Environmental, Social and Health Impact Assessment (ESHIA) for Onshore Myanmar Land Seismic Survey Activities in Block RSF-5






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Acronyms and Definitions:

Acronym	Definition
ADSL	Asymmetric Digital Subscriber Line
AIDS	Acquired lmmunodeficiency Sindrome
ALTID	Asian Land Transport Infrastructure Development
AN	Antenatal
AOW	Arakan Oil Watch
ARPU	Average Revenue per User
ASEAN	Association of Southeast Asian Nations
ASSK	Aung San Suu Kyi
AUP	Assistance to Uprooted People Programme
AZE	Alliance for Zero Extinction
BCG	Bacillus Calmette Guerin
BEWG	Burma Environmental Working Group
BGF	Border Guard Forces
BOD	Biological Oxygen Demand
BRIDGE	Bridging Rural Integrated Development and Grassroots Empowerment
CEDAW	Convention on the Elimination of All Forms of Discrimination against Women
CI	Conservation International
CIA	Central Intelligence Agency
CMT	Crisis Management Team
CRPD	Convention on the Rights of Persons with Disabilities
CPI	Consumer Price Index
CRC	Convention on the Rights of the Child
CSF	Child-Friendly School
CSIS	Center for Strategic and International Studies
COD	Centre of Gravity
COG	Chemical Oxygen Demand
DBKA	Democratic Karen Buddhist Army
DDA	Department for Development Affairs
Downstream	Moving or situated in the direction from that in which a current flows.
DPT	Diphtheria, Pertussis, Tetanus
ECC	Emergency Communications Centre
ECD	Diphtheria, Pertussis, Tetanus
EPC	Early Childhood Development
ER	Emergency Response
ERI	Engineering, Procurement, and Construction
EBAs	Earth Rights International
ESA GOCE	European Space Agency Gravity field and Ocean Circulation Explorer Endemic bird Areas
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
ESHIA	Environmental, Social and Health Impact Assessment
ES&SR	Environment Safety and Social Responsibility
EU	European Union

Acronym	Definition
FAO	Food and Agriculture Organization
FFP	Fund for Peace
FG	Focus Group
GDP	Gross Domestic Product
GEF	Global Environment Facility
GGE	General Government Expenditures
GHG	Greenhouse gas
GJP	Global Justice Center
Grav-Mag	Gravimetric and Magnometric
HIV	Human Immunodeficiency Virus
HPPs	Hydra Power Plants
HR	Human Resources
IBAs	Important Bird Areas
IDMC	Internal Displacement Monitoring Centre
IDP	Internally Displaced People
IBAT	Integrated Biodiversity Assessment Tool
IfS	Instrument for Stability
ILO	International Labour Organization
IMT	Incident Management Team
Indigenous people	Ethnic groups and native communities
INC	Initial National Communication
IPIECA	The global oil and gas industry association for environmental and social issues
IUCN	International Union for Conservation of Nature
LA	Local Authorities
LiDAR	Light Detection And Ranging
LNDO	Lahu National Development Organization
L.O.D.	Limit of Detection
KDNG	Kachin Development Networking Group
KESAN	Karen Environmental and Social Action Network
KIA	Kachin Independence Army
KII	Key Informant Interviews
KIO	Kachin Independence Organisation
MBBS	Bachelor of Medicine, Bachelor of Surgery
MCDC	Mandalay City Development Committee
MDG	Millennium Development Goals
MEPE	Myanmar Electric Power Enterprise
mGal	Milligals
MIMU	Myanmar Information Management Unit
MMI	Modified Mercalli Intensity
MNCWA	Myanmar National Working Committee for Women's Affairs
MPBND	Ministry of Progress of Border Area Development and National Races and Development Affairs
MPI	Multidimensional Poverty Index

Acronym	Definition
NAAQS	National Ambient Air Quality Standards
NCEA	National Commission for Environmental Affairs
NGO	Non-governmental organization
NHC	National Health Committee
NSA	Non-State actor
NDSC	National Defence and Security Council
NEED	Network for Environmental and Economic Development
NGOs	Non-Governmental Organizations
NHC	National Health Committee
NLD	National League for Democracy
NOAA	National Oceanic and Atmospheric Administration
NSA/LA	Non-State actor programme and Local Authorities
nT	nanoteslas
OCHA	Office for the Coordination of Humanitarian Affairs
OPHI	Oxford Poverty and Human Development Initiative
ORT	Oral Rehydration Therapy
PAC	Public Access Centres
PAs	Protected Areas
PARIS	Public and Relative Information Service
PCCDs	Pollution Control and Cleansing Departments
Pcgn	Permanent Committee on Geographical Names
PR	Public Relations
PN	Postnatal
PSC	Production Sharing Contract
QC	Quality Control
Sapawa	Shan Sapawa Environmental Organization
SGM	Shwe Gas Movement
SPDC	State Peace and Development Council
SRTM	Shuttle Radar Topography Mission
SSA-N	Shan State Army-North
SSA-S	Shan State Army-South
S.T.E.L.	Short Term Exposure Limit
TBBC	Thailand-Myanmar Border Consortium
TMO	Township Medical Officer
TSS	Total Suspended Solids
UASC	Unaccompanied and Separated Children
UNHCR	United Nations High Commissioner for Refugees
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFPA	United Nations Population Fund
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund

Acronym	Definition
UNICEF	United Nations Children's Fund
US EPA	United States Environmental Protection Agency
UWSA	United Wa State Army
WASH	Water, Sanitation and Hygiene Sector
WDPA	World Database on Protected Areas
WHO	World Health Organization
WMO	World Meteorological Organization

Myanmar
ESHIA STUDY FOR THE EXPLORATION BLOCK RSF-5

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1.0 EXECUTIVE SUMMARY

1.1 INTRODUCTION

This Executive Summary reports the main finding of the Environmental, Social and Health Impact Assessment (ESHIA) of the onshore hydrocarbon exploration activities in Myanmar, planned by eni within Block RSF-5. The ESHIA is structured in compliance with the new EIA Procedure, issued by the Ministry of Natural Resources and Environmental Conservation.

The project foresees the acquisition of a 3D seismic survey within the Block, aimed at identifying potential opportunities for further hydrocarbon exploration activities. The 3D seismic survey will be executed on a portion of 500 km^2.

This is issued as the final ESHIA report and it is based on the initial ESHIA completed by ERM (Environmental Resource Management), which was integrated with primary information gathered during the environmental and social surveys performed by International Environmental Management Co., Ltd. (IEM) in association with the local partner Environmental Quality Management Co., Ltd. (EQM).

The baseline sampling and survey has been carried out in March 2016 covering the area potentially affected. The area comprises of Magway and Myothit townships. Minhla has been not included, because it is across the Ayeryrawaddy river and no seismic activities will be conducted in this township, so there is no risk of potential impact.

1.2 THE PROJECT

The Project follows the invitation to apply for hydrocarbon exploration authorizations and subsequent hydrocarbon exploitation licenses, announced by the Republic of the Union of Myanmar on 17/02/2013 and awarded to eni Myanmar BV on the 31st July 2014.

The Block RSF-5 covers an area of 1292 km^2 in the Magway Region of Myanmar as shown in Figure 1.1. The full surface coordinates for Block RSF-5 are presented below (Table 1.1).

Table 1.1 Coordinates for Block RSF-5

Point	Longitude (E)	Latitude (N)
1	95°00'00"	20°15'00"
2	95°20'00"	20°15'00"
3	95°20'00"	19°55'00"
4	95°00'00"	19°55'00"

Source: Myanmar Ministry of Energy, 2013

Figure 1.1 Location of the RSF-5 Block

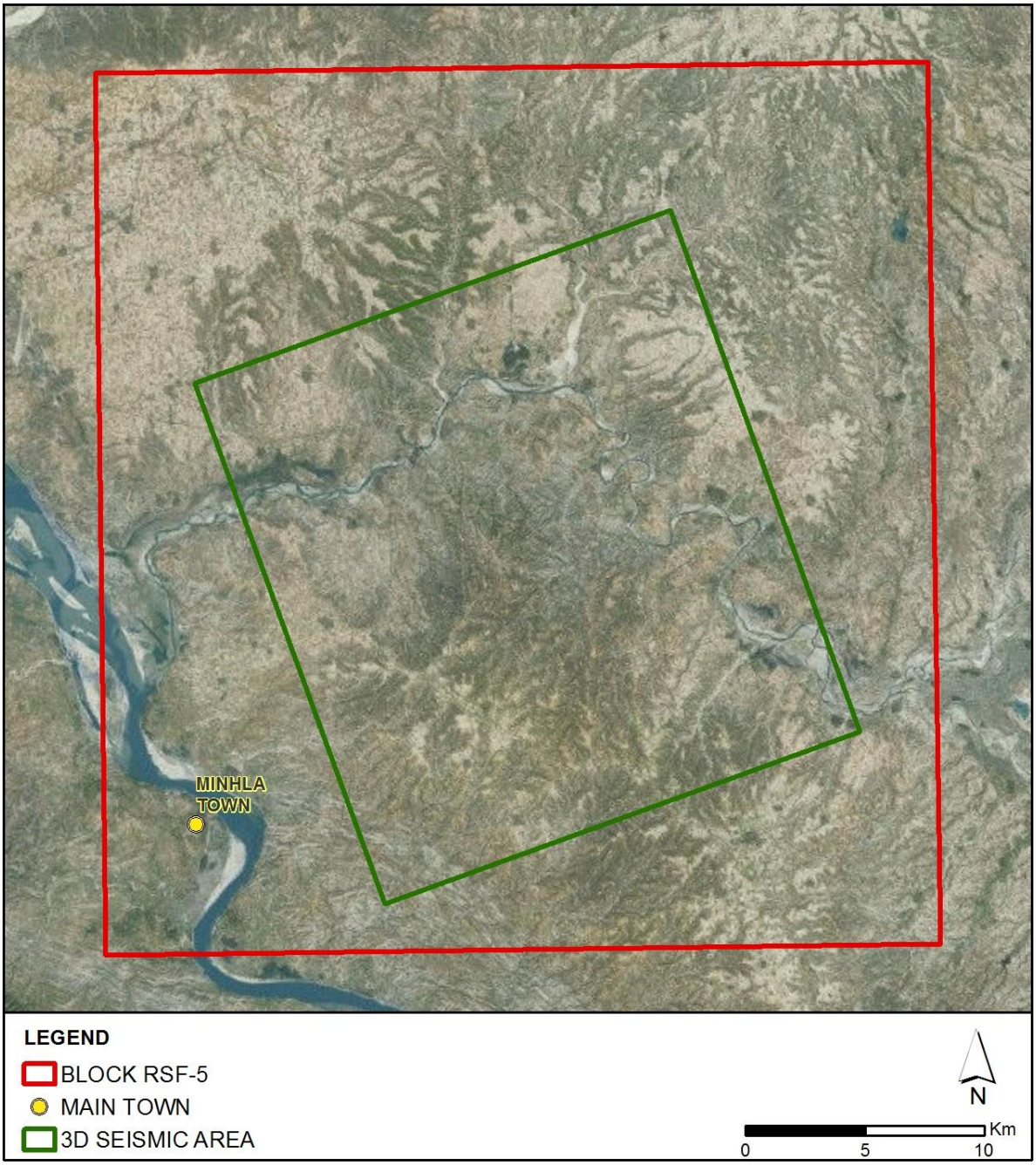


The Project includes a 3D seismic survey in the Block RSF-5. Such activities represent the first step of the exploration plan. The seismic survey has been designed based on the results of the geophysical feasibility study performed by eni specialists. The objective of the 3D seismic survey is to give a deep understanding of the subsurface geological features in the RSF-5 block, by obtaining an high quality of imaging features through a better Signal-to-Noise ratio and a good continuity of main targets. The 3D seismic volume

will also provide a dense dataset, which should allow attempting a more reliable sedimentogical and structural interpretation.

The layout of the 3D seismic surveys is shown in Figure 1.2.

Figure 1.2 3D seismic survey layout



Block RSF-5 is characterised by the dominance of agricultural land made of small and medium size crops. The seismic acquisition technique to be used will be carried out using explosive and vibroseis depending by the terrain and the environmental sensitivities. The existing road network not always (mainly tracks and dirt roads) gives sufficient access also to small vehicles. A discrete proportion of the Study Area is characterized by the presence of erosional landforms (gullies and rills) and natural vegetation (mainly shrubs, and forest patches along rivers and trenches), so line clearance is expected. A policy of minimal clearance will be implemented by *eni Myanmar* in accordance with *eni* Standards.

Prior to the arrival of geophysical equipment on site, the sources and receivers lines will be surveyed in order to avoid any important sensitivity along the lines.

Along the receiver lines, a series of geophones (small devices act to detect the seismic energy whose sizes are approximately 3 cm in diameter and 20 cm in length) will be pierced in the ground by hand every four (4) meters and connected by a low voltage electric cable. Since these operations will be carried out without any mechanical support, no damages to the environment are foreseen along such lines.

Along the source lines, in order to minimize as much as possible the environmental impact, *eni Myanmar* will instruct his seismic contractor to utilize:

a) Four vibroseis in line with vibropoints every 50 m only when the terrain conditions and distances between trees is sufficient to grant the entrance with vibroseis without support of bulldozer and woodcutting. The use of vibroseis is preferred because during the dry season (the seismic acquisition will last from January to April 2017) and on a natural grass coat, the environmental impact will be negligible and for a short time period;
b) Explosive charges every 50 m located at 25 m depth, wherever the vegetation density and the terrain morphology do not allow vibroseis accessibility. It this case, portable drilling units (about 2.5 x 2.5 m) carried and mounted on site by specialized personnel will be utilized to drill the 6 inches shot holes. All drilling locations will be properly selected, and in case, moved from the theoretical coordinates, in the most suitable place in order to avoid cutting any trees. Moreover, we ensure that no chemical material or additives will be added to the drilling waters. Any material resulting from the drilling will be removed and disposed accordingly with the local legislation, no consequences of the activities will be detectable once the operation will be completed, as the area will be totally restored.

Finally, in the swampy areas, permanently flooded during the year, portable drilling units will be used and the operation will be localized in an area of few square meters and for a short time period.

The use of bulldozer, trucks, crane and other mean of transportation will be limited only to guarantee the safe access to these areas, but never applied within the forest and the plantations.

3D survey comprises about 21,600 source locations and 23,300 receiving locations. In order to calibrate the shallow seismic signal, upholes will be drilled along the survey lines. The location of upholes (at least 20 Upholes at min depth of 60m) will be carefully considered to avoid particularly sensitive areas.

One main camp will be placed for the duration of the whole survey and fly camps to follow the seismic activities carried out using explosive will be organized as well. The Main explosive Storage will be located at the nearby Military Compound. Considering that the main explosive storage centre is too far from the area of operations, a temporary explosive storage center will be realized in proximity of the survey area. In any case this

area will be approved by MOD (Ministry Of Defence). The location of the structure will be defined by the contractor personnel and *eni Myanmar* representatives during the camp preparation. The structure will be fenced and access will be allowed only to authorized and trained personnel. Adequate fire prevention systems will be installed. A specific Site Abandonment Plan will be prepared by *eni Myanmar*, documenting how the camp locations should be closed. Camp closure will involve the removal of all vehicles, equipment, infrastructure and fixtures.

1.2.1 Benefits of the Project

In line with the National Plan, this Project of Hydrocarbon exploration will provide new job opportunities, the possibility to benefit from the use of hydrocarbon resources within the country

1.2.2 Implementation schedule

The overall duration of the activities will be within the 3 year Exploration Period of the PSC.

1.3 LEGISLATIVE FRAMEWORK AND APPLICABLE LEGISLATION

The ESHIA document has been developed following the requirements of the new EIA Procedure, issued by the Ministry of Natural Resources and Environmental Conservation of Myanmar.

The ESHIA considers the following relevant guidelines, standards and regulations:

- international policies, principles and standards, adopted by eni, such as IPIECA and WHO guidelines, IFC standards;
- international treaties and agreements, ratified by Myanmar, related to environmental issues;
- Myanmar administrative, environmental, social, health and safety regulations. As important issue for the development of the Project, special attention is given recent laws related to ESHIA requirements: the Environmental Conservation Law (2012), the Environmental Conservation Rules, (2014), the Foreign Investment Law (2012) as amended in 2015 and the Foreign Investment Rules (2013) the Environmental Impact Assessment Procedures (2016), Environmental Quality Standards (2016), the Protection and Preservation of Cultural Heritage Region law (1998) as amended in 2009, the Protection and Preservation of Ancient Monuments Law (2015) and the Protection and Preservation of Antique Objects Law (2015);
- Eni SpA and *eni Myanmar* standards, technical and operating guidelines, instruction and procedures.

1.4 DESCRIPTION OF THE SURROUNDING ENVIRONMENT (BASELINE)

The aim of the ESHIA baseline is to provide an exhaustive overview of the characteristics of the different environmental, social and health components present in the Block RSF-5, representing the Project Location. The Baseline is based on a primary and secondary data

review, through specific environmental, social and health surveys, contacts and interviews with public and local stakeholders.

The seismic survey extent covers the majority of the RSF-5 Block, the Area of Influence for environmental social and health baseline has been defined as the boundary of the Block itself as shown in Figure 1.3.

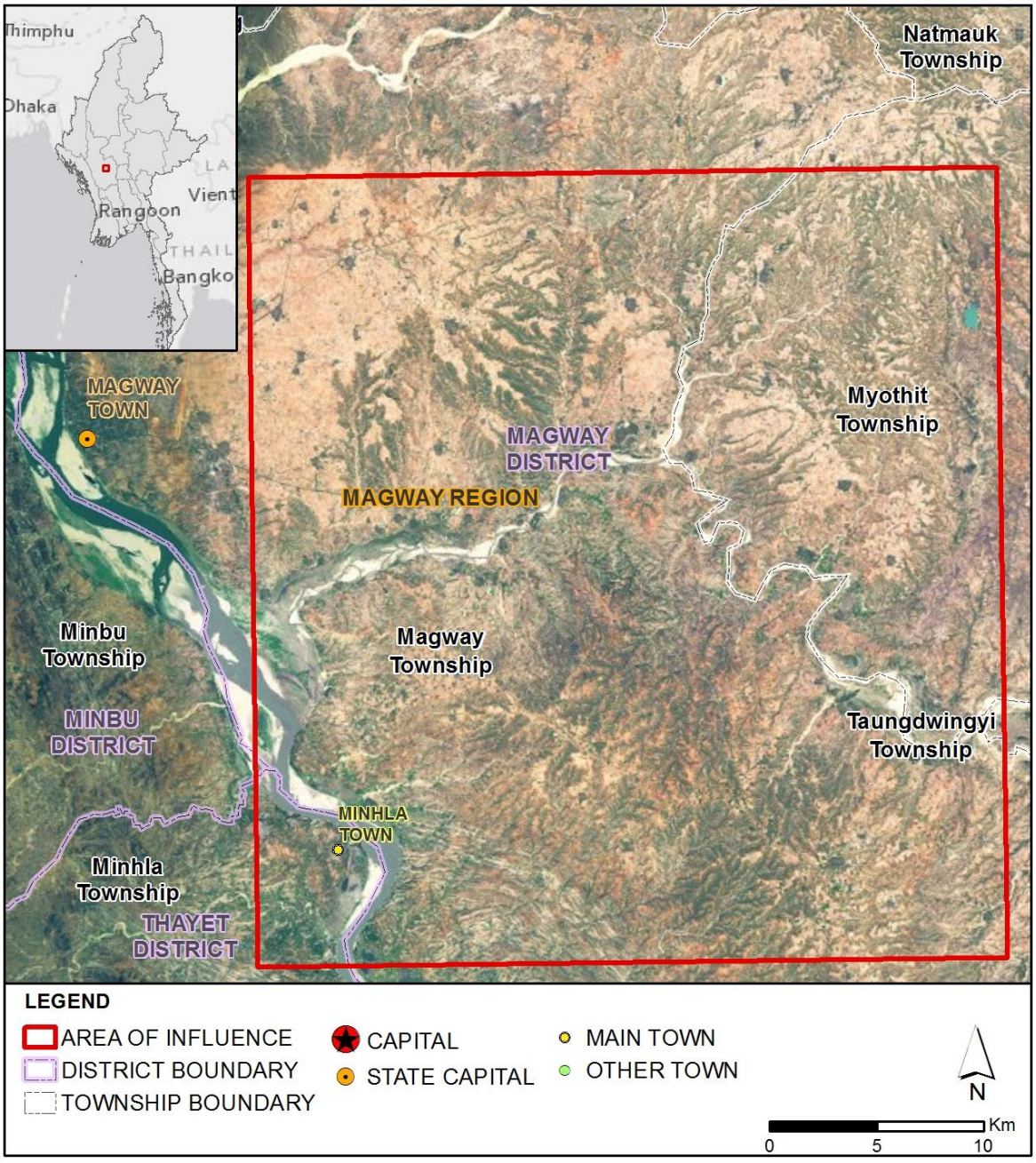
The baseline characterization of the Study Area has been conducted through a review of the available information, mainly at national and regional levels, and through a high level analysis of the environmental, social and health components. On the basis of a satellite images analysis and land cover information of the whole Block, the following main land cover areas have been identified (described in section 5.3.5 of the ESHIA):

- bare soil;
- vegetation;
- building;
- roads;
- urban area;
- urban vegetation;
- crop lands;
- green land;
- island river;
- River Gravel and Rock White;
- rivers;
- water bodies.

The project footprint on these land cover areas has been considered as the basis for the related Impact Assessment.

The Baseline has been organised into six main components: Physical, Biological, Socio-Economic, Cultural, Visual and Health.

Figure 1.3 Area of Influence for Environmental, Social, and Health Baseline



1.4.1 Physical Component

Block RSF-5 is located in Magway Region as shown in Figure 1.3 in the rain shadow area of the Yakhaing Yoma; and it obtains most of its rainfall from the southwest monsoon. The undulating land is subjected to severe erosion under rain and strong winds. The capital city is Magway Town (1994 population estimated at 300,000). Located in the Central Lowlands and drained by the Ayeyarwady River and its major tributaries, the region is

characterized by folded small mountain ranges, a volcanic line and the Sagaing Fault zone, and a regionally significant active right lateral strike-slip fault.

Air

- Block RSF-5 is located between the following two climatic zones: Tropical savannah climate (around the Dry Zone), and Tropical steppe climate (Dry Zone);
- The region is characterized by a monthly maximum temperature between 30.2 and 40.4 and a monthly minimum temperature between 13.5 and 26.6°C. The highest temperature is measured in April;
- The highest values of humidity are recorded from June to November that corresponds approximately to the cyclones season. During the wet season the heat index is located in the "Extreme Caution" section, it ranges between 95 and 100;
- The visibility is low during the rainy season, whereas in the dry season is good, even though foggy sunrise and sunset are frequent;
- The region is dominated by a southwest monsoon wind in the rainy season and northeast monsoon wind in the winter or cold-dry season Mean monthly wind speed at Magway Meteorological Station varies from 0.88 mph to 1.67 mph;
- Air quality monitoring stations were deployed in RSF-5 from March 11 to March 24, 2016, to collect ambient air monitoring data along with meteorological data on wind speed, wind direction, temperature and relative humidity;
- Baseline air quality concentrations from the baseline indicate the Particulate levels (PM2.5 and PM10) were higher than WHO guidelines at all locations except Nwar Hla Village and Taung Yar Taw Village, which only had PM10 values above the guidelines. NO_2, CO, O3 and atomic radiation levels met the standards. Other gases such as VOC, NH3, CH_4 were monitored to reveal the existing baseline ambient concentration. SO_2 levels exceeded guidelines at all locations except (2) stations including Pay Pin San village and Taung Yar Taw under Magway Township. Although the SO_2 levels of above two villages were not above the guideline, these were close to the limit;
- Concerning Climate Change, trends for CH_4 and N_2O emissions in agriculture sector clearly highlighted the sharp increase in the short term (2000-2005) as well as in the long term (1990-2030). Waste sector also showed an increase in CH_4 emissions due to the population growth. Land use change and forestry sector is the major emitter which comes from deforestation. On the other hand, total annual CO_2 removals by natural forests are also declining steadily due to the decrease of the natural forest areas;
- Due to the rural nature of the area, the acoustic environment is considered to have low ambient noise levels. Ambient noise measurements taken within Block RSF-5 had 24-hour equivalent noise levels ranged from 40.4 dB (A) to 61.5 dB (A). The time base for LAeq for "daytime" and "night-time" is 16 h and 8 h, respectively. The night noise level for Sai Kya, Pay Pin San, Gal Gyi Kone, Ma Nawt Kone and Nwar Hla were above the WHO standards Leq-Night guidelines for Outside bedrooms resulting in Sleep disturbance with window open (outdoor values). This is most likely the result of motorbike traffic and diesel generator use for electricity.

Water

- Block RSF-5 is located across the Ayeyarwady (Irrawaddy) river, which skirts the block at the south west corner but it doesn't touch the 3D survey grid. Yin Chaung river (a large Irrawaddy primary tributary) flows in the northern and Eastern portions of the 3D seismic area. Leik Chaung and Mon Chaung which depart from Yin Chaung in the north direction;
- Surface water sampling was completed at 14 locations within Block RSF-5, all parameters were within water quality standards except for pH, Total Dissolved Solid and

Manganese. pH was above standard for aquatic environments in seven locations. The high pH is due to the sampling being conducted during the dry season; in fact the river, streams and ponds had low water in the locations showing high pH. Manganese was detected above standard in three locations;

- The groundwater depth varied in the project area depending on the aquifers. The groundwater was found in the Block RSF-5 Survey in some areas in proximity of the ground surface starting from 1.83 m (6 ft) and quite deeper in other areas 231.65 m (~760 ft in tube well);
- Groundwater sampling was completed at 26 locations within Block RSF-5, High Total Dissolved Solids levels, exceeding the recommended levels for consumption, was recorded in the deep tube wells. The high Total Dissolved Solids appears to be caused naturally by evaporation, precipitation or rock weathering processes in the aquifers. This would explain why the villagers preferred to consume the groundwater from the shallow wells as all of them basically showed much lower levels of Total Dissolved Solids and salinity. PH was over maximum allowable levels in four locations. Manganese (Mn) was detected above standards in the ten versus twenty-six locations.

Land Cover

- The analysis allowed the detection of a series of main land cover classes as follows: bare soil, vegetation, building, roads, urban area, urban vegetation, crop lands, green land, island river, river gravel and rock white, rivers, water bodies.

Soil & Subsoil

- Block RSF-5 is located in the Central Lowlands, a fertile alluvial plain, intermittently cropped out by the mountain range and hills. A large active fault, the Sagaing Fault (Win Swe, 1981) crosses the eastern margin of this province;
- Block RSF-5 is characterized by the following three geological units: Irrawaddy Group and equivalents, Upper Pegu Group and marine brackish and terrestrial equivalents, Recent alluvium;
- The Area shows an altitude varying from 20m in the Ayeyarwady floodplain, up to 320m in the hilly areas. The slope in the area is flat or very gentle (<1%);
- Soil classes in Block RSF-5 are: Light Forest Soils (Cinnamon) Nitosol; Meadow Soils (Gleysol) and Meadow Alluvial Soil (Gleysol Fluvic); Red Brown Savanna Soils (Luvisol) and Dark Compact Soils (Vertisol);
- Overall Myanmar is considered seismologically unstable and prone to seismic risk. According to USGS, the Block RSF-5 is completely located in 7-8 MMI (according to MMI Modified Mercalli Intensity) area;
- No volcano is located within the Block RSF-5. However Myanmar has a few active volcanoes related to the subduction of the Indo-Pacific under the Eurasian tectonic plate.
- The land of Magaway region is mostly cultivated, not much natural vegetation is left. The landscape is mostly covered with mosaic croplands/vegetation;
- Soil sampling was completed at 20 locations within Block RSF-5. Soil pH ranged from 5.3 to 9.2 with locations eight locations) outside the standard. All soil samples were free of hydrocarbon contamination. With the exception of Arsenic (As), Nickel (Ni) and Chromium (Cr) metals data shows that all values are below standards for agricultural purposes. Nickel (Ni) was found above standards for agricultural use in three locations. One soil location had Arsenic (As), Nickel (Ni) and Chromium (Cr) metals above standards for agriculture use.

1.4.2 Biological Component

The whole territory of Myanmar (excluding the northern tip) is included in the Indo-Burma biodiversity hot spot, which was designated by the Conservation International organization. In 2009 NCEA (National Commission for Environmental Affairs) published the National Sustainable Development Strategy (NSDS) for Myanmar. A total of 14 conservation corridors and 43 Protected Areas have been identified in the country.

