Singapore.
Position:	Research Associate
Period:	Aug 2001 - May 2002
Place:	Civil Engineering Department, Asian Institute of Technology, Bangkok, Thailand..
Position:	Water Resources Engineer
Period:	Dec 1997 – Jun 1999
Place:	Seatec Int'l Consulting Engineering Co, Ltd., Bangkok, Thailand.
Position:	Water Resources Engineer
Period:	Jun 1995 - Nov 1997
Place:	Aloha Consulting Engineering Co., Ltd., Bangkok, Thailand.
Position:	Section Head, Design Criteria Section, Irrigation Centre Project
Period:	1993 - May 1995
Place:	Irrigation Department, Ministry of Agriculture, Yangon, Myanmar.
Position:	Assistant Engineer, Data Bank and Data Analyst Section, Irrigation Technology Center Project.



Period:	1989 – 1992
Place:	Irrigation Department, Ministry of Agriculture, Bago, Myanmar.
Position:	Assistant Engineer, South Nawin Dam Project
Period:	1986 – 1989
Place:	Irrigation Department, Ministry of Agriculture, Prome, Myanmar.
Position:	Assistant Engineer, Construction Industry Project.
Period:	1984 – 1985
Place:	Public Works Department, Ministry of Construction, Bago, Myanmar.

### Work undertaken/ tasks assignment

Name of assignment or project:	ESIA projects
Year:	Mar 2013 -,to date
Location:	Country wise, Myanmar
Client:	Project proponents, local and international
Main project features:	Projects includes; special economic zones, dredging, oil&gas exploration, fishery, hydropower, mining, transportation, ports, building construction and production industries.
Position held:	Director/EIA team member, E Guard Environmental Services Co., Ltd.
Activities performed:	Participated in Stakeholder (union, states & divisions, township, village tracks) engagement for EIA, IEE projects. Lead EIA/IEE project preparing scoping, baseline studies, impact studies and mitigation, environmental management, environmental and social due deligence Lead environmental quality survey team for sampling, analysis and reporting.
Name of assignment or project:	Upper Thanlwin (Mong Ton) Hydro Power Project EIA
Year:	2015
Location:	Mon State, Kayin State and Shan States of Myanmar.
Client:	SMEC(Myanmar)
Main project features:	Water quality sampling survey
Position held:	Team leader, E Guard Environmental Services Co., Ltd.
Activities performed:	Water and sediment quality sampling and analysis, sedimentation survey done for Thanlwin river at proposed dam site (Mong Ton), near Pha An, and near Mawlamyin. Measured for 2 seasons.
Name of assignment or project:	Rural Water Supply Project phase II
Year:	2015
Location:	Central Dry Zone, Myanmar
Client:	JICA Study Team, Earth System Sciences Co., Ltd., Japan
Main project features:	Water quality analysis for the provision of equipment for Rutal Water Supply Project
Position held:	Team leader, E Guard Environmental Services Co., Ltd.
Activities performed:	Sampling survey, laboratory analysis and reporting the results.
Name of assignment or project:	ADB PPTA 8758 – Preparing Third GMS Corridor Towns Development Project
Year:	2015
Location:	Pha An, Myawady at Kayin State and Maulamyin at Mon State
Client:	Safege Consulting Engineering, France
Main project features:	Design of water treatment plants
Position held:	Team leader, E Guard Environmental Services Co., Ltd.
Activities performed:	Water quality survey – sampling and analysis.
Name of assignment or project:	ADB TA-8472 MYA, Preparing Urban Services Improvement Project (47127-001)

