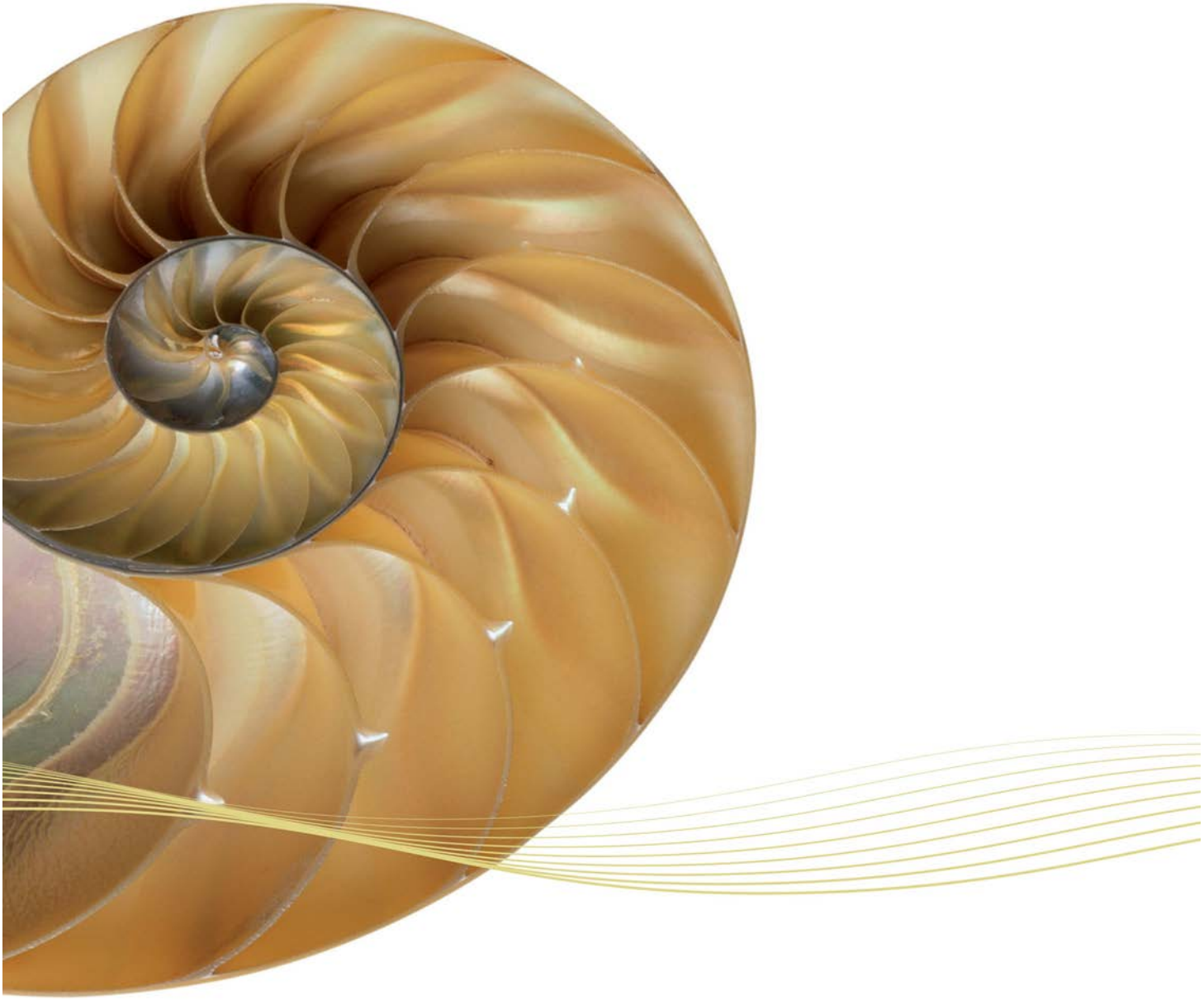

Environmental and Social Impact Assessment for the Seismic Survey and Workover Activities of Block IOR-6, Myanmar

Environmental and Social Impact Assessment Report

15th May 2015

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Environmental and Social Impact Assessment for the Seismic Survey and Workover Activities of Block IOR-6, Myanmar

Environmental and Social Impact Assessment Report

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Client:	Project No:
MPRL E&P	0267078
Summary:	Date: 15th May 2015
This document presents the Environmental and Social Impact Assessment Report and the Environmental and Social Management Plan for the proposed seismic survey and workover activities at Block IOR-6.	Approved by:  Craig A Reid *Partner*

Revision	Description	By	Checked	Approved	Date
0	ESIA Report	Var	JT	CAR	15/05/15

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CONTENTS

MPRL E&P Pte Ltd (MPRL E&P) was awarded the Exploration Block IOR-6 (a.k.a. Myanaung) in October 2014 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 2-Dimensional (2D) and 3-Dimensional (3D) surveys, across Block IOR-6. MPRL E&P is also planning to undertake workover activities at selected existing wells within the Block ("the Project").

Pursuant to *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, all Projects undertaken in Myanmar which have the potential to cause significant environmental and social impacts are required to undertake an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) and to obtain an Environmental Compliance Certificate (ECC) in accordance with the *Environmental Impact Assessment (EIA) Procedures* ("the *Procedures*").

In relation to the above, MPRL E&P has commissioned **Environmental Resources Management** (ERM), supported by local specialists from **Resource and Environment Myanmar** (REM), to undertake an Environmental and Social Impact Assessment (ESIA) Study for the Project in accordance with the requirements of the *Procedures*.

The overall purpose of the Study is to complete a robust ESIA to meet requirements of the *EIA Procedures* for the ESIA to be approved by the Ministry of Environmental Conservation and Forestry (MOECAF).

KEY ENVIRONMENTAL AND SOCIAL FEATURES

An overview of environmental and social baseline features for Block IOR-6 is presented in the ESIA Study. The main parameters described include:

- Physical environment, including climate and meteorology, geology, noise, air, surface water, groundwater and soil quality;
- Biological environment, including terrestrial habitats as well as the associated flora and fauna including avifauna, butterflies, herpetofauna, mammals and aquatic fauna ; and
- Socio-economic environment, including baseline information of the concerned Project Area, the region and the overall country profile.

Information on the above parameters has been collected through desktop review of publicly available information. Primary data collection has also been undertaken in December 2014 to establish the baseline biological, physical and socio-economic environment of the Project Area. The baseline data obtained have been used to characteristic the Project Area and informed

the assessment of potential environmental and social impacts from the proposed seismic surveys and workover activities at Block IOR-6.

IMPACT ASSESSMENT AND ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

During the impact assessment, potential impacts have firstly been identified through a systematic scoping process whereby the activities (both planned and unplanned) associated with the Project have been considered with respect to their potential to interact with environmental and social resources or receptors. Interactions which may generate potentially significant environmental and social impacts ranging from those associated with the land accessibility phase (e.g. loss of access to land by the community), through the preparation / mobilisation phase (e.g. site preparation and clearance impacts to terrestrial habitat and flora and fauna), subsequent seismic survey phase (e.g. impacts of detonation of explosives) and eventually to the close-out phase (e.g. positive impacts from rehabilitation of habitats) of the seismic surveys as well as the well workover activities within Block IOR-6.

The potentially significant environmental and social impacts are further assessed in the ESIA Study, with appropriate mitigation and enhancement measures recommended for alleviating potential negative impacts or enhancing potential positive impacts from the Project. With proper implementation of the mitigation measures, it is predicted that the potential environmental and social impacts causing by the proposed seismic survey and workover activities of Block IOR-6 would be of **Negligible, Minor** or **Moderate** significance.

CUMULATIVE IMPACTS

Cumulative impacts of the proposed seismic survey and workover activities at Block IOR-6 with other potential development in the vicinity are also assessed in the ESIA Study. Cumulative impact refers to that generated by other developments or activities in the vicinity of the Project Area, which when added to the impacts of the proposed seismic survey and workover activities combine to cause a greater impact.

Block IOR-6 is surrounded by other onshore blocks including Block IOR-4 and Block IOR-7. It is understood that seismic surveys may be carried out concurrently at these blocks and their seismic survey areas may overlapped slightly with that of Block IOR-6 at the boundary between the blocks. However, it is expected that the environmental and social impacts from seismic surveys and well workover activities, if properly mitigated, will be localised within the onshore blocks and restricted to environment / communities within them. As such, it is not expected that seismic surveys at adjacent blocks, if undertaken concurrently, will lead to cumulative impacts to the physical, biological or human environment within Block IOR-6.

1 INTRODUCTION

1.1 PROJECT OVERVIEW

MPRL E&P Pte Ltd (MPRL E&P) was awarded the Exploration Block IOR-6 (a.k.a. Myanaung) in October 2014 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 2-Dimensional (2D) and 3-Dimensional (3D) surveys, across Block IOR-6. MPRL E&P is also planning to undertake workover activities at selected existing wells within the Block ("the Project").

The location of the Block is shown in *Figure 1.1*.

1.2 PROJECT PROPONENT

The proponent of the Project is MPRL E&P Pte Ltd.

MPRL E&P is an independent oil and gas exploration and production company, headquartered in Yangon with operations in various offshore and onshore blocks in Myanmar. Further information about the company is available at the website http://mprlexp.com/.

1.3 THIS ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Pursuant to *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, all Projects undertaken in Myanmar which have the potential to cause significant environmental and social impacts are required to undertake an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) and to obtain an Environmental Compliance Certificate (ECC) in accordance with the *Environmental Impact Assessment (EIA) Procedures* ("the Procedures") [(1)].

In relation to the above, MPRL E&P has commissioned **Environmental Resources Management** (ERM), supported by local specialists from **Resource and Environment Myanmar** (REM), to undertake an Environmental and Social Impact Assessment (ESIA) Study for the Project in accordance with the requirements of the Procedure. This ESIA Report has been prepared for MPRL E&P by ERM and presents the objectives, methodology and outcomes of the IA in accordance with the EIA Procedures.

(1) EIA Procedures (8th Draft) dated January 2015.

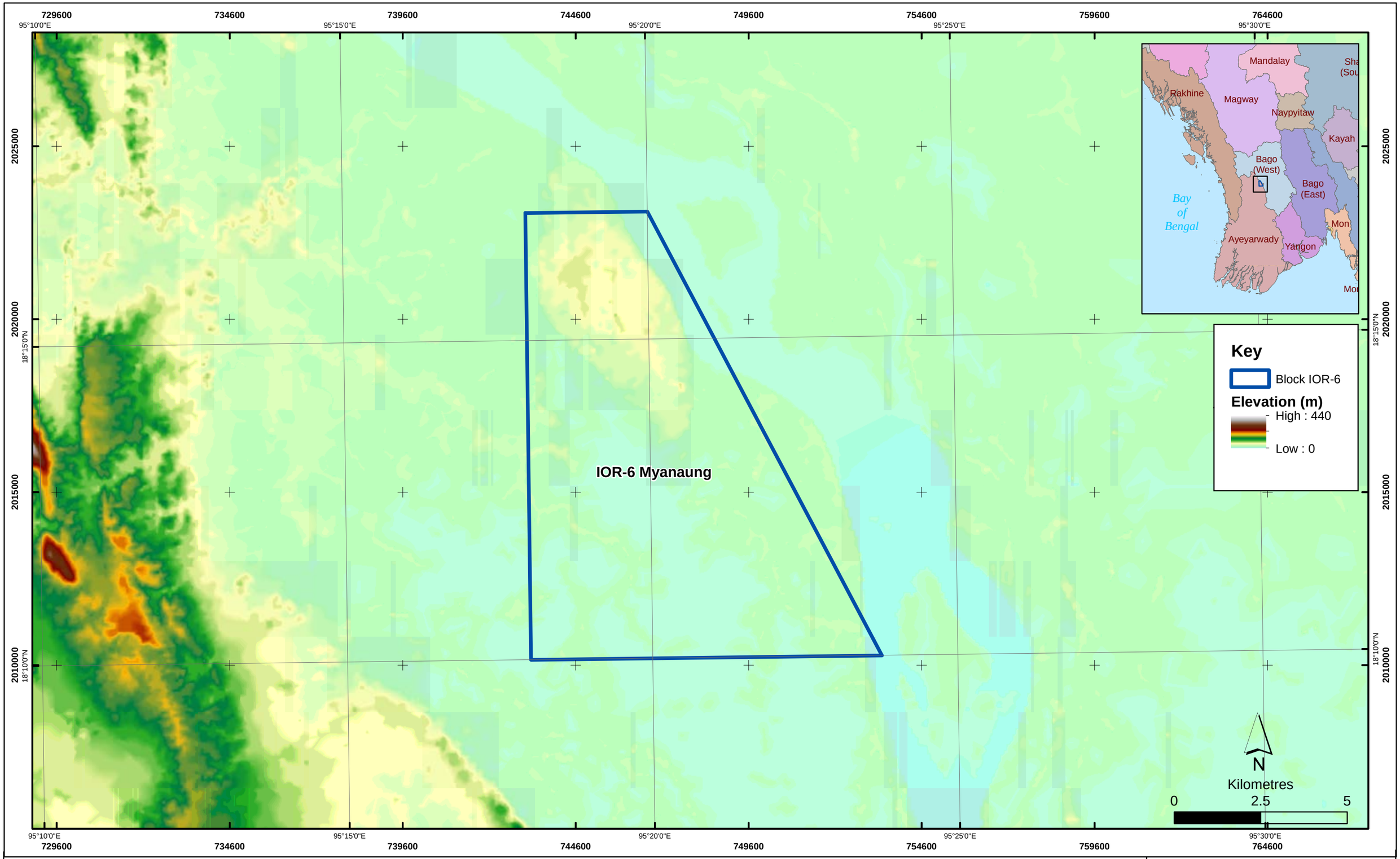

Figure 1.1

Block IOR-6

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Date: 24/3/2015

Environmental Resources Management

ERM

1.4 IMPACT ASSESSMENT OBJECTIVES

The overall purpose of the Study is to complete a robust ESIA to meet requirements of the EIA Procedures for the ESIA to be approved by the Ministry of Environmental Conservation and Forestry (MOECAF).

Specifically, the objectives of the ESIA are:

- To review the proposed Project activities including its alternatives with respect to their potential to interact with environmental and social receptors and resources;
- To identify the potentially vulnerable environmental and social components;
- To identify and evaluate environmental and social impacts arising from the Project;
- To recommend mitigation or enhancement measures to remove, reduce or avoid negative impacts;
- To provide an environmental and social management plan (ESMP) including an approach for monitoring; and
- To summarise public consultation and disclosure of the Project.

1.5 STUDY LIMITATIONS

This IA is based on the Project description obtained from MPRL E&P at the time of the Study. Any future changes to the Project description, upon which this report is based or additional relevant information revealed as Project design, equipment and service procurement proceed may affect the analysis, assessment and conclusions contained in this report. Should significant changes occur, they would be the subject of further study to verify that the conclusions of this ESIA do not change and to determine whether any additional mitigation, management or monitoring measures are warranted.

1.6 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT EXPERTS

The key ESIA experts deployed for the Project are presented in *Table 1.1* below.

Table 1.1 ESIA Experts deployed for the Project

Team	Name	Role	Organisation
Project Management Team	Craig A. Reid	Project Director	ERM
Project Management Team	Jovy Tam	Project Manager	ERM
Advisory Team	Dr Robin Kennish	EIA / EMP Expert	ERM
Advisory Team	Neena Singh	SIA Expert	ERM
ESIA and ESMP Technical Team	Dr Jasmine Ng	EIA Specialist	ERM
ESIA and ESMP Technical Team	Mandy To	Noise Specialist	ERM
ESIA and ESMP Technical Team	Winnie Ko	Air Specialist	ERM
ESIA and ESMP Technical Team	Angus Choi	Soil and Groundwater Specialist	ERM
ESIA and ESMP Technical Team	Dr Tom Glenwright	Water Specialist	ERM
ESIA and ESMP Technical Team	Terence Fong	Ecology Specialist	ERM
ESIA and ESMP Technical Team	Manish Singh	SIA Specialist	ERM
ESIA and ESMP Technical Team	Kary Kwok	GIS Specialist	ERM
Local Team	Daw Khin Ohnmar Htwe	SIA Survey Team Leader	REM
Local Team	Thura Aung	Noise, Air, Soil and Groundwater Survey Team Leader	REM
Local Team	Dr Ko Myint		REM
Local Team	Dr Win Kyi		REM
Local Team	Dr Myat Htoo Aung		REM
Local Team	Dr Win Maung	Local Specialist	REM
Local Team	Soe Thura Tun	Local Specialist	REM

1.7 REPORT STRUCTURE

The remainder of this report is structured as follows:

- *Section 2* defines the institutional framework for the Project including a summary of legislation, guidelines and standards applicable to the Project.
- *Section 3* presents the Project description and alternatives selection.
- *Section 4* presents a summary of environmental and social baseline conditions within the Project Area.
- *Section 5* presents the impact assessment methodology and the findings of the assessment of potentially significant impacts to environmental and social receptors and resources and proposed mitigation measures.
- *Section 6* presents findings of assessment of cumulative impacts to environmental and social receptors and resources within the Project Area.
- *Section 7* details the Environmental and Social Management Plan and any monitoring measures to be completed.
- *Section 8* presents a summary of the public consultation and disclosure carried out for the Project.

2 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This section sets out the relevant legal and policy context in Myanmar and documents the environmental and social standards with which the Project will achieve compliance as well as the international standards that the Project will follow. Specifically, this section summarises the following:

- MPRL E&P Environmental and Social Policy;
- Myanmar administrative and legislative framework as well as existing regulatory requirements;
- Pending ESIA requirements in Myanmar;
- International organizations such as the World Bank and International Finance Corporation (IFC) environmental and social guidelines and standards that relate to both conducting an ESIA as well as to the technical performance standards considered by the Project; and
- A discussion of international conventions to which Myanmar is a signatory and with which the Project must therefore comply.

Specific benchmarks used to assess individual impacts are also summarized under each assessment topic in *Section 5.*

2.1 CORPORATE ENVIRONMENTAL AND SOCIAL POLICY

MPRL E&P has adopted a comprehensive HSE Management System. This system is an important and integral part of the company's overall management system and is shown in *Figure 2.1* below. This ESIA Study is conducted in accordance with MPRL E&P's environmental and social guidelines which require the Project to follow the fundamental goals of:

- Zero accidents;
- No harm to people; and
- No damage to environment.

Figure 2.1 MPRL E&P's HSE Policy

MPRL E&P

MPRL E&P HSE Policy

MPRL E&P is committed to continuous improvement in Health, Safety and Environmental performance, consistent with our fundamental goals of:

- Zero accidents,
- No harm to people,
- No damage to the environment.

MPRL E&P adheres to and strives to meet the following principles throughout its operations:

- All accidents are preventable.
- No activity is so important that it cannot be done safely.
- Minimize the environmental impact our activities may cause.
- Meet or exceed the requirements of applicable HSE legislation, regulations and Company HSE expectations.
- HSE performance depends on all employees and Contractor personnel working with MPRL E&P. Everyone is responsible for working safely.
- Continually strive to reduce the impact of our business on health, safety and the environment by applying safe work practices, reducing waste, and using energy efficiently.
- Eliminate injuries by rectifying and reporting all actions and conditions, which could result in an accident / incident.
- Conduct appropriate training to ensure all our personnel are competent in their respective jobs and understand and adhere to this policy.
- Ensure business plans and personal objectives include measurable HSE targets, which are established annually and reviewed regularly.

Responsibilities for HSE performance are visible throughout the organization, with clarity for line management accountability. The MPRL E&P Health, Safety and Environment Management System, is fundamental to our business and is applicable to all areas of our operations.

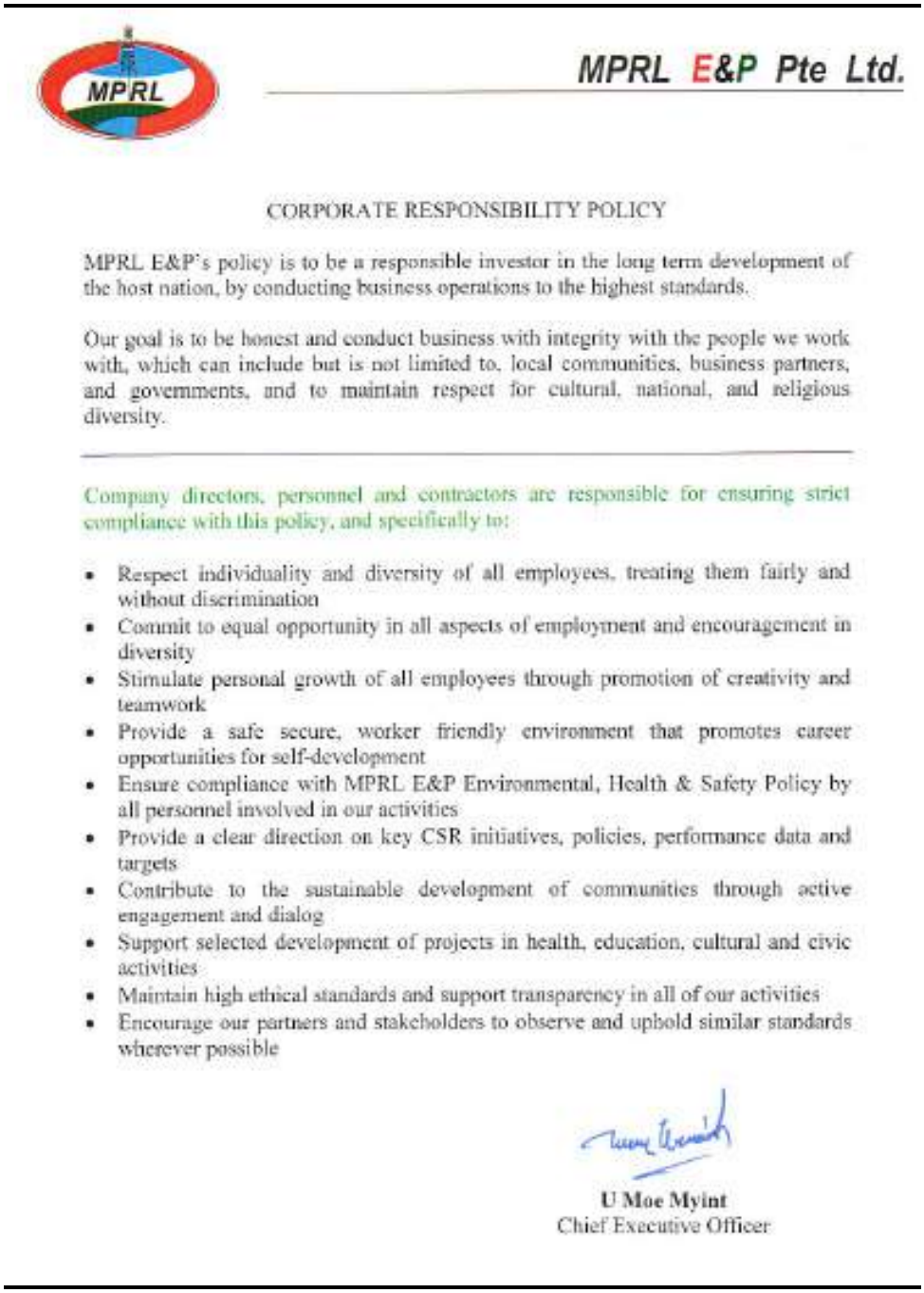
MPRL E&P Senior Management is accountable for implementation of this policy. Implementation is achieved by adhering to our management systems, and where appropriate the management systems used by those who work with us.

U Myo Tin
General Manager
MPRL E&P Pte Ltd.

Date of revision : 13-May-2013

Apart from the HSE policy, MPRL E&P also has in place a corporate responsibility policy and a human rights policy, as can be seen in the following *Figures 2.2-3*.

Figure 2.2 MPRL E&P Corporate Responsibility Policy



MPRL E&P Pte Ltd.

CORPORATE RESPONSIBILITY POLICY

MPRL E&P's policy is to be a responsible investor in the long term development of the host nation, by conducting business operations to the highest standards.

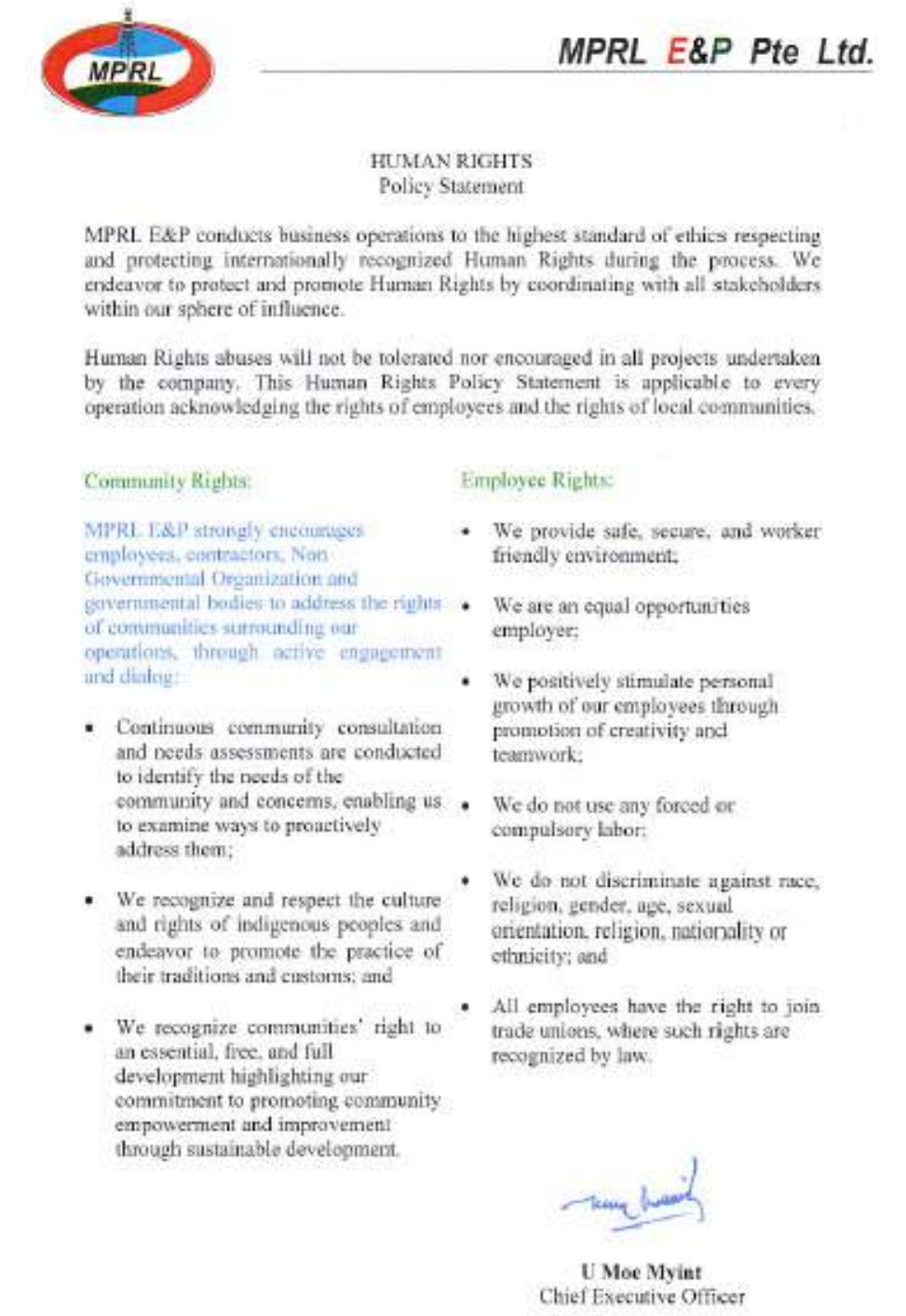
Our goal is to be honest and conduct business with integrity with the people we work with, which can include but is not limited to, local communities, business partners, and governments, and to maintain respect for cultural, national, and religious diversity.

Company directors, personnel and contractors are responsible for ensuring strict compliance with this policy, and specifically to:

- Respect individuality and diversity of all employees, treating them fairly and without discrimination
- Commit to equal opportunity in all aspects of employment and encouragement in diversity
- Stimulate personal growth of all employees through promotion of creativity and teamwork
- Provide a safe secure, worker friendly environment that promotes career opportunities for self-development
- Ensure compliance with MPRL E&P Environmental, Health & Safety Policy by all personnel involved in our activities
- Provide a clear direction on key CSR initiatives, policies, performance data and targets
- Contribute to the sustainable development of communities through active engagement and dialog
- Support selected development of projects in health, education, cultural and civic activities
- Maintain high ethical standards and support transparency in all of our activities
- Encourage our partners and stakeholders to observe and uphold similar standards wherever possible

U Moe Myint
Chief Executive Officer

Figure 2.3 MPRL E&P Human Rights Policy



MPRL E&P Pte Ltd.

HUMAN RIGHTS
Policy Statement

MPRL E&P conducts business operations to the highest standard of ethics respecting and protecting internationally recognized Human Rights during the process. We endeavor to protect and promote Human Rights by coordinating with all stakeholders within our sphere of influence.

Human Rights abuses will not be tolerated nor encouraged in all projects undertaken by the company. This Human Rights Policy Statement is applicable to every operation acknowledging the rights of employees and the rights of local communities.

Community Rights:

MPRL E&P strongly encourages employees, contractors, Non Governmental Organization and governmental bodies to address the rights of communities surrounding our operations, through active engagement and dialog:

- Continuous community consultation and needs assessments are conducted to identify the needs of the community and concerns, enabling us to examine ways to proactively address them;
- We recognize and respect the culture and rights of indigenous peoples and endeavor to promote the practice of their traditions and customs; and
- We recognize communities' right to an essential, free, and full development highlighting our commitment to promoting community empowerment and improvement through sustainable development.

Employee Rights:

- We provide safe, secure, and worker friendly environment;
- We are an equal opportunities employer;
- We positively stimulate personal growth of our employees through promotion of creativity and teamwork;
- We do not use any forced or compulsory labor;
- We do not discriminate against race, religion, gender, age, sexual orientation, religion, nationality or ethnicity; and
- All employees have the right to join trade unions, where such rights are recognized by law.

U Moe Myint
Chief Executive Officer

2.2 MYANMAR REGULATORY REQUIREMENTS

Matters pertaining to Health, Safety and Environmental (HSE) requirements are generally under the jurisdiction of the ministries and state-owned enterprises in the oil and gas sector. Key ministries/ agencies / state-owned enterprises that have jurisdiction over HSE matters in oil and gas operations include the following:

- MOECAF;
- Ministry of Fisheries, Livestock and Rural Development;
- Ministry of Labour;
- Ministry of Energy (MOE);
- MOGE; and
- Myanmar Investment Commission (MIC).

Table 2.1 provides a list of laws relevant to HSE of the proposed Project.

Table 2.1 List of Existing Sectorial Laws in Myanmar related to Environmental and Social issues as of March 2014

Sector	Relevant Laws in Myanmar
Administrative	The Territorial Sea and Maritime Zones Law, 1977
	The Emergency Provisions Act, 1950
	The Police Act, 1945
	The Poisons Act, 1919
	The Yangon Police Act, 1899
	The Explosives Act, 1887
	The Penal Code, 1861 of Offences Affecting the Public Health, Safety, Convenience, Decency and Morals
	Foreign Investment Law, 2012
	The Child Law (Law No. 9/93).
	Myanmar Maternal and Child Welfare Association Law (No. 21/90).
	Myanmar Investment Commission Notification (1994)
	The Private Industrial Enterprise Law - SLORC Law No. 22/90
Agriculture and Irrigation	The Fertilizer Law, 2002
	The Plant Pest Quarantine Law, 1993
	The Pesticide Law, 1990
	The Embankment Act, 1909
	Underground Water Act, 1930
	Farmland Rules - Notification No 62/2012 (English)
	Vacant, Fallow and Virgin Lands Management Rules - Notification No. 1/2012
	Vacant, Fallow and Virgin Land Management Act - Pyidaungsu Hluttaw Law No. 10/2012
Culture	The Protection and Preservation of Cultural Heritage Region law, 1998
Public Health	The National Food Law, 1997
	The Traditional Drug Law, 1996
	The Prevention and Control of Communicable Disease Law, 1995, revised

Sector	Relevant Laws in Myanmar
	in 2011.
	The Narcotics Drugs and Psychotropic Substances Law, 1993
	The National Drugs Law, 1992
	The Union of Myanmar Public Health Law, 1972
	Private Health Act, 2007
	The Penal Code of Offences Affecting the Public Health, Safety, Convenience, Decency and Morals (1861)
Occupational Health and Safety	Factory Act, 1951 (safe and healthy workplaces)
	Employment and skill Development Law, 2013
Tourism	The Myanmar Hotel and Tourism Law, 1993
Industrial	Myanmar Special Economic Zone Law No. 2011
	Dawei Special Economic Zone Law, 2011
	Myanmar Special Economic Zones Law (The Pyidaungsu Hluttaw Law No. 1/2014)
	The Private Industrial Enterprise Law, 1990
	The Factories Act, 1951
	The Oilfield (Labour and Welfare) Act, 1951
	Employment Restriction Act (1959)
	Workmen's Compensation Act 1923, amended in 2005
	Shops and Establishment Act, 1951
	Leave and Holidays Act, 1951
	Minimum Wage Act 1949, replaced by a new law in 2013
	Payment of Wages Act 1936
	Social Security Act 1954
	Trade Dispute Act 1929
	Settlement of Labour Dispute Law (2012)
	Employment and Skill Development Law
	Employment Statistics Act (1948)
	Water Power Act (1927)
Land Use	Land Acquisition Act, 1894
	The Towns Act, 1907
	The Village Act, 1907

2.3 PENDING ESIA LEGISLATION IN MYANMAR

Legislation related to environmental assessment, conservation and protection in Myanmar is currently within a development phase. Under *Section 7* of the *Environmental Conservation Law (2012)* and *Articles 52* and *53* of the *Environmental Conservation Rules (2014)* of the Republic of the Union of Myanmar, there is a requirement for the undertaking of an IEE or an EIA to obtain an ECC for certain development projects. Presently, the MOECAF is drafting both *EIA Procedures* and *EIA Guidelines*, along with the supporting of an EIA drafting committee comprising the representatives of relevant union ministries, union attorney general's office, development committees and Non-governmental Organizations (NGOs) and technical support by experts from the Asian Development Bank Greater Mekong Subregion – Environment Operations Center (ADB GMS-EOC). Within the latest *Version 8* of the *EIA Procedures* made publically available in 2015, the requirements for an EIA system are described as follows:

"An EIA investigation shall consider all biological, physical, social, economic, health, cultural and visual-components of the environment, together with all pertinent legal matters relating to the environment (including land use, resources use, and ownership of and rights to land and other resources) that may be affected by the Project during all project phases including pre-construction, construction, operation, decommissioning, closure, and post-closure; and shall identify and assess all Adverse impacts and risks that potentially could arise from the project. "

An EIA process is also outlined in the *EIA Procedures* which are described in the following sections.

2.3.1 Screening

The EIA process starts with the Screening Process as shown in *Figure 2.4*. The MOECAF is empowered and has the exclusive authority to define screening criteria for a project.

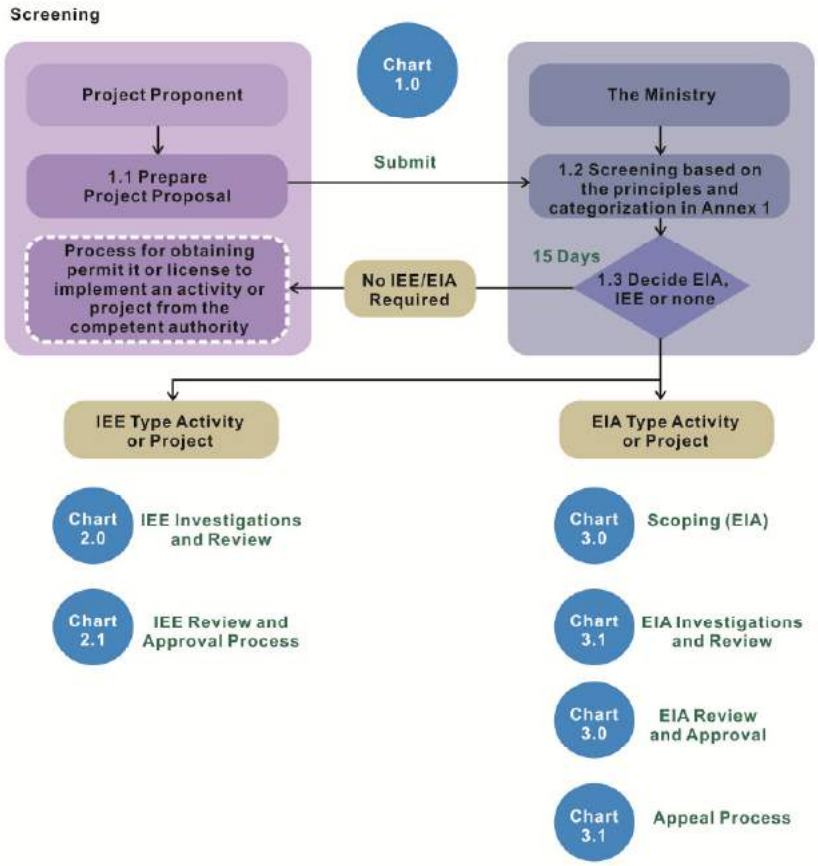
Guidance is provided as to which projects or activities should carry out an IEE or an EIA, as presented in the *Annex* to the *EIA Procedures (8th Draft)* [1]. If, as a result of that determination, an IEE or an EIA is required, then the Proponent of the project or activity shall be obliged to prepare, obtain approval for, and implement an appropriate Environmental Management Plan (EMP) in respect of the proposed project or activity. Any appeal from such determination must be made in accordance with the *EIA Procedure*s.

The Annex to the *EIA Procedures (8th Draft)* shows for each type of economic activity, the criteria for selection of whether IEE or EIA apply to the proposed economic activity. The MOECAF determines whether the project is an IEE Type Project, or an EIA Type Project, or is neither an IEE or an EIA Type Project and is therefore exempt from (not required) to undertake any environmental assessment.

For the purposes of this Project, the EIA has been selected as the methodology to follow under the *EIA Procedures*.

(1) EIA Procedures (8th Draft) *Op. cit.*

Figure 2.4 Screening within the Myanmar EIA Process



Source: EIA Procedures (8th Draft) Annex 2 - Environmental Assessment Procedure Flowchart (1)

On the basis that an EIA is to be conducted for the Project, the remainder of this discussion has focussed on the required EIA process.

The Project Proponent shall be required to submit a project proposal (completed in accordance with MOECAF's guidelines) to the Environmental Conservation Department of MOECAF for screening.

Within 15 days of receiving the complete project proposal, the MOECAF shall determine the type of environmental assessment (EIA, IEE, or none) which the project will require, and shall inform the Project Proponent in writing about its determination. In addition, the MOECAF can change the status of an IEE Type Project to be an EIA Type Project but there are no criteria for changing the status to none or exempt from environmental assessment.

Under the Procedure, a Project Proposal Report which confirmed that an ESIA is required for the proposed seismic activities was submitted to Ministry of Environmental Conservation and Forestry (MOECAF) (1).

(1) EIA Procedures (8th Draft) *Op. cit.*

2.3.2 Scoping

All EIA Type Projects are required to undergo Scoping. The Project Proponent shall be responsible to ensure that the Scoping and the preparation of the Term of Reference (TOR) for the EIA Report are undertaken in a professional manner and in accordance with any applicable guidelines issued or adopted by the MOECAF. The Scoping shall, in respect to the proposed Project:

a) Define the Project Area, area of influence, time boundaries, project phases, and potential stakeholders;

b) Start the process of understanding the applicable regulations and standards, and their context for Project design and completion of the EIA;

c) Make a provisional identification of environmental, social and, if any, health impacts, focusing in particular on the environmental, social and health issues that need to be addressed in subsequent EIA studies;

d) Provide an indication of what baseline data and information are required, and how it is proposed to obtain it (although there is no need to actually collect any data at this stage);

e) Provide an opportunity for consultants, relevant authorities, project developers, interested and affected parties to express their views and concerns regarding the proposal before an EIA proceeds;

f) Enable an efficient and comprehensive assessment process that saves time, resources, costs and delays; and

g) Identify potentially affected communities and other stakeholders with an interest in the Project.

As part of the Scoping, the Project Proponent shall ensure that the following public consultation and participation process is carried out.

a) Disclose information about the proposed Project to the public and civil society through local media, including by means of the prominent posting of legible sign boards and advertising boards at the Project Area which are visible to the public; and

b) Arrange the required complement of consultation meetings as advised by the MOECAF, with local communities, potentially Project Affected Persons (PAPs), local authorities, community based organisations, and civil society.

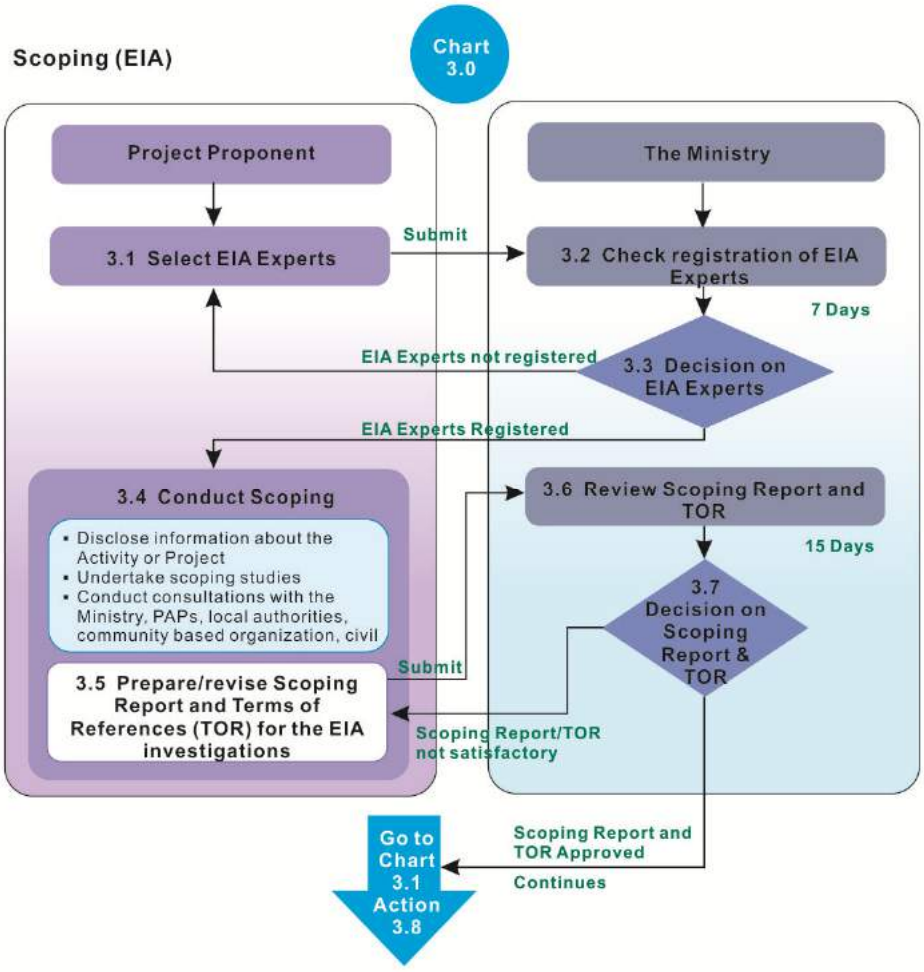
(1) ERM (2014) Project Proposal Report for the Seismic Surveys at Block IOR-6, Myanmar. Submitted to MOECAF on 18 November 2014.

For the Scoping Exercise of the Project, consultations were undertaken amongst the local community in five (5) villages from Pyay Township in accordance with the *draft EIA Procedures*. The consultations were undertaken as per the guidance of the township administrators, and were only carried out in villages where the tract leaders are living.

The Project Proponent shall prepare a Scoping Report and TOR for the EIA investigations and submit the completed Scoping Report and TOR to the MOECAF for review and approval. The Scoping process is shown in *Figure 2.5*.

Under the Procedure, a Scoping Report and TOR for the proposed seismic and workover activities was submitted to Ministry of Environmental Conservation and Forestry (MOECAF) [1].

Figure 2.5 Scoping within the Myanmar EIA Process



Source: EIA Procedures (8th Draft) [2]

(1) ERM (2015) Scoping Report for the Seismic Surveys and Workover Activities at Block IOR-6, Myanmar. Submitted to MOECAF on 2nd February 2015.

(2) EIA Procedures (8th Draft) *Op. cit.*

2.3.3 EIA Investigation and Report Preparation

The Project Proponent shall ensure that the EIA investigation properly addresses all adverse impacts and is undertaken in accordance with the approved TOR. The EIA investigation shall consider all biological, physical, social, economic, health, cultural and visual components of the environment, together with all pertinent legal matters relating to the environment (including land use, resources use, and ownership of and rights to land and other resources) that may be affected by the Project during all project phases, including pre-construction, construction, operation, decommissioning, closure, and post-closure; and shall identify and assess all adverse impacts and risks for environment, social and, if relevant, health that potentially could arise from the Project.

The *EIA Procedures* does not address the social impacts of Involuntary Resettlement or which relate to Indigenous People. Separate procedures shall be issued by responsible ministries, and in the absence of such procedures all such Projects shall adhere to international practice on Involuntary Resettlement and Indigenous People (IPs).

The Project Proponent is obliged to use, comply with and refer to applicable national standards, international standards adopted by the Government and/or the MOECAF, or, in the absence of relevant national or adopted international standards, such standards as may be agreed with the MOECAF.

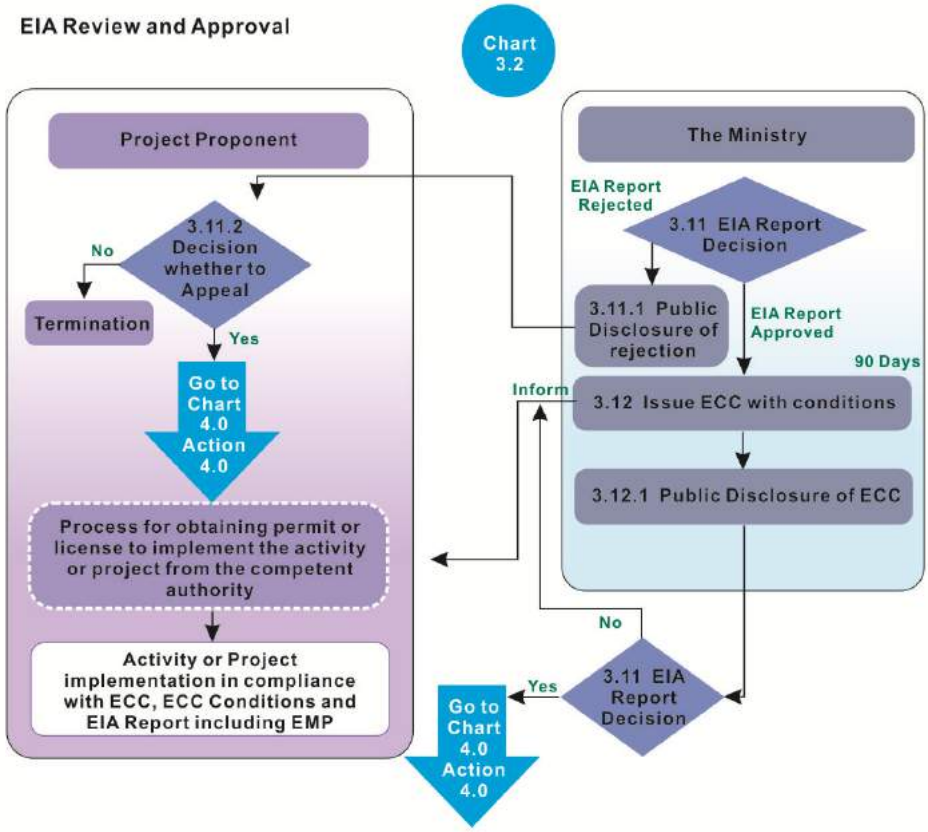
The EIA Report shall consider the views, concerns, and perceptions of stakeholders, communities and individuals that could be affected by the Project or who otherwise have an interest in the Project. The EIA should include the results of public consultations and negotiations with the affected populations on the environmental and social issues. Public concerns should also be taken into account in assessing impacts, designing mitigation measures, and selecting monitoring parameters. After completing all investigations and public consultation and participation processes required for EIA Type Projects, the Project Proponent shall submit the EIA Report to the MOECAF in both digital and hard copy, together with the required service fee.

The MOECAF shall within 10 days after submission disclose the EIA Report to civil society, PAPs, concerned government organisations, and other interested stakeholders. The MOECAF shall submit the EIA Report to the EIA Report Review Body for comment and recommendations and also arrange for public consultation meetings at national and State / Regional / local levels where the Project Proponent shall present the EIA Report. All comments and recommendations received, including those of the EIA Report Review Board, will be collected and reviewed by the MOECAF prior to making a final decision on approval of the EIA Report.

The MOECAF shall deliver its final decision within 90 days of receipt of the EIA Report. All costs incurred in completing to the EIA Report disclosure

and review, including the public participation process, shall be borne by the Project Proponent. Upon completion of its review of the EIA Report, the MOECAF will issue an ECC or inform the Project Proponent of its decision to reject the EIA Report and publically disclose its decision. The proposed flow chart covering the EIA review process is shown in *Figure 2.6*.

Figure 2.6 EIA Review and Approval within the Myanmar EIA Process



Source: EIA Procedures (8th Draft) [1]

2.4 *INTERNATIONAL STANDARDS, GUIDELINES AND TREATIES/CONVENTIONS RELEVANT TO THE PROJECT*

In addition to national legislation, a range of international standards, including IFC Performance Standards (IFC PS) and the World Bank Guidelines, have been considered for the Project. Where possible, alignment with such standards have been applied which then may complement and reinforce national legislation with a view to allowing the Project to be conducted under international practice. The IFC PS and the World Bank Guidelines provide guidance on how to identify risks and impacts, and are designed to help avoid, mitigate, and manage risks and impacts as a way of doing business in a sustainable way, including stakeholder engagement and

(1) EIA Procedures (8th Draft) *Op. cit.*

disclosure obligations of the Project Proponent in relation to project-level activities [1] [2].

In the case of its direct investments (including project and corporate finance provided through financial intermediaries), the IFC PS require its clients to manage environmental and social risks and impacts so that development opportunities are enhanced.

The applicable guidelines and standards that the Project has aligned with where practical are as follows:

- IFC Performance Standards (IFC PS) (2012);
- World Bank Group (WBG) Environmental Health and Safety (EHS) General Guidelines (2007);
- WBG EHS Guidelines for Onshore Oil and Gas Development (2007); and
- Relevant international treaties to which Myanmar is a signatory, including those related to waste management, biodiversity conservation as well as labour and human rights conventions.

2.4.1 International Finance Corporation (IFC) Performance Standards (PS)

The IFC of the World Bank Group updated its Sustainability Framework in January 2012. This included revising the PS which replaced the previous safeguard policies and will be used to evaluate any project seeking funding through the IFC.

The IFC PS represent the 'policy framework' for the ESIA and sustainable social and environmental management for the Project, whereas the World Bank Group's 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. The relevant IFC PS are listed in *Table 2.2* and the General Guidelines and Onshore Oil and Gas Guidelines are detailed in *Table 2.3* and *Table 2.4*, respectively.

[1] IFC Performance Standards on Environmental and Social Sustainability, January 2012, International Finance Corporation, World Bank Group.

[2] Environmental, Health and Safety (EHS) Guidelines – General EHS Guidelines: Introduction, April 2007, International Finance Corporation, World Bank Group

Table 2.2 IFC Performance Standards (1)

Performance Standards	Objectives
Performance Standard 1 –Assessment and Management of Environmental and Social Risks and Impacts *Underscores the importance of managing social and environmental performance throughout the life of a project (any business activity that is subject to assessment and management).*	• *Impact identification and assessment.* To identify and assess social and environmental impacts, both adverse and beneficial, in the project's area of influence. • *Mitigation.* To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment. • *Stakeholder engagement.* To ensure that affected communities are appropriately engaged on issues that could potentially affect them. • *Effective management.* To promote improved social and environment performance of companies through the effective use of management systems.
Performance Standard 2 – Labour and Working Conditions *Recognises that the pursuit of economic growth through employment creation and income generation should be balanced with protection for basic rights of workers.*	• To promote fair treatment, non-discrimination and equal opportunity of workers, and compliance with national labour and employment laws. • To establish, maintain and improve the worker management relationship. • To promote compliance with national employment and labour laws. • To protect the workforce by addressing child labour and forced labour. • To promote safe and healthy working conditions, and to protect and promote the health of workers.
Performance Standard 3 - Resource Efficiency and Pollution Prevention *Recognises that increased industrial activity and urbanisation often generate increased levels of pollution to air, water, and land that may threaten people and the environment at the local, regional, and global level.*	• To avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities. • To promote more sustainable use of resources, including energy and water. • To reduce project –related GHG emissions.
Performance Standard 4 – Community Health, Safety and Security *Recognises that project activities, equipment, and infrastructure often bring benefits to communities including employment, services, and opportunities for economic development.*	• To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances. • To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimises risks to the Affected Communities.
Performance Standard 5 – Land Acquisition and Involuntary Resettlement *Outlines that involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss of assets or access to assets that leads to loss of income sources or means of livelihood) as a result of project-related land acquisition*	• To avoid, and when avoidance is not possible, minimise displacement by exploring alternative project designs. • To avoid forced eviction. • To anticipate and avoid, or where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation and the informed participation of those affected.

(1) IFC Performance Standards on Environmental and Social Sustainability, January 2012, International Finance Corporation, World Bank Group

Performance Standards	Objectives
	• To improve, or restore, the livelihoods and standards of living of displaced persons. • To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.
Performance Standard 6 – Biodiversity Conservation and Sustainable Management of Natural Resources *Recognises that protecting and conserving biodiversity—the variety of life in all its forms, including genetic, species and ecosystem diversity—and its ability to change and evolve, is fundamental to sustainable development*	• To protect and conserve biodiversity. • To maintain the benefits from ecosystem services. • To promote the sustainable management of living natural resources through the adoption of practices that integrated conservation needs and development priorities.
Performance Standard 7 – Indigenous Peoples *Recognises that Indigenous Peoples, as social groups with identities that are distinct from dominant groups in national societies, are often among the most marginalised and vulnerable segments of the population.*	• To ensure that the development process fosters full respect for the dignity, human rights, aspirations, cultures and natural resource-based livelihoods of Indigenous Peoples. • To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not feasible, to minimise, mitigate, or compensate for such impacts, and to provide opportunities for development benefits, in a culturally appropriate manner. • To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner. • To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the life of the project. • To ensure the Free, Prior and Informed Consent (FPIC) of the Affected Communities of the IPs when the circumstances described in this Performance Standard are present. • To respect and preserve the culture, knowledge and practices of Indigenous Peoples.
Performance Standard 8 – Cultural Heritage *Recognises the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities.*	• PS 8 aims to protect the irreplaceable cultural heritage and to guide clients on protecting cultural heritage in the course of their business operations. In addition, the requirements of this PS on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity. PS 8 recognises the importance of cultural heritage with an objective to: • Protect cultural heritage from the adverse impacts of project activities and support its preservation; and • Promote the equitable sharing of benefits from the use of cultural heritage in business activities. • The PS requires the project proponent to comply with relevant national law on the protection of cultural heritage, including national law implementing the host country's obligations under the Convention Concerning the Protection of the World Cultural and Natural Heritage and other relevant international law.

2.4.2 *International Finance Corporation (IFC)/World Bank Environmental, Health, and Safety (EHS) Guidelines*

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 and the contents are summarised in *Table 2.3* and *Table 2.4*. *Table 2.5* presents effluent and waste guideline values for onshore oil and gas development which may be considered to be adopted by the Project.

Application of the EHS Guidelines to existing facilities may involve the establishment of site-specific targets, with an appropriate timetable for achieving them. 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 an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account. The applicability of specific technical recommendations should be based on the professional opinion of qualified and experienced persons.

Where different standards are prescribed by the different agencies, the most stringent of the national and international standards have been considered for the Project:

"*When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.*"

Table 2.3 IFC/World Bank General EHS Guidelines [1]

Applicable Guideline
General Environmental Guidelines
1. Environment
1.1 Air Emissions and Ambient Air Quality
1.2 Energy Conservation
1.3 Wastewater and Ambient Water Quality
1.4 Water Conservation
1.5 Hazardous Materials Management
1.6 Waste Management
1.7 Noise
1.8 Contaminated Land
General Occupational Health and Safety Guidelines
2. Occupational Health and Safety
2.1 General Facility and Design and Operation
2.2 Communications and Training
2.3 Physical Hazards
2.4 Chemical Hazards
2.5 Biological Hazards
2.6 Radiological Hazards
2.7 Personal Protective Equipment (PPE)
2.8 Special Hazards Environments
2.9 Monitoring
General Community Health and Safety
3.1 Water Quality and Availability
3.2 Structural Safety and Project Infrastructure
3.3 Life and Fire Safety (L&FS)
3.4 Traffic Safety
3.5 Transport of Hazardous Materials
3.6 Disease Prevention
3.7 Emergency Preparedness and Response
General Construction and Demolition Guidelines
4.1 Environment
4.2 Occupational Health and Safety
4.3 Community Health and Safety

(1) Environmental, Health and Safety (EHS) Guidelines – General EHS Guidelines: Introduction, April 2007, International Finance Corporation, World Bank Group.

Table 2.4 IFC/World Bank EHS Guidelines for Onshore Oil and Gas Development [1]

Applicable Guideline	
1.0	**Industry-Specific Impacts and Management**
1.1	**Environment**
	- Air Emissions
	- Wastewaters
	- Waste Management
	- Hazardous Materials Management
	- Noise
	- Terrestrial Impacts and Project Footprint
	- Spills
	- Decommissioning-
1.2	**Occupational Health and Safety (OH&S)**
	- Fire and Explosion
	- Air Quality
	- Hazardous Materials
	- Transportation
	- Well Blowouts
	- Emergency Preparedness and Response-
1.3	**Community Health and Safety**
	- Physical Hazards
	- Hydrogen Sulfide
	- Security
2.0	**Performance Indicators and Monitoring**
2.1	**Environment**
	- Emission and Effluent Guidelines
	- Environmental Monitoring
2.2	**Occupational Health and Safety (OH&S)**
	- OH&S Guidelines
	- Accident and Fatality Rates
	- OH&S Monitoring

(1) Environmental, Health and Safety Guidelines for Onshore Oil and Gas Development, April 2007, International Finance Corporation, World Bank Group.

Table 2.5 Effluent and Waste Guideline Values for Onshore Oil and Gas Development

Parameter	Guideline Value
Produced Water	For discharge to surface waters or to land: • Total hydrocarbon content: 10 mg/L • pH: 6 - 9 • BOD: 25 mg/L • COD: 125 mg/L • TSS: 35 mg/L • Phenols: 0.5 mg/L • Sulfides: 1 mg/L • Heavy metals (total) [a]: 5 mg/L • Chlorides: 600 mg/l (average), 1200 mg/L (maximum)
Hydrotest water	For discharge to surface waters or to land, see parameters for produced water above.
Completion and well work- over fluids	For discharge to surface waters or to land: : • Total hydrocarbon content: 10 mg/L. • pH: 6 – 9
Stormwater drainage	Stormwater runoff should be treated through an oil/water separation system able to achieve oil & grease concentration of 10 mg/L.
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
Sewage	Treatment as per guidance in the General EHS Guidelines, including discharge requirements.
Air Emissions	Emission concentrations as per General EHS Guidelines, and: • H_2S: 5 mg/Nm^3

Notes:

a Heavy metals include: Arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, vanadium, and zinc.

2.4.3 International Conventions

Myanmar as a State Party has signed and ratified various international conventions, laws and treaties which are now an obligation for the nation. The related environmental and social conventions are listed below.

Environmental Conventions

The United Nations Convention on Biodiversity 1992

This Convention seeks to conserve biodiversity and promote its sustainable use. It requires the identification and monitoring of the biodiversity in an area and adopting the necessary conservation measure. Myanmar became party to this Convention in 1994.

The Basel Convention 1989

This was developed under the auspices of the United Nations Environmental Programme (UNEP) in response to the growing worldwide awareness of the problem of international traffic in hazardous waste. The *Basel Convention 1989* is the first and foremost global environmental treaty that strictly

regulates the trans-boundary movement of hazardous wastes. It obligates parties to ensure environmentally sound management, especially during the disposal process.

The objectives of the Convention are to:

- Ensure that waste is disposed of as near as possible to the place or source of its generation;
- Reduce trans-boundary waste and where it cannot be avoided, to be disposed of in an environmentally sound and efficient manner; and
- Provide assistance to developing countries in the management of hazardous waste and the generation.

Labour and Human Rights Conventions

Myanmar as a State party has signed and ratified various international conventions, laws and treaties which are now an obligation for the nation. Below mentioned labour conventions provide a comprehensive framework to fight injustice with the blue collar workforce through preventive measures, law enforcement and international cooperation. Also by agreeing to the land and agriculture related conventions the country is promising its people of their right on the land and to practice agriculture on it.

Table 2.6 Labour, Land and Human Rights Conventions

Convention Type	Name of the Convention	Dated
Labour Conventions	Hours of Work (Industry) Convention, 1919	14 Jul 1921
	Unemployment Convention, 1919	14 Jul 1921
	Night Work of Young Persons (Industry) Convention, 1919	14 Jul 1921
	Right of Association (Agriculture) Convention, 1921	11 May 1923
	Weekly Rest (Industry) Convention, 1921	11 May 1923
	Minimum Age (Trimmers and Stokers) Convention, 1921	20 Nov 1922
	Medical Examination of Young Persons (Sea) Convention, 1921	20 Nov 1922
	Workmen's Compensation (Accidents) Convention, 1925	16 Feb 1956
	Workmen's Compensation (Occupational Diseases) Convention, 1925	30 Sep 1927
	Equality of Treatment (Accident Compensation) Convention, 1925	30 Sep 1927
	Inspection of Emigrants Convention, 1926	14 Jan 1928
	Seamen's Articles of Agreement Convention, 1926	31 Oct 1932
	Minimum Wage-Fixing Machinery Convention, 1928	21 May 1954
	Marking of Weight (Packages Transported by Vessels) Convention, 1929	07 Sep 1931
	Workmen's Compensation (Occupational Diseases) Convention (Revised), 1934	17 May 1957
	Holidays with Pay Convention, 1936	21 May 1954
	Convention concerning Statistics of Wages and Hours of Work, 1938 Excluding Parts III and IV	24 Nov 1961
	the New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards	15th July 2013
	Forced Labour Convention, 1930	04 Mar 1955

Convention Type	Name of the Convention	Dated
	Freedom of Association and Protection of the Right to Organise Convention, 1948	04 Mar 1955
Land and Agriculture Conventions	Constitution of the Food and Agriculture Organization	
	Agreement on Agriculture	
	Agreement establishing the International Fund for Agricultural Development	
Human rights Treaties	Convention on the Elimination of All Forms of Discrimination against Women	22 July 1997
	United Nations Convention against Transnational Organized Crime	30 March 2004
	Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations Convention against Transnational Organized Crime Preamble, supplementing the United Nations Convention against Transnational Organized Crime	30 March 2004
	Protocol against the Smuggling of Migrants by Land, Sea and Air, supplementing the United Nations Convention against Transnational Organized Crime	30 March 2004
	Convention for the Suppression of the Traffic in Persons and of the Exploitation of the Prostitution of Others	14 Mar 1956
	Convention on the Rights of the Child	15 Jul 1991
	Freedom of Association and Protection of the Right to Organise Convention	4 Mar 1955
	Convention concerning Forced or Compulsory Labour	4 Mar 1955
	Convention on the Prevention and Punishment of the Crime of Genocide	14 Mar 1956
	Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field	25 Aug 1992
	Geneva Convention for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea	25 Aug 1992
	Geneva Convention relative to the Treatment of Prisoners of War	25 Aug 1992
	International Convention for the Suppression of Terrorist Bombing	12 Nov 2001
	International Convention for the Suppression of the Financing of Terrorism	12 Nov 2001
	International Convention for the Suppression of Unlawful Seizure of Aircraft	22 May 1996
	Convention on the Privileges and Immunities of the United Nations	25 Jan 1955

The significance of confirming to the international criminal court is an essential step taken by the country towards universal justice. In a way it has signed in to ensure that no ruler, State or army is an exception to abuse human rights with impunity. Binding to this humanitarian law prohibits Myanmar from torture and other forms of ill treatment to anyone living in the country. The legal principles within the definition of torture have been recognized in previous international treaties, including Geneva Convention. It is mandatory to adopt necessary and corresponding national legislations in conformity with this treaty for Myanmar as a signatory.

3 PROJECT DESCRIPTION AND ALTERNATIVE SELECTION

This section provides the detailed descriptions of the proposed onshore seismic survey and well workover activities to be conducted across Block IOR-6. Information provided in this section is based on those made available during preparation of this ESIA Report.

3.1 PROJECT BACKGROUND

Block IOR-6 includes the Myanaung oil field which was discovered in 1964 and consisting of approximately 172 wells. The oil-in-place is estimated by MOGE at 77 MMbbls, of which about 23 MMbbls have been produced. The field, a 6 km by 2 km complex faulted anticline, also includes gas caps which have produced approximately 49 Bcf. Production peaked at 9,200 bopd in 1969, and only 15 wells are now producing ~37 bopd and 0.11 MMscfd gas. Water flooding is indicated as "initiated" by MOGE, however, the present status is unknown. The pressure regime is depleted in the oil-bearing reservoirs and the salinity of the formation waters is also unknown. The deeper potential of the field does not appear to have been assessed by drilling.

Under the IPR Contract, MPRL E&P will be undertaking activities to develop appropriate field redevelopment plans consisting of pilot programmes that will include enhanced oil recovery, production acceleration and further exploration drilling activities. In order to inform the field redevelopment plan, it is necessary to undertake seismic surveys within the block to acquire data on the damaged reservoir zone as well as for evaluating the feasibility of restoring reservoir pressure. In addition, well workover activities are required to improve oil production of existing wells within the block.

3.2 PROJECT DESCRIPTION OF SEISMIC SURVEY

3.2.1 Proposed Location

Block IOR-6 is located in the Hinthada District of the Ayeyarwady Region of Myanmar. It is on the western bank of the Ayeyarwady River, about 60 km south of Pyay City of the Bago Region and 271 km north northwest of Yangon. The block covers an area of 116.55 km^2, including the Myanaung field, and consists almost entirely of cultivated land. The Block location is presented in *Figure 1.1* with coordinates detailed in *Table 3.1.* The proposed 3D seismic area, which covers an area of 110 km^2, is illustrated in *Figure 3.1*.