- No International protected areas are present in the Study Area;
- A key biodiversity area is present (the Ayeyarwaddy River Sinbyugyun to Minbu Section) within Block RSF-5; it covers less than 1% of the land within the block but is not in the seismic area;
- The whole Block RSF-5 is included in the Endemic Bird Area of Irrawaddy Plains;
- The nearest Protected Areas to the Block RSF-5 are the Shwesettaw Wildlife Santuary and the Wethtikan Bird Sanctuary;
- According to IUCN Red List, RSF-5 Block could hosts: 5 Critically Endangered species, 6 Endangered species, 9 Vulnerable species.
- On August 29-31, 2016 biodiversity reconnaissance survey was conducted and confirmed the presence of 32 species of birds and 2 species of mammals. Focused community interviews identified potentially a further 15 mammals, 13 birds, 30 species of reptile, 21 species of amphibian, 14 species of invertebrate, and 17 species of fish that may be resident or transient in the block. These include a number of species with special conservation status including 2 critically endangered species, 6 endangered, 7 vulnerable and 14 near threatened species;
- The IPIECA Methodology has been adopted in order to identify the habitats on the Area of interest. The resulting habitat types are: Grassland habitats, Forest habitats, Cultivated habitats and Wetland, river and lake habitats;
- The ecosystem Services involved are manifold and they can be grouped into the following categories: Provisioning, Regulating, Cultural. ESHIA section 5.4 contains the detailed list of Ecosystem Services.

1.4.3 Social Components

Block RSF-5 is located in Magway Region. This Region is situated in the rain shadow area of the Yakhaing Yoma and obtains most of its rainfall from the southwest monsoon. The undulating land, composed mainly of sandy loam with low fertility, is subjected to severe erosion under rain and strong winds.

Magway Region is made up of Magway, Minbu, Thayet, Pakokku and Gangaw districts, comprising 25 townships and 1,696 ward village-tracts. The capital city is Magway Town (1994 population estimated at 300,000). Other major towns are Pakokku and Minbu.

Magway Region is located in the Central Lowlands, a relatively low-lying terrain drained by the Ayeyarwady River and its major tributaries. Rolling hills, ridges and small mountains are present in some areas. The region is characterized by folded small mountain ranges, a volcanic line and the Sagaing Fault zone, a regionally significant active right lateral strike-slip fault.

The main findings for the socioeconomics baseline point of view are listed below:

- Myanmar is a resource-rich country, especially oil and gas, mining, and timber;
- Myanmar is an agricultural country, with about 70% of the population living in rural areas. The major agricultural production is rice, which covers about 60% of the country's total cultivated land area;

- Population below poverty line is 25.6%. The majority of people in Myanmar spend 70% of their income on food, with little left for health care and education for their children;
- in Myanmar, the adult literacy rate is quite high (92.3%). The majority of children of primary school age (90.2%) attend school; this value is slightly higher for the Magway Region (93.5%). However only 58.3% (55.8% in Magway Region) of the children of secondary school age are attending secondary school. At the national level there is no notable difference between boys and girls;
- the working age population of Myanmar is about 37.44 million and the working population is 30.13 million. So, the unemployment rate is 4%;
- Most of Myanmar's country roads are unpaved and many become impassable during the monsoon season.

1.4.4 Cultural Component

The main findings of the analysis of the cultural heritage available data are the following:

- Myanmar currently has one site on the World Heritage List, the Pyu Ancient Cities, which includes the remains of three brick, walled and moated cities of Halin, Beikthano and Sri Ksetra located in vast irrigated landscapes in the dry zone of the Ayeyarwady (Irrawaddy) River basin. The nearest site to the Study Area is the Beikthano site located 6 km from the closest shot-point. Vibration impact monitoring with the use of Peak Particle Velocity meter (PPV) will be carried out during seismic measurements in order to monitor vibrations level that may affect cultural sites that are in vicinity of seismic source. PPV measurements will be executed according to the local legislations. In case of lack of local norms, PPV procedure will be established based on the eni standard safety distance table;
- Myanmar has been referred to as the Land of Pagodas, as there are a considerable number of Buddhist pagodas; within the block RSF-5 there are 96 temples, all the archaeological sites are managed and monitored through the "Cultural Heritage Monitoring Plan".

1.4.5 Visual Component

The territory of the Block RSF-5 could be divided in the following main macro-areas, on the basis of a satellite images analysis:

- Agricultural areas, characterized by continuous agricultural plots, served by an intricate track network made of very narrow trails connecting isolated farms and the crop themselves. The area is served by the main natural drainage network, from which, small artificial trenches have been developed in order to serve the agricultural areas;
- Floodplains areas, dominated, thanks to high water availability, by intensive agriculture alternated to vigorous natural vegetation patterns, mainly grassland and small trees forest. The rivers are mainly braided and their beds are characterized by the presence of wide sand dunes and small islands. Many wide settlements are located in the floodplains and are connected with a network of major roads;
- Erosional landforms in hilly areas, dominated by presence of shrubs and bush with forest patches located close to minor tributaries and streams. These landforms are alternated to agricultural areas that occupy hills edges or valley bottoms. These zones are not served by a well-developed road network and settlements and sparse houses are rare;
- Settlements and villages.

1.4.6 Health Component

The health conditions in the Study Area presented in the ESHIA are based on a review of available information, mainly at national and regional levels. The main findings are summarized below:

- Access to health information and health services is limited for some population groups particularly vulnerable to health problems. These include people living in rural, remote and border areas, and low-income families in peri-urban areas;
- A National Health Plan is developed with the ultimate aim of ensuring health and longevity for the citizens. A long-term (30 years) visionary plan, the National Comprehensive Development Plan - Health Sector has been drawn up to meet the future health challenges;
- In Myanmar life expectancy at birth is 65.9 years for total population, 63.6 years for male and 68.5 years for female;
- In Magway Region the most common sources of drinking water are tube well/borehole (53.9%) and protected well (18.9%), but as many as 7.2% use unprotected wells and 10.6% surface water;
- In Myanmar access to improved sanitation facilities is strongly correlated with wealth and area of residence. In urban areas 94.4% of the population have access to sanitary means of excreta disposal, compared to 80.4% in rural areas, and only 59.8% of the poorest population have access to improved facilities, compared to 98.2% among the richest population;
- Magway Region has one of the highest infant mortality rate and under five mortality rate of Myanmar (respectively 72.9 deaths per 1,000 live births and 113.6 deaths per 1,000 live births). The maternal mortality ratio is 2.9 deaths per 1,000 live births (data from National Mortality Survey, 1999).

1.5 ASSESSMENT OF POTENTIAL IMPACTS AND MITIGATION MEASURES

Identification and assessment of the Project's environmental social and health impacts has been conducted for the 3D seismic survey activities of the Project.

The significance of each impact (positive or negative), has been assessed through the application of the following criteria in line with eni Standard requirements (*Environmental, Social and Health Impact Assessment in Exploration – AMTE – TG 002 r00*):

- temporal scale of the impact (i.e. temporary, short-term, long-term, permanent);
- spatial scale of the impact (i.e. local, regional, national, trans-boundary);
- sensitivity, resilience and/or importance of the receptor/resource that is being impacted;
- number of elements (including individuals, households, enterprises, species and habitats) that could be affected by the impact.

Proper mitigation measures have been identified and taken into account in the definition of residual impacts for each environmental social and health component analysed in the impact assessment.

1.5.1 Environmental Impacts

The seismic survey extent covers the majority of the RSF-5 Block. Potential impacts have been assessed for each of the following detected main land cover types: bare soil, vegetation, building, roads, urban area, urban vegetation, crop lands, green land, island river, river gravel and rock white, rivers and water bodies.

The potential environmental impacts associated with the Project are connected to the following components:

- air quality;
- noise and vibration;
- water;
- soil and subsoil;
- flora and vegetation;
- fauna and habitat;
- ecosystem services.

Impacts on environment have the potential to occur during the activities of the Project (seismic survey).

Potential impacts on the above mentioned components are reported in the following sections and have been summarized in Annex 3.

1.5.1.1 Air

- Impacts due to dust emission caused by micro-charges blast is expected to be low for all the land cover types. Mitigations such as: wet suppression, limited vehicles speed, dust control measures, periodical maintenance of the roads will be implemented.
- Impacts due to pollutants emission by vehicles and power generators exhausts is expected to be low for all the land cover types. Mitigations will be implemented such as: regular maintenance, vehicles use minimization, generators in line with WHO recommendations and located down-wind.

Taking into account the nature of the impact and the implemented mitigation measures, the overall evaluation of potential impacts from the activities related to the seismic survey are expected to be **Low** for the whole territory. This is mainly due to the characteristics of duration and extent of the impacts; both dust and pollutants emissions are considered temporary and limited to the operating sites and their immediate environments.

1.5.1.2 Noise & Vibration Emissions

- Short Term Impact due to noise & vibration emission during the site preparation and line clearance are expected to be low for the whole Area of Interest. Mitigations such as vehicles turning off when not in use will be implemented.
- Short Term Impact due to noise and vibration emission during the blasting activities is expected to be low for the whole Area of Interest. Reduction measures will be implemented such as: vehicles turning off when not in use, schedule of different noisy activities to occur concurrently since the combined effect may not be significant, limitation to noise activity to the least noise-sensitive hours.

Noise and vibration emission resulting from Seismic Survey activities can be considered temporary and limited to the operating sites and their immediate environments. Taking into account the implemented mitigation measures, the overall potential impacts is expected to be **Low** for the whole territory except for the area where are located settlements or villages, where the impacts have been evaluated as **Medium**. A Noise Monitoring plan will be developed in order to evaluate real noise emissions and effectiveness of mitigation measures.

1.5.1.3 Water

Sources of impacts on the water for seismic survey activities are: preparation of the site, line clearance and construction of roads, consumption of water, movements of vehicle; equipment and personnel, waste management. The resulting impacts and adopted mitigation measures are the following.

- Potential Impacts from unexpected Contamination of Water Resources with Solid and Liquid Waste are evaluated to be Medium. A specific Water and Waste Management plan will be performed (see ESHIA Section 8) and no discharge of liquid waste to water resources will be allowed.
- Potential Impacts from unexpected Contamination from Fuels, Lubricant Oils and Chemicals are evaluated to be Medium. Management measures to be adopted will be: temporary fuel storage carefully bounded, refuelling sites with appropriate spill containment equipment, personnel training in emergency spill response, no washing of machinery allowed near watercourses.
- Impacts from potential Effects Arising from Runoff are expected to be low. Mitigation measures to be adopted are: a storm water management strategy (within Environmental Management Plan), controlled access point for authorised vehicles only, minimisation of vegetation clearance, drains diversion if required, sediment retention through devices like silt fences and check dams, drainage system maintenance, geomorphological and vegetational restoration to prevent sediment runoff, avoid operation in alluvial plans in risky periods; groundwater quality and hydrogeological surveys to verify absence of contamination following uphole drilling.
- Effects of Sediment Plumes on Water Resources are expected to be low. Mitigation measures such as limited vehicle speed in proximity of water bodies or topsoil protected storage will be implemented.
- Consumption of Water Resources during site preparation and survey will cause an impact expected to be low for the whole Area of Interest. Bottled drinkable water will be supplied to the camp sites.
- Potential Contamination of Groundwater Quality & Hydrology during drilling of shot holes and shooting/recording are evaluated to be Medium. Mitigation measures to reduce Impacts to groundwater quality and hydrology include plugging holes with water flow suitable weight muds, use suitable charge and shot hole depth for local geology, provide drip pans and absorbents to contain any spillage, provide drainage and sediment traps around project area to reduce suspended particles in runoff from the well site and to contain minor oil spills.

Considering the potential of regional extent and the long duration, the impacts on freshwater due to potential contamination (liquid waste, waste, fuel, oil, etc.) has been evaluated as **Medium**. The impact on freshwater due to interference on hydrological and hydraulic regime, sediment plumes and water consumption are considered **Low.**

1.5.1.4 Soil & Subsoil

Sources of impacts on soil and subsoil are: preparation of the site, line clearance, construction of roads, down-hole drilling, movements of vehicles equipment and personnel, waste management. The resulting impacts and adopted mitigation measures are the following:

- Potential Impacts from unexpected contamination of the Soil are evaluated to be Medium. Mitigations such as reinforced concrete pads, storage tanks with secondary containment, paved areas in refuelling locations, Waste Management Plan.
- Impacts from potential Disturbance and Degradation are expected to be Low. Mitigation measures will be the following: erosional landforms will be avoided or, if this is no possible, minimized in survey planning; after heavy rainfall temporary surface stabilisation materials will be installed; vehicles access will be restricted to the traffic corridors. Erosion and sediment control measurements will be implemented.
- Impacts from land take are expected to be Low as no machinery will be allowed to leave the access roadways or the worksites.

The impact is expected to be **Low** for the whole territory except the potential contamination of soil in erosion landforms habitat that has been evaluated as **Medium**.

1.5.1.5 Flora and Vegetation

Sources of impacts on flora and vegetation are: preparation of the site, line clearance, construction of roads, down-hole drilling, movements of vehicles equipment and personnel, waste management. The resulting impacts and adopted mitigation measures are the following:

- Impacts from Loss of natural vegetation are expected to be Low (Medium for Erosional Landforms). A monitoring plan will be performed along the survey lines and at the campsite (§ 8.8.3, Biodiversity Action Plan); through an ante and post operam monitoring campaign, a record of the variability in species occurrence, abundance and distribution will be provided in the most sensitive habitats identified within the area of influence of the Project. Vegetational restoration will be implemented in natural and critical habitats.
- Impacts from Invasive alien plants are expected to be Low (Medium for Erosional Landforms). An ante – and post – operam monitoring will allow to define the presence of alien species.
- Impacts from Degradation of Abiotic Components of Ecosystems are expected to be Low (Medium for Erosional Landforms). Mitigations measures will be: minimization of earthworks, vegetational and geomorphological restoration suggested for habitats. The impact on flora and vegetation component due to Project activities is **Low** for the whole territory except for erosion landforms, where the impacts have been evaluated as **medium**.

1.5.1.6 Fauna and Habitats

Sources of potential impacts on fauna and habitats are: temporary land-take for Project construction; site clearance and preparation; use of machinery and heavy equipment; use storage and management of hazardous raw materials; production and management of domestic wastes; presence of workforce. The resulting impacts and adopted mitigation measures are the following:

- impacts from alteration of abiotic components in ecosystems are expected to be Low,
- impacts from modification of the Ecological Network are expected to be Low,

- impacts from increasing collision rate from traffic are expected to be Low.

With regards to the mitigation measures to minimise wildlife impact the use of night light will be limited; fences will avoid access of wild animals to the campsites. An ante and post operam monitoring plan will be carried out to assess any change in fauna and habitat.

The impact on fauna component due to Project activities is expected to be **Low** for the whole territory.

1.5.1.7 Biodiversity and Ecosystem Services

The Ecosystem Services impacts identification has been performed applying the IPIECA Ecosystem Services Guidance (IPIECA, 2011) for each of the four habitats detected in the study area. This approach provides a set of checklists to identify for the habitats involved in the area of influence, ecosystem service dependencies and impacts of oil and gas developments.

The mitigation measures are identified in the Social, Biological or Environmental Impact Assessment Sections.

1.5.2 Social Impacts

The potential social impacts associated with the Project are connected to the following components:

- economy and employment;
- infrastructures and public services;
- land and livelihood.

Potential impacts on the above mentioned components are reported in the following sections and have been summarized in Table 2 and Table 7 reported in Annex 3.

1.5.2.1 Economy and Employment

Project activities may bring potential positive impacts on the regional and local economy during the seismic survey phase, related to the creation of employment and economic development and diversification, as following:

- employment impacts, since *eni Myanmar* will contract a specialist survey company to undertake the work, the workforce will consist of a mixture of Burmese sourced from the local area and expatriates employed. The creation of indirect employment is expected to be important on a regional and local level; indirect employment includes people working for enterprises providing goods and services for the project;
- economic impacts, since the local economy is likely to benefit from an increase in spending and earning of personnel employed by the Project or of households and individuals owning services and facilities in the area surrounding the Project.

The following measures will be implemented to minimise any potential adverse impact on economy and employment and enhance any positive ones:

- sourcing local goods and services where possible: purchasing strategy that stipulates how national and local purchase of goods will be optimised;

- integrity of recruitment process: equal opportunities and non-discrimination will be guaranteed in the recruiting process. All contractors will also be encouraged to implement favourable local hiring guidelines. All job vacancies will be listed clearly with skills and experience required to fill the position and the duration of the employment contract. Clear information on the recruiting process and the selection criteria will be publically available;
- managing public expectations: the Project will provide clear information on the number and timescales of employment opportunities, trying to fulfil as much as possible expectations of the community and thus avoid calling effect into the Project area;
- meet with local authorities to discuss and design local employment hiring to limit impacts on local businesses and key agricultural seasons;
- employ qualified local workers;
- purchase local supplies and services, whenever possible;
- host a pre-project local community awareness program with communities to facilitate awareness of opportunities and benefits;
- terms of contract for recruitment of manpower in these companies needs to include emphasis on hiring locals, especially for unskilled and semi-skilled workforce;
- restrict workers to within project boundaries and do not allow local interaction within the communities.

The impacts on the economy and employment component, due to the seismic survey activities, can be considered **Positive**, since the development of the Project will give the possibility to persons to get new jobs, even if for a temporary period, and to gain new skills.

1.5.2.2 Infrastructures and Public Services

The following types of potential impacts have been identified:

- degradation and temporary disruption of road infrastructures, since an arise of heavy machinery and truck traffic, equipment and procurement of materials could be possible and the existing roads could be deteriorated as a result. This could potentially cause an increase in road accidents and disturbance to the population, having an indirect impact on the health and welfare of the community;
- increased pressure on public services and utilities, services and utilities will be purchased from local suppliers, where possible. All waste materials will be collected, stored and transported separately in appropriate and approved bins and containers;
- increased pressure on health care facilities, project employees will potentially utilise local health facilities located in Magway and Mandalay, but anyway the base camp will be equipped by its own medical facility and also doctors fully dedicated to the project will be hired, so the existing public health infrastructure will be not stressed.

The following specific mitigation measures should be employed during the seismic survey phase to reduce impacts on local infrastructures:

- the project will not use the electrical infrastructure, all power will be generated on site;
- the amount of waste that is generated will be minimised;
- the amount of waste that is recovered for recycling will be maximised, including segregation of recyclable wastes at source;
- the amount of waste that is deposited at landfill will be minimised;
- ensure all wastes are properly contained, labelled and disposed of in accordance with local regulations;

- dispose of waste in accordance with the waste management plan;
- primary health care and basic first aid for workers will be provided at worksites;
- notify the local authority on the oversized load and put an escort in-front of this convoy with horn and hazard lights;
- restrict/ avoid movement of heavy equipment during rush hours;
- provide traffic signs or flags at junction of access roads and main roads;
- investigate any complaints and handle appropriately. Keep records of complaints and follow-up;
- if the project needs to construct, upgrade or reroute access roads, the Operator must get permission from the appropriate government offices;
- strictly enforce training programs to reduce transport incident cases by its contractors;
- restore any damage to roads as caused by contractor or company;
- purchase or lease land for road access to campsite;
- restrict local traffic on eni Myanmar private access roads;
- cooperate with Military for storage and transport of explosives.

The potential impact on infrastructures and public services, due to the seismic survey, results as **Low** for the whole territory.

1.5.2.3 Land and Livelihood

During seismic survey, some portion of land will be used and consequently cause soil loss. The expected occupied land use will be related to the temporary occupation of the camp sites, the source locations and the down-hole drilling locations. All the facilities will be placed in bare lands or in arable lands. Local agricultural activities can be temporarily stopped in the neighbourhood of the receiving lines in case big machinery is involved.

As mitigation measure, the commitment of the Project will be to restore economic livelihoods to pre-Project levels. Moreover all affected households will be compensated for any loss of assets.

The potential impact on land and livelihood, due to the seismic survey, results as **Low** for the whole territory.

1.5.3 Cultural Impacts

Direct potential impacts on archaeological artefacts located in the proximity of project activities, during the seismic survey, include the following:

- Direct physical disturbance or damage to cultural heritage sites, due to the line clearance activities which will result in the disturbance of topsoil and subsoil;
- Degradation or damage to cultural heritage sites due to vibration, caused by the micro charges blast, but also by operation of machinery and heavy vehicle traffic.

As mitigation measure, the charges should be blasted at an adequate distance from the known sites: a visual inspection will be conducted along the route and any important sensitivity of high scientific or cultural value will be identified and avoided as appropriate. If a chance find of high importance will be discovered during seismic activities, the route will be changed and related procedures should be conducted as outlined by international and national standards.

The potential impact on cultural heritage, due to the seismic survey, results as **Low** for the whole territory.

1.5.4 Visual Impacts

Direct visual impacts during the seismic survey will be temporary and limited to small areas and will include the following:

- direct landscape losses or physical changes to landscape elements, including loss of vegetation, arising from line clearance;
- direct changes to the receiving landscape resulting from the introduction of temporary structures and facilities in correspondence of the camp sites;
- presence of machinery and vehicles associated with the seismic survey activities;
- lighting impact: for safety reasons, the camp sites will be illuminated during night time.

Particular mitigation measures are not needed during the seismic survey; only the reinstatement of the originally land cover will be carried out along the seismic lines and in correspondence of the camp site.

Appropriate mitigation measures will also be put in place in order to reduce the light pollution.

The potential impact on landscape, due to the seismic survey, results as **Low** for the whole territory.

1.5.5 Health Impacts

The following types of potential impacts on community health and welfare have been identified during the seismic survey phase:

- increased transmission of communicable diseases to the local population through interaction with the external workforce. Communicable diseases of concern are likely to include malaria, tuberculosis, leprosy, hepatitis, diarrhoeal diseases and acute respiratory infections. The presence of an external workforce has also the potential to lead to a local increase in sexually transmitted diseases;
- pressure on health care facilities. A light increased pressure on, and decreased access to, health care facilities could be possible throughout the seismic survey phase due to the workforce and potential changes in the disease profile of the local population;
- seismic activities will result in changes to the physical environment, with the potential to affect the health and welfare of communities. In particular it is expected a potential temporary annoyance due to the charges explosion noise and vibration for any receptor closest to work sites and a potential temporary annoyance due to the dust emission and exhaust emissions due to the charges explosion and the vehicles;
- impacts on community safety, in particular increased risk of road accidents, due to increased project-related traffic.

The following mitigation measures should be employed during the seismic survey phase to reduce any impacts on community health and welfare.

- implementation of good hygiene practices for the workers (such as hand washing), especially before eating, drinking, smoking and so on;
- monitoring local health trends in order to be aware of and respond appropriately to any negative health trends that may be linked to the Project and its workers;
- prevention of illness among workers in local communities through health awareness and education initiatives;
- ensuring that all workers receive education about transmission routes and the symptoms of the communicable diseases of concern;

- develop a training and awareness programme for contractors to deliver to their employees to ensure alignment with eni corporate requirements for occupational health and safety management including driving and traffic safety;
- ensure sufficient health services are made available by Contractors to meet the day to day needs of Project personnel and families without impacting on access to and overload local health care services for communities;
- implementation of a rapid response grievance mechanism;
- make sure that Company & Contractor undertake stakeholder engagement prior to the commencement of project activities to inform communities of the activities proposed, the timing of activities and the duration;
- make sure that Company & Contractor develop agreed routes for transportation for all Project movements (materials, goods and worker movements) to minimise risk of accidents.

The potential impact on community health, due to the seismic survey, results as **Low** for the whole territory except for the potential increased risk of transmission of communicable diseases, which results as **Medium**.

1.6 CUMULATIVE IMPACTS

eni Myanmar holds the hydrocarbon exploitation licence in the entire RSF-5 Block and no other O&G activity operates in the same Block; furthermore, based on the available data regarding the area, there is no evidence of other industrial activity which may have a potential of cumulative impacts with the project.

The exploration phase (seismic activities & drilling) is the first step in the O&G development cycle. It is a short term and temporary activity with low risk of cumulative impacts. Cumulative impacts will be investigated in greater detail during the future production phase of the project.

1.7 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

The purpose of the Environmental Management and Monitoring Plan (EMMP) is to define the framework and the required actions for the monitoring of the status and progress of a variety of sensitive receptors present in the study area. It also provides relevant information to evaluate the success of the mitigation measures for the project impacts identified by the ESHIA as well as compliance with applicable environmental standards.

In particular, the EMMP has the following objectives:

- To define the environmental monitoring requirements for the different receptors in accordance with the applicable national legislation;
- To provide tools to monitor compliance with the applicable eni Standards and facilitate any operational changes that may be needed;
- To monitor specific parameters in order to report on selected Key Performance Indicators (KPIs);
- To monitor the results in order to evaluate the success of the implemented mitigation measures in protecting the environment.

The preliminary EMMP has been outlined considering:

- eni Standards (Environmental, Social and Health Impact Assessment – doc. N. 1.3.1.47);
- applicable Myanmar legislation;
- international standards, in case of lack of provision in the national legislation.

The EMMP defines the monitoring requirements for all the environmental components affected by the Project, and provides details for their direct and effective implementation on site during the different developmental phases. In general, the EMMP aims to:

- estimate the inherent variation within the environment.
- compare the variation within the environment.
- make comparisons between different situations (for example, pre-survey and post-survey) and to detect changes.
- make comparisons against a standard or target level.
- evaluate the success of implemented mitigation measures.

The Plans included in the EMMP are the following:

- Noise Management Plan;
- Biodiversity Action Plan;
- Waste Management Plan;
- Water Management Plan;
- Cultural Heritage Management Plan;
- Emergency Plan.

1.8 PUBLIC CONSULTATION AND DISCLOSURE

Stakeholder engagement is a key element of the ESHIA process. The purpose of stakeholder engagement is to allow stakeholders to interact with the decision-making process, express their views and influence mitigation and technical solutions to concerns voiced during the process. Stakeholders include affected communities, enterprises and individuals, community organizations, local authorities, non-governmental organizations (NGOs), media, national and regional governments and general public.

In March 2016, IEM conducted focus group meetings with approximately 400 villagers in 8 villages in the Magway and Myothit townships of Magway District in RSF-5. As part of the public involvement process, Key Informant Interviews were also conducted with village leaders and health providers. Further, Traditional Ecological interviews and surveys were conducted with villagers and farmers during the combined socio-economic and environmental baseline surveys.

At the focus group meetings prior to conducting the socio-economic questionnaires, the villagers were informed that *eni Myanmar* is planning to conduct seismic acquisition and exploratory drilling. The purpose of the socio-economic questionnaire was to collect general socio-economic information in this area and to obtain perceptions and understanding of *eni Myanmar*'s planned seismic exploration program.

The Socio-Economic Survey was designed to focus on gaining household member information and attitudes on:

- the structure and demographics of the household;
- household living standards, employment, income, social and economic conditions;

- household and individual health;
- information on the natural environment and human use of the environment;
- attitudes on the prospective impacts of project during and after construction.