Year:	2015
Location:	Mandalay Division, Myanmar
Client:	Project Management International Ltd., Ireland..
Main project features:	Design of wastewater treatment plant
Position held:	Team leader, E Guard Environmental Services Co., Ltd.
Activities performed:	Wastewater and sediment quality survey
Name of assignment or project:	ADB TA Project
Year:	2014
Location:	Mandalay Division, Myanmar
Client:	Project Management International Ltd., Ireland..
Main project features:	Preparation of IEE report for ADB TA
Position held:	Team leader, E Guard Environmental Services Co., Ltd.
Activities performed:	Water quality profiling survey
Name of assignment or project:	Indoor Air Quality Certification for Large Tax Payer Office
Year:	2014,
Location:	Large Tax Payer Office, Pansodan, Yangon, Myanmar.
Client:	Internal Revenue Department, Ministry of Finance, Yangon, Myanmar.
Main project features:	Indoor Air Quality, Asbestos free certification
Position held:	Team leader, E Guard Environmental Services Co., Ltd.
Activities performed:	Indoor air quality survey, sampling and analysis, reporting and certification. Clients asked for asbestos free certification. Air sampling at the site was done and sent to certified lab in Singapore and issued the certificates from the test results.
Name of assignment or project:	Thilawar Special Economic Zone Development Project
Year:	2013-2015
Location:	Thanlyin, Myanmar
Client:	JICA Study Team, ERM Consultant, Japan.
Main project features:	Preparation of strategic environmental assessment
Position held:	Local consultant
Activities performed:	Baseline survey of physical environment, project coordination. Stakeholder engagement.
Name of assignment or project:	Mekong River Water Level Monitoring Project
Year:	2009
Location:	Shan State, Myanmar.
Client:	Directorate of Water Resources and Improvement of River Systems (DWIR), Ministry of Transport, Myanmar
Main project features:	Installation of water level gauging station
Position held:	Contractor
Activities performed:	Training, installation and commissioning
Name of assignment or project:	Various Projects
Year:	2002-2005
Location:	Environmental Landscape Pte Ltd., Singapore
Client:	Various clients
Main project features:	Design, built and install water features
Position held:	Water feature specialist
Activities performed:	Responsible for design, build and maintain water treatment system, water features, pools and ponds, irrigation systems, etc., of private and public facilities.
Name of assignment or project:	Ban Kheng Water Supply Project
Year:	2001-2002
Location:	Asian Institute of Technology, Bangkok, Thailand
Client:	Bankok Metro Politan
Main project features:	Water quality modeling
Position held:	Research Associate, Civil Engineering Department, Asian Institute of Technology.
Activities performed:	Impact assessment on water quality of raw water source for Ban Kheng water treatment plants by Mike 11 Modelling software for the proposed design of the covering structure for other design alternatives
Name of assignment or project:	Various Projects
Year:	1997-1999