Table 3.1 **Block IOR-6 Coordinates**

Point	Latitude	Longitude
A	18° 17' 0'	95° 18' 0'
B	18° 17' 0'	95° 20' 0'
C	18° 10' 0'	95° 23' 45'
D	18° 10' 0'	95° 18' 0'

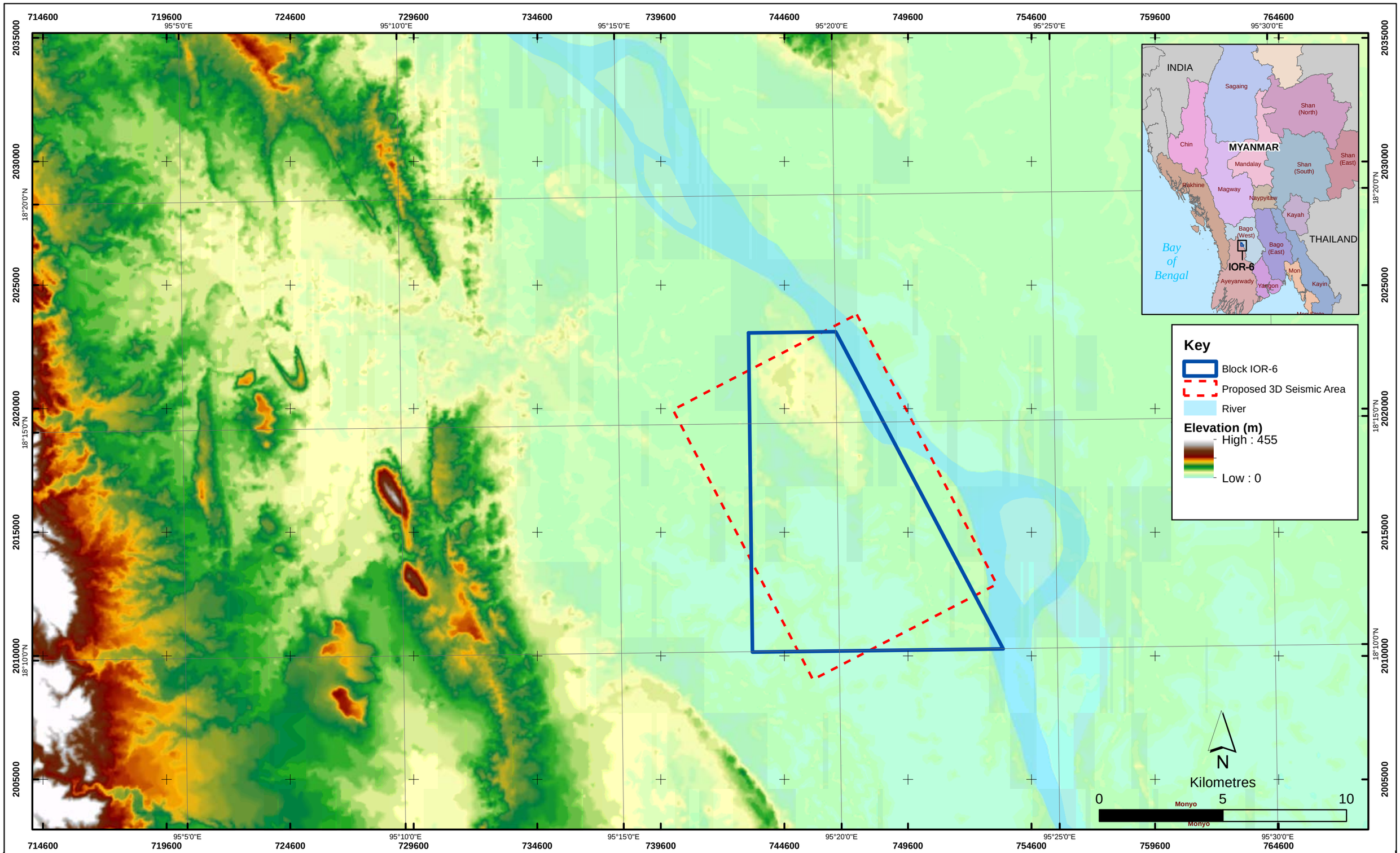


Figure 3.1

Indicative Proposed Seismic Survey Area of Block IOR-6

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Date: 24/3/2015

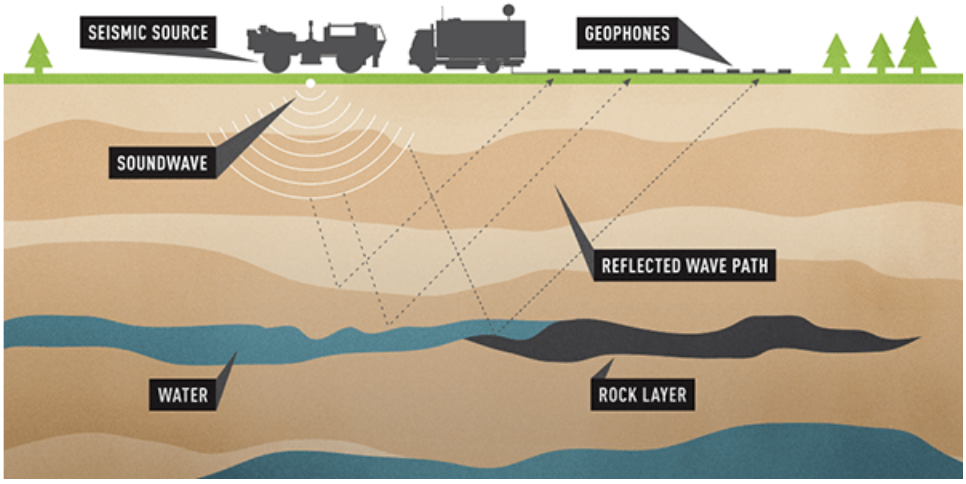
Environmental Resources Management

ERM

3.2.2 *General Introduction of Seismic Survey*

The seismic survey method uses high intensity, low frequency sound waves which are directed through layers of rock below the ground surface and reflected at boundaries between geological layers with different physical and chemical properties. The reflected sound waves can be processed to provide information about the structure and composition of geological formations below the surface. This is the basis for the use of high intensity seismic signals to identify prospects for hydrocarbon reservoirs, as well as any shallow drilling hazards. The schematic of the seismic survey network is presented in *Figure 3.2*.

Figure 3.2 ***Schematic of Onshore Seismic Surveys***



Seismic surveys are relatively intensive operations utilising large teams of personnel and a number of different machinery and equipment. Whilst being an intensive operation, seismic operations are a well understood practice used the world over and have been demonstrated to have minimal impacts on the surrounding environment and community.

Seismic surveys can typically be divided into the following phases:

- Land accessibility phase;
- Preparation / mobilisation phase;
- Seismic survey phase; and
- Close-out phase.

3.2.3 Programme of the Seismic Survey

The programme of the proposed seismic survey is presented in *Figure 3.3*. While no land accessibility phase is expected as presented in *Section 3.2.4* below, it is expected that activities associated with the seismic survey will commence in the 1st quarter of 2016 for the preparation / mobilisation phase and be completed in the 2nd quarter of 2016 for the close-out phase.

3.2.4 Land Accessibility Phase

During the land accessibility phase, ownership of land and properties that fall within the seismic lines will be determined. Appropriate engagement and procedures to obtain permission and notify owners to access land to conduct the survey will be performed. However, it is understood that no land acquisition is planned as all sites required by MPRL E&P will be in areas already occupied by MOGE. The current land uses of those areas are mainly farming areas.

3.2.5 Preparation / Mobilisation Phase

Preparation and mobilisation generally involves the construction of associated facilities and determination and development of access tracks for equipment, resources and workforce.

According to the preliminary programme, the camp set up will be undertaken in the first quarter of 2016 for the proposed seismic survey in Block IOR-6. However, information on the location, layout and facilities at the camp is not available during the preparation of this report.

Materials to be used for the site preparation and road construction (i.e. gravel, shale, sand, cement, wood etc.) are likely to be sourced via local suppliers from the Myanaung Township.

3.2.6 Seismic Survey Phase

The seismic survey is planned to be undertaken in the fourth quarter of 2015 for a period of about 150 days. It may cover up to the whole block, acquiring a total of 110 km^2 (fullfold) 3D seismic survey lines in approximately 11 km (North-South) x 10 (East-West) km grid as shown in *Figure 3.1*.

During the seismic survey phase, vegetation clearance and creation of access routes will be an on-going activity for placement of seismic sources and sensors. Existing access road / tracks will be used as far as possible. In case new road / track are needed, they will be designed and constructed with appropriate drainage facilities to avoid soil erosion.

Seismic and Acoustic Sources

Given the hilly nature of the seismic area within Block IOR-6, explosive seismic charges will be used as the acoustic source of the survey. The charge will be set off just below the ground surface to generate sound waves which

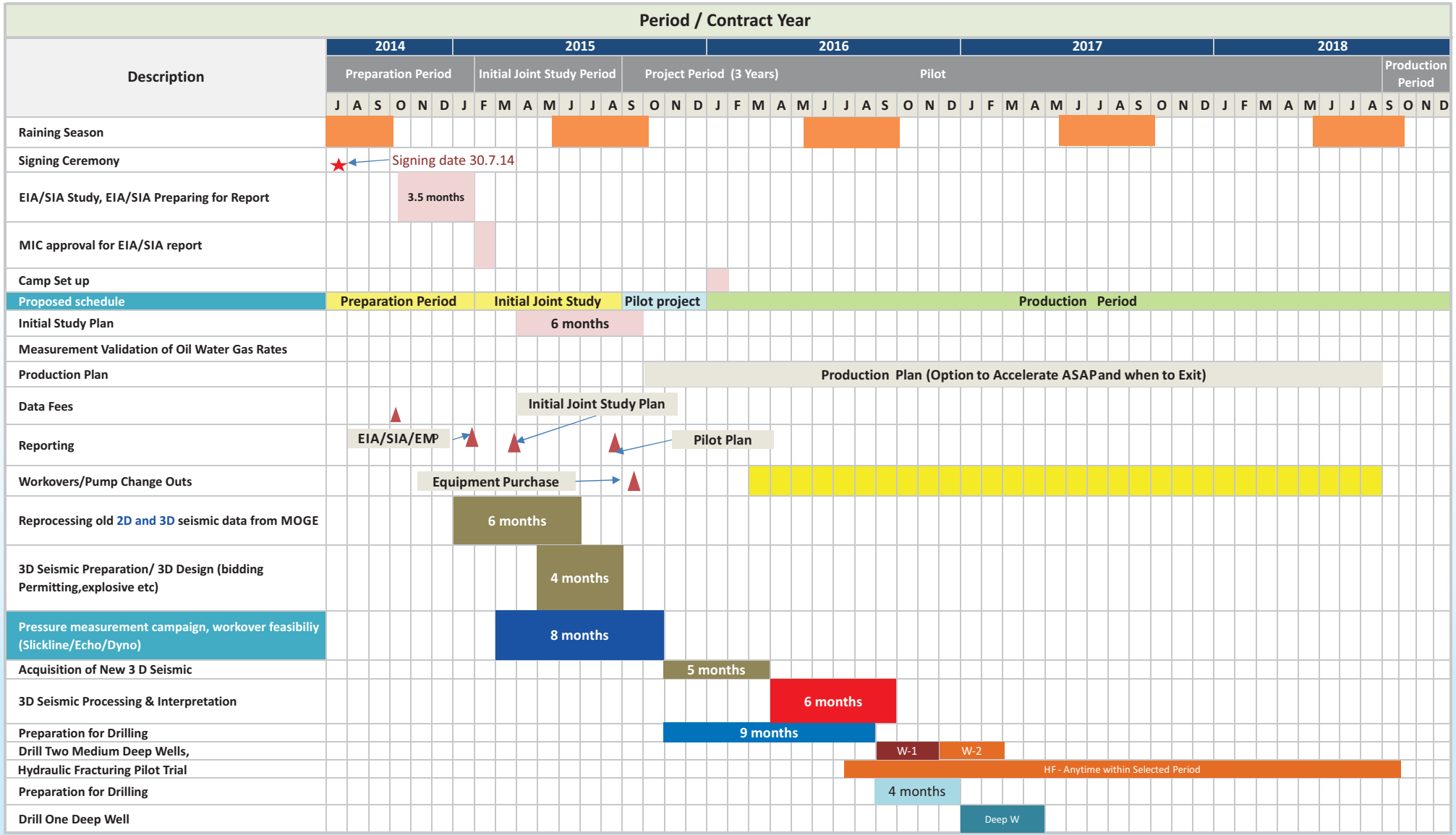


Figure 3.3

Overall Work Programme for Block IOR 6

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Environmental Resources Management

ERM

are bounced off underground rock formations and the waves that reflected back to the surface are captured by recording sensors for later analysis. Generally, drilling will be undertaken for the placement of dynamite inside the shot holes along the seismic lines. Shot holes, typically 9-10 m deep and 6-10 cm in diameter, will be drilled using surface water with man portable drills or vehicular mounted drills depending on the type of access available within the seismic area.

Layout parameters of the proposed seismic survey for Block IOR-6 are presented in *Figure 3.4*. For the current survey, there will be a total of 18 source lines within the seismic survey area, each of which measures 13 km in length. The total length of the source lines will thus be 234 km. The distance between adjacent source lines will be 500 m. There will be a total of 4,680 shot points (SPs) on the source lines, with 260 SPs on each of the 18 sources lines. The interval between adjacent SPs will be 50 m.

Seismic Sensors and Processing

Seismic processing requires the use of seismic sensors to acquire the data generated by the acoustic source. Generally seismic surveys use vector sensors, most notable using geophones. These sensors are used to record compressional and shear seismic data onshore. This can be used to interpret seismic information including magnitude, force, time, velocity and direction. As geophones are directional sensors and can distinguish between vertical and horizontal earth motions, they are used to record multicomponent seismic data [1]. A range of geophones and receiver lines will be deployed in an array along the seismic line in order to receive the seismic data. Sensors need to be planted to ensure good coupling with the earth, typical layout is for 6-12 geophones in a straight line (every 25-30 m). For the current survey, it is preferred to use wireless Geophone but conventional cable systems may also be used depending on the surface area restriction. The Geophone will be placed at receiver stations. A total of 9,207 receiver stations are planned for the current seismic survey. These receiver stations will be distributed along 27 receiver lines, with 341 stations on each line. The distance between adjacent receiver stations will be 25 m. Each receiver line will be ~8.5 km long and the separation distance will be 500 m between adjacent lines. The total length of the receiver lines is 230.2 km. Layout parameters of the proposed seismic survey for Block IOR-6 are presented in *Figure 3.4*.

[1] http://petrowiki.org/Seismic_data_acquisition_equipment, accessed 20 October 2014

Figure 3.4 Layout Parameters of the Seismic Surveys for Block IOR-6

3D GEOMETRY CALCULATION

Client : **MPRL E&P**
Prospect : IOR-6

# Boxes available	600
# channels available	3,600
60% array max.	2,160

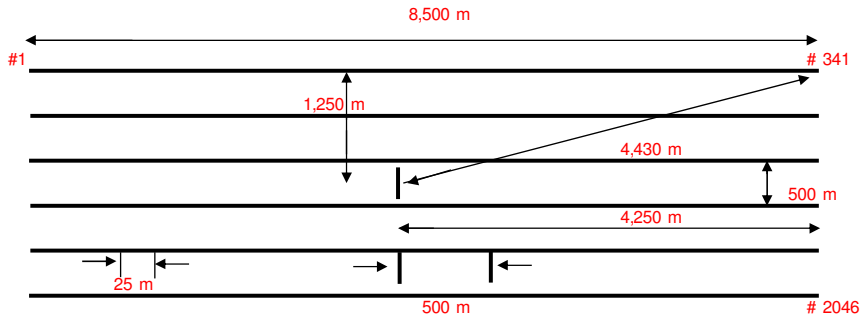
Number of Receiver Lines in Array	6
Number of Receiver Stations per line	341
Receiver Station Interval	25 m
Receiver Line Interval	500 m
Number of SP's in Array	10
SP Interval	50 m
Source Line Interval	500 m

Maximum Offset	4,430 m	**Bin Size**
Nominal Fold	25.58	12.5 m In-line
Total Live Receivers	2046	25 m X-line

Survey Area Size

Receiver Line Direction	8,500 m	S- Line Direction	13,000 m
# Receiver Lines	27	# Source Lines	18
Receivers per line	341	SP's per line	260
Receiver Stations	9,207	Total SP's	4,680
Receiver Line Length	230.2 km	Source Length	234 km
Total Survey Area	110.5 km^2	Total Line Length	464.2 km

Array Diagram of the above parameters



Labour and Accommodation Requirements

The Project will involve a total of 20 people initially and up to a maximum of 200 people during the seismic surveys. The ratio of skilled to unskilled labour is expected to be 1:5 to 1:10, and will be higher when seismic crew is in place. Labour is planning to be hired from local townships for routine work. The seismic crew will be housed in the camp. Water supply will be from existing river water while power supply will be from 11 kva power line.

Camp doctor will be available to handle minor injuries / incidents. Serious incidents and injuries will be handled at Myanaung Hospital.

Materials, Supplies & Logistics

Materials to be used for the site preparation and road construction (i.e. gravel, shale, sand, cement, wood etc.) are likely to be sourced via local suppliers from the Myanaung Township.

It is expected that high speed diesel of ~250-300 gallons per day will be used during the seismic survey. The fuel will be stored temporarily at MOGE storage area or in a new fuel station to be built for the Project. Fuel may also be obtained from local townships.

For munitions bunkers, they will be in existing military barracks or a new one will be built within the military compound.

For transportation, existing roads will be used where possible in addition to temporary to semi-permanent roads paved by laterite/gravel. New roads may be built and it is expected that these roads will have appropriate drainage. Transportation of labour will mainly use trucks, buses or cars. The existing Yangon Airport will be used to supply the Project.

3.2.7 Close-Out Phase

During the close-out phase, the demand for labour, equipment and services will decrease and eventually cease when the seismic survey is completed.

Informed decision-making for reinstatement of terrestrial habitat is highly dependent on the findings and recommendations from the ESIA Study. For cultivated land, it is expected that rehabilitation will be performed by the farmer / land owner with the crop compensation.

Transportation of equipment, materials, waste and workforce out of the survey area will take place during the close-out phase. A traffic management plan will be developed to minimise the impact associated with road traffic.

3.2.8 Project Alternatives for Seismic Survey

Consideration of Project options and alternatives is a fundamental requirement in the planning of any project as a means of avoiding or reducing adverse environmental and social impacts and maximising or enhancing project benefits. Several options that have been / are considering for the Project include the following:

- Access requirements: existing roads and tracks will be used as far as practicable to avoid the need to construct new facilities which would lead to a larger environmental footprint of the Project;

- Siting of facilities: existing facilities will be used as far as practicable to avoid unnecessary construction of new facilities and hence disturbance to the environmental and social sensitive receptors. For example, munitions bunkers in existing military barracks will be used. Should

new one be required, it will be built within the military compound which is an already developed area.

- Types of drilling fluid for drilling of shot holes: surface water will be used to reduce the volume and level of contamination in drilling wastes, when compared to the options of using synthetic or oil-based fluid;

- Types of drill: man portable drills with less environmental impacts will be used as far as possible instead of vehicular mounted drills depending on the type of access available within the seismic area; and

- Geophone system: it is preferred to use wireless Geophone which reduce the requirements for receiver line laying, and hence less disturbance to the environment. However, conventional cable systems may also be used depending on the surface area restriction.

Many of these options are of relevance to the assessment of potential impacts. Therefore, as the project options will not be finalised until the tendering process has been completed the relative impacts of each option will be considered where possible in the impact assessment. Where this is not possible a conservative approach will be taken to undertake the subsequent impact assessment as outlined in further in *Section 5*.

3.3 PROJECT DESCRIPTION OF WORKOVER ACTIVITIES

3.3.1 Workover Location

Workover activities will be undertaken at existing wells within Block IOR-6. These include producing, temporarily suspended, abandoned or water injection / disposal wells. During the preparation of this ESIA Report, the wells where workover activities will be undertaken were as yet not selected.

The locations of all 171 wells within Block IOR-6 are shown in *Figure 3.5*.

3.3.2 Workover Activities and Programme

When a well has been completed and has produced for some time, it must be monitored, maintained and also mechanically altered in response to changing conditions. When a well has been temporarily abandoned, well workovers may also be carried out to reopen them to restart production. Well workover, or interventions, are typically performed by inserting tools in wellbores to conduct remedial actions for the purpose of restoring, prolonging or enhancing the production of hydrocarbons. Routine maintenance of the well is not being considered as part of the workover activities.

The following workover activities will be undertaken for the selected wells within Block IOR-6:

- Well Deepening;

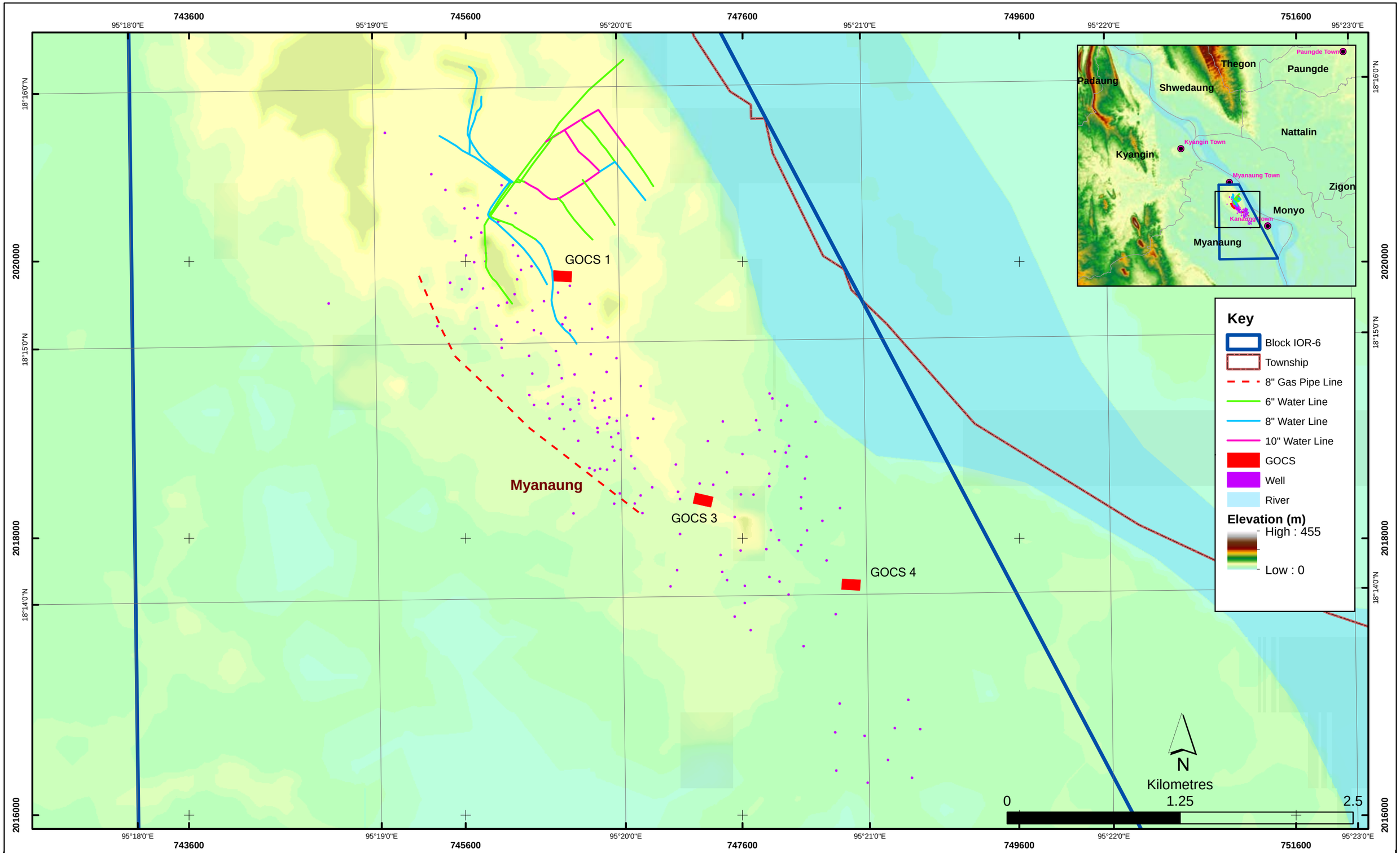


Figure 3.5

Locations of Wells and GOCS within Block IOR-6

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- Pump servicing;
- Swabbing and bailing;
- Zone isolation;
- Re-perforations; and,
- Improvement of wellheads.

As a pre-requisite for carrying out the workover activities, there will be a requirement to access the wells using drilling equipment. For wells that are temporarily suspended, drilling will include removal of the cement plug on the well with debris removed by scrapping and bailing. On penetration of the well, first operation will include pressure testing and temperature measurements. As the drill passes down the well, risk will include drilling through corroded casings into new formations. Drilling will require use and disposal of cuttings and drilling fluids.

The above activities are scheduled to be undertaken from October 2015 to October 2018. Brief descriptions of the above activities are provided in the following sections. It should be noted that details on plant inventory and plant programme are not available during the preparation of this ESIA Repot and thus not presented below.

Deepening

The primary objective of well deepening is to explore opportunity of producing additional oil at deeper depth from the existing wells. The following procedures will generally be adopted for well deepening:

1. Pressure test to all squeezed zones until the test results sound.
2. Drill cement collar and deepen the well to a certain depth below shoe with water based mud (WMB) and then KCL polymer mud. WBM will be recycled as far as possible for the deepening of another well.
3. After reaching objective depth, wireline logging will be conducted and subsequently slotted liner will be set for production testing.

Typical environmental issues related to well deepening include the use, disposal and potential accidental spillage of drilling and waste fluids from the deepening operations.

Pump Servicing

Pump servicing should be conducted when the fluid level is high and the production is not satisfactory. The servicing will be undertaken by well serving truck and will include pumping checking, replacement and cleaning in order to achieve for higher production levels. It is also expected that the serviced pump will be quieter. However, pump servicing may lead to the

generation of paraffin from the well which will require to be disposed of properly.

Swabbing and Bailing

If the fluid level is found low and the well is producing less or not producing oil, swabbing and bailing will be considered to be undertaken to enhance oil production. Well servicing truck will be used for the swabbing and bailing operations.

Swabbing creates a path for the oil to travel into a production zone. It can clean the perforations and induce the formation fluid come into the hole. The swabbing tool assembly comprises a swab mandrel with a swab cup that extends off the mandrel. The swab mandrel is a steel rod that allow for a quick, easy movement of the swab cup out of the hole. This creates the vacuum that brings the well into production. Before swabbing, scraper will be used to remove scale, mud cake, cement sheath, embedded bullets and other foreign material from the inside of the casing wall to avoid blockage of the swab cup.

For bailing, bailer will be used to remove formation sand/rock and other such debris left over from the well in order to improve production.

Potential hazard associated with swabbing and bailing include the loss of well control during the operations.

Zone Isolation

Zone isolation will be undertaken for selected wells using production packers, service packers and bridge plug. Production packers are those that remain in the well during well production while service packers are used temporarily during well service activities such as cement squeezing, acidizing, fracturing and well testing. In wells with multiple reservoir zones, packers are used to isolate the perforations for each zone and isolate or temporarily abandon producing zones.

Re-perforations

Re-perforations is undertaken for better control of the well. Re-perforation creates a channel between the pay zone and the wellbore, causing oil and gas to flow to the wellbore easily. Before re-perforations are conducted, scrapping and bailing, and if necessary drilling, will be undertaken first to remove debris at the desired depth. During re-perforations, casing guns and charges will be used at the desired depth to create the perforations.

Improvement of Wellheads

Existing well heads will be improved via the following activities:

- The dug earth holes around the wellheads will be replaced by new cemented cellars in which leakage of oil to soil would be reduced;
- Tie backs to surface to provide additional pressure integrity;
- Checking tubing/casing strings for leaks and cementing as required to isolate oil leakage from the existing well;
- Fixing wellhead leaks; and
- General housekeeping around the well heads.

It is expected that the above activities would be beneficial to the environmental by reducing the potential of leakage as well as improving the general environment around the wellheads.

3.3.3 Waste Generation from Workover Activities

The type and amount of wastes that may be generated from the workover activities are estimated based on specific data available for similar operations at the Mann Oil Field and also general understanding of typical onshore oil and gas operations. The information is presented in *Table 3.2* below.

It is expected that a Waste Management Plan will be designed and implemented for Block IOR-6 to describe the appropriate means of managing the predicted waste streams in order to alleviate impacts to the environmental and social sensitive receptors.

Table 3.2 Expected Waste Inventory for Workover Activities

Waste Type	Source	Amount
Food Waste	Camp	20 L / day
Paper Waste (dry waste)	Camp	120 Kg / week
General Waste (leave , grass)	Workshop & GOCSs	150 Kg / week
Used Lubricating Oil	Vehicle	1 bbl / month
Rags	Petroleum equipment cleaning	1 bbl / for one processing
Oil and Grease Contaminated Waste	GOCS	1 bbl / month
Oily Waste water	Drainage from locations of steaming & cleaning of petroleum equipment	3 bbl / one processing
Black Water	Camp (toilet)	n.a.
Grey Water	Camp (kitchen, toilet)	n.a.
Workover Fluids which may contain weighted brines, acids, methanol and glycols, and other chemical systems.	Workover wells	n.a.
Drilling Mud (3.5 % KCl)	Well deepening	300 bbl / every well deepening
Sludge (formation sand/clay)	GOCS	10 m^3 / month

3.3.4 Project Alternatives for Workover Activities

Several options that have been / are considering for the workover activities include the following:

- Types of drilling fluid: WMB and KCL polymer mud will be used for the drilling operations to reduce the volume and level of contamination in drilling wastes, when compared to the option of using oil-based fluid; and

- Handling of used drilling fluids: WBM will be recycled, but not disposed of, as far as possible for the deepening of well to reduce the amount of water consumption and waste generation.

As for alternative options of seismic survey, the relative impacts of each option will be considered where possible as the option selected is yet to be finalised. Where this is not possible a conservative approach will be taken to undertaking the subsequent impact assessment as outlined in further in *Section 5*.

4 DESCRIPTION OF THE SURROUNDING ENVIRONMENT

This section provides information on the bio-physical and social baseline characteristics and conditions in the Project Area. The discussion is limited to the factors and environmental and social components that could have a direct impact on the Project, or which may be impacted by the Project. The baseline is presented as follows:

- Physical Environment;
- Biological Environment; and
- Socio-economic Environment.

4.1 SETTING THE STUDY LIMITS

For the purposes of defining the Project Area, environmental and social components within the entire Block IOR-6, where the proposed seismic survey and workover activities will be carried out, have been considered as appropriate. Other environmental and social resources / components located further away from the block have also been described where relevant to this ESIA.

4.2 OBJECTIVES AND METHODOLOGY

The objectives of the baseline review and data collection are as follows:

- To characterise the baseline environmental and social components of the Project Area which may potentially be affected by the Project activities;
- To provide baseline information for the assessment of potential impacts from the Project to the environmental and social components of the Project Area; and
- To provide baseline data before commencement of the Project which may be used for future monitoring of the Project impacts by comparing the baseline data within the impact monitoring (i.e. obtained during Project implementation) and post-project monitoring data (i.e. obtained after Project completion).

The information presented has been obtained through desktop research on secondary information and primary data collection through baseline field surveys, interviews and focus group discussions. Baseline field surveys were conducted in December 2014 (dry season) within Block IOR-6. Detailed methodologies of the baseline field surveys are presented in the relevant sections under which the baseline findings are discussed.

4.3 LITERATURE REVIEW

The information provided in this section is based on a desktop review of published information, supplemented with information collected from and provided by various stakeholders consulted as part of the Project, and through review of available MPRL E&P, ERM and REM in-house literature. It is important to note that literature on the physical and biological environment of Myanmar are both limited spatially and temporally, and are arguably outdated in many areas / disciplines.

4.3.1 Physical Environment

Project Area Setting

Block IOR-6 covers an area of 116.55 km^2 (*Figure 3.1*). Within the Block, there are a total of 14 producing wells, 86 temporarily shut wells and 82 permanently shut wells. Locations of these existing wells and GOCS (Gas and Oil Collecting Station) are shown in *Figure 3.5*. The existing GOCS is shown in *Figure 4.1*. According to the latest available information, the daily production rate from the block is currently 34 barrels. Produced water is generated from the GOCSs and well sites and the volumes are estimated to be 2,500 bwpd and 150 bwpd, respectively. The produced water is temporary stored in concrete cellular and then treated in the produced water treatment system to remove slug, oil and other contaminants (e.g. heavy metals, suspended solids, and salinity).

Details of current well production are summarized in *Table 4.1* below.

Table 4.1 Well Production in IOR 6 (Myanaung Field)

Parameters	Quantity
Producing Well	14
Temporarily Shut Well	86
Permanently Shut Well	82
Daily Production Rate	34 barrels

Apart from existing oil and gas operations, current land uses mainly included cultivated land.

Figure 4.1 ***Photo of Existing GOCS (Gas and Oil Collecting Station) within Block IOR-6 taken during the Site Visit as part of the Scoping Exercise in October 2014***

Geography

The main geographic features of Myanmar can be divided into four physiogeographic zones, characterized by elongated north-south trend regions (*Figure 4.2*). The four physiogeographic zones are:

- Rakhine Coastal Area
- Western Ranges (Rakhine Mountain Ranges)
- Central Lowlands
- Eastern Highlands

A major topographical feature of Myanmar is the Ayeyarwady River watershed. The Ayeyarwady Delta is considered very fertile and covers about 47,000 km^2. Hkakabo Razi, which is the highest peak in Southeast Asia at 5,881 m, is located in Myanmar. The Arakan Yoma range (a barrier between India and Myanmar) has peaks that range between 915 m and 1,525 m. Almost half of Myanmar is covered in forests that are comprised of teak, rubber, cinchona, acacia, bamboo, ironwood, mangrove, coconut and betel palm. The forests in the northern highlands are comprised of oak, pine and many varieties of rhododendron. There are many tropical fruits to be found as well, including citrus, bananas, mangoes and guavas in the coastal region.

Block IOR 6 is located within the Central Lowland which is a relatively low-lying terrain drained by the Ayeyarwady River and its major tributaries.

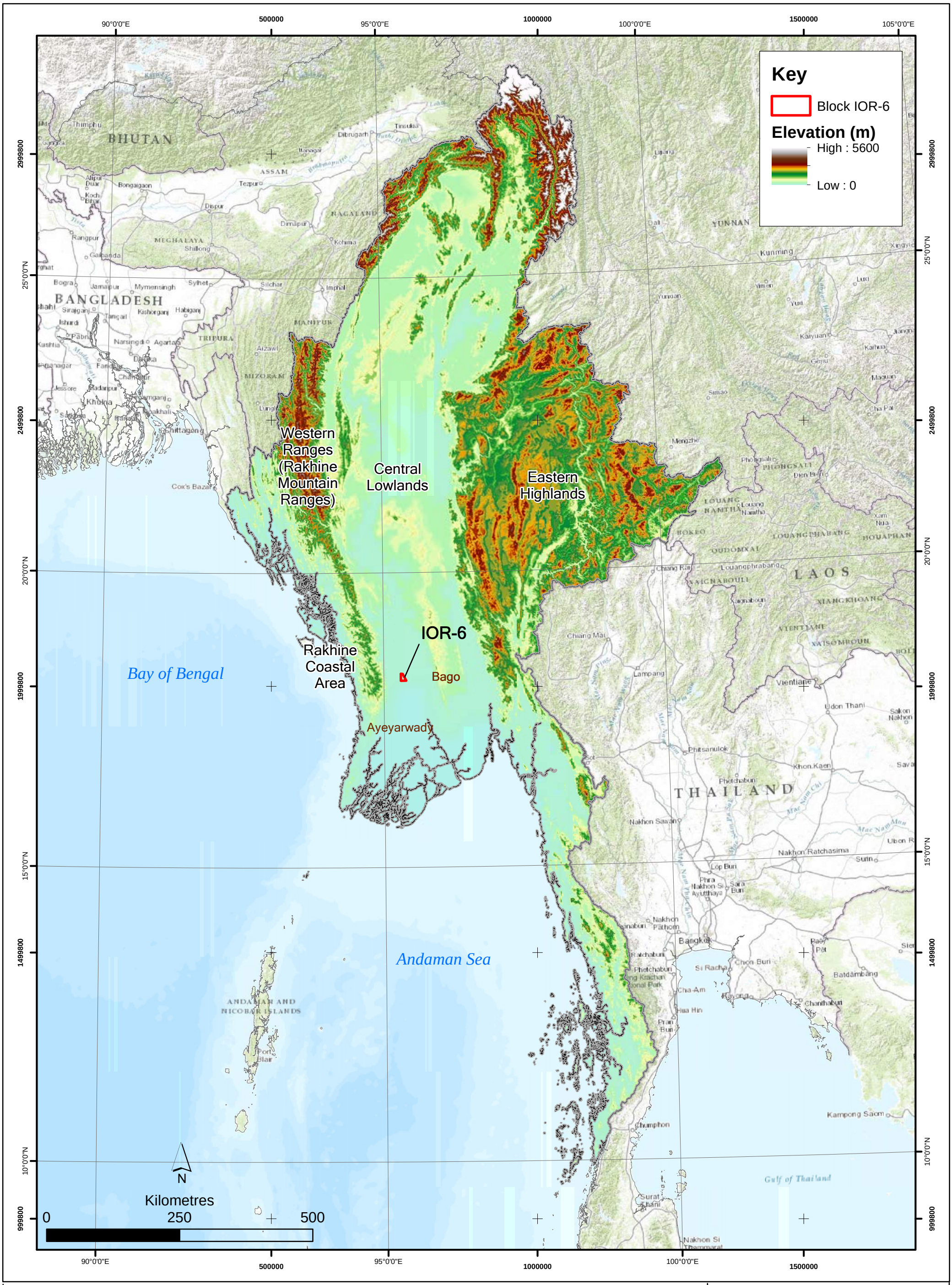

Figure 4.2

Myanmar's Geographic Zones

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Rolling hills, ridges and small mountains are present in some areas. The region is characterized by folded small mountain ranges.

Climate and Meteorology

Myanmar is characterised by a dominant tropical monsoon climate. Seasons can generally be classified as into a cool dry season from December to April and a hot rainy season from May through November which is driven by the rainy southwest monsoon [1]. The southern part of Myanmar is the first part affected by the southwest monsoon starting in May and the entire country is experiencing the rainy season by the beginning of June. Climate variability within the country is largely controlled by topography which affects exposure to the southwest monsoon.

Block IOR-6 is situated halfway between the two regional cities, Pyay and Hinthada. This region is being categorised as *Tropical Savanna Climate (Köppen climate classification Aw).* Temperature is hot throughout the year especially in the months before the monsoon from March to May when average maximum temperature has been reported to exceed 36 °C (97 °F) [2]. The winter months (December-February) are milder than the rest of the year. Heavy rain falls in the summer particularly in the month of July when 626 mm of rainfall has been recorded in the region [3].

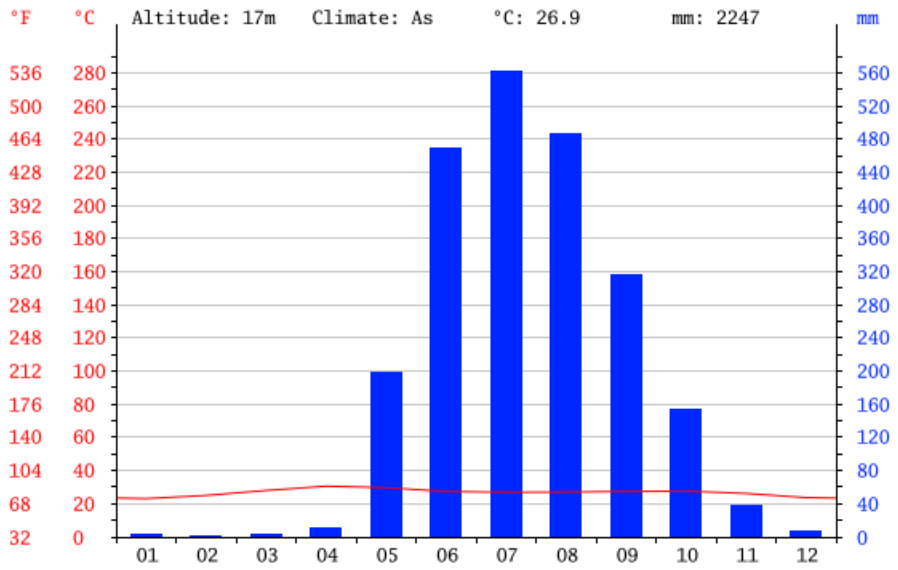
The average temperature and rainfall of the Hinthada District are presented in *Figures 4.3a to c*.

[1] Kye Baroang (2013) Background Paper No. 1 - Myanmar Bio-Physical Characterization: Summary of Findings and Issues to Explore.

[2] ftp://ftp.atdd.noaa.gov/pub/GCOS/WMO-Normals/RA-II/MM/48077.TXT, National Oceanic and Atmospheric Administration, accessed 21 Oct 2014

[3] ftp://ftp.atdd.noaa.gov/pub/GCOS/WMO-Normals/RA-II/MM/48077.TXT, National Oceanic and Atmospheric Administration, accessed 21 Oct 2014

Figure 4.3a *Average Monthly Temperature and Rainfall Chart of Hinthada, Myanmar (1982 – 2012) (Sources: http://en.climate-data.org/location/325/)*



Tropical Cyclones

A tropical cyclone is a tropical storm with rotating winds at speeds of greater than 74 miles (119 km) per hour. Myanmar is vulnerable to cyclones, which often originate in the Southern Andaman Sea and enter the Bay of Bengal. These cyclones can result in heavy rains, storms, and floods. There are two prominent cyclone seasons for the country, between April to May and October to December. Historically, cyclone-related disasters tend to occur every 3 to 4 years in this region and on average every ten years a major cyclone makes a landfall in Myanmar [1].

The Cyclone Mala which hit Myanmar in April 2006 has been reported to causing damage to infrastructure and crops in Hinthada and communication lines in Pyay had been lost (*Figure 4.4*) [2] .

[1] Asian Disaster Reduction Centre, 2003. Theilen-Willige B., (2009) Natural Hazard Assessment of SW Myanmar – A contribution of remote sensing and GIS methods to the detection of areas vulnerable to earthquakes and Tsunami Cyclone Flooding. Science of Tsunami Hazards., Vol. 28 No. 2, page 108

[2] http://www.ifrc.org/docs/appeals/07/mdrmm001fr.pdf

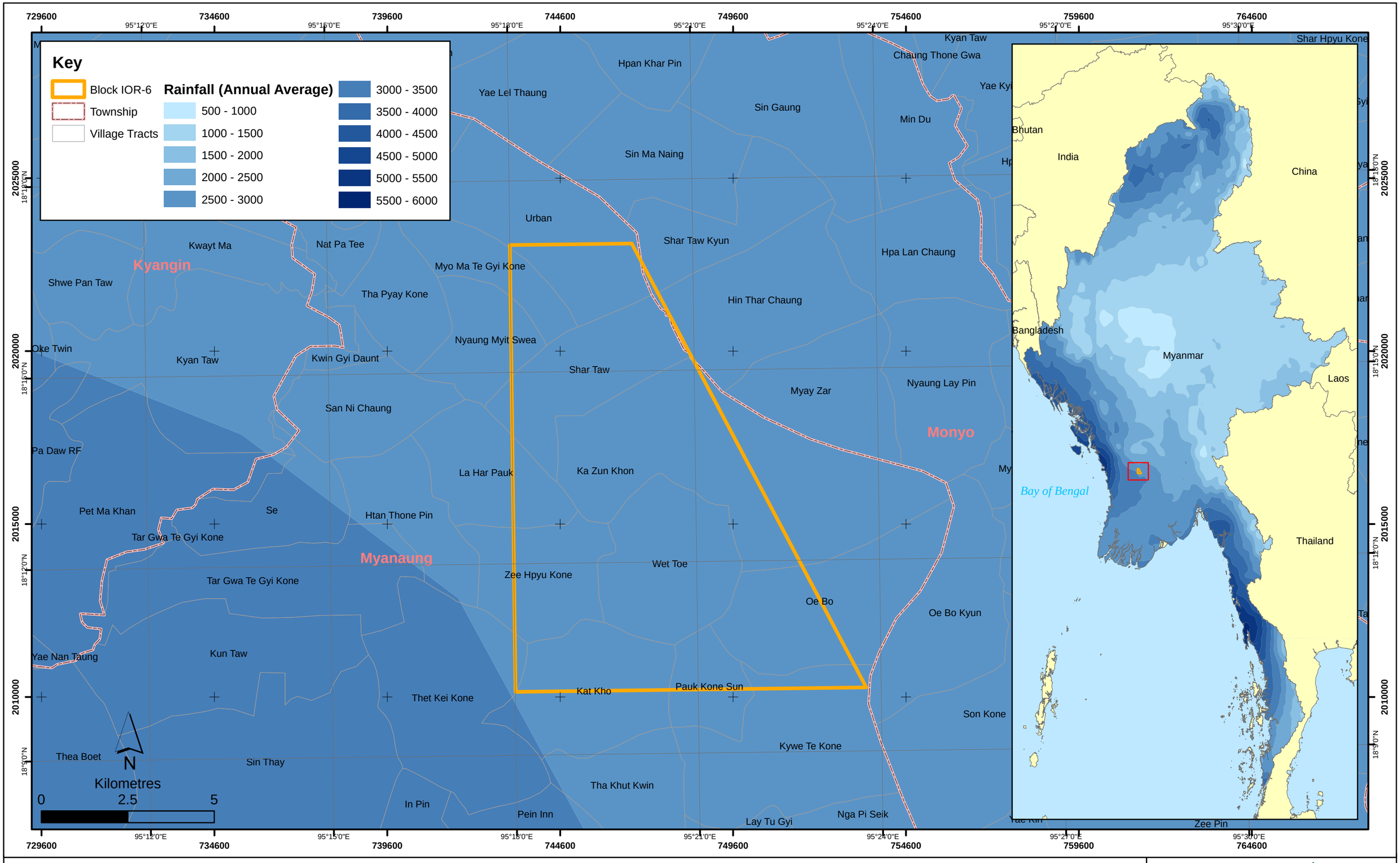


Figure 4.3b

Rainfall (Annual Average) of Block IOR-6

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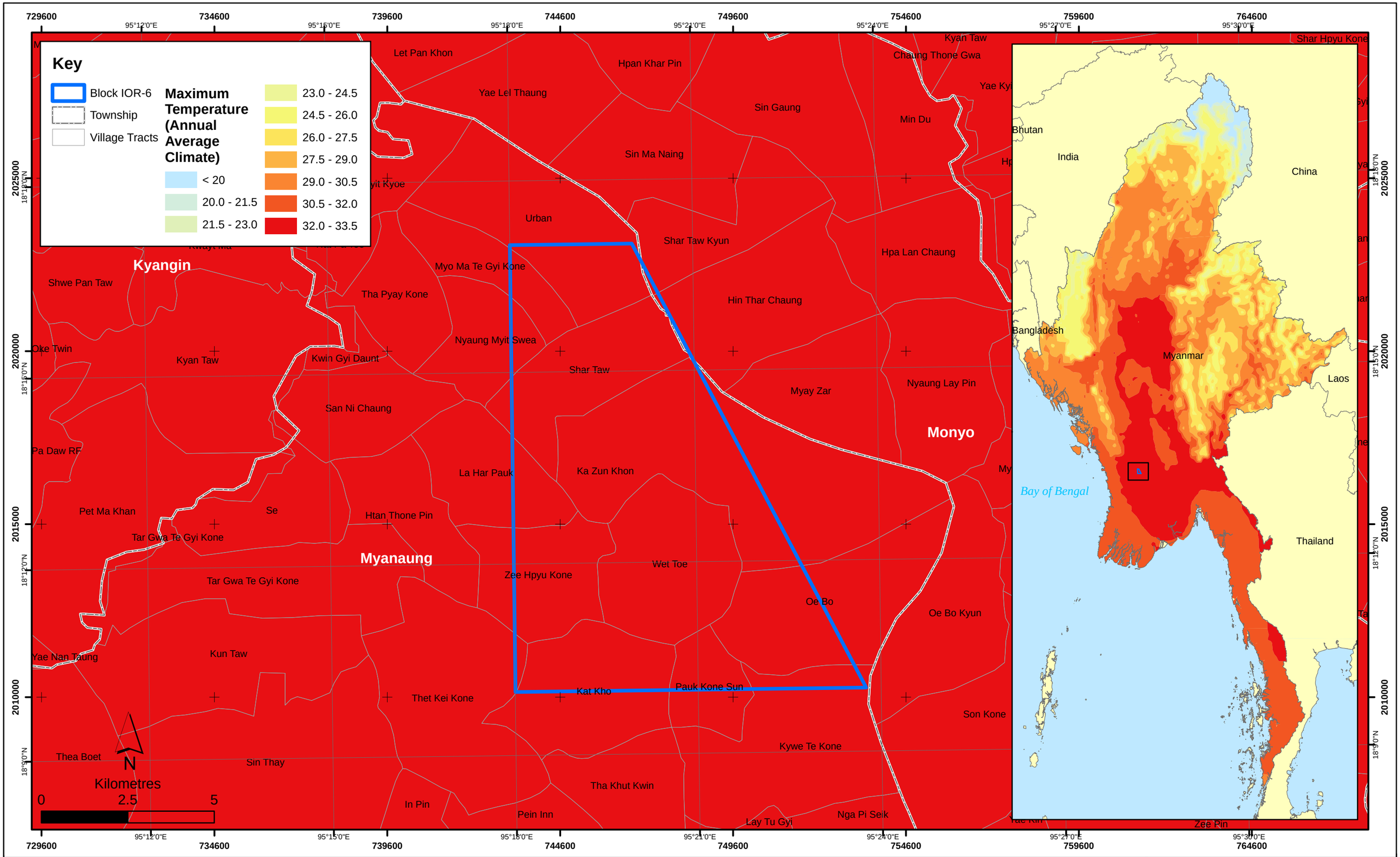

Figure 4.3c

Maximum Temperature (Annual Average Climate) of Block IOR-6

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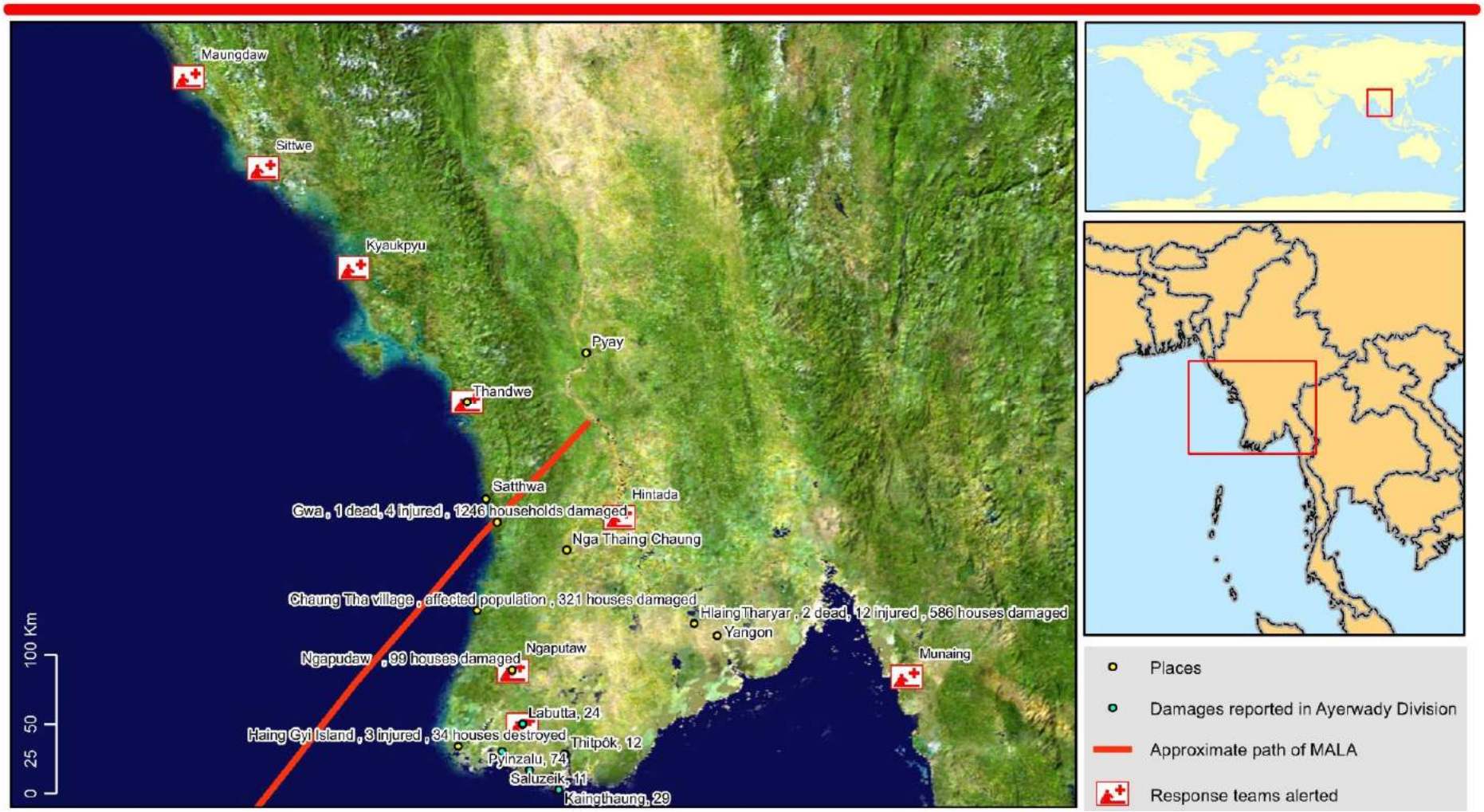
Figure 4.4 Track of Tropical Cyclone Mala (Sources: http://reliefweb.int/sites/reliefweb.int/files/resources/8E8AD333CBB3CC03C12571640036B100-ifrc_TC_mmr020506.pdf)



Climate Change Projections

Projected climate changes over Myanmar have been studied based on both General Circulation Model (GCMs) used in the Intergovernmental Panel on Climate Change (IPCC's) fourth assessment, and using dynamic downscaling with regional climate models forced by the GCMs (1).

Myanmar has been witnessing changing weather events in almost every year during the last two three decades. These include the onset, withdrawal, duration and intensity of monsoon, and the frequency of the monsoon depressions (2). The frequency of hot days and nights is expected to increase, while the frequency of cold days/nights will decrease.

Earthquakes

A review of available literature has shown that Myanmar is seismologically unstable and vulnerable to earthquakes (3). Historic records show that at least 15 major earthquakes with magnitudes M≥7.0 have occurred in Myanmar in the last hundred years (*Figure 4.5*).

Earthquakes occurred within the Ayeyarwady Delta in 1930 at Bago, in 1970 at Yangon and in 1975 at Pagan (4). The Sagaing earthquake of 16 July 1956 caused damages to religious edifices and buildings at Sagaing and about 40 lives were lost (5) .

Historical records of earthquakes are noted for the Pyay and Hinthada District.

Air Quality

Secondary data are not available on ambient air quality in the Project Area. The principal sources of emissions to the atmosphere in the immediate vicinity of the Project Area are likely to be from household fires for domestic purposes (i.e. heating and cooking) and exhaust emissions from road transportation and oil and gas activities.

Noise

Secondary data are not available on noise in the Project Area. However, the sources of noise pollution are likely to include the road traffic from the nearby main road and existing oil and gas operations.

(1) Intergovernmental Panel on Climate Change. IPCC Fourth Assessment Report (AR4), (2007), Climate Change: Synthesis Report

(2) Tun Lwin, Khin and Cho Cho Shein., 2006. Hydrology and Meteorology report of Myanmar.

(3) Theilen and Pararas-Carayannis (2009) Op cite

(4) Union of Myanmar (2009), Hazard Profile - Myanmar

(5) http://aeic.bmg.go.id/aeic/myanmar.html, accessed 10 July 2014

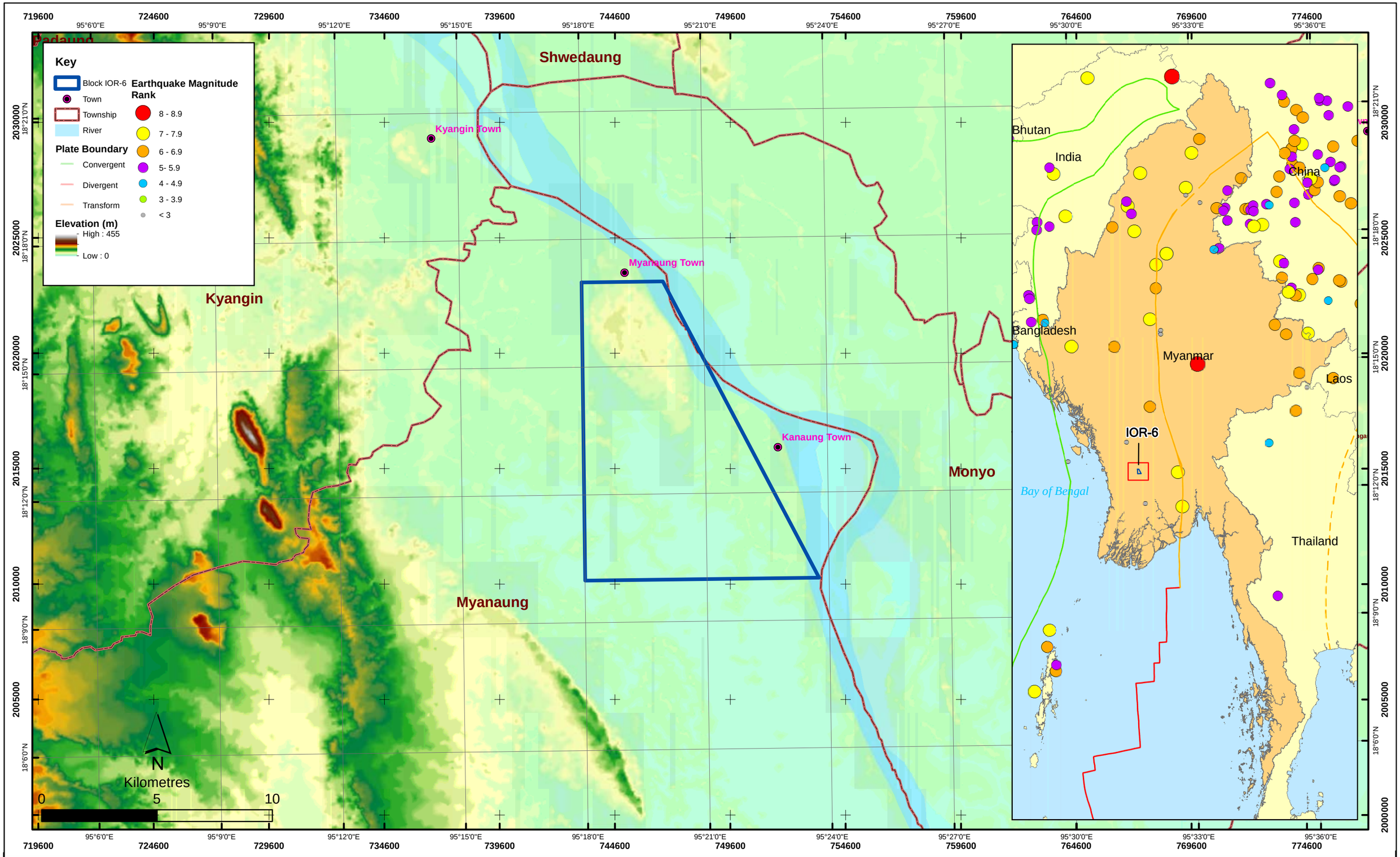


Figure 4.5

Earthquake Magnitude and Tectonic Plate Boundary in Myanmar

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Soil

The Land Use Division (LUD) of Myanmar Agricultural Service is responsible for carrying out soil surveys, producing soil maps and coordinating the research activities with related agencies for the introduction of soil conservation and land improvement practices. According to the soil analysis undertaken by LUD, Myanmar has altogether 24 different soil types which are related with adaptable crops. The Ayeyarwady Region, where Block IOR-6 is located, is being classified as gleysol soil type which is favourable for the cultivation of paddy, pulses, sesame, maize, sugarcane, vegetable, groundnut, cotton, jute, tobacco etc (*Figure 4.6*). High rates of soil erosion and reduced sediment delivery have contributed to a sedimentation problem throughout the Ayeyarwady River Basin. The sediment budget has broad effects upon several processes of soil erosion in the Ayeyarwady River Basin which are of serious concern. In addition, the problem of zinc deficiency is also reported to occur in Ayeyarwady Region which is often observed in rice growing area [(1)].

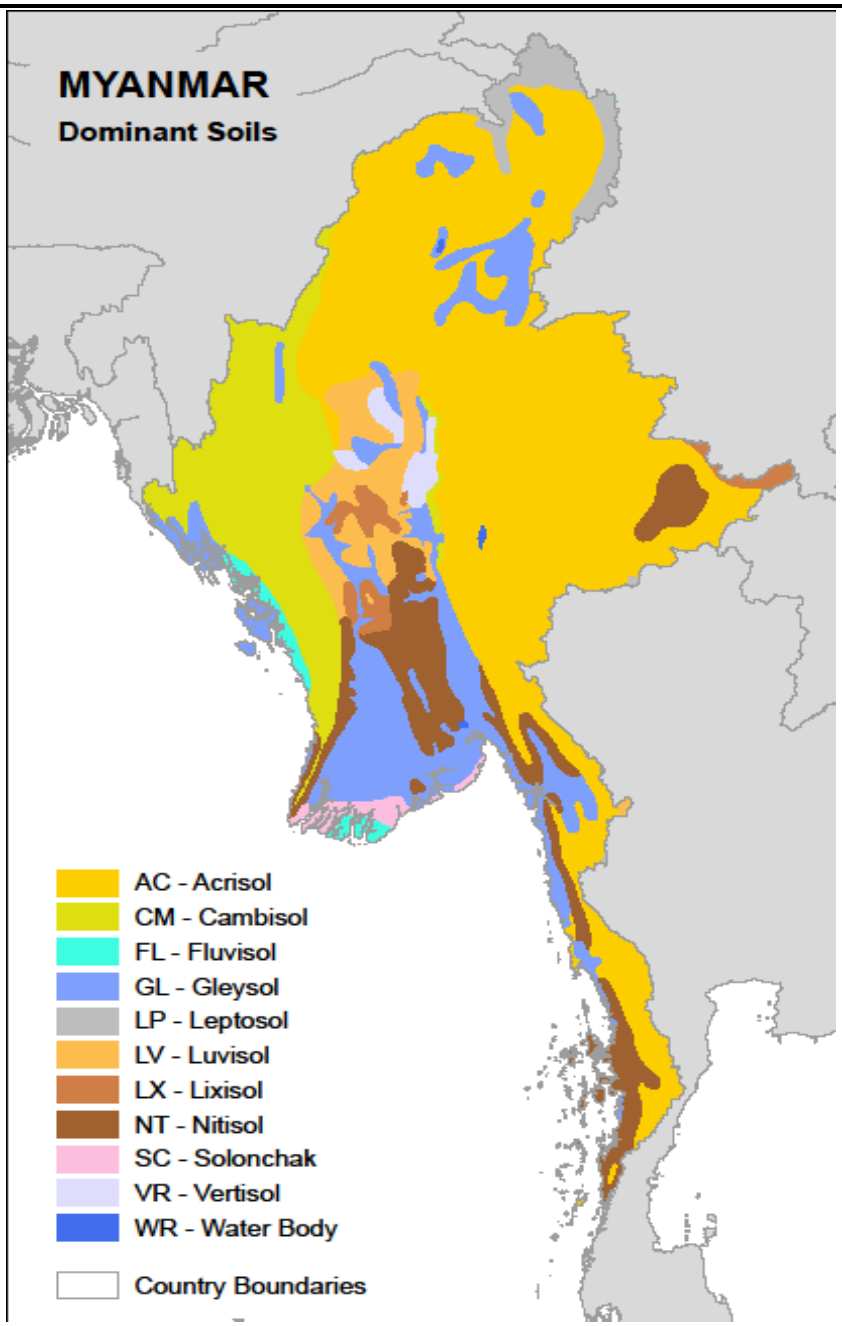
Surface Water Quality

The main source of surface water within Block IOR-6 is noted to be the Ayeyarwady River which is located on the eastern boundary of the block (*Figure 4.7*). The principal sources of pollution to the Ayeyarwady River are expected to be potential water contamination from agriculture inputs, boat vessel emissions and surface run-off. Agricultural inputs, such as chemical fertilizers and pesticides are increasingly distributed either partially or wholly by the private sector [(2)].

(1) http://www.fao.org/docrep/010/ag120e/AG120E15.htm

(2) Kan Zaw, Nu Nu Lwin, KhinThida Nyein, and Mya Thandar, 2011. Agricultural Transformation, Institutional Changes, and Rural Development in Ayeyarwady Delta. Economic Research Institute for Asean and East Asia.

Figure 4.6 Soil Types and Distribution in Myanmar



Source: Reliefweb International (2014) [1]

[1] http://reliefweb.int/sites/reliefweb.int/files/resources/329CF8B14D479D85852574560063A495-2-fao_NTR_mmr080527.pdf accessed, 14 June 2014.

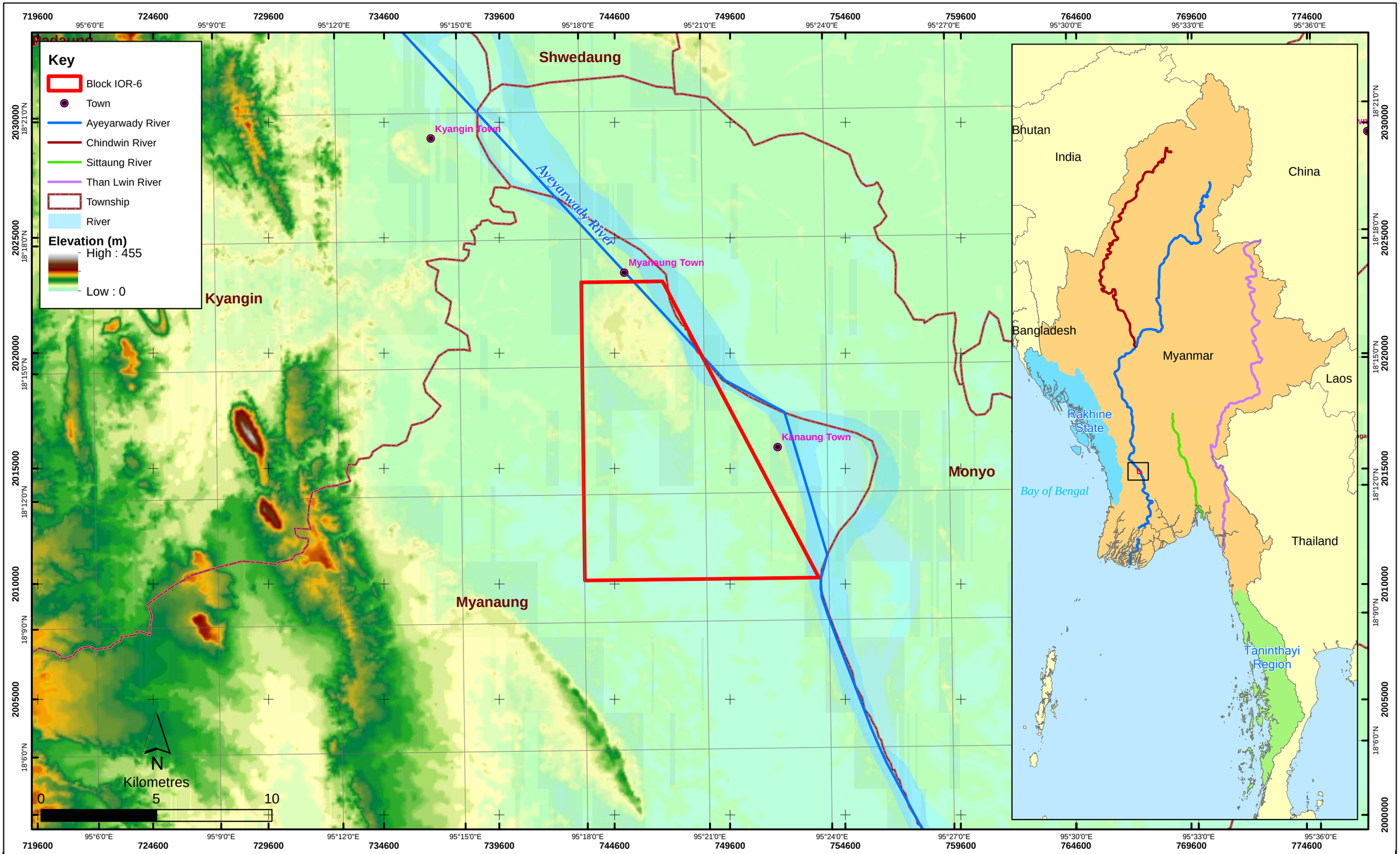


Figure 4.7

River Basin in Myanmar

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Groundwater Quality

In Myanmar groundwater resources have been estimated as 454 km^3/year; but a large part of this water (about 443 km^3/year) comprises the base flow of the rivers and is also accounted for as surface runoff [1]. It was estimated that 91% of the total water withdrawal in Myanmar comes from surface water and 9% from groundwater [2]. Currently there is no single institution that is responsible for the overall management of national water resources in the public and private sectors.