မြန်မာ

တူးဖော်ရှာဖွေရေးဆိုင်ရာ ESHIA လေ့လာမှု

လုပ်ကွက် RSF-5

မာတိကာ

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ဤစီမံကိန်းတွင် လုပ်ကွက်ဇရိယာအတွင်းတွင် 3D ဆိုက်စမစ် မြေတိုင်းအချက်အလက်များရယူခြင်းလုပ်ငန်းကို ကြိုတင် တွက်ချက်ထားပြီး ဟိုက်ဒရိုကာဗွန်တူးဖော်ရေးလုပ်ငန်းဆောင်ရွက်မှုများအတွက် အထောက်အပံ့ဖြစ်စေနိုင်မည့် အလားအလာရှိသော အခွင့်အရေးများကို ဖော်ထုတ်သတ်မှတ်နိုင်ရေးအတွက် ရည်ရွယ်လုပ်ဆောင်ခြင်းဖြစ်သည်။ ယင်း 3D Seismic Survey ကို ၅၀၀ စတုရန်းကီလိုမီတာအကျယ်အဝန်းရှိသော မြေဇရိယာအစိတ်အပိုင်းတစ်ခုပေါ်တွင် ပြုလုပ် ဆောင်ရွက်မည်ဖြစ်ပါသည်။

ယခုအစီရင်ခံစာသည် သဘာဝပတ်ဝန်းကျင်၊လူမှုပတ်ဝန်းကျင်ဆိုင်ရာ သုတေသနပြုမှုများ နောက်ဆုံး ESHIA အစီရင်ခံစာတစ်ခုဖြစ်သည့်အပြင် International Environmental Management Co., Ltd. (IEM) နှင့် ပြည်တွင်းမိတ်ဖက်လုပ်ငန်း တစ်ခုဖြစ်သော Environmental Quality Management Co., Ltd. (EQM) တို့ပူးပေါင်း သုတေသနပြုပြီး ကနဦးကွင်းဆင်းလေ့လာထားချက်များမှ ရရှိသည့် အချက်အလက်များကိုပါ ထည့်သွင်းပေါင်းစပ် ပြုစုထားသည့် ERM (Environmental Resource Management) ၏ ကနဦး ESHIA အစီရင်ခံစာပေါ်တွင် အခြေခံ ပြုစုထားခြင်းဖြစ်ပါသည်။

၂၀၁၆ ခုနှစ် မတ်လတွင် အခြေပြုနမူနာအချက်အလက်များကောက်ယူခြင်းနှင့် စစ်တမ်းကောက်ယူမှုအား သက်ဆိုင်ရာ သက်ရောက်မှုဖြစ်ပေါ်နိုင်မည့်ဒေသတစ်ခုလုံးတွင် ဆောင်ရွက်ခဲ့ပါသည်။ စစ်တမ်းများကောက်ယူခဲ့သည့် ဒေသများမှာ မကွေးနှင့် မြို့သစ်မြို့နယ်တို့ဖြစ်ကြပြီး မင်းလှမြို့တွင် စစ်တမ်းပြုစုမှု ဆောင်ရွက်ခြင်းမရှိခဲ့ပါ။ ယင်းသို့မဆောင်ရွက်ရခြင်းမှာ ယင်းမြို့သည့် ဇရာဝတီမြစ်တစ်ဖက်ကမ်းတွင်တည်ရှိနေ၍ဖြစ်ပြီး ဆိုက်စမစ်တိုင်းတာမှုလုပ်ငန်းများကိုလည်း ယင်းမြို့တွင် ဆောင်ရွက်မှုရှိမည်မဟုတ်၍ သက်ရောက်မှုဖြစ်ပေါ်စေနိုင်မည့် အလားအလာများမရှိဟု လေ့လာများရှိရခြင်းကြောင့် ဖြစ်ပါသည်။

၁.၂ စီမံကိန်း

စီမံကိန်းအား အကောင်အထည်ဖော်ဆောင်ရာတွင် ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်၏ ၂၀၁၃ ခုနှစ် ဖေဖော်ဝါရီလ ၁၇ ရက်နေ့ရက်စွဲပါ ကြေညာချက်တွင် ဟိုက်ဒရိုကာဗွန်တူးဖော်ခွင့် နှင့် ဆက်စပ်ဟိုက်ဒရိုကာဗွန်အသုံးချမှုဆိုင်ရာ လိုင်စင်များ လျှောက်ထားနိုင်ကြသည်ဟူသော ဖိတ်ခေါ်ချက်အရ ယခုစီမံကိန်းကို ဆောင်ရွက်ရန် လျှောက်ထားခဲ့ခြင်းဖြစ်ပြီး ၂၀၁၄ ခုနှစ် ဇူလိုင်လ ၃၁ ရက်နေ့တွင် eni Myanmar BV အား ပေးအပ်ခဲ့ခြင်းဖြစ်သည်။

လုပ်ကွက် RSF-5 အား ပုံ 1.1 တွင် ပြထားသည့်အတိုင်း မြန်မာနိုင်ငံ မကွေးတိုင်းဒေသကြီးရှိ ၁၂၉၂ စတုရန်းကီလိုမီတာအကျယ်အဝန်းရှိသည့် ဒေသတွင် ဆောင်ရွက်အကောင်အထည်ဖော်မည်ဖြစ်သည်။ ယင်းလုပ်ကွက်၏ မျက်နှာပြင် ကိုဩဒိနိတ်များအပြည့်အစုံကို အောက်တွင်ဖော်ပြပေးထားပါသည်။ (ဇယား 1.1)

ဇယား 2.1 RSF - 5 လုပ်ကွက် ၏ ကိုဩဒိနိတ်များ

Point	Longitude (E)	Latitude (N)
1	95°00′00″	20°15′00″
2	95°20′00″	20°15′00″
3	95°20′00″	19°55′00″
4	95°00′00″	19°55′00″

ကိုးကား - စွမ်းအင်ဝန်ကြီးဌာန (၂၀၁၃)

ပုံ ၁.၁ RSF -5 လုပ်ကွက်တည်နေရာပြမြေပုံ



ဤစီမံကိန်းတွင် RSF -5 လုပ်ကွက်အတွင်းဆောင်ရွက်မည့် 3D Seismic Survery တစ်ခုပါဝင်သည်။ ယင်းသို့သော လုပ်ငန်းဆောင်ရွက်မှုများသည်တူးဖော်ရေးစီမံကိန်း၏ပထမဆြေလှမ်းအဖြစ်ကိုယ်စားပြုနေပါသည်။ ဆိုက်စမစ်မြေတိုင်းလုပ်ငန်းဆောင်ရွက်မှုများအား eni မှ ပညာရှင်များ၏ ဘူမိရူပဗေဒဆိုင်ရာဖြစ်နိုင်ချေရှိမရှိ လေ့လာမှု၏ ရလဒ်များအပေါ် တွင်အခြေခံပြီးမြေတိုင်းလုပ်ငန်းအားအစီအစဉ်ချမှတ်ချထားခြင်းဖြစ်ပါသည်။ယခု 3DSeismicမြေတိုင်းလုပ်ငန်းဆောင်ရွက်ရခြင်း၏ရည်ရွယ်ချက်မှာRSF5လုပ်ကွက်ဇရိယာအတွင်းရှိမြေအောက်ဘူမိဗေဒအသွင်အပြင်အနေအထားများအားနက်ရှိုင်းစွာနားလည်သဘောပေါက်မှုရှိစေရန်ဖြစ်ပါသည်။ယင်းသို့ဆောင်ရွက်ရာတွင်ပိုမိုကောင်းမွန်သည့်

Signal-to-Noise Ratio နှင့် အချိတ်အဆက်ကောင်းမွန်သည့် Main Targets များကို အသုံးချလျက် အရည်အသွေးမြင့်မားသည့် Imaging Features များကို ရယူပြီး တိုင်းတာမှုလုပ်ငန်းများ ဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ 3D Seismic Volume ကိုအသုံးချခြင်းဖြင့် Dense Dataset တစ်ခုကိုရယူနိုင်မည်ဖြစ်ပြီး ယင်းကိုအသုံးချလျက် ပိုမိုတိကျ သည့် နန်းပို့ချမှုဆိုင်ရာနှင့် မြေအောက်မြေသားဖွဲ့စည်းမှုဆိုင်ရာ အချက်အလက်များကို ပံ့ဖော်ရယူနိုင်မည်ဖြစ်ပါသည်။

3D seismic surveys များ၏ ပုံစံကြမ်းကို ပုံ ၁.၂ တွင်ကြည့်ပါ။
ပုံ ၁.၂ 3D Seismic Survey ၏အနေအထားပုံစံ



လုပ်ကွက် RSF -5 အသေးစားနှင့်အလတ်စား သီးနှံများစိုက်ပျိုးသည့် စိုက်ပျိုးမြေများလွှမ်းခြုံရာ ဒေသတစ်ခုဖြစ်သည်။ ဆိုက်စမစ်တိုင်းတာရာတွင် အသုံးပြုမည့် နည်းပညာတွင် ပေါက်ကွဲစေသည့်ပစ္စည်းများ နှင့် တုန်ခါမှုထုတ်လွှတ်စက်ကြီး များ (Vibroseis) များကိုပါ ထည့်သွင်းအသုံးပြု ဆောင်ရွက်ရခြင်းတို့ကြောင့် လုပ်ငန်းဆောင်ရွက်မည့် မြေအနေအထားနှင့် သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ ခံနိုင်အားရှိမှုတို့အပေါ်တွင် မူတည်ပြီး

တိုင်းတာဆောင်ရွက်မည်ဖြစ်ပါသည်။ ယင်းဒေသရှိ လမ်းပန်းဆက်သွယ်မှုကွန်ယက်များသည်လည်း (အထူးသဖြင့် ယာဉ်နှင့် စွန့်ပစ်ပစ္စည်းများသယ်ဆောင်ရာလမ်းမများ) တွင် ယာဉ်ငယ်များအတွက်လည်း အမြဲတမ်း လုံလောက်သည့် အသုံးပြုခွင့်ရရှိမည်မဟုတ်ပါ။ မြေတိုင်းလေ့လာသည့် နေရာတွင် တိုက်စားမှုကြောင့်ဖြစ်လာသည့် မြေသားပုံစံ (Erosional Landforms) များ (ဥပမာ- လျှုမြောင်နှင့် စမ်းချောင်းများ)အပြင် သဘာဝပေါက်ပင်များ (အထူးသဖြင့် မြစ်နှင့် ချောင်းစပ်၊ မြောင်းစပ်များတွင် ချုံတောများ၊ သစ်တောစပ်များ) တည်ရှိနေသည်ကို လေ့လာများရှိရသဖြင့် Line Clearence ပြုလုပ်ရန်လိုအပ်ပါမည်။ *eni Myanmar* အနေဖြင့် ရှင်းလင်းမှု အနည်းဆုံးဖြစ်စေမည့် မူဝါဒကို eni ၏ စံနှုန်းများနှင့်အညီ ချမှတ်အကောင်အထည် ဖော်သွားပါမည်။

လုပ်ငန်းဆောင်ရွက်ရာနေရာသို့ ဘူမိရူပဗေဒဆိုင်ရာ ကိရိယာတန်ဆာပလာများ ရောက်ရှိမလာခင်အချိန်တွင် Line များ တစ်လျှောက်ရှိ ထိခိုက်မှုမခံနိုင်သော မည်သည့်အရေးကြီးနေရာကိုမဆို ရှောင်ရှားသွားနိုင်ရန်အတွက် Source Lines များနှင့် Receiver Lines များအားလုံးတို့အား ကြိုတင်တိုင်းတာမှုကို ဆောင်ရွက်သွားမည်ဖြစ်သည်။

Receiver Lines များတစ်လျှောက်တွင် (ဆိုက်စမစ်စွမ်းအင်ကိုအာရုံခံသိရှိနိုင်သည့် အချင်းဝက် ၃ စင်တီမီတာ အလျား ၂၀ စင်တီမီတာခန့်သာ ရှိသော သေးငယ်သည့် ကိရိယာများဖြစ်သည့်) Geophones အတွဲများကို ၄ မီတာအကွာအဝေးစီခြား ပြီး မြေပြင်တွင် လက်ဖြင့်စိုက်သွင်းထားမည်ဖြစ်သည်။ ယင်း Geophone များကို ဗို့အားနိမ့်လျှပ်စစ်ကေဘလ်ကြိုး တစ်ချောင်းဖြင့် ချိတ်ဆက်ထားမည်ဖြစ်ပါသည်။ ယင်းသို့ဆောင်ရွက်ရာတွင် မည်သည့်စက်ကိရိယာအကူအညီမှ မပါဝဲ လုပ်ဆောင်မည်ဖြစ်သောကြောင့် ယင်း Lines များတည်ရှိနေမည့် လမ်းကြောင်း တစ်လျှောက်တွင် သဘာဝပတ်ဝန်းကျင် ထိခိုက်မှု မရှိစေကြောင်း လေ့လာများရှိရပါသည်။

Source Lines များတည်ရှိရာ လမ်းကြောင်းတစ်လျှောက်တွင် သဘာဝပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှုအား တတ်နိုင်သမျှအနည်းဆုံးဖြစ်စေရန်အတွက်eniMyanmarအနေဖြင့် seismic လုပ်ငန်းဆောင်ရွက်မည့်အဖွဲ့အစည်းအား အောက်ပါတို့ကို လုပ်ဆောင်ရန် ညွှန်ကြားသွားမည်ဖြစ်သည်။

က) သစ်ပင်အုပ်များအကြား Vibroseis များလွတ်လပ်စွာ ဝင်နိုင်သည့် အကွာအဝေးများရှိသော မြေပြင်အခြေအနေများကြုံများရပါက ဘူဒိဇာစက်ယန္တရားများနှင့် သစ်ပင်ခုတ်ခြင်းများမပြုလုပ်ဘဲ ၅၀ မီတာ အကွာအဝေး နေရာတိုင်းရှိ Vibropoint များနှင့် တစ်တန်းတည်းတွင် Vibroseis လေးစီးကို အသုံးပြုရန်။ ဆိုက်စမစ်မြေတိုင်းတာမှုလုပ်ငန်းသည် ၂၀၁၇ ခုနှစ် ဇန်နဝါရီလမှ ဧပရယ်လ် လအတွင်း ဆောင်ရွက်ရမည်ဖြစ်သည့်အတွက် ခြောက်သွေ့သည့်ရာသီချိန်နှင့် သဘာဝမြက်ခင်းပြင်များရှိသည့် နေရာများတွင်သဘာဝပတ်ဝန်းကျင်သက်ရောက်မှုကိုလစ်လျူရှုထားနိုင်သည့်အပြင်ကာလတိုလုပ်ငန်း ဖြစ်သည့်အတွက်ကြောင့်Vibroseisများအသုံးပြုမှုကို ပိုမိုအားပေးတိုက်တွန်းရခြင်းဖြစ်သည်။

ခ) သဘာဝပေါက်ပင်များ ထူကဲသည့်နေရာတိုင်းနှင့် မြေပြင်အနေအထားလေ့လာမှုအရ Vibroseis များကို အသုံးပြုခွင့်မပေးနိုင်သည့်နေရာတိုင်းတို့တွင် ၂၅ မီတာအနက်ပေရှိသောကျင်းများအား ၅၀ မီတာ အကွာအဝေးစီခြားပြီး ဖောက်ခွဲရေးပစ္စည်းများ အသုံးပြုကြရန်။ ယင်းသို့ဆောင်ရွက်ရပါက သက်ဆိုင်ရာကျွမ်းကျင်သူ ပညာရှင်က သယ်ဆောင်လာပြီး တပ်ဆင်ပေးမည့် ၂.၅ မီတာ × ၂.၅ မီတာ ရှိသည့် အသေးစား တူးဖော်ရေးစက်ကိရိယာများ (Portable Drilling Units) ကိုအသုံးပြုကာ ၆ လက်မ Shot Hole များကိုတူးဖော်သွားမည်ဖြစ်သည်။ တူးဖော်သည့်နေရာများအားလုံးကို သေချာစွာ ရွေးချယ်သွားမည် ဖြစ်ပြီး လိုအပ်ပါက သစ်ပင်များ ခုတ်လှဲခြင်းကို ရှောင်ရှားနိုင်ရန်အတွက် သီအိုရီအရ တွက်ချက်ထားသော ကိုဩဒိနိတ်များတွင်မဟုတ်ဘဲ အခြားအသင့်လျော်

ဆုံးနေရာများရှိရာသို့ ရွှေ့ပြီး လုပ်ငန်းဆောင်ရွက်ပါမည်။ တူးဖော်သည့်အခါသုံးသည့် ရေများအား မည်သည့်ဓာတုပစ္စည်း သို့မဟုတ် အဖြည့်ပစ္စည်းများကို မဆို အသုံးပြုခြင်းမရှိစေရန် အာမခံပါသည်။ တူးဖော်မှုကြောင့် ထွက်ရှိလာသော မည်သည့်ပစ္စည်းများကိုမဆို ဒေသဆိုင်ရာဥပဒေများနှင့်အညီ ဖယ်ရှားစွန့်ပစ်ပေးသွားမည်ဖြစ်ပြီး လုပ်ငန်း ဆောင်ရွက်မှုများ ပြီးဆုံးသည်နှင့် တစ်ပြိုင်နက် အခြားမည်သည့်လုပ်ငန်းဆောင်ရွက်မှုမှ ထပ်မလုပ်တော့ဘဲ လုပ်ငန်းဆောင်ရွက်ခဲ့သည့်နေရာအား ယခင်အတိုင်းပြန်လည်ထိန်းသိမ်းမှု ဆောင်ရွက် ပေးသွားမည်။

စိုစွတ်ပျော့ပြောင်းသည့်မြေနေရာများနှင့်တစ်နှစ်တာလုံးရေလွှမ်းနေသည့်နေရာများတွင်အသေးစားတူးဖော်ရေးပစ္စည်းများ ကိုအသုံးပြုသွားမည်ဖြစ်ပြီး ယင်းသို့တူးဖော်စမ်းသပ်မှုကို သတ်မှတ်ထားသည့် မိတာအနည်းငယ်အတွင်း ခေတ္တခဏသာ လုပ်ငန်းဆောင်ရွက်သွားပါမည်။

ဘူဒိဇာများ၊ ထရပ်ကားများ၊ ဝန်ချီစက်ကရိန်များ နှင့် အခြားသယ်ယူပို့ဆောင်ရေးနည်းလမ်းများအားလုံးကို အသုံးပြုမှုအား ယင်းဒေသများတွင် လုံခြုံဘေးကင်းစွာ သွားလာသယ်ဆောင်နိုင်ရန် ကန့်သတ်အသုံးပြုသွားမည်ဖြစ်ပြီး သစ်တောများနှင့် သဘာဝပေါက်ပင်များအကြား လုံးဝအသုံးပြုသွားမည်မဟုတ်ပါ။

3D Survey တွင် source locations ၂၁၆၀၀ နှင့် receiving locations မှာ ၂၃၃၀၀ ခန့်စီ ရှိကြပါသည်။ ပြင်းအားပျော့သော ဆိုက်စမစ် signal များပစ်လွှတ်နိုင်ရန်အတွက် survey lines များတစ်လျှောက်တွင် upholes များကို တူးဖော်အသုံးပြုသွား ပါမည်။ (အနည်းဆုံးအနက်ပေ ၆၀ ပေ ရှိသော Upholes အရေအတွက် အနည်းဆုံး ၂၀ တွင်း) ၏ တည်နေရာကို သေချာစွာ ရွေးချယ်သွားမည်ဖြစ်ပြီး အထိခိုက်ခံနိုင်စွမ်းမရှိသည့်နေရာများကို လုံးဝ ရှောင်ကွင်းရွေးချယ်သွားမည်ဖြစ်သည်။

ပင်မစခန်းတစ်ခုအား Survey လုပ်ငန်းစဉ်များဆောင်ရွက်နေသမျှကာလပတ်လုံး တည်ဆောက်ထားရှိသွားမည်ဖြစ်ပြီး ဖောက်ခွဲရေးပစ္စည်းများအသုံးပြုပြီးဆောင်ရွက်ရမည့်ဆိုက်စမစ်လုပ်ငန်းဆောင်ရွက်မှုများကိုဆက်လက်လုပ်ဆောင်နိုင်ရန်အတွက်ရွက်ဖျင်တဲစခန်းများကိုလည်းတည်ဆောက်အသုံးပြုသွားပါမည်။
ဖောက်ခွဲရေးပစ္စည်းများပင်မထားသိုရာနေရာမှာ နီးစပ်ရာ တပ်မတော်တပ်ရင်းများအနီးတွင်တည်ရှိမည်ဖြစ်ပါသည်။ အကယ်၍ ဖောက်ခွဲရေးပစ္စည်းပင်မထားသိုသည့်နေရာ မှာ လုပ်ငန်း ဆောင်ရွက်မှုနှင့် အလွန်ဝေးကွာသည့် နေရာတွင် တည်ရှိနေပါကယာယီထားသိုရာနေရာများကိုလည်းSurveyဆောင်ရွက်သည့်နေရာအနီးတစ်ဝိုက်တွင်တည်ဆောက်အသုံးပြုပါမည်။မည်သို့ပင်ဖြစ်စေယင်းနေရာများကိုရွေးချယ်ရာတွင်ကာကွယ်ရေးဝန်ကြီးဌာန၏
ခွင့်ပြုချက်ကိုရယူသွားမည်ဖြစ်သည်။စခန်းချမှုအတွက်ပြင်ဆင်ဆောင်ရွက်ခြင်းများပြုလုပ်ရာတွင်တည်နေရာကို ရွေးချယ်ခြင်းအားကန်ထရိုက်တာဘက်မှအရာရှိများနှင့်eniMyanmar၏ကိုယ်စားလှယ်များကိုသာရွေးချယ် သတ်မှတ်စေပါမည်။
လုပ်ငန်းဆောင်ရွက်ရာဝင်းအားခြံစည်းရိုးခတ်ထားမည်ဖြစ်ပြီးတာဝန်ရှိသူများနှင့်ကောင်းစွာလေ့ကျင့်ထားသူများကိုသာ ဝင်ခွင့်ပြုသွားပါမည်။ မီးအန္တရာယ်ကြိုတင်ကာကွယ်မှု စနစ်များ ကိုလည်း ကောင်းစွာ ပြင်ဆင်ဆောင်ရွက်သွားပါမည်။ သီးသန့် Site Abandonment Plan တစ်ခုကိုလည်း eni Myanmar ဘက်မှ ပြုစုတင်ပြသွားမည်ဖြစ်ပြီး ယင်း Camp စခန်းများအားမည်သို့ပိတ်သိမ်းခဲ့ရမည်ဆိုသည့်လုပ်ငန်းစဉ်များကိုထည့်သွင်းရေးဆွဲသွားပါမည်။
စခန်းများပိတ်သိမ်းမှုတွင် ယာဉ်ယန္တရားများ ၊ စက်ကိရိယာများ၊ အဆောက်အအုံများ နှင့် အခြားစခန်းသုံးအသေတပ်ဆင်ထားသည့်အသုံးအဆောင်ပစ္စည်းများအားလုံးတို့အားဖယ်ရှားခြင်းကိုလည်းထည့်သွင်းဆောင်ရွက်သွားပါမည်။

၁.၂.၁ စီမံကိန်း၏ ကောင်းကျိုးများ

ယခုဆောင်ရွက်မည့် ဟိုက်ဒရိကာဗွန် တူးဖော်ရေးစီမံကိန်းသည် အမျိုးသားစီမံကိန်း (National Plan) နှင့်အညီ အလုပ်အကိုင်အခွင့်အလမ်းသစ်များကို ဖန်တီးပေးနိုင်မည်ဖြစ်ကာ နိုင်ငံအတွင်း ဟိုက်ဒရိကာဗွန်အရင်းအမြစ်များကို အသုံးချနိုင်ခြင်းမှတဆင့် အကျိုးရလဒ်များကို ဖြစ်ထွန်းလာစေနိုင်မည်ဖြစ်သည်။

၁.၂.၂ အကောင်အထည်ဖော်ရေးအစီအစဉ်

ထုတ်လုပ်မှုအပေါ်အကျိုးတူခွဲဝေရေးစာချုပ်(PSC) အရ တူးဖော်မှုကာလ ၃ နှစ်အတွင်းသာ အလုံးစုံသော လုပ်ငန်းဆောင်ရွက်မှုများကို အကောင်အထည်ဖော်သွားမည်ဖြစ်ပါသည်။

၁.၃ ဥပဒေမူဘောင် နှင့် တည်ဆဲဥပဒေများ

ယခု ESHIA အစီရင်ခံစာအား သယံဇာတနှင့် သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနမှ ထုတ်ပြန်ထားသည့် EIA လုပ်ထုံးလုပ်နည်းအသစ်များတွင် သတ်မှတ်ထားသည့် အတိုင်းသာ လိုက်နာပြုစုထားခြင်းဖြစ်ပါသည်။

ယခု ESHIA အစီရင်ခံစာကိုပြုစုရာတွင် အောက်ပါ လမ်းညွှန်ချက်များ ၊ စံနှုန်းများနှင့် စည်းကမ်းများအား လိုက်နာပြုစုထားခြင်းဖြစ်ပါသည် -

- eni မှ လက်ခံကျင့်သုံးသည့် IPIECA နှင့် WHO ၏ လမ်းညွှန်ချက်များ IFC စံနှုန်းများ ကဲ့သို့သော နိုင်ငံတကာမူဝါဒများ ၊ ဥပဒေသများနှင့် စံနှုန်းသတ်မှတ်ချက်များ၊
- မြန်မာနိုင်ငံမှအသိအမှတ်ပြုထားသော နိုင်ငံတကာဆိုင်ရာ သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာကိစ္စများနှင့်ဆက်စပ်စာချုပ်စာတမ်းများ နှင့် သဘောတူညီချက်များ။
- မြန်မာနိုင်ငံ၏ စီမံခန့်ခွဲမှု၊ သဘာဝပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေး၊ လုံခြုံရေးဆိုင်ရာ စည်းမျဉ်းဥပဒေများ။ စီမံကိန်းဖွံ့ဖြိုးရေးအတွက် အရေးကြီးအကြောင်းခြင်းရာများဖြစ်ခြင်းကြောင့် ESHIA ၏သတ်မှတ်ချက်များနှင့် သက်ဆိုင်အကျုံးဝင်သည့် တည်ဆဲဥပဒေများအားလုံးနှင့်ကိုက်ညီအောင် အထူးအလေးထားပါသည်။ ယင်းဥပဒေများမှာ သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၂)၊ သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေး နည်းဥပဒေများ (၂၀၁၄)၊ နိုင်ငံခြားရင်းနှီးမြှုပ်နှံမှုဥပဒေ (၂၀၁၂) နှင့် ယင်းဥပဒေကိုပြင်ဆင်ထားသည့်ဥပဒေ (၂၀၁၅)၊ နိုင်ငံခြားရင်းနှီးမြှုပ်နှံမှုနည်းဥပဒေများ (၂၀၁၃)၊ သဘာဝပတ်ဝန်းကျင်သက်ရောက်မှုစစ်ဆေးတိုင်းတာ ရေး လုပ်ထုံးလုပ်နည်းများ (၂၀၁၆)၊ သဘာဝပတ်ဝန်းကျင်အရည်အသွေးစံနှုန်းသတ်မှတ်ချက်များ(၂၀၁၆)၊ယဉ်ကျေးမှုအမွေအနှစ်ဒေသများကာကွယ်ထိန်းသိမ်းရေးဥပဒေ(၁၉၉၈)၊ယဉ်ကျေးမှုအမွေအနှစ်ဒေသများကာကွယ်ထိန်းသိမ်းရေးဥပဒေဥပဒေကိုပြန်လည်ပြင်ဆင်ထားသည့်ဥပဒေ (၂၀၁၉)၊ ရေးဟောင်းအဆောက် အအုံများ ကာကွယ်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၅) နှင့် ရေးဟောင်းဝတ္ထုပစ္စည်းများကာကွယ်ထိန်းသိမ်းရေးဥပဒေ (၂၀၁၅) တို့ဖြစ်ကြပါသည်။
- Eni SpA နှင့် eni Myanmar စံနှုန်းများ၊ ပညာရပ်ဆိုင်ရာနှင့် လုပ်ငန်းဆောင်ရွက်မှု လမ်းညွှန်ချက် Guidelines များ၊ ညွှန်ကြားချက်များနှင့် လုပ်ထုံးလုပ်နည်းများ။

၁.၄ စီမံကိန်းဒေသတစ်ဝိုက်၏ သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာအခြေပြုအချက်အလက်များ

ESHIA အခြေပြုအချက်အလက်များ၏ ရည်ရွယ်ချက်မှာ RSF-5 လုပ်ကွက်ဧရိယာအတွင်းတွင် တည်ရှိနေသော မတူညီသည့်သဘာဝပတ်ဝန်းကျင်၊လူမှုရေးနှင့်ကျန်းမာရေးအခြေခံစံနှုန်းများကိုစီမံကိန်းတည်နေရာတစ်ခုလုံး၏ကိုယ်စားပြု အချက်အလက်များအနေဖြင့် ပြည့်စုံစေ့စပ်စွာ ခြုံငုံသုံးသပ်ထားချက်တစ်ရပ်ထွက်ပေါ်လာစေရန်ဖြစ်ပါသည်။ အခြေပြုအချက်အလက်များကိုတိကျသည့်အများပြည်သူနှင့် ဒေသခံပြည်သူများနှင့် သဘာဝပတ်ဝန်းကျင်၊လူမှုရေးနှင့် ကျန်းမာရေး ဆိုင်ရာ သုတေသနပြုလေ့လာမှုများ အဆက်အသွယ်များ၊ အင်တာဗျူးများ လက်များ့ကွင်းဆင်းလေ့လာမှုမှရရှိသည့် အချက်အလက်များနှင့် တစ်ဆင့်ခံအချက်အလက်များအား သုံးသပ်ချက်တစ်ခု အပေါ်တွင် အခြေခံထားပါသည်။

ဆိုက်စမစ်တိုင်းတာလေ့လာမှု၏အတိုင်းအတာမှာ RSF -5 လုပ်ကွက်၏ ဧရိယာအများစုတွင် ပြုလုပ်ရမည်ဖြစ်ပါသည်။ ပုံ ၁.၃ တွင်ပြထားသည့်အတိုင်း လုပ်ကွက်၏နယ်နိမိတ်အား သဘာဝပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေး အခြေပြုအချက်အလက်များအတွက် လွှမ်းမိုးမှုဧရိယာ (Area of Influence) အဖြစ်သတ်မှတ်ထားပြီးဖြစ်ပါသည်။