<p>Location: Bangkok, Thailand  Client: Bangkok Metropolitan, ADB  Main project features: Ground water quality and quantity, EIA, SEA  Position held: Water Resources Engineer, Seatec International Consultant  Activities performed: Study of surface water quality and source sufficiency for the feasibility assessment of Bangkok's Aquifer Storage Recovery Project.  Assistant to Team Leader in preparation of</p> <ul style="list-style-type: none"> <li>- EIA guidelines for the Environmental Strengthening Project in Cambodia.</li> <li>- Proposal for Strategic Environment Framework for the GMS (ADB-TA No.5783)</li> </ul>
<p>Name of assignment or project: Various Projects  Year: 1995-1997  Location: Thailand.  Client: Team Consultants  Main project features: Water resources development, water supply, irrigation canal design  Position held: Water Resources Engineer, Aloha Consulting Engineering Co., Ltd.  Activities performed: Design of dams outlet works and water distribution system. Quantity estimation and preparation of contract documents.  Design of irrigation canals, and related structures was done by Basic programs written by self written hydraulic calculation programs. Cost estimation of the projects. Irrigation distribution system design and cost estimation for pumping stations.</p>
<p>Name of assignment or project: Irrigation Technology Centre Project  Year: 1989-1995  Location: Irrigation Department, Yangon, Myanmar.  Client: JICA  Main project features: Technical transfer project  Position held: Section Head (<i>Design Criteria Section</i>), Assistant Engineer (<i>Data Bank and Data Analyst Section</i>)  Activities performed: <i>Design Criteria Section</i>: Work for the adaptation of design criteria (Design of Fill Dams, Canal Designs and Head Works Design) for the implementation of future water resource development projects by the irrigation department incorporation with technical assistance from JICA. Arranged, conducted, and attended several technical transfer training courses concerning hydraulic, hydrology, modeling, material testing (soil, concrete &amp; water quality) sponsored by JICA.  <i>Data analyst Section</i>: Collection and analysis of hydro-meteorology data. Establishment of program library and database management system for the water resources development projects. Preparation of technical analysis program</p>
<p>Name of assignment or project: South Nawin Irrigation Project  Year: 1986-1989  Location: Irrigation Department, Prome, Myanmar.  Client: Government  Main project features: Water resources development, irrigation and hydro power production  Position held: Assistant Engineer, Diversion Dam &amp; Appurtenant Structures  Activities performed: Design of irrigation canal and related structures. Supervision of earthfill dam and appurtenance structure construction. Worked on site. Construction of earthen dam and appurtenance structures.</p>
<p>Name of assignment or project: Construction Industry Project  Year: 1984-85  Location: Payarkalay, Bago Division, Myanmar.  Client: Government  Main project features: Upgrading the existing Wal-Payargyi road  Position held: Assistant Engineer,  Activities performed: Construction material testing and quality control of highway road construction. On-site CBR, moisture testing, laboratory material testing and analysis and mix design for the road construction.</p>

# Curriculum Vitae



## Personal data

Name	Myat Mon Swe
Contact Address/ Email	No.Ma-20, Neik Bain Da Street, Nanthargone Qr., Insein Township, Yangon, Myanmar Email: <a href="mailto:myatmonswe@eguardservices.com">myatmonswe@eguardservices.com</a> , <a href="mailto:myatmonswe@gmail.com">myatmonswe@gmail.com</a>
Contact Number	+95-9-797005166, +95-9-420111902
Date of Birth	January 13, 1966
Nationality	Myanmar
Sex	Female
Marital Status	Married
NRC No.	12/ Ah Sa Na (Naing) 029616
Passport No.	MA 765340
Language Proficiency	Myanmar - Native Speaker English - Speaking (Good), Writing (Good), Listening (Good), Reading (Good) German - Speaking (Good), Writing (Good), Listening (Good), Reading (Good)

## Educational qualifications

Diploma in Geographical Information System	January 2006 to September 2006 Yangon University, Yangon, Myanmar
Master of Engineering - Energy and Environmental Management	October 1996 to June 1998 University of Flensburg, Germany
Bachelor of Agriculture	June 1984 to March 1987 Yezin Agricultural University, Yezin, Myanmar
Diploma of Science	June 1982 to March 1983 Yangon University, Hlaing Campus, Yangon, Myanmar

## Employment records

Position:	Senior Consultant
Period:	Strated from 15 May 2014 – upto now
Place:	Eguard Environmental Services Co., Ltd, Yangon, Myanmar
Position:	Consultant / Project Manager
Period:	Dec 2013 - April 2014
Place:	IMCM, Institute of Management Consultant Myanmar, Yangon, Myanmar

Position:	Technical Consultant
Period:	August 2010 to November 2013
Place:	Golden Key Co., Ltd, Yangon, Myanmar
Position:	Technical Consultant
Period:	Jan 2010 to July 2010
Place:	Rupa Dagon Co., Ltd, Yangon, Myanmar
Position:	Deputy Staff Officer to Assistant Manager
Period:	March 1987 to December 2009
Place:	Ministry of Agriculture and Irrigation, Yangon, Myanmar