The area of Block IOR-6 is located within the Lower Ayeyarwady River Basin which has the highest groundwater potential in Myanmar (*Figure 4.8*). Groundwater in the region is dependent upon natural recharge from Ayeyarwady River. Villages within Block IOR-6 reported the use of groundwater from deep tube wells and hand dug wells as water supply. Study in the Ayeyarwady Division, which is adjacent to Block IOR-6 and also located within the Lower Ayeyarwady River Basin, has shown that arsenic contamination is a problem occurred in the groundwater of the basin [3]. It was observed that 66.6 % of the groundwater samples from wells have arsenic levels of >50 µg/L, which is much higher than the World Health Organization (WHO) guideline value in drinking water (10µg/L) [4].

4.3.2 Biological Environment

Habitat

Myanmar is well endowed with forests and other natural resources. Forests cover about 40% of the total land area. Forest exploitation is controlled by law but the government allows rural communities to use various forest products (except protected plants and animal species) [5]. However, it is noted that loss in forest area is reported to be an ongoing issue in the wider Bago Region due to change in land use [6].

Limited information is available for the habitat type within Block IOR-6. Based on preliminary review of aerial photos within the block and the initial site visit, almost the entire block is covered in cultivated land with areas of forest and stream or river, as well as developed areas (e.g. village) (*Figure 4.9*). These habitats have the potential to support fauna groups including mammals, birds, amphibians, reptiles, butterflies and fishes.

(1) FAO (2010), FAO's information system on water and agriculture, http://www.fao.org/nr/water/aquastat/countries_regions/myanmar/index.stm, accessed 19-06-2014

(2) FAO (2010), *Op cite*

(3) http://www.bioline.org.br/pdf?hn06020

(4) World Health Organization (2011) Guidelines for Drinking-water Quality. Fourth Edition.

(5) http://www.fao.org/docrep/005/ac648e/ac648e08.htm, accessed 21 Oct 2014

(6) http://rainforests.mongabay.com/20myanmar.htm

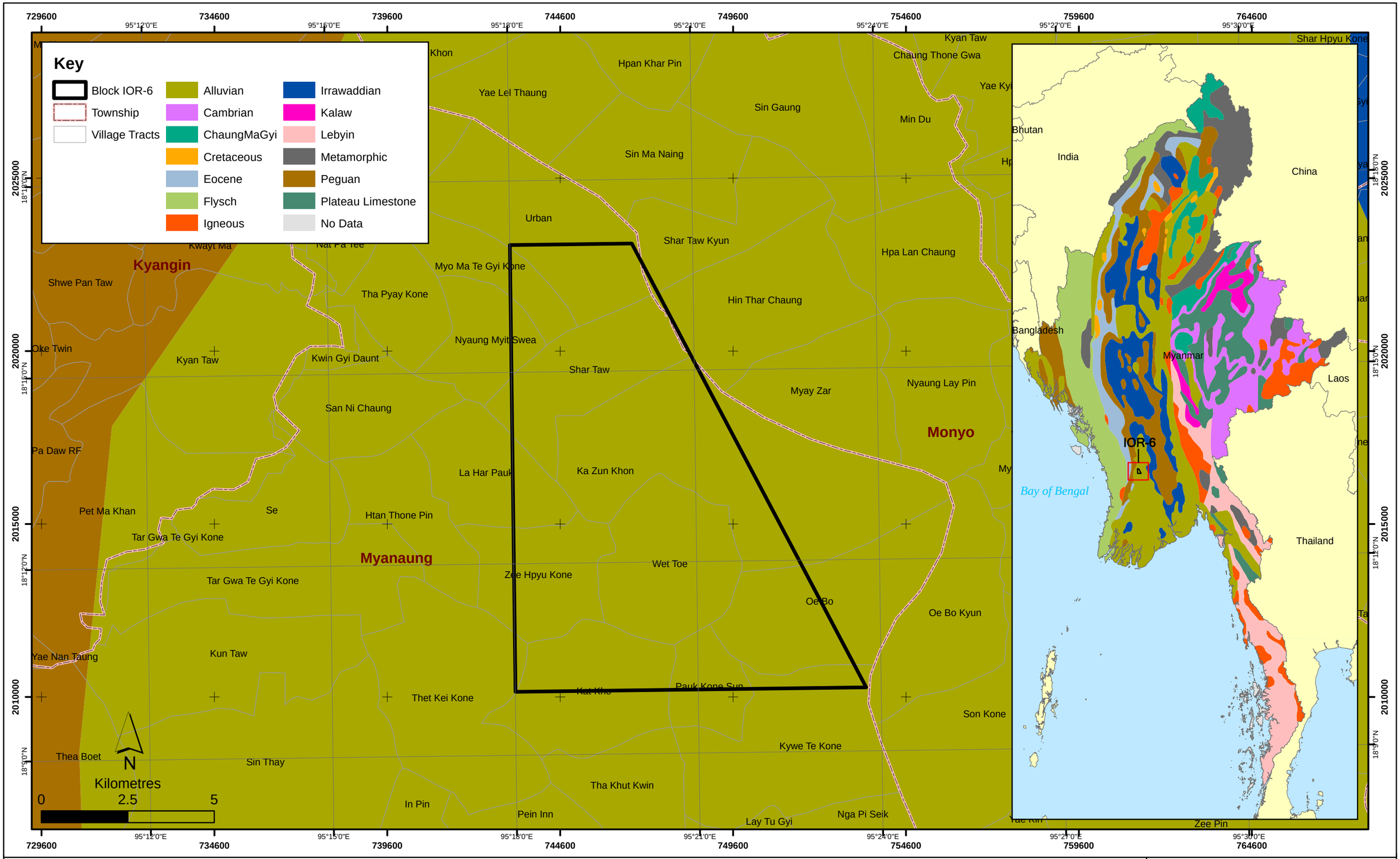

Figure 4.8

Types of Aquifer in Myanmar

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Date: 24/3/2015

Environmental Resources Management

ERM

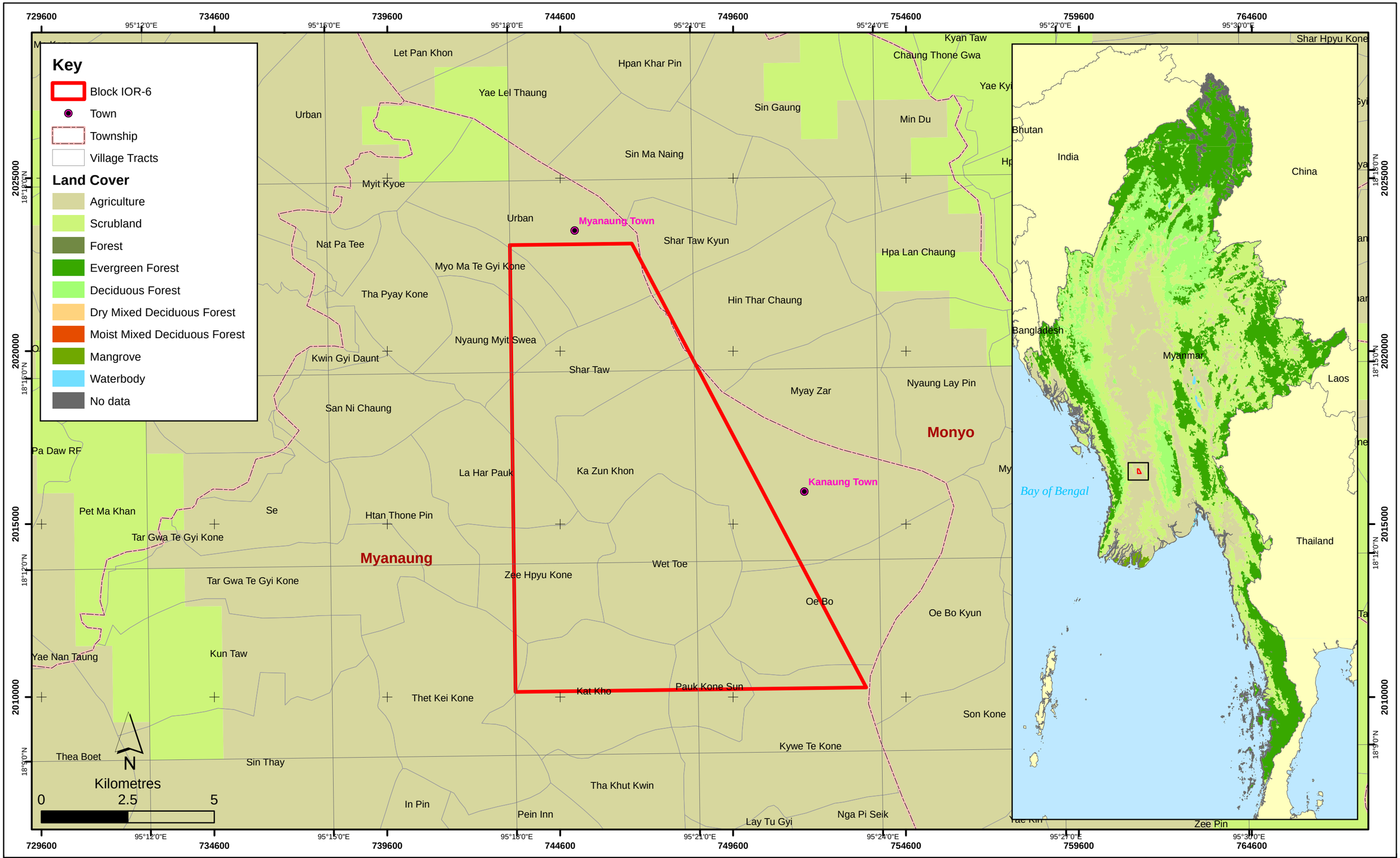

Figure 4.9

Land Cover in Block IOR-6

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Date: 24/3/2015

Environmental Resources Management

ERM

Terrestrial and Aquatic Fauna

Limited baseline ecological information is available for the terrestrial and aquatic fauna groups within Block IOR-6. The Ayeyarwady River, where Irrawaddy dolphin was reported, is located adjacent to Block IOR-6. The Irrawaddy dolphin is a euryhaline species of oceanic dolphin found in discontinuous subpopulations near sea coasts and in estuaries and rivers in parts of the Bay of Bengal and Southeast Asia. In Myanmar, it is found in the Mekong, Ganga, Brahmaputra and Ayeyarwady rivers. There is currently insufficient data to accurately assess the population status in Myanmar. IUCN estimates a population of 58-72 in the Ayeyarwady River (IUCN, 2011) [(1)]. The Irrawaddy Dolphin (Ayeyarwady subpopulation) is regarded as Critically Endangered under the IUCN Red List [(2)]. The Ayeyarwady River is also home to a large diversity of animals, including about 43 fish species [(3)].

The Ayeyarwady Delta is located to the south of the block and is rich in birds, especially from the end of the rainy season in September-October when a large number of migrant birds fly south from their breeding sites in Central Asia and Siberia to winter in Myanmar. Many of the waders make their way to the paddy plains, coastal mud flats and tidal creeks of the delta [(4)]. Due to the migratory nature of the species, it is expected that some species normally found in the neighbouring delta may pass by or through the Project Area.

No details on the terrestrial ecology of the block appear to be publically available at present.

Protected & Environmentally Sensitive Areas

Information from the Istituto Oikos and BANCA (2011) reported a total of 43 designated or proposed protected areas with IUCN categories existing in Myanmar [(5)]. It should be noted that some of the locations are proposed as protected area without authorised designation (i.e. "soft" designation). None of these protected or environmentally sensitive areas lie within the block. The distance to the Bago Yomas Protected Area from Block IOR-6 is around 49 km (*Figure 4.10*).

4.3.3 Socio-economic Environment

This section presents finding of the desktop literature review of the socio-economic environment in the wider regional and country level. The secondary information pertaining to the socio-economic profile of the country,

(1) The IUCN Red List of Threatened Species, (2011); http://www.iucnredlist.org/details/44556/0 , accessed 10 Oct 2014

(2) The IUCN Red List of Threatened Species lists the Irrawaddy Dolphin as a critically endangered species: http://www.iucnredlist.org/details/44556/0

(3) http://fish.mongabay.com/data/ecosystems/Irrawaddy.htm, accessed 15 Oct 2014

(4) http://www.worldwildlife.org/ecoregions/im0116, accessed 04 Oct 2014

(5) http://www.istituto-oikos.org/files/download/2012/MyanmarProtectedAreas.Context_CurrentStatusandChallenges.pdf

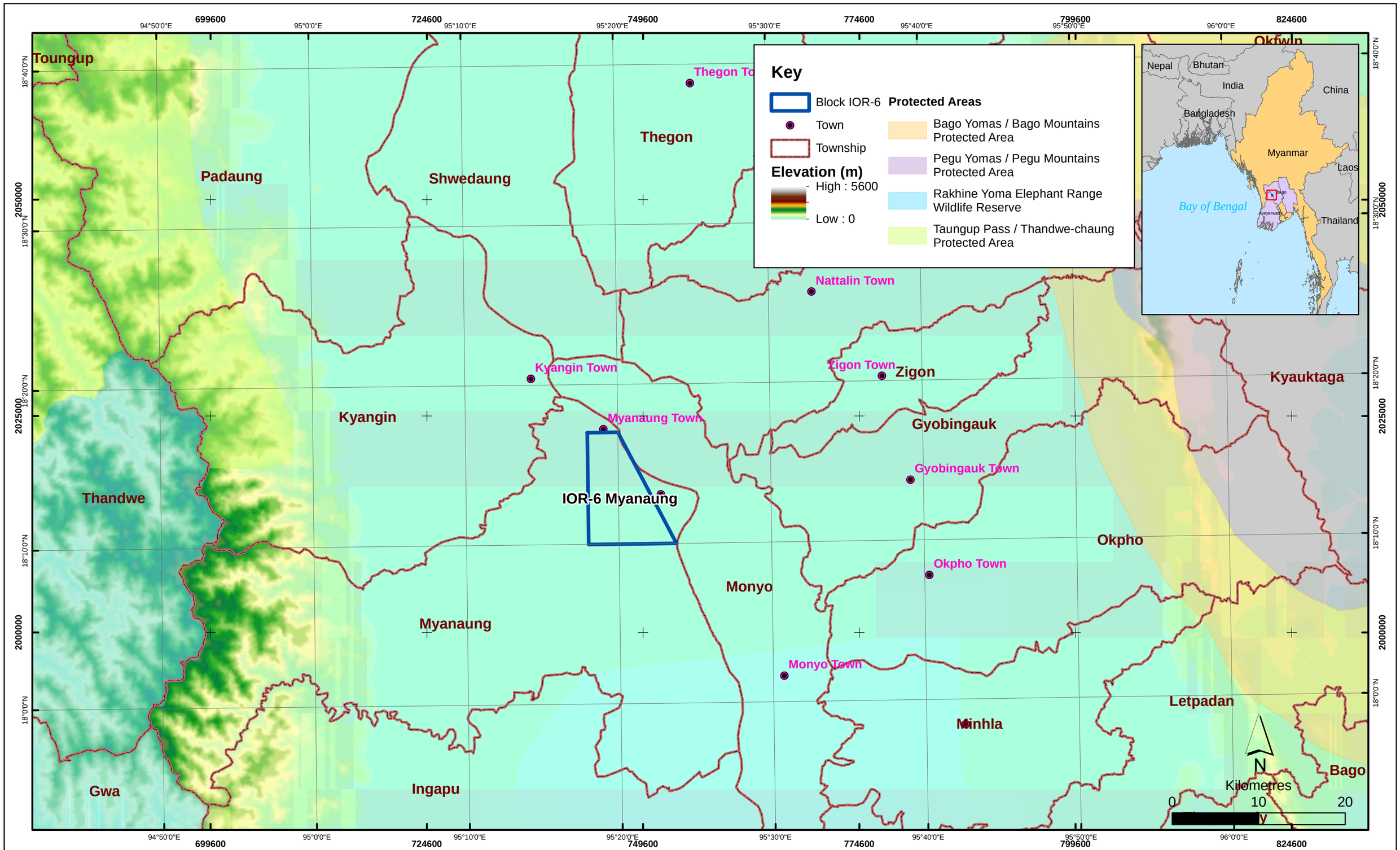

Figure 4.10

Protected Areas near Block IOR-6

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Environmental Resources Management

ERM

the region and the Project Area is extremely limited and is restricted to the reports of organizations such as United Nation Development Programme (UNDP). Thus, the following desktop baseline review has been undertaken on the basis of the limited secondary information available from reliable sources.

Country Profile: Myanmar

This subsection provides a brief understanding of the socio-economic profile of Myanmar, in terms of its demographic profile, land and livelihood profile.

Administrative Structure

The Republic of the Union of Myanmar is characterised as a presidential republic with a bicameral legislature. The country is governed by its Constitution, passed in September 2008. The country is divided into seven state and seven regions. The administrative divisions are further subdivided into districts, and in turn townships, wards and villages. An understanding of the administrative divisions in the country is shown in *Table 4.2.*

Table 4.2 Administrative Structure of Myanmar

No.	State/Region	Districts	Townships	Cities /Towns	Wards	Village groups	Villages
1	Kachin State	3	18	20	116	606	2630
2	Kayah State	2	7	7	29	79	624
3	Kayin State	3	7	10	46	376	2092
4	Chin State	2	9	9	29	475	1355
5	Sagaing Region	8	37	37	171	1769	6095
6	Tanintharyi Region	3	10	10	63	265	1255
7	Bago Region	4	28	33	246	1424	6498
8	Magway Region	5	25	26	160	1543	4774
9	Mandalay Region	7	31	29	259	1611	5472
10	Mon State	2	10	11	69	381	1199
11	Rakhine State	4	17	17	120	1041	3871
12	Yangon Region	4	45	20	685	634	2119
13	Shan State	11	54	54	336	1626	15513
14	Ayeyarwady Region	6	26	29	219	1912	11651
	Total	**63**	**324**	**312**	**2548**	**13742**	**65148**

Source: Wikipedia.org accessed on June 18, 2014

While regions are understood to be predominantly inhabited by the dominant ethnic group, the states are areas that are occupied by ethnic minorities.

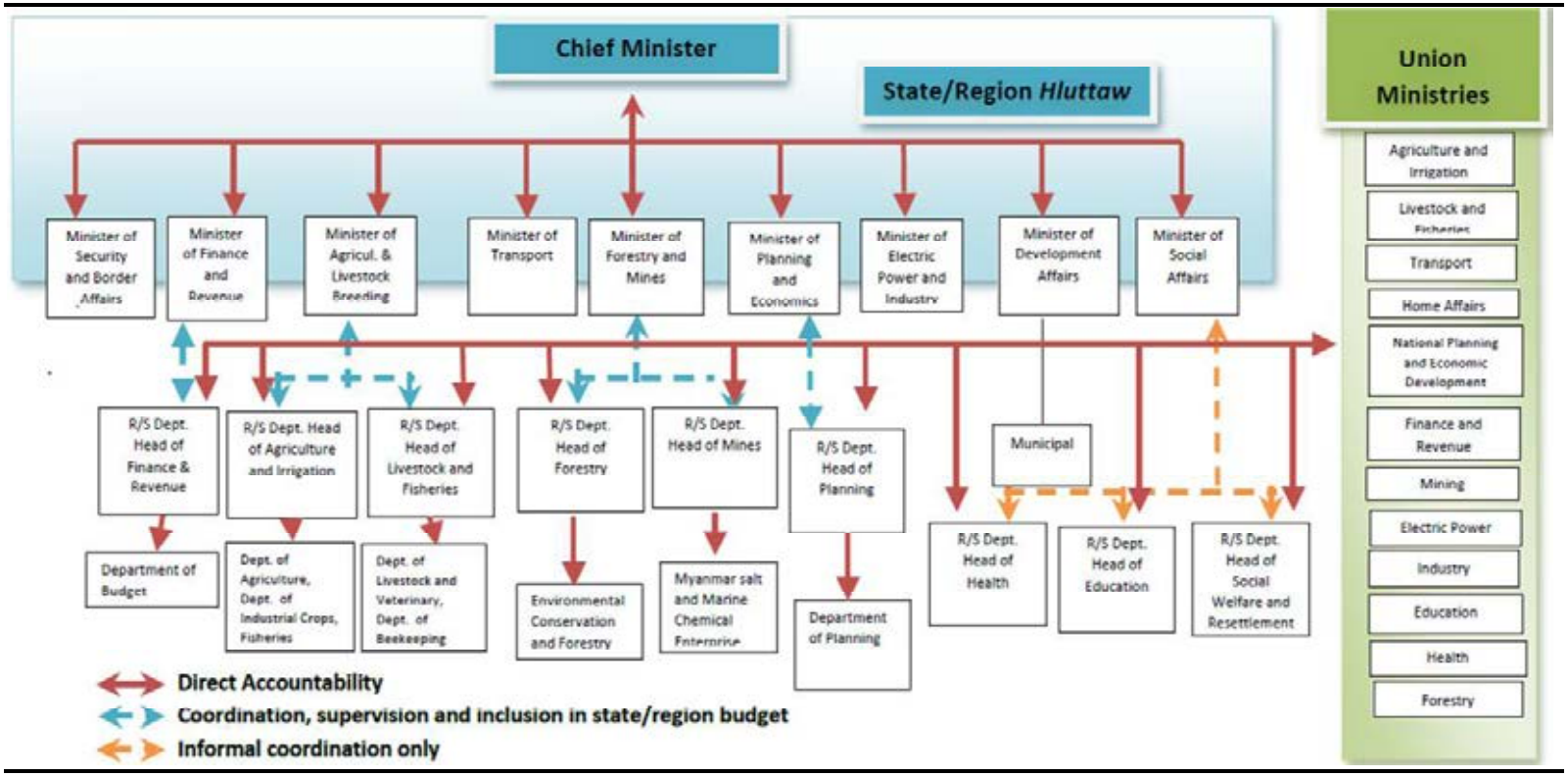
The lowest levels of government offices are generally located in the townships. These in turn report to the government offices at the district and region levels. The regions are governed by a Chief Minister appointed by the President, who is turn is supported by a unicameral legislative assembly

(*Figure 4.11*). Each state / region has a unicameral legislative assembly (Hluttaw), but laws passed by the Union Legislative Assembly (Pyidaungsu Hluttaw) are superior to those passed at the state / region level. Furthermore, the unicameral legislative assembly can only pass laws for eight (8) sectors listed in *Schedule Two of the Constitution*. While the assembly at the regional level can pass laws on "Energy, Electricity, Mining and Forestry", it does not have powers to formulate laws for any matters relating to the Oil and Gas sector [(1)].

The region assemblies can legislate on matters of land revenue, municipal taxes on buildings and land as well as the sales, lease and other matters involving property of the region or state. On the other hand, revenues from the exploitation of the natural resources of a region or state are to be paid to the Union Fund and not the region or State Fund. The Union Government does not need approval from state or regional governments for large scale investments in their local jurisdictions, although they must be informed, and their views are sought as part of the evolving ESIA process and on foreign lease of land in their area.

(1) Myanmar Oil and Gas Sector-Wide Impact Assessment: Government Structure and Legal Framework

Figure 4.11 Indicative Organization of State and Regional Government [1]



(1) MDRI-CESD & The Asia Foundation (2013) State and Region Government in Myanmar

Demographic Profile

The Republic of the Union of Myanmar is a sovereign state in Southeast Asia. The country borders Laos, Thailand, China, Bangladesh and India. The country of Myanmar is characterised by the following demographic profile in *Table 4.3*.

Table 4.3 Demographic Profile of Myanmar

Attribute	Number
Area (sq. km)	676,578
Population	52.8 Million
Population Density (population per sq. km)	78.03
Population Growth (average annual % for 2010-2015)	0.8
Sex Ratio (women per thousand men)	971
Urban Population (%) (2012)	33.2
Rural Population (%) (2012)	66.8
Urban Population Growth (average annual % for 2010-2015)	2.5
Rural Population Growth (average annual % for 2010-2015)	-0.1
Population aged 0-14 years (%) (2012)	24.8
Population aged 60+ years (%) (2012)	8.45

Source: UN data [1] and BTI (2014) Myanmar Country Report [2]

Estimation and classification of Myanmar's population is difficult due to the absence of reliable data and the complex ethnic identity. The last proper census was conducted in 1931 (an incomplete census was also conducted in 1983). The data available is in the form of that collected by different independent agencies such as the United Nations (UN) and World Bank amongst others.

Myanmar with an area of 676,578 km^2 is the 40th largest country in the world and the second largest in Southeast Asia. It is also the 24th most populous country in the world. The country is characterised by a population density of 78.03 individuals per km^2 with most of the population being concentrated in the rural areas. However, it should be noted that while the rural population is dominant, there has been a shift towards urban areas, with the rural population experiencing a negative average growth rate in the years 2010-2015. In comparison to this, the urban population has experienced a growth rate of 2.5% in the same time period, which is higher than the overall growth rate of the Country.

Of the total population, approximately 33.25% is characterised as dependent population, comprised those below the age of 14 years and higher than 60 years. The country is characterised by a sex ratio of 971 females per thousand males.

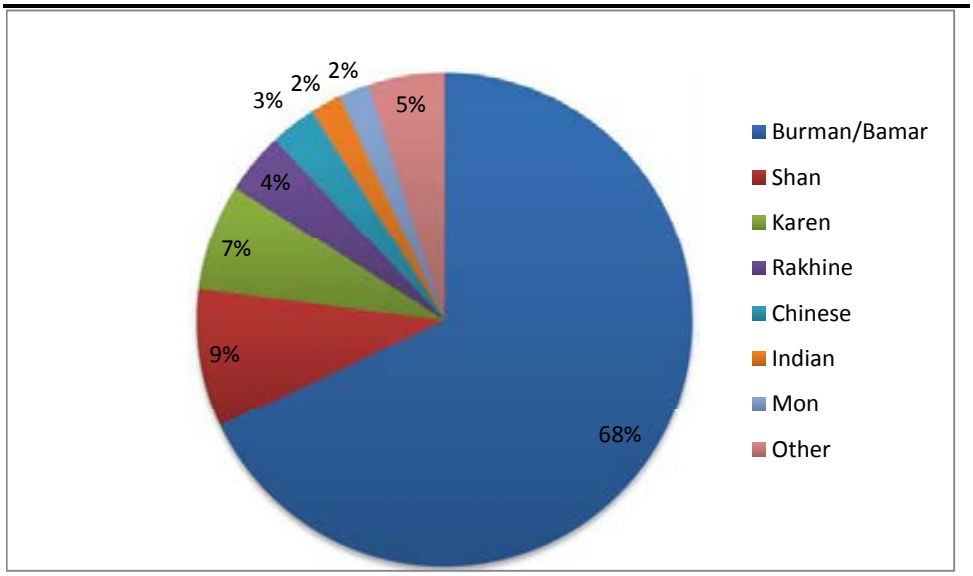
(1) http://data.un.org/CountryProfile.aspx?crName=MYANMAR#Social

(2) http://www.bti-project.org/fileadmin/Inhalte/reports/2014/pdf/BTI%202014%20Myanmar.pdf

Social Stratification

The population of the country is composed of a number of ethno linguistic groups. The majority of the population is comprised of Tibeto-Burman groups, along with Tai-Kadai, Hmong-Mien and Austroasiatic groups, including Burman groups. The main ethnic groups include Burman, Shan, Mon, Rakhine, Chin, Kachin, Kernni Kayan, Chinese, Indian, Danu, Akha, Kokang, Lahu, Naga, Palaung, Pao, Rohyinga, Tavoyan and Wa. The following *Figure 4.12* provides the ethnic composition of the country.

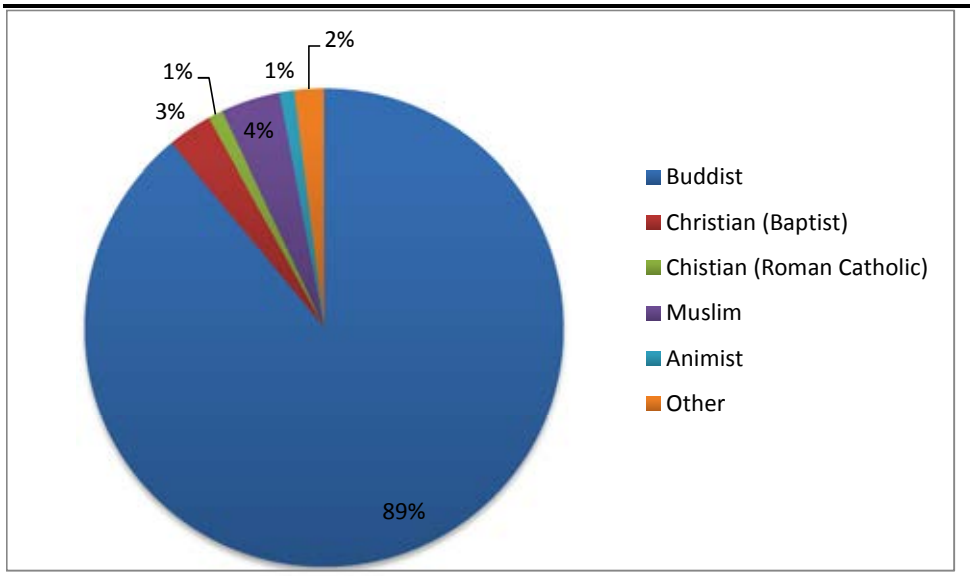
Figure 4.12 Ethnic Composition of Myanmar (2014)



Source: indexmundi.com

Myanmar's population is characterised by four main language families, namely, the Sino-Tibetan, Tai-Kadai, Austro-Asiatic and Indo-European, of which the Sino-Tibetan are the dominant languages. Burmese is the official language of the country.

Figure 4.13 Religious Composition of Myanmar (2014)



Source: indexmundi.com

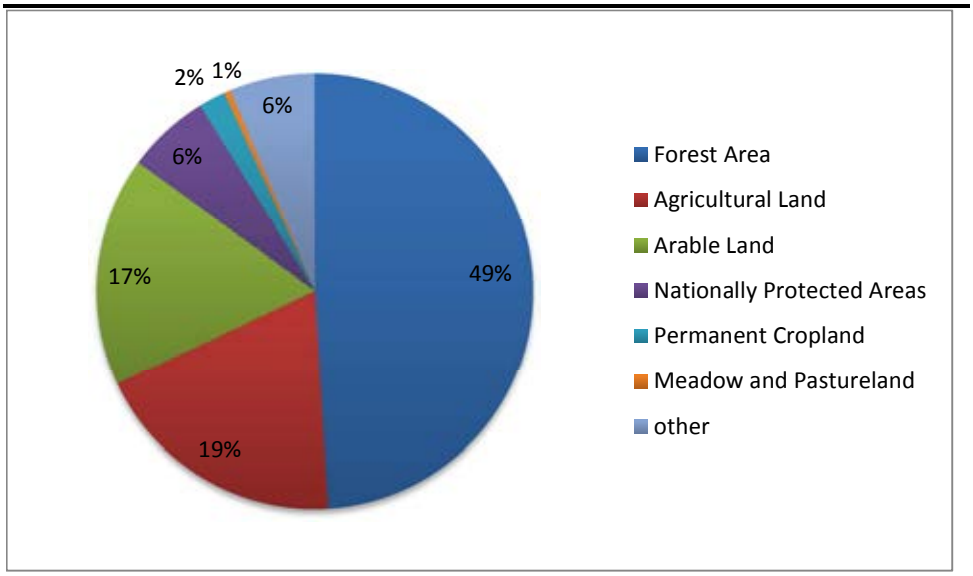
In terms of religious groups, the country is composed of mostly Buddhist population, with the other religious groups included Christianity (Protestant and Catholic), Muslim, Hindu, Animalism, Mahayan Buddhism and other East Asian religions. *Figure 4.13* given above provides an understanding of the religious composition of the population.

Land Use and Ownership

The country is divided into three physical zones, namely Uplands, the Dry Zone and the Irrawaddy Delta. The Uplands, comprised of the states of Kachin, Karenni, Karen, Chin and parts of Shan, Mon and Arakan, are characterised by a hilly terrain, ranging from 1,000 to 2,000 m in altitude. In the past swidden agriculture (traditional shifting) was common in the areas. However, due to an increase in the population density, farmers are increasing clearing the steep hills in the area, which are characterised by poor soil quality which does not allow for sustained agriculture or appropriate fallow periods.

The Dry Zone is referred to as the central heartland and spans the semiarid region of the country. The Project Area partly falls in the dry zone. This area is characterised by frequent draughts and increasing land degradation due to loss of natural vegetation, soil erosion and decreasing soil fertility. The following *Figure 4.14* provides an understanding of the land classification in the country.

Figure 4.14 Land Classifications in Myanmar (2009 – 2010)



Source: USAID Country Profile: Property Rights and Resource Governance, Burma

As can be seen from the above figure, the dominant land use in the country is forest area followed by agricultural land. Of the agricultural land (~128,549.82 km^2), approximately 25% is classified as irrigated land. The forest area is comprised of tropical evergreen forests, hill forests and temperate evergreen forests. However, due to activities such as legal and illegal logging and traditional practices there has been a rapid depletion of the country's forest resources, with the country losing 19% of its forest cover during the period of 1990-2010.

The primary central body governing land in Myanmar is the Ministry of Agriculture and Irrigation (MoAI) and departments under the Ministry are responsible for land planning, water resources, irrigation, mechanisation, settlement and land records, amongst other matters. The Farmland Management Body (FMB) and the Central Committee for the Management of Vacant, Fallow and Virgin Land (CCVFV), both established by laws enacted in 2012 and chaired by the head of MoAI are responsible along with their lower-level branches for approving certain requests for land- use rights.

The land ownership in the country is vested in the state, with the citizens and organizations being provided with user rights. While the dependence on land as a source of livelihood is high in the country, especially amongst the rural areas, it is estimated at 30-50% of the rural areas are landless. The average farm size in the country is 6.7 acres, which is considered to be moderate by Southeast Asian standards and low by international standards. The largest average sizes are found in Irrawaddy (11.2 acres), Yangon (9.3 acres) while the lowest is in Chin state (1.7 acres)

The proportion of landless households is reported to vary across the regions in the country with the Bago Region in lower Myanmar, Mandalay Region in Central Myanmar and Rakhine State in Western Myanmar having the highest

proportion. While the country's constitution and the Customary Laws (governing Buddhist groups) guarantees women equal rights before the law in terms of property matters, in practice, however, certain systems applicable on the ground do not afford them equal rights. Furthermore, the country's latest laws pertaining to land such as Farmland Law and Vacant, Fallow and Virgin Land (VFV) Law are reported to not be gender neutral with no mechanism for joint ownership of property between husbands and wives. These laws state that the land will be registered to the head of the household, which is interpreted to mean the husband.

Land Tenure Types

In Myanmar, the state is the owner of all land, thus, all private tenure rights are usufruct rights, and are determined according to the type of land involved. While attempts have been made to simplify the land classifications through several new laws in 2012, their success is still unclear. In 2009, 12 land categories were identified, which are discussed in *Table 4.4* below.

Table 4.4 Land Types in Myanmar

No	Land Type	Description
1	Freehold Land	Freehold land equates roughly to 'ancestral land,' existing mostly in urban areas and rarely in small towns and villages. Freehold land is transferrable, not subject to land revenue taxes and can be taken by the state only pursuant to laws on compulsory acquisition.
2	Grant Land	Owned and allocated by the state, grant land is common in cities and towns, but rare in village areas. The state may lease grant land out for extendable periods of ten, thirty, or ninety years. Grant land is transferable, is subject to land tax and may be reacquired by the state during a lease period in accordance with laws governing compulsory acquisition.
3	Farmland	The Farmland Law of 2012 has replaced the earlier classification of Agricultural Land with Farmland. Farmland includes garden land; paddy lands; dry land (ya); alluvial land (kiang); perennial plant land; coastal land (dhani); shifting cultivation land (taungya); alluvial islands; and land for growing vegetables and flowers. Farmland is transferable through sale, lease, inheritance and donation, with the condition that transfers must be registered with the state. Farmland rights may also be "pawned" as security for a loan, with the condition that the loan can only be used to finance agricultural production. Unless the user obtains express permission for other uses, land held under a farmland use right must be used for permitted purposes. The user cannot allow the farmland to remain fallow without sound reason and cannot transfer the use right to a foreigner or an organization that includes a foreigner without state permission.
4	Grazing land	Grazing land is for use by cattle of nearby villagers and is protected from trespassers and is not subject to land taxes.
5	Town land	While in most cases, town land is the same as freehold land or grant land, an exception exists in reference to La Na 39 land. This category is provided for in the article 39 of the Land Nationalization Act 1953. This land is defined as farmland that has been re-categorised for another purpose. This land is transferable and those who have it registered under their name must pay land tax to

No	Land Type	Description
		the government.
6	Village land	Village land is land located outside the parameters of town land and can either be grant land or La Na 39 land. Village land is transferable, but only if it has been transformed into La Na 39 land or grant land. Those with village land must pay land tax to the government unless their plot is less than one-fourth of an acre and occupied by a building.
7	Cantonment Land	Cantonment land is land that the state has acquired for the military's exclusive use. When an area is earmarked as cantonment land, the government issues a declaration of the designation, and the state acquires it under the Land Acquisition Act, which provides that owners should be compensated if the land was classified as freehold land, grant land or La Na 39 land. The military is required to surrender cantonment land to the government once it is no longer necessary for military use.
8	Monastery Land	Monastery land is that which the Ministry of Home Affairs has declared as such. If that land is freehold land, grant land, La Na 39 land or farmland, the government must invoke the Land Acquisition Act, and the state must pay compensation to the right holders before acquiring the land for use as monastery land. Land classified as monastery land is not subject to land taxes and retains its classification for eternity.
9	Vacant, Fallow and Virgin Land	According to the VFV Law, land users who hold use rights to vacant, fallow or virgin land cannot mortgage, give, sell, lease or otherwise transfer or divide land without permission from the Cabinet of the Union Government. The seven categories of use of these lands are as follows: • Perennial plants and industrial crops; • Orchards; • Use by a rural farmer and a family; • Aquaculture; • Breeding and raising of livestock and poultry; • Mining; and • Other.

Source: USAID Country Profile: Property Rights and Resource Governance, Burma

Apart from these statutory tenures, there also exist customary tenures, which do not enjoy formal legal recognition. These tenures, though declining, play an important role in the ethnic areas in the Uplands. One such customary tenure is as identified by the Karen group. In practicing shifting cultivation, the Karen population classifies forest areas as rotational farms, irrigated farms, orchard farms, communal forest, grazing land and sacred forest.

Livelihood Profile

Myanmar's economy is heavily dependent upon the natural resources and agriculture. While very limited data is available on the economic profile of the country, the *Table 4.5* provides a summary of the basic economic profile of the country.

Table 4.5 Economic Profile of Myanmar

Attribute	Number
GDP (Billions current US$) (2014)	60.29
GDP per capita (current US$) (2014)	910.36
GNI (current US$) (2012)	1,126
Labour Force Participation (female) (%) (2011)	75
Labour Force Participation (male) (%) (2011)	84.9
Labour Force Participation (total) (%) (2011)	81.9

Source: http://data.worldbank.org/country/myanmar and **http://knoema.com/** IMFWEO2014Apr/ imf-world-economic-outlook-april-2014?country=1001140-myanmar

Myanmar characterised by a GDP of US$55,320 is amongst the countries with the lowest GDP in the world and is significantly lower than the GDP across South Asia at US$2,303,123.

The economic growth in recent years has averaged at 5% with a per capita income of US$ 702. Issues such as inadequate infrastructure, limited access to finance, limited access to agricultural and off-farm 'know-how' and administrative constraints have resulted in a stagnation of the non-urban economy. This is also reflected in the high poverty levels in the country, with 26% of the population falling below the poverty levels (below US$ 1.25 per day).

Some of the key sources of income are agriculture, natural resources, employment in the service sector and casual labour.

Agriculture

The agriculture in the country varies across the regions. The Uplands are increasingly characterised by a high dominance of rain-fed paddy. On the other hand, the Dry Zone is characterised by commercial farming of cash crops such as sesame, pulses, beans, potatoes, tomatoes, cotton, onions and vegetables. Of these, the crops sesame, pulses and beans are grown for mostly export. The Irrawaddy Delta has mostly paddy cultivation and is identified as the centre of the country's rice economy, responsible for a large share of the country's rice export. Myanmar is the 6th largest rice exporter in the world, with estimated 1.5 metric tons in export in 2012. This can be seen in the fact that 25% of the households in the region identify paddy cultivation as its most important income source. Rice farmers reportedly keep 25% of the produce for self-consumption and next year's seeds while 75% is sold in the market. Since 2008, the government has also been encouraging large-scale monoculture plantations of cassava, sugar cane, rice, jatropha, palm oil and rubber, mostly through military- favoured domestic companies.

Natural Resource Based Income

Myanmar has rich natural resource reserves including oil and gas, minerals, precious stones and gems (ruby, sapphire, diamond, spinel etc), timber and forest products, hydropower potential etc. Of these, natural gas, rubies, jade and timber logs comprise of a substantial proportion of the national income.

While the Northern Shan Plateau is characterised by deposits of silver, lead, zinc and gold, the Tenasserim region is identified for tin and tungsten while Maymyo in the central basin is known for its reserves of barite. Myanmar also has major coal deposits, mostly concentrated in the upper Irrawaddy and Chindwin valleys.

Non-Farm based activities

Issues such as frequent droughts, floods and landslides, increasing land degradation, increasing population density, loss of natural vegetation, soil erosion, deterioration of soil fertility, increase in extractive industrial activities etc. have resulted in an increasing shift towards non-farm based activities. In terms of non-farm based livelihoods, the main sectors include the industrial and service sectors. The main industries in the country include agricultural processing, wood and wood products, copper, tin, tungsten, iron, cement, construction materials, pharmaceuticals, fertilizers, oil and natural gas, garments etc.

While manufacturing sector has grown in the country since its independence, its growth rate is slower than that across the other countries in the region. The main enterprises in the sector comprise of tobacco producing factories and cottage industries, producing cigarettes and cheroots (a type of small cigar). Apart from this, the other major manufacturing sectors include steel processing, nonelectrical machinery and transportation equipment production, cement production and textiles. While the textile industry has played a crucial role in the areas of Yangon, Myingyan and other cities, the growth of the industry has slowed down since the late 20th century due to international sanctions.

Water and Sanitation

While limited information is available pertaining to the country's water availability and quality and sanitation facilities, it is understood that the country is characterised by a lack of effective delivery of basic services such as water and sanitation. According to a United Nations Children's Fund (UNICEF) survey undertaken in 1995 and 1996, 59.7% of the total population has access to safe drinking water, while the rural urban proportions were 50 and 78.5%, respectively. The common sources of drinking water are in the form of open wells, springs, rivers or ponds. Most of the villages do not have access to piped water supply and require the households to walk a certain distance to collect water. This task of collecting the water usually falls upon the women and children. The situation is reported to be aggravated during the dry months when due to the drying up of local sources, at times, women and children have to walk several miles for water, or even resort of consumption of contaminated water in situations where safe water is not readily available. The country is characterised by common practices of open defecation, especially in rural areas, and generally poor sanitation knowledge and standards.

Transport and Communication

The infrastructure in the country is reported to be severely inadequate. The main forms of transport are road, rail and water ways. The railways are reported be old and rudimentary, having undergone minimal maintenance since their construction in the 19th century. Outside of the major cities, the highways are mostly unpaved. In terms of electricity, despite the large deposits of natural gas, the electricity supply in the country is from fossil fuels. However, hydroelectricity is increasingly accounting for a significant portion of the total power supply. Most of the hydropower projects are located on the five main rivers in the country, namely, Irrawaddy, Chindwin, Salween, Sittaung and Tenasserim. About 73% of the population lacks access to electricity and the consumption of electricity is one of the lowest in the world – 20 times less than the world average. Existing power infrastructure can only meet about half of the current demand, resulting in frequent blackouts and rationing of the electricity supply. Telecommunications and internet access are also very limited.

Education Profile

The country's education system is classified into two sectors: the basic education sub-sector and the higher education sub-sector. The basic education system comprises of 3 years of lower primary level, 2 years in upper primary level, 4 years at lower secondary level and 2 years in upper secondary level. This is followed by a matriculation examination. The education system is based on the United Kingdom's system. Almost all the schools are government operated, however, there has been an increase in the number of privately funded English language schools. Schooling is compulsory till the elementary school level. The following *Table 4.6* provides a summary of the literacy profile the country.

Table 4.6 Literacy Rate of Myanmar (2012)

Attribute	Number
Total Literacy Rate (15+ years)	92.68
Male Literacy Rate (15+ years)	95.09
Female Literacy Rate (15+ years)	90.37

Source: http://data.worldbank.org/country/myanmar

The high literacy rates, prevalent since independence are associated with the presence of Burmese schools as well as monastic schools, which play a major role in the education of poorer sections of society. While the overall literacy rate is reported to be high, as a result of widespread poverty, only a small percentage of children continue their formal education after primary school. Many schools are under-resourced, lacking essential equipment such as desks and chairs. During the devastating Cyclone Nargis, more than 4,000 schools were either damaged or completely destroyed further limiting access to education for many children. Also, during the socialist regime, the education system is reported to have suffered in terms of the maintenance of infrastructure, teacher education and pay. Furthermore, while during this

period Burmese was made the medium for teaching at all schools, English remained the language at the higher education levels, which in turn resulted in a large proportion of population discontinuing their education.

Health Profile

As can be seen from the following *Table 4.7*, Myanmar has high rates of infant, under-five and maternal mortality. The country is also characterised by a high prevalence of HIV/AIDS, tuberculosis and malaria. Access to health care facilities is extremely poor outside of the major cities and towns, with only 0.5-3 % of the GDP being allocated to health. While the health care, provided by the government is nominally free, public hospitals lack basic facilities and equipment and often require the patients to pay for their own treatment and medicine.

Table 4.7 Health Profile of Myanmar

Attribute	Number
Life Expectancy (years)	65.2
Infant mortality rate (2010)	50
Under-5 mortality rate (2010)	66
Neonatal mortality rate (2010)	32
Maternal mortality ratio (2010)	200
Fertility Rate (live births per woman) (2010-2015)	1.9

Source: http://www.unicef.org/eapro/MNH_Myanmar.pdf

The main diseases in the country pertain to water borne diseases such as diarrhoea, Hepatitis A and typhoid, which are attributed to the poor sanitation facilities in the country. Also due to the poor hygiene, health problems such as intestinal worms and skin diseases are common.

The top causes of death in the country include coronary heart disease, influenza and pneumonia, stroke, tuberculosis, lung diseases, HIV/AIDS, hypertension, malaria, Hepatitis B, drug use, syphilis, peptic ulcer disease, rheumatic heart disease and oral cancer. Of these, the deaths by Hepatitis B, drug use, syphilis, peptic ulcer disease, rheumatic heart disease and oral cancer are the highest in the world.

Ayeyarwady Region Profile

The following sub sections provide the socio-economic profile for the Ayeyarwady Region where the block is located.

Demographic Profile

The Ayeyarwady Region is located in the southwestern Myanmar. It is bordered by the Bago and Yangon Regions in the northeast and east, respectively, the Rakhine State in the northwest, and the Bay of Bengal and Andaman Sea to the west and south, respectively. The following *Table 4.8* provides an understanding of the brief demographic profile of the region.

Table 4.8 Demographic Profile of the Ayeyarwady Region

Attribute	Ayeyarwady
Districts	6
Townships	26
Wards	219
Village Groups	1,912
Villages	11,651
Total Population	8,041,084
Area (sq. km)	35,032
Population Density (persons per sq. km)	230
Sex Ratio (females per thousand males)	1,052
Average Household Size	4.1
Rural Population %	85.9
Urban Population %	14.1

Source: Ayeyarwady Delta Final Report, Wikipedia.org accessed on June 18, 2014

As can be seen from the above table, the Ayeyarwady Region is comprised of 35,032 km^2 and has a total population of 8,041,084. The region is amongst the three most highly populated regions in the country along with Mandalay and Yangon and contributes to approximately 15% of the total population of the country. It is the tenth largest region in the country in terms of surface area covering approximately 5% of the country total surface area.

The region is one of the most rural regions in the country, with the urban population comprising only ~14.1% of the total population. The average household size in the region is 4.1 people, which is lower than that of the national average of 4.4. The region's townships tend to be larger than the national average, with the most populous township being Hinthada with a population of 337,880 while Kyangin has the lowest population with 96,090 individuals[1].

Social Groups

While official data regarding the ethnic groups in the region is presently unavailable, the region is reported to be comprised of the social groups such as Bamar, Karen/Kayin and Rakhine. Of these, the Bamars are reported to be in majority while the Rakhine are reported as the minority group, primarily found in the western coastal regions [(2)].

Bamars: The Bamar or Burman people, are the majority ethnic group of Burma. They are of Sino-Tibetan origin and reside predominantly in the central plains near the Irrawaddy and Sittang Rivers. According to population estimates, they compose 68% of the country's total population, though some claim these numbers are exaggerated to favour the Bamar majority. The Bamar population is itself divided into various sub-groups and thus is not a homogenous ethnic category. Traditional Bamar culture strongly influences contemporary Burmese national customs and identity.

(1) UNDP: Local Governance Mapping: The State of Local Governance: Trends in Ayeyarwady

(2) *Ibid.*

The Bamar are predominately Theravada Buddhists. Their native language (Burmese) is the official language of the country and they dominate the government and military. Due to the ethnic group's predominance, its members are often believed to have a social and political advantage over the country's minority populations. Some ethnic groups claim that the country has been subject to a policy of 'Burmanisation' since the 1962 coup.

Karen/Kayin: The Karen people of Burma, thought to number around 7 million people, make up one of the largest ethnic groups in the country. The religious make-up of the Karen people is a combination of Buddhism, Animism and Christianity. They reside mainly in the Southern and South Eastern part of the country, whilst thousands live over the border in Thailand in a state of limbo. The Karen sided with the allied forces during the Second World War and were hopeful that with peace they would be able to achieve long sought-after independence. However, the decolonisation process saw Karen State remain part of Burma, which along with continued aggression towards Burma's ethnic people, helped to instigate an armed uprising against the central government. This uprising was led by the Karen National Liberation Army and resulted in one of the longest running civil wars in history. In January 2012, after more than 60 years of armed conflict, the main democratic party of the Karen, the Karen National Union (KNU), signed a ceasefire agreement with the Burmese government. However, fighting is still noted to be ongoing.

Rakhine: The Rakhine people or 'Arakanese' are the largest ethnic group in Rakhine State, formerly known as Arakan, which is found in the west of Burma, extending along the Bay of Bengal. The Rakhine or Arakanese dialect is also spoken by around 35,000 people in neighbouring Bangladesh. The population, as with most areas in Burma, is difficult to establish reliably, especially since the patchy census data only counts the number within the state and not the population of the ethnic groups. It is estimated that those in Rakhine state make up 4-5.5% of the total population of Burma. They are predominantly Theravada Buddhists, and are one of the four main Buddhist ethnic groups of Myanmar (the others being the Bamar, Shan and Mon). The state itself is also home to populations from other ethnic groups, like the Chin, Mro, Chakma, Khami, Dainet and Maramagri. There is also a large minority population of Muslim Rohingya

In terms of religion, it is characterized by a majority of Buddhist, followed by Christians and Muslims.

Land Use

The Ayeyarwady Region falls in the Ayeyarwady (Irrawaddy) Delta. The land in the region is fertile and low lying and is characterised by a soil type of thick alluvium bought down by the Ayeyarwady River. Three main types of soil are reported to be found in the area, meadow gleyey clay soils, meadow swampy soils and saline gleyey soils. The following *Table 4.9* showcases the land use of the Ayeyarwady Region.

Table 4.9 Land Use in the Ayeyarwady Region (2012 – 2013)

Type	Area in Ha	%
Cultivable Land	1,818,467	51.91
Forest and Reserved Forest	720,088	20.55
Cultivable Waste Land	149,168	4.26
Virgin Land	23,020	0.66
Other Area	792,447	22.62
Total area	3,503,190	100

Source: Ayeyarwady Delta Final Report

The average farm size per household in the region is 11.2 acres (~4.5 ha) according to a UNDP report and is ranked the highest in terms of farmland size per household. One of the possible reasons identified for this is that the process of settling of immigrants in the Ayeyarwady Delta started only around 100 years ago, thereby making it easy for people to expand their lands.

Land holdings are reported to play a very critical role in the income and livelihood patterns in the region, with the average household income of the land right holders being more than double than that of the landless households. However, due to the high rate of population increase, the ratio of landless farmers in the delta has been steadily increasing. Some people reportedly lost their tiller's right to cover school expense or medical payment. In some townships such as Laputta, Bogalay and Mawlamyaingyun, it is estimated that more than half of the population is landless.

Education Profile

Pre-school attendance amongst children aged 3-5 years is low with less than a quarter of all children nation-wide attending. Sixteen percent (16%) of children aged 3-5 in the Ayeyarwady Region attend pre-school and the primary school enrollment rate in Bago West is 81%. Only 51% of all children attending primary school complete schooling on time in Bago West. Hinthada City has three universities which are University of Computer Studies, Hinthada and Hinthada University and Technological University, Hinthad [(1)].

Livelihood Profile

The Ayeyarwady River and Delta are reported to play a critical role in the economy and livelihood of the region, with rice cultivation and fishing dominating the economic activities, especially in the rural areas. On the other hand, the sectors of industry, infrastructure and services are still lagging behind, primarily due to the remoteness and status of development in the area. The following sub sections provide an understanding of the main livelihood activities in the region, namely, agriculture and fishing.

(1) http://most.gov.mm/most2eng/

Agriculture

The region has historically been a major agricultural producer in the country, being known as the country's rice bowl, accounting for 30% of the country's rice production. Crop production was reported to be comprised of 31% of the region's GDP in 2013, which was followed by the fisheries sector contributing 15.8%. The annual rice production of the region is reported to be 6 MT (Million Ton).

The paddy production in the region was given an additional boost with the World Bank Projects, namely Paddy Land Development Projects 1 and 2 in 1976-1988. The projects consisted mainly of construction of polders (a piece of low-lying land reclaimed from the sea or river) in the lower delta with embankments, sluice gates and drainage systems, for the purpose of protecting the land from salt water intrusion.

Apart from rice, black gram is the most important crop in the area and is the winter crop of the area. The community also plants vegetable which are mostly for home consumption with the excess production being sold for income. However, vegetable production plays a critical role in the income generation for those households with small land holdings. The most common vegetables are cauliflower, cucumber, water melon, pumpkin and leaf vegetables. It is reported that the profit margin in vegetables is higher in comparison to paddy production.

The agriculture in the area is reported to be low on technology with most of the farmers depending upon water buffaloes instead of machinery. The use of hand tractors is limited. Most of the economically weaker households cultivate a single crop of traditional monsoon paddy, while the economically stronger farmers are able to grow the High Yielding Variety (HYV) paddy as well as take an additional crop of groundnuts or soya bean.

Furthermore, for the monsoon paddy, only local rice varieties and minimal inputs are applied. This is reported to be the result of the fact that the HYV are not suitable for the uncontrollable water levels which are characteristic of the monsoon season in the region. Also, the average annual rainfall can be more than 3,000 mm and concentrated in the months of May to October, thereby not necessitating irrigation for the monsoon paddy.

At the end of the monsoon season the fresh rainwater is stored in the drainage canal for irrigation, livestock and miscellaneous purposes for the dry season. In the lower delta irrigation is practiced during the dry season from November to April. Due to the unavailability of fresh water in the lower delta, the irrigated summer paddy is only cultivated in the middle and higher regions of the delta, unless special water canal are constructed for the transport of fresh water from the upstream tidal reaches of the river. Diesel pumps are used and lifted water is conveyed through small ditches or in plot to plot method. There are, however, also several special polder areas where

irrigation water is conveyed from the intake of the upstream reach of the tidal river where the water is fresh and free from salt water contamination.

As a result of the above factors, the crop yields are low. According to the Agricultural Census 1985-86 to 1995-96, average cropping yield of paddy in Ayeyarwady Region is 3,250 kg/hectare. Information obtained from the Irrigation Department in the Pyapon District indicates an average production of 55 baskets/acre (2,890 kg/hectare) for rain-fed monsoon paddy and 95 baskets/acre (4,990 kg/hectare) for irrigated summer paddy.

A minimum price for rice is guaranteed by the government. Due to reasons such as low storage capacity, lack of farmer organisations, need for cash for daily life and repayment of loans, the farmers tend to sell their products for a low price immediately after the harvest instead of waiting for the prices to increase over time.

In addition to rice farming, aquaculture, poultry and pig farms are important sources of income in the area. Livestock is an important asset and workforce for farmers, with most of the farmers owning water buffaloes, pigs and/or poultry. However, it is reported that the livestock holdings, especially water buffaloes, were considerably reduced due to the Cyclone Nargis. In certain areas such as the Labutta Township, salt production is undertaken.

Fisheries

Apart from agriculture, fisheries comprises of the second most important sector in the region, comprising of 15.8% of the total GDP. The main types of fisheries are described below:

- Freshwater
  - Fish Culture
  - Leasable Resource
  - Open Fisheries
- Marine
  - Inshore Fisheries
  - Offshore Fisheries

These fishery practices take place in three main ecological zones in the delta, on the basis of the distance to the sea and the salinity levels:

- Floodplains: these are characterised by freshwater and very low salinity.
- Estuarine: these zones are characterised by multiple waterways, temporary brackish water, as well as degraded mangroves, patchwork of rice fields, trees and villages along the waterways.

- Coastal: these zones are characterised by very flat land, quasi-permanent brackish water, salty soils, almost no vegetation and fishing activities targeting the coastal and marine zones.

The production system for fishes is dominated by extensive and semi-intensive ponds, with some marine and cage culture and rice fish farming. While the scale of production varies, in the delta large ponds and commercially oriented enterprises are the most common. The fishery sector maintains a high per capita consumption in the region of about 43 kg/year according to the statistics of 2008-2009. Prawn is reported to be the most important source income in the aquaculture industry with the region having important dry prawn, fried fish and prawn paste making industries in almost all villages.

This sector forms an important source of livelihood for the landless and those with small landholdings, with many marginal farmers being reported to be engaged in fishing and crabbing. Those who fish typically do not own fishing gear or boats and depend on fish traders for such resources. However, employment opportunities in fisheries and aquaculture are seasonal in nature. Also, pressures such as overfishing, destructive fishing practices, reduced fish migration routes due to dams, exploitation of mangroves, limited research and development and increasing water pollution has impacted the fish stocks and the natural resources which support the fishing sector in the delta. This has resulted in concerns surrounding the current fish production and consumption as well as the maintenance of the export earnings levels.

The region was severely impacted by the Cyclone Nargis on 2 May 2008, which was reported to be one of the worst natural disasters in the history of the country with 138,000 lives lost and severe damage to the infrastructure and fishery sector of the area. The region is also prone to flooding, which poses a significant risk to farmers and fishermen [(1)].

Social and Physical Infrastructure

Water and Sanitation

The traditional sources of drinking water in the delta are from rainwater harvesting, communal water ponds and tube and open wells. Most villages do not have access to piped water and nearby tidal rivers are saline. Groundwater is another source that is highly used in the delta region. The ponds are especially important for the local community during the dry season which stretches from November to May.

However, the sources of water in the area are impacted by issues such as water pollution and salinity along with the impact with the Cyclone Nargis. The groundwater, which is an important water source, is affected by floods and high waves through cyclones and monsoons, leading to an increase in the

(1) UNDP: Local Governance Mapping: The State of Local Governance: Trends in Ayeyarwady

salinity of the water. Furthermore, due to various policy reforms in the agricultural sector as well as an increase in the use of chemical fertilizers and pesticides has resulted in an increase in the water pollution levels. This concern is increased due to the increase in mining activities in the area and the growth of cities and industrial zones in the delta. The disposal of untreated domestic wastewater also leads to an increase in the oxygen demand and water pollution in surface waters.

Health Seeking Behaviour

At regional level in Ayeyarwady, the access to health facilities is summarized in *Table 4.10* below.

Table 4.10 Access to Health Infrastructure in the Ayeyarwady Region

Health Facilities	Figures (in Numbers)
Specialist Hospital	
General Hospital/Teaching Hospital	5
District Hospital	
Township Hospital	21
Station Hospital	67
Other Ministry's Hospital	1
Rural Health Center	204
Sub Health Center	997
Other Health Centers (Maternal and Child Health Center+ School Health Center + Urban Health Center)	54
Private Clinics & Maternity Homes	417
Doctors	410
Nurses	565
Midwifes	1217

Source: MIMU Baseline Data 2011-12

The large number of midwifes in the region is an indicator that people are dependent on the local health services rather than institutional delivery. Though the number of health institutions seems decent, the capacity of these institutions cannot be commented upon. Household surveys indicate that access to health services is one area that needs attention.

Project Area Profile

This sub section provides an understanding of the socio-economic environment of the Project Area in terms of the demographic profile of the region, the economic resources, the health conditions, education and cultural resources of the community.

Populated Areas

The main township in Block IOR-6 is Myanaung which is half way between two regional cities, Pyay of Bago Region and Hinthada of Ayeyarwady Region. Myanaung Township is subdivided into 59 villages and at least 300 communities were recorded. The communities are congregated towards the north and east of the block and sporadically in the south. However, analysis

of available imagery indicates that communities are distributed throughout the block. The communities are aligned along roads as well as along some segments of rivers.

Economic Resources

As revealed during the initial site visit as part of the ESIA scoping in October 2014, the main crops grown in the villages of the Myanaung are rice, sesame and ground nut (*Figure 4.15*). Ground nut is cultivated for two seasons while rice and sesame are cultivated for a single season only. While the sesame and ground nut are grown as household use, rice is the main cash crop in the area. The crop yield for rice is maximum 50 to minimum 20 baskets per acre, where one basket is equivalent to 1.6 kg. The market rate is about 400,000 MMK per 100 baskets during cultivating season and 600,000 MMK in ploughing season. Agricultural inputs such as fertilizer and pump for irrigation are regarded as the immediate need of the villages.

Figure 4.15 Cultivated Area recorded within Block IOR-6 during the Site Visit as part of the Scoping Exercise in October 2014

Demographic and Health Conditions

According to the information made available, it is understood that most of the villages in the Myanaung region have access to one rural health centre and one mid wife (*Figure 4.16*). Villagers are known to travel to the town for access to health services.

Figure 4.16 Photo of Medical Facility in Myanaung taken during the Site Visit as part of the Scoping Exercise in October 2014

Water Supply

During the consultations undertaken in October 2014, the local community reported dependence upon deep tube wells and river water for water use (*Figure 4.17*). Previously the local community in Tae Gone reported using water from hand dug well, however, the well cannot be used now due to problem of salty water. The main sources of pollution to the Ayeyarwady River are expected to be potential water contamination from agriculture inputs, boat vessel emissions and surface run-off.

Figure 4.17 Photos of Water Supply Facilities in Myanaung taken during the Site Visit as part of the Scoping Exercise in October 2014

4.3.4 *Conclusion of Literature Review*

From the literature review of desktop information presented above, it is revealed that significant information gaps existed on the physical, biological and socio-economic environment within Block IOR-6. These data gaps would require to be filled in for the understanding of potentially significant impacts from the Project and derivation of appropriate mitigation measures to control such impacts to the environmental and social receptors. Thus, the baseline surveys of the following aspects were conducted prior to the commencement of the Project to address the key environmental and social issues:

For the impact assessment of both seismic survey and workover activities:

- Biological Environment

- Habitat mapping and vegetation surveys;
- Terrestrial fauna surveys, including avifauna (birds), mammals, herpetofauna (amphibians and reptiles) and butterflies; and
- Aquatic fauna.

- Human Environment
  - Household survey; and
  - Stakeholder consultation.

For the impact assessment of workover activities only:

- Physical Environment
  - Ambient air quality;
  - Acoustic environment;
  - Groundwater;
  - Surface water; and
  - Soil quality.

The methodology and findings of surveys for physical, biological and socio-economic environment are detailed in the following *Sections 4.4-6*.

4.4 BASELINE SURVEYS FOR PHYSICAL ENVIRONMENT

4.4.1 Air Quality

Methodology

Four air quality monitoring stations (6AQN1, 6AQN2, 6AQN3 and 6AQN4) were set up within the core area for the proposed activities in Block IOR-6. The designated monitoring stations are chosen to assess the potential impacts to the air sensitive receivers (ASRs) in the Project Area due to dust-generating land-based activities of the workover activities. Details of the monitoring location are shown in *Table 4.11* and illustrated in *Figure 4.18*. The surrounding environment of the air quality monitoring stations is showed in *Figure 4.19*.

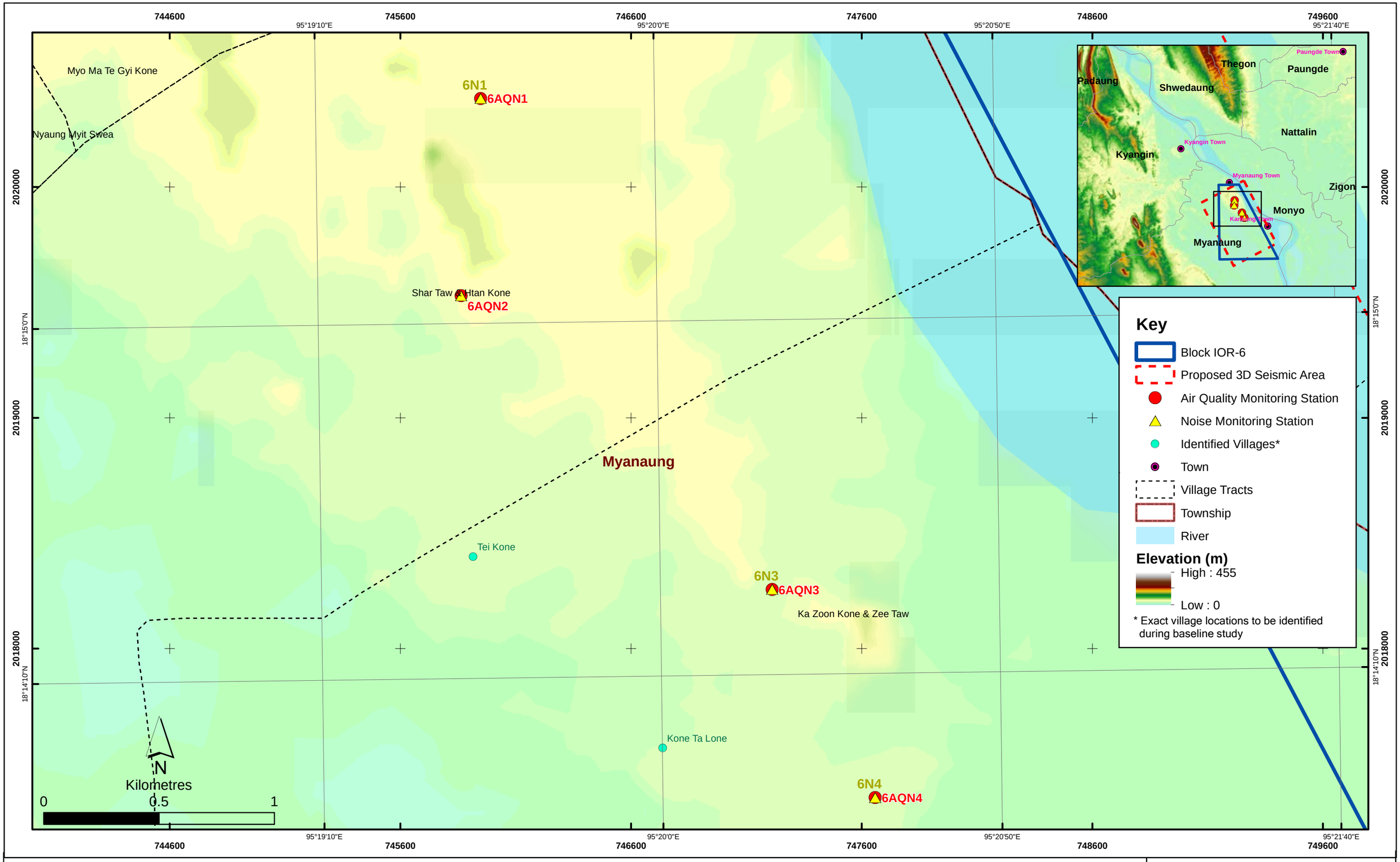


Figure 4.18

Locations of Air and Noise Sampling

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Table 4.11 Ambient Air Quality Monitoring Stations

Sampling Point	GPS Coordinates	Description	Land use
6AQN1	18°15'31.68" N 95°19'34.24" E	Near maintenance department of MOGE in Myanaung oil field, northeast of oil production well No.171	Bare ground
6AQN2	18°15'3.91" N 95°19'30.98" E	West of electricity department of MOGE in Myanaung oil field	Bare ground
6AQN3	18°14'22.01" N 95°20'16.31" E	At southeast of oil production well No.159 and southwest of oil storage tanks, Myanaung oil field	Bare ground
6AQN4	18°13'52.50" N 95°20'31.14" E	At northeast of Kon Ta Lon village in Myanaung oil field	Agricultural Land

Monitoring Parameters and Equipment

Sampling and analysis of ambient air pollutants was conducted according to the guidelines of United States Environmental Protection Agency (U.S. EPA). The Haz-Scanner EPAS Wireless Environmental Perimeter Air Station was used to collect Ambient Air Monitoring data, which is a portable monitor recorded real time data that directly logged the ambient air quality measurements as well as climatological data. The air quality parameters and meteorological data collected in the current survey are listed in *Table 4.12*.