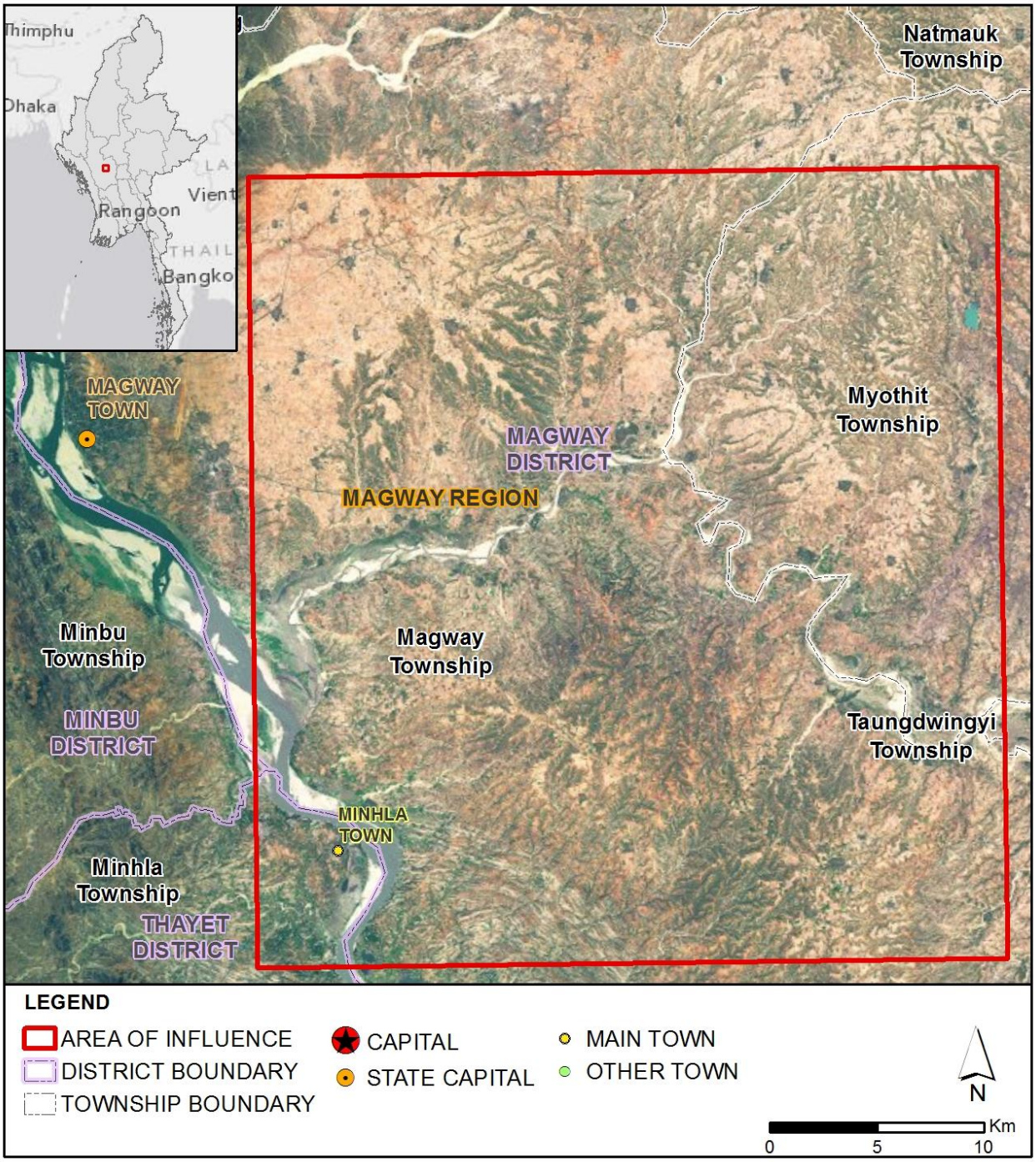
လေ့လာမှုဧရိယာ(Study Area)၏ အခြေပြုအချက်အလက်ဖော်ထုတ်ခြင်းကို ရရှိသမျှသတင်းအချက်အလက်များအား သုံးသပ်အခြေခံပြီး ဆောင်ရွက်သွားမည်ဖြစ်သည်။ အထူးသဖြင့် နိုင်ငံတော်အဆင့်နှင့် တိုင်းဒေသကြီးအဆင့် သဘာဝပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေးအခြေခံ သတင်းအချက်အလက်များကို အခြေခံဆောင်ရွက်သွားမည် ဖြစ်ပါသည်။ လုပ်ကွက်ဧရိယာတစ်ခုလုံး၏ မြေအနေအထားသတင်းအချက်အလက်များ ဂြိုလ်တုဓာတ်ပုံများအား လုံးတို့ကို အခြေခံပြီး အောက်ပါ ပင်မကုန်းမြေဧရိယာများကို သတ်မှတ်ဖော်ထုတ်သွားပါမည်။ (ESHIA ၏ အပိုဒ် ၅.၃.၅ တွင် ဖော်ပြထားပြီးဖြစ်ပါသည်။)

- မြေလွတ်မြေရိုင်း
- သဘာဝပေါက်ပင်များ
- အဆောက်အဦ
- လမ်းများ
- မြို့ပြဧရိယာ
- မြို့ပြစိုက်ပျိုးရေးနေရာများ
- ကောက်ပဲသီးနှံစိုက်ပျိုးမြေများ
- မြက်ခင်းပြင်များ
- မြစ်အတွင်းထွန်းနေသည့်သောင်များ
- ကျောက်ဖြန်း နှင့် ကျောက်စရစ်ဖြူများ
- မြစ်များ
- ရေတွင်းရေကန် အင်းအိုင်မြစ်ချောင်းများ

အထက်ပါ ယင်းမြေမျက်နှာသွင်ပြင်အထားများကို သက်ဆိုင်ရာသက်ရောက်မှုစစ်ဆေးတိုင်းတာချက်အတွက် အခြေခံ အချက်များ အဖြစ် ထည့်သွင်းစဉ်းစားထားပြီးဖြစ်ပါသည်။

အခြေပြုအချက်အလက်များကို သဘာဝတရားပိုင်း ၊ ဇီဝဗေဒဆိုင်ရာ၊ လူမှုစီးပွားရေး၊ ယဉ်ကျေးမှု၊ အသွင်အပြင်ပိုင်း နှင့် ကျန်းမာရေးပိုင်းဟူ၍ အဓိကကဏ္ဍ (၆) ခုအဖြစ် ခွဲခြမ်းစုစည်းတင်ပြထားပါသည်။

ပုံ ၁.၃ သဘာဝပတ်ဝန်းကျင်လူမှုရေးနှင့်ကျန်းမာရေး အခြေပြုအချက်များအတွက် လွှမ်းမိုးမှုဧရိယာ



၁.၄.၁ သဘာဝတရားနှင့်ဆိုင်သော အချက်အလက်များ

RSF-5 လုပ်ကွက်သည် ပုံ ၁.၃ တွင်ပြထားသည့်အတိုင်း မကွေးတိုင်းဒေသကြီးတွင်တည်ရှိပြီး ရခိုင်ရိုးမ၏ မိုးရိပ်ဇရိယာ အတွင်းတွင် ကျရောက်နေပါသည်။ ရခိုင်ရိုးမ၏ သည် မိုးရေများအား အနောက်တောင်မုတ်သုံလေမှ အများဆုံးရရှိသည်။လှိုင်းပမာမို့မောက်နိမ့်ဂုမ်းနေသည့်မြေပြင်အသွင်သဏ္ဌာန်သည်မိုးရေနှင့်လေများပြင်းထန်စွာ တိုက်စားမှုကြောင့် ဖြစ်ပေါ် လာခြင်းဖြစ်ပါသည်။ မြို့တော်အမည်မှာ မကွေးမြို့ (၁၉၉၄ ခုနှစ် သန်းခေါင်စာရင်းအရ လူဦးရေ ၃ သိန်း) ဖြစ်သည်။ အလယ်ပိုင်းမြေနိမ့်လွင်ပြင်တွင်တည်ရှိပြီး ဇရာဝတီမြစ်နှင့် မြစ်လက်တက်အများစု၏ ရေလွှမ်းဒေသလည်း ဖြစ်သောကြောင့် ယင်းဒေသတွင် တောင်ကုန်းငယ်များရှိပြီး မီးတောင်များလည်း ရှိသည့်အပြင် စစ်ကိုင်းပြတ်ရွှေ့ကြောင်းဇုန်အတွင်းလည်း ကျရောက်နေသည်ကို များရှိရသည်။ ထို့ပြင် ယင်းဒေသသည် ဘေးတိုက်ရွှေ့ပြတ်ရွှေ့ကြောင်းပေါ်တွင် သိသာထင်ရှားစွာ တည်ရှိနေပါသည်။

လေထု

- RSF- 5 လုပ်ကွက်သည် အောက်ပါ ဥတုရာသီနှစ်မျိုးဖြစ်သော အပူပိုင်းဆာဗားနားရာသီဥတု (ခြောက် သွေ့ဖုန် အနီးတစ်ဝိုက်) နှင့် အပူပိုင်းမြက်ခင်းလွင်ပြင် (ခြောက်သွေ့ဖုန်) တို့အကြားတွင် တည်ရှိနေသည်။
- ယင်းဒေသ၏ လစဉ်အများဆုံးအပူချိန်မှာ ၃၀.၂ နှင့် ၄၀.၄ ဒီဂရီစင်တီဂရိတ်အထိရှိပြီး အနိမ့်ဆုံးအပူချိန်မှာ ၁၃.၅ မှ ၂၆.၆ဒီဂရီစင်တီဂရိတ်အထိသာလျော့နည်းတတ်သည်။အမြင့်ဆုံးအပူချိန်ကိုဇပရယ်လ်လတွင်တိုင်းတားထားခြင်း ဖြစ်သည်။
- အမြင့်ဆုံးစိုထိုင်းဆတန်ဖိုးများကို ဆိုင်ကလုန်းရာသီနှင့်နီးကပ်သည့် ဇွန်လ မှ နိုဝင်ဘာလအထိ တိုင်းတာသည်။ မိုးရာသီ တွင် အမြင့်ဆုံး အပူချိန်အညွှန်ကိန်းမှာ "Extreme Cation" လွန်ကဲအဆင့် သို့ရောက်ရှိတတ်ပြီး ၉၅ မှ ၁၀၀ အကြားရှိတတ်သည်။
- မိုးရာသီတွင် ရာသီဥတုကြည်လင်မှုနည်းပါးပြီး ခြောက်သွေ့သောရာသီများတွင် နေထွက် နှင့် နေဝင်ချိန်များတွင် မကြာခဏဆိုသလို မြူထခြင်းများရှိသော်လည်း ရာသီဥတုကြည်လင်သည်။
- ယင်းဒေသကို မိုးရာသီတွင် အနောက်တောင်မုတ်သုံလေဝင်ရောက်လေ့ရှိပြီး အေးမြခြောက်သွေ့သည့် ရာသီများတွင်အရှေ့မြောက်မုတ်သုံလေဝင်ရောက်လေ့ရှိသည်။မကွေးမိုးလေဝသနှင့်ဇလဗေဒဌာနမှတိုင်းတာ ချက်များအရ လေတိုက် နှုန်းများမှာ တစ်နာရီလျှင် ၀.၈၈ မိုင်မှ ၁.၆၇ မိုင်အတွင်းတိုက်ခတ်သည်။
- လေထုအရည်အသွေး တိုင်းတာရေးဌာနများကို RSF -5 လုပ်ကွက်အတွင်း ၂၀၁၆ ခုနှစ် မတ်လ ၁၁ ရက်နေ့မှ ၂၄ ရက်နေ့ အထိ လေတိုက်နှုန်း၊ လေဦးတည်ရာအရပ်၊ လေထုအပူချိန် နှင့် လေထုစိုထိုင်းဆတို့ကို လေ့လာပြီး ဝန်းကျင်လေထုအရည်အသွေးဒေတာများနှင့် မိုးလေဝသနှင့်ဇလဗေဒဆိုင်ရာ အချက်အလက်များကို စောင့်ကြည့် လေ့လာမှုများပြုလုပ်ရန် တာဝန်ချထားခဲ့ပြီးဖြစ်သည်။
- အခြေပြုအချက်အလက်များမှ စုဆောင်းကောက်ယူထားသော အခြေပြုလေထုအရည်အသွေးများအရ နွားလှရွာ နှင့် တောင်ယာတောရွာတို့မှ လွဲ၍ ကျန်သည့်နေရာများအားလုံးတို့တွင် WHO ၏ Guideline များထက် Particulate Level များဖြစ်သော PM2.5 နှင့် PM10 တို့မှာ ပိုမြင့်နေကြောင်းနှင့် ဖော်ပြပါ ရွာနှစ်ရွာ၏ Particulate Level တန်ဖိုးများမှာWHO Guideline များအထက် PM10 values များသာလျှင်ရှိကြောင်းလေ့လာများရှိရပါသည်။ NO2 ၊ CO ၊ O3 နှင့် Atomic Radiation Level များမှာ သတ်မှတ်စံနှုန်းများနှင့် ကိုက်ညီကြောင်းများရှိရပါသည်။ အခြားဓာတ်ငွေ့များဖြစ်သော VOC ၊ NH3 ၊ C H_4 တို့ကိုလည်း လက်ရှိအခြေပြု ဝန်းကျင်လေထုအတွင်းပါဝင်မှု မည်မျှရှိကြောင်း စောင့်ကြည့်လေ့လာခဲ့ပြီး ဖြစ်ပါသည်။ SO_2 ပါဝင်မှုပမာဏသည် မကွေးမြို့နယ်အတွင်းရှိ

ပေပင်စမ်းရွာနှင့် တောင်ယာတောရွာ (၂) ရွာမှလွဲ၍ ကျန်နေရာများအားလုံးတို့တွင် သတ်မှတ် Guideline များထက် ပါဝင်မှုပမာဏပိုနေကြောင်းလှလာများရှိရပါသည်။ အထက်ပါရွာနှစ်ရွာ၏ SO_2 ပါဝင်မှုပမာဏသည် သတ်မှတ် Guideline များထက် နိမ့်ကျနေသော်လည်း သတ်မှတ်ပမာဏ နှင့် အနည်းငယ်သာကွာဟနေကြောင်း လေ့လာများရှိရပါသည်။

- ဥတုရာသီအပြောင်းအလဲနှင့်ပတ်သက်၍ စိုက်ပျိုးရေးကဏ္ဍရှိ CH_4 နှင့် N_2O ထုတ်လွှတ်မှုလမ်းကြောင်းများကို ၂၀၀၀ မှ ၂၀၀၅ ခုနှစ် ရေတိုကာလအတွင်းနှင့် ၁၉၉၀-၂၀၃၀ ရေရှည်ကာလအတွင်းတို့တွင်ပါ သိသာစွာတိုးတက်လာကြောင်း ထင်ရှားစွာဖော်ပြထားပါသည်။ ထို့ပြင် လူဦးရေတိုးတက်လာမှုကြောင့် အမှိုက်စွန့်ပစ်မှုကဏ္ဍတွင်လည်း CH_4 ထုတ်လွှတ်မှုပမာဏ သိသာစွာတိုးတက်လာသည်ကို များရပါသည်။ သစ်တောများပြုန်းတီးမှုကြောင့်ဖြစ်ပေါ်လာသောမြေယာအသုံးပြုမှုပြောင်းလဲလာခြင်းနှင့် သစ်တောကဏ္ဍတို့မှလည်း ယင်းဓတ်ငွေ့ကိုအဓိကထုတ်လွှတ်လာခြင်းများများရှိရပါသည်။ထို့အပြင်သဘာဝသစ်တောဇရိယာများလျော့နည်းလာမှုကြောင့်သဘာဝသစ်တောများ၏စုစုပေါင်းနှစ်စဉ် CO_2ဖယ်ရှားစုပ်ယူနိုင်စွမ်းမှာလည်းပုံမှန်ကျဆင်းလျက်ရှိသည်။
- စီမံကိန်းတည်ရှိရာဒေသသည် ကျေးလက်ဒေသဖြစ်သောကြောင့် အသံပိုင်းဆိုင်ရာပတ်ဝန်းကျင်အနေဖြင့် ဝန်းကျင်ဆူညံမှု နည်းပါးနိုင်ပါသည်။ RSF-5 လုပ်ကွက်အတွင်း ၂၄ နာရီဆူညံမှု ပမာဏ တိုင်းတာမှုလုပ်ဆောင်ရာတွင် ဆူညံမှုပမာဏများမှာ ဝန်းကျင်ဆူညံမှုအဆင့် 40.4 dB (A) မှ 61.5 dB (A) အကြား ရှိနေပါသည်။ ယင်းသို့တိုင်းတာရာတွင် LAeq အတွက် အခြေခံခွဲခြားသည့်အချိန်များမှာ နေ့ခင်းအချိန်တွင် ၁၆ နာရီနှင့် ညဘက်ပိုင်းတွင် ၈ နာရီအသီးသီးတွင် တိုင်းတာခဲ့ခြင်းဖြစ်သည်။ စိုင်ကျ၊ ပေပင်စမ်း ၊ ခဲကြီးကုန်း၊ မနေ့ကုန်း နှင့် နွားလှရွာတို့၏ ညဘက်ဆူညံမှုအဆင့်များသည် WHO စံနှုန်းများနှင့် တံခါးဖွင့်အိပ်နေချိန် (Outdoor Values) ပြင် ပမှ ဆူညံမှုများ အိပ်ခန်းတွင်းသို့ဝင်ရောက်မှုအတွက် သတ်မှတ်ထားသော Leq-Night Guidlines များ၏ အထက်တွင်ရှိနေကြောင်း များရှိရပါသည်။ ယင်းပမာဏသည် မော်တာဆိုင်ကယ်များနှင့် လျှပ်စစ်ဓာတ်အားအတွက်အသုံးပြုသော ဒီဇယ်အင်ဂျင်မီးစက်များ၏ ရလဒ်တန်ဖိုးများနှင့် အနီးစပ်ဆုံးတူညီမှုရှိပါသည်။

<u>ရေထု</u>

- RSF-5လုပ်ကွက်သည် ဇရောဝတီမြစ်ကိုဖြတ်လျက်တည်ရှိနေခြင်းဖြစ်ပြီး ယင်းမြစ်သည် လုပ်ကွက်ဇရိယာအား အနောက်တောင်ဘက်ထောင့်တွင် ပတ်ကွေ့သွားသော်လည်း 3D Survey Grid ကိုထိစပ်ခြင်းတော့ မရှိပါ။ ရင်ချောင်းမြစ် (ဇရောဝတီမြစ်၏မူလမြစ်လက်တက်ကြီး) သည် 3D Seismic ဇရိယာ၏ မြောက်ဘက်နှင့် အရှေ့ဘက်အပိုင်းတို့အတွင်းသို့ စီးဝင်နေပါသည်။ ရင်ချောင်းမြစ်လက်တက်မှ ခွဲထွက်လာသော လိပ်ချောင်းနှင့် မွန်ချောင်းတို့သည်လည်း မြောက်ဘက်အရပ်သို့ စီးထွက်သွားပါသည်။
- RSF-5 အတွင်းရှိ နေရာ ၁၄ ခုတွင် မျက်နှာပြင်ရေနမူနာရယူခြင်းလုပ်ငန်းကို ဆောင်ရွက်ပြီးစီးပြီးဖြစ်ပါသည်။ pH စုစုပေါင်းပျော်ဝင်မြေစိုင်များနှင့် မန်ဂနိတို့မှလွဲ၍ ကျန် Parameter များအားလုံးတို့သည် ရေအရည်အသွေး စံနှုန်းများအတွင်းသာ ရှိပါသည်။ pH ပမာဏမှာ တည်နေရာ (၇) ခုရှိ ရေထုပတ်ဝန်းကျင်များအတိုင်း သတ်မှတ် စံနှုန်းအထက်တွင်ရှိပါသည်။ pH မြင့်မားခြင်းမှာ ခြောက်သွေ့ရာသီအတွင်းရယူထားသော ရေနမူနာ များကြောင့်ဖြစ်ပါသည်။ ယင်းတည်နေရာများတွင် မြစ်ချောင်းအင်းအိုင်ရေကန်များအတွင်း ရေပမာဏလျော့နည်း ကာ pH ပမာဏ မြင့်တက်လာလေ့ရှိပါသည်။ မန်ဂနိဓာတ်သည် တည်နေရာ (၃) ခုတွင် သတ်မှတ်စံနှုန်းအထက် တွင်ရှိနေသည်ကိုများရသည်။

- မြေအောက်ရေအနက်များမှာလည်း စီမံကိန်းဒေသအတွင်းရှိ ရေအောင်းလွှာများအပေါ် မူတည်ပြီး တူညီမှုမရှိကြ ကြောင်းများရှိရသည်။ စီမံကိန်းဧရိယာအတွင်း မြေအောက်ရေများရှိရတတ်သည့် ခန့်မန်းခြေအနက်မှာ ၁.၈၃ မီတာ (၆ ပေ) အနက်မှ စ၍များရတတ်ပြီး အချို့နေရာများတွင် ၂၃၁.၅ မီတာ (အဝီစိတွင်းများတွင် ~၇၆၀ ပေ) မှစ၍ များရတတ်သည်။
- မြေအောက်ရေနမူနာရယူခြင်း ကို RSF-5 လုပ်ကွက်ဧရိယာအတွင်း တည်နေရာ ၂၆ ခုသတ်မှတ်ပြီး ရယူစစ်ဆေး ခဲ့သည်။ အဝီစိတွင်းနက်များတွင် Total Dissolved Solid ပမာဏမှာ ရယူနိုင်သည့်သတ်မှတ်ပမာဏထက် ပိုမိုမြင့် မားကျော်လွန်နေသည်ကိုများရှိ မှတ်တမ်းတင်ထားပါသည်။ ယင်းသို့မြင့်မားမှု၏ အကြောင်းရင်းမှာ ရေအောင်းလွှာများအတွင်း သဘာဝ အလျောက် ရေငွေ့ပြန်ခြင်း၊ မိုးရွာခြင်း သို့မဟုတ် ကျောက်သားများ ကြေမွခြင်းဖြစ်စဉ်တို့ကြောင့်ဖြစ်ပါသည်။ ထို့ကြောင့်သာ ရွာသားများအနေဖြင့်အဝီစိတွင်းများအားလုံးတို့တွင်ရေတွင်းအနယ်ထိုင်ခြင်းနှင့် နှန်းကျခြင်းများဖြစ်ပေါ်မှုကြောင့် ရေတိမ်တွင်းများကိုသာ အသုံးပြုပြီး ရေရယူ ကြခြင်း ဖြစ်ပါသည်။ တည်နေရာ (၄) ခုတွင် pH ပမာဏသည် သတ်မှတ်ထားသည့် အများဆုံးပမာဏစံနှုန်း အထက်တွင်ရှိနေပါသည်။ မန်ဂနိ (Mn) သည်လည်း တည်နေရာ (၁၀) ခုမှ (၂၆) ခုခန့်အထိတွင် သတ်မှတ်စံနှုန်း များ၏ အထက်တွင်ရှိနေကြောင်းလေ့လာများရှိရပါသည်။

<u>မြေထု</u>

- သုံးသပ်လေ့လာမှုအရ RSF-5 လုပ်ကွက်အတွင်းရှိ ကုန်းမြေပုံစံအနေအထားများကို ပင်မ Land cover အမျိုးအစားများအဖြစ် မြေလွတ်မြေရိုင်း ၊ သဘာဝပေါက်ပင်များ ၊ အဆောက်အဦ၊ လမ်းများ ၊ မြို့ပြဧရိယာ ၊ မြို့ပြစိုက်ပျိုးရေးနေရာများ၊ကောက်ပဲသီးနှံစိုက်ပျိုးမြေများ၊ မြက်ခင်းပြင်များ၊ မြစ်အတွင်းထွန်းနေသည့်သောင်များ၊ ကျောက်ဖြိုန်း နှင့် ကျောက်စရစ်ဖြူများ၊ မြစ်များ၊ ရေတွင်းရေကန် အင်းအိုင်မြစ်ချောင်းများ ဟုခွဲခြားသတ်မှတ်နိုင်ပါသည်။

<u>အပေါ်ယံမြေဆီလွှာနှင့် အောက်မြေဆီလွှာ</u>

- RSF-5 လုပ်ကွက်သည် အလယ်ပိုင်းမြေနိမ့်လွင်ပြင်များတွင် တည်ရှိပါသည်။ ယင်းဒေသများသည် မြေသြဇာကောင်းမွန်သော ရွှံ့ဝေျးမြေပြန့်လွင်ပြင်များဖြစ်ကြပြီး ကြိုကြားကြိုကြားနေရာများတွင် တောင်ကုန်းတောင်တန်းများလည်း တည်ရှိနေပါသည်။ စစ်ကိုင်းငလျင်ပြတ်ရွှေ့ကြောင်းကြီး (ဝင်းဆွေ ၁၉၈၁) သည် ယင်းဒေသ၏ အရှေ့ဘက်ဖျားအစွန်းမှ ဖြတ်သန်းတည်ရှိနေခြင်းဖြစ်ပါသည်။
- RSF-5 လုပ်ကွက်တွင် အောက်ပါ ဘူမိဆိုင်ရာ ယူနစ်သုံးခုရှိနေကြောင်းများရှိရပါသည်။ ဧရာဝတီအုပ်စု နှင့် အခြားတူညီသောအုပ်စုများ၊ အထက်ပဲခူးအုပ်စု၊ ပင်လယ်ရေငန်ငြိငြို နှင့် အခြားကုန်းမြေဆိုင်ရာ အလားတူအုပ်စုများ၊ သက်နုနှုန်းမြေများဖြစ်ပါသည်။
- ယင်းဒေသတွင် ဧရာဝတီရေလွှမ်းလွင်ပြင်များသည် ပင်လယ်ရေမျက်နှာပြင်အထက် ပေအမြင့် ၂၀ မီတာတွင်ရှိပြီး ကုန်းမြင့်ဒေသများတွင် ၃၂၀ မီတာအထိအမြင့်ရှိပါသည်။ ယင်းဒေသ၏ လျောစောက်မှာ အလွန်ပြေလျော (<1%) ပါသည်။
- လုပ်ကွက်အတွင်းရှိ မြေသားအမျိုးအစားများမှာ- Light Forest Soils (Cinnamon) Nitosol ၊ Meadow Soils (Gleysol) ၊ Meadow Alluvial Soil (Gleysol Fluvic) ၊ Red Brown Savanna Soils (Luvisol) နှင့် Dark Compact Soils (Vertisol) တို့ဖြစ်ကြပါသည်။

- မြန်မာနိုင်ငံတစ်ဝှမ်းလုံးတွင် ဆိုက်စမစ်ပညာရပ်အရ တည်ငြိမ်မှုမရှိဘဲ ဆိုက်စမစ်ဖြစ်လွယ်သည့် အန္တရာယ်များလည်း ရှိနေကြောင်း များစွာရှိရပါသည်။ USGS ၏ အဆိုအရ RSF-5 လုပ်ကွက်သည် (Modified Mercalli Intensity အရ) 7-8 MMI ဇရိယာအတွင်းတွင် လုံးဝတည်ရှိနေကြောင်းများစွာရှိရပါသည်။
- စီမံကိန်းဇရိယာအတွင်း မီးတောင်မရှိသော်လည်း မြန်မာနိုင်ငံတွင် ယူရေးရှန်း tectonic plate အောက်တွင်ရှိနေသော အင်ဒိုပစိဖိတ် subduction နှင့်ဆက်စပ်လျက်ရှိသည့် မီးတောင်အရှင်အနည်းငယ် ရှိနေပါသည်။
- မကွေးတိုင်းဒေသကြီးတွင် စိုက်ပျိုးမြေအများဆုံးရှိနေပြီး သဘာဝပေါက်ပင်အနည်းငယ်သာ ကျန်ရှိနေသည်ကို များစွာ ရှိ ရပါသည်။ မြေပြင်တစ်ခုလုံးကို အရောင်စုံ ကောက်ပဲသီးနှံများနှင့် စိုက်ခင်းများက ဖုံးလွှမ်းထားသည်ကို များစွာရှိရပါသည်။
- မြေဆီလွှာနမူနာစမ်းသပ်မှုအား လုပ်ကွက်အတွင်းရှိ တည်နေရာ (၂၀) ခုတွင် စမ်းသပ်ခဲ့ပါသည်။ မြေဆီလွှာ၏ pH ပမာဏများမှာ တည်နေရာ (၈) ခုတွင် ၅.၃ မှ ၉.၂ အထိ ရှိနေပြီး စံနှုန်းများအထက်တွင်ရှိနေသည်ကိုများစွာရပါသည်။ မြေဆီလွှာနမူနာများအားလုံးတွင် ဟိုက်ဒရိကာဗွန်ပါဝင်မှု မရှိသည်ကိုများစွာရပါသည်။ Arsenic (As) ၊ Nickel (Ni) နှင့် Chromium (Cr) သတ္တုများမှလွဲ၍ အခြားတန်ဖိုးများအားလုံးမှာ စိုက်ပျိုးရေးအသုံးပြုမှုဆိုင်ရာ စံနှုန်းများအောက်တွင် သာရှိနေသည်ကိုများစွာရပါသည်။ တည်နေရာတစ်ခုတွင် Arsenic (As) ၊ Nickel (Ni) နှင့် Chromium (Cr) သတ္တုများမှလွဲ၍ အခြားတန်ဖိုးများအားလုံးမှာ စိုက်ပျိုးရေးအသုံးပြုမှုဆိုင်ရာ စံနှုန်းများအထက်တွင်ရှိနေသည်ကိုများ ရပါသည်။