### Work undertaken/ tasks assignment

Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	Driling (Thalin-1) for Offshore Block AD-7 2016 (on going) Rakhine State Woodside Energy (Myanmar) Pte., Ltd, Daewoo International Cooperation, ERM (HK) Initial Environmental Examination (IEE) Local Consultant Public Consultation and Fishery Survey
Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	Marine Seismic Survey for Offshore Block AD-7 2016 (on going) Rakhine State Woodside Energy (Myanmar) Pte., Ltd, Daewoo International Cooperation, ERM Initial Environmental Examination (IEE) Local Consultant Public Consultation and Fishery Survey
Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	3D Marine Seismic Survey for Offshore Block A-7 2016 (on going) Ayeyarwaddy Region Woodside Energy (Myanmar) Pte., Ltd, BG Exploration & Production (Myanmar) Pte Ltd (BGEPM) and AECOM Initial Environmental Examination (IEE) Local Consultant Public Consultation, Fishery Survey, Team Leader of Community Leison Officers- CLO/Grievance-Mechanism
Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	Amazing Ngapali Resort 2016 (on going) Thandwe, Rakhine State Advanture Myanmar Tours & Incentives Company Limited Environmental Management Plan (EMP) Local Consultant Team Leader
Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	3D Marine Seismic Survey for Offshore Block AD-5 2015 Ayeyarwaddy Region Woodside Energy (Myanmar) Pte., Ltd, BG Exploration & Production (Myanmar) Pte Ltd (BGEPM) and AECOM Initial Environmental Examination (IEE) Local Consultant Public Consultation, Fishery Survey, Team Leader of Community Leison Officers- CLO/Grievance-Mechanism

Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	3D Drilling (Shwe Yi Tun -1) for Offshore Block A-6 2015 Ayeyarwaddy Region Woodside Energy (Myanmar) Pte., Ltd, AECOM Initial Environmental Examination (IEE) Local Consultant Public Consultation
Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	National Power Transmission Network Project (500kV) 2015 Yangon, Bago, Taungoo, Meiktilar Ministry of Electric Power Enterprise (MEPE) and JICA Initial Environmental Examination (IEE) Local consultant Public Consultation, Biodiversity and Social Survey
Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	National Power Transmission Network Project (500kV) 2015 Yangon, Bago, Taungoo, Meiktilar Ministry of Electric Power Enterprise (MEPE) and JICA Resettlement Action Plan (RAP) Local consultant Public Consultation and Social Survey
Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	Preparatory Survey on Thilawa SEZ Development Project (2000Ha) 2015 Thilawa, Thanlyin Township Thilawa SEZ Management Committee and JICA Strategic Environmental Assessment (SEA) Local consultant Public Consultation, Environmental Quality Analysis, Biodiversity Survey , Traffic Survey and Social Survey
Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	Preparatory Survey on Thilawa SEZ Development Project (2000Ha) 2015 Thilawa, Thanlyin Township Thilawa SEZ Management Committee and JICA Environmental Impacts Assessment (EIA) for the whole area of 2000Ha Local consultant Public Consultation, Environmental Quality Analysis, Biodiversity Survey , Traffic Survey and Social Survey
Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	Thingaha (Ngapali) Hotel 2015 Thandwe, Rakhine State Eden Hotels and Resorts Co., Ltd. Environmental Management Plan (EMP) Consultant Team Leader
Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	Manufacturing of the Varieties of Shoes Factory 2014 Thardukan Industrial Park, Yangon Myanmar Pou Chen Co., Ltd. Initial Environmental Examination (IEE) Consultant Team Leader
Name of assignment or project Year: Location: Client: Main project features: Position held: Activities performed:	No-5 Sugar Mill (Myohla) 2014 Myohla Internatiional Gateways Group of Co., Ltd. Environmental Management Plan (EMP) Consultant Team Leader