Table 4.12 Parameters measured by the Haz-Scanner EPAS Wireless Environmental Perimeter Air Station

Parameters	Unit	Method and Duration
Air Quality		*In situ* reading for 24-hour
Sulfur dioxide (SO_2)	ppm	
Carbon monoxide (CO)	ppm	
Nitric oxide (NO)	ppm	
Nitrogen dioxides (NO_2)	ppm	
Particulate matter < 2.5 µm (PM2.5)	mg/m^3	
Particulate matter < 10 µm (PM10)	mg/m^3	
Meteorological Data		
Relative Humidity (R.H.)	%	
Temperature	°C	
Wind speed	kph	
Wind direction	-	

Figure 4.19a Surrounding Environment of Ambient Air Quality and Noise Monitoring Stations

↑ Station: 6AQN1 and 6N1

↑ Station: 6AQN2 and 6N2

Figure 4.19b Surrounding Environment of Ambient Air Quality and Noise Monitoring Stations

↑ Station: 6AQN3 and 6N3

↑ Station: 6AQN4 and 6N3

Monitoring Period and Frequency

The ambient air quality and the meteorological data were collected at the four designated air quality monitoring station for 24-hour in December 2014. The sampling dates and hours are summarised in *Table 4.13*.

Table 4.13 Sampling Dates and Hours for Ambient Air Quality and Meteorology

Monitoring Station	Sampling Date	Sampling Hour
6AQN-1	20 – 21 December 2014	1300 to 1300 hour
6AQN-2	20 – 21 December 2014	1430 to 1430 hour
6AQN-3	19 – 20 December 2014	1230 to 1230 hour
6AQN-4	19 – 20 December 2014	1330 to 1330 hour

Baseline Air Quality Results

The monitoring results for air quality and meteorological information are summarized in *Table 4.14*.

The major dust sources in the monitoring period included activities at the existing oil production activities and traffic emission. All air quality parameters are well below the assessment criteria, except for the mean PM2.5 at 6AQN1, 6AQN2 and 6AQN4 which are slightly higher than the IFC's 24-hour average guideline value in some occasions.

Table 4.14 Summary of Baseline Air Quality Monitoring Results in December 2014

Station	CO (ppm) (min – max)	NO2 (ppm) (min – max)	NO (ppm). (min – max)	PM2.5 (mg/m³) (min – max)	PM10 (mg/m³) (min – max)	SO2 (ppm) (min – max)	Temperature (°C) (min – max)	Relative Humidity (%) (min – max)	Wind Speed (m/s) (min – max)	Wind Direction
6AQN1	0.26 (< 0.01 - 0.87)	0.04 (< 0.01 - 0.1)	0.08 (< 0.01 - 3.8)	0.030 (0.001 - 0.132)	0.04 (0.01 - 0.11)	< 0.01 (< 0.01 - 0.09)	21.96 (15 - 43)	72.33 (22 - 99)	0.20 (0.23 – 2.03)	Southeast
6AQN2	0.31 (0.07 - 1.63)	0.03 (< 0.01 - 0.09)	0.02 (< 0.01 - 0.3)	0.038 (< 0.010 - 0.245)	0.05 (0 - 0.31)	< 0.01 (< 0.01 - 0.04)	20.4 (15 - 28)	72.13 (39 - 97)	1.88 (0.54 – 3.11)	Southeast
6AQN3	0.18 (< 0.01 - 2.12)	0.05 (< 0.01 - 0.27)	0.33 (< 0.01 - 5.3)	0.022 (0.007 - 0.161)	0.04 (0.02 - 0.12)	< 0.01 (< 0.01 - 0.26)	21.97 (17 - 29)	59.98 (35 - 85)	1.10 (1.12 – 3.13)	Northwest
6AQN4	0.18 (< 0.01 - 1.55)	0.03 (< 0.01 - 0.22)	0.02 (< 0.01 - 0.3)	0.033 (< 0.010 - 0.401)	0.04 (0 - 0.54)	< 0.01 (< 0.01 - 0.08)	21.25 (16 - 29)	65.15 (38 - 89)	0.76 (0.22 – 1.86)	Northwest
Assessment criteria IFC Guideline Value										
24hr	-	-	-	0.025	0.05	-			—	—
1 hr	-	0.2 mg/m3	-	-	-	0.02 mg/m3			—	—

4.4.2 *Noise*

The aim of baseline noise monitoring is to establish the background level at nearby Noise Sensitive Receivers (NSRs).

Methodology

Four noise monitors were set up to measure background noise levels for 24 hours at the identified NSRs, which was the same location and monitoring period as per the ASRs. Details are shown in *Table 4.15* and illustrated in *Figure 4.18.* The surrounding environment of the noise quality monitoring stations is showed in *Figure 4.19.*

Table 4.15 Noise Monitoring Stations

Sampling Point	GPS Coordinates	Description	Land use
6N1	18°15'31.68" N 95°19'34.24" E	Near maintenance department of MOGE in Myanaung oil field, northeast of oil production well No.171	Bare ground
6N2	18°15'3.91" N 95°19'30.98" E	West of electricity department of MOGE in Myanaung oil field	Bare ground
6N3	18°14'22.01" N 95°20'16.31" E	At southeast of oil production well No.159 and southwest of oil storage tanks, Myanaung oil field	Bare ground
6N4	18°13'52.50" N 95°20'31.14" E	At northeast of Kon Ta Lon village in Myanaung oil field	Agricultural Land

The 24-hour baseline noise monitoring was conducted by using the portable sound meter (Lutron, SL-0423SD, unit: dB). Noise level (L_{Aeq}) were measured and recorded at a ten-minute interval and averaged at an hourly and daily (i.e. 24-hour) interval using the following formula:

$L_{Aeq} = 10*LOG_{10}(AVERGAE(10^((RANGE)/10)))$

Baseline Noise Measurements

The results of baseline noise monitoring are summarized in *Table 4.16*.

Since there is no noise standard of operation activities to receptors in Myanmar, the IFC standards for operational activities were adopted to evaluate the measured noise levels in the area which was in the vicinity of existing oil and gas operations (*Table 4.16*). The results of noise monitoring showed that the hourly and daily noise levels at all monitoring stations are well below the standard as stipulated in the IFC guidelines, and it thus appeared that the existing oil producing facilities were operated in environmentally acceptable manner in relation to noise emissions.

Table 4.16 Hourly L_{Aeq} Values at the Designated Noise Monitoring Stations

Monitoring Time	Stations			
	6N1	6N2	6N3	6N4
6:00-7:00	52	38	51	44
7:00-8:00	50	38	46	44
8:00:9:00	47	38	46	41
9:00-10:00	54	37	54	46
10:00-11:00	48	37	46	47
11:00-12:00	47	38	45	42
12:00-13:00	39	51	41	36
13:00-14:00	44	46	37	46
14:00-15:00	38	38	45	45
15:00-16:00	50	38	44	42
16:00-17:00	49	38	40	43
17:00-18:00	39	37	40	52
18:00-19:00	38	37	39	42
19:00-20:00	42	38	37	46
20:00-21:00	39	51	39	40
21:00-22:00	41	46	41	44
Day L_{Aeq}	45	40	43	44
22:00-23:00	39	40	39	38
23:00-24:00	39	37	39	38
24:00-1:00	40	37	37	38
1:00-2:00	39	37	37	37
2:00-3:00	39	39	39	37
3:00-4:00	39	39	39	38
4:00-5:00	38	41	41	51
5:00-6:00	39	40	40	46
Night L_{Aeq}	39	39	39	40

Table 4.17 IFC Noise Standards at Operation Stage

Description	Daytime (Leq, dB) (0700 to 2200, 15 hours)	Nighttime (Leq, dB) (2200 to 0700, 9 hours)
Residential; Institutional; Education	55	45
Industrial; Commercial	70	70

4.4.3 Surface Water Quality

Methodology

Sampling Locations

To characterise the surface water quality within the Project Area, surface water sampling was carried out at four locations in December 2014. Details of sampling locations were presented in *Table 4.18* below and indicated in *Figure 4.20.* The surrounding environment of surface water sampling location is shown in *Figure 4.21*.

Sampling Procedures

Water samples were taken by Alpha horizontal water sampler and collected in sterilized sample containers. All sampling was in strict accordance with

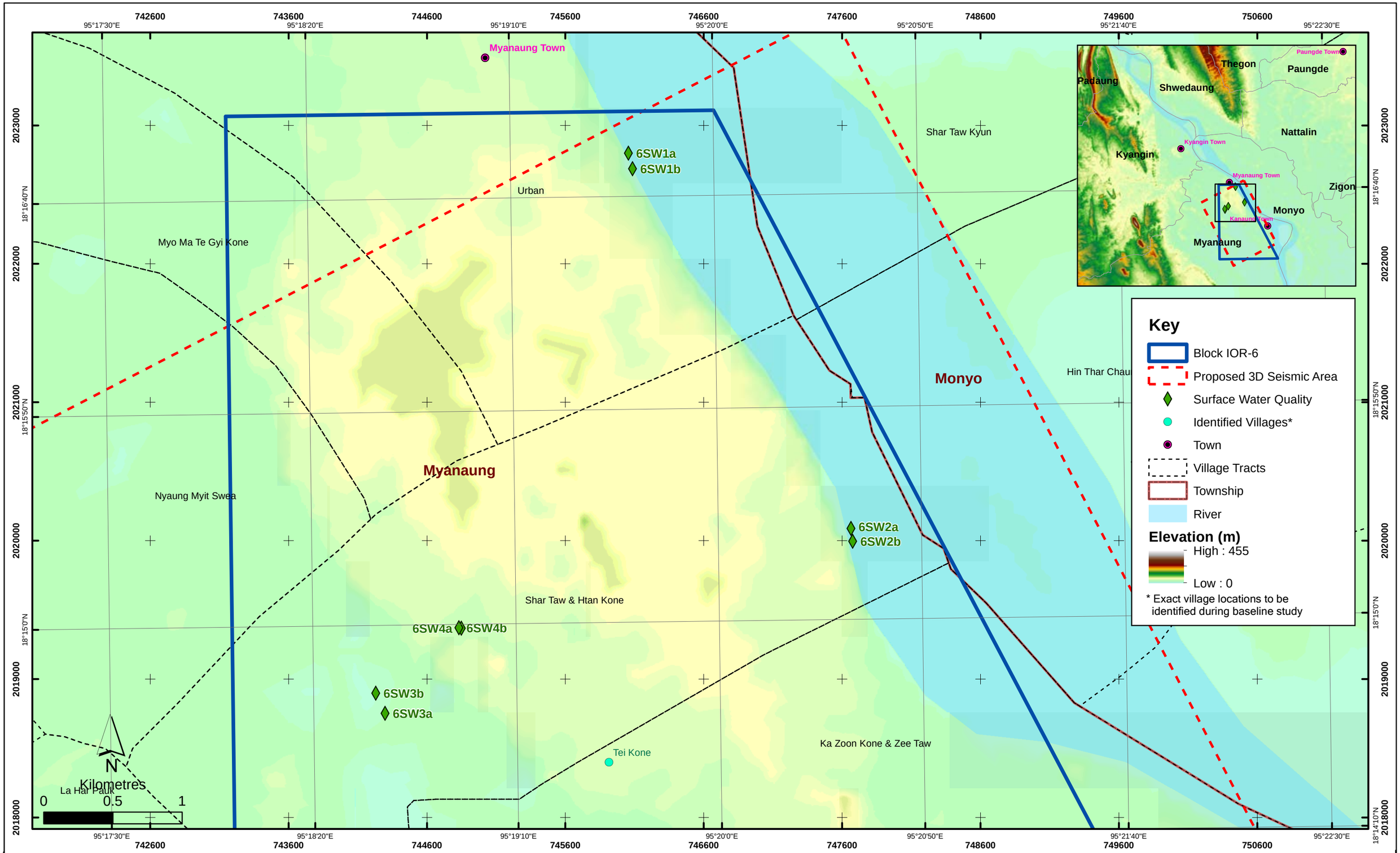

Figure 4.20

Surface Water Quality Sampling Location

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recognized standard procedures. The parameters for *in situ* measures included pH, temperature, dissolved oxygen (DO), electrical conductivity (EC), and turbidity and surface water samples were concurrently collected. Two samples were taken at each sampling location. Samples were then stored at 4 °C for transportation to laboratory analyses under chain-of-custody procedures. The parameters for laboratory analyses were listed in *Table 4.19*. Equipment for surface water sampling is showed in *Table 4.20.*

Table 4.18 Sampling Locations for Surface Water Quality

Sampling Location	Coordinates	Description	Sampling Date
6SW-1	18°16'50.17" N 95°19'38.95" E	In the Ayeyarwady River, East of Myanaung Town	21 December 2014
6SW-2	18°15'21.38" N 95°20'32.49" E	In the Ayeyarwady River, Southeast of Myanaung Town	21 December 2014
6SW-3	18°14'39.40" N 95°18'37.36" E	In the Sangon Stream, SW of Sat Pya Gyin village, Myanaung Township	19 December 2014
6SW-4	18°14'59.12" N 95°18'56.40" E	In the small tributary of Sangon Stream, West of Sat Pya Gyin village, Myanaung Township	20 December 2014

Table 4.19 Parameters for Laboratory Analyses of Baseline Surface Water Monitoring

Parameters	Unit
BOD5	mg/L
COD	mg/L
Total Suspended Solids	mg/L
Total Nitrogen	mg/L
Total Phosphorous	mg/L
Total Coliform Bacteria	
Oil and Grease	mg/L
Heavy Metals	

Table 4.20 Equipment for Surface Water Sampling

Equipment	Brand	Model
Multiparameter (water quality)	HANNA	HI7609829 (with 3 sensors)
pH meter	HANNA	HI 98129
Alpha Bottle (Water Sampler)	Wildlife Supply Company®	-

Figure 4.21a Surrounding Environment of Surface Water Sampling Locations

↑ Station: 6SW1

↑ Station: 6SW2

Figure 4.21b Surrounding Environment of Surface Water Sampling Locations

↑ Station: 6SW3

↑ Station: 6SW4

With reference to *Figure 4.7*, IOR 6 is located within the lower Ayeyarwady River Basin. The total length of lower Ayeyarwady River Basin is 690 km with a total catchment area of 95,600 km^2 and annual surface water of 85.80 km^3 [(1)]. Results of surface water quality monitoring are summarized in *Table 4.21*.

Table 4.21 Result Summary of Surface Water Quality Monitoring

Item/Sample Name	6SW-1A	6SW-1B	6SW-2A	6SW-2B	6SW-3A	6SW-3B	6SW-4A	6SW-4B
Weather	Cloudy	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny
Transparency	Medium	Medium	High	High	Low	Low	High	High
Temperature _Water (C)	24.5	23.6	23.4	22.6	26.4	25.5	25.1	24.7
pH	24.5	23.6	23.4	22.6	26.4	25.5	8.65	8.62
DO (mg/l)	8.5	8.20	8.3	8.8	8.20	8.15	8.7	8.5
EC (µs)	333	330	409	460	1025	1202	1306	1317
TDS (ppm)	165	164	204	229	512	605	653	656
Turbidity (FNU)	54.6	60.5	25.8	18.9	89.3	110.2	8.8	8.7
Colour (TCU)	5	10	5	Nil	160	130	10	5
Alkalinity	5	10	5	Nil	160	130	10	5
Hardness	113	108	120	146	335	400	424	424
BOD5 (mg/l)	94	91	91	82	22	65	38	38
COD (mg/l)	8	8	10	7	20	18	8	6
Total Nitrogen (mg/l)	32	32	32	32	64	64	32	32
Total Phosphorus (mg/l)	<2	<2	4	<2	4	3	2	<2
Oil and grease (mg/l)	0.053	0.056	0.039	0.045	0.013	0.026	0.123	0.136
TSS (mg/l)	<1	<1	<1	<1	<1	<1	<1	<1
Total Coliform	22	32	17	7	681	470	9	7

4.4.4 Groundwater

Methodology

To access groundwater quality in the Project Area, a total of four existing residential wells (dug wells and drilled/ tube wells) were sampled. The sampling locations were selected to represent the spatial extent and sensitive receivers in the residential areas of the block.

A total of two replicate groundwater samples were collected by sampler or clean bucket at each location. Immediately after collection, the samples were transferred to labelled sample containers containing the necessary preservatives prepared by the laboratory. Samples were then stored at 4 ºC for transportation to laboratory analyses under chain-of-custody procedures. The parameters for assessing the groundwater quality are the same as those for the surface water quality monitoring in *Section 4.4.3*. Details of groundwater sampling location are presented in *Table 4.22* and indicated on

(1) http://www.wepa-db.net/pdf/1203forum/10.pdf

Figure 4.22. The surrounding environment of groundwater sampling is presented in *Figure 4.23*.

Table 4.22 Groundwater Sampling Locations at Block IOR-6

Sampling Location	Replicate No.	Coordinates	Description	Sampling Date
6GW1	1	18°15'16.43" N 95°19'52.35" E	Well in Payathonesu (west) monastery compound, South of Myanaung town	20 December 2014
	2	18°15'39.66" N 95°19'51.20" E	Tube well near Buddha religious house, Shar Taw village, South of Myanaung town	20 December 2014
6GW2	1	18°15'3.85" N 95°19'33.45" E	Tube well of MOGE electricity department compound	21 December 2014
	2	18°15'3.85" N 95°19'33.45" E	Same as 6GW-2A	21 December 2014
6GW3	1	18°14'12.58" N 95°20'36.41" E	Tube well in Kyaung Gon village, Myanaung township	20 December 2014
	2	18°14'23.03" N 95°19'55.93" E	Tube well in the agriculture land, southeast of Te Gon village, Myanaung township	20 December 2014
6GW-4	1	18°13'52.62" N 95°20'30.09" E	Well in the Kontalone village, Myanaung township	20 December 2014
	2	18°13'51.21" N 95°20'28.76" E	Well in the Kontalone village, Myanaung township	20 December 2014

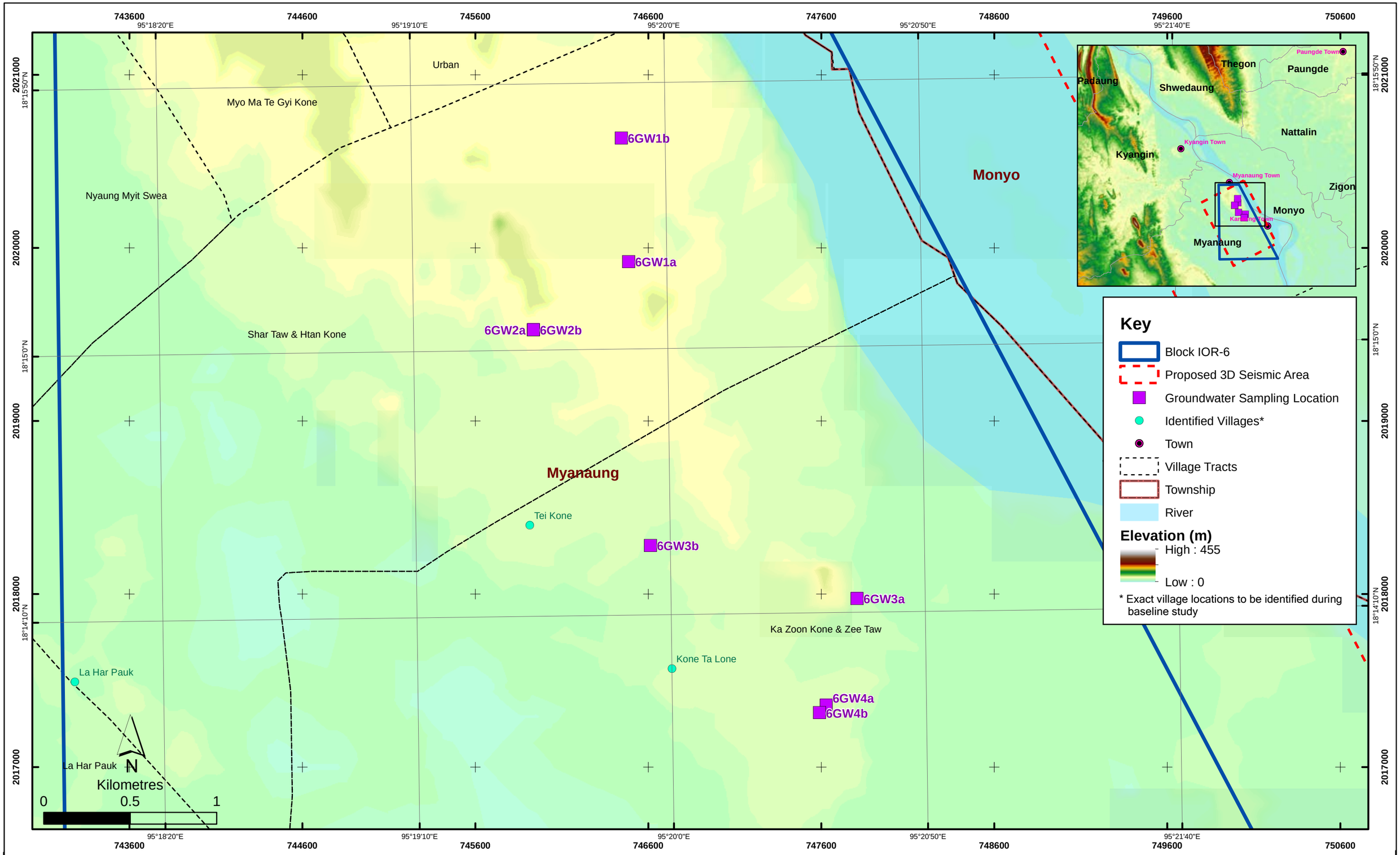

Figure 4.22

Groundwater Sampling Location

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Figure 4.23a Surrounding Environment of Groundwater Sampling Locations

↑ Station: 6GW1

↑ Station: 6GW2

Figure 4.23b Surrounding Environment of Groundwater Sampling Locations

↑ Station: 6GW3

↑ Station: 6GW4

Baseline Groundwater Quality Results

The aquifer within Block IOR 6 is mainly Alluvian aquifer (*Figure 4.8*). It is estimated that the groundwater potential in the lower Ayeyarwady region, where IOR 6 is situate at, is approximately 153.25 km^3 [1]. Results of groundwater quality monitoring are summarized in *Table 4.23*.

Table 4.23 Results Summary of Groundwater Quality Monitoring

Item/Sample Name	6GW-1A	6GW-1B	6GW-2A	6GW-2B	6GW-3A	6GW-3B	6GW-4A	6GW-4B
Weather	Sunny	Sunny	Partly cloudy	Sunny	Sunny	Sunny	Sunny	Sunny
Transparency	High	High	High	High	High	High	High	High
Temperature (°C)	28.9	28.9	28.00	28.00	28.3	30.00	25.2	29.21
pH	6.80	6.62	8.01	8.01	7.48	7.88	7.28	6.69
DO (mg/l)	6.20	6.19	8.10	8.10	6.31	6.40	6.31	5.91
EC (µs)	122	1099	632	632	20.26	730	107	262
Turbidity (FNU)	2.8	1.3	1.9	1.9	17.8	15.4	15.5	4.2
Colour (TCU)	Nil	Nil	Nil	Nil	Nil	Nil	10	Nil
Alkalinity	41	115	139	140	213	317	52	63
Hardness	28	144	95	97	246	7	36	57
BOD5 (mg/l)	6	7	7	7	10	6	10	8
COD (mg/l)	32	32	32	32	32	32	32	32
Total Nitrogen (mg/l)	<2	<2	<2	<2	<2	<2	<2	<2
Total Phosphorus (mg/l)	0.073	0.108	0.055	0.050	0.057	0.261	0.059	0.046
Oil and grease (mg/l)	<1	<1	<1	<1	<1	<1	<1	<1
TSS (mg/l)	<5	<5	<5	<5	<5	<5	12	<5
Total Coliform	>23	<1.1	<1.1	<1.1	<1.1	<1.1	16	1.1

4.4.5 Soil

Methodology

Soil Sampling Location

The soil sampling locations were chosen as close as practicable to the existing oil wells within Block IOR-6. For safety reasons, underground utilities inspection was conducted at the proposed borehole location jointly with the staff from MOGE before soil sampling. Details of the monitoring location are shown in *Table 4.24* and illustrated in *Figure 4.24*. The surrounding environment of the soil sampling stations and soil condition are showed in *Figure 4.25*.

[1] http://danishwater.dk/wp-content/uploads/2013/09/Ministry-of-Agriculture-and-Irrigation-Department-of-Water-Resources-Utilization-Sustainable-Development-and-Management-of-Groundwater-in-Myanmar.pdf

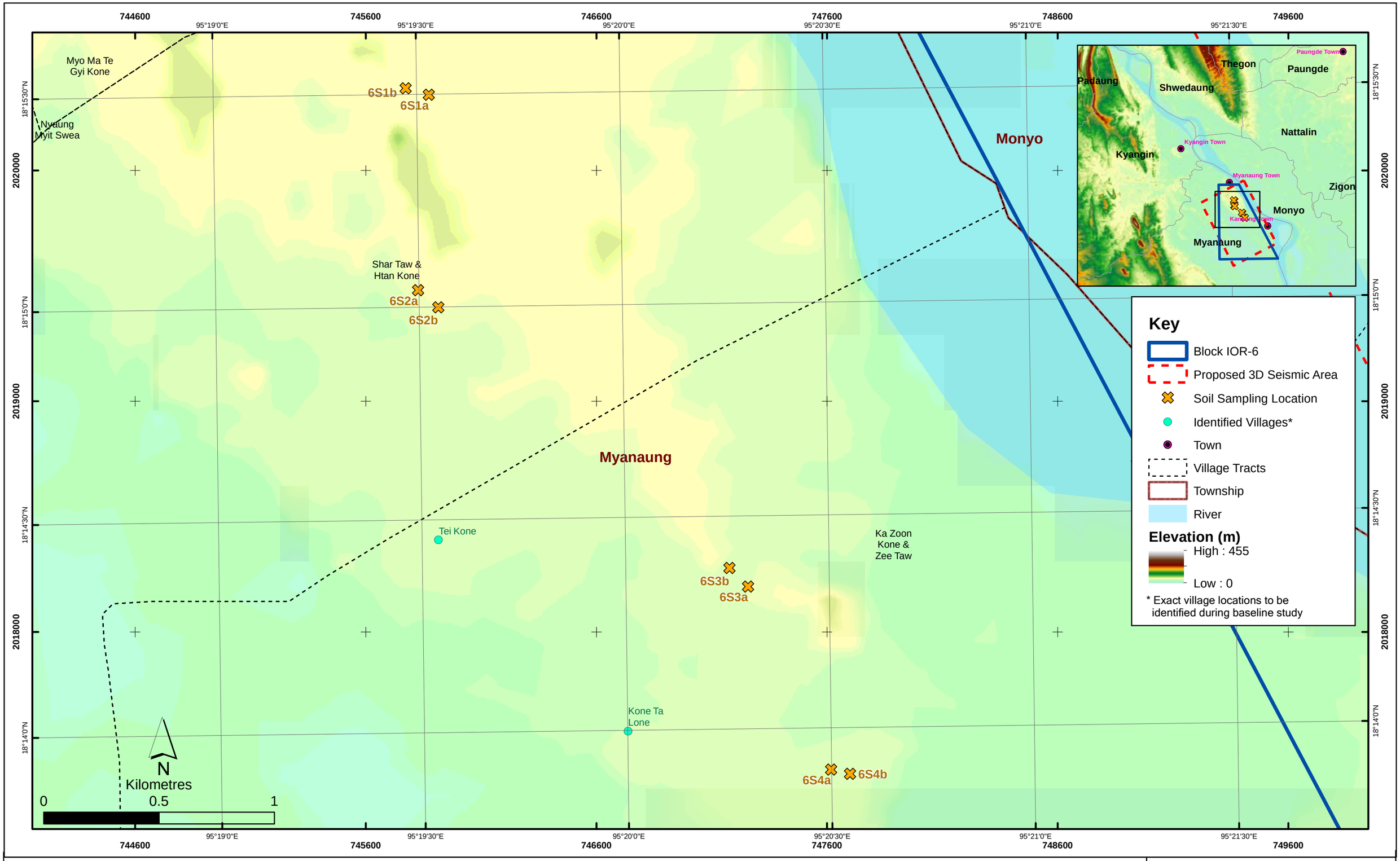

Figure 4.24

Soil Quality Sampling Location

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Sampling Methodology and Equipment

All soil boring/ excavation and sampling were undertaken by means of dry rotary drilling method. At each sampling location, a total of two (2) replicate samples were collected for laboratory analyses. Parameters for laboratory analyses included:

- pH;
- Arsenic (As);
- Lead (Pb);
- Cadmium (Cd);
- Copper (Cu);
- Zinc (Zn);
- Manganese (Mn); and
- Iron (Fe).

Table 4.24 Baseline Soil Sampling Locations in December 2014

Sampling Station	Replicate	Coordinates	Description	Sampling Date
6S-1	1	18°15'29.91" N 95°19'31.66" E	In the close proximity of oil producing well No.171, Myanaung oil field	20 December 2014
	2	18°15'30.87" N 95°19'28.26" E		
6S-2	1	18°15'2.40" N 95°19'29.72" E	Nearby the MOGE electricity department and northwest of oil producing well No.82, Myanaung oil field	20 December 2014
	2	18°14'59.95" N 95°19'32.65" E		
6S-3	1	18°14'20.04" N 95°20'17.83" E	In the harvested sesame land, nearby oil production well No.159 and southwest of oil storage tanks, Myanaung oil field	19 December 2014
	2	18°14'22.70" N 95°20'15.12" E		
6S-4	1	18°13'54.09" N 95°20'29.73" E	In the sesame land, northeast of Kon ta lon village	19 December 2014
	2	18°13'53.46" N 95°20'32.51" E		

Figure 4.25a Surrounding Environment of Soil Sampling Locations

↑ Station: 6S1

↑ Station: 6S2

Figure 4.25b Surrounding Environment of Soil Sampling Locations

↑ Station: 6S3

↑ Station: 6S4

In the course of survey, sampling procedure, sample preservation and sample analysis recommended in standard operating procedure of U.S. EPA (SOP-2013, SOP2016, and SOP 2003) were referred. In soil sampling, the standard agricultural sampler (Soil Auger) was applied. The sampler is a stainless steel tube that is sharpened on one end and fitted with a long, T-shaped handle. This tube is approximately three inches inside diameter. To refrain from contamination, about 20 – 30 cm of top soil was removed by the sampler before sampling. Then sample was taken and collected in cleaned plastic bag. Chemical preservation of samples was not applied because it is generally not recommended by standard method. Samples were cooled in an ice box which temperature was under 4 ℃. Samples were protected from sunlight to minimize any potential chemical reaction. Soil texture and colour were also recorded upon sampling.Baseline Soil Quality Results

The results of baseline soil quality monitoring are summarized in *Table 4.25.*

In general, the soil in the sampling locations is sandy in nature and was previously disturbed by agricultural activities. As there is no relevant national guideline or IFC standard to assess the soil quality, the Dutch Standard 2000 is adopted for evaluation, and all the measured parameters meet the assessment criteria.

Table 4.25 Results Summary of Baseline Soil Quality Monitoring in December 2014

Parameter	Unit	Station				Dutch Standard 2000
		6S1	6S2	6S3	6S4	
pH	-	6.7	6.8	6.7	6.6	–
As	mg/kg	N.D.	N.D.	N.D.	N.D.	55
Pb	mg/kg	180	164	164	152	530
Cd	mg/kg	0.008	0.005	0.007	0.007	12
Cu	mg/kg	87.5	107.5	116.5	102.5	800
Zn	mg/kg	87.5	91.0	97.5	104.0	720
Mn	mg/kg	32.5	26.5	31.0	17.5	–
Fe	mg/kg	5,290	5,650	5,800	6,025	–
Soil Texture	-	Sand to Clay	Silty Sand	Silty Sand	Silty Sand to Clayey Sand	–
Soil Colour	-	Yellow to Light Gray	Yellow Brown	Reddish Brown	Reddish Brown to Gray	–

Notes: N.D. = Not Detected

4.5 BASELINE SURVEYS FOR BIOLOGICAL ENVIRONMENT – TERRESTRIAL ECOLOGY

This section describes the biological environment of the Project Area for the proposed seismic survey and workover activities. The baseline information has been gathered during focussed baseline field surveys conducted during the dry season in December 2014. The discussion is limited to those biological components either recorded or likely to be found within the Project Area. These include the following:

- Habitats and Vegetation;
- Avifauna (Birds);
- Herpetofauna (Amphibians and Reptiles);
- Mammals;
- Butterflies; and
- Aquatic fauna.

Each of the above are discussed in turn below.

4.5.1 Habitats and Vegetation

Methodology

Field survey focusing on habitat and vegetation (including trees) within the Project Area was performed in December 2014 to establish the general terrestrial ecological profile of the Project Area. Habitats were mapped based on publicly available aerial photos and field ground-truthing. Representative areas of each habitat type were surveyed on foot. Plant species of each habitat type encountered and their relative abundance were recorded with special attention to rare or protected species.

Results

The area surveyed within the Project Area was found to comprise five (5) key habitat types, including agricultural land, cultivated land / village, developed area, shrubland and river / reservoir (*Figure 4.26*). Sizes of these habitats are presented in *Table 4.26*. Agricultural land was the main habitat type within the Project Area, covering 73.4% of the Project Area. Overall, the main feature of the Project Area was that it was predominantly composed of human-modified habitats (i.e. agricultural land, cultivated land / village and developed area).

Table 4.26 Areas (Total and Percentage) of Habitat Types recorded within the Project Area during the December 2014 Field Survey

Habitat	Total Area within the Project Area (sq. km)	Percent of Habitat in the Project Area (%)
Agricultural Land	65	73.4
Cultivated Land / Village	9	9.7
Developed Area	11	12.4
Shrubland	1	0.6
River / Reservoir	3	3.8
TOTAL	**89**	**100**

A total of 92 plant species were recorded within the Project Area (see *Annex A*). No plant species of recognised conservation interest were recorded

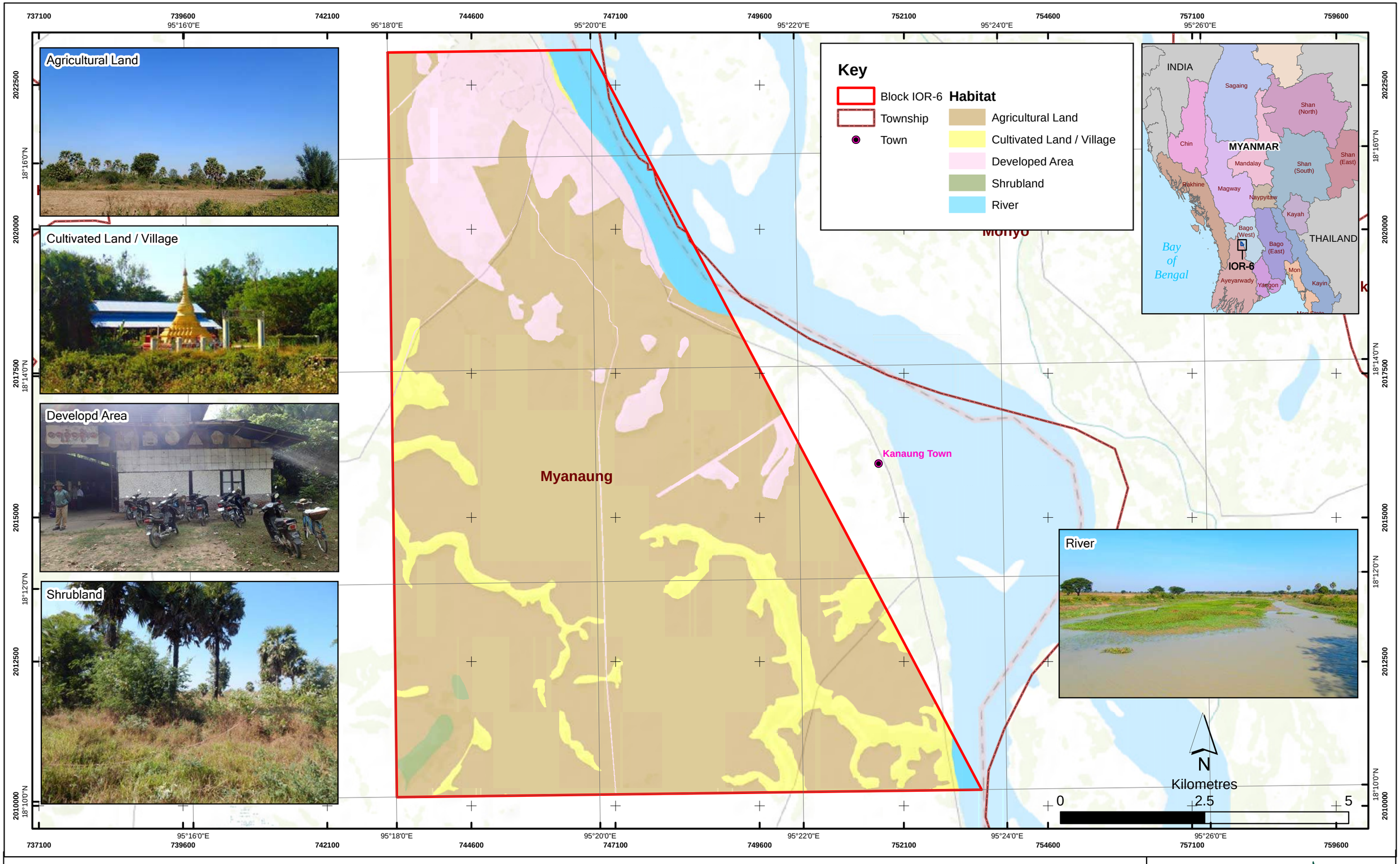

Figure 4.26

Recorded Habitats in Block IOR-6

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within the Project Area. The photos of representative plant species recorded in Myanaung are shown in *Figure 4.27.*

The following sections present a description of the vegetation of each habitat type along with representative photos.

Agricultural Land

Agricultural habitat was the largest habitat type found within the Project Area which was observed nearly across the whole Block IOR-6 (see Habitat Map in *Figure 4.26*). This habitat was mainly restricted to low terrain areas and covered a total area of 65 km^2, which accounted for 73.4% of the Project Area. Agricultural land is regarded as modified habitat with low ecological value / receptor sensitivity.

Agricultural land is mainly paddy field cultivated with Asian Rice (*Oryza sativa L*). Cultivated patches of Cow Pea (*Vigna catjang Walp*). and Maize (*Zea mays L*). were also commonly recorded (see *Annex A*). A total of 49 plan species were observed at the agricultural land with no plant species of recognised conservation interest found.

Representative photo of agricultural land is shown in *Figure 4.28*.

Figure 4.27a Photos of Representative Plant Species

↑ *Bambusa siamensis* Kz.

↑ *Lannea coromandelica* Houtt. Merr.

Figure 4.27b Photos of Representative Plant Species

↑ *Morinda tinctoria* Roxb.

↑ *Streblus asper Lour*

Figure 4.28 Representative Photo of Agricultural Land Habitat Type

Cultivated Land / Village

Cultivated land and village were often inseparable in terms of habitat mapping given the high extent of planting of fruit and crop trees in village areas. As is common practice, cultivated land / village is used as a habitat type given that no separation is possible across many parts of the Project Area. They are regarded as man-made, disturbed habitat with low ecological value / receptor sensitivity.

Cultivated Land / Village were observed mainly near the southeastern and southwestern boundary of the Project Area (see Habitat Map in *Figure 4.26*). A photographic record of cultivated land/village is shown in *Figure 4.29*.

A total of 36 plant species were recorded in cultivated land / village. Common plant species of the cultivated land included Maize (*Zea mays L*). and Mango Tree (*Mangifera indica L*). (see *Annex A*). Plant species of recognised conservation interest was not recorded within the cultivated land / village habitat type of the Project Area.

Figure 4.29 Representative Photo of Cultivated Land / Village Habitat Type

Developed Area

Developed area is mainly found in the northern part of the Project Area which covered an area of 11 km² (see Habitat Map in *Figure 4.26*). It is mainly the outskirt of Myanaung Town. The developed area is regarded as man-made, disturbed habitat with low ecological value / receptor sensitivity. A photographic record of developed area is shown in *Figure 4.30*.

A total of 49 plant species was found within the developed area of the Project Area (see *Annex A*). The plant species in the developed area was dominated by flowering plants and Mango Tree (*Mangifera indica L.*), Neem (*Azadirachta indica*) and Banana Tree (*Musa* spp) were commonly found. No plant species of recognised conservation interest was recorded within this habitat type.

Figure 4.30 Representative Photo of Developed Area

Shrubland

Two small patches of shrubland are found near the southwestern concern of the Project Area, covering a total area of less than 1 km^2 (see Habitat Map in *Figure 4.26*). It is mainly the outskirt of Myanaung Town. A photographic record of developed area is shown in *Figure 4.31*.

A total of 22 plant species was found within the shrubland of the Project Area (see *Annex A*). The plant species was dominated by a flowering herb species (*Acmella vliginosa (Sw.) Cass*). No plant species of recognised conservation interest was recorded within this habitat type.

According to villagers, the reptile species Yellow-headed Tortoise (*Indotestudo elongata*) (Yellow-headed Tortoise) and King Cobra (*Ophiophagus hannah*) have previously been found in shrubland, which are listed as endangered and vulnerable species in the *2015 IUCN Red List of Threatened Species*, respectively [1].

[1] The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 27 January 2015.

Figure 4.31 Representative Photo of Shrubland Habitat Type

River

The Ayeyarwady River is the main river identified within the Project Area (*Figure 4.26*). The total area of the river within the Project Area was estimated to be approximately 3 km^2. Vegetation record was not made for the river as it was included in the record of adjacent habitats. It is considered as with medium ecological value / receptor sensitivity with regard to its naturalness and size.

A photographic record of river is shown in *Figure 4.32*.

Figure 4.32 Representative Photo of River Habitat Type

4.5.2 *Avifauna (Bird)*

Methodology

The avifauna (bird) communities of each habitat types within the Project Area were surveyed using the qualitative transect count method. During the survey, all birds seen or heard from either sides of the transect were identified to species where possible with their relatively abundance noted. Signs of breeding (eg nests, recently fledged juveniles) within the Project Area were also recorded, if any. Observations were made using binoculars and photographic records were taken, if possible. Special attention was paid to egretry, wetland dependent and migratory birds.

Results

A total of 42 bird species were recorded during the survey period within the Project Area (see *Annex B*). Eurasian Tree Sparrow (*Passer montanus*), House Sparrow (*Passer domesticus*), Common Myna (*Acridotheres tristis*), Rock Dove (*Columba livia*) and Barn Swallow (*Hirundo rustica*) were common bird species found in the Project Area. The abundance of bird was noted to be higher in agricultural land and developed area while the species richness was highest in cultivated land / village.

No bird species of recognised conservation interest was found within the Project Area. Photo records of identified bird species are shown in *Figure 4.33*.

Figure 4.33a Photo Records of Identified Bird Species

Burmese Shrike *(Lanius collurioides)*

Asian Green Bee-eater *(Merops orientalis)*

4.5.3 Herpetofauna (Amphibians and Reptiles)

Methodology

Herpetofauna survey was conducted through direct observation and active searching in all habitat types in potential hiding places such as amongst leaf litter, inside holes, under stones and logs within the Project Area. Particular attention was given to streams and watercourses. Auditory detection of species-specific calls was also used to survey frogs and toads. During the surveys, all reptiles and amphibians sighted and heard were recorded. Interviews were also conducted with villagers to gather information of the herpetofauna species they found within the Project Area.

Results

During the herpetofauna survey, six (6) amphibian species and 16 reptiles species were record within the Project Area through observation and interview (see *Annex C*). It is important to note, however, that data obtained through the interviews has not been verified through observation by the survey team.

The species richness of herpetofauna was the highest in shrubland within the Project Area. According to villagers, the reptile species Yellow-headed Tortoise (*Indotestudo elongata*) (Yellow-headed Tortoise) and King Cobra (*Ophiophagus hannah*) have previously been found in shrubland. Yellow-headed Tortoise is listed as an endangered species in the *2015 IUCN Red List of Threatened Species* [1] and is also protected by *Myanmar Forest Law*. While having a widespread distribution in Asia, its numbers have drastically declined due to over-collection. Owing to its high value in the wildlife trade, it is likely that this species is much depleted in the Project Area. In terms of habitat preference, it is reported that this species prefers humid forest areas and is therefore more likely to occur in less degraded forested areas where canopy cover maintains humidity. King Cobra (*Ophiophagus hannah*) is listed as a vulnerable species in the *2015 IUCN Red List of Threatened Species* [2]. This species has a wide distribution but is considered not common in any area in which it occurs. Habitat loss and exploitation are believed to be the main threats to this species.

Other species recorded are regarded as common and widespread species within no recognised conservation interest. Photo records of identified herpetofauna are shown in *Figure 4.34*.

(1) The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 27 January 2015.

(2) *Ibid*.

Figure 4.34 Photo Records of Identified Herpetofauna Species

Skin of Checkered Keelback (*Xenochrophis piscator*)

Common Garden Lizard *Calotes versicolor*

4.5.4 Mammals

Methodology

As most mammals often occur at low densities, all sightings, tracks, and signs of mammals (including droppings) were actively searched along the survey transects during the field survey. Interviews were also conducted with villagers to gather information of the mammal species they found within the Project Area.

Results

Five (5) mammal species were recorded within the Project Area through observation and interview (see *Annex D*). It is important to note, however, that data obtained through the interviews has not been verified through observation by the survey team. Amongst the recorded mammal species, the Hoary-bellied Squirrel (*Callosciurus pygerythrus*) was considered to be common species within the Project Area. The number of mammal species recorded was comparable between habitats. All mammal species recorded are regarded as common and widespread species within no recognised conservation interest (*Figure 4.35*).

Figure 4.35 Domestic Ox (Bos Taurus) observed in the Study Area

4.5.5 Butterflies

Methodology

Butterflies at different habitats within the Project Area were surveyed using qualitative transect count method. Butterflies from either side of the survey transect were identified with their relatively abundance noted.

Results

In total, 19 butterflies species were recorded within the Project Area (see *Annex E*). It was noted that the relatively abundance of butterfly was higher in developed area and agricultural land while the species richness was the highest at agricultural land. No butterfly species of recognised conservation interest was found within the Project Area. Photo records of identified butterflies species are shown in *Figure 4.36*.

4.5.6 Aquatic Fauna

Methodology

Fishes were collected with the help of local fishermen within the Project Area by using local fishing gears (e.g. fish traps, gill nets etc) to obtain a qualitative species list. Fish species which could not be identified in the field were preserved in 10% formalin solution and sent to laboratory for later identification.

Results

A total of 21 fish species were recorded from the aquatic habitats of the Project Area (see *Annex F*). Photo records of identified aquatic fauna species are shown in *Figure 4.37*.

Commercially important fish species including Long Whisker Catfish (*Mystus gulio*), Hilsa Shad (*Tenualosa ilisha*), Yellotail Catfish (*Pangasius pangasius*), Catla (*Catla catla*), Bronze Featherback (*Notopterus notopterus*) and Wallago (*Wallago attu*) were recorded within the Project Area. Amongst the recorded species, Butter Catfish (*Ompok bimaculatus*) and Wallago (*Wallago attu*) were considered as near threatened in the *2015 IUCN Red List of Threatened Species* [1]. However, Butter Catfish (*Ompok bimaculatus*) is reported to be relatively abundant throughout its distribution and no empirical data on declines in its entire range is available. For Wallago (*Wallago attu*), it is also considered as widely distributed and hence has a very large population although it is noted to be overexploited as a food fish.

[1] The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 27 January 2015.

Figure 4.36 Photo Records of Identified Butterflies Species

Junonia almana

Papilio demoleus

Figure 4.37 Photo Records of Identified Aquatic Fauna Species

Clarias batrachus

Villagers catching fishes in river

4.6 SOCIO-ECONOMIC ENVIRONMENT – STAKEHOLDER ENGAGEMENT AND CONSULTATION MEETING

4.6.1 Approach and Methodology

For the purpose of establishing the human environment baseline, a phased participatory approach was adopted, as is discussed in the following sub sections. Through this approach an attempt was made to integrate the local understanding and perspective into the impact assessment process and the identification of the mitigation measures. The purpose of such an approach was to allow for:

- The triangulation of the information available from secondary sources through the information made available by the local community, both qualitative and quantitative;
- Formulation of the socio-economic baseline on the basis of a combination of primary and secondary qualitative and quantitative data;
- An understanding to be developed of the community's perception towards the industries, the past interaction with similar projects and the experiences of the same; and
- An understanding to be developed of the local community's perception of the project and its activities and the possible impacts from the same and the desirable mitigation measures.

In keeping with this approach, the SIA Study was divided into the following stages.

Definition of Project Area

The Project Area for the purpose of the social impact assessment was limited to the villages where the seismic survey and workover activities will be carried out. This was done with an understanding that most of the impacts associated with the Project Area are supposed to be localized. The baseline section capture the information pertaining to the villages identified in the Project Area.

Scoping and Initial Studies

As part of the scoping exercise for the Project, MPRL E&P undertook a site reconnaissance visit to the proposed block and the surrounding communities in October 2014. The purpose of this visit was to develop an understanding of the site settings, the environmental and social sensitivities, to identify relevant stakeholders and to collect secondary data relevant to the Project.

As part of the visit, limited consultations with the local community were conducted to understand the local environmental and social issues in the area and to receive feedback from the stakeholders on the same as interviews were

only allowed to be conducted in villages where the village tract leaders lived (only 3 out of 8 identified villages were visited).

In addition to this, an understanding was developed of the national and international regulatory requirements for the Project. Also, a desk based review was undertaken of the Project documents and the information available on the Project Area in the public domain.

Secondary Data Collection

Refer to *Section 4.3.3* for the detailed findings of the secondary data examination. For the purpose of secondary data collection for the baseline, the information available in the public domain was collected and reviewed. This, along with the primary data collected was used to develop the social baseline for the Project. The secondary data collection and review was undertaken across the Study period. However to start with this was primarily to understand the preliminary socio economic profile of the region, critical issues related to livelihood, gender, ethnic issues (if any), dependency on land, presence of civil society and NGOs in the area etc. The information specific to the Project Area is limited and generic in the public domain (especially available online). Nevertheless it has informed the development of survey and consultation tools to be used for the purpose of baseline data collection and subsequently informing the impact assessment process for the Project.

Formulation of the Primary Data Collection Tools

On the basis of the understanding thus developed on the Project, ERM identified the tools for the purpose of the primary data collection for the impact assessment of the Project. These tools included both qualitative and quantitative tools such as Focus Group Discussions (FGD) checklists and household (HH) and community survey tools. The purpose of these tools was to allow for a triangulation of the information available from the secondary sources as well as capture the individual perceptions/viewpoints of the various stakeholder groups towards the Project, its activities and its possible impacts and mitigation measures.

The community and HH survey tools were aimed at allowing for an understanding to be developed of the village profile and the community's perceptions towards the Project and its activities. The FGD Checklists on the other hand were identified for the purpose of understanding the specific impacts on land use and activities such as agriculture due to the Project activities and the perceptions of the various stakeholder groups. These tools were aimed at developing an understanding of the following:

- Previous instances of land acquisition in the area and the impacts associated with it in the long run;

- Changing patterns of land use and livelihood profiles in the villages owing to the oil and gas sector in the area;

- Nature of interaction with Project;
- Tradeoffs between the negative and positive aspects of the Project in the area;
- Sharing of development benefits with the villages and expectations of the community, both directly and indirectly affected; and
- Gender based impacts in the villages.

As part of the primary data collection, a random sample of 61 households in the seven (7) villages was covered. In addition to this, community surveys were undertaken across the seven (7) villages in the Project Area. Apart from the quantitative data collection, for the purpose of qualitative information, consultations were undertaken with the farmers group and women group in Myanaung.

Stakeholder Identification and Analysis

The stakeholders identified during the scoping stage were updated and an understanding was developed of the individual concerns, expectations and influences of the stakeholders on the Project. The purpose of such an understanding was to allow for a proper assessment and mitigation of the impacts. On the basis of this understanding, an exercise of stakeholder mapping was undertaken, the purpose of which was to:

- Identify each stakeholder group;
- Study their profile and the nature of the stakes;
- Understand each group's specific issues, concerns as well as expectations from the Project; and
- Gauge their influence on the Project.

On the basis of such an understanding, the stakeholders were categorised into High Influence/Priority, Medium Influence/ Priority and Low Influence/Priority on the basis of their influence/power as well as interest in the Project.

Compilation of the Socio-Economic Baseline

On the basis of the information thus made available from primary and secondary sources, the following socio-economic information for the Project Area was generated:

- Demographic profile of the population
- Socio-economic profile of the affected households/communities;
- Current land use;

- Land ownership and size of holdings;
- Local physical and social infrastructure; and
- Livelihood, health and welfare characteristics of the community.

Social Impact Assessment and Formulation of Mitigation Plans

On the basis of the baseline thus established, an impact assessment was undertaken in accordance with the national guidelines and with reference to the applicable reference framework. As part of this impact assessment, a process of prediction, evaluation and mitigation of impacts was undertaken. The impacts were evaluated as positive and negative, short term and long terms and direct or indirect. The criteria for the ratings of impacts are provided in *Section 5*.

On the basis of the baseline data and the impact assessment, a number of management plans were formulated for the Project. The details of these are provided in the section on approach and methodology for the Project.

4.6.2 Results and Findings

This section provides the results of the primary data collection undertaken in December 2014, in the form of the socio-economic baseline of the area. Refer to *Section 4.3.3* for the detailed findings of the secondary data examination.

Project Area Profile

During the primary data collection, the following three (3) village tracts were identified within the proposed Project Area of Block IOR-6:

- Ka Zun Khon
- Kan Zoon Kone
- Shar Taw

Figure 4.38 provides an understanding of the Project Area and the identified villages in the vicinity of the proposed seismic area of the Project Area.

The following sub sections provide an understanding of the Project Area socio-economic profile in terms of the village tracts and the villages surveyed. This profile is based on the secondary information available on the region and the primary data collected through the community and sample household surveys and focus group discussions undertaken in the community.

Demographic Profile

The following *Table 4.27* provides an understanding of the demographic profile of the village tracts and villages in the Project Area

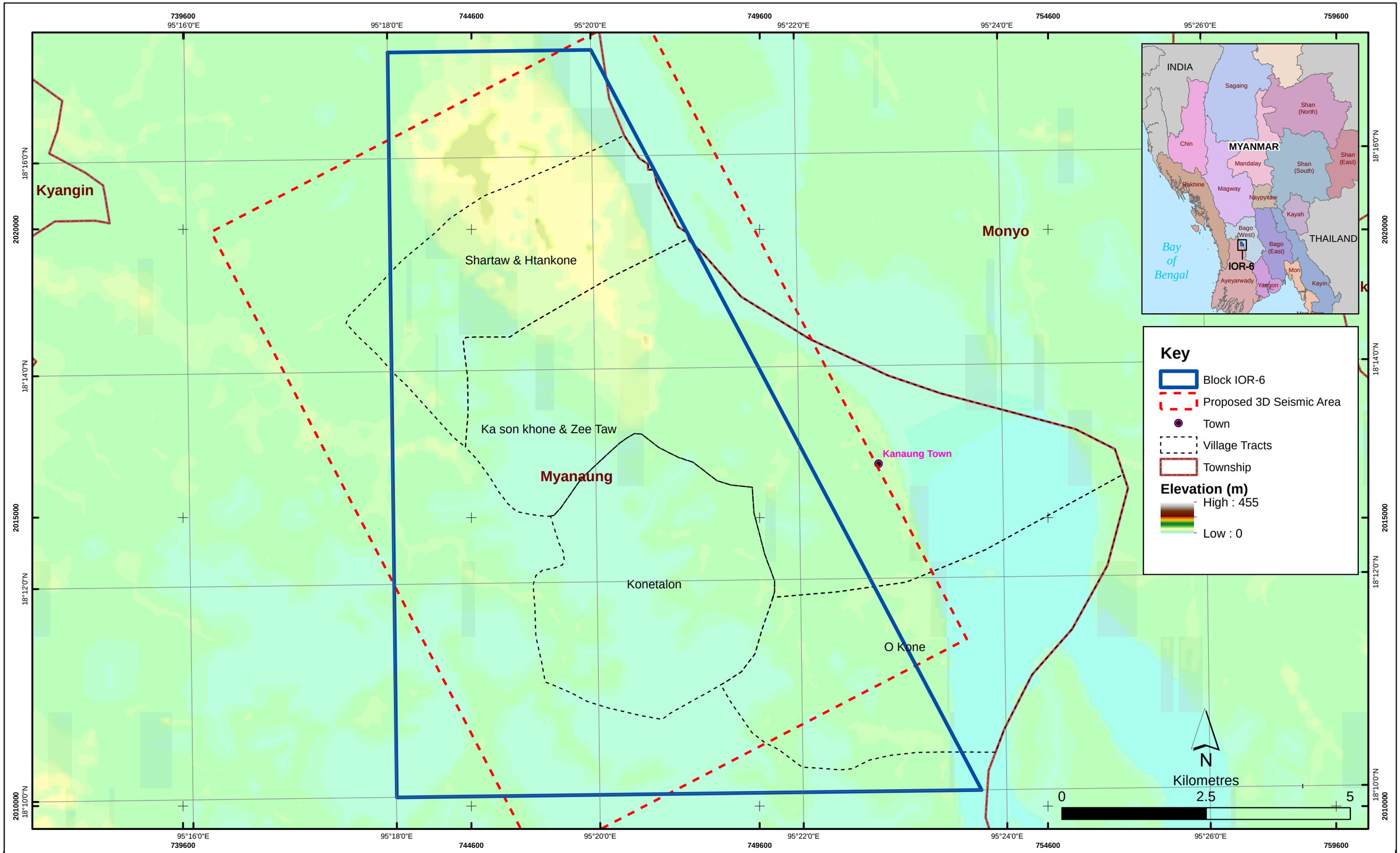

Figure 4.38

Locations of Villages Surveyed during the Primary Data Collection in December 2014

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Date: 24/3/2015

Environmental Resources Management

ERM

Table 4.27 Demographic Profile of the Villages in the Project Area

Village Name	Total Population	Total No. of HHs	Population Surveyed	Number of HHs Surveyed	Sex Ratio	Average HH size
Htan Kone	610	122	39	10	1050	3.9
Kan Zoon Kone	326	92	25	7	923	3.6
Kone Ta Lone	1834	540	31	6	938	5.2
Oh Kone	625	171	42	10	1211	4.2
Shar Taw	1147	338	56	9	1545	6.2
Tae Khone	481	126	50	11	1273	4.54
Zee Taw	195	52	32	8	778	4
Grand Total	**5218**	**1441**	**275**	**61**	**1108**	**4.5**

Source: HH survey, 2014

As has been mentioned above, the Project Area is characterized by three (3) village tracts and seven (7) villages. The total population of the village tracts is reported to be 5,218 individuals across 1,441 households with an average household size of 3.62 individuals per household and an average sex ratio of 1,165 females per thousand males.

As can be seen from the above table, the 61 households surveyed in the Project Area are characterized by a total population of 275 individuals, and an average household size of 4.5 and a sex ratio of 1,108 females per thousand males, which is comparable to the sex ratio in the region. Amongst the households surveyed, the households in the village Shar Taw and Kone Ta Lone are reported to have the highest average household size at 6.2 and 5.2 individuals, respectively.

In terms of sex ratio, the village Shar Taw and Tae Khone are reported to have the highest sex ratio in the region at 1545 and 1273 females per thousand males, respectively. On the other hand, the villages Zee Taw, Kan Zoon Kone and Kone Ta Lone are reported as having the lowest sex ratios at 778, 923 and 938 females per thousand males, respectively. These three are also the only villages which are reported as having negative sex ratio (with the number of females lower than the number of males).

According to the information available, majority of the households (60 of 61) are reported to be Buddhist, while one household in Zee Taw was reported as Christian.

Of the 275 population in the households surveyed, the dependents are understood to be those individuals who are single, widow(er), either above 60 years of age or below 14 years of age and those who are physically or mentally disabled. The following *Table 4.28* provides an understanding of this dependent population in the households surveyed.

Table 4.28 Total Dependent Population in the Households Surveyed

Village Name	Total Pop	Single	Widow(er)	Below 14 years age	Above 60 years age	Disabled
Htan Kone	39	11	2	7	5	
Kan Zoon Kone	25	10	0	5	3	
Kone Ta Lone	31	9	2	3	6	
OH Kone	42	20	1	6	9	1
Shar Taw	56	24	0	11	2	
Tae Khone	50	13	4	9	35	
Zee Taw	32	14	0	6	4	
Total	**275**	**101**	**9**	**47**	**64**	**1**

Source: HH survey, 2014

As can be seen from the above table, of the total population of 275 individuals, 101 are reported to be single while 9 are reported to be widow(er)s, comprising a total of 40% of the population. In terms of age groups, the number of individuals not in the productive age (below 14 years of age and above 60 years of age) comprise of approximately 40.4% (111 individuals of 275) of the total population. In terms of the disabled population, only one individual was reported to be physically handicapped in the village OH Kone.

Women and their Role in Society

As has been discussed, the Project Area is characterised by a positive sex ratio, with more women than men in the village tracts and with women reported to be having an equal status to men in the society. According to the information made available during the focus group discussions, it is understood that there is no clear division of labour along gender in the society, with women being involved in agriculture and men assisting women in the domestic chores. However, the involvement of women in employment in the formal sector is restricted to a small proportion of women being involved in the government sector. This was reported to be primarily resultant from the low levels of education, as most women were reported to drop out of schools after primary school, once they were able to read and write.

Furthermore, while the land and other assets are primarily in the name of men, the women understand the ownership to be of a joint nature, with women having a say in the utilization of the movable and immovable asset.

However, the role of women in the decision making process is reported to be restricted to family affairs, with very few women being involved in the leadership roles in the society. For the purpose of enrichment of women and supporting women in the society, the key organizations are the Myanmar Women's Affairs Federation (MWAF) and the Maternal and Child Welfare Association (MCWA). These groups are reported to play an important role in the social affairs of the society, especially in cases of domestic dispute.

Land Use and Ownership

As part of the household survey, an attempt was made to develop an understanding of the land use and ownership by the households. The following *Table 4.29* provides an understanding of the total land and number of plots farmed.

Table 4.29 Land Use in the Households Surveyed

Village Name	Total Land (Acres)	Average of total land (acre)	Total Plots Farmed	Average No. of Plots Farmed
Htan Kone	41.16	4.57	36.5	4.56
Kan Zoon Kone	31.96	4.57	29.3	5.44
Kone Ta Lone	72.9	12.15	67.5	11.25
OH Kone	47.11	4.71	41.5	4.61
Shar Taw	29.44	3.27	24.00	2.67
Tae Khone	104.35	9.49	93	10.33
Zee Taw	28.40	3.55	25.50	3.64
Total	**355.31**	**5.92**	**317.3**	**5.88**

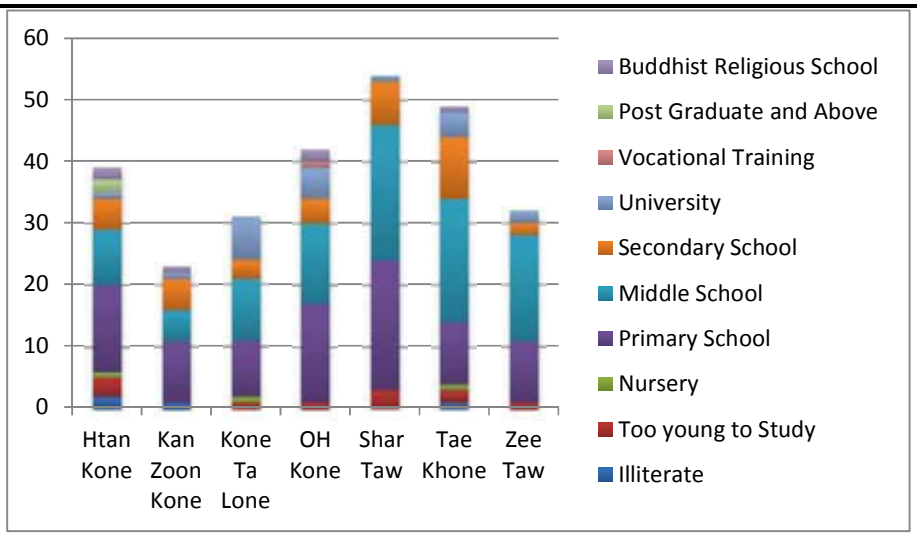
Source: HH survey, 2014

As can be seen from the above table, the total number of plots farmed across the villages is 224.3, while the total area in terms of acre is 250.97 acres. The average land cultivated across the households surveyed is 5.63 acres and 5.36 plots. Of the households surveyed, the households in the village Kone Ta Lone were reported to have cultivated the highest number of plots and acres.

Education Profile

The following *Figure 4.39* provides an understanding of the education levels of the households surveyed as part of the ESIA.