၁.၄.၂ ဇီဝဗေဒဆိုင်ရာအခြေခံအချက်အလက်များ

မြန်မာနိုင်ငံတစ်ဝှမ်းလုံး (မြောက်ဖျားပိုင်းဒေသများမှလွဲ၍) သည် အင်ဒိုဘားမား ဇီဝမျိုးကွဲစုံစုပေါင်းရာ Hot Spot အတွင်း တည်ရှိနေပါသည်။ ယင်း Hot Spot ကို နိုင်ငံတကာထိန်းသိမ်းရေးအဖွဲ့အစည်း (CIO) မှ သတ်မှတ်ထားခြင်းဖြစ်သည်။

၂၀၀၉ခုနှစ်တွင်NCEA(သဘာဝပတ်ဝန်းကျင်ကိစ္စရပ်များဆိုင်ရာ အမျိုးသားကော်မရှင်အဖွဲ့) က နိုင်ငံတော်အဆင့် တောက်လျှောက်ဖွံ့ဖြိုးတိုးတက်မှုမဟာဗျူဟာ (NSDS) ကို မြန်မာနိုင်ငံအတွက် ချမှတ်ပေးခဲ့ပါသည်။ နိုင်ငံအတွင်း ထိန်းသိမ်းမှုပြုလုပ်ရမည့် လမ်းကြောင်း (၄) ခုနှင့် ကာကွယ်ရမည်ဇရိယာ ၄၃ ခုကို သတ်မှတ်ဖော်ထုတ်ပေးပြီး ဖြစ်ပါသည်။

- လေ့လာမှုဇရိယာအတွင်းတွင် နိုင်ငံတကာမှ ကာကွယ်ထားသောဇရိယာများမပါဝင်ပါ။
- အဓိက Biodiversity Area ဖြစ်သော (ဇရာဝတီမြစ် ဆင်ဖြူကျွန်းမှ မင်းဘူးအထိ) မှာ RSF-5 လုပ်ကွက်အတွင်းတည်ရှိ ပါသည်။ ယင်းဇရိယာသည် လုပ်ကွက်ဇရိယာ၏ ၁ ရာခိုင်နှုန်းအောက်သာ ဖုံးလွှမ်းထားပြီး ဆိုက်စမစ်ဆောင်ရွက်ရာ ဇရိယာအတွင်းတွင် ရှိနေခြင်းမဟုတ်ပါ။
- RSF-5 လုပ်ကွက်တစ်ခုလုံးသည် ဇရာဝတီမြေပြန့်လွင်ပြင်များ၏ Endemic Bird Area အတွင်းတွင် တည်ရှိနေပါသည်။
- လုပ်ကွက်နှင့် အနီးဆုံး ကာကွယ်ထားခံရသည့်ဇရိယာများမှာ ရွှေစက်တော်သဘာဝဘေးမဲ့တော နှင့် ဝက်ထီးကန် ကျေးငှက်ဘေးမဲ့တောများ ဖြစ်ကြပါသည်။
- ICUN ၏ Red List အရ ၂၀၁၆ ခုနှစ်အတွက် ဇီဝမျိုးစုံကွဲပြားမှုထောက်လှမ်းလေ့လာခြင်းသုတေသနကို ဆောင်ရွက်ခဲ့ပြီး ငှက်မျိုးစိတ်ပေါင်း ၃၂ စိတ်နှင့် နို့တိုက်သတ္တဝါမျိုးစိတ် ၂ စိတ်ရှိနေကြောင်းအတည်ပြုခဲ့ပါသည်။ ဒေသခံများနှင့်ပြုလုပ်သည့် များစုံမေးမြန်းမှုများအရ နောက်ထပ် နို့တိုက်သတ္တဝါ ၁၅ မျိုး၊ ငှက် ၁၃ မျိုး၊ တွားသွား မျိုးစိတ် ၃၀ မျိုးနှင့် ကုန်းနေရေနေမျိုးစိတ် ၂၁ မျိုး၊ ကျောရိုးမဲ့သတ္တဝါ မျိုးစိတ် ၁၄ မျိုး၊ ငါးမျိုးစိတ် ၁၇

မျိုးတို့သည် စီမံကိန်း ဇရိယာအတွင်း ရှိနေနိုင်ကြောင်း လေ့လာများရှိရပါသည်။ ယင်းမျိုးစိတ်များထဲတွင် အထူးထိန်းသိမ်းစောင့် ရှောက်ရန်ရမည့် မျိုးတုန်းလုနီးပါးဖြစ်နေသော မျိုးစိတ် ၂ မျိုး၊ Endangered အဆင့် ၆ မျိုး၊ Vulnerable အဆင့် ၇ မျိုး Threatened အဆင့် မျိုးစိတ် ၁၄ မျိုးတို့ရှိနေကြောင်းများရှိရသည်။

- IPIECA နည်းပညာကို အသုံးပြု ယင်းဒေသများအတွင်းရှိ သက်ရှိများကျက်စားနေမှုကို လေ့လာဖော်ထုတ်ထားပြီး ဖြစ်ပါသည်။များရှိရသောသက်ရှိများမှာ မြက်ခင်းပြင်တွင်ကျက်စားသည့် သတ္တဝါများ၊ သစ်တောအတွင်းကျက်စား သည့်သတ္တဝါများ၊ စိုက်ပျိုးမြေများအတွင်းကျက်စားသည့်သတ္တဝါများ နှင့် ရေဝပ်ဒေသ၊ မြစ်ချောင်းအင်းအိုင် ရေကန်များတွင် ကျက်စားသည့်သတ္တဝါများဟူ၍ များရှိရပါသည်။
- ပါဝင်နေသောဂေဟစနစ်ဝန်ဆောင်မှုများမှာအမျိုးစုံရှိနေပြီးယင်းတို့ကိုအောက်ပါအတိုင်းအုပ်စုခွဲဖော်ပြနိုင်ပါသည်။ Provision ၊ Regulating နှင့် Cultural တို့ဖြစ်ပါသည်။ ESHIA အပိုဒ် ၅.၄ တွင် ဂေဟစနစ်ဝန်ဆောင်မှုစာရင်း အသေး စိတ်ကိုဖော်ပြထားပါသည်။

၁.၄.၃ လူမှုရေးဆိုင်ရာအခြေခံအချက်များ

RSF-5 လုပ်ကွက်သည် မကွေးတိုင်းဒေသကြီးတွင်တည်ရှိပါသည်။ ယင်းဒေသသည် အနောက်တောင်မုတ်သုံလေများ တိုက်ခတ်ဝင်ရောက်သည့် ရခိုင်ရိုးမ၏ မိုးရိပ်အောက်တွင် တည်ရှိပါသည်။ မြေဩဇာကောင်းမွန်မှုနည်းသော သဲနှုန်းအနှစ်များအများစုနှင့်ဖွဲ့စည်းထားပြီး မိုးနှင့်လေတို့၏ ပြင်းထန်စွာတိုက်စားမှုဒဏ်ကိုခံရသော ဒေသဖြစ်ပါသည်။

မကွေးတိုင်းဒေသကြီးတွင် မကွေး၊ မင်းဘူး ၊ သရက်၊ ပခုက္ကူ နှင့် ဂန့်ဂေါခရိုင်များဖြင့်ဖွဲ့စည်းထားပြီး မြို့နယ်ပေါင်း ၂၅ မြို့နယ် နှင့် ၁၆၉၆ ရပ်ကွက်-ကျေးရွာအုပ်များ စုပေါင်းပါဝင်ပါသည်။ မြို့တော်မှာ မကွေးမြို့ (၁၉၉၄ ခုနှစ်တွင် ခန့်မှန်းခြေလူဦးရေ ၃ သိန်းရှိ) ဖြစ်ပါသည်။ အခြားထင်ရှားသော မြို့များမှာ ပခုက္ကူနှင့် မင်းဘူးတို့ဖြစ်ကြသည်။

မကွေးတိုင်းဒေသကြီးသည်အလယ်ပိုင်းမြေနိမ့်လွင်ပြင်ဒေသတွင်တည်ရှိပြီးဇရာဝတီမြစ်နှင့် ယင်းမြစ်လက်တက်ကြီးများ၏ ရေလွှမ်းရေဝပ်ခံဒေသများလည်း ဖြစ်ပါသည်။ တောင်ကုန်းများ၊ တောင်ကြောများ နှင့် တောင်ငယ်များအချို့ နေရာများတွင် တည်ရှိပါသည်။ ဤဒေသတွင် တောင်ကြောငယ်များအထပ်ထပ်ရှိပြီး မီးတောင်များနှင့် စစ်ကိုင်းပြတ်ရွှေ့ကြောင်းပေါ်တွင် တည်နေသည့် ဒေသဖြစ်ပါသည်။ ယင်းဒေသသည် အဓိကထင်ရှားသော အလျားလိုက်ပြတ်ရွှေ့ကြောင်းကြီးပေါ်တွင် တည်ရှိနေခြင်းဖြစ်ပါသည်။

လူမှုစီးပွားဆိုင်ရာ အဓိကလေ့လာများရှိချက်များကို အောက်ပါအတိုင်းဖော်ပြအပ်ပါသည်။

- မြန်မာနိုင်ငံသည် အရင်းအမြစ်သယံဇာတကြွယ်ဝသော အထူးသဖြင့် ရေနံနှင့်သဘာဝဓာတ်ငွေ့ အပြင် ကျွန်းသစ်များ ပေါကြွယ်ဝသည့် နိုင်ငံတစ်ခုဖြစ်သည်။
- စိုက်ပျိုးရေးအဓိကလုပ်ကိုင်သည့်နိုင်ငံဖြစ်ပြီးလူဦးရေ၏၇၀% မှာ ကျေးလက်တွင်နေထိုင်ကြသူများဖြစ်သည်။ အဓိက စိုက်ပျိုးသည့်သီးနှံမှာ ဆန်စပါးဖြစ်ပြီး နိုင်ငံတစ်ဝှမ်းလုံး၏ စုစုပေါင်း စိုက်ပျိုးမြေ ၆၀ % ကို ဆန်စပါးကိုသာ စိုက်ပျိုးပါသည်။
- ဆင်းရဲသားလူတန်းစားဦးရေမှာ ၂၅.၆%ရှိပြီး နိုင်ငံသားအများစုမှာ မိမိတို့ဝင်ငွေကို အစားအသောက်ပေါ်တွင် ၇၀%နှုန်းအသုံးချကြပြီးကျန်ရှိသည့်ရာခိုင်နှုန်းအနည်းငယ်ကိုကျန်းမာရေးစောင့်ရှောက်မှုနှင့် မိမိကလေးငယ်များ ၏ ပညာရေးအတွက် အသုံးပြုကြပါသည်။
- မြန်မာနိုင်ငံတွင် လူကြီးစာတတ်မြောက်မှုနှုန်းမှာ အတော်လေး မြင့်မား (၉၂.၃%ရှိ) ပါသည်။ မူလတန်းအရွယ် ကလေးငယ်အများစု (၉၀.၂%) သည် ကျောင်းတက်နိုင်ကြပြီး ယင်းတန်ဖိုးမှာ

မကွေးတိုင်းဒေသကြီး အတွက် အတန်ငယ်(၉၃.၅%) မြင့်မားပါသည်။ ထို့ကြောင့် ၅၈.၃% (မကွေးတိုင်းဒေသကြီးတွင် ၅၅.၈%) သော အလယ်တန်းကျောင်းတက်ရမည့်အရွယ်ကလေးများက ကျောင်းတက်နေကြပါသည်။ နိုင်ငံတော်အဆင့်တွင် ကျား နှင့် မ လူဦးရေမှာ သိသာစွာ ခြားနားခြင်းမရှိပါ။

- အလုပ်လုပ်နိုင်သည့်အရွယ် လူဦးရေမှာ ၃၇.၄၄ သန်းရှိပြီး ယင်းအထဲမှ ၃၈.၁၃ သန်းမှာ အလုပ်လုပ်နေကြပါသည်။ အလုပ်လက်မဲ့နှုန်းမှာ ၄% သာရှိပါသည်။
- နိုင်ငံအတွင်းရှိ လမ်းအများစုကို ခင်းထားခြင်းမရှိသေးသည့်အပြင် မိုးရာသီတွင် လမ်းအများစုမှာ ဖြတ်သန်းသွား ရန် ခက်ခဲလှပါသည်။

၁.၄.၄ ယဉ်ကျေးမှုအခြေခံအချက်အလက်များ

ယဉ်ကျေးမှုအမွေအနှစ်များနှင့်ပတ်သက်ပြီး လေ့လာသုံးသပ်ရသမျှ များရှိချက်များမှာ အောက်ပါအတိုင်းဖြစ်ပါသည်။

- လက်ရှိမြန်မာနိုင်ငံတွင်ကမ္ဘာ့အမွေအနှစ်စာရင်းဝင်ဒေသ တစ်ခုသာရှိပြီး ပျူရှေးဟောင်းမြို့တော်များနယ်မြေ ဖြစ်ပါသည်။ယင်းဒေသတွင် အုတ်နံမုခ်ဦးတပ်ထားသည့် ဟန်လင်း၊ ဗိသုနိုးနှင့် သရေခေတ္တရာမြို့ဟောင်းတို့ ပါဝင်နေပါသည်။ယင်းမြို့ဟောင်းများသည်ဇကာဝတီမြစ်ဝှမ်းဒေသ၏ရေမဝပ်သောကြီးမားသည့်မြေပြန့်ဇုန်တွင် တည်ရှိပါသည်။ လေ့လာမှုဇရိယာနှင့် အနီးဆုံးနေရာမှာ ဗိသုနိုးမြို့ဟောင်းဖြစ်ပြီး အနီးဆုံး Shot-Point မှာ ၆ ကီလိုမီတာအကွာအဝေးတွင်တည်ရှိပါသည်။ Peak Particle Velocity meter ၂ PPV ဖြင့် တုန်ခါမှုဆိုင်ရာသက်ရောက်မှုစစ်ဆေးလေ့လာခြင်းကို ဆိုက်စမစ်တိုင်းတာမှုများပြုလုပ်စဉ်တွင် တစ်ပါတည်း ပြုလုပ်သွားမည်ဖြစ်ပြီးယင်းသို့ပြုလုပ်ခြင်းဖြင့်ဆိုက်စမစ်လှိုင်းများပုံ့နှံ့ရာဇရိယာအတွင်းရှိယဉ်ကျေးမှုဒေသမျ ားကို သက်ရောက်မှုရှိစေနိုင်ခြင်း ရှိမရှိကို လေ့လာသိရှိနိုင်စေရန်ဖြစ်သည်။ PPV တိုင်းတာမှုများကို ဒေသတွင်းတည်ဆဲဥပဒေစည်းမျဉ်းများနှင့်အညီဆောင်ရွက်သွားမည်ဖြစ်ပါသည်။ ဒေသစံနှုန်းများမရှိခဲ့ပါလျှင် PPVလုပ်ထုံးလုပ်နည်းများကိုeni၏လုံခြုံရေးအကွာအဝေးပြစံနှုန်းဇယားအားအခြေခံပြီးသတ်မှတ် ဆောင်ရွက်သွားမည်ဖြစ်သည်။
- မြန်မာနိုင်ငံသည် ဘုရားစေတီများပေါများသည့် နိုင်ငံတစ်ခုဖြစ်သောကြောင့် စီမံကိန်းဇရိယာအတွင်း ဘုရားစေတီများသိသာထင်ရှားသည့်ပမာဏတစ်စုအထိတည်ရှိနေသည်ကိုများရှိရပါသည်။ လုပ်ကွက်ဇရိယာ အတွင်းစေတီပေါင်း၉၆ဆူတည်ရှိနေပါသည်။
  ရှေးဟောင်းသုတေသနနယ်မြေများကို "ယဉ်ကျေးမှုအမွေအနှစ်များစောင့်ကြည့်လေ့လာရေးစီမံကိန်း" ဖြင့် စီမံခန့်ခွဲစောင့်ကြည့်လေ့လာသွားမည်ဖြစ်ပါ သည်။

၁.၄.၅ အသွင်အပြင်ဆိုင်ရာအခြေခံအချက်အလက်များ

RSF-5 လုပ်ကွက်၏ နယ်မြေဇရိယာအား ဂြိုလ်တုမြေပုံများပေါ်တွင် အခြေခံပြီး အောက်ပါအတိုင်း အဓိက ဇရိယာကြီးများအဖြစ် ခွဲခြားသတ်မှတ်နိုင်ပါသည်။

- စိုက်ပျိုးမြေဇရိယာများ-ယင်းဇရိယာများတွင်စိုက်ပျိုးမြေကွက်များတစ်ဆက်တည်းတည်ရှိနေပြီး ယင်းမြေကွက်များအကြားစိုက်ပျိုးမြေကွက်တစ်ကွက်နှင့်တစ်ကွက်ကိုဆက်စပ်ပေးထားသည့်အလွန် ကျဉ်းမြောင်းသောကွန်ယက်သဖွယ်ဖြစ်နေသည့်လယ်ကန်သင်းရိုးများဖြင့်ချိတ်ဆက်ထားသည်။

ယင်း ဇရိယာကို အဓိကသဘာဝ ရေမြောင်းကွန်ယက် (ရိုး) စနစ်မှ စိုက်ပျိုးရေးဖြန့်ဖြူးပေးပြီး လူအားဖြင့် တူးဖော်ထားသော ရိုးငယ်များဖြင့် စိုက်ပျိုးမြေကွက်များသို့ ရေရရှိအောင် ဖောက်သွယ်ထားသည်။

- ရေလွှမ်းမြေပြန့်ဒေသများ - ယင်းဒေသများသည် ရေရရှိနိုင်မှုအလွန်မြင့်မားသောကြောင့် ကြီးမားသည့် သဘာဝပေါက်ပင်များလွှမ်းမိုးပေါက်ရောက်နေကြသည်။အဓိကအားဖြင့် မြက်ခင်းပြင်နှင့် သစ်တောကွက်ငယ်များတည်ရှိသည်။ မြစ်များကို အဓိကအားဖြင့် ယှက်နွယ်နေကြပြီး မြစ်ကြမ်းပြင်များတွင် သဲနုန်းများနှင့် ကျွန်းငယ်များ အများအပြားတည်ရှိသည်။ အနယ်ကျနန်းများကို ရေလွှမ်းမြေပြန့်ဒေသများတွင် ကျယ်ပြန့်စွာ များရပြီး လမ်းများဖြင့် ဆက်သွယ်ထားသည်ကိုများရသည်။
- တောင်ကုန်းဒေသတွင် တိုက်စားမှုကြောင့်ဖြစ်ပေါ်သောမြေအမျိုးအစားများရှိသည့် ဇရိယာ - ယင်းဇရိယာတွင် ချုံပုတ်၊ ချုံနွယ်များ၊ တောအုပ်များသည် မြစ်လက်တက်ငယ်များနှင့် ချောင်းစပ်များအထိ ပေါက်ရောက်လွှမ်းမိုးထားကြသည်။တောင်ကုန်ချိုင့်ဝှမ်းနှင့်တောင်ကြားများအကြားရှိယင်းမြေအမျိုးအစားများကိုစိုက်ပျိုးဇရိယာများအဖြစ်ပြောင်းလဲထားကြသည်။ယင်းဇုန်များသို့ခေတ်မီလမ်းပန်းဆက်သွယ်မှုများမပေါက်ရောက်သေးသည့်အပြင် လူနေထိုင်ခြင်းနှင့် လူနေအိမ်ခြေများ ရှားပါးနေကြောင်းများရှိရပါသည်။
- လူနေအိမ်ခြေများနှင့် ကျေးရွာများ

၁.၄.၆ ကျန်းမာရေးအခြေခံအချက်အလက်

ESHIA တွင်ဖော်ပြထားသည့် လေ့လာမှုဇရိယာအတွင်းရှိ ကျန်းမာရေးအခြေအနေများမှာ နိုင်ငံတော်အဆင့်နှင့် တိုင်းဒေသ ကြီးအဆင့်ရှိ ရရှိနိုင်သော သတင်းအချက်အလက်များကို သုံးသပ်ထားမှုများမှတဆင့် အခြေခံပြီးပြုစုထားခြင်းဖြစ်သည်။ အဓိကလေ့လာများရှိမှုများမှာ အောက်ပါအတိုင်ဖြစ်ပါသည်။

- ကျန်းမာရေးပြဿနာများကိုခံနိုင်စွမ်းမရှိသည့်အချို့အရပ်များတွင်ကျန်းမာရေးသတင်းအချက်အလက်များနှင့် ကျန်းမာရေးဝန်ဆောင်မှုများရရှိမှုမှာအကန့်အသတ်ဖြင့်ရှိနေပါသည်။ ယင်းတို့အထဲတွင် ကျေးလက်ဒေသနေပြည်သူများ၊ ဝေးလံခေါင်ဖျားသည့်အရပ်ဒေသနေသူများနှင့် မြို့စွန်မြို့ဖျားမှ ဝင်ငွေနည်းသော မိသားစုများတို့ပါဝင်ပါသည်။
- နိုင်ငံသားများ ကျန်းမာအသက်ရှည်ကြစေရန်ကြီးမားသည့်ရည်ရွယ်ချက်ဖြင့် နိုင်ငံတော်အဆင့်ကျန်းမာရေးစီမံကိန်းကို ဖော်ထုတ်ထားပြီးဖြစ်ပါသည်။ အနာဂါတ်တွင် ကျန်းမာရေးစိန်ခေါ်မှုများကိုဖြေရှင်းနိုင်ရန်အတွက် နှစ်ဝက်နှစ်ရှည်စီမံကိန်းကြီးများ၊ နိုင်ငံတော်ကဏ္ဍစုံဖွဲ့ဖြိုးတိုးတက်ရေးစီမံချက်များကိုကျန်းမာရေးကဏ္ဍအတွက် ထည့်သွင်းချမှတ်ပြီးဖြစ်ပါသည်။
- မြန်မာနိုင်ငံ၏ လူသက်တမ်းပျမ်းမျှ ၆၅.၉ နှစ်ရှိပါသည်။ အမျိုးသားများမှာ ၆၃.၆ နှစ်ပျမ်းမျှဖြစ်ပြီး အမျိုးသမီးများမှာ ၆၈.၅ နှစ်ပျမ်းမျှဖြစ်ပါသည်။
- မကွေးတိုင်းဒေသကြီးတွင် သောက်သုံးရေရယူသည့်အဓိကအရင်းအမြစ်များမှာ အဝီစိတွင်းများမှရယူမှုမှာ ၅၃.၉ % ဖြစ်ပြီး အကာအရံရှိသည့်ရေတွင်းမှာ ၁၈.၉% ဖြစ်သော်လည်း ၇.၂% သောရေတွင်းများမှာ အကာအရံ မရှိသော တွင်းများဖြစ်ကြပြီး ၁၀.၆%မှာ ရေတွင်းရေကန်များမှ ရယူခြင်းဖြစ်သည်။
- မြန်မာနိုင်ငံတွင် မိလ္လာနှင့်ရေဆိုးနှုတ် စနစ်များဖွံ့ဖြိုးတိုးတက်မှုသည် ဒေသခံများ၏ စီးပွားရေး၊ နေထိုင်ရာအရပ်ဒေသတို့ နှင့် ကြီးမားစွာဆက်စပ်နေပါသည်။ မြို့ပြများတွင် လူဦးရေ၏ ၉၄.၄ % သည် မိလ္လာနှင့်ရေဆိုး စနစ်များကို ရရှိအသုံးပြုနိုင်ကြပြီး ကျေးလက်များတွင် ၈၀.၄ % နှင့် အဆင်းရဲဆုံးလူတန်းစားများအနေဖြင့် တိုးတက်သည့် အခြေခံအဆောက်အအုံများကို ၅၉.၈% ခန့်သာလျှင် ရရှိကြသည်။ အချမ်းသာဆုံး လူတန်းစားများအကြားတွင် ၉၈.၂% ခန့်ရရှိကြသည်ကိုများရသည်။

- မကွေးတိုင်းဒေသကြီးတွင် ကလေးသူငယ်များ မွေးသေဆုံးနှုန်းမှာ အမြင့်မားဆုံးဖြစ်ပြီး မြန်မာနိုင်ငံ၏ သေဆုံးနှုန်းနှင့် အဆင့် ၅ အောက်တွင်ရှိသည်။ (မွေးဖွားပြီးအသက်ရှင်နှုန်းမှာ ၁၈၈၀ ဦးရေတွင် ၇၂.၉ သေဆုံးပြီး ၁၈၈၀ တွင် ၁၁၃.၆ သေဆုံးနှုန်းရှိသည်) ။ မိခင်သေဆုံးမှုနှုန်းမှာ ၁၈၈၀ မွေးဖွားလျှင် ၂.၉ ဦးသေဆုံးသည်(နိုင်ငံတော်အဆင့်သေစာရင်းသုတေသန၁၉၉၉ခုနှစ်မှအချက်အလက်များကိုအခြေခံသည်။)

၁.၅ သက်ရောက်မှုစစ်ဆေးတိုင်းတာခြင်းနှင့် လျော့ချရေးနည်းလမ်းများ

စီမံကိန်း၏ သဘာဝပတ်ဝန်းကျင်၊ လူမှုရေးနှင့် ကျန်းမာရေးသက်ရောက်မှုများအား
သတ်မှတ်ဖော်ထုတ်တိုင်းတာခြင်းတို့ကို စီမံကိန်းနှင့်ပတ်သက်သော 3D Seismic Survey
လုပ်ငန်းဆောင်ရွက်မှုများအတွက် ဆောင်ရွက်ပြီးဖြစ်ပါသည်။

(ကောင်းကျိုး သို့မဟုတ် ဆိုးကျိုး) သက်ရောက်မှုတစ်ခုချင်းစီ၏ ထူးခြားမှုများကို eni ၏ စံနှုန်းသတ်မှတ်ထားချက်များ (Environmenatal , Social and Health Impact Assessment in Exploration_ AMTE - TG 002 r00) :နှင့်အညီ အောက်ပါ စံနှုန်းသတ်မှတ်ချက်များကို အသုံးပြုလျက် စစ်ဆေးတိုင်းတာထားပြီဖြစ်ပါသည်။

- သက်ရောက်မှု၏ ကာလအတိုင်းအတာ (ဥပမာ - ယာယီ၊ ကာလတို၊ ကာလရှည်၊ အမြဲတမ်း)
- သက်ရောက်မှု၏ အကွာအဝေးအတိုင်းအတာ (ဥပမာ - နယ်မြေအတွင်း၊ ဒေသအတွင်း၊ နိုင်ငံတော်အတွင်း၊ နယ်နိမိတ်ဖြတ်ကျော်သက်ရောက်မှု)
- သက်ရောက်မှုခံရသော receptor/resource ၏ ခံနိုင်မှု၊ မူလအခြေအနေပြန်ဖြန်နိုင်မှု နှင့်/သို့မဟုတ် အရေးပါမှု
- သက်ရောက်မှုကို ခံစားရနိုင်သည့် အရာများအရေအတွက် (လူပုဂ္ဂိုလ်များ၊ အိမ်ထောင်စုများ၊ လုပ်ငန်းများ၊ မျိုးစိတ်များ၊ စားကျက်မြေများ)

သက်ရောက်မှုလျော့ချစေနိုင်မည့် ထိရောက်သော ဆောင်ရွက်မှုများကို ဖော်ထုတ်ထားပြီးဖြစ်သည့်အပြင် သက်ရောက်မှုစစ်ဆေးတိုင်းတာမှုတွင် ယင်းဆောင်ရွက်မှုများမကို သက်ဆိုင်ရာ သဘာဝပတ်ဝန်းကျင် ၊ လူမှုရေးနှင့် ကျန်းမာရေးအခြေခံအချက်အလက်များအသီးသီးစီအားဒေသတွင်းသက်ရောက်မှုများအဖြစ်အရေးပေးလေ့လာသုံးသပ် ထားပြီးဖြစ်ပါသည်။