## Attended trainings and workshops

First Aid Training	29 <sup>th</sup> December 2015 to 31 <sup>st</sup> December 2015
WHAT, WHY, WHO, WHEN AND HOW SIA, Resettlement Planning, Livelihood Restoration & Stakeholder Enguagement Workshop	23 <sup>rd</sup> November 2015 to 27 <sup>th</sup> November 2015 Kent, United Kingdom
OH&S Management System Standard Awareness Course (OHSAS 18001:2007)	9 <sup>th</sup> August, 2015 WIN OSHE SAFETY ACADEMY, Yangon, Myanmar
Summer School on Solar Applications for Rural Development	31 <sup>st</sup> May 2011 to 6 <sup>th</sup> June 2011 Albert-Ludwigs Universität Freiburg, Germany
“Double Your Customers and Profit”, Brian Tracy Training	5 <sup>th</sup> November 2012 Bangkok, Thailand
South Asian Regional Workshop on Renewable Energy for Sustainable Development	19 <sup>th</sup> May 2008 to 23 <sup>rd</sup> May 2008 Flensburg Association for Energy Management-Nepal (FAME- Nepal), Kathmandu and Pokhara, Nepal
Summer School on “Photovoltaic – Scientific and Technical Potential for Developing Countries”	27 <sup>th</sup> August 2006 to 10 <sup>th</sup> September 2006 Technische Universität Bergakademie Freiberg, Germany
e Government Workshop Training Course	19 <sup>th</sup> September 2005 to 28 <sup>th</sup> October 2005 Telecommunication and Postal Training Centre, Yangon, Myanmar Ministry of Communications, Post and Telecommunication, Yangon, Myanmar
Certificate of Adult Core English	21 <sup>st</sup> July 2005 to 31 <sup>st</sup> August 2005 The American Center, Yangon, Myanmar
Certificate of Training Course on GMS Rural Renewable Energy	3 <sup>rd</sup> July 2005 to 17 <sup>th</sup> July 2005 Foreign Economic Cooperation Center, Ministry of Agriculture, Bejjine, China
Certificate of Network Security Management	8 <sup>th</sup> August 2005 to 19 <sup>th</sup> August 2005 Center of the International Cooperation for Computerization and Myanmar Computer Federation
Certificate of English Language Proficiency Course	1 <sup>st</sup> June 2004 to 20 <sup>th</sup> August 2004 EUROPA- International Education Academy, Yangon, Myanmar
Certificate of Training Workshop on Policy Analysis	13 <sup>th</sup> May 2004 to 18 <sup>th</sup> May 2004 Department of Agricultural Planning, Ministry of Agriculture and Irrigation, Yangon, Myanmar
Multidisciplinary German – Myanmar Workshop on Sustainability in Rural and Urban Environments	17 <sup>th</sup> November 2003 to 21 <sup>st</sup> November 2003 Yangon University, Yangon, Myanmar
Certificate of Intermediate Course on GIS	13 <sup>th</sup> January 2003 to 17 <sup>th</sup> January 2003 MCC- MASTECH, Yangon, Myanmar
Certificate of Office Database Application	6 <sup>th</sup> November 2002 to 2 <sup>nd</sup> January 2003 Ministry of Agriculture and Irrigation, Yangon, Myanmar
Certificate on Basic GIS Training Course (JICA)	13 <sup>th</sup> November 2002 to 22 <sup>nd</sup> November 2002 MCC- MASTECH, Yangon, Myanmar
Research Fellowing Summer Semester (1/4/-19/7/2002)	1 <sup>st</sup> March 2002 to 31 <sup>st</sup> May 2002 University of Flensburg, Germany
GIS Introduction and Workshop	3 <sup>rd</sup> April 2000 to 7 <sup>th</sup> April 2000 Myanmar Intergraph, IBC, Yangon, Myanmar
Certificate of German Language	April 1996 to September 1996 University of Flensburg, Germany
Certificate of Computer Application	1 <sup>st</sup> January 1996 to 1 <sup>st</sup> March 1996 University of Computer Science, Yangon, Myanmar
Certificate of German Language	September 1995 to December 1995 University of Foreign Languages (Yangon)
Certificate of Secretarial Studies	1 <sup>st</sup> August 1992 to 30 <sup>th</sup> November 1992 ACE Data System, Yangon, Myanmar

## **Annex 3.1 Ophir Energy's Policies**



## **PART ONE: Health, Safety and Security**

Ophir Energy has a dedicated commitment to our Corporate Responsibility; our approach is underlined with the same principles as those of our core activities which are determination, innovation and excellence. As an integral part of our Corporate Responsibility commitments Ophir Energy is dedicated to the implementation, review and continuous improvement of its Health, Safety and Security (HSS) performance and to minimizing risks related to its operations for people.