Figure 4.39 Education Levels of the Households Surveyed



Source: HH survey, 2014

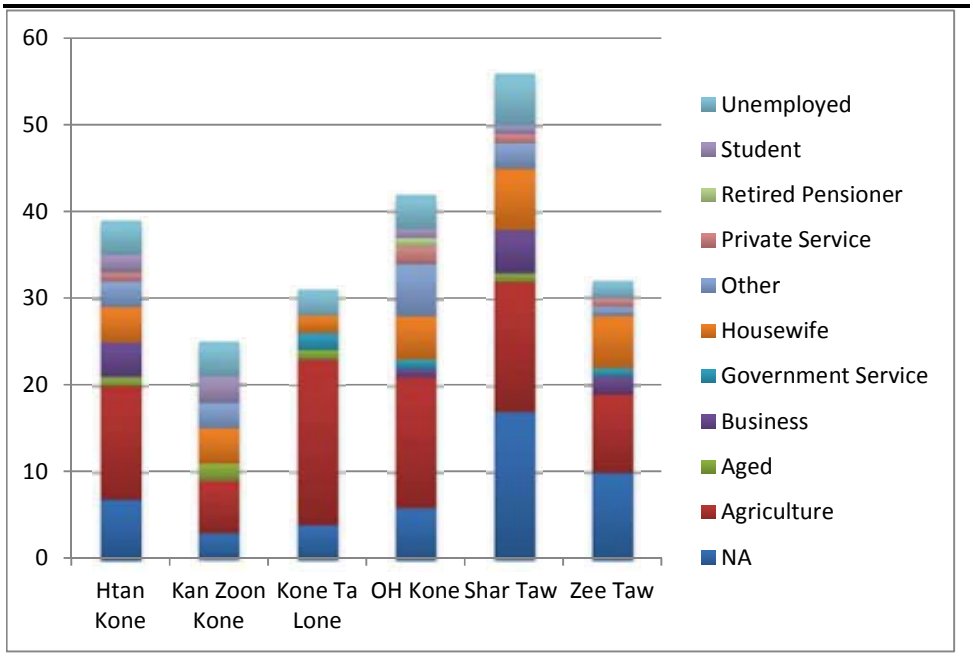
As can be seen from the above figure, a majority of the individuals (68.72% or 189 individuals of 275) were reported to have education till primary or middle

school level. Only 4 individuals were reported as illiterate. Twenty three (23) of the 225 individuals (8.36%) were reported to have attended universities or have vocational training or were post graduates and above.

Livelihood Profile

As can be seen from the following *Figure 4.40*, agriculture is the most important source of livelihood amongst the households surveyed, with 43.25% (77 of 225) of the individuals reporting agriculture as their main occupation.

Figure 4.40 Main Occupation of the Households Surveyed



Source: HH survey, 2014

Of the 275 individuals, the occupational information is available for 218 individuals. Of these 218 individuals, 52 were reported to be not involved in any income generating activity, being aged, retired, students or housewives. Another 24 individual (8.72%) were reported as being unemployed.

Apart from agriculture, the individuals were reported to be primarily involved in business activities (15 individuals of 218) while four (4) individuals were reported to be involved in government service and seven (7) were involved in private service.

The following sub sections provide an understanding of the farm based livelihoods, which form the prominent source of income for the households surveyed.

Agriculture and Farm Based Activities

As has been discussed in the socio-economic baseline of the Ayeyarwady Region, the staple crop in the area is rice. While rice is the main cash crop in the area, other crops such as chilli, long bean, sesame and ground nut are also

reported to be grown, but for household consumption. *Table 4.30* provides an understanding of the production cycle of the main crops.

These crops are reported to be chosen based on the consumption needs of the households, the market trends as well as the suitability according to the soil type (Alluvial Sand).

The crop yield in the area for rice is reported to be approx. 20 to 50 baskets per acres. The market rate for rice is about 420,000 MMK per 100 baskets during the cultivating season and 600,000 MMK in the ploughing season. Most of the product is reported to be sold in the market, with the farmers reporting sale on an average of 60% of the paddy produce and 70% of the other crops such as sesame and peanuts. However, as has been discussed earlier, despite the increased value in the ploughing season, most of the farmers are reported to sell their crop just after harvest due to issues such as storage and need for money.

Agriculture activity is understood to be an activity that is undertaken by the entire household, with a division of labour along gender and age lines. The children are usually involved during breaks from their schools and are mostly involved in processes such as weeding and never in pesticide spraying due to the health concerns associated with the exercise. Women are involved in sowing, weeding and harvesting while men undertake activities such as ploughing, spreading the seeds, paddy processing and pesticide spraying. However, the younger generation is reported to be moving from agriculture as a key source of livelihood, with a significant proportion of the youth being reported to resort to migrant labour.

Table 4.30 Seasonal Calendar for Main Crops

Crop	Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Rained Rice	Sowing Period												
	Harvesting Period												
Rained Sesame	Sowing Period												
	Harvesting Period												
Winter Sesame	Sowing Period												
	Harvesting Period												
Peanut	Sowing Period												
	Harvesting Period												

Source: Farmer FGD, 2014

In addition to using the labour from within the family, the farmers also hire local labour during periods such as harvesting time. The wage rate for men and women as labourers vary, with men getting 3,000/3,500 kyats per day, while women get 2,000/2,500 kyats per day. The men are reported to be preferred as labours than women, despite the higher wage rate. In addition to the wage labour, the other key expense in agriculture pertains to the expenditure on seeds, fertilizers and transportation. The following *Table 4.31* provides a summary of the expenses according to the key crops grown.

Table 4.31 Expenditure in Agriculture

Crop	Total Expenditure on Labour Per Crop Cycle	Expenditure on fertilizer
Rice	90,000	22,000
Beans and Pulses	200,000	20,000

Source: Farmer FGD, 2014

In addition to manual labour, the farmers also reported the use of machinery such as tractors, which are readily purchased from the markets. These agricultural practices in the area and region are supported by the presence of government agriculture schemes. These schemes by the government assist the agriculture in the area by provisioning of better species of paddy, by making technology effective as well as provisioning of agricultural loans. The loans for agriculture are given through the agriculture bank, and usually a loan of 1 lakh kyat per acre can be availed, at an interest rate of 500 kyats per 1 lakh.

Apart from agriculture, the households in the Project Area were also reported to be engaged in rearing of livestock for personal use as well as commercial purposes, with 48 of 61 households (768.69%) surveyed reported to have some livestock. The most common livestock holdings were in the form of poultry, cattles and pigs. The following *Table 4.32* provides an understanding of the livestock holdings in the households surveyed.

Table 4.32 Livestock Holdings in the Households Surveyed

Village Name	Cattles	Poultry	Pigs	Buffaloes	Goats	Horses
Htan Kone	0	50	6	0	0	0
Kan Zoon Kone	17	9	6	0	0	0
Kone Ta Lone	15	0	0	0	0	0
OH Kone	6	125	3	0	0	0
Shar Taw	25	106	2	0	0	0
Tae Khone	30	55	1			
Zee Taw	22	45	4	0	0	0
Total	115	390	22	0	0	0

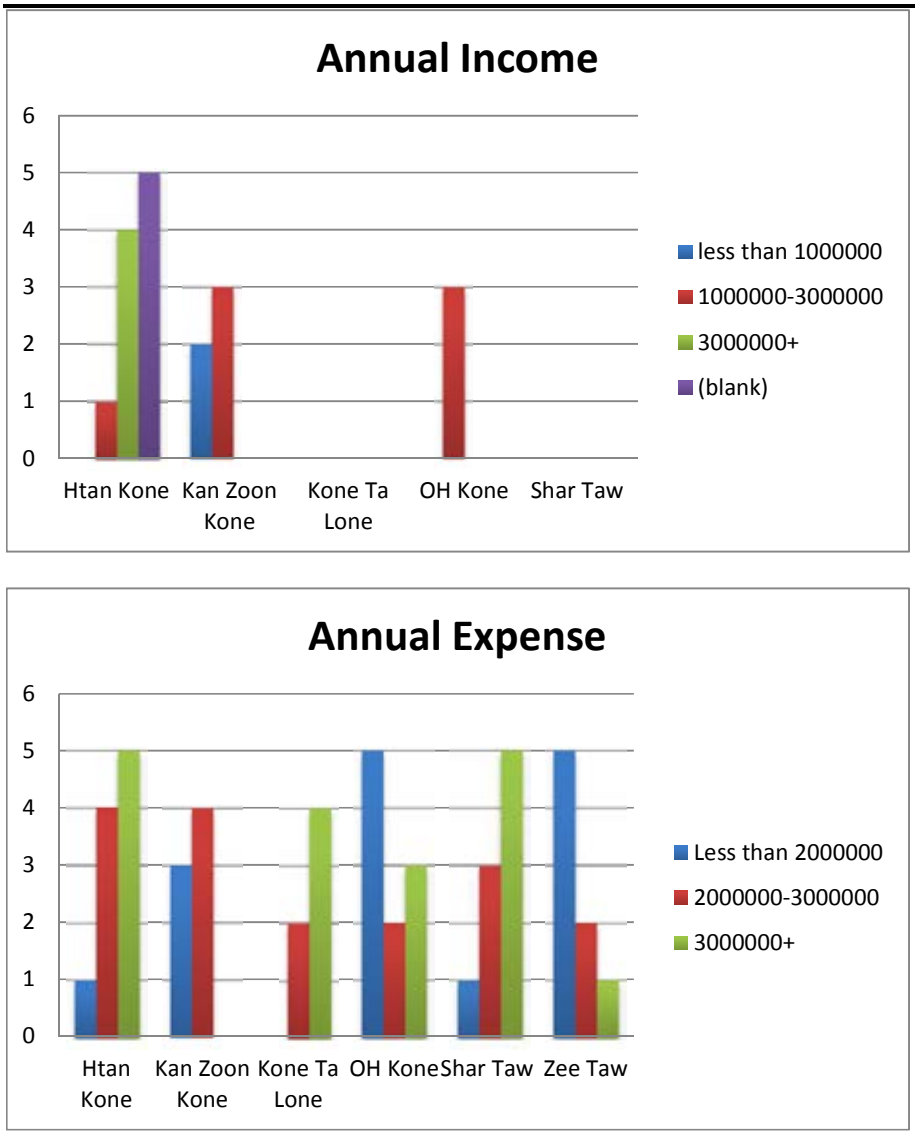
Source: HH survey, 2014

While the livestock holdings of cattle are reported to be primarily for use by the household in agriculture, the holdings of pigs are primarily for sale purposes for meat. The poultry holdings on the other hand, were reported to

be both for self-consumption by the household as well as sale for meat or eggs.**Income and Expenditure**

According to the information made available during the household surveys, most of the households (10 of 14 households) reported an income of between 1,000,000-3,000,000 MMK. The total income and expenditure across the households is showcased in the *Figure 4.41* below.

Figure 4.41 ***Annual Income and Expenditure***



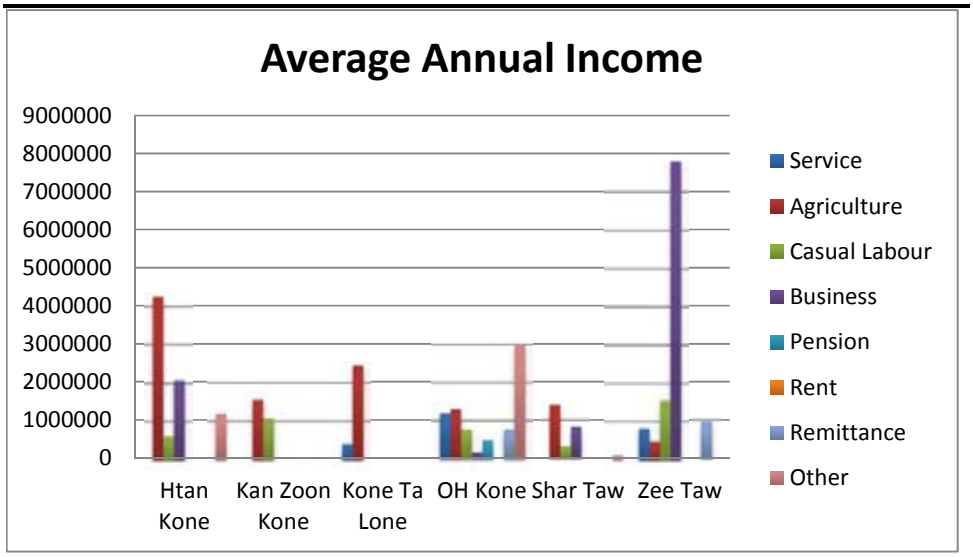
Source: HH survey, 2014

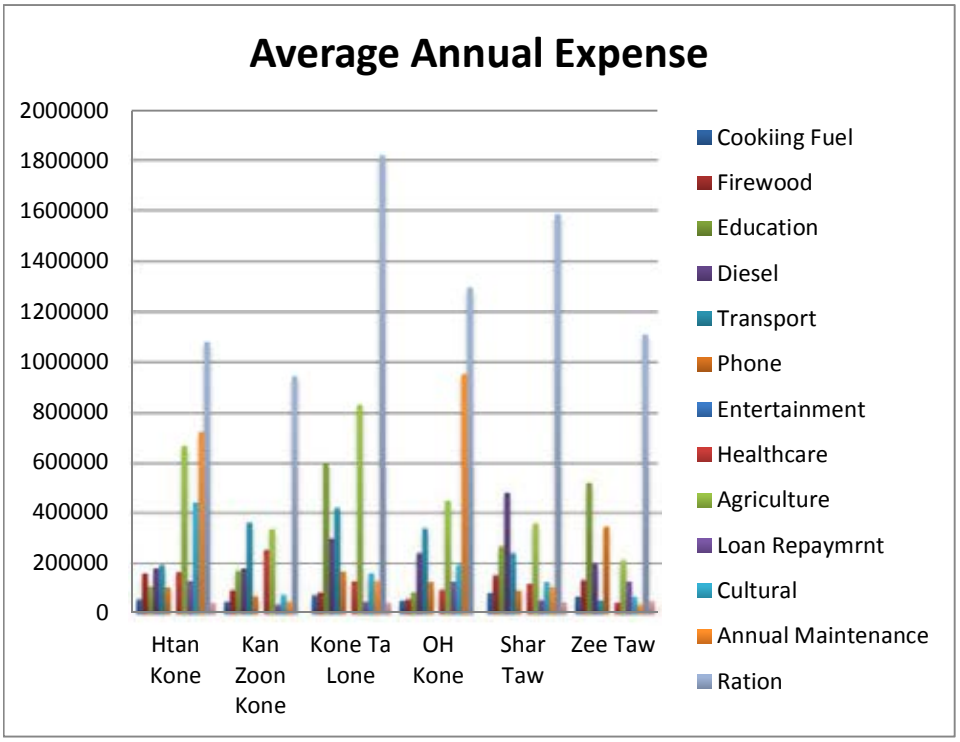
It can be seen from the above figure, that of the 13 households for whom information of annual income is available, two (2) reported an income of less than 1,000,000 MMK, and two (2) households reported an income of more than 3,000,000 MMK.

In terms of annual expenditure, 26 of 61 households reported an annual expenditure of more than 3,000,000 MMK while 19 households reported an

annual expenditure between 2,000,000-3,000,000 MMK. The following *Figure 4.42* provides an understanding of the average expenditure and income across the various heads.

Figure 4.42 *Average Annual Expenditure and Income across Households Surveyed*





Source: HH survey, 2014

As can be seen from the above figures, the highest average income is from agriculture and business. On the other hand, the highest average expense per household is reported to be for ration, agriculture, annual maintenance, diesel and firewood.

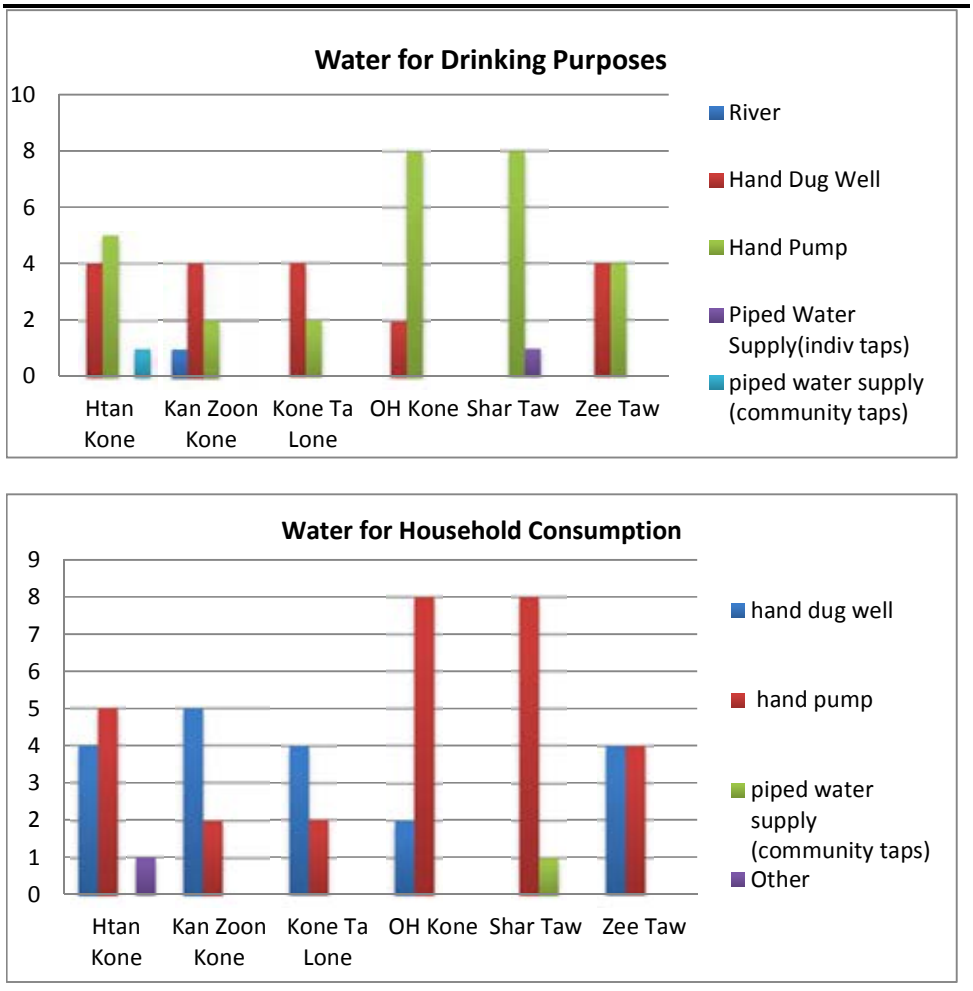
Social and Physical Infrastructure

Physical infrastructure includes infrastructure which are essential for maintenance and supply of basic services and amenities resulting in economic and social well-being. On the other hand, social infrastructure is one of the most important indicators of human development in any society, with the indices of health and education facilities occupying a central place in policy formulation and development planning.

Water and Sanitation

According to the information made available during the household surveys, most of the households have access to water for household consumption and drinking purposes through hand pumps. The following *Figure 4.43* provides an understanding of the various sources of water.

Figure 4.43 Sources of Water for the Household Surveys



Source: HH survey, 2014

The above figures suggest that, apart from hand pumps, the main sources of drinking water is hand dug wells, while the villages Htan Kone and Shar Taw are reported to also have access to piped water supply at the community and household level, respectively. However, it should be noted that in these

villages only one (1) household each reported the dependence on these sources.

In terms of the months of availability of drinking water, the hand pumps were reported to be perennial sources of water, with most of the households (58 households out of 61) reporting the water quality to be good. Forty-eight (48) of the 61 households reported having access to drinking water at the household level, while nine (9) households reported having access to water source at a distance of less than 10 m, and only one (1) household reported having access to a source 1 km away. However, five (5) households from Tae Khone and Zee Taw village reported to have scarcity of water supply in the months of March to June.

In terms of water for household consumption, the main sources of water are hand pumps and hand dug wells. The village Shar Taw also reported to have access to piped water supply at the community level, however, once again only one (1) household reported dependence on the same. In terms of the availability of water for household purposes, 40 households reported to have access to perennial supply of water. In keeping with the access to water for drinking purposes, 48 households reported to have access to water for household consumption at the household level, while nine (9) households reported to have access at a distance of less than 10 m. Fifty-six (56) of the 61 households reported the water quality to be good.

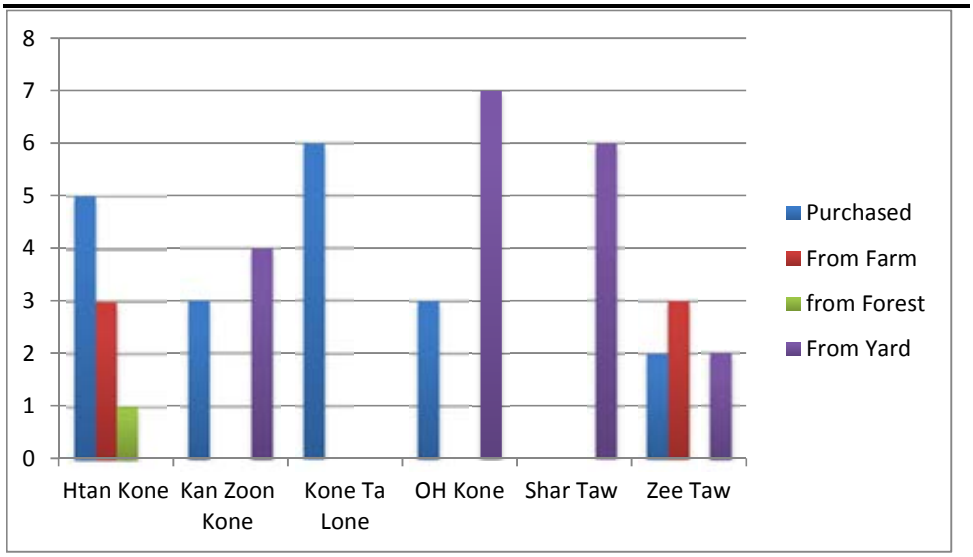
Of the 61 households, all were reported to have access to personal latrines with septic tanks, with no household reporting instances of open defecation.

Access to Electricity and Cooking Fuel

In terms of access to electricity, 49 of 61 households reported having access to electricity while twelve (12) households from the villages Kan Zoone Kone, Tae Khone and Shar Taw reported not having access to electricity.

In terms of cooking fuel, 56 households reported dependence upon fire wood as cooking fuel. Of these 45 households, 26 reported purchasing the fire wood required while 30 reported collecting firewood from their own farms, yards or the nearby forests. The following *Figure 4.44* provides an understanding of the sources of firewood for the community.

Figure 4.44 Sources of Firewood



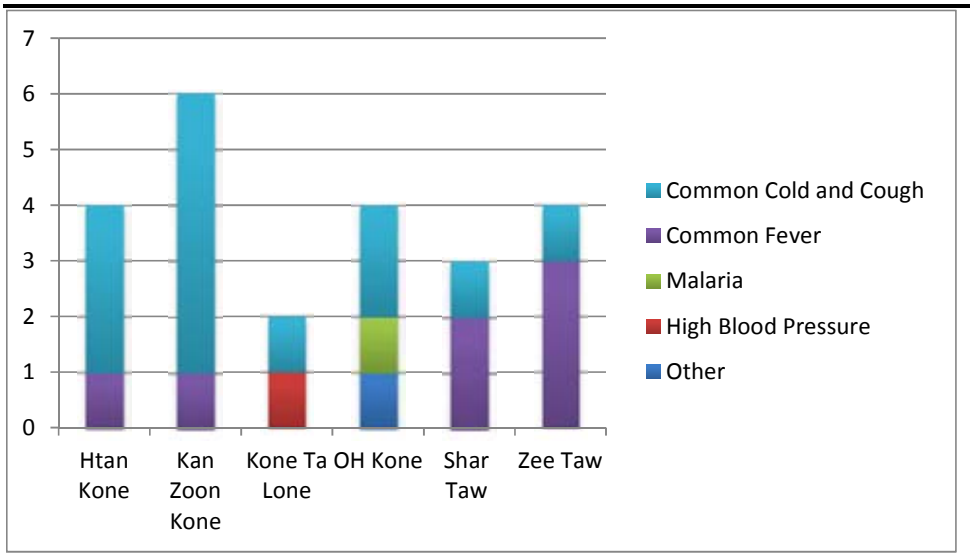
Source: HH survey, 2014

Most of the households reported to have a requirement of one cart of firewood per month (36 of 56 households).

Access to Health Services and Health Seeking Behaviour

In terms of the availability of health services in the project area, it is understood that the Myanaung has access to one rural health centre and one midwife. According to the information made available during the HH survey, 49 of the 61 households reported preference for private medical facilities while seeking medical attention. Most of these preferred medical facilities are reported to be located in the neighbouring towns, with 52 of the 61 households reporting preference for facilities located outside the village of residence. The following *Figure 4.45* provides an understanding of the illnesses reported by the community in the last year.

Figure 4.45 Illnesses Reported in the Last Year



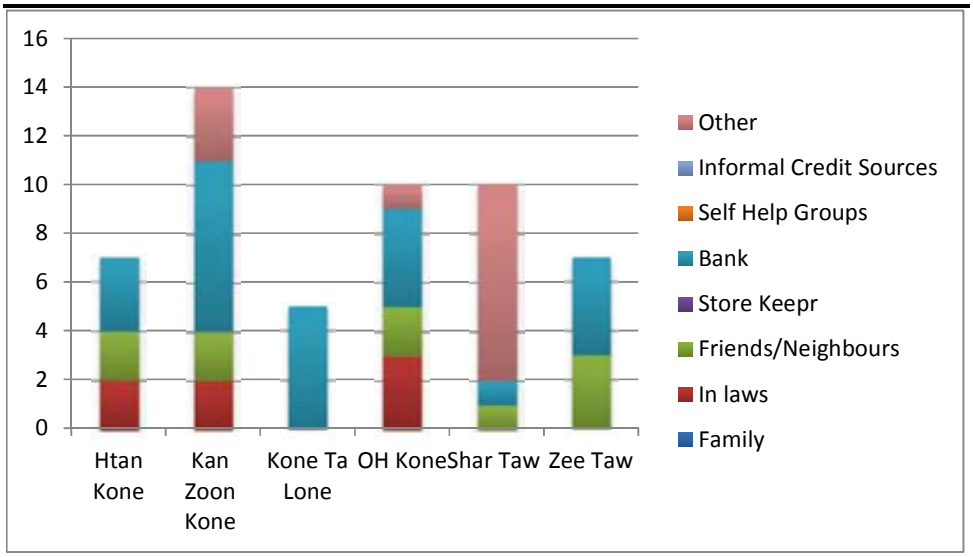
Source: HH survey, 2014

As can be seen from the above figure, the most common illnesses reported in the last year were common fever and cold and cough, with the village OH Kone and Tae Khone reporting a case of malaria each and Kone Ta Lone village reporting a case of high blood pressure. Most of these illnesses (11 of 20 cases) were reported to have occurred in the months of May to July.

Access to Credit and Markets

In terms of access to credit facilities, the households surveyed reported maximum dependence on banks, friends and neighbours and in- laws. The dependence on different sources of income can be seen from *Figure 4.46* below.

Figure 4.46 Sources of Credit



Source: HH survey, 2014

The main reasons for undertaking loans were reported to include field preparation and purchasing seeds and for purchasing food items. This can be seen in the fact that households (51 households) having reported a running loan, 46 reported to have borrowed the money for agriculture while 3 reported having borrowed money for purchasing food and 2 reported borrowing money for both agriculture and purchase of food items.

The households reported dependence on the local market within their villages for their daily needs. These markets are reported to be located within a distance of 5 minutes for most of the households surveyed (51 of 61). However, for the purpose of buying and selling of seeds, agricultural implements and agricultural produce, 57 of the 61 households reported being dependent upon markets located in the larger villages or township. Most of the households (50 of 61 households) reported having market access at a distance of 15-30 minutes from their residence.

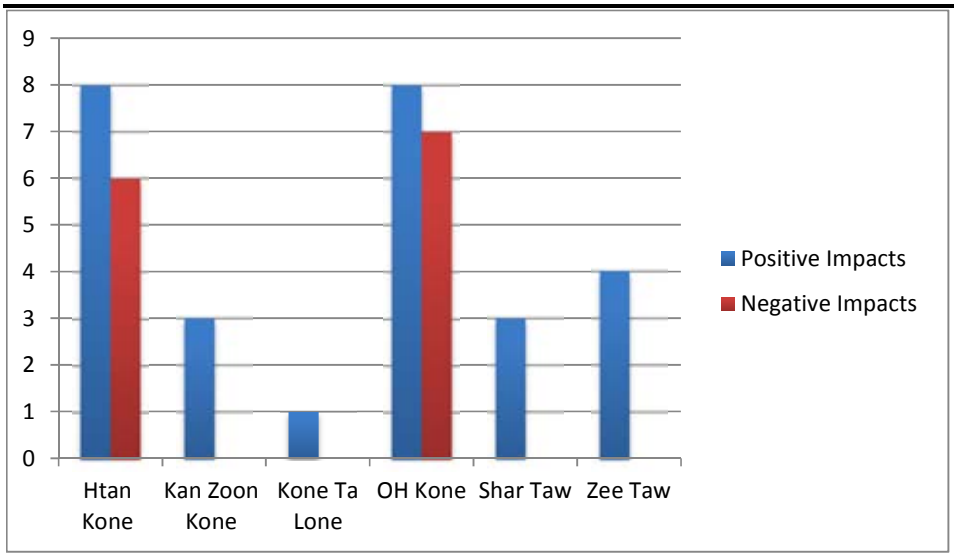
Previous Cases of Land Acquisition

As part of the household surveys, an attempt was made to develop an understanding of the previous cases of land acquisition and the impact of the same on the households. Of the 61 households surveyed, 18 reported having lost land in previous cases of acquisition, which was reported to have been undertaken in the 1970s. Similarly, 19 households also reported to have lost land due to the present Project. Of these 19 surveyed HHs, seven (7) households reported having received compensation from the Project, however, details of the same are presently not available. According to the information made available, the compensation was paid by either the government (MOGE) or previous contractors used instead of MPRL E&P which has not commenced its operations yet.

Knowledge about the Project

Of the 61 households, 30 households reported having access to information regarding the Project and its activities, while 29 households reported having no knowledge about the Project. The households identified the government as the most desirable source of information regarding the project. Apart from this, the households also reported having received information directly from the company (12 households of 61) and their neighbours (18 households of 61).

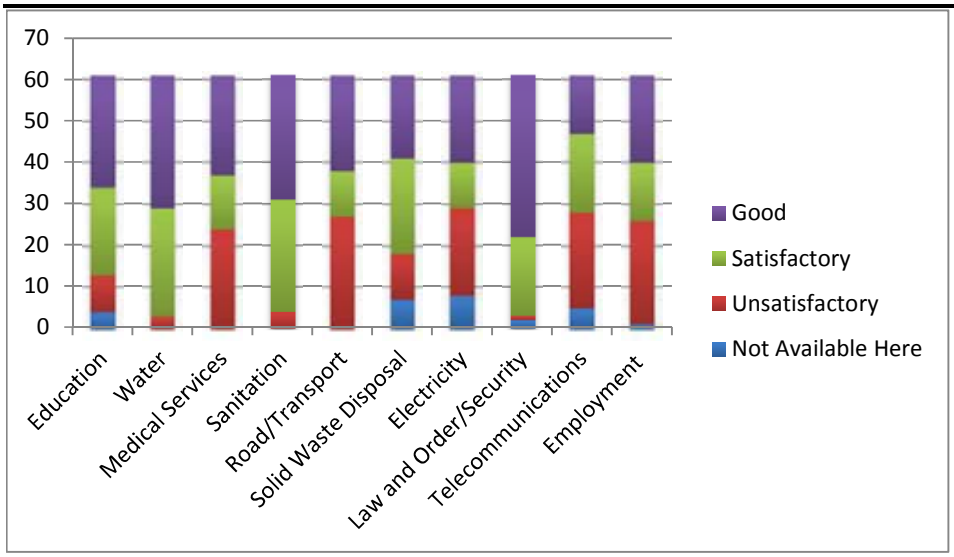
Figure 4.47 Anticipated Impacts from the Project



Source: HH survey, 2014

As can be seen from the above *Figure 4.47*, most of the households (33 households of 61) reportedly expected the Project to have positive impacts for the community, while 15 households from Htan Kone, Tae Khone and OH Kone reported to also anticipate negative impacts from the project. The following *Figure 4.48* provides an understanding of the expectations from the Project, in terms of the availability of services.

Figure 4.48 Perception on the Existing Services in the Community



Source: HH survey, 2014

As can be seen from the above figure, the services such as transportation and road infrastructure, electricity, telecommunication, employment, solid waste disposal and education are reported to be the services which are either not available in the villages or are of an unsatisfactory nature.

Stakeholder Identification and Analysis

This sub section summarises the stakeholder identification and analysis undertaken as part of the Project. This sub section provides the list of Project stakeholders identified, consisting of individuals, groups and organisation that are affected or may be influenced by the proposed Project in the area and sorts them according to their impact on the Project and the impact the Project will have on them. This information is then used for the formulation of the Stakeholder Engagement Plan (SEP) for the Project.

The importance of such an analysis lies in the role played by such an understanding in the assessment of the socio-political environment surrounding the Project and its activities. It allows for the:

- Identification of key stakeholders, their primary groupings and sub groupings;
- Identification of the interests, concerns and potential risks surrounding the stakeholders, as well as conflicts of interests (if any);
- Key groups/individuals to be pin pointed who need to informed about the Project activities at various stages;
- Identifying stakeholders (those who are likely to have an adverse impact on the project) and taking appropriate measures to combat their influence;
- Identification of the impact and influence of the Project on the stakeholders and of the stakeholders on the Project; and
- Generation of information essential to the planning, implementation and monitoring of the Project.

The process of stakeholder identification and analysis thus allows for the formulation of a robust engagement strategy, which in turn allows for the concerned stakeholders to be involved in the process of identification of areas of concerns as well as formulation of mitigation measures. This in turn allows for the stakeholders to develop an understanding of the Project operations as well as the maintenance of positive relations between the stakeholders and the Project proponents.

Stakeholder Identification

A stakeholder is "a person, group, or organization that has a direct or indirect stake in a project/organization because it can affect or be affected by the Project/organisation's actions, objectives, and policies". As part of this sub section, an attempt has also been made to identify and analysis the stakeholder groups likely to be impacted due to the activities for the Project, which are listed below.

Table 4.33 Stakeholder Groups

Primary Stakeholders	Secondary Stakeholders
• Local community • Farmers • Vulnerable Groups, including women, elderly, handicapped etc. • Fishing groups	• Government Ministries • Local Authorities • Village Level Institutions • NGOs and Civil Society Organizations • Local Media • Political Parties

Stakeholder Mapping

"Stakeholder mapping" is a process of examining the relative influence that different individuals and groups have over a Project as well as the influence of the Project over them. The purpose of a stakeholder mapping is to:

- Identify each stakeholder group;
- Study their profile and the nature of the stakes;
- Understand each group's specific issues, concerns as well as expectations from the Project; and
- Gauge their influence on the Project.

On the basis of such an understanding, the stakeholders are categorised into High Influence/Priority, Medium Influence/ Priority and Low Influence/Priority. The stakeholders who are categorised as high influence are those who have a high influence on the Project or are likely to be heavily impacted by the Project activities, and are thus high up on the Project proponent's priority list for engagement and consultation. Similarly, the stakeholders categorised as medium influence are those who have a moderate influence on the Project or even though they are to be impacted by the Project, it is unlikely to be substantial and these stakeholders are thus neither high nor low in the Project proponent's list for engagement. On the other hand, the stakeholders with low influences are those who have a minimal influence on the decision making process or are to be minimally impacted by the Project and are thus low in the Project proponent's engagement list.

The following table provides a brief profile of the various stakeholders identified with their key concerns in terms of the Project activities and their degree of influence.

Table 4.34 Stakeholder Mapping

Stakeholders	Stakeholder Profile	Level of Influence
Primary Stakeholders		
Local community	This stakeholder group is comprised of the local community in the project, as identified in the social baseline. This group is comprised of the community in the six villages in the area.	High
Farmers	This stakeholder group is comprised of individuals and households who undertake agriculture in the project area and its surroundings.	Medium
Vulnerable Groups, including women, elderly, handicapped etc.	This stakeholder group is comprised of those members of the community who due to their socio-economic status are perceived to be more susceptible to the impacts from the project and will required special considerations.	High
Fishing groups	This stakeholder group is comprised of those individuals and households who undertake fishing in the Ayeyarwady river and the other surface water bodies in the area.	High
Secondary Stakeholders		
Government Ministries	This stakeholder group is comprised of the central and region level government departments. These authorities may influence the project in terms of establishing policies, and implementation of the project. This stakeholder group comprises of ministries such as: • Ministry of Environment Conservation and Forestry • Ministry of Agriculture and Irrigation • Ministry of Labour • Ministry of Social Welfare, Relief and Resettlements	High
Local Authorities	this stakeholder group is comprised of the local government bodies, who have the power to regulate or otherwise influence the Project in terms of establishing policy, granting permits and approvals for the Project, monitoring and enforcing compliance with the applicable rules and regulations and making available the necessary infrastructure and resources for the Project. These departments are also store house of relevant information both for the impact assessment as well as to help implement management plans. The authorities which are likely to have the maximum influence on the Project include the authorities such as: • Myanaung Township Administration • Deputy Township Administration • Community Development Office • City Development Office • Township Education Office • Township Health Office • Township Police Office • Township Land Department	High
Village Level Institutions	This stakeholder group is comprised of institutions including the health and education	Low

Stakeholders	Stakeholder Profile	Level of Influence
	institutions at the village level	
NGOs and Civil Society Organizations	This group includes all other people in society who may have an interest in the Project and its social and environmental aspects and non-governmental organisations representing their interests. It includes members of the wider general public in the state and district, civil society organisations such as religious groups, cooperatives, professional associations, cultural groups and citizens' associations, environmental and social groups and universities and other academic and research institutions undertaking work relevant to the Project, who may have views on the Project or information that will be useful for the assessment of Project impacts.	Medium
Local Media		High
Members of Parliament	This stakeholder group comprises of the representatives of the Ayeyarwady region in the parliament. It is important to engage with these stakeholders from an early stage of the Project, as they play a critical role in the formulation of the government policies and norms at the local, regional and national level.	High

On the basis of the understanding thus developed, the process of public consultation and disclosure for the Project was undertaken, as part of the ESIA Study, as is discussed below.

4.7 SUMMARY OF CONSULTATIONS AND ACTIVITIES UNDERTAKEN

As part of the ESIA for the Project, meetings were undertaken with the ministry and the local authorities including the MOGE (*Figure 4.49*). As part of these meetings, an understanding was provided of the proposed Project activities and the impact assessment process for the same. In these meetings the local stakeholders who need to be engaged with as part of the impact assessment process were identified. The following table provides the schedule of the meetings and consultations undertaken as part of the ESIA Study.

It is understood that the land required for the Project has already been taken control over by the MOGE. In keeping with this, during the engagement with the MOGE, an understanding was developed of the land availability for the Project and the manner in which the engagement with the local community is to be undertaken regarding possible compensation, if any.

In consultation with the MOGE, prior to the commencement of the consultations, Project information was disclosed to the local community through pamphlets containing project information.

Post this disclosure of information consultations were undertaken amongst the local community in five (5) villages from Pyay and three (3) from the Myanaung Township. The consultations were undertaken as per the guidance of the MOGE representative, township administrators, and were only carried out in villages were the tract leaders are living. For the purpose of these consultations, an MOGE representative was also present with the field team.

Photo 1: Interview with villagers at Myanaung accompanied by MOGE Representative

Photo 2: Stakeholder Consultation Meeting for Block IOR 6 at Myanaung

Photo 2: Q&A Section in Stakeholder Consultation Meeting for Block IOR 6 at Myanaung

Photo 4: Women Focus Group Survey for Block IOR 6 at Myanaung

Photo 5: Farmers Focus Group Survey for Block IOR 6 at Myanaung

Figure 4.49

Photo Records of Stakeholder Consultation at Block IOR 6

DATE: 06/03/2013

Environmental Resources Management

ERM

Table 4.35 Schedule of Meetings and Consultations undertaken as part of the ESIA Study

Date	Activity	Purpose
18-12-2014	Meet with MPRL and MOGE	Kick off meeting with MOGE
19-12-2014	Meet with MOGE	Permission of stakeholder meeting at Myanaung Township.
	Meet with U Min Min Tun, Administrator, General Administrative Department, Myanaung Township	Permission of stakeholder meeting at Myanaung Township.
20-12-2014	Meet with U Min Min Tun, Administrator, General Administrative Department, Myanaung Township	Secondary Data Collection.
	Meet with MOGE	Stakeholder Meeting and Fieldwork Planning.
	Meet with Head of village and villagers of Shar Taw and HtanKone villages	Undertaking community and household surveys across a sample population of the community.
	Meet with villagers of Oh Kone and Tae Kone Villages	Undertaking community and household surveys across a sample population of the community.
21-12-2014	Meeting with Stakeholders	Stakeholder meetings and FGDs with a sample population.
	Meet with villagers of Sat Pyar Kone and Pan Bae Kone Villages	Undertaking community and household surveys across a sample population of the community.
22-12-2014	Meet with villagers of Ka Sun Kone, Tha Pyay Seik and Zee Taw Villages	Undertaking community and household surveys across a sample population of the community.
	Meet with villagers of Kone Ta Lone, Ywar Thit Seik and Hmone Taing Villages	Undertaking community and household surveys across a sample population of the community

Through these engagement activities an attempt was made to develop an understanding of the socio-economic profile, including the livelihood profile, the agricultural patterns in the area, access to health services, water supply and transportation and the village development plans and presence of local civil society organizations in the area. These concerns and expectations were then taken into account while assessing the impacts from the Project activities and the identification of the proposed mitigation measures.

As part of these engagement activities, a verbal understanding was also provided to the local community representatives of the proposed Project and its activities and the purpose of the engagement activities.

For the purpose of the primary data collection, household and community surveys were undertaken in the seven (7) villages. A total of 61 household surveys and seven (7) community surveys were undertaken across the seven (7) villages. Apart from this, two (2) focus group discussions were undertaken for farmers and women's group in the Myanaung Township.

4.8 KEY FINDINGS OF CONSULTATIONS

As has been mentioned above, as part of the ESIA process a public meeting was undertaken in the Myanaung Township. As part of these meetings, REM and MOGE provided an understanding of the Project and its proposed activities, as well as provided clarifications on any queries of the community.

Table 4.36 provides a summary of the questions/concerns of the community and the responses provided.

Box 4.1 Message to the Community in Public Meeting

We are here today as consultants from two companies (ERM & REM Company). IOR-6, Myanaung Oilfield & MPRL Company will be cooperated for new oil production project. We will carry out the assessments for this project and will consult if there are any impacts on environment. Old and new oil pits will be explored with the cooperation of Ministry of Energy and MPRL Company. Project Area is situated in Myanaung Township. Among 170 old oil pits, 15 are currently running and approximately 216 square kilometres will have to be explored. By the Environmental Conservation law which was enacted on 6th June, 2014 and the environmental impact assessment rules and regulations (Draft), EIA (Environmental Impact Assessment) will be necessary for this project. According to the size and type of project which is on-shore oil and gas production, ESIA will have to be carried out. We're here today to carry out ESIA. We'll evaluate the impact of project on environment and communities. Our aims are:

- To gather the background information about project area
- To rate the advantages and disadvantages upon environment and community
- To consult the methods for reducing possible drawbacks
- To develop an environmental conservation program so as to manage environmental impact once the project is getting started.

When we start carrying out ESIA, we'll collect background information of the project and measure the area of the project. Then stakeholder meeting will be held. After that, we will collect baseline data and we will write draft ESIA report. Based on the collected data, we will have presentation and suggestion sessions.

Environmental Impact Assessment includes _

(a) Air quality
(b) Water quality
(c) Noise Measurement
(d) Land quality
(e) Botanical, zoological and ecological assessment

Social Impact Assessment includes _

(a) Household
(b) Socio-economic survey
(c) Daily livelihoods
(d) Cultural Heritage
(e) Farmers' Right
(f) Women's Right

Actions that will be taken upon investigation:

Based on the investigation results, we will consult the following factors.

- Ways to reduce environmental degradation
- Environmental Observation Plans
- Environmental Management Plans
- Ways to reduce impact on society and other development programmes will be submitted to Environmental Conservation Committee.

The confirmation of EIA report includes:

- Planning stakeholder meetings
- Having farmers' right discussion sessions
- Having women's right discussion sessions
- Making Socio-economic and suggestion questionnaires

We would like to hear your suggestions besides our investigation and assessments. All the suggestions will be included in the ESIA report. All the participants and guests from Kazunkhone Village Tract and Shardaw Village Tract are invited to discuss and suggest openly

Table 4.36 Public Meeting undertaken as part of the ESIA Process

Questions	Answers Provided
There's no destruction on Myanaung Oilfield and also there's no employment currently. When old pits will be extracted again, there may not be any destruction. However, I think there will be impacts when exploring new pits. Local people from Shardaw village and Kazunkhone village are currently working on the farms near old oil pit. Although the compensation has given for the farmlands which may be affected by new pit, I would like to suggest creating long term employment for local people. And the people from nearby villages should be given priority for employment so that the employments outweigh the lost.	Our country's situation has changed. There is now more transparency and the processes are gradually being put in place. When a project is carried out in specific area, the company will have to use parts of their benefits for the development of local communities. And so does MPRL E&P. We will record your suggestion and put it in our report. However, the details of when that has to be done by the company and the government requirements associated with it will be discussed in future. That is between the community, company and the Government. We will primarily cover the impacts and mitigation measures required; MOGE will finally review the report.
Project Area covers our farmlands. We don't want any negative impacts on our community. Our village's education, social and religious affairs depend on the incomes from those farmlands. There were only compensations for crops in 1960. No compensation for farmland. The project was started in 1964. After 20 years of running the project, soil quality degradation occurred and they used bull dozers at that time. The soil was maintained and recovered in recent years. So, the conservation process should be carried out carefully for the project as local people lives depend mainly on that soil. Big Holes occurred after the project has run for 20-30 years. We don't believe in companies, actually. They usually look for their benefits. If they do as they say, we can accept that. If they don't, things will be changed. We want to know where the products will be sold out. We have not known their specific plans. Once we knew their plans, we can discuss more.	We heard that the project will be started in 2015. MOGE & MPRL E&P will work in cooperation. Depending on the production, the benefits will be split up as per the Government mandate. Location and area of site, whether old pits or new pits can be decided soon upon submission of the report to Environmental Conservation Department (ECD). Only when the permit is given from ECD the project can be started. At that time, detailed information about the project will be explained. The village administrators will be informed, if the village area is affected.
Myanaung Oilfield has been forest since our ancestor's time. In 1960, the area was considered as Oilfield. At that time, 3 villages (Taungpawgone, Thapyaygone & Kyaunggone villages) were moved because of the extension of project area. Also, Aung Yadanar village, Bayint Naung new ward, Shwe Pyaung new ward, Aung Mingalar new ward were moved. As they moved to new places, their employments were lost and they got into trouble. The project will be resumed again now. Wastewater should also be managed well so as not to flow through farmlands. Wastewater will destroy domestic water. Gases and dust will also destroy environment. So how will the waste water be managed? If there are any negative impacts on environment, we cannot accept the project.	We will do assessment on environment as well. Current pH level in water resource is also measured. Our assessment will also include measuring the impact on local people because of the project. We have preliminary information about wastewater and we will measure if there is any change on underground water. When exploring oil, management committee has to be formed and the measurement and assessment will have to be done monthly. Moreover, water quality test, air quality test and environmental impact assessment will always be done. ECD will also come and observe the Project Area. Ayeyarwady Division has its own ECD and thus, the situations are different from before.

Questions	Answers Provided
I would like to discuss on social impact assessment. Local people cleaned up the land areas and those land areas became farmland. During project, vehicles from oilfield passed through the areas and affected farmlands. Concerning farmers' right, their daily lives became harder because of land lost. Emitted gas from oilfield affected paddy fields and 400 acres of field were damaged in the past. Because of lack of any responsible act, social, education and economic status of farmers and their offspring were lower. Thus, we want the employment of local people in the project. Also, we want responsible person to take the development of our area into consideration. Road construction, repair and electricity supply are also necessary for villages as well as health sector. Concerning health sector, we have suffered cholera and other diseases in our region and thus, we want government clinics.	CSR Program will run the development program for the region. Also, the company has to lay down plans on how to use some proportion of their benefits (1%, 5%, ect) for the development of the region. These plans will be submitted together with our report. We have found out that some villages around Project Area have no electricity. Yet, some have requirement for education, religion, transportation and healthcare services. Thus, local people have to go to Myanaung for necessary healthcare. According to CSR Program, we will include in our report that the area needs development on the above-mentioned sectors. Furthermore, project contractor will have to carry out tour with mobile clinics. We will comprise the fact to do medical check-up for local people in our report.

Apart from these meetings, engagement was undertaken with the local stakeholders in the form of focus group discussions during the impact assessment process, certain key concerns and expectations of the local community were identified during the impact assessment process:

- **Impact on Land Availability**: One of the key concerns of the local community was in terms of the impact of the Project activities on the availability of land in the area and the agriculture undertaken by the community. From the information made available it is understood that agriculture is the primary source of livelihood for a majority of the local community. Thus the project activities are likely to result in a reduction of the land available for agriculture, which in turn would impact the income and livelihood sources for the community. This impact is likely to be heightened for those households who are solely dependent upon agriculture, whose majority land holdings are impacted by the Project and those who do not have alternative land available.

- **Payment of Crop Compensation**: According to the information made available by the local community, it is understood that while a number of households have lost their land for the Project (19 of the 61 surveyed households), few have received compensation for the loss (7 of the 61 households). Furthermore, the compensation received has been in the form of crop compensation provided by the previous project developers or the government (MOGE). While the exact information pertaining to the number of households compensated and the amount of compensation paid was unavailable, one of the key expectations of the community from the Project was the provisioning of adequate compensation for the loss of land and crop due to the Project. However, it is understood, that

according to the discussions undertaken with the government, no further compensation is to be paid for this Project.

- **Community Development Activities**: In keeping with this understanding of the impact of the Project activities on the livelihood of the community, the community identified certain areas of expectations from the Project in terms of financial and/or technical assistance for undertaking agriculture and other livelihood activities, especially in terms of providing irrigation facilities.

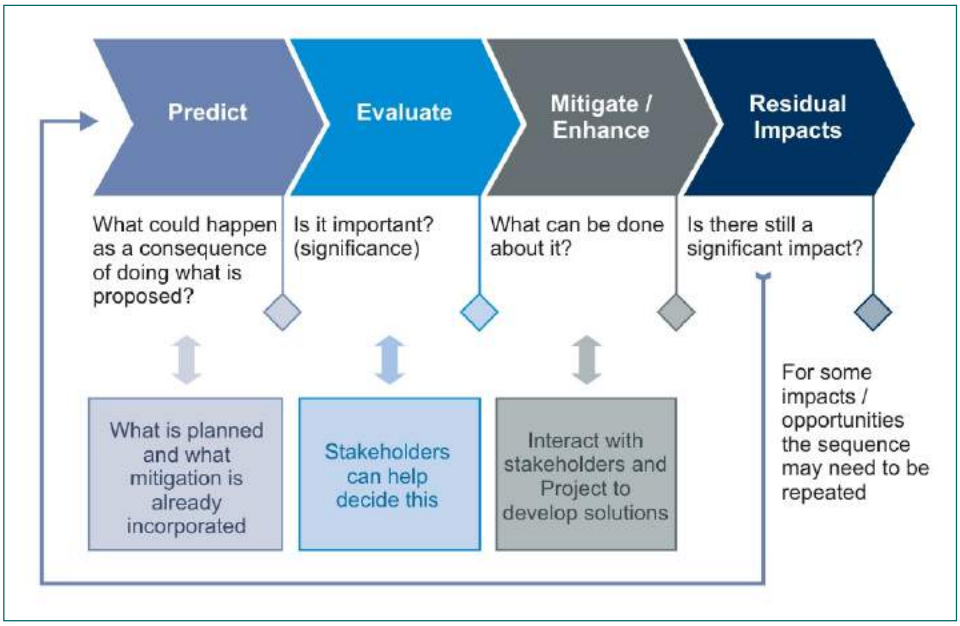
5 IMPACT ASSESSMENT

5.1 IMPACT ASSESSMENT METHODOLOGY AND APPROACH

Impact identification and assessment starts with scoping and continues through the remainder of the impact assessment process (IAP). The principal impact assessment (IA) steps are summarized in *Figure 5.1* 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 and likelihood of occurrence, 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 5.1 Impact Assessment Process



Prediction of Impacts

Prediction of impacts is essentially an objective exercise to determine what could potentially happen to the environment as a consequence of the Project and its associated activities. This is essentially a repeat of the process undertaken in scoping, whereby the potential interactions between the Project

and the Baseline environment are identified. In the impact assessment stage, these potential interactions are updated based on additional Project and Baseline information. From these potential interactions, the potential impacts to the various resources/receptors are identified, and are elaborated to the extent possible. The diverse range of potential impacts considered in the IA process typically results in a wide range of prediction methods being used including quantitative, semi-quantitative and qualitative techniques.

Evaluation of Impacts

Once the prediction of impacts is complete, each impact is described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is shown in *Table 5.1.*

Table 5.1 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 the impact.	[no fixed designations; intended to be a numerical value]

The definitions for the *type* designations are shown in *Table 5.2.* Definitions for the other designations are resource/receptor-specific, and are discussed in the resource/receptor-specific chapters.

Table 5.2 Impact Type Definitions

Designations (Type)	Definition
Direct	Impacts that result from a direct interaction between the Project and a resource/receptor (e.g., between occupation of a plot of land and the habitats which are affected).
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., viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land).
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).

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is *likelihood*. The *likelihood* of an unplanned event occurring is designated using a qualitative scale, as described in *Table 5.3*.

Table 5.3 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).

Once an impact's characteristics are defined, the next step in the impact assessment phase is to assign each impact a 'magnitude'. Magnitude is a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent
- Duration
- Scale
- Frequency

Additionally, for unplanned events only, magnitude incorporates the 'likelihood' factor discussed above.

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. As discussed above, the magnitude designations themselves are universally consistent, but the definitions for these designations vary on a resource/receptor-by-resource/receptor basis, as further discussed in each of the resource/receptor-specific chapters. The universal magnitude designations are:

- Positive
- Negligible
- Small
- Medium
- Large

In the case of a *positive* impact, no magnitude designation (aside from 'positive') is assigned. It is considered sufficient for the purpose of the IA to indicate that the Project is expected to result in a *positive* impact, without characterising the exact degree of positive change likely to occur.

In the case of impacts resulting from unplanned events, the same resource/ receptor-specific approach to concluding a magnitude designation is utilised, but the 'likelihood' factor is considered, together with the other impact characteristics, when assigning a magnitude designation.

In addition to characterising the magnitude of impact, the other principal impact evaluation step is definition of the sensitivity / vulnerability / importance of the impacted resource/receptor. There are a range of factors to be taken into account when defining the sensitivity / vulnerability / importance of the resource/receptor, which may be physical, biological, cultural or human. Other factors may also be considered when characterising sensitivity/vulnerability/importance, such as legal protection, government policy, stakeholder views and economic value.

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

- Low
- Medium
- High

Once magnitude of impact and sensitivity/vulnerability/importance of resource/receptor have been characterised, the significance can be assigned for each impact. Impact significance is designated using the matrix shown in *Figure 5.22.*

Figure 5.2 Impact Significances

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		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, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations that enter into the matrix. *Box 5.1* provides a context for what the various impact significance ratings signify.

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 IA Process). An example of an embedded control is a standard acoustic enclosure that is designed to be installed around a piece of major equipment. The avoids the situation where an impact is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls.

Box 5.1 Context of Impact Significances

An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity 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 (with or without mitigation) and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. 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. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). 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 valued/sensitive resource/receptors. An aim of IA 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 (i.e. ALARP has been applied). 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.

Identification of Mitigation and Enhancement Measures

Once the significance of an impact has been characterised, the next step is to evaluate what mitigation and enhancement measures are warranted. For the purposes of this IA, ERM has adopted the following Mitigation Hierarchy:

- **Avoid at Source; Reduce at Source**: avoiding or reducing at source through the design of the Project (e.g., avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).

- **Abate on Site**: add something to the design to abate the impact (e.g., pollution control equipment, traffic controls, perimeter screening and landscaping).

- **Abate at Receptor**: if an impact cannot be abated on-site then control measures can be implemented off-site (e.g., noise barriers to reduce noise impact at a nearby residence or fencing to prevent animals straying onto the site).

- **Repair or Remedy**: some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.

- **Compensate in Kind; Compensate Through Other Means**: where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation and amenity space).

The priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

Residual Impact Evaluation

Once mitigation and enhancement measures are declared, the next step in the IA Process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation and enhancement measures.

Management and Monitoring

The final stage in the IA Process is definition of 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 impacts and compensatory measures and offsets are reducing effects to the extent predicted.

A Environmental Management Plan, which is a summary of all actions which the Project Proponent has committed to executing with respect to environmental/social/health performance for the Project, is also included as part of the EIA report. The Environmental Management Plan includes mitigation measures, compensatory measures and offsets and management and monitoring activities.

5.2 IDENTIFICATION OF POTENTIAL IMPACTS OF THE PROJECT

For the Project, potential impacts have been identified through a systematic process whereby the activities (both planned and unplanned) associated with the Project have been considered with respect to their potential to interact with environmental and social resources or receptors.

The results from the scoping process for the Project are presented in the Scoping Matrix in *Table 5.4* and *Table 5.5*. The Scoping Matrix displays Project activities against resources/receptors, and supports a methodological identification of the potential interactions each Project activity may have on the range of resources/receptors within the Area of Influence for the Project. Entries in the matrix cells are coloured to indicate whether:

- 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 (grey);
- An interaction is reasonably possible and at least one of the resulting impacts is likely to lead to an effect that is significant (black); or
- An interaction will possibly lead to positive impacts (green).

For the purpose of the scoping exercise, seismic activities are divided into the following phases for seismic activities:

- Preparation/mobilisation phase;
- Seismic survey phase;
- Close-Out phase; and
- Accidental events.

A separate scoping matrix is presented for the well workover activities.

Table 5.4 Scoping Matrix for Seismic Surveys

Project Activity/ Hazards \ Resource/ Receptors	Physical													Biological						Socio/Economic Resources							
	Ambient Air Quality	Global Climate	Ambient Noise	Vibration	Ground Water Quality	Surface Water Quality	Hydrology	Hydrogeology	Soil	Topography	Landscape and Visual Character	Use of Natural Resources	Sediment	Terrestrial Habitat	Terrestrial Flora	Terrestrial Fauna	Aquatic Habitat (freshwater)	Aquatic Flora & Fauna(freshwater)	Designated Areas	Community Health and Safety	Indigenous People	Demographic Pattern (including	Employment and Income	Transportation	Occupational Health and Safety	Education and Skills	Infrastructure Services
Seismic Exploration																											
Preparation & Mobilisation																											
Construction of workforce camp																											
Labour, equipment and services supply																											
Site preparation/ clearance & creation of access routes																											
Transportation of equipment, materials and waste																											
Mobile Power Generation																											
Disposal of waste																											
Sewage and wastewater discharge																											
Seismic Surveying																											
Labour, equipment and services supply																											
Site preparation/ clearance & creation of access routes																											
Transportation of equipment, supplies and workforce																											
Surveying and pegging route of line																											
Mobile power generation																											
Drilling (daylight hours)																											
Laying of receivers and cables for data collection																											
Detonation of explosives																											
Retrieval of cables and receivers (similar to laying cables but less significance in scale)																											
Reinstatement																											
Waste disposal																											
Sewage and wastewater discharge																											
Close-Out Phase																											
Labour, equipment and services supply																											
Decommissioning of labour camp and facilities																											
Removal of access routes, etc.																											
Transportation of equipment, materials, waste and workforce																											
Disposal of waste																											
Sewage and wastewater discharge																											
Accidental Events																											
Spills/leaks																											
Fires and explosions																											
Vehicle accidents																											
Equipment/infrastructure damage																											
Disruption of utilities																											

- 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 (grey);
- An interaction is reasonably possible and at least one of the resulting impacts is likely to lead to an effect that is significant (black); or
- An interaction will possibly lead to positive impacts (green).

Table 5.5 Scoping Matrix for Workover Activities

Project Activity/ Hazards \ Resource/ Receptors	Physical													Biological						Socio/Economic Resources								
	Ambient Air Quality	Global Climate	Ambient Noise	Vibration	Ground Water Quality	Surface Water Quality	Hydrology	Hydrogeology	Soil	Topography	Landscape and Visual Character	Use of Natural Resources	Sediment	Terrestrial Habitat	Terrestrial Flora	Terrestrial Fauna	Aquatic Habitat (freshwater)	Aquatic Flora & Fauna(freshwater)	Designated Areas	Community Health and Safety	Indigenous People	Demographic Pattern (including livelihood) displacement)	Employment and Income	Transportation	Occupational Health and Safety	Education and Skills	Infrastructure Services	Cultural Heritage
Workover Activities																												
Well deepening	■		■		▒	▒			▒					▒	▒	▒	▒			■			▒		■	▒		
Pumping servicing	▒		▓		▒	▒			▒					▒	▒	▒	▒			■			▓		■	▒		
Swabbing and bailing	▒		▒		▒	▒			▒					▒	▒	▒	▒			■			▓		■	▒		
Zone isolation																				■			▓		■			
Re-perforations																				■			▓		■	▒		
Disposal of waste					■	■			■					■	■	■	■	■		■					■			
Improvement of well heads					▓	▓			▓											■			▓		■			
Accidental Events																												
Spills/leaks					■	■			■					■	■	■	■	■		▒					▒			
Fires and explosions	■	▒	▒	▒	■	■			▒		■	■		■	■	■	■	■		▒					▒		▒	
Vehicle accidents																				▒					▒			
Equipment/infrastructure damage																									▒		▒	
Disruption of utilities																									▒			

- 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 (grey);
- An interaction is reasonably possible and at least one of the resulting impacts is likely to lead to an effect that is significant (black); or
- An interaction will possibly lead to positive impacts (green).

5.3 KEY POTENTIAL IMPACTS

The prioritisation of impacts indicates that the majority of identified interactions of the seismic surveys and workover activities with the environment and social receptors are not expected to be significant. For activities predicted to have no significant impact (ie those in white in the Matrix), no detailed quantification or further assessment will be conducted under the ESIA.

For activities where an interaction is reasonably possible but none of the resulting impacts would be considered likely to lead to significant effects, this evaluation recommends that they be reviewed and confirmed within the detailed ESIA.

Those interactions from seismic survey and workover activities which have the potential to generate **significant** impacts are:

Environmental Impacts of Seismic Survey

Preparation / Mobilisation Phase

- Impacts from construction of workforce camp on terrestrial habitats and associated fauna and flora;
- Impacts from labour (including hunting), equipment and services supply on terrestrial and aquatic flora and fauna;
- Impacts from site preparation / clearance and creation of access routes on terrestrial habitats and associated flora and fauna;
- Impacts from mobile power generation on terrestrial fauna;
- Impacts from waste disposal on surface water quality, ground water quality, soil, terrestrial habitats and aquatic habitats as well as their associated flora and fauna; and
- Impacts from sewage and wastewater discharge on surface water quality, ground water quality, soil, terrestrial habitats and aquatic habitats as well as their associated flora and fauna.

Seismic Survey Phase

- Impacts from labour (including hunting), equipment and services supply on terrestrial and aquatic flora and fauna;
- Impacts from site preparation / clearance and creation of access routes on terrestrial habitats and aquatic habitats as well as their associated flora and fauna;
- Impacts from mobile power generation on terrestrial fauna;

- Impacts from drilling on terrestrial fauna;
- Impacts from detonation of explosive on terrestrial fauna;
- Positive impacts from reinstatement on terrestrial habitats and aquatic habitats as well as their associated flora and fauna;
- Impacts from waste disposal on surface water quality, ground water quality, soil, terrestrial habitats and aquatic habitats as well as their associated flora and fauna; and
- Impacts from sewage and wastewater discharge on surface water quality, ground water quality, soil, terrestrial habitats and aquatic habitats as well as their associated flora and fauna.

Close-Out Phase

- Impacts from labour (including hunting), equipment and services supply on terrestrial and aquatic flora and fauna;
- Positive impacts from removal of access routes on terrestrial habitats and aquatic habitats as well as their associated flora and fauna;
- Impacts from waste disposal on surface water quality, ground water quality, soil, terrestrial habitats and aquatic habitats as well as their associated flora and fauna; and
- Impacts from sewage and wastewater discharge on surface water quality, ground water quality, soil, terrestrial habitats and aquatic habitats as well as their associated flora and fauna.

Accidental Events

- Impacts from spills/leaks on on surface water quality, ground water quality, soil, terrestrial habitats and aquatic habitats as well as their associated flora and fauna; and
- Impacts from fires and explosions on air quality, ground water quality, surface water quality, landscape and visual character, use of natural resources, terrestrial habitats and aquatic habitats as well as their associated flora and fauna.

Environmental Impacts of Well Workover Activities

Well Workover Activities

- Impacts from operation of mechanical equipment required for workover activities on ambient air and noise conditions;
- Positive impact from pumping service on ambient noise condition;

- Impacts from disposal of waste from workover activities on surface water quality, ground water quality, soil, terrestrial habitats and aquatic habitats as well as their associated flora and fauna; and

- Positive impact from improvement of wellheads on soil, surface water and groundwater quality

Accidental Events

- Impacts from spills/leaks on surface water quality, ground water quality, soil, terrestrial habitats and aquatic habitats as well as their associated flora and fauna; and

- Impacts from fires and explosions on air quality, ground water quality, surface water quality, landscape and visual character, use of natural resources, terrestrial habitats and aquatic habitats as well as their associated flora and fauna.

Social Impacts of Seismic Survey

Preparation / Mobilisation Phase

- Impacts from construction of workforce camp on community health and safety, employment and income, and infrastructure services;

- Impacts from labour (including hunting), equipment and services supply on community health and safety, transportation, occupational health and safety and infrastructure services;

- Impacts from site preparation / clearance and creation of access routes on employment and income;

- Impacts from transportation of materials, equipment and wastes on community health and safety, transportation, occupational health and safety and infrastructure services;

- Impacts from waste disposal on community health and safety; and

- Impacts from sewage and wastewater discharge on community health and safety.

Seismic Survey Phase

- Impacts from labour (including hunting), equipment and services supply on community health and safety, transportation, occupational health and safety and infrastructure services;

- Impacts from site preparation / clearance and creation of access routes on demographic pattern (including livelihood), employment and income, transportation, occupational health and safety and infrastructure services;

- Impacts from transportation of equipment, supplies and workforce on community health and safety, transportation, occupational health and safety and infrastructure services;
- Impacts from drilling on community health and safety, occupational health and safety and infrastructure services;
- Impacts from laying of receivers and cables for data collection on community health and safety and occupational health and safety;
- Impacts from detonation of explosive on community health and safety and occupational health and safety;
- Impacts from retrieval of receivers and cables on community health and safety and occupational health and safety;
- Impacts from waste disposal on community health and safety, education and skills and infrastructure services; and
- Impacts from sewage and wastewater discharge on community health and safety, education and skills and infrastructure services.

Close-Out Phase

- Impacts from labour (including hunting), equipment and services supply on community health and safety, transportation, occupational health and safety and infrastructure services;
- Impacts from transportation of equipment, materials, waste and workforce on community health and safety, demographic pattern (including livelihood), transportation, occupational health and safety and infrastructure services;
- Impacts from waste disposal on infrastructure services; and
- Impacts from sewage and wastewater discharge on infrastructure services.

Accidental Events

- Impacts from spills/leaks on community health and safety and occupational health and safety;
- Impacts from fires and explosions on community health and safety, employment and income and occupational health and safety;
- Impacts from vehicle accident on community health and safety and occupational health and safety;
- Impacts from equipment/infrastructure damage on employment and income; and

- Impacts from disruption of utilities on employment and income and infrastructure services.

Social Impacts of Well Workover Activities

Well Workover Planned Activities

- Positive impact from workover activities on employment and income; and
- Impacts from workover activities on community health and safety and occupational health and safety.

5.4 ENVIRONMENTAL IMPACT ASSESSMENT AND MITIGATION

Drawing on the outcomes of scoping, *Sections 5.5 – 5.30* below present the assessment of the potential impacts to the environment associated with the seismic survey and well workover activities. The assessment is presented in the order of impacts as identified during scoping.

PREPARATION / MOBILISATION PHASE

5.5 IMPACTS FROM CONSTRUCTION OF WORKFORCE CAMP ON TERRESTRIAL HABITATS AND ASSOCIATED FAUNA AND FLORA

5.5.1 *Source of Impact*

Direct impacts to terrestrial ecology associated with the construction of the camp will include:

- Habitat and vegetation loss within the footprint of the camp resulting from land take; and
- Potential loss of inactive or less mobile wildlife that are nesting in or inhabiting the affected area.