၁.၅.၁ သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုများ

Seismic Survey ကို RSF-5 လုပ်ကွက်ဧရိယာအများစုတွင် ဆောင်ရွက်သွားမည်ဖြစ်ပါသည်။ ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှုများကိုလည်း ပင်မ Land Cover များအဖြစ် မြေလွတ်မြေရိုင်း ၊ သဘာဝပေါက်ပင်များ ၊ အဆောက်အဦ၊ လမ်းများ ၊ မြို့ပြဧရိယာ ၊ မြို့ပြစိုက်ပျိုးရေးနေရာများ ၊ ကောက်ပဲသီးနှံစိုက်ပျိုးမြေများ၊ မြက်ခင်းပြင်များ၊ မြစ်အတွင်းထွန်းနေသည့်သောင်များ၊ ကျောက်ဖြုန်း နှင့် ကျောက်စရစ်ဖြူများ၊ မြစ်များ၊ ရေတွင်းရေကန် အင်းအိုင်မြစ်ချောင်းများ ဟုခွဲခြားသတ်မှတ်ထားပြီးဖြစ်ပါသည်။

စီမံကိန်းကြောင့် ဖြစ်ပေါ်နိုင်သည့် သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ သက်ရောက်မှုများမှာ အောက်ပါတို့နှင့်ဆက်နွယ်နေပါသည်။

- လေထုအရည်အသွေး
- ဆူညံမှုနှင့် တုန်ခါမှု
- ရေထု
- မြေဆီလွှာနှင့် အောက်မြေဆီလွှာ

- ဒေသရင်းအပင်များနှင့် သဘာဝပေါက်ပင်များ
- ဒေသရင်းတိရစ္ဆာန်များနှင့် စားကျက်မြေများ
- ဂေဟစနစ်ဝန်ဆောင်မှုများ

သဘာဝပတ်ဝန်းကျင်အပေါ် သက်ရောက်မှုများသည်ဆိုက်စမစ်မြေတိုင်းလုပ်ငန်းစီမံကိန်းဆောင်ရွက်မှုများပြုလုပ်နေချိန်တွင် ဖြစ်ပေါ်နိုင်သည့်အလားအလာရှိပါသည်။

အထက်ဖော်ပြပါအခြေခံအမျိုးအစားများအပေါ် ဖြစ်ပေါ်လာနိုင်သည့် သက်ရောက်မှုများအား အောက်ပါ ကဏ္ဍများဖြင့် ဖော်ပြမည်ဖြစ်ပြီး အချပ်ပို ၃ တွင်လည်း အကျဉ်းချုပ်ဖော်ပြထားပါသည်။

၁.၅.၁.၁ လေထု

- LandCoverအမျိုးအစားအားလုံးအတွက်အသေးစားဖေါက်ခွဲမှုများမှ ဖုန်မှုန့်များထုတ်လွှတ်မှုကြောင့်ဖြစ်သော သက်ရောက်မှုများမှာ နည်းပါးကြောင်းမျှော်လင့်ရပါသည်။ လျော့ချခြင်းများ ဥပမာ Wet Suppression နည်းကို အသုံးပြုခြင်း၊ စက်ယန္တရားများ၏ အရှိန်ကိုကန့်သတ်ခြင်း၊ ဖုန်မှုန့်ထွက်ရှိမှုကို ထိန်းချုပ်သည့် နည်းလမ်းများအသုံးပြုခြင်း၊လမ်းများအားအချိန်သတ်မှတ်ပြီးပုံမှန်ပြုပြင်ပေးခြင်းတို့ကို အကောင်အထည်ဖော်ရပါမည်။
- ယာဉ်များနှင့် မီးစက်များမှ မှုတ်ထုတ်လိုက်သော လေထုညစ်ညမ်းစေသည့် အရာများထုတ်လွှတ်မှုကြောင့် ဖြစ်ပေါ်သော သက်ရောက်မှုမှာလည်း Land Cover အမျိုးအစားအားလုံးအတွက် နည်းပါးမည်ဟု မျှော်လင့်ရပါသည်။ပုံမှန်ပြုပြင်ထိန်းသိမ်းခြင်း၊ယာဉ်ယန္တရားများအသုံးချမှုကိုလျော့ချခြင်း၊ မီးစက်များကိုလည်း WHO ၏ထောက်ခံလမ်းညွှန်ချက်များနှင့်အညီ လေအောက်ဘက် အရပ်များတွင်သာ ထားရှိသုံးစွဲခြင်းစသည့် လျော့ချရေးလုပ်ငန်းစဉ်များကို အကောင်အထည်ဖော်ဆောင်ရွက်သွားပါမည်။

သက်ရောက်မှု၏ သဘာဝနှင့် အကောင်အထည်ဖော်မည့် လျော့ချရေးနည်းလမ်းများကို ထည့်သွင်းစဉ်းစားကြည့်ပါက ဆိုက်စမစ်မြေတိုင်းလုပ်ငန်းဆောင်ရွက်မှုကြောင့်ဖြစ်ပေါ်လာသော သက်ရောက်မှုများမှာ ဒေသတစ်ခုလုံးအတွက် **နည်းပါး မည်**ဟု မျှော်လင့်ရပါသည်။

၁.၅.၁.၂ ဆူညံမှုနှင့် တုန်ခါမှုဖြစ်ပေါ်စေခြင်း

- လုပ်ငန်းခွင်ပြင်ဆင်နေရာချခြင်းနှင့် Line Clearance တို့လုပ်ဆောင်ချိန်အတွင်း ဆူညံမှုနှင့် တုန်ခါမှုဖြစ်ပေါ်ခြင်းတို့ကြောင့်ဖြစ်သော ကာလတိုသက်ရောက်မှုများမှာ ယခုလေ့လာသည့် ဇရိယာတွင် နည်းပါးမည်ဟု ခန့်မှန်းရပါသည်။ယာဉ်ယန္တရားများအားအသုံးမလိုပါကစက်ရပ်ထားစေခြင်းစသည့် သက်ရောက်မှုလျော့ချရေးလုပ်ငန်းစဉ်များကို အကောင်အထည်ဖော်သွားပါမည်။
- ဖောက်ခွဲမှုလုပ်ငန်းဆောင်ရွက်မှုကြောင့်ဖြစ်ပေါ်လာမည့်ဆူညံမှုနှင့်တုန်ခါမှုများမှာ ယခုလေ့လာသည့်ဇရိယာတွင် နည်းပါးမည်ဟု ခန့်မှန်းရပါသည်။ ယာဉ်ယန္တရားများအား အသုံးမလိုပါက စက်ရပ်ထားစေခြင်း၊ ဆူညံမှုဖြစ်စေမည့် လုပ်ငန်းဆောင်ရွက်မှုများကို တစ်ပြိုင်နက်တည်း ပူးပေါင်းဆောင်ရွက်စေခြင်း ဖြင့် ဆူညံမှုကို တစ်ပြိုင်တည်းဖြစ်ပေါ်စေခြင်း၊ ဆူညံမှုကို ခံနိုင်စွမ်းမရှိဆုံးဖြစ်သည့် အချိန်များတါင် ဆူညံမှု ဖြစ်ပေါ် စေမည့် လုပ်ငန်းဆောင်ရွက်မှုများကိုကန့်သတ်ထားခြင်းစသည့်လျော့ချမှုနည်းလမ်းများအားအကောင်အထည်ဖော်သွားပါမည်။

ဆိုက်စမစ်လုပ်ငန်းဆောင်ရွက်မှုများကြောင့် ထွက်ပေါ်လာသော ဆူညံမှုနှင့် တုန်ခါမှုများမှာ ယာယီသာဖြစ်ပြီး လုပ်ငန်းဆောင်ရွက်သည့် ဆိုက်များနှင့် ကပ်လျက်ပတ်ဝန်းကျင်မှာ အကန့်အသတ်ဖြင့်သာ သက်ရောက်မှုရှိစေမည် ဖြစ်ပါသည်။ လူနေပတ်ဝန်းကျင်များနှင့် ရွာများတွင် **အတန်အသင့်** သက်ရောက်မှုရှိမည်ကလွဲ၍ ဇရိယာတစ်ခုလုံးတွင် သက်ရောက်မှု**နည်းပါးမည်**ဟုခန့်မှန်းရပါသည်။ဆူညံမှုထွက်ပေါ်စေမှုများဖော်ထုတ်နိုင်စေရန်နှင့်လျော့ချမှုနည်းလမ်းများကို အမှန်တကယ် ထိရောက်စွာ ဖော်ထုတ်နိုင်စေရန် အတွက် ဆူညံမှုကို တိုင်းတာ စောင့်ကြည့်သည့် အစီအစဉ်တစ်ခုကို သတ်မှတ်ဖော်ထုတ်ထားပြီးဖြစ်ပါသည်။

၁.၅.၁.၃ ရေထု

ဆိုက်စမစ်လုပ်ငန်းဆောင်ရွက်မှုများမှ အတွက် ရေထုအပေါ်သက်ရောက်နိုင်သည့် အကြောင်းများမှာ လုပ်ငန်းခွင်ပြင်ဆင်တည်ဆောက်ခြင်း၊ Line Clearance ပြုလုပ်ခြင်း၊ နှင့် လမ်းများဖောက်လုပ်ခြင်း၊ ရေသုံးစွဲခြင်း၊ စက်ယန္တရားများ သွားလာလှုပ်ရှားခြင်း၊ စက်ကိရိယာများနှင့် လုပ်သားများ သွားလာလှုပ်ရှားကြခြင်း၊ အညစ်အကြေးစီမံခန့်ခွဲမှုဆောင်ရွက် ခြင်းတို့ဖြစ်သည်။ ဖြစ်ပေါ်လာမည့် သက်ရောက်မှုများနှင့် ဆောင်ရွက်မည့် လျော့ချရေးနည်းလမ်းများမှာ အောက်ပါအတိုင်း ဖြစ်ကြသည်။

- အဖတ်နှင့်အရည်အညစ်အကြေးများကြောင့် ရေအရင်းအမြစ်များအား မမျော်လင့်ဘဲ ညစ်ညမ်းစေရာမှ ဖြစ်ပေါ်နိုင် ချေရှိသည့် သက်ရောက်မှုများမှာ **အတန်အသင့်** သာရှိမည်ဟု တွက်ချက်ထားပါသည်။ ရေနှင့်အညစ်အကြေး စီမံခန့်ခွဲမှုအတွက် သီးသန့်အစီအစဉ်တစ်ခု (ESHIA ၏ အပိုဒ် ၈ ကိုကြည့်ပါ)ကို ထည့်သွင်းဆောင်ရွက် သွားမည် ဖြစ်ပြီး စွန့်ပစ်အရည်များအား ရေအရင်းအမြစ်များထဲသို့ စွန့်ပစ်ခြင်းအား ခွင့်ပြုမည်မဟုတ်ပါ။
- လောင်စာဆီများ၊ ချောဆီများနှင့် ဓာတုပစ္စည်းများကြောင့် ညစ်ညမ်းအဆိပ်သင့်ခြင်းများဖြစ်ပေါ်ခြင်းကြောင့် ဖြစ်သော သက်ရောက်မှုများ **အတန်အသင့်** သာရှိပါမည်။ သက်ရောက်မှု လျော့ချခြင်း နည်းလမ်းများ အဖြစ် ယာယီလောင်စာသိုလှောင်မှုများကိုသေချာစွာစနစ်တကျစည်းကမ်းဖြင့်လုပ်ဆောင်စေမည်၊လုပ်ငန်းခွင် အတွင်းလောင်စာဆီပြန်လည်ဖြည့်တင်းမှုကိုဖိတ်စင်မှုမဖြစ်ပေါ်စေရန်လိုအပ်သည့်ကိရိယာစက်ပစ္စည်းများ ဖြင့်ဆောင်ရွက်စေမည်၊မတော်တဆလောင်စာဆီယိုဖိတ်မှုဖြစ်ပေါ်ခြင်းများတွင်အရေးပေါ်တုံ့ပြန် ဆောင်ရွက်နိုင်ရန်အတွက် လုပ်ငန်းဆောင်ရွက်သူများအား လေ့ကျင့်သင်ကြားပေးထားမည်။ မြစ်ချောင်းများ ရေစပ်များတွင် မည်သည့် စက်ပစ္စည်းကိုမှ ဆေးကြောသန့်စင်ခြင်း မပြုလုပ်စေအောင် ကွပ်ကဲသွားမည်။
- အရည်များလျှံထွက်ခြင်းကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် သက်ရောက်မှုများမှာ **နည်းပါးမည်** ဟု ခန့်မှန်းပါသည်။ လုပ်ဆောင်မည့် သက်ရောက်မှုလျော့ချရေးလုပ်ငန်းစဉ်များမှာ _ (သဘာဝပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ် အတွင်း) ရေလျှံမှုအား စီမံခန့်ခွဲမှုဗျူဟာ၊ Access point တစ်ခုချင်းစီအတွက် တာဝန်ကျ ယာဉ်ယန္တရားသာရှိနေ စေရန် ထိန်းချုပ်ထားခြင်း၊ သစ်ပင်ချုံပုတ်များ ခုတ်ထွင်ခြင်းအား အနည်းဆုံးဖြစ်စေခြင်း၊ လိုအပ်လျှင် ရေမြောင်း များကို လမ်းလွှဲခြင်း ၊ နန်းကာများ နှင့် ရေကာတာများကဲ့သို့ အတားအဆီးများဖြင့် အနည်ကျမှုကို လျော့ချခြင်း ၊ ရေမြောင်းစနစ်များအား ပြုပြင်ထိန်းသိမ်းခြင်း၊ အန္တရာယ်ရှိသည့် ကာလများတွင် နန်းမြေပေါ်တွင် လုပ်ရသော လုပ်ငန်းဆောင်ရွက်မှုများကို ရှောင်ကျဉ်စေခြင်း Uphole များ တူးခြင်းကြောင့် နောက်ဆက်တွဲဖြစ်ပေါ်လာသော ညစ်ညမ်းမှုများ မရှိခြင်းသေချာအောင် စစ်ဆေးမည့် မြေအောက်ရေအရည်အသွေး နှင့် မြေအောက်ရေဘူမိဗေဒ ဆိုင်ရာ Survey များကို ဆောင်ရွက်ခြင်းတို့ကို ဆောင်ရွက်သွားမည်ဖြစ်ပါသည်။

- ရေအရင်းအမြစ်များတွင် အနယ်ကျမှုများဖြစ်ပေါ်ခြင်း၏ ထိခိုက်မှုများမှာ **နည်းပါးမည်** ဟုခန့်မှန်းရပါသည်။ သက်ရောက်မှုလျော့ချနိုင်ရေးဆောင်ရွက်မှုများအဖြစ်ရေနှင့်အနီးတစ်ဝိုက်ရေစပ်နေရာများ ၊ အပေါ်ယံမြေသားပါးလွှာသောမြေအောက်ရေအောင်းလွှာများရှိနိုင်သည့်နေရာများတွင်စက်ယန္တရားများမောင်းနှင်ရမည့် အရှိန်ကို ကန့်သတ်လျော့ချခြင်း စသည်တို့ကို အကောင်အထည်ဖော်ဆောင်ရွက်မည်ဖြစ်ပါသည်။
- လုပ်ငန်းခွင်နေရာပြင်ဆင်တည်ဆောက်ခြင်းများပြုလုပ်နေစဉ်နှင့် Survey ပြုလုပ်နေစဉ်အတောအတွင်း ရေအရင်း အမြစ်များ အသုံးပြုမှုကြောင့် လေ့လာမည်ဇရိယာအတွက် သက်ရောက်မှုဖြစ်ပေါ်ခြင်းမှာ **နည်းပါးမည်**ဟုခန့်မှန်းရပါသည်။လုပ်ငန်းခွင်များတွင်သောက်ရေသန့်ဘူးများကိုထောက်ပံ့ပို့ဆောင်ပေးထားမည် ဖြစ်ပါသည်။
- Shot Holes များတူးဖော်နေစဉ်၊ Shooting နှင့် Recording လုပ်ငန်းစဉ်များ ဆောင်ရွက်နေစဉ်အချိန်အတွင်း မြေအောက်ရေအရည်အသွေးနှင့်မြေပေါ်နှင့်လေထုအတွင်းရှိရေဓာတ်များအားညစ်ညမ်းစေမည့် အလားအလာ များမှာ **အတန်အသင့်** ရှိမည်ဟု လေ့လာတွက်ဆထားပါသည်။ အဆိုပါသက်ရောက်မှုများကို လျော့ချနိုင်ရန် အတွက် ရေစီးသည့် တွင်းပေါက်များအား သင့်တော်မည် ရွှံ့တုံးများဖြင့် ပိတ်ဆို့ခြင်း၊ Charge လုပ်ခြင်းကို တန်ရုံသင့်ရုံသာ ဖြစ်စေခြင်း၊ Shot Hole ၏ အနက်ပေကို ဒေသ၏ ဘူမိဗေဒနှင့်ကိုက်ညီစေမည့် အနက်ပေအထိသာ တူးစေခြင်း၊ ဖိတ်စင်မှုများဖြစ်ပေါ်ပါက ဗန်းများဖြင့် ခံခြင်း၊ ဆီစုပ်သည့်အရာဝတ္ထုများဖြင့် ဖိတ်စင်သည့်ဆီများ ကိုစုပ်ယူစေခြင်း၊ စီမံကိန်းဇရိယာတစ်ဝိုက်တွင် နန်းတားများကိုခံထားစေခြင်းဖြင့် ရေတွင်းများမှ လျှံကျမှုများအား အတားအဆီးများလျော့ချပေးနိုင်ပြီး ဖိတ်စင်သည့် လောင်စာများ အနည်းငယ်ခန့်သာပါဝင်အောင်တားဆီးနိုင်စေခြင်းစသည့်နည်းလမ်းများကိုအကောင်အထည်ဖော် ဆောင်ရွက်ပါမည်။

ဒေသတွင်းအတိုင်းအတာနှင့် အချိန်ကြာရှည်စွာဆောင်ရွက်မှုတို့ကို ထည့်သွင်းစဉ်းစားကြည့်လျှင် (စွန့်ပစ်အရည်များ၊ အညစ်အကြေးများ၊ လောင်စာများ၊ ဆီများ၊ အစရှိသည်တို့ကြောင့်) ဖြစ်ပေါ်နိုင်သည့် ညစ်ညမ်းမှုများကြောင့် ရေချိုအရင်းအမြစ်များ အပေါ် သက်ရောက်မှု များမှာ **အတန်အသင့်** ရှိမည်ဟုတွက်ဆနိုင်ပါသည်။ ရေနှင့် ဆီရေစနစ်များ အနယ်များ၊ ရေသုံးစွဲမှုများကို အတားအဆီးဖြစ်စေသောကြောင့် ရေချိုများအပေါ် သက်ရောက်မှုမှာ **နည်းပါးမည်** ဟု ခန့်မှန်းရပါသည်။

၁.၅.၁.၄ မြေဆီလွှာနှင့် အောက်မြေဆီလွှာ

မြေဆီလွှာနှင့် အောက်မြေဆီလွှာတို့အား သက်ရောက်မှုဖြစ်စေနိုင်သည့် အကြောင်းရင်းများမှာ လုပ်ငန်းခွင်ပြင်ဆင်တည်ဆောက်ခြင်း၊ Line Clearance ပြုလုပ်ခြင်း၊ လမ်းများဖောက်လုပ်ခြင်း၊ Down-hole များတူးဖော်ခြင်း၊ စက်ယန္တရားများ သွားလာလှုပ်ရှားခြင်း၊ စက်ကိရိယာများနှင့် လုပ်သားများ သွားလာလှုပ်ရှားကြခြင်း၊ အညစ်အကြေးစီမံခန့်ခွဲမှုဆောင်ရွက် ခြင်းတို့ဖြစ်သည်။ ဖြစ်ပေါ်လာမည့် သက်ရောက်မှုများနှင့် ဆောင်ရွက်မည့် လျော့ချရေးနည်းလမ်းများမှာ အောက်ပါအတိုင်း ဖြစ်ကြသည်။

- မြေဆီလွှာကို မမျှော်လင့်ဘဲ ညစ်ညမ်းစေခြင်းမှ ဖြစ်ပေါ်လာစေမည့် သက်ရောက်မှုများမှာ **အတန်အသင့်** ရှိမည် ဟု တွက်ဆရပါသည်။ သံကုန်းကန်ရစ်ပြားများ၊ တစ်ဆင့်ခံလာရောက်သယ်ထုတ်နိုင်မည့် သိုလှောင်ကန်များ၊ လောင်စာဆီပြန်လည်ဖြည့်တင်းရသည့် နေရာများတွင် လမ်းများခင်းပေးထားခြင်း၊ စွန့်ပစ်အညစ်အကြေး စီမံခန့်ခွဲ ခြင်းအစီအစဉ်အစရှိသည့် သက်ရောက်မှုလျော့ချရေးအစီအစဉ်များကို အကောင်အထည်ဖော်သွားပါမည်။

- မြေသားကို အရည်အသွေးလျော့ကြေစေခြင်းနှင့် မြေသားပြောင်းလဲမှုကြောင့် ဖြစ်ပေါ်နိုင်သော သက်ရောက်မှုများမှာ**နည်းပါးမည်**ဟုခန့်မှန်းရပါသည်။တိုက်စားမှုဖြစ်ပေါ်နိုင်သည့်မြေသားများကိုရှောင်ရှားခြင်း၊ မဖြစ်နိုင်ပါက မြေတိုင်းစီစဉ်မှုတွင် ယင်းမြေအမျိုးအစားများတွင်ဆောင်ရွက်မှုအား လျော့ချခြင်း၊ မိုးသည်းထန်စွာရွာပြီးချိန်မျိုးတွင်မြေသားကြံ့ခိုင်အောင်ထောက်ပံ့သည့်ပစ္စည်းကိရိယာများကို ယာယီတပ်ဆင်အသုံးပြုခြင်း၊ယာဉ်အသွားအလာရှိသောလမ်းကြောင်းများပေါ် သို့ယာဉ်များတက်ရောက် မောင်းနှင်ခြင်းအား ကန့်သတ်ခြင်းတို့ကို သက်ရောက်မှုလျော့ချခြင်းနည်းလမ်းများအဖြစ်အသုံးပြုပါမည်။ မြေတိုက်စားမှုနှင့် အနယ်ကျမှု ထိန်းချုပ်သည့် နည်းလမ်းများကို အကောင်အထည်ဖော်အသုံးပြုပါမည်။
- လုပ်ငန်းခွင်သုံးယာဉ်များကို အများပြည်သူသွားလာသည့် ယာဉ်လမ်းကြောင်းများပေါ် တက်ရောက် မောင်းနှင်ခြင်း ကိုလုံးဝခွင့်ပြုမည်မဟုတ်ဘဲ ယင်းတို့အတွက် သတ်မှတ်ပေးထားသည့် အသုံးပြုလမ်းများ၊ လုပ်ငန်းခွင်များ တွင်သာရှိစေရန် ထိန်းချုပ်ကန့်သတ်ထားမည် ဖြစ်သောကြောင့် အများပြည်သူလမ်းများ ယာဉ်ကြော ပိတ်ဆို့မှု အခက်အခဲဖြစ်စေမည့် သက်ရောက်မှုများ **နည်းပါးမည်** ဟုခန့်မှန်းရပါသည်။

မြေသားထုစားကျက်မြေများတွင် တိုက်စားမှုဖြစ်ပေါ်ခြင်းကြောင့် ညစ်ညမ်းဖြစ်ပေါ်စေနိုင်သည့်အလားအလာ မှာ **အတန်အသင့်** ဖြစ်မည်ဟုခန့်မှန်းရသည်မှ လွဲ၍ ကျန်လုပ်ငန်းခွင်ဇရိယာတစ်ခုလုံးအပေါ် သက်ရောက်မှုမှာ **နည်းပါးမည်** ဟု ခန့်မှန်းရပါသည်။

၁.၅.၁.၅ ဒေသရင်းအပင်များနှင့် သဘာဝပေါက်ပင်များ

ဒေသရင်းအပင်များနှင့် သဘာဝပေါက်ပင်များအပေါ် သက်ရောက်မှုဖြစ်စေမည့် အကြောင်းရင်းများမှာ - လုပ်ငန်းခွင်ပြင်ဆင် တည်ဆောက်ခြင်း၊ Line Clearance ပြုလုပ်ခြင်း၊ လမ်းများဖောက်လုပ်ခြင်း၊ Down-hole များတူးဖော်ခြင်း၊ စက်ယန္တရားများ သွားလာလှုပ်ရှားခြင်း၊ စက်ကိရိယာများနှင့် လုပ်သားများ သွားလာလှုပ်ရှားကြခြင်း၊ အညစ်အကြေးစီမံခန့်ခွဲမှုဆောင်ရွက် ခြင်းတို့ဖြစ်သည်။ ဖြစ်ပေါ်လာမည့် သက်ရောက်မှုများနှင့် ဆောင်ရွက်မည့် လျော့ချရေးနည်းလမ်းများမှာ အောက်ပါအတိုင်း ဖြစ်ကြသည်။

- သဘာဝပေါက်ပင်များပျက်စီးဆုံးရှုံးခြင်းကြောင့် ဖြစ်ပေါ်လာမည့် သက်ရောက်မှုများမှာ **နည်းပါးမည်** ဟုခန့်မှန်းရပါသည်။ (တိုက်စားမှုဖြစ်နိုင်သည့်မြေသားပုံစံများတွင် **အတန်အသင့်** ရှိမည်ဟုခန့်မှန်းရပါသည်) ။ Survey Line များတစ်လျှောက်နှင့် လုပ်ငန်းခွင်စခန်းများတို့ တွင် စောင့်ကြည့်လေ့လာရေးအစီအစဉ်များ ဖြင့် ဆောင်ရွက်သွားမည်ဖြစ်သည်။ (Biodiversity Action Plan ၈.၈.၃ တွင်ကြည့်ပါ) လုပ်ငန်းခွင်ဆောင်ရွက်မှုများ မစတင်မီနှင့် ပြီးဆုံးသွားသည့်အချိန်များတွင် စောင့်ကြည့်လေ့လာသည့် အစီအစဉ်များကိုပြုလုပ်မည်ဖြစ်ပါသည်။ မျိုးစိတ်များရှိနေမှု ပေါ်ကြွယ်ဝမှုနှင့် ပျံ့နှံ့ပေါက်ရောက်မှုဆိုင်ရာ ကွဲပြားခြားနားမှု မှတ်တမ်းတစ်ခုကို စီမံကိန်းလွှမ်းမိုးမှုဇရိယာအတွင်းဖော်ထုတ်သတ်မှတ်ထားသည့် Sensitive အဖြစ်ဆုံး စားကျက်မြေများအတွက် ပေးပို့ထားပေးမည်ဖြစ်သည်။ သဘာဝပေါက်ပင်များ ပြန်လည်ရှင်သန်လာစေရေးအစီအစဉ်များကိုသဘာဝနှင့်အရေးကြီးစားကျက်မြေများတွင် ပြန်လည်အကောင်အထည်ဖော်ဆောင်ရွက်ပေးမည်ဖြစ်ပါသည်။
- အခြားပေါက်ရောက်နေကြအပင်များပြန်လည်စိုက်ပျိုးမှုကြောင့် ဖြစ်ပေါ်လာနိုင်သည့် သက်ရောက်မှုများမှာ နည်းပါးမည် ဟုခန့်မှန်းရပါသည်။ (တိုက်စားမှုဖြစ်နိုင်သည့်မြေသားပုံစံများတွင် **အတန်အသင့်** ရှိမည်ဟု ခန့်မှန်းရပါသည်)ဒေသရင်းမဟုတ်သည့် အပင်မျိုးစိတ်များရှိနေမှုကို သိနိုင်မည့် စောင့်ကြည့်ရေးအစီအစဉ်ကို လုပ်ငန်းခွင်မစတင်မီနှင့် ပြီးဆုံးသည့်အချိန်အထိအကောင်အထည်ဖော်ဆောင်ရွက်သွားပါမည်။