To meet these objectives we operate in accordance with the following principles; Ophir Energy:

- Complies with all applicable Health Safety and Security (HSS) laws, regulations and standards applying responsible standards in line with industry best practice.
- Implements a systematic framework of hazard identification and risk assessment through which safe operations can be managed.
- Implement a HSS management system that focuses on the minimising of risks associated with our activities. This system includes the appropriate protective measures to control risks and to respond to any emergency resulting from our operations.
- Promote a culture within the company whereby all employees have a commitment to, and are involved in, the implementation of HSS management systems and establish a transparent line of accountability and responsibility within the organisation management line.
- Recognise that all activities on our behalf can impact our operations and subsequently ensure that all partnerships, contractors and business relations share a common responsibility for HSS and are compliant with our standards.
- Ensure that employees, contractors and any individuals under our duty of care are adequately trained and aware of the importance of the HSS aspects of their jobs. All Ophir employees and contractors are guided by our Medical and Fitness to Work and Travel standards, which must be adhered to at all times.
- Monitor and review all aspects of our HSS policy on a regular basis to ensure suitability and effectiveness.

A handwritten signature in blue ink, appearing to read "Nick Cooper", written over a horizontal line.

**Nick Cooper**  
**Chief Executive Officer**  
**Ophir Energy plc**  
**August 2014**

## **Annex 7.1 Public consultation Record and Attendance List**

# Consultation Record of Town Hall Meeting

Basic details			
<b>Project</b>	Ophir Block AD-3 Drilling, Rakhine Basin in Myanmar		
<b>Office/ Department/ Organization</b>	District GAD Office, Thandwe	<b>Region/ State</b>	Rakhine State
<b>District</b>	Thandwe	<b>Township</b>	Thandwe
<b>Village Tract (if applicable)</b>	N/A	<b>Village (if applicable)</b>	N/A
<b>Remark</b>	Meeting was held at District GAD organized by the Township GAD The meeting lasted just under one hour: <ul style="list-style-type: none"> <li>- ~20 mins for presentation</li> <li>- ~40 mins for Q&amp;A</li> </ul>		
<b>Purpose of the visit</b>	Public consultation for the EIA Report for exploration drilling in Block AD-3.		