Indirect impacts to terrestrial ecology will include:

- Potential impacts to the surrounding habitat and associated wildlife due to disturbance of this habitat including noise and increased human activity

5.5.2 *Existing/ In Place Controls*

Measures to control/ minimise adverse impacts of habitat loss are assumed to include:

- Footprint of the proposed camp is minimised during the design stage.

- Construction activities will be restricted to works areas that will be clearly demarcated.
- Work site boundaries will be regularly checked to ensure that they are not breached and that damage does not occur to surrounding areas.
- It is assumed felling of large perennial vegetation (i.e. large trees such as roadside trees) will be avoided.
- Works areas in temporarily affected areas would be reinstated with tree/shrub planting after completion of the works, as far as practicable.
- Workforce camp is assumed to be temporary and will be removed in the close-out phase.

5.5.3 Significance of Impacts

The location for the workforce camp is in the planning phase and not finalized. Developed land, agricultural land, village cultivated land/village and shrubland habitats in the block are modified habitat that are ranked as low sensitivity. Plants are observed to be common and widespread species and none are considered species of conservation interest. Less mobile fauna that were recorded in the block by baseline survey did not include species of conservation interest except for King Cobra (Vulnerable) and Yellow-headed Tortoise (Endangered) in shrubland habitat. Provided that the existing/in place controls are followed, the impact of habitat loss and disturbance is ranked of **Minor** significance.

Table 5.6 Assessment of Impacts on Habitat and Flora (Construction of Workforce Camp)

Impact	Loss of habitats and vegetation during workforce camp construction				
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Direct: <1ha. Indirect: Expected to be confined to the immediate vicinity				
Frequency	Short term.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	

Table 5.7 ***Assessment of Impacts on Terrestrial Fauna (Construction of Workforce Camp)***

Impact	Disturbances to fauna and potential increase in wildlife mortality.				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Exact extent of indirect affects unknown but considered local				
Frequency	Continuous				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	

5.5.4 Additional Mitigation, Management and Monitoring

The assessment has indicated that impacts with habitat loss and disturbance to fauna are expected to be minor, hence, no additional mitigation or monitoring activities are considered necessary over and above the existing or in-place controls.

5.5.5 Significance of Residual Impacts

Residual impacts would be expected to be of **Minor** significance.

5.6 IMPACTS FROM LABOUR (INCLUDING HUNTING), EQUIPMENT AND SERVICES SUPPLY ON TERRESTRIAL AND AQUATIC FLORA AND FAUNA

5.6.1 Source of Impact

Hunting may increase in the surrounding areas as a result of worker influx into the area and increased traffic may result in increase in animal strike on roads. The creation of access routes or cutting of seismic lines and establishment of workforce camp has the potential to expose wildlife to the risk of poaching by Project staff/ workers. Hunting, poaching and wildlife trade are critical issues for the conservation of biodiversity globally. Unsustainable hunting to obtain meat, animal parts or live individuals for the pet trade has caused population declines and local extinction of many species and threatens some species with global extinction. During surveys, mammals recorded from habitats were mainly representatives of Rodentia (Rodents: Rats, Squirrels and Hares) but also included species of conservation interest Yellow-headed Tortoise (Endangered) based on interviews, though this species was not directly observed in surveys.

5.6.2 Existing/ In Place Controls

Measures to control/ minimise adverse impacts from labour, equipment and services supply will include:

- Oil fields are restricted areas and therefore existing access restrictions will be in place and patrolled within the block. Priority areas for patrolling should be identified within the Environmental Monitoring Plan (e.g. shrubland areas where new access routes are created).

- Project activities undertaken with sufficient lighting only.

- Minimisation of night-time driving.

5.6.3 Significance of Impacts

In the absence of controls on workforce, loss of fauna due to hunting/poaching (intentional take) have potential to be of up to **Moderate** significance depending on species taken.

Table 5.8 Assessment of Impacts on Terrestrial and Aquatic Fauna and Flora from Labour, Equipment and Services Supply

Impact	Loss of fauna due to impacts (eg hunting) from labour, equipment and services supply			
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Loss of fauna individuals dependent on hunting effort.			
Frequency	Intermittent.			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major

5.6.4 Additional Mitigation, Management and Monitoring

- Induction training for personnel is recommended to include a mandatory segment on biodiversity. In this induction details of key requirements will be provided to include ban on fishing and hunting.

- Prohibit workers from uncontrolled interaction and commerce with the local community in terms of buying and selling goods particularly Non-Timber Forest Products (NTFP), bush meat and wildlife (pets, souvenirs).

- Prohibit staff from introducing pets, livestock and other animals.

- Engagement with local community to convey the message that workers are not allowed buying Non-Timber Forest Products (NTFP), bushmeat and wildlife (pets, souvenirs).

- Work with local authorities and communities through the stakeholder engagement plan to monitor and control hunting and poaching arising from new access in the project area.

- A monitoring programme will be established to ensure mitigation measures are being implemented effectively.

5.6.5 Significance of Residual Impacts

Based on the assumption that MPRL E&P will be able control and mitigate the impacts arising directly from its own workforce (including contractors), species mortality due to poaching by Project staff/ workers is evaluated to be **Negligible**. .

5.7 IMPACTS FROM SITE PREPARATION / CLEARANCE AND CREATION OF ACCESS ROUTES ON TERRESTRIAL HABITATS AND ASSOCIATED FLORA AND FAUNA

5.7.1 Source of Impact

Determination and development of access tracks for equipment, resources and workforce for the seismic survey will commence in the preparation/ mobilization phase. A grid of straight lines to acquire seismic data in both shot and receiver lines will need to be accessed by the survey team. This will involve the survey team accessing the lines on foot requiring them to tread on vegetation and land and where necessary cut vegetation to make or clear a path. The need to cut vegetation will be greater in more densely vegetated areas of shrubland habitat and less in open areas such as agricultural land, although potentially impacting on planted crops.

The survey team may need to cut vegetation for drilling of shot holes which may cause some vegetation loss in that area. In some areas, vegetation will be cleared for construction of access roads.

The presence of workforce and associated disturbance such as from noise will likely result in temporary displacement of terrestrial fauna away from works areas. Affected fauna will include birds and potentially small mammal species recorded in habitat such as Hare and Squirrels.

5.7.2 Existing/ In Place Controls

Measures to control/ minimise adverse impacts will include:

- Teams for deployment of source lines will access areas on foot, as far as practicable and follow/ clear a narrow path.

- On the basis that vegetation clearance for tracks to allow access will be by hand, it is assumed felling of large perennial vegetation (i.e. large trees) will be avoided.

- Minimize footprint of access roads at the design stage (width of any new road should be less than 5 m).

5.7.3 *Significance of Impacts*

Impacts on terrestrial flora from clearance and creation of access routes are expected to be local in extent, short-term in duration, reversible and small magnitude. It is unlikely vegetation growth will be significantly reduced where teams have trod across. Crops can be replaced in next planting. Given the low sensitivity of the modified habitats and vegetation cutting will limited to narrow seismic lines and access tracks, impacts to vegetation and habitats is evaluated as **Minor**.

Disturbance and displacement-causing activities will only be temporary in nature and limited in extent and duration. As such the magnitude is considered small. Given terrestrial fauna are typically mobile and will move away from a source of disturbance, sensitivity is considered low. Significance of potential impacts to fauna is ranked as **Minor**. Nevertheless due to the potential for adverse worker-wildlife interactions, further management measures are recommended. Good practice measures are also recommended.

Table 5.9 Assessment of Impacts on Habitat and Flora (Site Preparation and Clearance of Access Routes)

Impact	Cutting of vegetation on access to seismic lines.				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	Cutting on seismic lines on narrow path				
Frequency	One time activity for any given track				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate		Major

Table 5.10 Assessment of Impacts on Terrestrial Fauna (Site Preparation and Clearance of Access Routes)

Impact	Disturbances to fauna.				
Impact Nature	Negative		Positive		Neutral
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term		Permanent
Impact Extent	Local		Regional		International
Impact Scale	At seismic lines				
Frequency	Disturbance: During presence of survey team.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate		Major

5.7.4 Additional Mitigation, Management and Monitoring

- Induction training for personnel is recommended to include a mandatory segment on biodiversity. In this induction details of key requirements will be provided to include:
    - Outline vegetation clearance procedures including species not to cut, and the minimum size of tree that should be felled (20 cm diameter at breast height (dbh) (i.e. diameter of the tree truck measured at 1.3 m above ground).
    - What to do in the advent of disturbing species (eg snakes) (both from an occupational safety and biodiversity perspective).
- Minimise clearing of vegetation along seismic lines ie leave in place smaller vegetation, topsoil, root stock, seeds.
- Minimise clearing of vegetation along seismic lines by selecting the 'path of least resistance' through vegetation.
- Minimise vegetation cutting at shot hole and receiver station, as far as practicable.
- The width of seismic lines will be no greater than 1.5 m.

5.7.5 Significance of Residual Impacts

Provided that the mitigations are followed, the residual impact of site preparation and clearance of access route is expected to be **Minor**.

5.8 IMPACTS FROM MOBILE POWER GENERATION ON TERRESTRIAL FAUNA

5.8.1 Source of Impact

Use of mobile power generators for drilling equipment will give rise to noise emissions and vibration which in turn will have the potential to modify the movement and behaviour of terrestrial fauna. The most common response to disturbance is active avoidance of an area with associated ecological effects (e.g. move from an individual's territory, disturbance of breeding activities etc.).

5.8.2 Existing/ In Place Controls

Measures to control/ minimise adverse impacts will include:

- Specifications of power generator.
- Project activities undertaken within sufficient lighting only.

5.8.3 *Significance of Impacts*

While disturbance effects have the potential to occur, they will be temporary in nature and local in scale. The impact magnitude is expected to be small. The sensitivity of terrestrial fauna in the habitats in the block, all of which are modified in nature, is considered to be low. Provided that the existing/in place controls are followed, the impact of disturbance to terrestrial fauna due to mobile power generation is ranked of **Minor** significance.

Table 5.11 Assessment of Impacts on Terrestrial Fauna (Mobile Power Generation)

Impact	Disturbances to fauna.				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Exact extent of indirect affects unknown but considered local				
Frequency	Continuous				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	

5.8.4 *Additional Mitigation, Management and Monitoring*

The assessment indicates impacts associated with mobile power generations are expected to be minor, hence no further mitigations are required.

5.8.5 *Significance of Residual Impacts*

The residual impact of mobile power generation to terrestrial fauna is expected to be **Minor.**

5.9 *IMPACTS FROM WASTE DISPOSAL ON SURFACE WATER QUALITY, GROUND WATER QUALITY, SOIL, TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA*

5.9.1 *Source of Impact*

Construction of the camp will generate general construction waste and some hazardous waste (eg oily rags, paints, chemicals). Project activities and seismic team accommodated at the camp will generate some quantities of general refuse, recycle waste and other wastes (eg packaging materials and papers).

Improper waste disposal has the potential to lead to contamination of soil and ground water through leachate or direct contamination of surface water and water quality impacts to aquatic fauna.

5.9.2 *Existing/ In Place Controls*

Measures to control/ minimise adverse impacts will include:

- Planning material requirements the at design stage to reduce unnecessary generated waste.
- MPRL E&P HSE Management System requires Waste Management Plan for the Project.

5.9.3 *Significance of Impacts*

Provided that proper disposal mechanism for waste will be implemented in accordance with MPRL E&P HSE Management System requirements and all waste will be removed from site and responsibly disposed by approved waste contractor, the significance of waste disposal is ranked as **Minor**.

Table 5.12 ***Assessment of Impacts from Waste Disposal on Surface Water Quality, Ground Water Quality, Soil, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna***

Impact	Impacts on Surface Water Quality, Ground Water Quality, Soil, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna.				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Exact extent of indirect affects unknown but considered local				
Frequency	Continuous				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	

5.9.4 *Additional Mitigation, Management and Monitoring*

Significance of potential impacts is ranked as minor. Nevertheless, good practice measures are also recommended.

- A Waste Management Plan will be developed by MPRL E&P or a third party separately from but administered under the Environmental and Social Management Plan. The plan will identify and estimate generated volumes of different waste types and set out procedures for responsible management and disposal and will be regularly audited.
- Induction training for personnel (including contracted local workers) is recommended to include waste management system

5.9.5 Significance of Residual Impacts

Provided the mitigations are followed, the residual impact of surface water quality, ground water quality, soil, terrestrial habitats and aquatic habitats and their associated flora and fauna in the Project Area is ranked as **Negligible**.

5.10 IMPACTS FROM SEWAGE AND WASTEWATER DISCHARGE ON SURFACE WATER QUALITY, GROUND WATER QUALITY, SOIL, TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA

5.10.1 Source of Impact

It is estimated that up to 200 workers for the seismic surveys will be required. Seismic crew will be housed on site; the remaining others will be bussed in from local surroundings. Black and grey water will arise from the construction workforce and from drainage from cooking and cleaning activities. The volume of sewage and grey-water generated at the camp is estimated to be 50 to 75L/person/day.

Discharged wastewater is generally characterized as having a high concentration of solids (suspended and dissolved), biochemical oxygen demand (BOD) and chemical oxygen demand (COD), nutrients (ammonia) and faecal coliform counts. Potential impacts associated with mis-management of sewage and other wastewaters include contamination of surface waters and water supplies, which may result in localised land/ecological contamination and impacts to health.

5.10.2 Existing/ In Place Controls

Measures to control/ minimise adverse impacts to water and soil quality and associated impacts are assumed to include:

- Provision of properly designed and installed service tank for sewage from toilet facilities.
- Provision of properly designed and installed water pit for greywater from kitchen.
- Service tank and water pit are separated from drainage and stormwater.
- Ensure the service tank and water pit are well maintained to allow effective operation.

5.10.3 Significance of Impacts

The existing area has no sewerage collection and treatment systems. The water pit and service tank will serve as a septic system which allows for aerobic digestion of organic matter. Effluent from the tanks is assumed to pass into groundwater aquifers. In groundwater effluent will be subject to

dilution by existing groundwater flows. The duration of the impact will be for the duration of the seismic survey activities and potential for impacts to groundwater will be local in nature. On the assumption that tanks and pit are regularly monitored and maintained to ensure proper functioning, the impact significance is ranked as **Minor**.

Table 5.13 ***Significance of Impacts on Water and Soil Quality from Wastewater and Sewage***

Impact	Operational impacts on water and soil quality from wastewater and sewage			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	The scale of the impact is estimated to be point-based source from the Project area.			
Frequency	Throughout the life time of the workforce camp.			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major

5.10.4 Additional Mitigation, Management and Monitoring

The assessment indicates impacts from wastewater and sewage are expected to be minor, hence additional mitigation measures are not recommended.

5.10.5 Significance of Residual Impacts

With the implementation of in place controls, the residual impact of wastewater and sewage is ranked as **Minor**.

SEISMIC SURVEY PHASE

5.11 IMPACTS FROM LABOUR (INCLUDING HUNTING), EQUIPMENT AND SERVICES SUPPLY ON TERRESTRIAL AND AQUATIC FLORA AND FAUNA

5.11.1 Significance of Residual Impacts

The impacts, controls and mitigations and residual impact significance during the seismic survey phase are as previously assessed in *Section 5.6*.

5.12 IMPACTS FROM SITE PREPARATION / CLEARANCE AND CREATION OF ACCESS ROUTES ON TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA

5.12.1 Existing/ In Place Controls

Existing controls will be as described previously in *Section 5.7*. In addition, the requirement for clearance and cutting will be reduced by use of wireless geophones on receiver lines, as far as practicable

5.12.2 Significance of Residual Impacts

The impacts, controls and mitigations and residual impact significance during the seismic survey phase are as previously assessed in *Section 5.7*.

5.13 IMPACTS FROM MOBILE POWER GENERATION ON TERRESTRIAL FAUNA

5.13.1 Significance of Residual Impacts

The in place controls, impacts and residual impact significance during the seismic survey phase are as previously assessed in *Section 5.8*.

5.14 IMPACTS FROM DRILLING ON TERRESTRIAL FAUNA

5.14.1 Source of Impact

At source lines, shot holes will be drilled to 10 m depth and at 50 m intervals using portable drills. Noise and increased human activity at the shot hole locations will have the potential to modify the movement and behaviour of terrestrial fauna. The most common response to disturbance is active avoidance of an area with associated ecological effects (e.g. move from an individual's territory, move into sub-optimal habitat, disturbance of breeding activities etc.).

5.14.2 Existing/ In Place Controls

Measures to control/ minimise adverse impacts of drilling will include:

- Drilling of shot holes by portable drills.
- Vegetation cutting by hand to minimise disturbance and degradation of the habitats.
- It is assumed felling of large perennial vegetation (i.e. large trees which typically provide habitat for higher densities of terrestrial fauna) will be avoided.
- Shot holes will be backfilled after shooting is completed.

5.14.3 *Significance of Impacts*

Based on baseline survey findings, mammal species including mobile species such as Rats, Hares and Squirrels. Low mobility species in shrubland area may include Yellow-headed Tortoise (Endangered) based on interview records but its presence was not confirmed by direct observation during surveys. While disturbance effects have the potential to occur, they will be temporary in nature and local in scale. The impact magnitude is expected to be small. Temporarily displaced terrestrial fauna will be expected to move back into an area once activities at a location have ceased. Provided that the existing/in place controls are followed, the impact of disturbance to terrestrial fauna due to drilling is ranked of **Minor** significance.

Table 5.14 Assessment of Impacts on Terrestrial Fauna (Drilling)

Impact	Disturbances to fauna.				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Exact extent of indirect affects unknown but considered local				
Frequency	Continuous				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	

5.14.4 *Additional Mitigation, Management and Monitoring*

As good site practice, it is recommended that the immediate vicinity of shot hole locations is checked for presence of Yellow-Headed Tortoise (Endangered) and if found will be relocated to a safe distance away from the drilling activity.

5.14.5 *Significance of Residual Impacts*

The assessment indicates no further mitigations are required. The residual impact of drilling to terrestrial fauna is expected to be **Minor**.

5.15 *IMPACTS FROM DETONATION OF EXPLOSIVE ON TERRESTRIAL FAUNA*

5.15.1 *Source of Impact*

Shot holes will be drilled to a depth of 10 m and loaded with a small charge backfilled and a shot-hole plug installed for operation. Explosives used for shooting will therefore generate noise that will be a brief muffled pulse and at low levels. Seismic surveys strive to 'contain' the detonation within the shot hole in order to achieve maximum energy input and eliminate/minimize energy spent on venting.

Short pulsed noises typically elicit a greater behavioural response in terrestrial fauna than continuous noise at the same level. Sudden impulsive noise has potential to elicit a "startle" response in fauna, leading to temporary cessation of normal activities and mobile fauna potentially moving away from the source.

5.15.2 *Existing/ In Place Controls*

Measures to control/ minimise adverse impacts of detonations will include:

- Minimise the use of charges as far as practicable.
- Shotholes will be backfilled.
- Charges detonated at ~10m below ground level or as deep underground as practicable.
- Daytime shooting only.

5.15.3 *Significance of Impacts*

Noise generated by the seismic survey is expected to be small (muffled) and localized and by its nature brief. A typical backfilled explosive has a noise level of 70 dB at a distance of 1m from the hole location and a noise level of 2 dB at a distance of 50 m. The acoustic energy produced by the explosion rapidly decreases in proportion to the square of distance. Based on interview records during baseline survey, species of conservation interest in shrubland area are Yellow-headed Tortoise (Endangered) and King Cobra (Vulnerable), but occur in low density in the Project Area. Noise impacts from detonation is expected to be small magnitude and brief and limited to temporary behavioural disturbance to any affected individuals, if present. The significance of detonation of explosives to terrestrial fauna is ranked as of **Minor** significance.

Table 5.15 Assessment of Impacts on Terrestrial Fauna (Detonation of Explosive)

Impact	Impact of detonation of explosive on terrestrial fauna.				
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Noise from firing detectable but likely at similar noise levels to ambient noise levels within in the order of 50m from source.				
Frequency	Throughout seismic survey period.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	

5.15.4 Additional Mitigation, Management and Monitoring

The assessment indicates no further mitigations are required.

5.15.5 Significance of Residual Impacts

Provided that the in place controls are followed, the residual impact of detonation of explosives is expected to be **Minor**.

5.16 POSITIVE IMPACTS FROM REINSTATEMENT ON TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA

5.16.1 Source of Impact

Once seismic shooting activities are completed reinstatement of disturbed areas will be undertaken.

The re-vegetation works will serve to rehabilitate habitat which is considered as a positive impact.

5.16.2 Existing/ In Place Controls

Measures to enhance the positive impact will include:

- MPRL E&P to compensate farmers to reinstate land in agricultural and cultivated/village areas.
- MPRL E&P commitment to appropriate reinstatement works for seismic survey.

5.16.3 Additional Mitigation, Management and Monitoring

- Materials introduced by the seismic survey will be removed at the disturbed areas.
- Disturbed areas will be monitored before Project commencement and for one year after completion of Project to track any natural recolonisation by vegetation after the Project completion. If natural recolonisation does not taken place or is not ideal (i.e. significantly different from the original condition as determined by monitoring), the disturbed areas will be restored/rehabilitated as much as is practicable to its original condition; this includes replanting areas where vegetation has been cleared including seismic line access routes, etc, using native vegetation.
- It is recommended a Terrestrial Habitat Reinstatement Plan will be developed in light of detailed plans for locations for seismic survey including temporarily cleared areas. The plan will identify provisions for sourcing native species from nursery and procedures for replanting. It will also identify priority areas for rehabilitation including at for instance *de-facto* protected areas such as near monastery and near cultural

heritage location if trees or vegetation are planned to be cleared from these locations.

5.16.4 Significance of Residual Impacts

Provided that reinstatement of habitat through planting is implemented appropriately, residual impact of reinstatement is expected to be **Neutral** or **Positive**.

5.17 IMPACTS FROM WASTE DISPOSAL ON SURFACE WATER QUALITY, GROUND WATER QUALITY, SOIL, TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA

5.17.1 Source of Impact

Sources of impact are as described in *Section 5.9*. In addition, wastes will be generated from firing of charges.

Explosive charges and their casings will be burned during firing leaving little residue. Gab wires of the detonator will remain and could be a source of contamination to water and soil if left uncollected.

5.17.2 Existing/ In Place Controls

Measures to control/ minimise adverse impacts are described in *Section 5.9* and will also include:

- Seismic team will collect gab wires to dispose or to re-use.
- Seismic team will check the shot hole and collect remaining residues, as far as practicable, to minimise waste in the area.

5.17.3 Significance of Impacts

Significance of impacts is as described in *Section 5.9*.

5.17.4 Significance of Residual Impacts

Significance of residual impacts is as described in *Section 5.9*.

5.18 IMPACTS FROM SEWAGE AND WASTEWATER DISCHARGE ON SURFACE WATER QUALITY, GROUND WATER QUALITY, SOIL, TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA

5.18.1 Source of Impact

Sources of impact are as described in *Section 5.10*. In addition, sources of wastewater will include those from drilling of shot holes and sewage from workers in the seismic survey area.

5.18.2 Existing/ In Place Controls

Measures to control/ minimise adverse impacts described in *Section 5.10* and also include:

- Fluids to shot hole will be limited to use of small quantities of water.
- Excess drilling mud (water) will be pumped back into the container (eg. barrel) for reuse.

5.18.3 Significance of Impacts

Impact significance is as described in *Section 5.10*. Owing to the small depth, small quantities of water will be required which would not be a significant source of impact.

5.18.4 Additional Mitigation, Management and Monitoring

It is recommended that portable toilet facilities be provided with collection of resultant sanitary waste to be carried out by an approved contractor for proper disposal.

Induction training and briefings for personnel (including contracted local workers) is recommended to include available provided sanitary facilities

5.18.5 Significance of Residual Impacts

Provided mitigations are implemented, the residual impact will be as described in *Section 5.10*.

CLOSE-OUT PHASE

5.19 IMPACTS FROM LABOUR (INCLUDING HUNTING), EQUIPMENT AND SERVICES SUPPLY ON TERRESTRIAL AND AQUATIC FLORA AND FAUNA

5.19.1 Significance of Residual Impacts

The impacts, controls and mitigations and residual impact will be as described in *Section 5.6.*

5.20 POSITIVE IMPACTS FROM REMOVAL OF ACCESS ROUTES ON TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA

5.20.1 Significance of Residual Impacts

The impacts and residual impact will be as described in *Section 5.16*.

5.21 *IMPACTS FROM WASTE DISPOSAL ON SURFACE WATER QUALITY, GROUND WATER QUALITY, SOIL, TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA*

5.21.1 *Significance of Residual Impacts*

The impacts, controls and mitigations and residual impact will be as described in *Section 5.9.*

5.22 *IMPACTS FROM SEWAGE AND WASTEWATER DISCHARGE ON SURFACE WATER QUALITY, GROUND WATER QUALITY, SOIL, TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA*

5.22.1 *Significance of Residual Impacts*

The impacts, controls and mitigations and residual impact will be as described in *Section 5.10.*

ACCIDENTAL EVENTS

5.23 *IMPACTS FROM SPILLS/LEAKS ON SURFACE WATER QUALITY, GROUND WATER QUALITY, SOIL, TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA*

5.23.1 *Source of Impact*

Sources of impact include spillage of diesel fuel at fuel storage locations (e.g. MOGE storage area or from a fuel station if built) and refuelling of plant and machinery. Spills could also occur in the seismic survey area during refuelling or emergency servicing of equipment. Fluids for shot hole drilling will be carried in barrels by teams in the seismic survey area.

Uncontrolled spills and leaks of fuel, chemicals or other pollutants have the potential to contaminate surface water, ground water and soil. Exposure to aquatic communities or uptake of contaminants through plant roots close to works areas could occur and could lead to direct lethal/non-lethal effects on vegetation and aquatic organisms.

5.23.2 *Existing/ In Place Controls*

Measures to control/ minimise adverse impacts from spills/leaks are:

- Drilling fluid for shot hole drilling will be water.
- Hazardous materials / chemicals will be stored at MOGE warehouse facility. Storage facilities at MOGE warehouse incorporate features for appropriate storage of fuels and hazardous materials.

5.23.3 *Significance of Impacts*

Accidents or malpractice may lead to contamination of water and soil with associated impacts and is a significant environmental risk but one that can be managed and controlled. A major spill such as from loss of containment at the storage facilities is considered unlikely but a small spill is considered likely over the life of the Project. The magnitude of impact is considered small for small spills and medium for larger spills. Resource sensitivity is considered medium. Impacts from spills are considered to be of **Minor** significance for small spills and **moderate** significance for larger spills.

Table 5.16 Assessment of Impacts on Water, Soil, Habitats, Flora and Fauna (Accidental Spillage and Leaks)

Impact	Impacts from spills/leaks on water, soil, habitats, flora and fauna.			
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Point source at works/refuelling area. Impact on water and soil is considered local.			
Frequency	Throughout the Seismic Survey			
Likelihood	Unlikely for large spills, likely for small spills			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major

5.23.4 *Additional Mitigation, Management and Monitoring*

- Fuel and chemical storage areas will have appropriate secondary containment (drip trays for small storage locations/impervious base and bund walls for tanks) and provide procedures for managing the containment systems. All ancillary equipment (e.g. valves, hoses) should be contained securely within the bund when not in use.

- Oil interceptors will be provided in the drainage system where necessary and regularly emptied to prevent the release of oil and grease into the storm water drainage system after accidental spillages.

- Storage tanks and components will meet international design standards as far as practicable. For example, storage tanks will be equipped with devices that prevent spills and overfills, including overfill alarms, automatic shut-off devices and catch basins around fill pipes.

- Fuel stores should be kept away from vehicle access routes to prevent collisions.

- Maintenance of storage tanks, pipes and components (seals, connectors and valves) will be carried out regularly, including daily inspection of fuelling equipment in satisfactory condition.

- All construction plants and machinery (e.g., trucks) will be maintained in good working order to avoid leakage or spillage of contaminants.
- Routine servicing of plant and equipment will be carried out off-site prior to mobilisation or within workshop facilities equipped with bunded areas and oil interceptor.
- Spill kits and shovels will be available onsite at all times for any accidental leakage of fuel or other hazardous substances during Project activities; it must be ensured that no such substance enters into groundwater or surface water resources.
- If emergency servicing of equipment is required in the field, spill kits and drip trays will be available.
- Any contaminated soil will be removed from site and disposed of in accordance with the waste management plan.
- Oils and other service fluids will be removed off-site by the Seismic Team and disposed in accordance with the waste management plan.
- The location, type and quantity of any fuel or chemical spill will be reported to HSE coordinator immediately.
- Shot holes will not be located within 50 m of a watercourse or water body.

5.23.5 Significance of Residual Impacts

Provided that mitigations are in place to prevent and control spillage/leak risk, residual risk is ranked as **Minor**.

5.24 IMPACTS FROM FIRES AND EXPLOSIONS ON AIR QUALITY, GROUND WATER QUALITY, SURFACE WATER QUALITY, LANDSCAPE AND VISUAL CHARACTER, USE OF NATURAL RESOURCES, TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA

5.24.1 Source of Impact

Accidental events may result from a number of Project activities, however, those that result in fire (e.g. mishandling of charges or serious traffic accident) have the potential to cause local fires within the Project area. In addition, an increase in the number of people who smoke (ie workers) could increase the potential for ignition and uncontrolled fires from discarded cigarettes in the Project Area. Other sources of ignition include sparks from machinery and vehicle exhausts.

5.24.2 Existing/ In Place Controls

There are no in place controls at the present time.

5.24.3 *Significance of Impacts*

Impacts from fire outbreaks have been evaluated to result in impacts of **Minor significance**. This is mostly due to the fact that habitat area could be lost will be localised and low-mobility species including potentially the Yellow-headed Tortoise (Endangered) are expected to occur in low density and limited to shrubland habitat. The likelihood of such events occurring is considered unlikely. Nevertheless, good site practice measures are recommended.

Table 5.17 Assessment of Impacts on Air, Visual Character, Water, Soil, Habitats, Flora and Fauna (Fire and Uncontrolled Explosions)

Impact	Impacts from fire and explosions on air, water, soil, habitats, flora and fauna.				
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Local scale .				
Frequency	Throughout the Seismic Survey				
Likelihood	Unlikely for large fires				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	

5.24.4 *Additional Mitigation, Management and Monitoring*

- Induction training for personnel is recommended to include a mandatory segment on fire safety and actions in the event of a fire.
- All seismic teams will carry first-attack fire-fighting equipment such as fire extinguisher, shovel and communications equipment to respond to small spot fires and communicate with the operations headquarters in the event of a fire.
- HSE induction will be undertaken at the site before work commencement which should include proper use of fire-fighting equipment and communication protocol in case of fire.
- It will be of key importance that explosives are kept in a safe manner and no uncontrolled explosions occur. Implement all required safety and management requirements relating to the transportation, storage and handling of explosives.
- Misfired charges from shot holes will be disabled and destroyed.
- Restrict smoking to designated areas only.

5.24.5 *Significance of Residual Impacts*

With measures to manage fire risk, it is considered the residual risk can be reduced to **Negligible**.

WORKOVER ACTIVITIES

5.25 *IMPACTS FROM OPERATION OF MECHANICAL EQUIPMENT REQUIRED FOR WORKOVER ACTIVITIES ON AMBIENT AIR AND NOISE CONDITIONS*

5.25.1 *Source of Impact*

Workover rig and well servicing truck will be used for activities at the selected existing wells. The existing wells are located at various locations across the Myanaung field in modified habitats and are mostly located away from sensitive receiver locations. A small proportion of wells are relatively nearby residential area, which are considered noise and air sensitive receptors of medium sensitivity. The wells that will be selected for workover will be planned based on the outcome of the seismic survey with any of the wells being potential candidates for workover.

Noise

Noise emissions from the workover rig and trucks are classed as construction phase noise. The Government of Myanmar has not yet established numerical standards for noise impact arising from construction noise and operation noise. In the absence of national standards, the Ministry of Environmental Conservation and Forestry (MOECAF) typically recommends that internationally accepted numerical environmental standards, such as International Finance Corporation (IFC) to be adopted for any noise assessment. However, the IFC Guidelines only specified noise limits for operation of a facility while no noise limits are set out for construction noise. In this circumstance, reference has been made to the Ambient Noise Standards in Thailand. A-weighted equivalent continuous sound level (L_{eq}) 24 hours should not exceed 70 dB(A) and the maximum equivalent sound level (L_{eq}) should not exceed 115 dB(A). Ambient noise levels recorded during baseline survey at the Myanaung field at four representative locations nearby to sensitive receptor recorded during day(LA_{eq}) ranged 40 dB to 45 dB and are well below the standard.

Air

Impacts to air quality will primarily arise through combustion of diesel fuel by the workover rig generator and service truck engines at the well site. Exhaust gas from vehicles, generator and engines have the potential to affect sensitive residential receptors. The primary pollutants emitted from engines include Particulate matter (PM), Carbon monoxide, (CO), Nitrogen oxides (NOx), Hydrocarbons (HC), and Volatile organic compounds (VOCs). Combustion of fossil fuels in stationary and mobile combustion sources will

produce greenhouse gases (e.g. carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

5.25.2 Existing/ In Place Controls

Measures to control/ minimise adverse impacts on air and noise.

- Activities carried out at existing well sites in existing oil field with separation from sensitive receptors.
- Project activities undertaken with sufficient lighting only.
- Well maintained equipment will be used
- Noise suppression box will be fabricated over the engine for the PMEs being operated nearby the NSRs (e.g. villages).
- Appropriate PPE e.g. ear protection will be used for MPRL E&P personnel.
- Workers not involved with the works will need to be at least 100 m away from the well head if practicable.
-
- Worker outside will need to be at least 100 m away from the well head.

5.25.3 Significance of Impacts

Noise

Noise levels associated with workover activities at a well site have been calculated to illustrate indicative noise levels at varying distances away from a well.

Table 5.18 Calculated Noise Levels at 50m, 100m, 150m and 200m from Workover Activities

Equipment to NSR Separation Distance	Workover Activities	Equipment	Noise Level, dB(A)	Assessment Criteria dB(A)[(a)]	Compliance
50m	Well deepening	1 x Tracked hydraulic drilling rig (P100 rig)	72	70	No
	Pump servicing; swabbing and bailing; zone isolation and re-perforations	2x rigid trucks	72	70	No
100m	Well deepening	1 x Tracked hydraulic drilling rig (P100 rig)	69	70	Yes
	Pump servicing; swabbing and bailing; zone isolation and re-perforations	2x rigid trucks	69	70	Yes
150m	Well deepening	1 x Tracked hydraulic drilling rig (P100 rig)	65	70	Yes
	Pump servicing; swabbing and bailing; zone isolation and re-perforations	2x rigid trucks	65	70	Yes
200m	Well deepening	1 x Tracked hydraulic drilling rig (P100 rig)	63	70	Yes
	Pump servicing; swabbing and bailing; zone isolation and re-perforations	2x rigid trucks	63	70	Yes

Note:
(a) Ambient Noise Standards in Thailand

Based on the calculations, it is expected there is potential for small magnitude noise exceedance to occur if noise sensitive receivers are located within about 100 m from the well. The significance of impact to such noise sensitive receivers is assessed as **Moderate**. If well sites are selected for workover that are within 100m from the nearest noise sensitive receiver, additional mitigation would be required.

For workovers at wells that are further than 100m from noise sensitive receivers, noise levels would not be expected to exceed assessment criteria due to activities at the well site. The significance of impacts to sensitive receivers in this event would be **Negligible** and further mitigation measures would not be required beyond good practice measures.

Table 5.19 Assessment of Impacts on Noise Conditions (Well workover)

Impact	Noise impact from workover drill rig and service trucks				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Noise levels are calculated to comply with noise criteria within about 100 m from the well site.				
Frequency	Throughout workover activity period at a well.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate		Major

Air

Potential impacts are likely to be small and limited to the Project area and hence would be considered to be local, however winds may potentially carry emissions into surrounding communities, if wells selected for workover are nearby air sensitive receivers. The combination of a medium resource sensitivity and small impact magnitude will result in an overall moderate potential impact, and hence additional mitigation measures are recommended.

Table 5.20 Assessment of Impacts on Ambient Air Conditions (Well workover)

Impact	Air impact from workover drill rig and trucks				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Limited to the Project area and hence would be considered to be local, however winds may potentially carry emissions into surrounding communities.				
Frequency	Well workover period.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor	Moderate		Major

5.25.4 Additional Mitigation, Management and Monitoring

- Well-maintained equipment to be operated on-site.
- Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components.
- Shut down or throttled down between work periods for machines and construction plant items (eg trucks) that may be in intermittent use.

- Shut down generators, compressors, and other equipment when not in use.
- Reduce the number of equipment operating simultaneously as far as practicable.
- Orientate equipment known to emit noise strongly in one direction so that the noise is directed away from receptors as far as practicable.
- Implement control measures, eg noise barrier at site hoarding, movable barrier or barrier that installed on the equipment, whenever applicable. The type of control measure that can be applied will be determined based on site conditions and constraints.

5.25.5 Significance of Residual Impacts

Noise

Provided that mitigation measures are followed, the residual impact of workover activities on ambient noise levels at noise sensitive receivers is expected to be **Negligible**.

Air

Provided that mitigation measures are followed, the residual impact of workover activities on air quality at noise sensitive receivers is expected to be **Minor**.

5.26 IMPACTS FROM DISPOSAL OF WASTE FROM WORKOVER ACTIVITIES ON SURFACE WATER QUALITY, GROUND WATER QUALITY, SOIL, TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA

5.26.1 Source of Impact

Solid and liquid wastes will be generated from the well workover activities. This will include scale, mud cake, wax, debris and other foreign material cleared by scrappers from the wells. Drilling for deepening wells will generate cuttings and use drilling muds, which are typically the largest waste stream during the workovers. Well fluids which typically include weighted brines, acids, methanol and glycols and other chemical additives may also be produced that will require disposal. Drill muds used for the workover will be water based mud (WBM) and potassium chloride (KCl) polymer mud.

Improper disposal of waste has the potential to contaminate surface waters and ground water with hydrocarbons or muds giving rise to sub lethal or lethal effects to exposed aquatic organism or terrestrial fauna due to salinity, exposure to elevated suspended solid (SS) levels and sedimentation and toxicity effects.

5.26.2 *Existing/ In Place Controls*

Measures to control/ minimise adverse impacts of waste disposal from workover activities will include:

- MPRL E&P HSE policy requires a waste management plan to be developed for the Project.
- Drill muds used will be WBM and KCl polymer mud and will be recycled and treated for future use.

5.26.3 *Significance of Impacts*

On the assumption that proper treatment and disposal mechanism for waste will be implemented and waste will be treated or removed from site and responsibly disposed on-site away from sensitive areas or by approved waste contractor, the significance of waste disposal is ranked as **Minor**s.

Table 5.21 Impacts from Disposal of Waste from Workover Activities on Surface Water Quality, Ground Water Quality, Soil, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna

Impact	Impacts on Surface Water Quality, Ground Water Quality, Soil, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna.				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	Exact extent of indirect affects unknown but considered local				
Frequency	Continuous				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	

5.26.4 *Additional Mitigation, Management and Monitoring*

- A Waste Management Plan will be developed by MPRL E&P or a third party to be administered under the Environmental and Social Management Plan. The plan will identify and estimate generated volumes of different waste types and set out procedures for responsible management and disposal and will be regularly audited.
- Careful selection of the fluid system to minimize environmental hazards related to chemical additives
- Careful selection of fluid additives taking into account technical requirements, chemical additive concentration, toxicity, bioavailability and bioaccumulation potential.

- Monitoring and minimizing the concentration of heavy metal impurities (mainly mercury and cadmium) in barite stock used in the fluid formulation, if used.

5.27 POSITIVE IMPACTS FROM PUMP SERVICING ON AMBIENT NOISE CONDITIONS

5.27.1 Source of Impact

Pump servicing will be undertaken as part of the workover activities which will include pumping checking, replacement and cleaning in order to achieve for higher production levels. It is also expected that the serviced pump will be quieter and would thus need to improvement to ambient noise conditions.

5.27.2 Existing/ In Place Controls

There is no existing / in place controls for this potential positive impact from pump service.

5.27.3 Significance of Residual Impacts

Residual impact to ambient noise is expected to be **Positive** after pump servicing

5.28 POSITIVE IMPACT FROM IMPROVEMENT OF WELLHEADS ON SOIL, SURFACE WATER AND GROUNDWATER QUALITY

5.28.1 Source of Impact

With the wellhead improvement works, it is expected that the potential of oil leakage from the well sites would be reduced. Also, the installation of cemented cellars will also help to reduce the amount of oil leak to the surrounding. As such, positive impacts on soil, surface water and groundwater quality are expected.

5.28.2 Existing/ In Place Controls

There is no existing / in place controls for this potential positive impact from wellhead improvement.

5.28.3 Significance of Residual Impacts

Residual impact to the environment is expected to be **Positive** after wellhead improvement works.

5.29 IMPACTS FROM SPILLS/LEAKS ON SURFACE WATER QUALITY, GROUND WATER QUALITY, SOIL, TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA

5.29.1 *Source of Impact*

Sources of leaks associated with well work over will include accidental spillage in refuelling of workover rig generator. Drilling muds (WBM and KCl polymer WBM) will be stored and treated on site.

Risks associated with workover include loss of well control due to kicks with potential for large volume well fluid release volumes to occur at the surface (i.e. a blowout). Well fluids may be hydrocarbons but can also be formation (fresh or salty) water.

Uncontrolled spills and leaks of fuel, chemicals or other pollutants have the potential to contaminate surface water, ground water and soil. Exposure to aquatic communities or uptake of contaminants through plant roots close to works areas could occur and could lead to direct lethal/non-lethal effects on vegetation and aquatic organisms. .

5.29.2 *Existing/ In Place Controls*

Measures to control/ minimise adverse impacts of spills/leaks from workover activities

- Competent and well-trained workover crews.
- Well-planned, well-supervised and standard workover/drilling procedures will be used at the wells to maintain well control (eg management of mud weight).
- Implementation of maintenance and inspection procedures.

5.29.3 *Significance of Impacts*

Accidents or malpractice may lead to contamination of water and soil with associated impacts and is a significant environmental risk but one that can be managed and controlled. A major spill such as from loss of well control is considered unlikely but a small spill is considered likely over the life of the Project. The magnitude of impact is considered small for small spills and medium for larger spills. Resource sensitivity is considered medium. Impacts from spills are considered to be of **Minor** significance for small spills and **Moderate** significance for larger spills.

Table 5.22 ***Assessment of Impacts on Water, Soil, Habitats, Flora and Fauna (Accidental Spillage and Leaks)***

Impact	Impacts from spills/leaks on water, soil, habitats, flora and fauna.			
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Point source at workover well site. Impact on water and soil is considered local.			
Frequency	Throughout the workover period			
Likelihood	Unlikely for large spills, likely for small spills			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High	
Impact Significance	Negligible	Minor	Moderate	Major

5.29.4 Additional Mitigation, Management and Monitoring

- Develop an Emergency Preparedness and Spill Response Plan to document communication procedures and actions to take in the event of uncontrolled well fluid release.
- Carefully plan drilling operation by identifying shallow hazards, using standard materials for well construction/modification, using standard drilling and well control standard operating procedures, and using proper drilling mud formulation with additives if necessary (well kill fluids, loss control and weighting agents).
- Undertake drilling with international best practice safety procedures.
- Test safety devices prior to start-up for function and integrity.
- Continuously monitor pressure in the well and recycled mud during drilling.
- Train employees on emergency procedures.
- Spill kits and shovels at well sites or appropriate locations for any accidental leakage of fuel or other hazardous substances during Project activities; it must be ensured that no such substance enters into groundwater or surface water resources.
- If emergency servicing of equipment is required in the field, spill kits and drip trays will be available.
- Any contaminated soil will be removed from site and disposed of in accordance with the waste management plan.
- The location, type and quantity of any fuel or chemical or mud spill will be reported to HSE coordinator immediately.

- Develop water treatment and injection facilities, if practicable.
- Improve cellars with double cellars for new and reactivated wells.
- Regularly pump out cellars oil and water separators and treatment water for injection.

5.29.5 Significance of Residual Impacts

With measures to manage accidental spill and leaks associated with well workover activities, it is considered the residual risk can be reduced to **Minor**.

5.30 IMPACTS FROM FIRES AND EXPLOSIONS ON AIR QUALITY, GROUND WATER QUALITY, SURFACE WATER QUALITY, LANDSCAPE AND VISUAL CHARACTER, USE OF NATURAL RESOURCES, TERRESTRIAL HABITATS AND AQUATIC HABITATS AS WELL AS THEIR ASSOCIATED FLORA AND FAUNA

5.30.1 Source of Impact

Accidental events may result from a number of Project activities however those that result in fire (e.g. loss of well control and equipment malfunction) have the potential to cause localised detrimental impacts on modified habitat within the Project area. In addition, an increase in the number of people who smoke (ie workers) could increase the potential for ignition and uncontrolled fires in the Project Area.

5.30.2 Existing/ In Place Controls

Measures to control/ minimise adverse impacts of impacts from workover activities.

- MPRL E&P HSE policy commitments, including
    - Assign designated smoking areas;
    - Smoking is only allowed away from the well head of more than 100 feet, up wind, with appropriate ash trays to contain any hot ashes.

5.30.3 Significance of Impacts

Impacts from fire outbreaks have been evaluated to result in impacts of up to **Moderate** significance. This is mostly due to impacts to air quality at air sensitive receivers. However, the likelihood of such events occurring is considered unlikely, and as such, with the proper mitigation and control measures in place, the residual impacts can be reduced.

Table 5.23 ***Assessment of Impacts on Air, Visual Character, Water, Soil, Habitats, Flora and Fauna (Fire)***

Impact	Impacts from fire and explosions on air, water, soil, habitats, flora and fauna.				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Local scale .				
Frequency	Throughout the workover activities				
Likelihood	Unlikely				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor		Moderate	Major

5.30.4 Additional Mitigation, Management and Monitoring

- Fire control equipment should be located at the well site or appropriate locations.
- Induction training for personnel is recommended to include a mandatory segment on fire safety and actions in the event of a fire.
- It will be of key importance that explosives used for re-perforation activities are kept in a safe manner and no uncontrolled explosions occur. Implement all required safety and management requirements relating to the transportation, storage and handling of explosives
- Misfired charges from re-perforation activities will be disabled and destroyed.
- Restrict smoking to designated areas only.
- Conduct fire training and response drills.

5.30.5 Significance of Residual Impacts

With measures to manage fire risk, it is considered the residual risk can be reduced to **Minor**.

5.31 SOCIAL IMPACT ASSESSMENT AND MITIGATION

Sections 5.32-37 below provide an understanding of the social impacts from the seismic survey and the workover activities for the Project.

5.32 COMMUNITY AND OCCUPATIONAL HEALTH AND SAFETY

5.32.1 Source of Impact

This section provides an analysis of the potential impacts which may directly affect the health and safety of the community within the Project Area, according to the various phases of the Project life.

Preparation and Mobilisation

The construction of the workforce camp is likely to result in an influx of migrant workers in the area, which may place additional pressure on the existing infrastructure and services, especially the social services and healthcare. It is understood that during this phase, there will be requirement of 20 unskilled workers. The influx of migrant workers may also result in a change in the socio-cultural composition of the area, which in turn may result in conflict and unrest in the society. Furthermore, the sewage and waste discharge from the construction camp site may result in a negative impact on the health of the community and workers if not managed properly.

There is expected to be a minor increase in traffic within the local area for the duration of the Project as Project vehicles will be utilised to transport staff, equipment and waste within the local area. While only a slight increase in overall traffic volume is expected, there is the possibility that a vehicle-related collision or other such incident could occur which may constitute significant impact if a member of the local community or the workforce were to be injured.

Waste disposal, sewage and wastewater discharge from the Project may lead to potential contamination of soil, surface water and ground water if undertaken improperly. This may in-turn affect the health and safety of the community and workforce who may in contact with these media. Refer to *Section 5.9* and *Section 5.10* for environmental issues related to waste disposal and discharge of sewage and wastewater.

Seismic Surveying

There is expected to be a minor increase in traffic within the local area for the duration of the Project as Project vehicles will be utilized to transport staff, equipment and waste within the local area. While only a slight increase in overall traffic volume is expected, there is the possibility that a vehicle-related collision or other such incident could occur which may constitute significant impact if a member of the local community or workforce were to be injured.

During this stage of the Project, explosives will be transported and utilized. These explosives will be handled in accordance with the best-practice industry safe protocols, which makes an accidental discharge incident highly unlikely. However if such an incident were to occur then the potential impact to the health and safety of the workers and the local community could be significant as such an incident could result in serious injury.

When the drilling activities and laying and retrieving of cables and receivers is undertaken, there is a possibility of soil expulsion incidents, whereby soil from the shot holes may be ejected forcibly and rise several meters into the air. While mitigation measures will be in place for the same, in case of such an occurrence, it could potentially result in minor injury to anyone standing in close proximity to the discharge point.

Waste disposal from the Project may lead to potential contamination of soil, surface water and ground water if undertaken improperly. This may in-turn affect the health and safety of the community and workforce who may in contact with these media. Environmental issues related to waste disposal is discussed in *Section 5.17*.

Furthermore, the sewage and waste discharge from the construction camp may result in a negative impact on the health of the community and the workers if not managed properly. It is understood that the workforce camps are to include mobile camps and trailers, with an accommodation capacity of at least 4 people per container. Environmental issues related to discharge of sewage and wastewater is discussed in *Section 5.18*.

Close-out Phase

Following the completion of the survey activities, there will be a demobilization and transportation of the Project employees, equipment and the waste generated. This may result in a minor increase in traffic within the local area for the duration of the phase as Project vehicles will be utilized to transport staff, equipment and waste within the local area. While only a slight increase in overall traffic volume is expected, there is the possibility that a vehicle-related collision or other such incident could occur which may constitute significant impact if a member of the local community or the workforce were to be injured.

Waste disposal, sewage and wastewater discharge from the Project may lead to potential contamination of soil, surface water and ground water if undertaken improperly. This may in-turn affect the health and safety of the community and workforce who may in contact with these media. Refer to *Section 5.21* and *Section 5.22* for environmental issues related to waste disposal and discharge of sewage and wastewater.

Workover Activities

During the activities such as well deepening, pump servicing and swabbing and bailing, there is a possibility of accidental spillages of the drilling and waste fluids. Furthermore, the pump servicing may result in the generation of paraffin, which can result in a significant risk to the workers and community's health if not disposed properly.

5.32.2 *Existing/In Place Controls*

As part of the project design, the accepted industry best practices will be utilized to manage these concerns such as maintain a 100 m- radius buffer around the shot hole within which no pedestrians or traffic will be allowed. For controls related to waste disposal and sewage and wastewater discharges, these are discussed in *Sections 5.9, 5.10, 5.17, 5.18, 5.21* and *5.22.*

5.32.3 *Significance of Impacts*

In the absence of adequate mitigation measures, the impacts on community and occupational health and safety are likely to be **Major**.

Table 5.24 Assessment of Impacts on Community and Occupational Health and Safety

Impact	Community and Occupational Health and Safety				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Affect workforce and local community in project area				
Frequency	Intermittent.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor		Moderate	Major

Additional Mitigation, Management and Monitoring

In order to adequately mitigate the potential impacts on the health and safety of the workers and the community, the following mitigation measures will be put in place:

- Proper road safety measures must be adopted including proper signage with relators and paints.
- Timings of traffic movements must synchronise with local community needs and the villages falling in heavy traffic movements must be consulted and speed limits must be fixed.
- If there is any damage to the existing road must be repaired immediately for uninterrupted traffic movements and road blockage.
- There must be ensured availability of break services of heavy vehicles during constriction stage to avoid traffic jams.
- If there are any accidents, the affect family must be given compensation as per country regulations and MPRL E&P rules (in case it is better than the country regulations). Further root cause analysis must be undertaken with and proper records must be maintained, based on the recent surveys. Improper road signage, high speed, diving under the influence of

intoxicants such as alcohols, continuous diving without taking proper rest, talking on mobile while driving were identified as some of key factors responsible to accidents. Therefore MPRL E&P must make policy with respect to the same which be applicable to all the works including subcontractor and other supply chain such as labour and logistics.

- The labour camps/ mobile camps or trailers should be placed at a distance from the village settlements.
- All the workers should have pre-employment medical check-ups and establish that only healthy were employed at site.
- Regular heath check-ups and health survey of the community must be undertaken to keep record of the changes in the health status. If there are changes in disease pattern, required actions must be taken in collaboration with heath department.
- For additional controls related to waste disposal and sewage and wastewater discharges, these are discussed in *Sections 5.9, 5.10, 5.17, 5.18, 5.21* and *5.22.*

For the purpose of the implementation of these mitigation measures, a Traffic Management Plan will be developed for the Project and will be implemented by the HSE team for the Project.

5.32.4 Significance of Residual Impacts

Based on the assumption that MPRL E&P will be able to control and mitigate the impacts arising from its project activities, the impacts on the health and safety of the community and the workforce are likely to be M**inor**.

5.33 IMPACT ON LIVELIHOOD PROFILE OF THE COMMUNITY

5.33.1 Source of Impact

Preparation and Mobilisation

As part of this phase of the Project, the Project is likely to result in the generation of economic opportunities in the form of the labour requirement for the construction of the workforce camp and the site preparation and clearance and support staff during the seismic survey and close out phase. According to the information presently available, it is understood that during seismic survey activities, approximately 20 unskilled workers will be required, which are likely to be sourced from the Project Area and the surrounding areas.

In addition to this, this phase of the Project is also likely to result in the creation of indirect opportunities due to the influx of the migrant workers in the area through increase in business of local shops and markets, establishment of small shops, rent etc.

Seismic Surveying

During this phase of the Project, the generation of economic opportunities is likely to be restricted to the requirement of unskilled workers for activities such as the site preparation and maintenance and clearance. It is understood that the total worker requirement for this phase of the Project is likely to be 200, of which 160 are likely to be unskilled workers, to be recruited from the Project Area and its surrounding areas.

In addition to this, this phase of the Project will result in the creation of indirect opportunities due to the influx of the migrant workers in the area through increase in business of local shops and markets, establishment of small shops, rent etc.

Close-out Phase

This phase is likely to result in a negative impact on the livelihood profile of the community, due to a loss of the direct and indirect economic opportunities generated by the Project.

Workover Activities

The workover activities are likely to result in the generation of contractual employment and other employment opportunities for the local community. However, while the exact number of jobs or employment opportunities to be created is presently not known, it is expected to be comparable to that of the seismic survey, and is thus likely to play an important role in the livelihood profile of the local community.

5.33.2 Existing/In Place Controls

For the purpose of the unskilled workforce and the local subcontractors required, the local community will be given preference. Even in terms of the vehicle 30 % will be hired locally while the 70 % will be company or sub-contractors own vehicles.

5.33.3 Significance of Impacts

In the absence of adequate mitigation measures, the significance of the impacts on the livelihood profile of the local community is likely to be **Positive**.

Table 5.25 Assessment of Impacts on Livelihood Profile of the Community

Impact	Change in Livelihood Profile of the Community				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Generation of direct and indirect economic opportunities for the local community. The project is likely to require 200 unskilled workers in the planning and mobilization phase and approx. 160 unskilled workers in the seismic survey phase.				
Frequency	Through the life of the project				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor		Moderate	Major

Additional Mitigation, Management and Monitoring

So as to maximize the benefits in terms of economic opportunity generation, the following additional measures such as preference to the vulnerable groups according to the skill requirements of the Project is recommended.

Significance of Residual Impacts

The potential impacts from the project on the livelihood profile of the community are expected to be **Positive**.

5.34 IMPACT ON TRANSPORT AND INFRASTRUCTURE SERVICES

5.34.1 Source of Impact

Preparation and Mobilisation

The impacts on the transport and infrastructure services in this phase of the Project are likely to pertain to the impacts due to the construction of the workforce camp (though mobile trailers and renting houses in the local community will be preferred) and transportation of labour, equipment, materials and waste. During this phase there is expected to be a minor increase in traffic within the local area. This may result in vehicle-related collision or other such incident could occur which may constitute significant impact if a member of the local community or the workforce were to be injured.

Refer to *Section 5.9* and *Section 5.10* for management issues related to waste disposal and discharge of sewage and wastewater.

Seismic Surveying

During this phase of the Project, the main impacts on the transportation and infrastructure services is likely to be resultant from the movement of labour,

equipment and waste material. It is understood that the Project will be using existing access roads and will not be creating a new one. Refer to *Section 5.17* and *Section 5.18* for management issues related to waste disposal and discharge of sewage and wastewater.

Apart from this, there is a potential of vibrations to be generated from the seismic charges which may damage local infrastructure such as roads, bridges, pipelines or buildings. Furthermore, due to the blasting and drilling exercises, there is a potential of soil expulsion and external vibrations. This in turn may result in an interruption of road and river access as transport routes.

Close-out Phase

During this phase of the Project, the main impacts on the transportation and infrastructure services is likely to be resultant from the movement of labour, equipment and waste material. Management issues related to waste disposal and discharge of sewage and wastewater are discussed in *Section 5.21* and *Section 5.22*.

5.34.2 Existing/In Place Controls

Mitigation measures will be put in place to reduce the impacts from the survey activities on the infrastructure of the area, such as maintain a 100m-radius buffer around the shot hole within which no pedestrians or traffic will be allowed. This will be done in order to reduce the potential of external vibrations to interfere with the results of the geophone readings and the prevent injury from soil expulsion upon activation of the seismic charges. In some cases this may result in the temporary interruption of transport routes in the vicinity of the active shot holes, which could be temporarily closed for a period of approximately 20 minutes at a time. This is not expected to be a significant impact, as the interruptions will be temporary in nature. Also, advance notice will be provided to the local residents and any road closures will be undertaken in consultation with the local government authorities.

5.34.3 Significance of Impacts

The significance of the impacts on transportation and infrastructure services are likely to be **Negligible** to **Minor.**

Table 5.26 Assessment of Impacts on Infrastructure and Transportation Services

Impact	Impact on infrastructure and transportation services				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	Impact on infrastructure and transportation services due to drilling and blasting for the survey and the transportation of labour, equipment and waste.				
Frequency	Through the life of the project				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor		Moderate	Major

Additional Mitigation, Management and Monitoring

Since the significance of impacts is considered negligible to minor with exiting control measures, additional measures are not considered necessary. However, as industrial best practices for the minimisation of the potential impacts on the infrastructure and transportation services due to Project activities, the following mitigation measures are recommended to be implemented:

- Proper road safety measures must be adopted including proper signage with relators and paints.
- Timings of traffic movements must synchronise with local community needs and the villages falling in heavy traffic movements must be consulted and speed limits must be fixed.
- If there is any damage to the existing road due to operations, it must be repaired immediately for uninterrupted traffic movements and road blockage.
- There must be ensured availability of break services of heavy vehicles during constriction stage to avoid traffic jams.
- Maintaining minimum offset distances from the surrounding infrastructure are recommended.
- For additional controls related to waste disposal and sewage and wastewater discharges are discussed in *Sections 5.9*, *5.10*, *5.17*, *5.18*, *5.21* and *5.22*.

In addition to the above, it is recommended to follow the guidelines of offset distances for seismic charges are shown in *Table 5.27*. These guidelines take into account the mass of the seismic charges, and are a conservative estimate in that they have been developed with significant safety margins which make it highly unlikely that the areas will be potentially impacted, even considering

worst-case-scenario parameters. They have been developed based on MPRL E&P's extensive seismic survey experience.

Table 5.27 Recommended Offset Distances for Seismic Charges (Based on Mass of Charge)

Constraint	Minimum Horizontal Distance (m)		
Explosives in 21m deep single shot hole	**2.0kg**	**1.0kg**	**0.5kg**
Wooden house	50	40	35
Cement, brick or concrete building	80	60	50
Cement or concrete canals	100	85	75
Ponds and unlined canals	25	15	10
Commercial fish or shrimp ponds	150	120	100
Fish or shrimp hatcheries	150	100	100
Commercial chicken farms	200	150	120
Power transmission line	Site dependent – charges will be placed no closer (horizontal distance from directly below the line) than twice the length of the detonator cable (approx. 60m)		
Tube water wells and concrete ring wells	150	120	100
Concrete bridges	150	100	80
Earth or concrete dams	200	200	200
Rivers and other flowing waterways	5	5	5
Concrete or cement water towers	200	170	150
Place of worship	200	170	150
Religious monuments and archaeological sites	200	170	150
Cemeteries	50	50	50
Gas, oil or main water pipelines	100	70	50
Local radio transmitters	Depends on power and frequency – report to Project Manager		

Significance of Residual Impacts

Based on the assumption that MPRL E&P will be able to effectively implement the mitigation measures identified, the potential impacts on the infrastructure and transportation services are likely to be **Negligible**.

5.35 IMPACT DUE TO LOSS OF LAND AND CROP LOSS

5.35.1 Source of Impact

It is understood that the land requirement for the seismic survey is primarily comprised of the land required for the survey activities and the mobilisation of the equipment. The accommodation will be primarily in the mobile camps and rented accommodation in the nearby settlements. The transportation

will happen on the existing roads and no new land will be required for the construction of the access road.

The survey activities are to be undertaken within the block IOR -6. However, survey will also be conducted outside the identified blocks as controlled samples for proposed block. The area within the block consists of almost entirely cultivated land. It is understood that no land acquisition for the Project was undertaken as the land required for the survey in already occupied by MOGE.

Of the 61 households surveyed as part of the impact assessment process, 19 reported to have lost land for the purpose of the Project. Of these 19 households, seven (7) households reported to have received compensation, and five (5) reported to having access to alternate pieces of land for cultivation. It is likely that the previous compensation was paid by either the government (MOGE) or the previous contractors used as MPRL E&P has not yet started the operation. It is also understood that the land acquisition for the land of the Project was undertaken by the government and MPRL E&P was not involved in the negotiations or compensation payment process.

5.35.2 Existing/In Place Controls

According to the information made available, the previous crop compensation was paid by either the government (MOGE) or the previous contractors used at the time. However, the exact details of the amount of agricultural land impacted, the amount of crop compensation paid and by whom are presently unavailable.

It is not clear if the land will be returned or not to the land losers, in case the seismic survey results are not encouraging. Or whether there will be another round of compensation (if any), in case the seismic survey results are encouraging.

5.35.3 Significance of Impacts

The significance of the impacts of land loss and crop loss is due to the Project is as **Major**.

Table 5.28 Assessment of Impacts owing to Land Loss and Crop Loss

Impact	Loss of Land and crop loss				
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	The local community in the 7 villages in the project area				
Frequency	In the land accessibility phase				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	

5.35.4 Additional Mitigation, Management and Monitoring

For the purpose of minimizing the impacts from the land loss, the following mitigation measures are recommended.

- Compensation for the crop loss should be provided and livelihood restoration facilities should be provided, however, this has to be done keeping cognisance of the local laws and regulations.

- In case of landlessness due to project, preference should be given for employment in various works depending upon the skill levels. Livelihood restoration options or support could be considered for these families.

- In case of any new land requirement, the compensation amount and any livelihood restoration options should be identified in consultation with the local community and the local authorities.

- Preference should be provided to the land owners for employment and sub-contractor works, in keeping with the skill requirement of the Project.

- Preference in community development and corporate responsibility activities.

Owing to a certain lack of clarity on the possible losses suffered by the land losers for the Project, it is imperative that before land access to any area, an inventorisation of the losses including assets, crops, trees etc and other details relating to the productivity of the land, land type, irrigation status, cropping pattern of land etc, should be completed. Also livelihood dependence of the family, ownership or tenure records pertaining to land should be collected. Further, alternate land or extra land available with the family should be documented. The asset inventorisation, documentation of the losses and livelihood dependence will help arrive at options for compensation and livelihood restoration options to ensure that the affected family condition is either equal to the previous status or better after the Project.

Owing to the role of the government in the procurement of the land, it is desirable to agree for the livelihood restoration options (preferably in kind keeping the local situation in context) in terms of framework which could be suitably rolled out for various categories of losses. A Livelihood Restoration Plan (LRP) for the Project should be developed keeping the above in context. The LRP based on the assessment of various livelihood restoration options available and preferred by the community and reflective of the needs of the community should be rolled out keeping the government in confidence. The LRP should also have clear reporting and monitoring indicators and the implementation mechanism including the institutional mechanism for the implementation of the same.

Significance of Residual Impacts

The potential impacts from the land loss for the project are likely to be **Moderate**.

5.36 IMPACTS ON SOURCE WATER VULNERABILITY

5.36.1 *Source of Impact*

It is understood that the water for the Project activities across the various phases and for the workforce camp will be sourced from the local water sources. The water sources identified within the block will be shared between the community and the Project. It is understood that the increased demand for water may have negative impacts during the life of the Project, which may result in a water shortage in the area for the local community. Also, wastes disposal and waste water discharges from the Project may lead to contamination of surface water and groundwater that are used by the community. The details of the competing water demand for the Project and the pressure that exert on the source water accessibility for the community is presently unavailable to be able to comment exactly on the magnitude of impact.

5.36.2 *Existing/In Place Controls*

As part of the Project design, the requirements for acceptable water quality standards and waste water discharge standards will be maintained. For controls related to waste disposal and sewage and waste water discharges, please refer to *Sections 5.9, 5.10, 5.17, 5.18, 5.21, 5.22* and *5.26.*

5.36.3 *Significance of Impacts*

The significance of the impacts due to water vulnerability in the Project is considered to be **Minor**.

Table 5.29 Assessment of Impacts due to Source Water Vulnerability

Impact	Source Water Vulnerability				
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional	International		
Impact Scale	local community in the project area				
Frequency	Through the life of the project				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low	Medium	High		
Impact Significance	Negligible	Minor	Moderate	Major	

5.36.4 Additional Mitigation, Management and Monitoring

For the purpose of minimizing the impacts on the source water due to the water requirement for the Project, the following additional controls are identified:

- For additional controls related to waste disposal and sewage and waste water discharges, please refer to *Sections 5.9, 5.10, 5.17, 5.18, 5.21, 5.22* and *5.26.*

- The local community will be engaged and a water use agreement will be formulated, which would minimize the pressure on the source water and ensure adequate water availability for the community.

5.36.5 Significance of Residual Impacts

The potential impacts on the source water for the project are likely to be **Minor**.

5.37 IMPACTS ON CULTURAL HERITAGE

5.37.1 Source of Impact

The planned activities including construction of workforce camp, site preparation / clearance and access routes creation, drilling and detonation of explosives may lead to direct physical impacts to the cultural heritage resources which may exist in the area. These resources may also be impacted by accidental events such as fire and explosions.

5.37.2 Existing/ In Place Controls

As part of the Project design, Project facilities / activities will be located away from sensitive cultural heritage resources. For instance, no known monuments, historic buildings and living heritage sites such as cemeteries are located within the proposed workforce camp.

5.37.3 Significance of Impacts

The significance of the impacts on the cultural heritage is considered to be **Minor** or **Moderate.**

Table 5.30 Assessment of Impacts on Cultural Heritage

Impact	Impact on Cultural Heritage				
Impact Type	Direct		Indirect		Induced
Impact Duration	Temporary	Short-term		Long-term	Permanent
Impact Extent	Local		Regional		International
Impact Scale	The local community in the 6 villages in the project area and the region				
Frequency	The entire life of the project				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
Resource Sensitivity	Low		Medium		High
Impact Significance	Negligible	Minor		Moderate	Major

5.37.4 Additional Mitigation, Management and Monitoring

For the purpose of minimizing the impacts on the cultural heritage in the area, the following mitigation measures are recommended.

- The Project will meet the international best practice for the documentation and protection of the cultural heritage and in case of chance finds.
- The Project will consider retaining professionals to assist in the identification and protection of cultural heritage.
- In case the removal of nonreplicable cultural heritage is required, the same will be undertaken in consultation with the affected communities and in keeping with the regulatory requirements for the same.
- The Project will ensure that the access to cultural heritage by the local community is not disrupted, and if required, alternative access routes will be provided.
- A proper protocol or Standard Operating Procedures (SOP) may be developed and people at Project Area location trained to act suitably in consonance with the regulatory requirement and beliefs and faith of the community, if any.