သက်မဲ့အစိတ်အပိုင်းများ ဂေဟစနစ်အတွင်းရှိနေခြင်းကြောင့် အဆင့်လျော့ကျမှုမှ ဖြစ်ပေါ်လာသော သက်ရောက်မှုမှာနည်းပါးမည်ဟုခန့်မှန်းရပါသည်(တိုက်စားမှုဖြစ်နိုင်သည့်မြေသားပုံစံများတွင်**အတန်အသင့်**ရှိမည်ဟု ခန့်မှန်းရပါသည်)။မြေသားဆိုင်ရာလုပ်ငန်းဆောင်ရွက်မှုများကိုလျော့ချခြင်း၊ စားကျက်မြေများနှင့် သင့်လျော်သည့် သဘာဝပေါက်ပင် ပြန်လည်စိုက်ပျိုးမှုများနှင့် မြေသားအသွင် အပြင်အနေအထားဆိုင်ရာ ပြန်လည်ပုံသွင်းခြင်း တို့ပြုလုပ်ခြင်းအား သက်ရောက်မှုလျော့ချရေးနည်းလမ်းများအဖြစ် အကောင်အထည်ဖော် ဆောင်ရွက်သွားပါမည်။ စီမံကိန်းလုပ်ငန်းများ ကြောင့် ဒေသရင်းအပင်များနှင့် သဘာဝပေါက်ပင်များအပေါ် ဖြစ်ပေါ်နိုင်သည့် သက်ရောက်မှုများမှာ တိုက်စားမှုဖြစ်ပေါ်စေနိုင်သည့်မြေသားပုံစံများတွင် **အတန်အသင့်** ဖြစ်မည်ဟုခန့်မှန်းရသည်မှ လွဲ၍ ကျန်လုပ်ငန်းခွင် ဇရိယာတစ်ခုလုံးအပေါ် သက်ရောက်မှုမှာ **နည်းပါးမည်** ဟု ခန့်မှန်းရပါသည်။

၁.၅.၁.၆ ဒေသရင်းတိရစ္ဆာန်နှင့်အလေ့အထများ

ဒေသရင်းတိရစ္ဆာန်နှင့်အလေ့အထများအပေါ် ထိရောက်သည့်အကျိုးရလဒ်များမှာ- ဆောက်လုပ်ရေးလုပ်ငန်းအတွက် ယာယီမြေနေရာယူခြင်း၊ မြေနေရာရှင်းလင်းပြင်ဆင်ခြင်း၊ စက်ပစ္စည်းနှင့် လေးလံသည့်စက်ကိရိယာများအသုံးချခြင်း၊ အန္တရာယ်များသောကုန်ကြမ်းပစ္စည်းများသိမ်းဆည်းသိုလှောင်ခြင်း၊
ပြည်တွင်းစွန့်ပစ်ပစ္စည်းထုတ်လုပ်ခြင်းနှင့်ရှင်းလင်းခြင်း၊အလုပ်သမားအင်အားရှိနေခြင်းတို့ဖြစ်ပါသည်။
အကျိုးရလဒ်နှင့်လျော့ပေါ့စီမံချက်များကိုအောက်တွင်ဖော်ပြထားပါသည်။

- ဂေဟစနစ်အတွင်းရှိသက်မဲ့အစိတ်အပိုင်းပြောင်းလဲမှုအကျိုးသက်ရောက်မှုမှာ **နည်းပါး**လာမည်ဟုခန့်မှန်းထားပါသည်
- စီးပွားရေးဆိုင်ရာချိတ်ဆက်ပြောင်းလဲသက်ရောက်မှုလည်းနည်းပါးလာမည်ဟုခန့်မှန်းထားပါသည်
- ယာဉ်တိုက်နှုန်းမြင့်တက်ခြင်းသက်ရောက်မှုလည်း**နည်းပါး**လာမည်ဟုခန့်မှန်းထားပါသည်

jတောတွင်းတိရစ္ဆာန်များအကျိုးသက်ရောက်မှုလျော့နည်းစေရန်ညီမီးသုံးစွဲမှုလျော့ချခြင်း အဆောက် အဦများ သို့ တိရစ္ဆာန်များဝင်မလာနိုင်အောင်ခြံခတ်ထားခြင်း စောင့်ကြည့်ခြင်းအစီအစဉ်မှ ဒေသတွင်းတိရစ္ဆာန်များနှင့်နေထိုင်ရာ ပြောင်းလဲခြင်းတို့ကိုသိရှိစေမည်ဖြစ်ပါသည်

ဤပရောဂျက်ကြောင့်နယ်မြေတစ်ခုလုံးရှိဒေသတွင်းတိရိစ္ဆာန်များသက်ရောက်မှုမှာ **နည်းပါး**လာဖွယ်ရှိပါသည်။

၁.၅.၁.၇ ဇီဝမျိုးစိတ်ကွဲပြားမှုနှင့် ဂေဟစနစ်ဝန်ဆောင်မှုများ

လေ့လာရေးနယ်မြေအတွင်းတွေ့ရှိခဲ့သော တည်နေရာလေးခုအတွက် ဂေဟစနစ်ဝန်ဆောင်မှုသတ်မှတ်ခြင်းကို IPIECA ဂေဟနစ်ဝန်ဆောင်လမ်းညွှန်မှု IPEAC 2011 မှာလျှောက်ထားဆောင်ရွက်ခဲ့ပြီးဖြစ်ပါသည်။

ထိုနည်းလမ်းဖြင့်ရှာဖွေခြင်းကနယ်မြေတစ်ခုချင်းစီတွင်ရှိသောသယံဇာတ၊ဂေဟစနစ်ဝန်ဆောင်မှုလိုအပ်ခြင်း၊ရေနံနှင့်ဓာတ်ငွေများ ပိုမိုထုတ်လုပ်နိုင်ရေးတို့ကိုတိုးတက်စေပါသည်။

ပျက်စီးမှုလျော့ချရေးလုပ်ငန်းစဉ်များကို လူမှုပတ်ဝန်းကျင်၊ဇီဝဗေဒဆိုင်ရာ သို့မဟုတ် သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ အကျိုးသက်ရောက်မှု ခန့်မှန်းခြေအတည်ပြုသတ်မှတ်ပေးထားပါသည်။

၁.၅.၂ လူမှုရေးဆိုင်ရာသက်ရောက်မှုများ

အလားအလာရှိသောလူမှုရေးဆိုင်ရာသက်ရောက်မှု များကိုအောက်ဖော်ပြပါအကြောင်းအရာပါ ပရောဂျက်များဖြင့် ဆက်နွယ်မှုရှိပါသည်။

- စီးပွားရေးနှင့်အလုပ်သမားဌာနရမ်းခြင်း
- အခြေခံအဆောက်အဦများနှင့်ပြည်သူဝန်ဆောင်မှုများ
- မြေယာနှင့်သက်မွေးဝမ်းကျောင်းပြမှု

အထက်ပါဖော်ပြပါ အလားအလာရှိသောသက်ရောက်မှုများကိုအောက်ပါအပိုဒ်များတွင်ဖော်ပြထားသကဲ့သို့

အချုပ်ပို ၃ ၏ဇယား ၂ နှင့် ဇယား ၇ တို့တွင်အကျဉ်းချုပ်ဖော်ပြခဲ့ပြီးဖြစ်ပါသည်

၁.၅.၂.၁ စီးပွားရေးနှင့်အလုပ်သမားဌာနရမ်းခြင်း

ပရောဂျက်လုပ်ဆောင်မှုများက ဆိုက်စမစ်လှုပ်ခတ်မှုအခြေအနေအတွင်း ဒေသဆိုင်ရာနှင့်နိုင်ငံတွင်းဆိုင်ရာ အလားအလာရှိသောအပြုသဘောဆောင်သည့်သက်ရောက်မှုများ အလုပ်သမားများဖန်တီးပေးမှုနှင့် စီးပွားရေး ဖွံ့ဖြိုးတိုးတက်မှု ကုန်စည်ထုတ်လုပ်မှုများကို အောက်ပါအတိုင်း ကောက်ယူ နိုင်ခဲ့ပါသည်။

- အလုပ်သမားဌာနရမ်းခြင်းအကျိုးသက်ရောက်မှုများ၊ eni Myanmarမှလုပ်ငန်းကိုတာဝန်ယူရန်ကွင်းဆင်းလေ့လာသောကုမ္ပဏီနှင့်အထူးစာချုပ်ချုပ်ဆိုခြင်းပြုရန် အလုပ်သမားအင်အားစုတွင် ပြည်တွင်းမှမြန်မာအလုပ်သမားများနှင့် ပြည်ပလုပ်သားများကိုပါ ထည့်သွင်းစဉ်းစားပေးခြင်းပြုရန်တို့ပါဝင်သည်။ အလုပ်အကိုင်များသွယ်ဝိုက်ဖန်တီးပေးခြင်းကို ဒေသဆိုင်ရာနှင့် နိုင်ငံတော်အဆင့် အရေးပါမှုအဖြစ်သတ်မှတ်ထားခြင်း သွယ်ဝိုက်အလုပ်သမားများကို ပရောဂျက် အတွက် ကုန်စည်နှင့်ဝန်ဆောင်မှု ထောက်ပံ့ရေးစီမံကိန်းများတွင်ပါဝင်စေခြင်း စီးပွားရေးဆိုင်ရာအကျိုးသက်ရောက်မှုများပရောဂျက် သို့မဟုတ် အိမ်ထောင်စုမှအလုပ်သမားများ၏သုံးငွေနှင့်ဝင်ငွေစရိတ်တွင် တိုးတက်မှုအကျိုးဖြစ်ထွန်းစေရန်ပြည်တွင်းစီးပွားရေးလုပ်ငန်းစုမှရည်ရွယ်ခြင်း ပရောဂျက်ပြုလုပ်နေသောနယ်မြေဒေသအတွင်းရှိ တစ်ဦးချင်းစီ၏ကိုယ်ပိုင်လုပ်အားနှင့်အရည်အချင်းများ တိုးတက်စေရန်ရည်ရွယ်ခြင်း အောက်ပါအတိုင်းအတာတို့ကို စီးပွားရေးနှင့်အလုပ်သမားဌာနရမ်းခြင်းမည်သည့်တိုးတက်မှုမှာမဆိုဖြစ်ပေါ်လာနိုင်သည့်ဆိုးကျိုးများကိုလျော့ချနိုင်စေရန်စီမံဖော်ဆောင်သွားပါမည်။
- ဖြစ်နိုင်ချေရှိသည့်နေရာတို့မှပြည်တွင်းကုန်စည်နှင့်ဝန်ဆောင်မှုအရင်းအမြစ်များရယူခြင်း-နိုင်ငံတော်နှင့်ပြည်တွင်းရှိကုန်စည်ဝယ်ယူမှုကို ကောင်းသထက်ကောင်းမွန်အောင်ပြဌာန်းချက်များရေးဆွဲ၍ဝယ်ယူခြင်းဗျူဟာ
- ဝန်ထမ်းသစ်များစုဆောင်းခြင်းစီမံကိန်း-တန်းတူအခွင့်အရေးများပေးခြင်းနှင့်ခွဲခြားဆက်ဆံမှုမရှိခြင်းကို ဝန်ထမ်းသစ်စုဆောင်းရေးစီမံကိန်းကအာမခံပါသည်။စာချုပ်ချုပ်ဆိုသူများအားလုံးသည် ပြည်တွင်းဝန်ထမ်းဌာနရမ်းမှုလမ်းညွှန်မှုများအတိုင်းလိုက်နာဆောင်ရွက်ရမည်။အလုပ်အကိုင်ခေါ်စာများတွင်လစ်လပ်ရာထူးအတွက်လိုအပ်သောအရည်အချင်းနှင့်လုပ်ငန်းအများအကြီး အလုပ်သမားဌာနရမ်းခြင်းစာချုပ်အတွက်သတ်မှတ်ကာလတို့ကိုအပြည့်အစုံဖော်ပြပေးရပါမည်။
  အလုပ်ခေါ်ယူခြင်းစီမံကိန်းအတွက်သတင်းအချက်အလက်ရှင်းလင်းတိကျခြင်းနှင့်စံပြရွေးချယ်မှုတို့ကို ပွင့်လင်းမြင်သာစွာ သိရှိစေခြင်း
- ပြည်သူများ၏မျှော်လင့်ချက်အားစီမံဆောင်ရွက်ပေးခြင်း- ဤပရောဂျက်မှ အလုပ်သမားတစ်ဦး၏အလုပ်ချိန်နှင့်ရပိုင်ခွင့်ပမာဏကို ရှင်းလင်းစွာသိမြင်စေရန်လူအဖွဲ့အစည်း၏ မျှော်လင့်ချက်များအား တတ်နိုင်သလောက်ဖြည့်ဆည်းပေးရန်နှင့် ပရောဂျက်နယ်မြေအတွင်းပျက်စီးဆုံးရှုံးများကိုရှောင်ကြဉ်ရန်
- ဒေသဆိုင်ရာလုပ်ငန်းများနှင့်စိုက်ပျိုးရေးကာလများတွင်အလုပ်သမားဌာနရမ်းခေါ်ယူမှုကန့်သတ်နိုင်ရန် ဒေသဆိုင်ရာ အာဏာပိုင်များနှင့်များဆုံ၍ဆွေးနွေးအတည်ပြုနိုင်ရန်စီစဉ်ပေးခြင်း

- ဘွဲ့ရပြီးသောပြည်တွင်းအလုပ်သမားများကိုခန့်ထားရေးတတ်နိုင်သလောက်ပြည်တွင်းကုန်စည်များနှင့်ဝန်ဆောင်မှုများကို ဝယ်ယူရေး အခွင့်အလမ်းနှင့်အကျိုးစီးပွားမြှင့်တင်မှုလွယ်ကူချောမွေ့စေရန် ဒေသဆိုင်ရာအဖွဲ့အစည်းမှ အခြားအဖွဲ့အစည်းများ နှင့်ပြုလုပ်သောအကြိုပရောဂျက်ကိုတင်ပြခြင်း
- ဤကဲ့သို့မျှော်မှန်းချက်များရှိလုပ်သားအင်အားခေါ်ယူစုဆောင်းရေးစာချုပ်ပါအချက်အလက်များတွင် ပြည်တွင်းအလုပ်သမားဌာနရမ်းခြင်းအထူးသဖြင့်အရည်အချင်းမပြည့်ဝသေးသူများနှင့်လုပ်သားအပြည့်အဝမပေးနိုင်သူများကို အလေးထားခေါ်ယူမှုများပါဝင်ပါသည်။
- ပရောဂျက်နယ်နိမိတ်အတွင်းလုပ်သားကန့်သတ်ခြင်းနှင့်အဖွဲ့အစည်းများအတွင်းမှဒေသခံများပြန်လှန်ဆက်သွယ်ခြင်းကိုခွင့်မပြုပါ။ဆိုက်စမစ်စာရင်းကောက်ယူချက်လုပ်ငန်းစဉ်များကြောင့်စီးပွားရေးနှင့်အလုပ်သမားဌာနရမ်းမှုဖွစ်ည်းပုံ၏ သက်ရောက်မှုများမှာ Positive အနေနှင့်စဉ်းစားနိုင်ပါသည်။

ပရောဂျက်ဖွံ့ဖြိုးတိုးတက်မှုမှပြည်သူများသို့အလုပ်အကိုင်သစ်များရအောင်စွမ်းဆောင်ပေးခြင်း
ကာလတိုဖြစ်သော်လည်း အများအကြိုသစ်များကို ရစေနိုင်ခြင်းများ ဖြစ်ပေါ်စေပါသည်။

၁.၅.၂.၂ အခြေခံအဆောက်အဦနှင့်အများပြည်သူဝန်ဆောင်မှု

အောက်ပါတို့မှာဖော်ထုတ်ထားပြီးဖြစ်သော အလားအလာရှိသည့်သက်ရောက်မှုများဖြစ်ပါသည်

- အခြေခံအဆောက်အဦထိခိုက်ပျက်စီးမှုနှင့်ယာယီပိတ်ဆို့မှု-စက်ပစ္စည်းများနှင့်ယာဉ်သွားလာမှုများ
  ကိရိယာတန်ဆာ ပလာ များ နှင့်သတ္တုများသိုလှောင်ခြင်းကြောင့် ရလဒ်အနေဖြင့် လမ်းမများပေါ်တွင် သွားလာရခက်ခဲစေပါသည်။
  ထိုရလဒ်ကြောင့်ကားတိုက်မှုများနှင့် လူဦးရေထူထပ်မှုကို အနှောင့်အယှက်ဖြစ်ပေါ်စေခြင်း လူအဖွဲ့အစည်း၏ ကျန်းမာ ရေးနှင့် ကောင်းကျိုးချမ်းသာကို ထိခိုက်ခြင်းများဖြစ်စေပါသည်။
- အများပြည်သူဝန်ဆောင်မှုနှင့်ကိရိယာတန်ဆာပလာများတိုးပွားလာမှု- ဒေသခံအရောင်းဆိုင်များမှဝန်ဆောင်မှုနှင့် ကိရိယာတန်ဆာပလာများကိုဝယ်ယူရပါမည်လေလွင့်သတ္တုများကိုစုဆောင်းခြင်း၊သိမ်းဆည်းခြင်း၊ သင့်တော်သော ဗင်ကားများနှင့်ကွန်တိန်နာများပေါ် သို့ခွဲထုတ်သယ်ယူခြင်းများပြုလုပ်ရပါမည်။
- ကျန်းမာရေးစောင့်ရှောက်မှုလုပ်ငန်းများပေါ်တွင်တွန်အားပေးခြင်း- မကွေးနှင့်မန္တလေးတွင်ရှိသော ဒေသန္တရ ကျန်းမာရေးဆေးခန်းများတွင်ပရောဂျက်ဝန်ထမ်းများမှဝန်ဆောင်မှုပေးနေသော်လည်း အခြေစိုက်စခန်းများတွင် ကိုယ်ပိုင်ဆေးဝါးဝန်ဆောင်မှုများနှင့် ပရောဂျက်အတွက် ဆေးကုသမှုအာရုံစိုက်လုပ်ဆောင်နိုင်မည့် ဆရာဝန်များ ဌာနရမ်းရန်လိုအပ်ပါသည်။ထို့ကြောင့်ပြည်သူ့ကျန်းမာရေးဝန်ဆောင်မှုပေးခြင်းကို အထူးတလည်စိုးရိမ်စရာမလိုအပ်ပါ။

ဆိုက်စမစ်စစ်တမ်းအတွင်းဒေသဆိုင်ရာအခြေခံအဆောက်အဦများပေါ်တွင်သက်ရောက်မှုလျော့ချရန်အောက်ပါနည်းလမ်းများဖြင့်ဆောင်ရွက်သင့်ပါသည်။

- ပရောဂျက်တွင်အများသုံးအခြေခံလျှပ်စစ်မာတ်အားကိုအသုံးပြုသွားမည်မဟုတ်ပါလျှပ်စစ်စွမ်းအင်ကို ဆိုက်အတွင်းမှ ထုတ်လုပ်သွားမည်ဖြစ်ပါသည်။
- လေလွင့်မှုပမာဏကိုအနည်းဆုံးဖြစ်အောင်စီမံသွားပါမည်။
- အများဆုံးပြန်လည်သုံးစွဲခြင်းဖြင့်လေလွင့်မှုပမာဏကိုကာမိအောင်၊လျှစ်စစ်စွမ်းအားပြန်းတီးမှုမှပြန်လည် အသုံးပြုနိုင် အောင် ခွဲထုတ်သွားပါမည်။
- ဖို့မြေများတွင်အနည်ကျမှုနည်းပါးအောင်၍လေလွင့်မှုနည်းပါးအောင်လျော့ချသွားပါမည်။

- ဒေသဆိုင်ရာစည်းမျဉ်းစည်းကမ်းများနှင့်အညီပါဝင်သောလေလွင့်မှုများအားလုံးကို သတ်မှတ်ရှင်းလင်းသွားပါမည်။
  စွန့်ပစ်ပစ္စည်းရှင်းလင်းရေးဆိုင်ရာအစီအစဉ်အရ စွန့်ပစ်ပစ္စည်းများကိုရှင်းလင်းရမည်။
- အလုပ်သမားများအတွက် ကျန်းမာရေးစောင့်ရှောက်မှုနှင့် အခြေခံရှေးဦးသူနာပြုစုနည်းကို အလုပ်ခွင်မှာ သတ်မှတ်ပြဋ္ဌာန်းထားရမည်။
- လိုအပ်သည်ထက်ပိုလုပ်ရသည့်တာဝန်များဆိုလျှင်အာဏာပိုင်အဖွဲ့ကိုအစီရင်ခံရမည်။ကြမ်းတမ်းပြီး အန္တရာယ်ရှိနိုင်သော လုပ်ငန်းခွင်များတွင် အစောင့်အကြပ်များထားရှိပေးရမည်။
- အလျင်စလိုလုပ်ရသောအချိန်တွင် လေးလံသောကိရိယာများအား ရွှေ့ခြင်းကို ကန့်သတ်/ရှောင်ကြဉ်ရမည်။
- တိုင်ကြားချက်များကိုစုံစမ်းစစ်ဆေးပြီးဆီလျော်မှန်ကန်စွာဖြေရှင်းပေးရမည်။တိုင်ကြားချက်များကို စာရင်းပြုစုထားပြီး ဆက်လက်စုံစမ်းရမည်။
- ပရောဂျက်တစ်ခုကို ဖန်တီးရမယ် အဆင့်မြှင့်ရမယ် အခွင့်အလမ်းရနိုင်မယ့်နည်းလမ်းပြန်ရှာရမယ်ဆိုရင် လုပ်ငန်းရှင်က သင့်လျော်မည့်အစိုးရရုံးများမှခွင့်ပြုချက်တောင်းပေးရမည်။
- လုပ်ငန်းရှင်များက သယ်ယူပို့ဆောင်ရေးကိစ္စများကိုလျော့ချနိုင်ဖို့ လေ့ကျင့်ရေးပရိဂရမ်များကို စည်းကမ်းတကျ ပြဋ္ဌာန်းရမည်။
- ကန်ထရိုက်တာ သို့မဟုတ် ကုမ္ပဏီကြောင့်ရရှိလာတဲ့ လမ်းအပျက်အစီးများကို ပြန်လည်ပြင်ဆင်ပေးရမည်။
- စခန်းချဖို့လမ်းအတွက် မြေနေရာများကိုဝယ်ရမည် ဒါမှမဟုတ် ငှားရမည်။
- eni Myanmar ကိုယ်ပိုင်ပုဂ္ဂလိကလမ်းများအပေါ် ယာဉ်အသွားအလာကိုကန့်သတ်ထားမည်။
- ပေါက်ကွဲနိုင်သောပစ္စည်းများသိုလှောင်ရေးနှင့်ပို့ဆောင်ရေးကိစ္စများတွင်တပ်မတော်နှင့် ပူးပေါင်းဆောင်ရွက်ရမည်

ဆိုက်စမစ်စစ်ဆေးမှုကြောင့် အခြေခံအဆောက်အအုံများနှင့် အများပြည်သူဝန်ဆောင်မှုများအပေါ် ထိရောက်သည့် အကျိုးသက်ရောက်မှုက ဒေသတစ်ခုလုံးအတွက် **နည်းပါးမည်**ဟုခန့်မှန်းရပါသည်။

၁.၅.၂.၃ နယ်မြေနှင့်အသက်မွေးမှု

ဆိုက်စမစ်စစ်ဆေးမှုလုပ်နေစဉ်နယ်မြေရဲ့တစ်ချို့သောအပိုင်းများအားအသုံးချပြီး မြေဆီလွှာဆုံးရှုံးမှုများဖြစ်ပေါ်လာသည်။ခန့်မှန်းခြေရယူထားတဲ့နယ်မြေအသုံးချမှုကယာယီစခန်းချအလုပ်၊ အရင်းအမြစ်တည်နေရာများနဲ့ Down-hole Drilling တည်နေရာများနဲ့ဆက်စပ်နေပါသည်။ လိုအပ်သည့်ပစ္စည်းများကို ကွင်းပြင်ဒါမှမဟုတ် စိုက်ပျိုးမြေများမှာ နေရာချထားရပါသည်။ စက်ပစ္စည်းများနေရာချထားသည့်နေရာများတွင် ဒေသတွင်းစိုက်ပျိုးမှုကို ယာယီရပ်တန့် ထားရသည်။

လျော့ပေါ့စီမံချက်အရ ကြိုတင်စီစဉ်ထားတဲ့အဆင့်အနေနဲ့ ၎င်းပရောဂျက်က အသက်မွေးဝမ်းကျောင်းစီပွားရေးကို ပြန်စီစဉ်ပေးရမည်။

ဆိုက်စမစ်စစ်ဆေးမှုကြောင့် နယ်မြေနှင့်အသက်မွေးမှု အပေါ်ထိရောက်သည့်အကျိုးသက်ရောက်မှုက ဒေသတစ်ခုလုံး အတွက် **နည်းပါးမည်** ဟုခန့်မှန်းရပါသည်။

၁.၅.၃ ယဉ်ကျေးမှုဆိုင်ရာထိရောက်သည့်အကျိုးသက်ရောက်မှု

ဆိုက်စမစ်စစ်ဆေးမှုများဆောင်ရွက်နေစဉ် လုပ်ဆောင်ချက်များနဲ့အနီးအနားမှာရှိနေတဲ့ ရှေးဟောင်းအသုံးအဆောင်ပစ္စည်းများအပေါ် တိုက်ရိုက်ထိရောက်သည့်အကျိုးသက်ရောက်မှု

- အပေါ်မြေဆီလွှာနဲ့အောက်မြေဆီလွှာများထိုးဖောက်ရှင်းလင်းရေးလုပ်ဆောင်မှုများကြောင့် ယဉ်ကျေးမှုအမွေအနှစ်များကိုပျက်စီးစေခြင်း
- ပေါက်ကွဲတုန်ခါမှုကြောင့် ယဉ်ကျေးမှုအမွေအနှစ်များပျက်စီးဆုံးရှုံးပေမယ့် စက်မှုနည်းနှင့် ယဉ်ကြောပိတ်ဆို့မှုကိစ္စရပ်များဖြေရှင်းခြင်းကြောင့်လည်းပျက်စီးနိုင်ပါသည်။

လျှော့ပေါ့စီမံချက်အရအောက်ဖော်ပြပါနေရာများမှလုံလောက်တဲ့အကွာအဝေးမှာပေါက်ကွဲမှုများလုပ်ဆောင်သင့်ပါသည်။လုပ်ငန်းတစ်လျှောက်မျက်မြင်စစ်ဆေးမှုကိုစီမံခန့်ခွဲရပါမည်။
အရေးကြီးတဲ့သိပ္ပံနည်းကျအချက်အလက်များဒါမှမဟုတ်ယဉ်ကျေးမှုတန်ဖိုးကိုခွဲခြားပြီးသိမ်းထားရမယ့်အရာများအဖြစ် ရှောင်ကြဉ်ရမည်။ဆိုက်စမစ်စစ်ဆေးမှုများလုပ်နေစဉ်အရေးကြီးတဲ့ရှာဖွေများရှိမှုတစ်ခုများလျှင် နိုင်ငံတကာနှင့်ပြည်တွင်းစံချိန်စံနှုန်းအတိုင်း နည်းလမ်းပြောင်းပြီး လုပ်ငန်းစဉ် များအား ပြန်လည်စီမံခန့်ခွဲရမည်။

ဆိုက်စမစ်စစ်ဆေးမှုကြောင့် ယဉ်ကျေးမှုအမွေအနှစ်အပေါ်ထိရောက်သည့်အကျိုးသက်ရောက်မှုကဒေသတစ်ခုလုံးအတွက် **နည်းပါးမည်** ဟုရလဒ်ထွက်ပေါ်လာပါသည်။

၁.၅.၄ မြင်နိုင်သောအကျိုးသက်ရောက်မှုများ

ဆိုက်စမစ်စစ်ဆေးနေစဉ်တိုက်ရိုက်မြင်နိုင်သောအကျိုးသက်ရောက်မှုများကိုနယ်မြေလေးများအဖြစ် ယာယီကန့်သတ်ထားပြီး အောက်ဖော်ပြပါအချက်များ ပါဝင်ပါသည်။

- ရှင်းလင်းရေးလုပ်ငန်းစဉ်များကြောင့်ဖြစ်ပေါ်နေသည့်ရှုခင်းပျောက်ကွယ်မှုဒါမှမဟုတ် ရှုခင်းများပြောင်းလဲမှုမှာ သဘာဝပေါက်ပင်ဆုံးရှုံးမှုပါဝင်နေခြင်း
- စခန်းချနေရာများနှင့်ဆက်နွယ်ပြီး ယာယီအဆောက်အအုံများကိုစတင်ဆောင်ရွက်ခြင်းမှ ရှုခင်း ပြောင်းလဲမှုကိုရရှိခြင်း
- ဆိုက်စမစ်စစ်ဆေးခြင်နှင့်ဆက်စပ်နေသည့်စက်များနှင့်ယာဉ်များတည်ရှိခြင်း
- မပြင်းထန်တဲ့အကျိုးသက်ရောက်မှုတစ်ခုက ညဘက်တွင် စခန်းချရာနေရာများမှမီးထွန်းပေးသည့်အတွက်ထိုနေရာ ပတ်ဝန်းကျင်တွင်လုံခြုံစိတ်ချရခြင်း။

လျှော့ပေါ့စေရေးအစီအစဉ်များက ဆိုက်စမစ်စစ်ဆေးခြင်းလုပ်နေစဉ်အသုံးမဝင်ပါ။ မူလနယ်မြေကိုပြန်လည်နေရာချခြင်း သည်သာ လျင်စစ်ဆေးမှုလမ်းကြောင်းနှင့် စခန်းချရာနေရာများတွင်အသုံးဝင်ပါသည်။