## (Question and Answer Session)

Consultation Record (Q= Question, A= Answer, S=Suggestion)	
<p>Prior to the town hall meeting, the District GAD was met separately to present information on the Project and thank him for helping with the arrangements for the meeting. The GAD mentioned that he was very busy due to the recent flooding in Rakhine. He was interested in the Project and particularly the CSR programs Ophir would undertake. He gave an example of some companies funding the building of a new hospital in Thandwe. He also mentioned that another operator (BG) were looking into CSR programs in the area.</p>	
<p><b>Q1 (U Nyi Nyi Htwe, District Commissioner):</b> What sort of Corporate Social Responsibility (CSR) Programs will Ophir have? When will the Project start?</p>	
<p><b>A1 (Mr. Andrew Chapman, Country Manager, Ophir):</b> CSR is very important to Ophir and wherever we operate, We consider supporting CSR programs as an essential part of our operation. In Myanmar, Ophir are at an early stage of the Project and we do not know if we will find any gas. We are hopeful but there might be nothing. However, a CSR program is part of the commitment in the PSC with MOGE if the Project goes to the Production Stage. The Project is due to commence in December 2016.</p>	
<p><b>Q2 (U Khin Maung Yi, Staff Officer, DOF):</b> Will Ophir release a Notice to Mariners?</p>	
<p><b>A2 (U Kyaw Zaya, Dy. Director, MOGE):</b> The Notice to Mariners will be announced in Newspapers, and Radio one month before the commencement of the activities. The Notice will be applied for by the MOGE through the Ministry of Information.</p>	
<p><b>S2 (U Nyi Nyi Htwe, District Commissioner):</b> The disclosure of the Notice to Mariners to fishermen is most effective through the by village leaders.</p>	
<p><b>Q (U Than Tun, Member of District Red-Cross):</b> What sort of Health and Safety Training (such as First Aid training) to workers is provided for survey activities?</p>	
<p><b>A (U Kyaw Zaya, Dy. Director, MOGE):</b> The operator is responsible for ensuring that all contractors have the appropriate training. Every seismic and drilling employee working offshore receives the required HSE training. The training is provided by relevant HSE managers of the sub-contractors. There is also doctors and medical centre on board the MODU for workers.</p>	
<p><b>Q (U Myint Tun, Fisherman):</b> What sort of compensation is provided for incidents? <i>Note: this in the reference to a 2015 seismic survey where there were cases of nets becoming entangled in seismic lines and fishing gear needed to be cut.</i></p>	
<p><b>A (Ms. Becky Summons, ERM, U Kyaw Soe, Parami, U Kyaw Zeya, MOGE and Daw Myat Mon Swe, EGuard):</b> We have visited Thandwe before and during these visits fishermen said they wouldn't be fishing out further than 30 miles offshore (where Block AD-3 is located). Block AD-3 is further offshore than the Block where the interactions with fishing occurred during last year's seismic survey for another operator. It should also be noted that this Project is the drilling of one well only, not a large seismic survey in the whole Block, so the area for interaction is much smaller. There will have a 500m-safety zone to prevent the any accidents and support vessels will communicate to the fishermen not to come in this study area.</p>	
<p><b>Q (U Nyi Nyi Htwe, District Commissioner):</b> What permissions are required to land the helicopters in the Thandwe area?</p>	
<p><b>A (U Kyaw Zaya, Dy. Director, MOGE):</b> The permission for landing helicopters for this Project comes from the navy. The permission is applied for by MOGE.</p>	

**Public Consultation**  
**Thandwe Township, Rakhine State**

<b>Government Department (16)</b>					
<b>No</b>	<b>Date</b>	<b>Name</b>	<b>Department</b>	<b>Occupation</b>	<b>Phone No.</b>
1	16.6.16	U Nyi Nyi Htwe	District GAD	Director	09-5188637
2	16.6.16	U Saw Khaing Oo	Forest Department	Staff Officer	09-5038844
3	16.6.16	U Khin Maung Ye	Dept of Fisheries	Staff Officer	043-65238
4	16.6.16	U Tun Tun Thant	Dept of Fisheries	Assistant Officer	043-65238
5	16.6.16	U Ko Ko Naing	Dept of Fisheries	Deputy Head of Section	09-260372991
6	16.6.16	U Aung Ye Kyaw	District GAD	Junior Clerk	09-250997558
7	16.6.16	U Aung Myint Myat	District GAD	Junior Clerk	09-203153420
8	16.6.16	U Thein Zaw Tun	District GAD	Junior Clerk	09-250756766
9	16.6.16	Daw Saw Thida	District GAD	Accountant	09-421735277
10	16.6.16	Daw Su Su Myat	District GAD	Clerk(2)	09-250997589
11	16.6.16	U Han Zaw Myint	Township GAD	Assistant Director	043-652
12	16.6.16	Daw Zin Mar Thu	Township GAD	Junior Clerk	09-254368441
13	16.6.16	Daw Khin Khin Thaw	Township GAD	Clerk	09-33614485
14	16.6.16	Dr.Soe Win	Chairman, Township Development Committee	Thandwe	09-421786212
15	16.6.16	U San Tun Baw	Quarter Administrative Officer	4 Quarter	09-250123980
16	16.6.16	U Tin Myint	Quarter Administrative Officer	3 Quarter	09-421762843