5.37.5 Significance of Residual Impacts

The potential impacts on cultural heritage for the project are likely to be **Minor.**

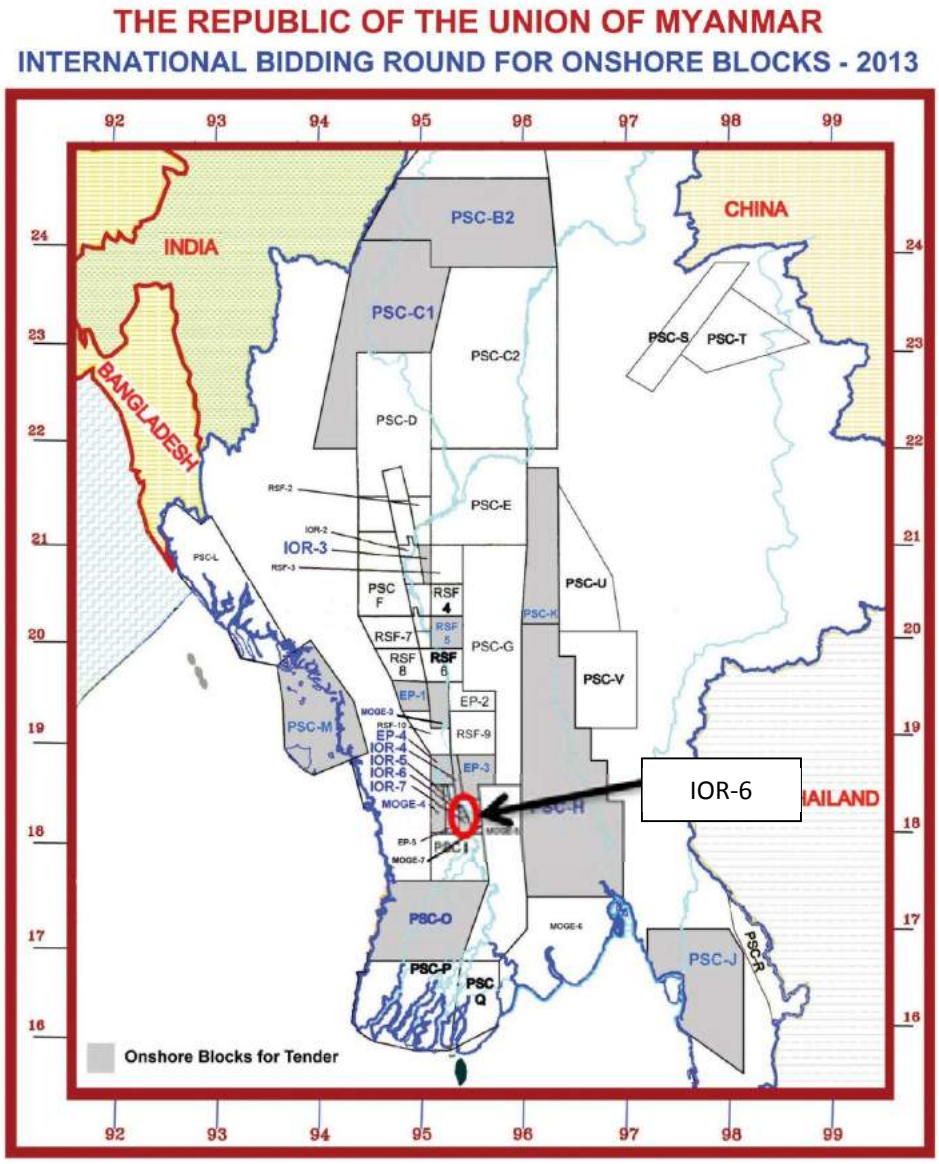
Cumulative impacts encompasses impacts that result from the incremental impact, on areas or resources used or directly impacted by the project, from other existing, planned or reasonably defined developments at the time the risks and impacts identification process is conducted. The IFC (2012) defines cumulative impacts as those generally recognised as important on the basis of scientific concerns and or concerns from Affected Communities [1]. Examples given include reduction of water flows in a watershed due to multiple withdrawals, increases in sediment load, increases in traffic congestion and accidents due to increases in vehicular traffic.

Cumulative impacts summarised in this section refer to the additional impacts that may be generated by other developments or activities in the vicinity of the Project Area that when added to the impacts of the proposed seismic survey and workover activities combine to cause a greater impact. Such impacts may arise due to spatial overlap in an impact (eg overlap in spatial extent of air or water quality changes) or temporal overlap (eg noise impacts caused by construction activities at the same time from different sources).

As indicated in *Figure 6.1*, Block IOR-6 is surrounded by other onshore blocks including Block IOR-4 and Block IOR-7. It is understood that seismic surveys may be carried out concurrently at these blocks and their seismic survey areas may overlapped slightly with that of Block IOR-6 at the boundary between the blocks. However, as assessed in *Section 5*, it is expected that the environmental and social impacts from seismic surveys and workover activities, if properly mitigated, will be localised within the onshore blocks and restricted to environment / communities within them. As such, it is not expected that seismic surveys at adjacent blocks, if undertaken concurrently, will lead to cumulative impacts to the physical, biological or human environment within Block IOR-6.

(1) IFC Performance Standards on Environmental and Social Sustainability, January 2012, International Finance Corporation, World Bank Group

Figure 6.1 Locations of Onshore Blocks, Myanmar



7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

This document provides the Environmental and Social Management Plan (ESMP) for the planning, construction and operation of the Project which is further described in *Section 7.1* below. This ESMP provides the procedures and processes which will be applied to the Project activities to check and monitor compliance and effectiveness of the mitigation measures to which MPRL E&P Pte Ltd (MPRL E&P) has committed. In addition, this ESMP is used to ensure compliance with statutory requirements and corporate safety and environmental policies.

The remainder of this ESMP is structured as follows:

- *Section 7.1* presents the Project description based on which the environmental and social impacts have been assessed with mitigation and monitoring measures derived.
- *Section 7.2* defines the environmental and social policies of the Project as well as the related legal requirements and institutional arrangements.
- *Section 7.3* presents a summary of environmental and social impacts associated with the Project, the recommended mitigation measures and the key elements related to the implementation of these measures as well as the overall HSE system of the Project.
- *Section 7.4* presents other detailed management and monitoring plans which are related to this ESMP.
- *Section 7.5* presents the emergency response plan for the Project.

7.1 PROJECT DESCRIPTION

MPRL E&P was awarded the Exploration Block IOR-6 (a.k.a. Myanaung) in October 2014 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 2-Dimensional (2D) and 3-Dimensional (3D) surveys, across Block IOR-6. MPRL E&P is also planning to undertake workover activities at selected existing wells within the Block ("the Project").

7.1.1 *Project Description of Seismic Survey*

Proposed Location

Block IOR-6 is located in the Hinthada District of the Ayeyarwady Division of Myanmar. It is on the western bank of the Ayeyarwady River, about 60 km south of Pyay City of the Bago Region and 271 km north northwest of Yangon. The block covers an area of 116.55 km^2, including the Myanaung field, and consists almost entirely of cultivated land. The Block location is presented in

Figure 7.1 with coordinates detailed in *Table 7.1.* The proposed 3D seismic area, which covers an area of 110 km^2, is illustrated in *Figure 7.2*.

Table 7.1 Block IOR-6 Coordinates

Point	Latitude	Longitude
A	18° 17' 0'	95° 18' 0'
B	18° 17' 0'	95° 20' 0'
C	18° 10' 0'	95° 23' 45'
D	18° 10' 0'	95° 18' 0'

Programme of the Proposed Seismic Survey

Seismic surveys can typically be divided into the following phases:

- Land accessibility phase;
- Preparation / mobilisation phase;
- Seismic survey phase; and
- Close-out phase.

The programme of the proposed seismic survey is presented in *Figure 7.3*. While no land accessibility phase is expected as presented in *Section 3.2.4* below, it is expected that activities associated with the seismic survey will commence in the 1st quarter of 2016 for the preparation / mobilisation phase and be completed in the 2nd quarter of 2016 for the close-out phase.

Land Accessibility Phase

During the land accessibility phase, ownership of land and properties that fall within the seismic lines will be determined. Appropriate engagement and procedures to obtain permission and notify owners to access land to conduct the survey will be performed. However, it is understood that no land acquisition is planned as all sites required by MPRL E&P will be in areas already occupied by MOGE.

Preparation / Mobilisation Phase

Preparation and mobilisation generally involves the construction of associated facilities and determination and development of access tracks for equipment, resources and workforce.

According to the preliminary programme, the camp set up will be undertaken in the first quarter of 2016 for the proposed seismic survey in Block IOR-6. However, information on the location, layout and facilities at the camp is not available during the preparation of this report.

Materials to be used for the site preparation and road construction (i.e. gravel, shale, sand, cement, wood etc.) are likely to be sourced via local suppliers from the Myanaung Township.

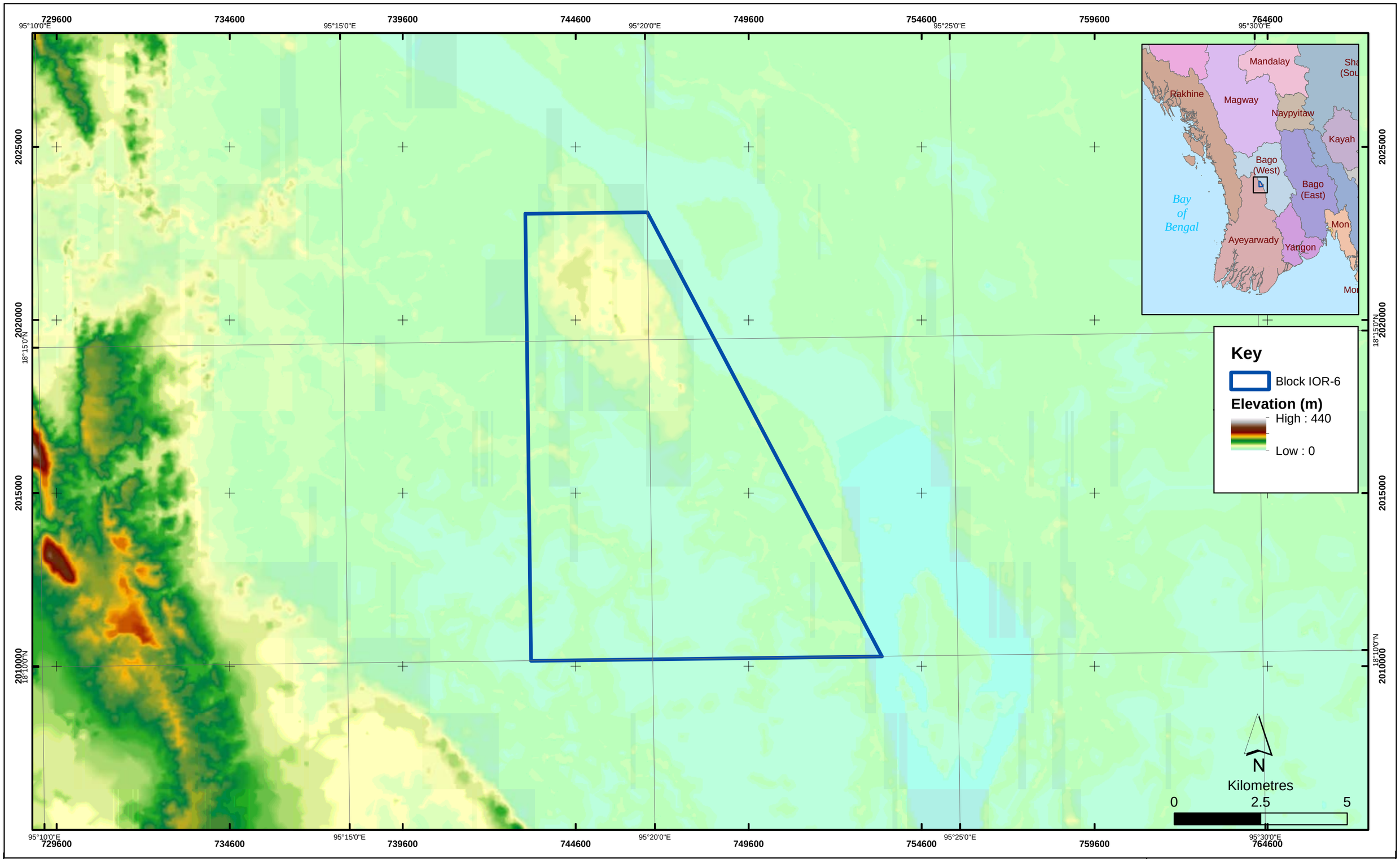


Figure 7.1

Block IOR-6

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Date: 24/3/2015

Environmental Resources Management

ERM

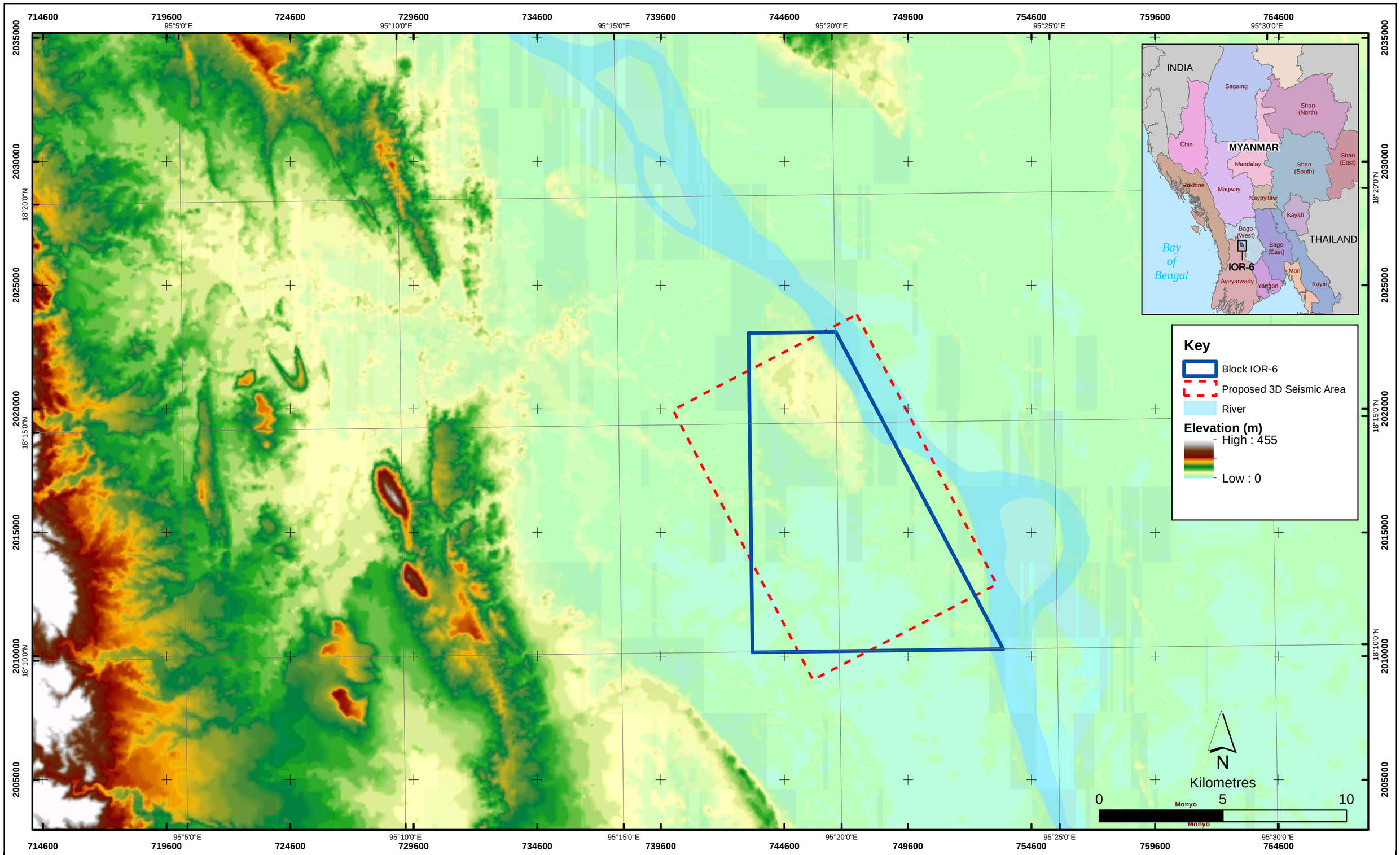

Figure 7.2

Indicative Proposed Seismic Survey Area of Block IOR-6

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Date: 24/3/2015

Environmental Resources Management

ERM

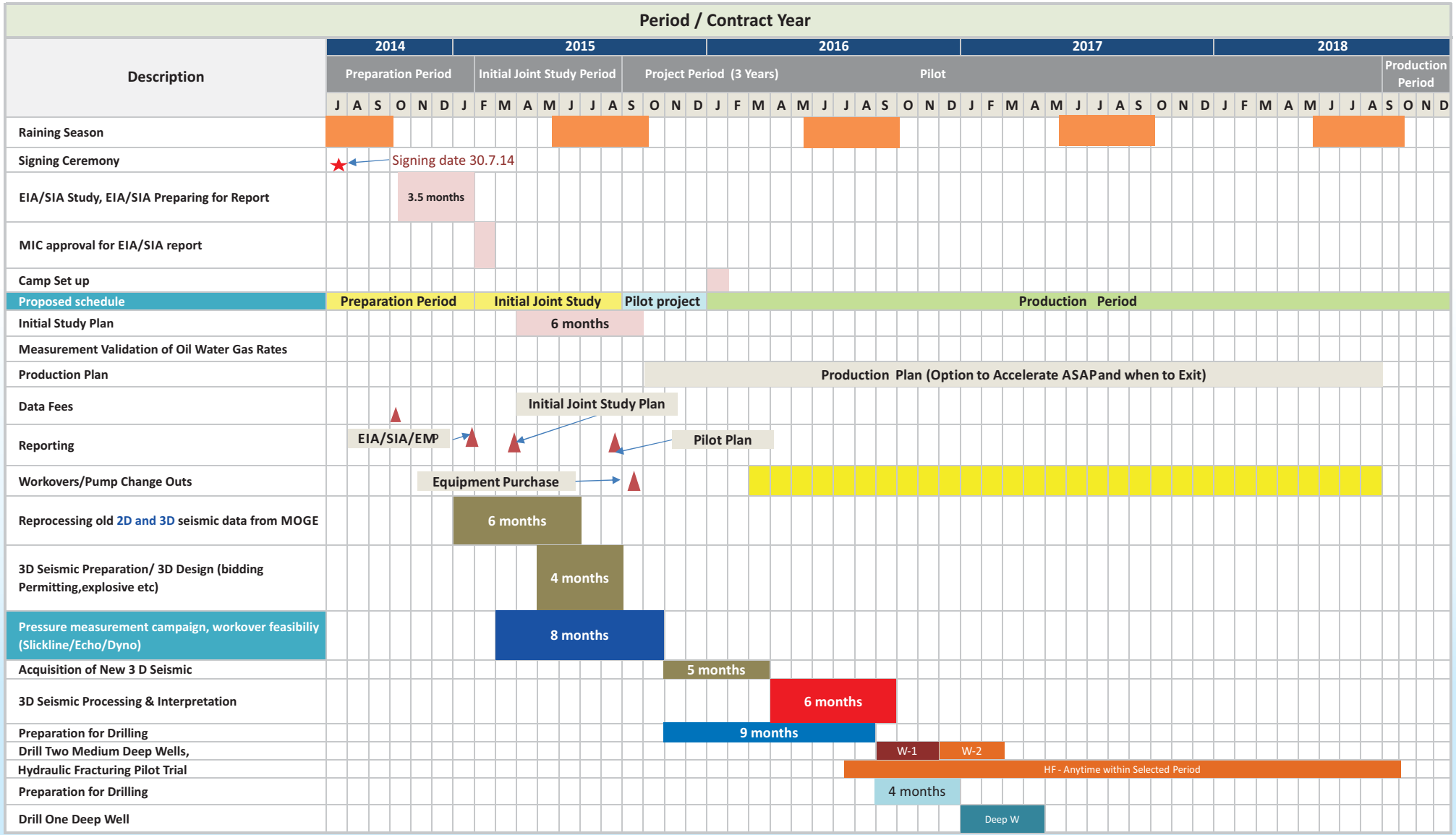

Figure 7.3

Overall Work Programme for Block IOR 6

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Environmental Resources Management

ERM

Seismic Survey Phase

The seismic survey is planned to be undertaken in the fourth quarter of 2015 for a period of about 150 days. It may cover up to the whole block, acquiring a total of 110 km² (fullfold) 3D seismic survey lines in approximately 11 km (North-South) x 10 (East-West) km grid as shown in *Figure 7.2*.

During the seismic survey phase, vegetation clearance and creation of access routes will be an on-going activity for placement of seismic sources and sensors. Existing access road / tracks will be used as far as possible. In case new road / track is needed, they will be designed and constructed with appropriate drainage facilities to avoid soil erosion.

Seismic and Acoustic Sources

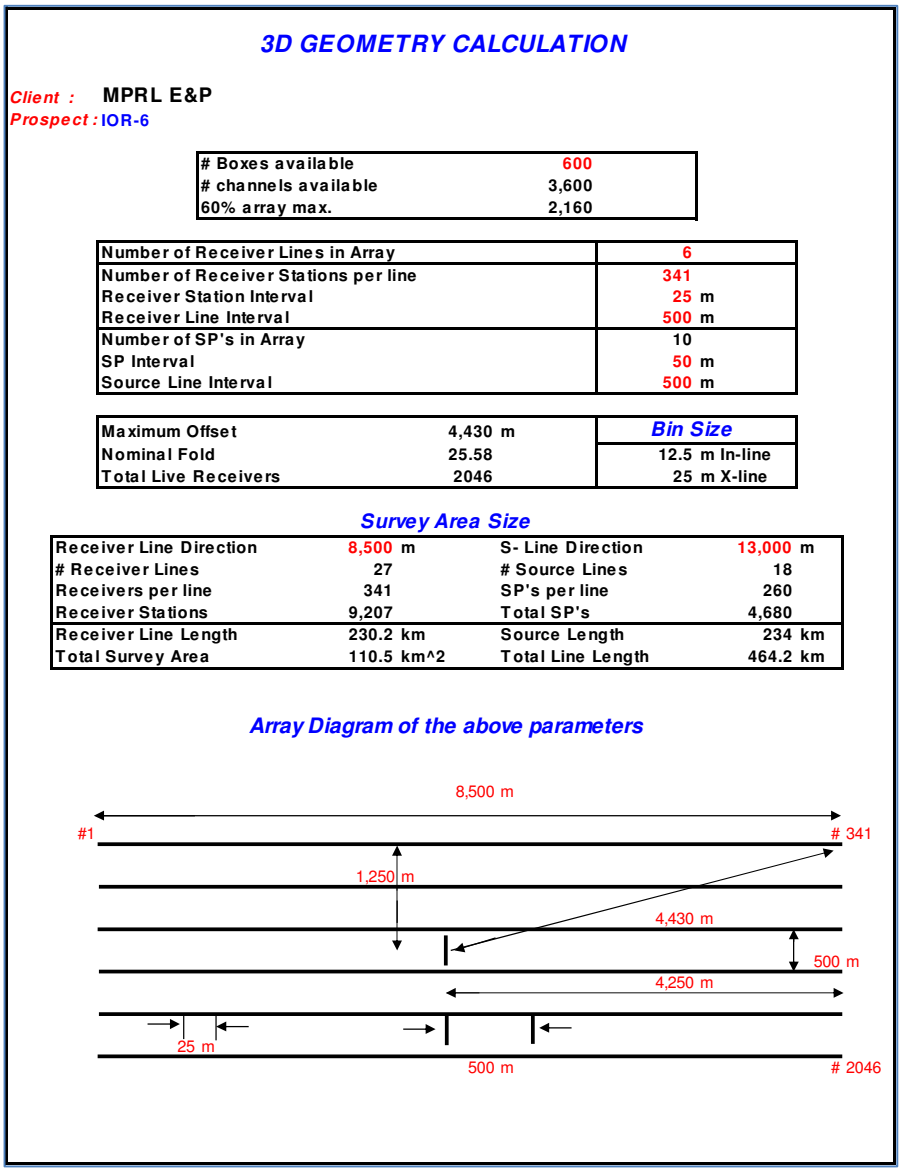
Explosive seismic charge will be used as the acoustic source of the survey. The charge will be set off just below the ground surface to generate sound waves which are bounced off underground rock formations and the waves that reflected back to the surface are captured by recording sensors for later analysis. Generally, drilling will be undertaken for the placement of dynamite inside the shot holes along the seismic lines. Shot holes, typically 9-10 m deep and 6-10 cm in diameter, will be drilled using surface water with man portable drills or vehicular mounted drills depending on the type of access available within the seismic area.

Layout parameters of the proposed seismic survey for Block IOR-6 are presented in *Figure 7.4*. For the current survey, there will be a total of 18 source lines within the seismic survey area, each of which measures 13 km in length. The total length of the source lines will thus be 234 km. The distance between adjacent source lines will be 500 m. There will be a total of 4,680 shot points (SPs) on the source lines, with 260 SPs on each of the 18 sources lines. The interval between adjacent SPs will be 50 m.

Seismic Sensors and Processing

To acquire the data generated by the acoustic source, it is preferred to use wireless geophone but conventional cable systems may also be used for the proposed seismic survey depending on the surface area restriction. The Geophone will be placed at a total of 9,207 receiver stations for the current seismic survey. These receiver stations will be distributed along 27 receiver lines, with 341 stations on each line. The distance between adjacent receiver stations will be 25 m. Each receiver line will be ~8.5 km long and the separation distance will be 500 m between adjacent lines. The total length of the receiver lines is 230.2 km. Layout parameters of the proposed seismic survey for Block IOR-6 are presented in *Figure 7.4*.

Figure 7.4 Layout Parameters of the Seismic Surveys for Block IOR-6



Labour and Accommodation Requirements

The Project will involve a total of 20 people initially and up to a maximum of 200 people during the seismic surveys. The ratio of skilled to unskilled labour is expected to be 1:5 to 1:10, and will be higher when seismic crew is in place. Labour is planning to be hired from local townships for routine work. The seismic crew will be housed in the camp. Water supply will be from existing river water while power supply will be from 11 kva power line.

Camp doctor will be available to handle minor injuries / incidents. Serious incidents and injuries will be handled at Myanaung Hospital.

Materials, Supplies & Logistics

Materials to be used for the site preparation and road construction (i.e. gravel, shale, sand, cement, wood etc.) are likely to be sourced via local suppliers from the Myanaung Township.

It is expected that high speed diesel of ~250-300 gallons per day will be used during the seismic survey. The fuel will be stored temporarily at MOGE storage area or in a new fuel station to be built for the Project. Fuel may also be obtained from local townships.

For munitions bunkers, they will be in existing military barracks or a new one will be built within the military compound.

For transportation, existing roads will be used where possible in addition to temporary to semi-permanent roads paved by laterite/gravel. New roads may be built and it is expected that these roads will have appropriate drainage. Transportation of labour will mainly use trucks, buses or cars. The existing Yangon Airport will be used to supply the Project.

Close-Out Phase

During the close-out phase, the demand for labour, equipment and services will decrease and eventually cease when the seismic survey is completed. Transportation of equipment, materials, waste and workforce out of the survey area will take place during the close-out phase. A traffic management plan will be developed to minimise the impact associated with road traffic.

7.1.2 Project Description of Workover Activities

Workovers Location

Workover activities will be undertaken at existing wells within Block IOR-6. These include producing, temporarily suspended, abandoned or water injection / disposal wells. The locations of all 171 wells within Block IOR-6 are shown in *Figure 7.5.*

Workovers Activities and Programme

The following workovers activities will be undertaken for the selected wells within Block IOR-6:

- Well Deepening;
- Pump servicing;
- Swabbing and bailing;
- Zone isolation;
- Re-perforations; and,
- Improvement of wellheads

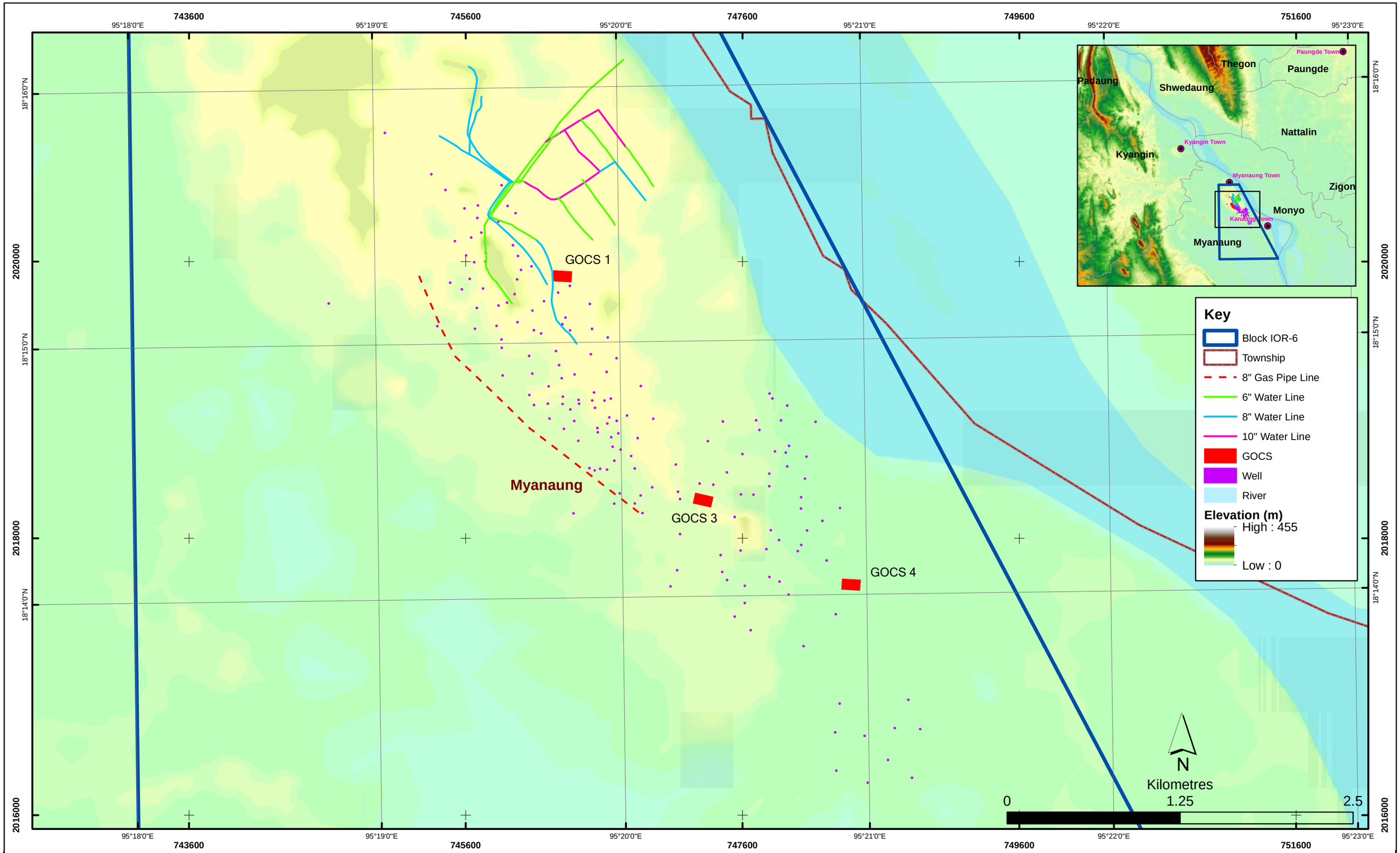


Figure 7.5

Locations of Wells and GOCS within Block IOR-6

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Date: 24/3/2015

Environmental Resources Management

ERM

The above activities are scheduled to be undertaken from October 2015 to October 2018. Brief descriptions of the above activities are provided in the following sections.

Deepening

The primary objective of well deepening is to explore opportunity of producing additional oil at deeper depth from the existing wells. The following procedures will generally be adopted for well deepening:

1. Pressure test to all squeezed zones until the test results sound.

2. Drill cement collar and deepen the well to a certain depth below shoe with water based mud (WMB) and then KCL polymer mud. WBM will be recycled as far as possible for the deepening of another well.

3. After reaching objective depth, wireline logging will be conducted and subsequently slotted liner will be set for production testing.

Typical environmental issues related to well deepening include the use, disposal and potential accidental spillage of drilling and waste fluids from the deepening operations.

Pump Servicing

Pump servicing should be conducted when the fluid level is high and the production is not satisfactory. The servicing will be undertaken by well serving truck and will include pumping checking, replacement and cleaning in order to achieve for higher production levels. It is also expected that the serviced pump will be quieter. However, pump servicing may lead to the generation of paraffin from the well which will require to be disposed of properly.

Swabbing and Bailing

If the fluid level is found low and the well is producing less or not producing oil, swabbing and bailing will be considered to be undertaken to enhance oil production. Well servicing truck will be used for the swabbing and bailing operations.

Swabbing creates a path for the oil to travel into a production zone. It can clean the perforations and induce the formation fluid come into the hole. The swabbing tool assembly comprises a swab mandrel with a swab cup that extends off the mandrel. The swab mandrel is a steel rod that allow for a quick, easy movement of the swab cup out of the hole. This creates the vacuum that brings the well into production. Before swabbing, scraper will be used to remove scale, mud cake, cement sheath, embedded bullets and other foreign material from the inside of the casing wall to avoid blockage of the swab cup.

For bailing, bailer will be used to remove formation sand/rock and other such debris left over from the well in order to improve production.

Potential hazard associated with swabbing and bailing include the loss of well control during the operations.

Zone Isolation

Zone isolation will be undertaken for selected wells using production packers, service packers and bridge plug. Production packers are those that remain in the well during well production while service packers are used temporarily during well service activities such as cement squeezing, acidizing, fracturing and well testing. In wells with multiple reservoir zones, packers are used to isolate the perforations for each zone and isolate or temporarily abandon producing zones.

Re-perforations

Re-perforations is undertaken for better control of the well. Re-perforation creates a channel between the pay zone and the wellbore, causing oil and gas to flow to the wellbore easily. Before re-perforations are conducted, scrapping, bailing, and if necessary drilling, will be undertaken first to remove debris at the desired depth. During re-perforations, casing guns and charges will be used at the desired depth to create the perforations.

Waste Generation from Workover Activities

The type and amount of wastes that may be generated from the workover activities are presented in *Table 7.2* below. A proper Waste Management Plan will be designed and implemented for Block IOR-6 to describe the appropriate means of managing the waste streams in order to avoid impacts to the environmental and social sensitive receptors.

Improvement of Wellheads

Existing well heads will be improved via the following activities:

- The dug earth holes around the wellheads will be replaced by new cemented cellars in which leakage of oil to soil would be reduced;
- Tie backs to surface to provide additional pressure integrity;
- Checking tubing/casing strings for leaks and cementing as required to isolate oil leakage from the existing well;
- Fixing wellhead leaks; and
- General housekeeping around the well heads.

It is expected that the above activities would be beneficial to the environmental by reducing the potential of leakage as well as improving the general environment around the wellheads.

Table 7.2 Expected Waste Inventory for Workover Activities

Waste Type	Source	Amount
Food Waste	Camp	20 L / day
Paper Waste (dry waste)	Camp	120 Kg / week
General Waste (leave , grass)	Workshop & GOCSs	150 Kg / week
Used Lubricating Oil	Vehicle	1 bbl / month
Rags	Petroleum equipment cleaning	1 bbl / for one processing
Oil and Grease Contaminated Waste	GOCS	1 bbl / month
Oily Waste water	Drainage from locations of steaming & cleaning of petroleum equipment	3 bbl / one processing.
Black Water	Camp (toilet)	n.a.
Grey Water	Camp (kitchen, toilet)	n.a.
Workover Fluids which may contain weighted brines, acids, methanol and glycols, and other chemical systems.	Workover wells	n.a.
Drilling Mud (3.5 % KCl)	Well deepening	300 bbl / every well deepening
Sludge (formation sand/clay)	GOCS	10 m^3 / month

7.2 PROJECT ENVIRONMENTAL AND SOCIAL POLICY AND INSTITUTIONAL ARRANGEMENT

This section sets out the environmental and social policies which are relevant to the Project as well as the institutional arrangement.

7.2.1 Corporate Environmental and Social Policy

MPRL E&P has adopted a comprehensive HSE Management System. This system is an important and integral part of the company's overall management system and is shown in *Figure 7.6* below. The Project will be required to follow the fundamental goals of:

- Zero accidents;
- No harm to people; and
- No damage to environment.

Figure 7.6 MPRL E&P's HSE Policy

MPRL E&P

MPRL E&P HSE Policy

MPRL E&P is committed to continuous improvement in Health, Safety and Environmental performance, consistent with our fundamental goals of:

- Zero accidents,
- No harm to people,
- No damage to the environment.

MPRL E&P adheres to and strives to meet the following principles throughout its operations:

- All accidents are preventable.
- No activity is so important that it cannot be done safely.
- Minimize the environmental impact our activities may cause.
- Meet or exceed the requirements of applicable HSE legislation, regulations and Company HSE expectations.
- HSE performance depends on all employees and Contractor personnel working with MPRL E&P. Everyone is responsible for working safely.
- Continually strive to reduce the impact of our business on health, safety and the environment by applying safe work practices, reducing waste, and using energy efficiently.
- Eliminate injuries by rectifying and reporting all actions and conditions, which could result in an accident / incident.
- Conduct appropriate training to ensure all our personnel are competent in their respective jobs and understand and adhere to this policy.
- Ensure business plans and personal objectives include measurable HSE targets, which are established annually and reviewed regularly.

Responsibilities for HSE performance are visible throughout the organization, with clarity for line management accountability. The MPRL E&P Health, Safety and Environment Management System, is fundamental to our business and is applicable to all areas of our operations.

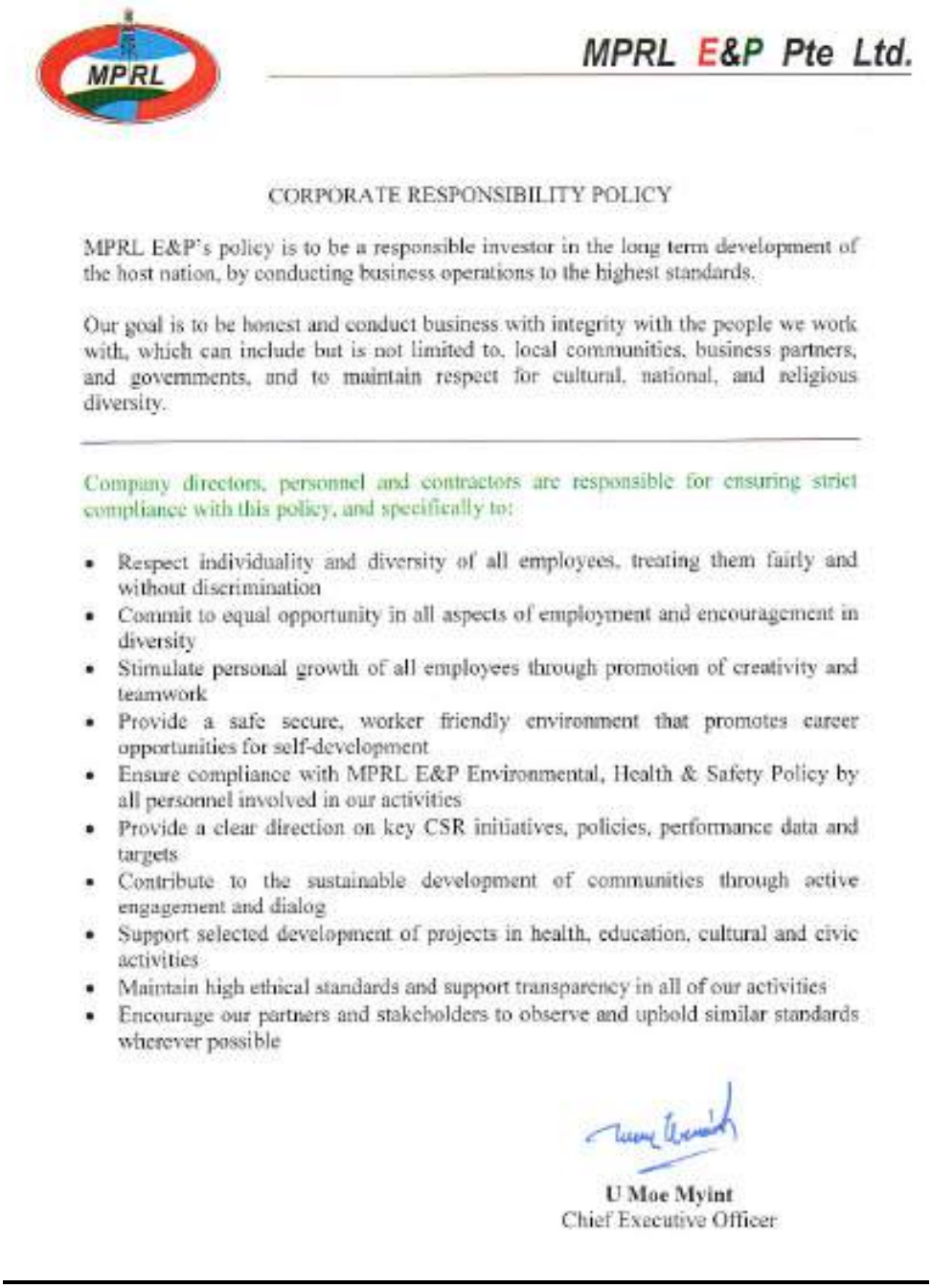
MPRL E&P Senior Management is accountable for implementation of this policy. Implementation is achieved by adhering to our management systems, and where appropriate the management systems used by those who work with us.

U Myo Tin
General Manager
MPRL E&P Pte Ltd.

Date of revision : 13-May-2013

Apart from the HSE policy, MPRL E&P also has in place a corporate responsibility policy and a human rights policy, as can be seen in the following figures

Figure 7.7 MPRL E&P Corporate Responsibility Policy



MPRL E&P Pte Ltd.

CORPORATE RESPONSIBILITY POLICY

MPRL E&P's policy is to be a responsible investor in the long term development of the host nation, by conducting business operations to the highest standards.

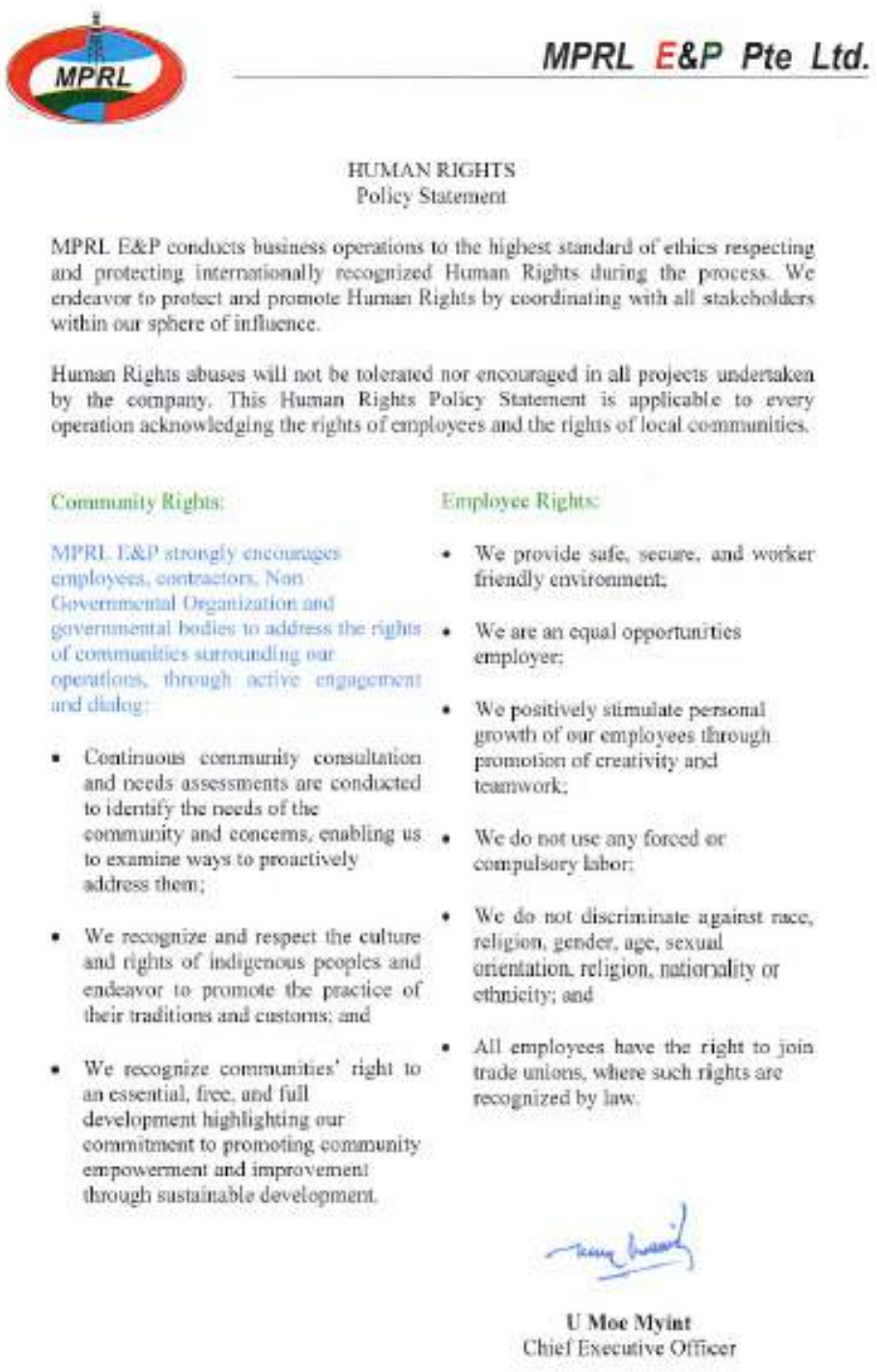
Our goal is to be honest and conduct business with integrity with the people we work with, which can include but is not limited to, local communities, business partners, and governments, and to maintain respect for cultural, national, and religious diversity.

Company directors, personnel and contractors are responsible for ensuring strict compliance with this policy, and specifically to:

- Respect individuality and diversity of all employees, treating them fairly and without discrimination
- Commit to equal opportunity in all aspects of employment and encouragement in diversity
- Stimulate personal growth of all employees through promotion of creativity and teamwork
- Provide a safe secure, worker friendly environment that promotes career opportunities for self-development
- Ensure compliance with MPRL E&P Environmental, Health & Safety Policy by all personnel involved in our activities
- Provide a clear direction on key CSR initiatives, policies, performance data and targets
- Contribute to the sustainable development of communities through active engagement and dialog
- Support selected development of projects in health, education, cultural and civic activities
- Maintain high ethical standards and support transparency in all of our activities
- Encourage our partners and stakeholders to observe and uphold similar standards wherever possible

U Moe Myint
Chief Executive Officer

Figure 7.8 MPRL E&P Human Rights Policy



MPRL E&P Pte Ltd.

HUMAN RIGHTS
Policy Statement

MPRL E&P conducts business operations to the highest standard of ethics respecting and protecting internationally recognized Human Rights during the process. We endeavor to protect and promote Human Rights by coordinating with all stakeholders within our sphere of influence.

Human Rights abuses will not be tolerated nor encouraged in all projects undertaken by the company. This Human Rights Policy Statement is applicable to every operation acknowledging the rights of employees and the rights of local communities.

Community Rights:

MPRL E&P strongly encourages employees, contractors, Non Governmental Organization and governmental bodies to address the rights of communities surrounding our operations, through active engagement and dialog:

- Continuous community consultation and needs assessments are conducted to identify the needs of the community and concerns, enabling us to examine ways to proactively address them;
- We recognize and respect the culture and rights of indigenous peoples and endeavor to promote the practice of their traditions and customs; and
- We recognize communities' right to an essential, free, and full development highlighting our commitment to promoting community empowerment and improvement through sustainable development.

Employee Rights:

- We provide safe, secure, and worker friendly environment;
- We are an equal opportunities employer;
- We positively stimulate personal growth of our employees through promotion of creativity and teamwork;
- We do not use any forced or compulsory labor;
- We do not discriminate against race, religion, gender, age, sexual orientation, religion, nationality or ethnicity; and
- All employees have the right to join trade unions, where such rights are recognized by law.

U Moe Myint
Chief Executive Officer

7.2.2 Myanmar Regulatory Requirements

Table 7.3 provides a list of existing laws relevant to environmental and social aspects of the proposed Project.

In addition to the above existing laws, it is understood that the MOECAF is currently formulating various environmental guidelines and standards, in consultation with financial institution such as the Asian Development Bank (ADB). References to "*Environmental Quality Standards*" *in Article 10, Section 6* of the *Environmental Conservation Law (2012)* are prescribed as follow:

"*The Ministry may stipulate the following* ***environmental quality standards:***

1. *Suitable* ***surface water quality standards*** *in the usage in rivers, streams, canals, springs, marshes, swamps, lakes, reservoirs and other inland water sources of the public;*

2. ***Water quality standards*** *for coastal and estuarine areas;*

3. ***Underground*** *water quality standards;*

4. ***Atmospheric*** *quality standards;*

5. ***Noise and vibration*** *standards;*

6. ***Emissions*** *standards;*

7. ***Effluent*** *standards;*

8. ***Solid wastes*** *standards; and*

9. ***Other*** *environmental quality standards."*

Based on the contents of above Article, it is expected that MOECAF will announce the environmental quality standards for various sectors upon the time that the EIA Regulation or Ordinance comes into force. The Project may then be required to follow those national standards when they are being announced and enforced.

Table 7.3 List of Existing Sectorial Laws in Myanmar related to Environmental and Social issues as of September 2014

Sector	Relevant Laws in Myanmar
Administrative	The Territorial Sea and Maritime Zones Law, 1977
	The Emergency Provisions Act, 1950
	The Police Act, 1945
	The Poisons Act, 1919
	The Yangon Police Act, 1899
	The Explosives Act, 1887
	The Penal Code, 1861 of Offences Affecting the Public Health, Safety, Convenience, Decency and Morals
	Foreign Investment Law, 2012
	The Child Law (Law No. 9/93).
	Myanmar Maternal and Child Welfare Association Law (No. 21/90).
	Myanmar Investment Commission Notification (1994)
	The Private Industrial Enterprise Law - SLORC Law

Sector	Relevant Laws in Myanmar
	No. 22/90
Agriculture and Irrigation	The Fertilizer Law, 2002
	The Plant Pest Quarantine Law, 1993
	The Pesticide Law, 1990
	The Embankment Act, 1909
	Underground Water Act, 1930
	Farmland Rules - Notification No 62/2012 (English)
	Vacant, Fallow and Virgin Lands Management Rules - Notification No. 1/2012
	Vacant, Fallow and Virgin Land Management Act - Pyidaungsu Hluttaw Law No. 10/2012
Culture	The Protection and Preservation of Cultural Heritage Region law, 1998
Public Health	The National Food Law, 1997
	The Traditional Drug Law, 1996
	The Prevention and Control of Communicable Disease Law, 1995, revised in 2011.
	The Narcotics Drugs and Psychotropic Substances Law, 1993
	The National Drugs Law, 1992
	The Union of Myanmar Public Health Law, 1972
	Private Health Act, 2007
	The Penal Code of Offences Affecting the Public Health, Safety, Convenience, Decency and Morals (1861)
Occupational Health and Safety	Factory Act, 1951 (safe and healthy workplaces)
	Employment and skill Development Law, 2013
Tourism	The Myanmar Hotel and Tourism Law, 1993
Industrial	Myanmar Special Economic Zone Law No. 2011
	Dawei Special Economic Zone Law, 2011
	Myanmar Special Economic Zones Law (The Pyidaungsu Hluttaw Law No. 1/2014)
	The Private Industrial Enterprise Law, 1990
	The Factories Act, 1951
	The Oilfield (Labour and Welfare) Act, 1951
	Employment Restriction Act (1959)
	Workmen's Compensation Act 1923, amended in 2005
	Shops and Establishment Act, 1951
	Leave and Holidays Act, 1951
	Minimum Wage Act 1949, replaced by a new law in 2013
	Payment of Wages Act 1936
	Social Security Act 1954
	Trade Dispute Act 1929
	Settlement of Labour Dispute Law (2012)
	Employment and Skill Development Law
	Employment Statistics Act (1948)
	Water Power Act (1927)
Land Use	Land Acquisition Act, 1894
	The Towns Act, 1907
	The Village Act, 1907

7.2.3 Institutional Arrangement

Matters pertaining to environmental and social requirements of the Project are under the jurisdiction of the ministries and state-owned enterprises in the oil and gas sector which include:

- Ministry of Environmental Conservation and Forestry (MECF);
- Ministry of Labour;
- Ministry of Energy (MOE);
- Myanmar Oil and Gas Enterprise (MOGE); and
- Myanmar Investment Commission (MIC).

Under the IPR Contract, MPRL E&P will mainly liaise with MOGE on the environmental and social issues of the Project who may coordinate with the other institutes as appropriate.

7.3 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Through the Project development and the ESIA process, MPRL E&P has made commitments to actions to ensure or improve environmental and social performance. These commitments are not recommendations, but are binding commitments on the part of the Project.

A summary of the Project impacts and the committed mitigation measures are presented in *Table 7.4* below. Schedule and responsibility of implementation of these mitigation measures are identified as necessary. Additional details on the key elements for the overall environmental and social management of the Project are also presented below.

Table 7.4 Summary of the Key Impacts and Control/Mitigation Measures

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
Environmental Impacts						
Preparation and Mobilization						
Impacts from Construction of Workforce Camp on Terrestrial Habitats and associated Fauna and Flora	• Footprint of the proposed camp will be minimised during the design stage.	Minor	Compliance Audit	Design Phase	MPRL E&P Project Team	N/A
	• Construction activities will be restricted to works areas that will be clearly demarcated. • Work site boundaries will be regularly checked to ensure that they are not breached and that damage does not occur to surrounding areas. • It is assumed felling of large perennial vegetation (i.e. large trees such as roadside trees) will be avoided. • Works areas in temporarily affected areas would be reinstated with tree/shrub planting after completion of the works, as far as practicable. • Workforce camp is assumed to be temporary and will be removed in the close-out phase.		Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	N/A
Impacts from Labour (including Hunting), Equipment and Services Supply on terrestrial and Aquatic Flora and Fauna	• Oil fields are restricted areas and therefore existing access restrictions will be in place and patrolled within the block. Priority areas for patrolling should be identified within the Environmental Monitoring Plan (e.g. shrubland areas where new access routes are created). • Project activities undertaken with sufficient lighting only. • Minimisation of night-time driving. • Induction training for personnel is recommended to include a mandatory segment on biodiversity. In this induction details of key requirements will be provided to include ban on fishing and hunting. • Prohibit workers from uncontrolled interaction and commerce with the local community in terms of buying and selling goods particularly Non-Timber Forest Products (NTFP), bush meat and wildlife (pets, souvenirs). • Prohibit staff from introducing pets, livestock and other animals.	Negligible	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	Environmental Monitoring Plan
	• Engagement with local community to convey the message that workers are not allowed buying Non-Timber Forest Products (NTFP), bushmeat and wildlife (pets, souvenirs). • Work with local authorities and communities through the stakeholder engagement plan to monitor and control hunting and poaching arising from new access in the Project Area. • A monitoring programme will be established to ensure mitigation measures are being implemented effectively.				MPRL E&P CSR Team	
Impacts from Site Preparation / Clearance and Creation of Access Routes on Terrestrial Habitats and Associated Flora and Fauna	• Minimize footprint of access roads at the design stage (width of any new road should be less than 5 m).	Minor	Compliance Audit	Design Phase	MPRL E&P HSE / Communications / CSR Teams	N/A

	• Teams for deployment of source lines will access areas on foot, as far as practicable and follow/ clear a narrow path.
	• On the basis that vegetation clearance for tracks to allow access will be by hand, it is assumed felling of large perennial vegetation (i.e. large trees) will be avoided.
	• Induction training for personnel is recommended to include a mandatory segment on biodiversity. In this induction details of key requirements will be provided to include:
	  ○ Outline vegetation clearance procedures including species not to cut, and the minimum size of tree that should be felled (20 cm diameter at breast height (dbh) (i.e. diameter of the tree truck measured at 1.3 m above ground).
	  ○ What to do in the advent of disturbing species (eg snakes) (both from an occupational safety and biodiversity perspective)
	• Minimise clearing of vegetation along seismic lines ie leave in place smaller vegetation, topsoil, root stock, seeds.
	• Minimise clearing of vegetation along seismic lines by selecting the 'path of least resistance' through vegetation.
	• Minimise vegetation cutting at shot hole and receiver station, as far as practicable.
	• The width of seismic lines will be no greater than 1.5 m and limited even narrower to 1 m where possible in the forest area.
			Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE and CSR Teams	N/A

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
Impacts from Mobile Power Generation on Terrestrial Fauna	● Specifications of power generator ● Project activities undertaken within sufficient lighting only.	Minor	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	N/A
Impacts from Waste Disposal on Surface Water Quality, Ground Water Quality, Soil, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna	● Planning material requirements the at design stage to reduce unnecessary generated waste. ● MPRL E&P HSE Management System requires Waste Management Plan for the project. A Waste Management Plan will be developed by MPRL E&P or a third party separately from but administered under the Environmental and Social Management Plan. The plan will identify and estimate generated volumes of different waste types and set out procedures for responsible management and disposal and will be regularly audited.	Negligible	Compliance Audit	Design Phase	MPRL E&P HSE Team	Waste Management Plan
	● Induction training for personnel (including contracted local workers) is recommended to include: ○ Waste management system	Negligible	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	Waste Management Plan
Impacts from Sewage and Wastewater Discharge on Surface Water Quality, Ground Water Quality, Soil, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna	● Wastewater treatment facilities will be properly designed and installed ● Provision of service tank for sewage from toilet facilities ● Provision of water pit for greywater from kitchen ● Service tank and water pit are separated from drainage and stormwater. ● Wastewater treatment facilities will be well maintained to allow effective operation.	Minor	Inspection & Compliance Audit	Design and Implementation Phase	MPRL E&P HSE Team	Waste Management Plan
Seismic Survey						
Impacts from Labour (including Hunting), Equipment and Services Supply on Terrestrial and Aquatic Flora and Fauna	● Oil fields are restricted areas and therefore existing access restrictions will be in place and patrolled within the block. Priority areas for patrolling should be identified within the Environmental Monitoring Plan (e.g. shrubland areas where new access routes are created). ● Project activities undertaken with sufficient lighting only. ● Minimisation of night-time driving. ● Induction training for personnel is recommended to include a mandatory segment on biodiversity. In this induction details of key requirements will be provided to include ban on fishing and hunting. ● Prohibit workers from uncontrolled interaction and commerce with the local community in terms of buying and selling goods particularly Non-Timber Forest Products (NTFP), bush meat and wildlife (pets, souvenirs). ● Prohibit staff from introducing pets, livestock and other animals.	Negligible	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	Environmental Monitoring Plan
	● Engagement with local community to convey the message that workers are not allowed buying Non-Timber Forest Products (NTFP), bushmeat and wildlife (pets, souvenirs). ● Work with local authorities and communities through the stakeholder engagement plan to monitor and control hunting and poaching arising from new access in the Project Area. ● A monitoring programme will be established to ensure mitigation measures are being implemented effectively.				MPRL E&P CSR Team	
Impacts from Site Preparation /	● Minimize footprint of access roads at the design stage (width of any new road should be less than 5 m).	Minor	Compliance Audit	Design Phase	MPRL E&P HSE Team	N/A

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
Clearance and Creation of Access Routes on Terrestrial Habitats and Associated Flora and Fauna	● Teams for deployment of source lines will access areas on foot, as far as practicable and follow/ clear a narrow path. ● On the basis that vegetation clearance for tracks to allow access will be by hand, it is assumed felling of large perennial vegetation (i.e. large trees) will be avoided. ● Induction training for personnel is recommended to include a mandatory segment on biodiversity. In this induction details of key requirements will be provided to include: o Outline vegetation clearance procedures including species not to cut, and the minimum size of tree that should be felled (20 cm diameter at breast height (dbh) (i.e. diameter of the tree truck measured at 1.3 m above ground). o What to do in the advent of disturbing species (eg snakes) (both from an occupational safety and biodiversity perspective) ● Minimise clearing of vegetation along seismic lines ie leave in place smaller vegetation, topsoil, root stock, seeds. ● Minimise clearing of vegetation along seismic lines by selecting the 'path of least resistance' through vegetation. ● Minimise vegetation cutting at shot hole and receiver station, as far as practicable. ● The width of seismic lines will be no greater than 1.5 m and limited even narrower to 1 m where possible in the forest area. ● Wireless geophones on receiver lines, as far as practicable		Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE and CSR Teams	N/A
Impacts from Mobile Power Generation on Terrestrial Fauna	● Specifications of power generator ● Project activities undertaken within sufficient lighting only.	Minor	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	N/A
Impacts from Drilling on Terrestrial Fauna	● Drilling of shot holes by portable drills ● Vegetation cutting by hand to minimise disturbance and degradation of the habitats ● It is assumed felling of large perennial vegetation (i.e. large trees which typically provide habitat for higher densities of terrestrial fauna) will be avoided. ● Shot holes will be backfilled after shooting is completed. ● As good site practice, it is recommended the immediate vicinity of shot hole locations is checked for presence of yellow-headed Tortoise (Endangered) and if found will be relocated to a safe distance away from the drilling activity.	Minor	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	N/A
Impacts from Detonation of Explosive on Terrestrial Fauna	● Minimise the use of charges as far as practicable. ● Shotholes will be backfilled. ● Charges detonated at ~10m below ground level or as deep underground as practicable. ● Daytime shooting only.	Minor	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	N/A
Positive Impacts from Reinstatement on Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna	● It is recommended a Terrestrial Habitat Reinstatement Plan will be developed in light of detailed plans for locations for seismic survey including temporarily cleared areas. The plan will identify provisions for sourcing native species from nursery and procedures for replanting. It will also identify priority areas for rehabilitation including at for instance de-facto protected areas such as near monastery and near cultural heritage location if trees or vegetation are planned to be cleared from these locations. Rehabilitation of vegetation on seismic lines will also be provided.	Neutral or Positive	Compliance Audit	Design Phase	MPRL E&P HSE Team	Terrestrial Habitat Reinstatement Plan
	● MPRL E&P commitment to appropriate reinstatement works for seismic survey ● MPRL E&P to compensate farmers to reinstate land in agricultural and cultivated/village areas ● Materials introduced by the seismic survey will be removed at the disturbed areas. ● Disturbed areas will be monitored before Project commencement and for one year after completion of Project to track any natural recolonisation by vegetation after the Project completion. If natural recolonisation does not taken place or is not ideal (i.e. significantly different from the original condition as determined by monitoring), the disturbed areas will be restored/rehabilitated as much as is practicable to its original condition; this includes replanting areas where vegetation has been cleared including seismic line access routes, etc, using native vegetation.		Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	Terrestrial Habitat Reinstatement Plan

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
Impacts from Waste Disposal on Surface Water Quality, Ground Water Quality, Soil, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna	• Planning material requirements the at design stage to reduce unnecessary generated waste. • MPRL E&P HSE Management System requires Waste Management Plan for the project. A Waste Management Plan will be developed by MPRL E&P or a third party separately from but administered under the Environmental and Social Management Plan. The plan will identify and estimate generated volumes of different waste types and set out procedures for responsible management and disposal and will be regularly audited.	Negligible	Compliance Audit	Design Phase	MPRL E&P HSE Team	Waste Management Plan
	• Induction training for personnel (including contracted local workers) is recommended to include: o Waste management system o Available provided sanitary facilities • Seismic team will collect gab wires to dispose or to re-use • Seismic team will check the shot hole and collect remaining residues, as far as practicable, to minimise waste in the area.	Negligible	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	Waste Management Plan
Impacts from Sewage and Wastewater Discharge on Surface Water Quality, Ground Water Quality, Soil, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna	• Wastewater treatment facilities will be properly designed and installed • Provision of service tank for sewage from toilet facilities • Provision of water pit for greywater from kitchen • Service tank and water pit are separated from drainage and stormwater. • Wastewater treatment facilities will be well maintained to allow effective operation. • Fluids to shot hole will be limited to use of small quantities of water • Excess drilling mud (water) will be pumped back into the container (eg. barrel) for reuse. • It is recommended that portable toilet facilities be provided with collection of resultant sanitary waste to be carried out by an approved contractor for proper disposal.	Minor	Inspection & Compliance Audit	Design and Implementation Phase	MPRL E&P HSE Team	Waste Management Plan
Close Out Phase						
Impacts from Labour (including Hunting), Equipment and Services Supply on terrestrial and Aquatic Flora and Fauna	• Oil fields are restricted areas and therefore existing access restrictions will be in place and patrolled within the block. Priority areas for patrolling should be identified within the Environmental Monitoring Plan (e.g. shrubland areas where new access routes are created). • Project activities undertaken with sufficient lighting only. • Minimisation of night-time driving. • Induction training for personnel is recommended to include a mandatory segment on biodiversity. In this induction details of key requirements will be provided to include ban on fishing and hunting. • Prohibit workers from uncontrolled interaction and commerce with the local community in terms of buying and selling goods particularly Non-Timber Forest Products (NTFP), bush meat and wildlife (pets, souvenirs). • Prohibit staff from introducing pets, livestock and other animals.	Negligible	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	Environmental Monitoring Plan
	• Engagement with local community to convey the message that workers are not allowed buying Non-Timber Forest Products (NTFP), bushmeat and wildlife (pets, souvenirs). • Work with local authorities and communities through the stakeholder engagement plan to monitor and control hunting and poaching arising from new access in the Project Area. • A monitoring programme will be established to ensure mitigation measures are being implemented effectively.				MPRL E&P CSR Team	

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
Impacts from Waste Disposal on Surface Water Quality, Ground Water Quality, Soil, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna	● Planning material requirements the at design stage to reduce unnecessary generated waste. ● MPRL E&P HSE Management System requires Waste Management Plan for the project. A Waste Management Plan will be developed by MPRL E&P or a third party separately from but administered under the Environmental and Social Management Plan. The plan will identify and estimate generated volumes of different waste types and set out procedures for responsible management and disposal and will be regularly audited.	Negligible	Compliance Audit	Design Phase	MPRL E&P HSE Team	Waste Management Plan
	● Induction training for personnel (including contracted local workers) is recommended to include: ○ Waste management system	Negligible	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	Waste Management Plan
Impacts from Sewage and Wastewater Discharge on Surface Water Quality, Ground Water Quality, Soil, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna	● Wastewater treatment facilities will be properly designed and installed ● Provision of service tank for sewage from toilet facilities ● Provision of water pit for greywater from kitchen ● Service tank and water pit are separated from drainage and stormwater.	Minor	Inspection & Compliance Audit	Design and Implementation Phase	MPRL E&P HSE Team	Waste Management Plan
Seismic Survey - Accidental Events						

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
Impacts from spills/leaks on surface water quality, ground water quality, soil, terrestrial habitats and aquatic habitats as well as their associated flora and fauna	• Drilling fluid for shot hole drilling will be water. • Hazardous materials / chemicals will be stored at MOGE warehouse facility. Storage facilities at MOGE warehouse incorporate features for appropriate storage of fuels and hazardous materials. • Fuel and chemical storage areas will have appropriate secondary containment (drip trays for small storage locations/impervious base and bund walls for tanks) and provide procedures for managing the containment systems. All ancillary equipment (e.g. valves, hoses) should be contained securely within the bund when not in use. • Oil interceptors will be provided in the drainage system where necessary and regularly emptied to prevent the release of oil and grease into the storm water drainage system after accidental spillages. • Storage tanks and components will meet international design standards as far as practicable.. For example, storage tanks will be equipped with devices that prevent spills and overfills, including overfill alarms, automatic shut-off devices and catch basins around fill pipes. • Fuel stores should be kept away from vehicle access routes to prevent collisions. • Maintenance of storage tanks, pipes and components (seals, connectors and valves) will be carried out regularly, including daily inspection of fuelling equipment in satisfactory condition. • All construction plants and machinery (e.g., trucks) will be maintained in good working order to avoid leakage or spillage of contaminants. • Routine servicing of plant and equipment will be carried out off-site prior to mobilisation or within workshop facilities equipped with bunded areas and oil interceptor. • Spill kits and shovels will be available onsite at all times for any accidental leakage of fuel or other hazardous substances during Project activities; it must be ensured that no such substance enters into groundwater or surface water resources. • If emergency servicing of equipment is required in the field, spill kits and drip trays will be available. • Any contaminated soil will be removed from site and disposed of in accordance with the waste management plan. • Oils and other service fluids will be removed off-site by the Seismic Team and disposed in accordance with the waste management plan. • The location, type and quantity of any fuel or chemical spill will be reported to HSE coordinator immediately. • Shot holes will not be located within 50 m of a watercourse or water body.		Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	Emergency Preparedness Plan
Impacts from Fires and Explosions on Air Quality, Ground Water Quality, Surface Water Quality, Landscape and Visual Character, Use of Natural Resources, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna.	• Induction training for personnel is recommended to include a mandatory segment on fire safety and actions in the event of a fire. • All seismic teams will carry first-attack fire-fighting equipment such as fire extinguisher, shovel and communications equipment to respond to small spot fires and communicate with the operations headquarters in the event of a fire. • HSE induction will be undertaken at the site before work commencement which should include proper use of fire-fighting equipment and communication protocol in case of fire. • It will be of key importance that explosives are kept in a safe manner and no uncontrolled explosions occur. Implement all required safety and management requirements relating to the transportation, storage and handling of explosives • Misfired charges from shot holes will be disabled and destroyed. • Restrict smoking to designated areas only. • Conduct fire training and response drills.	Minor	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE and Communications Teams	N/A
Workover Activities – Planned Events						

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
Impacts from Operation of Mechanical Equipment Required for Workover Activities on Ambient Air and Noise Conditions	• Activities carried out at existing well sites in existing oil field with separation from sensitive receptors. • Project activities undertaken with sufficient lighting only. • Well maintained equipment will be used • Noise suppression box will be fabricated over the engine for the PMEs being operated nearby the NSRs (e.g. villages). • Appropriate PPE e.g. ear protection will be used for MPRL E&P personnel. • Workers not involved with the works will need to be at least 100 m away from the well head if practicable. • Well-maintained equipment to be operated on-site. • Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components. • Shut down or throttled down between work periods for machines and construction plant items (eg trucks) that may be in intermittent use. • Shut down generators, compressors, and other equipment when not in use. • Reduce the number of equipment operating simultaneously as far as practicable. • Orientate equipment known to emit noise strongly in one direction so that the noise is directed away from receptors as far as practicable. • Implement control measures, eg noise barrier at site hoarding, movable barrier or barrier that installed on the equipment, whenever applicable. The type of control measure that can be applied will be determined based on site conditions and constraints.	Negligible for Noise and Minor for Air	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	N/A
Impacts from Disposal of Waste from Workover Activities on Surface Water Quality, Ground Water Quality, Soil, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna	• A Waste Management Plan will be developed by MPRL E&P or a third party to be administered under the Environmental and Social Management Plan. The plan will identify and estimate generated volumes of different waste types and set out procedures for responsible management and disposal and will be regularly audited. • Careful selection of the fluid system to minimize environmental hazards related to chemical additives • Careful selection of fluid additives taking into account technical requirements, chemical additive concentration, toxicity, bioavailability and bioaccumulation potential.	Minor	Compliance Audit	Design Phase	MPRL E&P HSE Team	Waste Management Plan
	• Drill muds used will be WBM and KCl polymer mud and will be recycled and treated for future use. • Monitoring and minimizing the concentration of heavy metal impurities (mainly mercury and cadmium) in barite stock used in the fluid formulation, if used.		Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	Waste Management Plan
Workover Activities - Accidental Events						
Impacts from Spills/Leaks on Surface Water Quality, Ground Water Quality, Soil, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna	• Develop an Emergency Preparedness and Spill Response Plan to document communication procedures and actions to take in the event of uncontrolled well fluid release. • Carefully plan drilling operation by identifying shallow hazards, using standard materials for well construction/modification, using standard drilling and well control standard operating procedures, and using proper drilling mud formulation with additives if necessary (well kill fluids, loss control and weighting agents). • Develop water treatment and injection facilities, if practicable.	Minor	Inspection & Compliance Audit	Design Phase	MPRL E&P HSE Team	Emergency Preparedness Plan and Spill Response Plan

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
	• Competent and well-trained workover crews. • Well-planned, well-supervised and standard workover/drilling procedures will be used at the wells to maintain well control (eg management of mud weight) • Implementation of maintenance and inspection procedures. • Undertake drilling with international best practice safety procedures. • Test safety devices prior to start-up for function and integrity. • Continuously monitor pressure in the well and recycled mud during drilling. • Train employees on emergency procedures. • Spill kits and shovels at well sites or appropriate locations for any accidental leakage of fuel or other hazardous substances during Project activities; it must be ensured that no such substance enters into groundwater or surface water resources. • If emergency servicing of equipment is required in the field, spill kits and drip trays will be available. • Any contaminated soil will be removed from site and disposed of in accordance with the waste management plan. • The location, type and quantity of any fuel or chemical or mud spill will be reported to HSE coordinator immediately. • Improve cellars with double cellars for new and reactivated wells. • Regularly pump out cellars oil and water separators and treatment water for injection.		Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	Emergency Preparedness Plan and Spill Response Plan
Impacts from Fires and Explosions on Air Quality, Ground Water Quality, Surface Water Quality, Landscape and Visual Character, Use of Natural Resources, Terrestrial Habitats and Aquatic Habitats as well as their Associated Flora and Fauna.	• Assign designated smoking areas; • Smoking is only allowed away from the well head of more than 100 feet, up wind, with appropriate ash trays to contain any hot ashes. • Fire control equipment should be located at the well site or appropriate locations. • Induction training for personnel is recommended to include a mandatory segment on fire safety and actions in the event of a fire. • It will be of key importance that explosives used for re-perforation activities are kept in a safe manner and no uncontrolled explosions occur. Implement all required safety and management requirements relating to the transportation, storage and handling of explosives • Misfired charges from re-perforation activities will be disabled and destroyed. • Restrict smoking to designated areas only. • Conduct fire training and response drills.	Minor	Inspection & Compliance Audit	Implementation Phase	MPRL E&P HSE Team	N/A
Social Impacts						
Land Accessibility Phase						
Impact regarding Loss of Access to Land	• A Livelihood Restoration Plan (LRP) for the Project should be developed based on the assessment of various livelihood restoration options available and preferred by the community and reflective of the needs of the community. The LRP should also have clear reporting and monitoring indicators and the implementation mechanism including the institutional mechanism for the implementation of the same.	Moderate	Compliance Audit	Design Phase	MPRL E&P CSR Team	Livelihood Restoration Plan
	• Compensation for the crop loss should be provided and livelihood restoration facilities should be provided, however, this has to be done keeping cognisance of the local laws and regulations. • In case of any new land requirement, the compensation amount and any livelihood restoration options should be identified in consultation with the local community and the local authorities. • In case of landlessness due to Project, preference should be given for employment in various works depending upon the skill levels. Livelihood restoration options or support could be considered for these families.		Compliance Audit	Design Phase	MPRL E&P CSR Team	Livelihood Restoration Plan
	• Preference to land owners for employment and sub-contractor works.		Employment records	Quarterly	MPRL E&P CSR Team	N/A
	• Preference to land owners in community development and corporate responsibility activities.		Community development activity records	Six Monthly	MPRL E&P CSR Team	N/A
Community and Occupational Health and Safety	• A Traffic Management Plan will be developed for the Project and will be implemented by the HSE team for the Project.	Minor	Compliance Audit	Design Phase	MPRL E&P HSE Team	Traffic Management Plan

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
	• Adopt proper road safety measures		Road Safety Policy	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	• Synchronize traffic movements with the local community needs.		N/A	Monthly	MPRL E&P HSE Team	Traffic Management Plan
	• Immediate repair of any damage to existing main roads which are caused by Project activities.		Visual Inspection/Records of repairs	Monthly	MPRL E&P HSE Team	N/A
	• Ensure availability of break services of heavy vehicles		Visual Inspection	Monthly	MPRL E&P HSE Team	N/A
	• In case of at-fault accidents, pay compensation to the affected family or next of kin in keeping with the applicable rules		Records of accidents and compensation paid/ grievance records	Monthly	MPRL E&P HSE Team/CSR Team	N/A
	• Undertake a root cause analysis of any accidents which take place		Root cause analysis reports	Monthly	MPRL E&P HSE Team	N/A
	• Develop a policy for safety measures to be undertaken while driving,		Road safety policy	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	• The Labour camps should be placed at a distance from the village settlements		Visual inspection	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	• Undertake • pre-employment medical check-ups for all workers		Medical records	Quarterly	MPRL E&P HSE Team	N/A
	• Undertake regular heath check-ups and health survey of the community.		Health survey reports	Quarterly	MPRL E&P HSE / CSR Team	N/A
Impact on Livelihood Profile of the Community	• Preference to the vulnerable groups according to the skill requirements of the project	Positive	Employment records	Quarterly	MPRL E&P CSR Team	N/A
Impact on Transport and Infrastructure Services	• Adopt proper road safety measures	Negligible	Road Safety Policy	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	• Synchronize traffic movements with the local community needs.		N/A	Monthly	MPRL E&P HSE Team	Traffic Management Plan
	• Immediate repair of any damage to existing main roads which are caused by Project activities.		Visual Inspection/Records of repairs	Monthly	MPRL E&P HSE Team	N/A
	• Ensure availability of break services of heavy vehicles		Visual Inspection	Monthly	MPRL E&P HSE Team	N/A
Impacts on Source Water Vulnerability	• As part of the Project design, the requirements for acceptable water quality standards and waste water discharge standards will be maintained.	Minor	Compliance Audit	Design Phase	MPRL E&P HSE Team	Waste Management Plan
	• The local community will be engaged and a water use agreement will be formulated, which would minimize the pressure on the source water and ensure adequate water availability for the community.		Compliance Audit	Design Phase	MPRL E&P CSR Team	N/A

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
Impacts on Culture Heritage	● As part of the Project design, Project facilities / activities will be located away from sensitive cultural heritage resources. ● A proper protocol or Standard Operating Procedures (SOP) may be developed and people at Project Area location trained to act suitably in consonance with the regulatory requirement and beliefs and faith of the community, if any.	Minor	Compliance Audit	Design Phase	MPRL E&P CSR Team	Culture Heritage SOP
	● The Project will meet the international best practice for the documentation and protection of the cultural heritage and in case of chance finds. ● The Project will consider retaining professionals to assist in the identification and protection of cultural heritage; ● In case the removal of nonreplicable cultural heritage is required, the same will be undertaken in consultation with the affected communities and in keeping with the regulatory requirements for the same; ● The Project will ensure that the access to cultural heritage by the local community is not disrupted, and if required, alternative access routes will be provided.		Inspection & Compliance Audit	Implementation Phase	MPRL E&P CSR Team	Culture Heritage SOP
Seismic Survey						
Community and Occupational Health and Safety	● A Traffic Management Plan will be developed for the Project and will be implemented by the HSE team for the Project.	Minor	Compliance Audit	Design Phase	MPRL E&P HSE Team	Traffic Management Plan
	● Maintain a 100m- radius buffer around the shot hole within which no pedestrians or traffic will be allowed.		Visual inspection	Daily	MPRL E&P HSE Team	Traffic Management Plan
	● Adopt proper road safety measures		Road Safety Policy	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	● Synchronize traffic movements with the local community needs.		N/A	Monthly	MPRL E&P HSE Team	Traffic Management Plan
	● Immediate repair of any damage to existing main roads which are caused by Project activities.		Visual Inspection/Records of repairs	Monthly	MPRL E&P HSE Team	N/A
	● Ensure availability of break services of heavy vehicles		Visual Inspection	Monthly	MPRL E&P HSE Team	N/A
	● In case of at-fault accidents, pay compensation to the affected family or next of kin in keeping with the applicable rules		Records of accidents and compensation paid/ grievance records	Monthly	MPRL E&P HSE Team/CSR Team	N/A
	● Undertake a root cause analysis of any accidents which take place		Root cause analysis reports	Monthly	MPRL E&P HSE Team	N/A
	● Develop a policy for safety measures to be undertaken while driving,		Road safety policy	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	● The Labour camps should be placed at a distance from the village settlements		Visual inspection	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	● Undertake pre-employment medical check-ups for all workers		Medical records	Quarterly	MPRL E&P HSE Team	N/A
	● Undertake regular heath check-ups and health survey of the community.		Health survey reports	Quarterly	MPRL E&P HSE / CSR Team	N/A
Impact on Livelihood Profile of the Community	● Preference to the vulnerable groups according to the skill requirements of the project	Positive	Employment records	Quarterly	MPRL E&P CSR Team	N/A
Impact on Transport and	● Maintain minimum offset distance from surrounding infrastructure	Negligible	Visual inspection	Daily	MPRL E&P HSE Team	N/A

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
Infrastructure Services	• Adopt proper road safety measures		Road Safety Policy	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	• Synchronize traffic movements with the local community needs.		N/A	Monthly	MPRL E&P HSE Team	Traffic Management Plan
	• Immediate repair of any damage to existing main roads which are caused by Project activities.		Visual Inspection/Records of repairs	Monthly	MPRL E&P HSE Team	N/A
	• Ensure availability of break services of heavy vehicles		Visual Inspection	Monthly	MPRL E&P HSE Team	N/A
Impacts on Source Water Vulnerability	• As part of the Project design, the requirements for acceptable water quality standards and waste water discharge standards will be maintained.	Minor	Compliance Audit	Design Phase	MPRL E&P HSE Team	Waste Management Plan
	• The local community will be engaged and a water use agreement will be formulated, which would minimize the pressure on the source water and ensure adequate water availability for the community.		Compliance Audit	Design Phase	MPRL E&P CSR Team	N/A
Impacts on Culture Heritage	• As part of the Project design, Project facilities / activities will be located away from sensitive cultural heritage resources. • A proper protocol or Standard Operating Procedures (SOP) may be developed and people at Project Area location trained to act suitably in consonance with the regulatory requirement and beliefs and faith of the community, if any.	Minor	Compliance Audit	Design Phase	MPRL E&P CSR Team	Culture Heritage SOP
	• The Project will meet the international best practice for the documentation and protection of the cultural heritage and in case of chance finds. • The Project will consider retaining professionals to assist in the identification and protection of cultural heritage; • In case the removal of nonreplicable cultural heritage is required, the same will be undertaken in consultation with the affected communities and in keeping with the regulatory requirements for the same; • The Project will ensure that the access to cultural heritage by the local community is not disrupted, and if required, alternative access routes will be provided.		Inspection & Compliance Audit	Implementation Phase	MPRL E&P CSR Team	Culture Heritage SOP
Close Out Phase						
Community and Occupational Health and Safety	• A Traffic Management Plan will be developed for the Project and will be implemented by the HSE team for the Project.	Minor	Compliance Audit	Design Phase	MPRL E&P HSE Team	Traffic Management Plan
	• Adopt proper road safety measures		Road Safety Policy	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	• Synchronize traffic movements with the local community needs.		N/A	Monthly	MPRL E&P HSE Team	Traffic Management Plan
	• Immediate repair of any damage to existing main roads which are caused by Project activities.		Visual Inspection/Records of repairs	Monthly	MPRL E&P HSE Team	N/A
	• Ensure availability of break services of heavy vehicles		Visual Inspection	Monthly	MPRL E&P HSE Team	N/A
	• In case of at-fault accidents, pay compensation to the affected family or next of kin in keeping with the applicable rules		Records of accidents and compensation paid/ grievance records	Monthly	MPRL E&P HSE Team/CSR Team	N/A
	• Undertake a root cause analysis of any accidents which take place		Root cause analysis reports	Monthly	MPRL E&P HSE Team	N/A

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
	• Develop a policy for safety measures to be undertaken while driving,		Road safety policy	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	• The Labour camps should be placed at a distance from the village settlements		Visual inspection	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	• Undertake • pre-employment medical check-ups for all workers		Medical records	Quarterly	MPRL E&P HSE Team	N/A
	• Undertake regular heath check-ups and health survey of the community.		Health survey reports	Quarterly	MPRL E&P HSE / CSR Team	N/A
Impact on Livelihood Profile of the Community	• preference to the vulnerable groups according to the skill requirements of the project	Positive	Employment records	Quarterly	MPRL E&P CSR Team	N/A
Impact on Transport and Infrastructure Services	• Adopt proper road safety measures	Negligible	Road Safety Policy	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	• Synchronize traffic movements with the local community needs.		N/A	Monthly	MPRL E&P HSE Team	Traffic Management Plan
	• Immediate repair of any damage to existing main roads which are caused by Project activities.		Visual Inspection/Records of repairs	Monthly	MPRL E&P HSE Team	N/A
	• Ensure availability of break services of heavy vehicles		Visual Inspection	Monthly	MPRL E&P HSE Team	N/A
Impacts on Source Water Vulnerability	• As part of the Project design, the requirements for acceptable water quality standards and waste water discharge standards will be maintained.	Minor	Compliance Audit	Design Phase	MPRL E&P HSE Team	Waste Management Plan
	• The local community will be engaged and a water use agreement will be formulated, which would minimize the pressure on the source water and ensure adequate water availability for the community.		Compliance Audit	Design Phase	MPRL E&P CSR Team	N/A
Impacts on Culture Heritage	• As part of the Project design, Project facilities / activities will be located away from sensitive cultural heritage resources. • A proper protocol or Standard Operating Procedures (SOP) may be developed and people at Project Area location trained to act suitably in consonance with the regulatory requirement and beliefs and faith of the community, if any.	Minor	Compliance Audit	Design Phase	MPRL E&P CSR Team	Culture Heritage SOP
	• The Project will meet the international best practice for the documentation and protection of the cultural heritage and in case of chance finds. • The Project will consider retaining professionals to assist in the identification and protection of cultural heritage; • In case the removal of nonreplicable cultural heritage is required, the same will be undertaken in consultation with the affected communities and in keeping with the regulatory requirements for the same; • The Project will ensure that the access to cultural heritage by the local community is not disrupted, and if required, alternative access routes will be provided.		Inspection & Compliance Audit	Implementation Phase	MPRL E&P CSR Team	Culture Heritage SOP
Workover Activities						
Community and Occupational Health and Safety	• A Traffic Management Plan will be developed for the Project and will be implemented by the HSE team for the Project.	Minor	Compliance Audit	Design Phase	MPRL E&P HSE Team	Traffic Management Plan

Potential Impact/Issue	Control / Mitigation Measures	Significance of Residual Impacts	Monitoring	Timing/Frequency	Responsible Party	Related Plans
	• Adopt proper road safety measures		Road Safety Policy	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	• Synchronize traffic movements with the local community needs.		N/A	Monthly	MPRL E&P HSE Team	Traffic Management Plan
	• Immediate repair of any damage to existing main roads which are caused by Project activities.		Visual Inspection/Records of repairs	Monthly	MPRL E&P HSE Team	N/A
	• Ensure availability of break services of heavy vehicles		Visual Inspection	Monthly	MPRL E&P HSE Team	N/A
	• In case of at-fault accidents, pay compensation to the affected family or next of kin in keeping with the applicable rules		Records of accidents and compensation paid/ grievance records	Monthly	MPRL E&P HSE Team/CSR Team	N/A
	• Undertake a root cause analysis of any accidents which take place		Root cause analysis reports	Monthly	MPRL E&P HSE Team	N/A
	• Develop a policy for safety measures to be undertaken while driving,		Road safety policy	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	• The Labour camps should be placed at a distance from the village settlements		Visual inspection	Prior to the commencement of the planning and mobilization phase	MPRL E&P HSE Team	N/A
	• Undertake pre-employment medical check-ups for all workers		Medical records	Quarterly	MPRL E&P HSE Team	N/A
	• Undertake regular heath check-ups and health survey of the community.		Health survey reports	Quarterly	MPRL E&P HSE / CSR Team	N/A
Impacts on Source Water Vulnerability	• As part of the Project design, the requirements for acceptable water quality standards and waste water discharge standards will be maintained.	Minor	Compliance Audit	Design Phase	MPRL E&P HSE Team	Waste Management Plan
	• The local community will be engaged and a water use agreement will be formulated, which would minimize the pressure on the source water and ensure adequate water availability for the community.		Compliance Audit	Design Phase	MPRL E&P CSR Team	N/A
Impacts on Culture Heritage	• As part of the Project design, Project facilities / activities will be located away from sensitive cultural heritage resources. • A proper protocol or Standard Operating Procedures (SOP) may be developed and people at Project Area location trained to act suitably in consonance with the regulatory requirement and beliefs and faith of the community, if any.	Minor	Compliance Audit	Design Phase	MPRL E&P CSR Team	Culture Heritage SOP
	• The Project will meet the international best practice for the documentation and protection of the cultural heritage and in case of chance finds. • The Project will consider retaining professionals to assist in the identification and protection of cultural heritage; • In case the removal of nonreplicable cultural heritage is required, the same will be undertaken in consultation with the affected communities and in keeping with the regulatory requirements for the same; • The Project will ensure that the access to cultural heritage by the local community is not disrupted, and if required, alternative access routes will be provided.		Inspection & Compliance Audit	Implementation Phase	MPRL E&P CSR Team	Culture Heritage SOP

7.3.1 Environmental Management Organisation

MPRL E&P is committed to providing resources essential to the implementation and control of the ESMP. 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 7.5.*

Table 7.5 Environmental Management Organisation Roles and Responsibilities

Position	Responsibility
MPRL E&P	
General Manager	Oversee and coordinate all activities pertaining to the Project; ultimately responsible for environmental and social issues. Ensure delivery by the asset of its environmental, social and operational targets. Ensure effective communication with all stakeholders.
Operations Manager	Technical aspects of the Project including contractor supervision during operations. Responsible for the execution of Emergency Response Plan including Oil Spill Contingency Plan.
Construction Manager	Technical aspects of the Project including subcontractor supervision during Project implementation.
HSE Coordinator	Ensuring that the Project and subcontractors operate in accordance with applicable regulatory environmental and social requirements and plans. Monitor implementation of environmental and social protection measures, and assist with technical input into oil spill response requirements.
Community Liaison Officer	Liaise with local communities, farmer and government regulators on the project's behalf. Implement environmental and social awareness and education programmes with communities.
Contractor	
Project Manager	Responsible for subcontractor technical performance and compliance.
HSE Manager	Ensure that environment and social regulatory requirements are met and that ESMP requirements are properly implemented.

Supervision of subcontractor activities will be conducted by MPRL E&P General Manager and Operations Manager. This will be accomplished through management controls over strategic project aspects and interaction with subcontractor staff where project activities take place. The MPRL E&P organisation will be staffed at a level to allow for continuous effective supervision of subcontractor activities and work products.

The construction manager and HSE coordinator will be placed locally at the Project Area to supervise contractors during construction while the operations manager and HSE coordinator will supervise contractors during operational

activities. The organisation includes a Community Liaison Officer (CLO) whose role is crucial to the successful implementation of the ESMP and the continuation of liaison with the local community.

7.3.2 Training and Awareness

MPRL E&P will identify, plan, monitor, and record training needs for personnel whose work may have a significant adverse impact upon the environment or social conditions. The Project recognises that it is important that employees at each relevant function and level are aware of the Project's environmental and social policy; potential impacts of their activities; and roles and responsibilities in achieving conformance with the policy and procedures.

This will be achieved through a formal training process. Employee training 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 ESIA and ESMP, in order to avoid or reduce those impacts; and
- Roles and responsibilities to achieve that conformity, including with regard to change management and emergency response.

The HSE coordinator is responsible for coordinating training, maintaining employee-training records, and ensuring that these are monitored and reviewed on a regular basis. The HSE Manager will also periodically verify that staff is performing competently through discussion and observation.

Employees responsible for performing site inspections will receive training by drawing on external resources as necessary. Training will be coordinated by the HSE coordinator prior to Project's implementation. Upon completion of training and once deemed competent by management, staff will be ready to train other people.

Similarly the Project will require that each of the contractors institute training programmes for its personnel. Each contractor is responsible for site HSE awareness training for personnel working on the job sites. The contractors are also responsible for identification of any additional training requirements to maintain required competency levels.

The contractor training program will be subject to approval by the Project and it will be audited to ensure that:

- Training programs are adequate;
- All personnel requiring training have been trained; and
- Competency is being verified.

7.3.3 Inspection

HSE inspections will be conducted by subcontractors on a daily basis. The results of the inspection and monitoring activities will be reported to MPRL E&P on a weekly basis or more frequently if requested by the HSE coordinator or the Operations Manager.

7.3.4 Monitoring

Monitoring will be conducted to ensure compliance with regulatory requirements as well as to evaluate the effectiveness of operational controls and other measures intended to mitigate potential impacts.

As a minimum, the following monitoring on biological and physical monitoring should be undertaken:

Biological Environment Monitoring for both Seismic Survey and Workover Activities

- Habitat mapping and vegetation surveys
- Terrestrial fauna surveys, including avifauna (birds), mammals, herpetofauna (amphibians and reptiles) and butterflies
- Aquatic fauna

Physical Environment Monitoring for Workover Activities only

- Ambient air quality
- Acoustic environment
- Groundwater
- Surface water
- Soil quality

The monitoring methodology should follow that adopted for the ESIA Study.

Monitoring should be undertaken during the following periods of the seismic survey:

- At least two weeks before the preparation / mobilisation phase for baseline data collection;
- Once during the preparation / mobilisation phase for monitoring impacts from this phase;
- Once during the seismic survey phase for monitoring impacts from this phase;

- Once during the close-out phase for monitoring impacts from this phase; and

- Once following the rehabilitation activities after the seismic survey to monitor the success of habitat restoration.

For workover activities, monitoring should be undertaken during the following periods:

- At least two weeks before the commencement of the workover activities;

- Quarterly monitoring during the workover activities period; and

- Once following completion of the workover activities.

In addition to the above, a programme will be developed to monitor for compliance with relevant regulatory standards. This programme will also ensure that subcontractors are meeting contractual obligations with respect to work practices and design specifications (eg Project emission standards). Monitoring will be carried out by the MPRL E&P and/or by an appointed third party.

A detailed Environmental Monitoring Plan should be developed to present the background, objective, methodology and reporting requirements of the monitoring programme.

7.3.5 Compliance Auditing

Beyond the routine inspection and monitoring activities conducted, compliance audits will be carried out internally by MPRL E&P to ensure compliance with regulatory requirements as well as their own HSE standards and policies. Audits to be conducted will also cover the subcontractor self-reported monitoring and inspection activities. The audit shall be performed by qualified staff and the results shall be communicated to the General Manager and management board.

The audit will include a review of compliance with the requirements of the ESIA and of this ESMP and include, at minimum, the following:

- Completeness of EHS documentation, including planning documents and inspection records;

- Conformance with monitoring requirements;

- Efficacy of activities to address any non-conformance with monitoring requirements; and

- Training activities and record keeping.

There will be a cycle of audits into specific areas of the Project such as waste management, and effectiveness of local content plans and discharge controls.

The frequency of audits will be risk based and will vary with the stage of the project (more frequent during construction and in the early stages of the project) and will depend on the results of previous audits.

7.3.6 Corrective Action

Impacts will be identified and associated risks addressed before an incident occurs. Investigating a 'near miss' or actual incident after it occurs can be used to obtain valuable lessons and information that can be used to prevent similar or more serious occurrences in the future.

MPRL E&P will implement a formal non-compliance and corrective action tracking procedure for investigating cause and identifying corrective actions in response to accidents or environmental or social non-compliances. This will ensure coordinated action between MPRL E&P and its subcontractors. The HSE coordinator will be responsible for keeping records of corrective actions and for overseeing the modification of environmental or social protection procedures and/or training programs to avoid repetition of non-conformances and non-compliances.

7.4 MANAGEMENT PLANS

The goal of this ESMP is to ensure full compliance with the Project's policies and with mitigation, monitoring and other commitments made in the ESIA Report. While this ESMP should also be treated as a high-level, framework document, it is linked to a number of detailed management plans as described below which will be developed to lay out the specifications for compliance with specific environmental and social elements.

7.4.1 Related Management Plans

A range of management plans will be developed to provide assurances that the outcomes of the ESIA are able to be implemented. These management plans will detail the management and mitigation measures required to be implemented, the time frame and responsibilities for their implementation, detailed training requirements, inspections/audits to check implementation, and reporting requirements. Where responsibilities will lay with bodies external to MPRL E&P (e.g. Contractors) the invitations to tender and contracts will contain specific clauses that bind contractors and sub-contractors. This will apply to all tiers of contractors, with penalties for non-compliance also set out in the contracts and rigorously enforced by MPRL E&P.

The key management plans are outlined in *Table 7.6* with information on how these relate to the activities and impacts being discussed in the ESIA Report, including reference to who has lead responsibility.

Table 7.6 ESMP Hierarchy of Key Plans

Plan Name	Includes	Plan Owner
ESMP	Overarching plan linking to other Management Plan	MPRL E&P
Terrestrial Habitat Reinstatement Plan	The plan will identify provisions for sourcing native species from nursery and procedures for replanting. It will also identify priority areas for rehabilitation including at for instance de-facto protected areas such as near monastery and near cultural heritage location if trees or vegetation are planned to be cleared from these locations. Rehabilitation of vegetation on seismic lines will also be provided.	MPRL E&P or a third party administered under the Environmental and Social Management Plan
Waste Management Plan	Project-related waste handling procedures for hazardous and non-hazardous wastes.	MPRL E&P
Emergency Preparedness Plan	Administration (policy, purpose, distribution, definitions, etc), organization of emergency areas (command centres, medical stations, etc), roles and responsibilities, communication systems, emergency response procedures, emergency resources, training and updating, checklists (role and action list and equipment checklist) and business continuity and contingency.	MPRL E&P
Spill Response Plan	As part of the ERP, describes the spill preventative measures and spill response procedures	MPRL E&P
Fire Risk Management Plan	As part of the ERP, including communications protocols and measures to control any fires that do arise and as well as identify where fire control measures should be located.	MPRL E&P
Traffic Management Plan	Controls over prescribed routes, driver training, vehicle maintenance, speed restrictions, appropriate road safety signage, and vehicle loading and maintenance measures and vetting procedures.	MPRL E&P
Environmental Monitoring Plan	Groundwater monitoring, routine effluent and discharge monitoring and air quality monitoring, noise monitoring, terrestrial ecology monitoring etc.	MPRL E&P or a third party administered under the Environmental and Social Management Plan

Plan Name	Includes	Plan Owner
Culture Heritage Standard Operating Procedures	Standard Operating Procedures (SOP) to act suitably in consonance with the regulatory requirement and beliefs and faith of the community, if any, for culture heritage.	MPRL E&P
Livelihood Restoration Plan	Developed based on the assessment of various livelihood restoration options available and preferred by the community and reflective of the needs of the community. The LRP should also have clear reporting and monitoring indicators and the implementation mechanism including the institutional mechanism for the implementation of the same.	MPRL E&P

7.4.2 *Contractor Environmental Management Plan(s)*

The Project will engage contractors to carry out Project activities. The contractors are responsible for performing all work:

- In compliance with relevant national and international HSE legislation and regulations, and with other requirements to which the project subscribes;
- In conformance with the Project's ESMP; and
- In accordance with contractual technical and quality specifications.

The Project will also provide specifications for environmental and social compliance and performance (through this ESIA and ESMP and the associated plans) and, as a contractual requirement, the contractor will develop and provide to the Project its own specific management plans demonstrating how they intend to comply with the stipulated requirements.

Contractors must also provide documentation detailing their plans for:

- Implementing the measures required in the ESIA and this ESMP;
- Local content;
- Logistics; and
- Community relations.

The contractor management plans must conform to the requirements of the Project's overarching plans. Contractor plans will be reviewed and approved by MPRL E&P and incorporated into, and form part of, the Project's overall ESMP.

Contractors will be required to self-monitor against their plan and the contractor's compliance with the plan will be routinely monitored by MPRL E&P directly or by third-parties. Contractors will be required to submit

regular reports of monitoring activities and the project will review these on a regular basis. An external assurance process will be conducted on an annual basis the results of which will be disclosed at completion of the process.

As a contractual requirement, the subcontractors are required to provide sufficient resources to manage HSE aspects of the work to be performed. This includes providing resources to ensure compliance of next tier subcontractors and a process for emergency stop-work orders in response to monitoring triggers.

7.5 EMERGENCY PREPAREDNESS AND RESPONSE

MPRL E&P has developed plans and procedures to identify the potential for and response to environmental accidents and health and safety emergency situations and for preventing and mitigating potentially adverse environmental and social impacts that may be associated with them.

Emergency preparedness and response will be reviewed by MPRL E&P on at least an annual basis and after the occurrence of any accidents or emergency situations to ensure that lessons learnt inform continuous improvement. Emergency exercises will be undertaken on a regular basis to confirm adequacy of response strategies. Investigations of accidents or incidents will follow formal documented procedures.

8 PUBLIC CONSULTATION & DISCLOSURE

8.1 METHODOLOGY & APPROACH

It is understood that Myanmar presently has a set of EIA Procedures being drafted by the MOECAF for achieving environmental protection. While Version 8 of the procedures is currently under review, the requirements of the latest version publically available (Version 4) since 2013 were taken into account while undertaking the ESIA for the seismic survey.

These procedures require the following steps to be undertaken as part of the EIA process in context to stakeholder engagement and disclosure of information:

- Scoping exercise:
    - Disclose information about the proposed Project to the public and civil society through local media, including by means of the prominent posting of legible sign boards and advertising boards at the Project Area which are visible to the public; and
    - Arrange the required complement of consultation meetings as advised by the Ministry, with local communities, potentially PAPs, local authorities, community based organizations, and civil society.
- EIA process:
    - Take into consideration the views, concerns and perceptions of the stakeholders that could be affected by the Project or who otherwise have an interest in the Project.
    - The EIA should include the results of public consultations and negotiations with the affected population on the environmental and social issues.
    - Timely disclosure of all relevant information about the proposed Project and its likely adverse impacts to the public and civil society through the local and national media, the website of the Project Proponent, at public places such as libraries and community halls and sign boards at the Project Area visible to the public.
    - Arrange consultation meetings at the national, state and local level with PAPs, authorities, community based organizations and civil society.
    - Undertake consultations with concerned government organizations including the Ministry, the concerned sector ministry, regional government authorities, and others.

- Field visits for the Ministry and concerned government organizations.

In keeping with these requirements, the engagement activities as part of the scoping and impact assessment process for the Project were undertaken, and are described in the following subsections.

8.2 *EVALUATION OF EFFECTIVENESS OF ENGAGEMENT DURING IMPACT ASSESSMENT STAGE*

In terms of undertaking the engagement activities during the scoping and impact assessment process, an attempt was made to conform to the EIA procedures for Myanmar as well as the applicable reference framework for the project. In keeping with this, prior to the commencement of the scoping exercise, meetings were held with the local authorities and the MOGE to identify the key stakeholders and the most appropriate manner in which to undertake the consultations.

Also, prior to the engagement activities for the scoping exercise, Project information was disclosed to the community in the form of pamphlets. However, keeping in mind the literacy levels of the community, the effectiveness of this means of information disclosure was not considered adequate. Thus, in order to ensure that the community had an understanding of the proposed Project activities and the impact assessment process, at the beginning of each consultation, a brief understanding was provided of the proposed Project activities and the purpose of the consultation.

In addition to these measures, certain additional engagement activities have been identified for the future phases of the project, and these are discussed in the following sub sections.

8.3 *FURTHER ON-GOING CONSULTATIONS*

While the above mentioned engagement has been undertaken as part of the impact assessment process, stakeholder engagement is understood to be a process undertaken throughout the life of the Project. In keeping with this, a stakeholder engagement plan has been prepared, which identifies the engagement activities to be undertaken throughout the remaining life of the Project. The proposed engagement activities are to include focus group discussions, community meetings, individual discussions, surveys and checklists etc.

These engagement activities will be undertaken in consultation with MOGE, with the following purpose:

- Allowing the local stakeholders to have an understanding of the Project activities across the various phases.

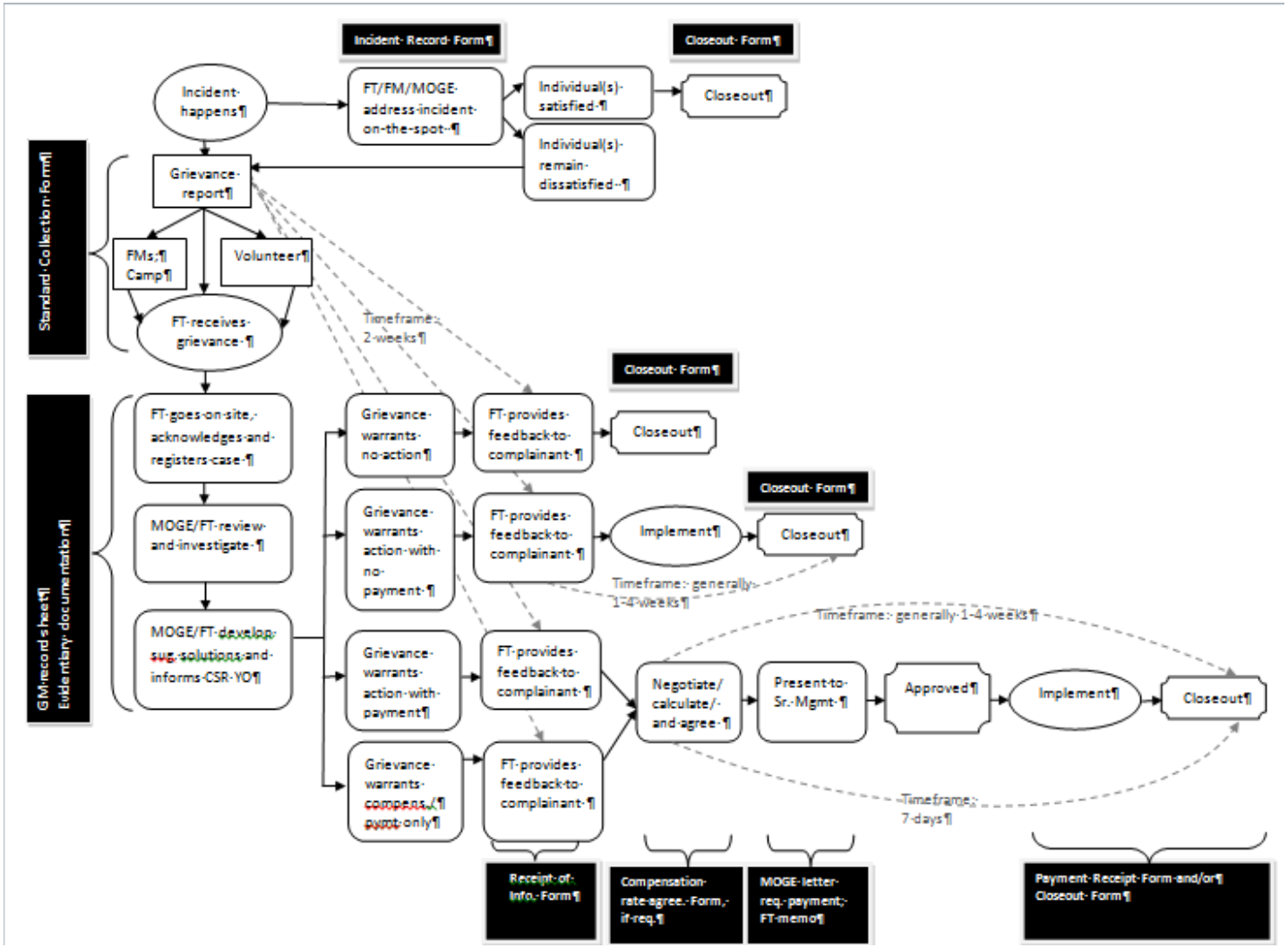
- To monitor the effectiveness of the mitigation measures for the Project impacts.

- To allow the local stakeholders to provide their feedback on the most desirable manner in which engagement can be undertaken as well as the efficacy of the mitigation measures and the community development activities to be undertaken.

8.3.1 Grievance Redressal Mechanism

In addition to these activities identified, a key form of engagement with the community will be the grievance redressal mechanism (GRM) of MPRL E&P, which will be implemented in the Project Area. The key purpose of the GRM will be to allow for an understanding to be developed of the community's perception towards the Project, especially in regards to the engagement and compensation process. The following figure provides an understanding of the GRM process proposed for the Project.

Figure 8.1 Grievance Redressal Process



8.4 *DISCLOSURE*

In addition to the proposed engagement activities and GRM for the remaining life of the Project, information disclosure will be undertaken through the life of the Project. This information disclosure will be aimed at allowing for the local stakeholders to develop an understanding of the Project activities across the various phases, and the implementation of the mitigation measures identified and the community development activities. The relevant information will be disclosed through the life of the project through pamphlets and reports being made available to the local community, through display of information in community areas and the Project Area signboards and verbally during the engagement activities with the local stakeholders.

Apart from this, the ESIA report for this Project will also be disclosed to the community, in keeping with the EIA procedures of Myanmar. This disclosure will be undertaken through the local media, in which a summary of the report will be provided, the website of the Project Proponent where the ESIA report will be uploaded and verbally in consultation meetings with the local community, if instructed by the MOECAF. On the basis of the feedback thus received, the ESIA will be reviewed and updated. This updated ESIA will then be finally disclosed to the local stakeholders, if deemed necessary.

For the purpose of consultation meetings, the villages will be informed of the purpose of meeting at least 2-3 days ahead before the day of the meeting, so as to allow the community to be prepared in terms of its expectations and queries. Furthermore, MPRL E&P will ensure that any reports disclosed will be made available in the local language in the village head offices or other common areas, as agreed with the community.

Annex A

Plant Species Recorded within the Study Area

Annex A List of Plant Species Recorded within the Study Area

No	Scientific Name	Family	Common Name(s)	Habit	IUCN Redlist status	Remark	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
1	*Abelmoschus esculentus* (L.) Moench	Malvaceae	Okra	Shrub	Not Assessed	Common		**v**	**v**	**v**
2	*Abrus precatorius L.*	Fabaceae	Bead Vine, Black-eyed Susan, Crab's Eyes, Indian Liqourice	Climber	Not Assessed	Common	**v**		**v**	
3	*Acacia auriculiformis* Cunn. Ex Benth.	Fabaceae	Earleaf Acacia	Tree	Least Concern	Common		**V**		**v**
4	*Achyranthes aspera* L.	Amarantaceae	Prickly Chaff Flower, Devil's Horsewhip	Herb	Not Assessed	Common			**v**	**v**
5	*Acmella uliginosa (Sw.) Cass.*	Asteraceae	-	Herb	Not Assessed	Very common	**v**	**v**	**v**	**v**
6	*Albizia lebbek* Benth.	Fabaceae	Lebbeck, Woman's Tongues Tree	Tree	Not Assessed	Common	**v**	**v**		**v**
7	*Albizia procera* Benth.	Mimosaceae	Black Siris, False Lebbeck, Forest Siris	Tree	Not Assessed	Common				
8	*Artocarpus heterophyllus* Lam.	Moraceae	Jack	Tree	Not Assessed	Common				**v**
9	*Azadirachta indica* A. Juss.	Melicaceae	Neem Tree	Tree	Not Assessed	Very common	**v**	**v**		**v**

No	Scientific Name	Family	Common Name(s)	Habit	IUCN Redlist status	Remark	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
10	*Bambusa siamensis* Kz.	Poaceae	Monastery Bamboo	Bamboo	Not Assessed	Common	v		v	v
11	*Bauhinia purpurea* L.	Fabaceae	Orchid Tree, Hong Kong Orchid Tree, Purple Bauhinia, Camel's Foot, Butterfly Tree, Hawaiian Orchid Tree	Tree	Least Concern	Common			v	v
12	*Bignonia spathacea* L. f.	Bignoniaceae	-	Tree	Not Assessed	Common			v	
13	*Borassus flabellifer* L.	Arecaceae	Sugar Palm	Tree	Endangered	Common	v		v	
14	*Bridelia burmanica* Hook.f.	Phyllanthaceae	-	Small tree	Not Assessed	Common			v	
15	*Bridelia retusa* (L.) Spreng.	Euphorbiaceae	-	Tree	Not Assessed	Common	v		v	
16	*Buchanania lanzan* Spreng.	Anacardiaceae	-	Tree	Not Assessed	Common			v	
17	*Butea monosperma* (Lam.) Taub	Fabaceae	Flame Tree Petals	Tree	Not Assessed	Common				
18	*Canavalia ensiformis* DC.	Fabaceae	Jack Bean	Climber	Not Assessed	Common	v	v	v	v
19	*Capparis tenera* Dalz.	Capparaceae	-	Shrub	Not Assessed	Common		v	v	v

No	Scientific Name	Family	Common Name(s)	Habit	IUCN Redlist status	Remark	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
20	*Capsicum annuum* L.	Solanaceae	Chilli Pepper, Bell Pepper		Not Assessed	Common		v	v	v
21	*Carica papaya* L.	Caricaceae	Papaya	Small tree	Not Assessed	Common		v	v	v
22	*Cassia alata* L.	Fabaceae	Candelabra Bush, Candle Bush, Golden Candelabra Tree	Shrub	Not Assessed	Common		v		v
23	*Clerodendrum siphonanthus* R. Br.	Lamiaceae	-	Shrub	Not Assessed	Common			v	v
24	*Cocos nucifera* (L.)	Arecaceae	Coconut	Tree	Not Assessed	Common		v	v	
25	*Crotalaria striata* DC.	Fabaceae	Streaked Rattlepod	Shrub	Not Assessed	Common	v	v	v	
26	*Cyperus* sp.	Cyperaceae	Papyrus Sedges, Flatsedges, Nutsedges, Umbrella-Sedges, Galingales	Marsh plant	Least Concern	Common			v	
27	*Desmodium triquetrum* (L.)DC.	Fabaceae	Tick Clover	Shrub	Not Assessed	Common		v		v
28	*Didymosperms nanum* H. Wendl. & Drude	Arecaceae	-	Small tree	Not Assessed	Common		v		
29	*Dipterocarpus caudatus*	Dipterocarpaceae	-	Tree	Not Assessed	Common	v			

No	Scientific Name	Family	Common Name(s)	Habit	IUCN Redlist status	Remark	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
30	*Dipterocarpus obtusifolius* Teysm.	Dipterocarpaceae	-	Tree	Least Concern	Common				
31	*Emblica officinalis* Gaertn.	Phyllanthaceae	Indian Gooseberry	Tree	Not Assessed	Common			v	
32	*Eucalyptus albens* Miq.	Melastomaceae	White Box	Tree	Not Assessed	Common	v	v	v	
33	*Eupatorium odoratum* L.	Asteraceae	-	Shrub	Not Assessed	Common	v	v		
34	*Euphorbia hirta* L.	Euphorbiaceae	-	Shrub	Not Assessed	Common				
35	*Ficus chittagonga* Miq.	Moraceae	Cluster Fig	Tree	Not Assessed	Common			v	
36	*Garuga pinnata* Roxb.	Burseraceae	-	Tree	Not Assessed	Common			v	v
37	*Heliotropium ovalifolium* Forssk.	Boraginaceae	Grey Leaf Heliotrope	Herb	Least Concern	Common			v	v
38	*Hibiscus hastatus* L. f.	Malvaceae	Purau Teruere, Tahiti Hibiscus	Shrub	Not Assessed	Common	v	v		
39	*Hygnophila phlomoides* Nees.	Acanthaceae	-	Herb	Not Assessed	Common		v	v	
40	*Ipomoea hederifolia* L.	Convolvulaceae	Batatillo, Tropical white morning-glory	Climber	Not Assessed	Common		v	v	

No	Scientific Name	Family	Common Name(s)	Habit	IUCN Redlist status	Remark	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
41	*Ipomoea* sp.	Convolvulaceae	Moring Glory, Sweet potato, Bindweed, Moonflower	Climber	Not Assessed	Common		v	v	v
42	*Jussiaea suffruticosa* Linn.	Onagraceae	Mexican Primrose-willow	Shrub	Not Assessed	Common		v	v	v
43	*Lagerstroemia villosa* Wall.	Lythraceae	-	Tree	Not Assessed	Common		v	v	
44	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Indian Ash Tree	Tree	Not Assessed	Common		v		
46	*Leucaena glauca* Benth.	Fabaceae	Cassie, Cowbush	Small tree	Not Assessed	Common	v	v		
48	*Leucas aspera* (Willd.) Link.	Laminaceae	-	Shrub	Not Assessed			v		
49	*Mangifera indica* L.	Anacardiaceae	Mango	Tree	Data Deficient	Very common	v	v		
51	*Markhamia stipulata* (Wall.) Seem.	Bignoniaceae	Cat-tail Tree	Tree	Not Assessed	Common				v
52	*Mikania scandens* (L.) Willd.	Asteraceae	Climbing Hempvine	Climber	Not Assessed	Common		v	v	v
53	*Mimosa dulcis* Roxb.	Fabaceae	Madras Thorn, Manila Tamarind, Sweet Inga	Tree	Not Assessed	Common	v	v		v
54	*Mimosa pudica* L.	Fabaceae	Sensitive Plant	Herb	Least Concern	Very common	v	v	v	v

No	Scientific Name	Family	Common Name(s)	Habit	IUCN Redlist status	Remark	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
55	*Mimusops elengi* Roxb.	Sapotaceae	Spanish Cherry, Bullet Wood	Tree	Not Assessed	Common		**v**		
56	*Morinda tinctoria* Roxb.	Rubiaceae	Indian Mulberry	Small tree	Not Assessed	Common		**v**		
57	*Moringa oleifera* Lam.	Moringaceae	Drumstick Tree, Horseradish Tree	Tree	Not Assessed	Common		**v**		
58	Mucuna prurita Hk.	Fabaceae	Velvet Bean	Climber	Not Assessed	Common		**v**		
60	*Musa* sp.	Musaceae	Banana	Herb	Not Assessed	Very common		**v**		**v**
61	*Oroxylum indicum* Vent.	Bignoniaceae	Midnight Horror	Tree	Not Assessed	Common		**v**		**v**
62	*Oryza sativa* L.	Poaceae	Asian Rice	Grass	Not Assessed	Common			**v**	**v**
63	*Physalis minima L.*	Solanaceae	Pygmy Groundcherry	Herb	Not Assessed	Common	**v**		**v**	**v**
64	*Plumbago zeylanica* L.	Plumbaginaceae	Ceylon Leadwort, Doctorbush	Shrub	Not Assessed	Common				**v**
65	*Poinciana regia* Bojer.	Caesalpinaceae	Royal Poinciana	Tree	Not Assessed	Common		**v**		
66	*Premna latifolia* Roxb.	Lamiaceae	Dusky Fire Brand Bark	Tree	Not Assessed	Common				

No	Scientific Name	Family	Common Name(s)	Habit	IUCN Redlist status	Remark	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
67	*Psidium guajava* L.	Myrtaceae	Guava, Yellow Guava, Lemon Guava	Tree	Not Assessed	Common		**v**		**v**
68	*Pterocarpus macrocarpus* Kz.	Fabaceae	Burma Padauk	Tree	Not Assessed	Common		**v**		
69	*Rauvolfia serpentina* (L.) Benth.	Apocynaceae	Indian snakeroot, Sarpagandha	Shrub	Not Assessed	Common		**v**	**v**	
70	*Saccharum narenga* Wall.	Poaceae	-	Grass	Not Assessed	Common			**v**	**v**
71	*Saccharum officinarum* L.	Poaceae	Sugarcane	Grass	Not Assessed	Common			**v**	
72	*Salmalia malabarica* (DC.) Schott & Endl.	Malvaceae	-	Tree	Not Assessed	Common	**v**			
73	*Sesbania aculeata* Pers.	Fabaceae	-	Shrub	Not Assessed	Common				
74	*Sida spinosa* L.	Malvaceae	Prickly Fanpetals	Shrub	Not Assessed	Common				
75	*Sida veronicaefolia* Lam.	Malvaceae	Country Mallow, Flannel Weed	Shrub	Not Assessed	Common			**v**	**v**
76	*Solanum melongena* L.	Solanaceae	Eggplant		Not Assessed	Common		**v**	**v**	**v**
77	*Spilanthes acmella* L.	Asteraceae	Toothache Plant, Paracress	Herb	Not Assessed	Common			**v**	

No	Scientific Name	Family	Common Name(s)	Habit	IUCN Redlist status	Remark	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
78	*Streblus asper* Lour.	Moraceae	Siamese Rough Bush, Toothbrush Tree	Small tree	Not Assessed	Common			v	
79	*Strychnos nux-vomica* L.	Loganiaceae	Nux Vomica, Poison Nut, Quaker Buttons	Tree	Not Assessed	Common			v	
80	*Tamarindus indica* L.	Fabaceae	Tamarind	Tree	Not Assessed	Common	v	v		
81	*Tectona grandis* L.f.	Lamiaceae	Teak	Tree	Not Assessed	Common				
82	*Terminalia alata* Heyne & Roth.	Combretaceae	Crocodile Bark	Tree	Not Assessed	Common				
83	*Terminalia catappa* L.	Combretaceae	Indian Almond	Tree	Not Assessed	Very common		v		
84	*Terminalia pyrifolia* Kz.	Combretaceae	Lein	Tree	Not Assessed	Common				
85	*Thumbergia laurifolia* Lindl.	Acanthaceae	Laurel Clock Vine, Blue Trumpet Vine	Climber	Not Assessed	Common				
86	*Tridax procumbens* L.	Asteraceae	Coat Buttons, Tridax Daisy	Herb	Not Assessed	Common			v	
87	*Typha* sp.	Cyperaceae	Bulrush	Marsh plant	Not Assessed	Common			v	
88	*Vigna catjang* Walp.	Fabaceae	Catjang	Shrub	Not Assessed	Common		v	v	v

No	Scientific Name	Family	Common Name(s)	Habit	IUCN Redlist status	Remark	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
89	*Xylia dolabriformis* Benth.	Fabaceae	Ironwood Of Burma	Tree	Not Assessed	Common	**v**	**v**	**v**	
90	*Zea mays* L.	Poaceae	Maize	Grass	Not Assessed	Common		**v**	**v**	**v**
91	*Ziziphus jujuba* (L.) Mill & Lam.	Rhamnaceae	Red Date, Chinese Date	Tree	Not Assessed	Common		**v**	**v**	**v**
92	*Ziziphus rugosa* Lam.	Rhamnaceae	Chunna berry	Small tree	Not Assessed	Common	**v**	**v**	**v**	

Annex B

Bird Species Recorded within the Study Area

Annex B Full List of Bird Species Recorded within the Study Area in December 2014

No.	*Scientific name*	Common name	IUCN Status	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
1	*Milvus migrans*	Black Kite	Least Concern	v			
2	*Accipiter badius*	Shikra	Least Concern	v		v	
3	*Falco tinnunculus*	Common Kestrel	Least Concern	v			v
4	*Bubulcus coromandus*	Eastern Cattle Egret	Not Assessed				v
5	*Egretta intermedia*	Intermediate Egret	Not Assessed				v
6	*Egretta garzetta*	Little Egret	Least Concern				v
7	*Ardeola bacchus*	Chinese Pond-heron	Least Concern				v
8	*Streptopelia orientalis*	Oriental Turtle Dove	Least Concern	v			v
9	*Metopidius indicus*	Bronze-winged Jacana	Least Concern	v	v	v	v
10	*Streptopelia tranquebarica*	Red Turtle-dove	Least Concern	v		v	v
11	*Columba livia*	Rock Dove	Least Concern		v	v	v
12	*Treron Phoenicopterus*	Yellow-Footed Green-Pegion	Least Concern		v	v	v
13	*Cypsiurus balasiensis*	Asian Palm-swift	Least Concern		v	v	v
14	*Hirundo rustica*	Barn Swallow	Least Concern		v	v	
15	*Vanellus indicus*	Red-wattled Lapwing	Least Concern	v			v
16	*Dicrurus macrocercus*	Black Drongo	Least Concern	v	v	v	v
17	*Lanius collurioides*	Burmese Shrike	Least Concern				v
18	*Halcyon smyrnensis*	White-breasted Kingfisher	Least Concern				v

No.	*Scientific name*	Common name	IUCN Status	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
19	*Coracias benghalensis*	Indian Roller	Least Concern				v
20	*Merops orientalis*	Asian Green Bee-eater	Least Concern			v	v
21	*Megalaima haemacephala*	Coppersmith Barbet	Least Concern	v	v		v
22	*Centropus sinensis*	Greater Coucal	Least Concern	v			v
23	*Corvus splendens*	House Crow	Least Concern		v		
24	*Copsychus saularis*	Oriental Magpie-Robin	Least Concern		v	v	v
25	*Pycnonotus jocosus*	Red-Whiskered Bul Bul	Least Concern		v	v	v
26	*Pycnonotus cafer*	Red-Vented Bul Bul	Least Concern	v	v	v	v
27	*Pycnonotus blanfordii*	Streak-eared Bul Bul	Not Assessed	v	v	v	v
28	*Sturnus contra*	Asian Pied Starling	Least Concern	v	v	v	v
29	*Acridotheres burmannicus*	Vinous-breasted Starling	Not Assessed	v	v	v	v
30	*Acridotheres tristis*	Common Myna	Least Concern	v	v	v	v
31	*Acridotheres fuscus*	Jungle Myna	Least Concern				v
32	*Acridotheres cristatellus*	Crested Myna	Least Concern			v	v
33	*Saxicola maura*	Siberian Stonechat	Not Assessed	v			v
34	*Prinia flaviventris*	Yellow-bellied Prinia	Least Concern	v	v	v	v
35	*Turdoides gularis*	White-throated Babbler	Least Concern				v
36	*Orthotomus sutorius*	Common Tailorbird	Least Concern	v	v		v
37	*Passer montanus*	Eurasian Tree Sparrow	Least Concern	v	v	v	v
38	*Passer domesticus*	House Sparrow	Least Concern	v	v	v	v

No.	*Scientific name*	Common name	IUCN Status	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
39	*Motacilla alba*	White Wagtail	Least Concern			v	v
40	*Lonchura punctulata*	Scaly-breasted Munia	Least Concern	v	v	v	v
41	*Lonchura striata*	White-rumped Munia	Least Concern	v			
42	*Lonchura atricapilla*	Chestnut Munia	Least Concern	v	v	v	v

Annex C

Herpetofauna Species Recorded within the Study Area

Annex C Full List of Herpetofauna Species Recorded within the Study Area in December 2014

No.	Scientific name	Common name	Family name	IUCN Status	Remark	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
	Snake	**(Myan Aung)**							
1	*Naja kaouthia*	Monocled Cobra	Elapidae	Least Concern	Interview	**v**	**v**	**v**	**v**
2	*Bungarus fasciatus*	Banded Krait	Elapidae	Least Concern	Interview	**v**	**v**	**v**	**v**
3	*Daboia russelii*	Eastern Russell's Viper	Viperidae	Least Concern	Interview	**v**	**v**	**v**	**v**
4	*Ptyas korros*	Indo-Chinese Rat Snake	Colubridae	Not Assessed	Interview	**v**	**v**	**v**	**v**
5	*Ahaetulla nasuta*	Long-nosed Whip Snake	Colubridae	Not Assessed	Observed	**v**			**v**
6	*Amphiesma stolata*	Buff Striped Keelback	Colubridae	Not Assessed	Observed	**v**	**v**	**v**	**v**
7	*Enhydris enhydris*	Striped Water Snake	Colubridae	Least Concern	Observed				**v**
8	*Xenochrophis piscator*	Checkered Keelback	Colubridae	Not Assessed	Observed	**v**	**v**	**v**	**v**
9	*Xenopeltis unicolor*	Asian Sunbeam Snake	Colubridae	Least Concern	Observed	**v**			**v**
10	*Ophiophagus hannah*	King Cobra	Xenopeltidae	Least Concern	Interview	**v**			
	Skink								
11	*Eutropis multifasciata*	Common Sun Skink	Scincidae	Not Assessed	Observed	**v**	**v**	**v**	**v**

No.	Scientific name	Common name	Family name	IUCN Status	Remark	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
	Lizard								
12	*Calotes versicolor*	Common Garden lizard	Agamidae	Not Assessed	Observed	v	v	v	v
13	*Gekko gecko*	Tokay Gecko	Gekkonidae	Not Assessed	Interview	v	v		
14	*Varanus sp*	Monitor Lizard	Varanidae	Not Assessed	Interview	v			
	Turtle/Tortoise								
15	*Dogania subplana*	Malayan Soft-shelled Turtle	Trionychidae	Least Concern	Interview	v			
16	*Indotestudo elongata*	Yellow-headed Tortoise	Testudinidae	Endangered	Interview	v			
	Frog and toad								
17	*Hoplobatrachus tigerinus*	Indian bull frog	Dicroglossidae	Least Concern	Interview			v	v
18	*Fejervarya limnocharis*	Asian Grass Frog	Dicroglossidae	Least Concern	Observed			v	v
19	*Polypedates maculatus*	Himalayan Tree Frog	Rhacophoridae	Least Concern	interview			v	v
20	*Bufo melanostictus*	Black-spectacled Toad	Bufonidae	Least Concern	Observed	v	v	v	v
21	*Kaloula pulchra*	Malaysian Narrowmouth Toad	Microhylidae	Least Concern	Interview	v	v	v	v
22	*Microhyla ornata*	Ant Frog	Microhylidae	Least Concern	Observed	v			

Annex D

Mammal Species Recorded within the Study Area

Annex D Full List of Mammal Species Recorded within the Study Area in December 2014

No.	*Scientific name*	Common Name	Family	Remark	IUCN Status	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
1	*Echinosorex gymnura*	Moonrat	Erinaceidae	Observed	Least Concern	v	v	v	v
2	*Niviventer fulvescens*	Chestnut White-bellied Rat	Muridae	Observed	Least Concern	v	v	v	v
3	*Callosciurus pygerythrus*	Hoary-bellied Squirrel	Sciuridae	Observed	Least Concern	v	v	v	v
4	*Lepus peguensis*	Burmese Hare	Leporidae	Interview	Least Concern	v			v
5	*Bos taurus*	Domestic Ox	Bovidae	Observed	Least Concern				v

Annex E

Butterfly Species Recorded within the Study Area

Annex E Full List of Butterfly Species Recorded within the Study Area in December 2014

No.	Species	Common name	Family	Remark	IUCN Status	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
1	*Danaus chrysippus* (Linnaeus, 1758)	Plain Tiger	Nymphalidae	Very Common	Not assessed	v	v	v	
2	*Danaus genutia* (Cramer, 1779)	Common Tiger or Striped Tiger	Nymphalidae	Very Common	Not assessed	v	v	v	
3	*Euploea core godartii* (Lucas, 1853)	Common Indian Crow	Danaidae	Common	Not assessed		v	v	v
4	*Tirumala limniace (*Butler, 1866)	-	Danaidae	Common	Not assessed		v	v	v
5	*Papilio memnon agenor* (Linnaeus, 1768)	Great Mormon	Papilionidae	Not Rare	Not assessed	v			v
6	*Papilio polytes (*Cramer, 1775)	Common Mormon	Papilionidae	Very Common	Not assessed	v	v	v	v
7	*Papilio demoleus* (Linnaeus, 1758)	Lime Butterfly	Papilionidae	Very Common	Not assessed	v	v	v	v
8	*Junonia almana* (Linnaeus, 1758)	Peacock Pansy	Nyamphalidae	Common	Least Concern	v	v	v	
9	*Junonia atlites* (Linnaeus, 1758)	Grey Pansy	Nyamphalidae	Common	Not assessed	v		v	
10	*Athyma perius (*Linnaeus, 1758)	Common Sergeant	Nyamphalidae	Common	Not assessed	v	v	v	v
11	*Hypolimnas bolina* (Linnaeus, 1758)	Common Eggfly	Nyamphalidae	Common	Not assessed	v	v	v	v
12	*Cupha erymanthis* (Druary, 1773)	-	Nyamphalidae	Common	Not assessed	v	v	v	v

No.	Species	Common name	Family	Remark	IUCN Status	Shrubland	Developed area	Agricultural Land	Cultivated Land / Village
13	*Eurema hecabe* (Linnaeus, 1758)	Common Grass Yellow	Pieridae	Very Common	Not assessed		v	v	v
14	*Catopsilia scylla* (Linnaeus, 1763)	Orange Emigrant	Pieridae	Common	Not assessed		v	v	v
15	*Hebomoia glaucippe* (Linnaeus, 1758)	Great Orange Tip	Pieridae	Common	Not assessed	v	v	v	v
16	*Catopsilia pomona* (Fabricius, 1775)	Common Emigrant	Peridae	Very Common	Not assessed	v		v	v
17	*Pareronia valeria* (Cramer, 1776)	Wanderer	Peridae	Un Common	Not assessed	v			v
18	*Leptosia nina* (Fabricius, 1793)	-	Peridae	Common	Not assessed	v	v	v	v
19	*Delias eucharis* (Drury, 1773)	-	Peridae	Common	Not assessed		v	v	

Annex F

Fish Species Recorded within the Study Area

Annex F Full List of Aquatic Fauna Species Recorded within the Study Area in December 2014

No.	Species	Common name	Local name	Family	IUCN Red list Status
1	*Mystus gulio*	Long Whisker Catfish	Nga Yway	Bagridae	Least Concern
2	*Channa striata*	Snakehead Murrel	Nga Yant	Channidae	Least Concern
3	*Tenualosa ilisha*	Hilsa	Ngathalauk	Clupeidae	Least Concern
4	*Pangasius pangasius*	Pangas Catfish	Nga Dan	Pangasiidae	Least Concern
5	*Xenentodon cancila*	Freshwater Garfish	Nga-PhaunYoe	Belonidae	Least Concern
6	*Sperata seenghala*	Giant River Catfish	Ngagyaung	Bagridae	Least Concern
7	*Mystus vittatus*	Striped Dwarf catfish	NgaZinYainn	Bagridae	Least Concern
8	*Clarias batrachus*	Walking Catfish	NgaKhu	Clariidae	Least Concern
9	*Heteropneustes fossilis*	Stinging Catfish	NgaKyee	Heteropneusti-dae	Least Concern
10	*Ompok bimaculatus*	Butter Catfish	Nga Nu Thann	Siluridae	Near Threatened
11	*Catla catla*	Catla	Nga-gyin Gaungpwa	Cyprinidae	Not assessed
12	*Notopterus notopterus*	Bronze Featherback	NgaPhe	Notopteridae	Least Concern
13	*Anabas testudineus*	Climbing Perch	Nga Byay Ma	Anabantidae	Data Deficient
14	*Oreochromis niloticus*	Nile Tilapia	TeLarr Pee Yarr	Cichlidae	Not assessed
15	*Cirrhinus mrigala*	Mrigal	Nga Gyinn	Cyprinidae	Least Concern
16	*Wallago attu*	Wallago	Nga Bat	Siluridae	Near Threatened
17	*Silonia silondia*	Silong catfish	Ngamyin	Schilbeidae	Least Concern
18	*Monopterus albus*	Rice Swampeel	Ngashint Nee	Synbranchidae	Least Concern
19	*Monopterus cuchia*	Gangetic Mudeel	Ngashint Mwe	Synbranchidae	Least Concern
20	*Macrognathus zebrinus*	Zebra Spiny Eel	Ngamway doe	Mystacembeli-dae	Least Concern
21	*Channa panaw*	Panaw Snakehead	Nga Panaw	Channidae	Least Concern

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