<b>Local People (5)</b>					
<b>No</b>	<b>Date</b>	<b>Name</b>	<b>Occupation</b>	<b>Place</b>	<b>Phone No</b>
1	16.6.16	U Hla Oo	Fisherman	Tha Byu Chaing	09-8617438
2	16.6.16	U Myint Naing	Fisherman	Tha Byu Chaing	09-250539055
3	16.6.16	U Soe Naing	Fisherman	Tha Byu Chaing	09-8516854
4	16.6.16	U Myint Tun	Fisherman	Tha Byu Chaing	09-250335009
5	16.6.16	U Soe Moe Naing	Fisherman	Thandwe	09-8515229

<b>NGO( 4)</b>					
<b>No</b>	<b>Date</b>	<b>Name</b>	<b>Position</b>	<b>Department</b>	<b>Phone No</b>
1	16.6.16	Daw Nan Aye Nu	Clerk	Myanmar Woman Association	09-262025748
2	16.6.16	Daw Thin Thin Mar	Clerk	Myanmar Woman Association	09-421737954
3	16.6.16	Daw Thu Zar Lwin	Clerk	Myanmar Woman Association	09-254432584
4	16.6.16	U Than Tun	Staff Officer	Red Cross	09-421012700



**Thandwe town hall meeting – Focus Group Discussion**

Date and time	Thursday 16 <sup>th</sup> June 2016 11:00
Venue	Thandwe General Administrative Department (GAD) Office
Attendees	5 offshore fishermen from Gyietaw village

**Boats**

Type of Boats	Amount of fish (units)	Size	Motor capacity	Distance covered (units)	Usually moves in Depth of (units)	Average fishing trip (time spent at sea)
Large / offshore (trawler)	>110 tonnes	Unknown	280-500	>60 miles from coast	150 m (490 ft.)	>1 month

	Questions	Responses
1.	<b>Where:</b> What are the best fishing locations? How far are these locations? <b>Indicate on a map</b>	Fishing is undertaken up to 60 miles from the mainland coast. The main fishing area is along the shelf edge in waters up to 490 ft. depth.
2.	<b>When:</b> What are the major fishing months? Which are the peak months? <b>[USE FISHING CALENDAR- Annex 1]</b>	See <i>Fishing Calendar</i>
3.	<b>How:</b> What are the typical fishing techniques used? <b>[USE FISHING METHODS SHEET- Annex 2]</b>	See <i>Fishing Methods</i>
4.	<b>Type of fish:</b> What are the major fish species caught in this area: List with annual/monthly production/season <b>[USE PICTURES]</b>	The fish species caught are: catfish, tuna, prawn, anchovy, and sea bass. Numerous species of fish are caught and none are specifically targeted (except prawns).
5.	<b>Who</b> are the fishermen that fish in the offshore (>10miles from the coast) or in deep waters? - Where do they come from? How far do they go?	Fishermen come from all over Myanmar. There are unlikely to be many local (Rakhine) fishing vessels in Block AD-3.
6.	How is information made available / disclosed to the fishing community?	The DOF distributes information to the fishing community and information comes via the Village Tract Leader.

FISHING CALENDAR	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Type of net used – Trawler												
Fishing reduced due to Cyclones or high tides												

FISHING METHOD	Location (from coast or water depth)	Type of fish (use pictures)	Season (when/ what time of year)	Small / medium / large (boats)	Dimensions of net (length, width, height)	Location in water column (bottom, surface or mid-water)?
Trawling	Up to 60 miles from coast	Catfish, tuna, prawn, anchovy	Year round, but only 10% of the trawlers go out during the monsoon season (June to October)	Large offshore	130 ft. (wide)	Mid-water and along seabed

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Korea	United Kingdom
Malaysia	United States
Mexico	Vietnam

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