လျှော့ပေါ့စီမံချက်များအား လျှပ်စစ်စွမ်းရည်လျှော့ကျစေဖို့အတွက်အသုံးချပါသည်။

ဆိုက်စမစ်စစ်ဆေးမှုကြောင့် ရှုခင်းများအပေါ်ထိရောက်သည့်အကျိုးသက်ရောက်မှုက ဒေသတစ်ခုလုံးအတွက် **နည်းပါးမည်** ဟုရလဒ်ထွက်ပေါ်လာပါသည်။

၁.၅.၅ ကျန်းမာရေးအကျိုးသက်ရောက်မှုများ

ဆိုက်စမစ်စစ်ဆေးစီမံမှုဆောက်ရွက်နေစဉ်ရပ်ကွက်ဒေသများ၏ကျန်းမာရေးနှင့်လူမှုဖူလူရေးကိစ္စရပ်များကို အောက်တွင် ဖော်ပြပေးထားပါသည်။

- ပြည်ပအလုပ်သမားများဆီက နိုင်ငံသားများဆီသို့ ရောဂါပျံ့နှံ့ကူးစက်ခြင်းတိုးပွားနေပါသည်။ ငှက်ဖျားရောဂါ အဆုတ်နာရောဂါ အနာကြီးရောဂါ အသည်းရောင်ရောဂါ ဝမ်းလျှောရောဂါ အသက်ရှူလမ်းကြောင်းဆိုင်ရာရောဂါများကူးစက်ပျံ့ပွားနိုင်ပါသည်။ပြည်ပအလုပ်သမားများရှိနေခြင်းကြောင့်လိင်မှုတစ်ဆင့်ကူးစက်တတ်သော ရောဂါများလည်းအဖြစ်များနိုင်ပါသည်။

- ကျန်းမာရေးစောင့်ရှောက်မှုအတွက်လိုအပ်သည့်ပစ္စည်းများထောက်ပံ့နိုင်ရမည်။ ဒီလိုများထောက်ပံ့နိုင်မှ ရောဂါဖြစ်ပွားမှုနှုန်းကိုလျော့ကျနိုင်မှာဖြစ်ပါသည်။အလုပ်သမားအင်အားနှင့် ပြည်တွင်းလူဦးရေ၏ ရောဂါအနေအထားပြောင်းလဲမှုကြောင့် ကျန်းမာရေးစောင့်ရှောက်မှုပစ္စည်းများကို ဆိုက်စမစ်စစ်ဆေးနေရင်းပင် အသုံးပြုနိုင်ပါသည်။
- ဆိုက်စမစ်စစ်ဆေးခြင်းကပတ်ဝန်းကျင်ပြောင်းလဲမှုကိုဖြစ်ပေါ် စေပါသည်။အထူးသဖြင့်လှုပ်ရှားမှု ဆောင်ရွက်နေသည့်ပတ်ဝန်းကျင်တွင် ပေါက်ကွဲမှုအသံများနှင့်တုန်ခါမှုများကြောင့် စိတ်အနှောင့်အယှက် ဖြစ်စေပါသည်။ ဖောက်ခွဲရေးပစ္စည်းများကြောင့် ဖုန်မုန့်များနှင့် မောပန်းနွမ်းနယ်မှုများဖြစ်စေပြီး ခဏတာ စိတ်ပင်ပန်းမှုကို ဖြစ်စေနိုင်ပါသည်။
- ဘေးကင်းစေဖို့အတွက်အကျိုးသက်ရောက်မှုမှာသယ်ယူပို့ဆောင်ရေးကြောင့်အက်ဆီးဒင့်များ မကြာခဏဖြစ်ပေါ် စေပါသည်။

ဆိုက်စမစ်တိုင်းတာစစ်ဆေးမှုလုပ်နေစဉ်ကျန်းမာရေးမထိခိုက်စေရန်အောက်ပါသက်ရောက်မှုလျော့ချရေးနည်းလမ်းများအား အသုံးချသင့်ပါသည်။

- အလုပ်သမားများ ထမင်းမစားခင် ရေမသောက်ခင် ဆေးလိပ်မသောက်ခင်စသောလုပ်ဆောင်မှုများမစခင် တစ်ကိုယ်ရေကျန်းမာသန့်ရှင်းရေးအတွက်အလေ့အကျင့်များ (လက်ဆေးခြင်းစသည်ဖြင့်)လိုအပ်ပါသည်။
- သတိထားရမယ့်ကျန်းမာရေးစစ်ဆေးလုပ်ဆောင်မှုများနှင့်လုပ်ငန်းခွင်နှင့်အလုပ်သမားများကြားအရေးပါသည့် ကျန်းမာရေးကိုထိခိုက်စေနိုင်သည့်ကိစ္စရပ်များကိုသတိထားဆင်ခြင်ရမည်။
- ပြည်တွင်းဒေသမှအလုပ်သမားများအားကျန်းမာရေးပညာပေးလုပ်ငန်းများလုပ်ဆောင်ခြင်းဖြင့် နေထိုင်မကောင်း ဖြစ်ခြင်းကိုဟန့်တားနိုင်ရမည်။

- ရောဂါကူးစက်နိုင်သည့်အကြောင်းအရာများနှင့် ကူးစက်တတ်သောရောဂါလက္ခဏာများအကြောင်း အလုပ်သမားများကိုသေချာပညာပေးနိုင်ရမည်။
- အလုပ်အကိုင်ဆိုင်ရာကျန်းမာရေး နှင့် ယာဉ်မောင်းခြင်း၊ ယာဉ်ကြောဘေးအန္တရာယ်ကင်းရှင်းရေးများ အစရှိသော ဘေးအန္တရာယ်ကင်းရှင်းရေးစီမံခန့်ခွဲမှုများအတွက် eni လုပ်ငန်းလိုအပ်ချက်များနှင့်အညီ မိမိဝန်ထမ်းများသိရှိနိုင်ရန် ကန်ထရိုက်တာများအားလေကျင့်သင်ကြားခြင်းနှင့် အသိပညာပေးခြင်းများဖွဲ့ဖြိုးတိုးတက်အောင်ဆောင်ရွက်နိုင်ရမည်
- လူမှုအသိုင်းအဝိုင်းအတွက်ဒေသတွင်းကျန်းမာရေးဝန်ဆောင်မှုများအားဝန်ပိုစေခြင်းမရှိစေဘဲ ဝန်ထမ်းနှင့်ဝန်ထမ်းမိသားစုဝင်တို့၏နေ့စဉ်လိုအပ်ချက်များပြည့်မီဖို့ရာ လုံလောက်သောကျန်းမာရေးဝန်ဆောင်မှုများပေးရန် ကန်ထရိုက်တာများအား ဆောင်ရွက်စေရမည်
- လုပ်ထုံးလုပ်နည်းမကျနပ်မှုများအား လျင်မြန်စွာတုံ့ပြန်ခြင်းများစတင်ဆောင်ရွက်ရမည်
- စီမံကိန်းလုပ်ဆောင်မှုများစတင်မီသတ်မှတ်လုပ်ငန်းဆောင်ရွက်မှုများ၊ လုပ်ငန်းဆောင်ရွက်မှုအချိန်များနှင့်ကြာချိန်များကို အများပြည်သူအားအသိပေးအကြောင်းကြားကာ ကုမ္ပဏီနှင့် ကန်ထရိုက်တာများအား အများပြည်သူပါဝင်လာအောင် ဆောင်ရွက်စေရမည်
- မတော်တဆမှုဘေးရန်များအားလျော့ချရန် ပရောဂျက်လုပ်ဆောင်မှု (ပစ္စည်းများ၊စားသောက်ကုန် နှင့် အလုပ်သမားသွားလာမှုများ) အားလုံးအတွက် ပို့ဆောင်ဆက်သွယ်ရေး လမ်းကြောင်းများအား ကုမ္ပဏီနှင့် ကန်ထရိုက်တာများအား တိုးတက်အောင်ဆောင်ရွက်စေရမည်

ဆိုက်စမစ်သုံးသပ်လေ့လာမှုကြောင့်ပြည်သူ့ကျန်းမာရေးအပေါ် ဖြစ်ပေါ်လာနိုင်သည့်သက်ရောက်မှုများသည် ဒေသတစ်ခုလုံးအတွက်**နည်းပါး**၍ ကူးစက်ရောဂါပျံ့ပွားမှုများလာနိုင်သည့်အလားအလာသည် **အတန်အသင့်**ရှိသည်။

၁.၆ တိုးပွားလာနိုင်သော သက်ရောက်မှုများ

eni Myanmar သည် RSF-5 လုပ်ကွက်တစ်ခုလုံးတွင် ဟိုက်ဒရိုကာဗွန်သုံးစွဲမှုလိုင်စင်ကိုရရှိထားပြီး အခြားသော O&G လုပ်ဆောင်မှုများ လုပ်ကွက်တစ်ခုတည်းတွင်ဆောင်ရွက်ခြင်းမရှိပါ။ ထို့အပြင် ၄င်းဇရိယာနှင့် ပတ်သက်၍ ရရှိနိုင်သော အချက်အလက်များအပေါ်အခြေခံကာ စီမံကိန်းနှင့်ပတ်သက်၍တိုးပွားလာနိုင်သည့် သက်ရောက်မှုအလားအလာ ရှိလာနိုင်သော စက်မှုလုပ်ငန်းလုပ်ဆောင်မှုသက်သေအထောက်အထားများမရှိပေ။

ရှာဖွေလေ့လာရေးကဏ္ဍ(ဆိုက်စမစ်လေ့လာရေးနှင့်အစမ်းလေ့ကျင့်ခြင်းများ)သည် O&G ဖွံ့ဖြိုးမှုစက်ဝန်းတွင် ပထမဆုံးခြေလှမ်းဖြစ်သည်။သက်ရောက်မှုတိုးပွားလာနိုင်ခြေနည်းပါးသောရေတိုနှင့်ယာယီဆောင်ရွက်မှုတစ်ခုဖြစ်သည်။စီမံကိန်း၏ရှေ့လျှောက်လုပ်ဆောင်မည့်ကဏ္ဍများအတွင်း တိုးပွားလာနိုင်သော သက်ရောက်မှုများအား အသေးစိတ် စုံစမ်းလေ့လာမည်ဖြစ်သည်။

၁.၇ သဘာဝပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုနှင့် စောင့်ကြည့်လေ့လာရေးစီမံထားမှု

သဘာဝပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုနှင့်စောင့်ကြည့်လေ့လာရေးအစီအစဉ်(EMMP)၏ရည်ရွယ်ချက်သည် လေ့လာမှုနယ်ပယ် အတွင်းရှိ အမျိုးမျိုးသောထိခိုက်လွယ်သည့် Recptor များ၏ အခြေအနေနှင့်တိုးတက်မှုများအား လေ့လာစောင့်ကြည့်ရေးအတွက် အခြေခံမူဘောင်များနှင့် လိုအပ်သောလုပ်ဆောင်မှုများကိုသတ်မှတ်ရန်ဖြစ်သည်။ ESHIA မှသတ်မှတ်ထားသော စီမံကိန်းသက်ရောက်မှုများလျှော့ချရေးဆောင်ရွက်မှုများ၏အောင်မြင်မှုအားတွက်ချက်ရန် သတင်းအချက်အလက် များပေးစွမ်းရုံသာမက သက်ဆိုင်ရာ ပတ်ဝန်းကျင်စံနှုန်းများအား လည်းလေးစားလိုက်နာမှုရှိစေသည်။

အထူးသဖြင့် EMMP ၏ရည်ရွယ်ချက်များမှာ-

- ဒေသအသိုးသီးအတွက်သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာလေ့လာစောင့်ကြည့်ရေးလိုအပ်ချက်များအား သက်ဆိုင်ရာနိုင်ငံတော်ဥပဒေနှင့်အညီသတ်မှတ်နိုင်ရန်။
- သက်ဆိုင်ရာeniစံနှုန်းထားများအားလေးစားမှုရှိမရှိစောင့်ကြည့်လေ့လာရန်နှင့်လိုအပ်လာနိုင်သောလုပ်ငန်းလည်ပတ်မှုဆိုင်ရာအပြောင်းအလဲများအားလွယ်ကူချောမောစေရန် အထောက်အကူပစ္စည်းများပေးစွမ်းရန်
- ရွေးချယ်ထားသောစွမ်းဆောင်မှုညွှန်းကိန်း(KPIs)များအားအစီရင်ခံရန်အလို့ငှာ သတ်မှတ်ချက်ဘောင်များအား လေ့လာ စောင့်ကြည့်ရန်
- သဘာဝပတ်ဝန်းကျင်ကာကွယ်ရေးအတွက် စတင်ပြီးသောလျှော့ချရေးဆောင်ရွက်မှုများ၏ အောင်မြင်မှုအားတိုင်းတာ နိုင်ရန်အတွက် ရလဒ်များအားစောင့်ကြည့်ရန်တို့ဖြစ်သည်။

ပဏာမ EMMP အားအောက်ပါအချက်တို့ဖြင့် အကြမ်းဖျင်းဖော်ပြထားသည် -

- eni စံနှုန်းထားများ(သဘာဝပတ်ဝန်းကျင် လူမှုပတ်ဝန်းကျင်နှင့်ကျန်းမာရေးသက်ရောက်မှု စစ်ဆေးတိုင်းတာခြင်းအစီရင်ခံစာအမှတ် ၁.၃.၁.၄၇)
- သက်ဆိုင်ရာမြန်မာနိုင်ငံတော်ဥပဒေ
- နိုင်ငံတော်ဥပဒေတွင်ပြဋ္ဌာန်းထားခြင်းမျိုးမရှိခဲ့လျှင် နိုင်ငံတကာစံနှုန်းထားများ

စီမံကိန်းသက်ရောက်မှုရှိသော သဘာဝပတ်ဝန်းကျင်ဒေသအားလုံးအတွက် စောင့်ကြည့်လေ့လာရေး လိုအပ်ချက်များအား EMMP မှ သတ်မှတ်ထားကာ ဖွံ့ဖြိုးမှုဆိုင်ရာကဏ္ဍအမျိုးမျိုးလုပ်ဆောင်နေစဉ် အတောအတွင်း တိုက်ရိုက်ကျ၍ ထိရောက်မှုရှိသောဆောင်ရွက်မှုများအတွက် အသေးစိတ်အချက်အလက်များပေးထားသည်။ ယေဘုယျ အားဖြင့် EMMP ၏ရည်ရွယ်ချက်များမှာ -

- သက်ဆိုင်ရာဒေသအတွင်း နဂိုရှိရင်းစွဲအပြောင်းအလဲများအားအကြမ်းဖျင်းခန့်မှန်းရန်
- သက်ဆိုင်ရာဒေသအတွင်း အပြောင်းအလဲများအားနှိုင်းယှဉ်ရန်
- မတူညီသောအခြေအနေများ(ဥပမာ- အကြိုလေ့လာချက်နှင့် နောက်ပိုင်းလေ့လာချက်) များအကြားနှိုင်းယှဉ်၍ ပြောင်းလဲမှုအားသတိပြုမိရန်
- ပစ်မှတ်ထားအလွှာနဲ့နှိုင်းယှဉ်လေ့လာရန်
- လုပ်ဆောင်ပြီးသောလျော့ချရေးဆောင်ရွက်မှုများ၏အောင်မြင်မှုများအားချင့်ချိန်ရန်

EMMP တွင်ပါဝင်သောအစီအစဉ်များမှာအောက်ပါအတိုင်းဖြစ်သည်။

- ဆူညံမှုစီမံခန့်ခွဲရေးအစီအစဉ်များ
- ဇီဝမျိုးကွဲထိန်းသိမ်းစောင့်ရှောက်ရေးအစီအစဉ်များ
- စွန့်ပစ်ပစ္စည်းစီမံခန့်ခွဲရေးအစီအစဉ်များ
- ရေစီမံခန့်ခွဲရေးအစီအစဉ်များ
- ယဉ်ကျေးမှုအမွေအနှစ်စီမံခန့်ခွဲရေးအစီအစဉ်များနှင့်
- အရေးပေါ်အစီအစဉ်များဖြစ်သည်။

၁.၈ ဒေသခံများအားဆွေးနွေးခြင်းနှင့် အသိပေးခြင်း

အများပြည်သူပါဝင်မှုသည် ESHIA လုပ်ငန်းစဉ်တွင် အဓိကကျသောအခန်းကဏ္ဍဖြစ်သည်။ အများပြည်သူပါဝင်မှု၏ ရည်ရွယ်ချက်သည် အများပြည်အား ဆုံးဖြတ်ချက်ချမှတ်ရေးဖြစ်စဉ်များတွင် ပါဝင်နိုင်စေရန်၊ ၄င်းတို့၏အမြင်များအား ထုတ်ဖော်လာနိုင်စေရန်၊ ဖြစ်စဉ်အတောအတွင်းထွက်ပေါ်လာသောစိုးရိမ်မှုများအား လျော့ချခြင်းနှင့် ပညာရပ်ဆိုင်ရာ ဖြေရှင်းနည်းတို့အားလွှမ်းမိုးနိုင်စေရန်တို့ဖြစ်သည်။ အများပြည်သူဟုဆိုရာတွင် လူမှုအသိုင်းအဝိုင်းများ၊ ပုဂ္ဂလိကပိုင် စီးပွားရေးလုပ်ငန်းများ၊ လူမှုအဖွဲ့အစည်းများ၊ ဒေသခံအာဏာပိုင်များ၊ အစိုးရမဟုတ်သောအဖွဲ့အစည်း(NGO) များ၊ မီဒီယာများ၊ နိုင်ငံတော်အစိုးရ၊ဒေသတွင်းအစိုးရနှင့် ပြည်သူလူထုများပါဝင်သည်။

၂၀၁၆ မတ်လတွင် IEM သည် RSF-5 အတွင်းရှိ မကွေးခရိုင်မှ မကွေးနှင့်မြို့သစ်မြို့နယ်ရှိ ကျေးရွာ (၈) ရွာမှ ရွာသူရွာသား(၄၀၀) ခန့်နှင့်များစွာဆုံခဲ့သည်။ပြည်သူလူထုပါဝင်မှုတစ်ရပ်အနေဖြင့် ကျေးရွာသူကြီးများနှင့်ကျန်းမာရေး စောင့်ရှောက်မှုပေးနေသူများနှင့်လည်းများစွာဆုံမှုများပြုလုပ်ခဲ့သည်။ထို့အပြင်လူမှုစီးပွားနှင့်သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ ပူးတွဲအခြေခံစစ်တမ်းများကောက်စဉ်အတွင်းရွာသူရွာသားများ၊ လယ်သမားများနှင့်လည်း ရိုးရာဂေဟစနစ်ဆိုင်ရာများ တွေ့ဆုံမေးမြန်းခြင်း၊ စစ်တမ်းကောက်ယူခြင်းများပြုလုပ်ခဲ့သည်။

လူမှုစီးပွားစစ်တမ်းမေးခွန်းများမမေးခင်အဆိုပါများစုံပွဲတွင်eniMyanmarအနေဖြင့်ဆိုက်စမစ်အချက်အလက်များနှင့် ရှာဖွေလေ့လာရေးဆောင်ရွက်မှုများလုပ်ဆောင်ရန်စီစဉ်ထားကြောင်းရွာသားများအားပြောပြခဲ့သည်။လူမှုစီးပွားမေးခွန်းလွှာများ၏ရည်ရွယ်ချက်မှာ ထိုဒေသအတွင်းရှိ ယေဘုယျလူမှုစီးပွား အချက်အလက်များအား စုဆောင်းရန်နှင့်

eni Myanmar ၏စီစဉ်ထားရှိပြီးသော ဆိုက်စမစ်ရှာဖွေလေ့လာရေး အစီအစဉ်အပေါ် သဘောထားနှင့်နားလည်မှုများရရှိရန်ဖြစ်သည်။

လူမှုစီးပွားစစ်တမ်းအား အိမ်ထောင်စုဇယား အချက်အလက်များနှင့် သဘောထားများအား သိရှိရန် ရေးဆွဲထား ခြင်း ဖြစ်သည်။ သဘောထားများမှာ -

- အိမ်ထောင်စုဇယားဖွဲ့စည်းပုံနှင့်လူဦးရေးနှင့်အခြားသောအချက်အလက်များ
- အိမ်ထောင်စု၏လူနေမှုဘဝအဆင့်အတန်း၊ အလုပ်အကိုင်၊ ဝင်ငွေ၊ လူမှုရေးနှင့်စီးပွားရေးအခြေအနေများ
- အိမ်ထောင်စုနှင့်တစ်ဦးချင်းကျန်းမာရေး
- သဘာဝပတ်ဝန်းကျင်အချက်အလက်များနှင့် သဘာဝပတ်ဝန်းကျင်အားလူအသုံးချမှု
- ဆောက်လုပ်ရေးလုပ်စဉ်နှင့်ဆောက်လုပ်ရေးပြီးနောက် စီမံကိန်း၏အနာဂတ်သက်ရောက်မှုများဖြစ်သည်။

Myanmar
ESHIA STUDY FOR THE EXPLORATION BLOCK RSF-5

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2.0 Introduction

On 17th of February 2013 the Republic of the Union of Myanmar announced an invitation to apply for hydrocarbon exploration authorizations and subsequent hydrocarbon exploitation licenses. On 31st July 2014 *eni Myanmar* signed in presence of the Country's Energy Ministry the Production sharing Contract (PSC) for the onshore Block RSF-5. This report presents the Environmental, Social and Health Impact Assessment (ESHIA) of the onshore hydrocarbon exploration activities, planned by eni within Block RSF-5 and is structured in compliance with the new EIA Procedure, issued by the Ministry of Natural Resources and Environmental Conservation.

The project foresees the acquisition of a 3D seismic survey within the Block, aimed to identify potential opportunities for further hydrocarbon exploration activities. Block RSF-5 covers an area of 1.292 km^2, but the seismic survey will be executed on a portion of 500 km^2.

This report is the final ESHIA report based on the initial ESHIA completed by ERM SpA – Environmental Resource Management, integrated with primary information gathered during the environmental and social surveys performed by International Environmental Management Co. Ltd. (IEM) in association with the local partner Environmental Quality Management Co. Ltd. (EQM).

The baseline sampling and survey has been carried out in March 2016 covering the area potentially affected. This area comprises Magway and Myothit townships. Minhla has been not included, because is across the Ayeryrawaddy River and no seismic activities will be conducted in this township, so there is no risk of potential impact.

2.1 PRESENTATION OF THE PROJECT PROPONENT

The Project proponent consists in a Joint Venture between *eni Myanmar* and the Myanmar Petroleum Exploration & Production Co., Ltd (MPEP). MPEP has operated in Myanmar since 1996. MPEP has operated the Mann onshore oil and gas block in Central Myanmar as a contractor to state-run Myanmar Oil and Gas Enterprise since 1996. It is registered in the British Virgin Islands.

The RSF-5 Joint Venture and Myanma Oil & Gas Enterprise (MOGE) signed a Petroleum Sharing Contract (PSC) for carrying out Petroleum Exploration and Production Activities in block RSF-5 on 30th July 2014.

RSF-5 Joint Venture is composed by Eni Myanmar with 90% of Participating Interest and MPEP with 10% of Participating Interest, carried in the Exploration periods, defined by the PSC between the RSF-5 Joint Venture and MOGE.

RSF-5 JV has been established in order to participate the 2nd Bid Round Onshore announced by the Ministry of Energy of the Republic of Myanmar on January 17th 2013 with deadline 23rd of August 2013. Mandatory criteria to take part to the Onshore Bidding Round was to establish JV with a local partner in order to guarantee good knowledge of the country legislation and territory. MPEP is respectable and well know Operator onshore and offshore Myanmar and is fully supporting Eni Myanmar to carry out exploration activities in block RSF-5.

Obligations and liabilities between the parties of the Joint Venture are established by the Joint Operating Agreement signed by Eni Myanmar and MPEP.

2.2 ESHIA EXPERTS

The impact assessment was completed by environmental consultants International Environmental Management Co. Ltd. (IEM) and Environmental Quality Management Co. Ltd. (EQM). IEM are experts in the oil and gas sector and have experience in undertaking environmental, social and health assessments and approvals internationally and throughout South East Asia. EQM is a local, Myanmar environmental company that has worked closely with IEM to complete environmental and social assessments of onshore and offshore oil and gas developments in Myanmar since 2009. The ESHIA assessment team members, their specialist areas and contributions to the report are set out described in **Table 2.1**.

Table 2.1 ESHIA Team

No.	Name	Company	Position
1	Chiara Aquino	ERM	Senior Project Manager
2	Ron Livingston	IEM	Project Manager / Environmental Expert
3	Dylan Jenkins	IEM	Environmental Analyst
4	Ubonwan Sinowatra	IEM	GIS Specialist
5	Komgrit Prawatlertudom	IEM	Environmental Analyst
6	Dr. Ohnmar May Tin Hlaing	EQM	Local Project Coordinator
7	Ms. Phyo Thet Kaing	EQM	Socio-Economic Team Leader
8	Ms. Thiri Tin Htut	EQM	
9	Ms. Myat Noe Yadanar Mg	EQM	Socio-Economic interview
10	Ms. Theint Yadanar Mg	EQM	
11	Ms. Shwe May Oo	EQM	
12	Mr. Lu Min Shane	EQM	
13	Mr. Lwin Ko	EQM	
14	Mr. Pyae Soe Oo	EQM	
15	Mr. Ye Phone Hlaing	EQM	
16	Mr. Myo Ko Ko Maung	EQM	
17	Mr. Aung Min Thu	EQM	
18	Mr. Randal Glaholt	IEM	International Biodiversity
19	Mr. Aung Myo Htet	EQM	Local Biodiversity
20	Mr. Lay Win	Myanmar Bird and Nature Society	Local Biodiversity
21	Mr. Nay Linn Htun	EQM	Local Biodiversity
22	Mr. Htet Myat Paing	EQM	Cultural Heritage
23	Mr. Win Si Thu	EQM	Ambient Air Monitoring
24	Mr. Thi Ha Htut	EQM	
25	Mr. Soe Pyae Htun	EQM	
26	Mr. Kyaw Ko Ko	EQM	

Myanmar
ESHIA STUDY FOR THE EXPLORATION
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3.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This Chapter summarizes the key environmental national and international conventions, legislation and regulatory standards applicable to the Project.

eni Myanmar commits to abide by all current and future national Myanmar laws and regulations applicable to the seismic survey project during the duration of the project activities.

3.1 ENI ENVIRONMENTAL AND SOCIAL POLICIES

eni has developed specific guidelines and standards for its operations that will be met during project activities as far as practicable. A summary of these guidelines are included below:

- eni E&P Division – Quality Requirements: this document defines the contractor's Management System requirements to be applied to the Contract Scope of Work during the bid stage and during the execution of works.
- eni E&P Division - Contract HSE Requirements for abroad services (Rev 01, Aug 2010): Sets out the minimum requirements, as well as recommendations for everything relevant to the Health, Safety & Environment aspects of the project.
- eni Upstream Technical Guideline – AMTE-TG-002 "Environmental & Social Impacts in Exploration" (11/03/2016),. This technical guideline describes the purpose and the basic steps to identify appropriate contents, relevant methodologies and responsibilities for the preparation and the implementation of an ESHIA.
- eni Upstream Technical Guideline - AMTE-TG-013 "Biodiversity and Ecosystem surveys Impact Assessment and Management". This Technical Guideline (TG) provides guidance for managing Biodiversity and Ecosystem Services (BES) issues in onshore and offshore oil and gas projects during all project phases, from exploration to decommissioning.
- eni Upstream Professional Operating Instruction: Local Stakeholder Engagement (opi ssc 001 eni spa); Social Context Analysis (opi ssc 002 eni spa); Community Investment Management (opi ssc 003 eni spa); Monitoring, reporting and audit activities (opi ssc 004 eni spa); Local Content (opi ssc 005 eni spa); Land Acquisition and Management (opi ssc 006 eni spa) – all issued in July 2015. These guidelines area aimed to ensure that eni Upstream activities are carried out and developed in a sustainable way.
- eni Upstream Technical Operating Instruction – opi sg hse 028 ups (11/03/2016) "Identification of significant environmental aspects". It sets the standards relevant to the methodology for the identification of significant environmental aspects.
- eni E&P division- Doc N° 1.3.2.11 MHS 2 "Health Risk Assessment".
- eni Upstream Technical Operating Instruction- AMTE-TG-010 "Waste Management in Upstream Oil&Gas Activities". It provides a set of minimum requirements and treatment options that shall be considered for the preparation of dedicated local-specific procedures for a correct management of all wastes, including waste-water, drilling waste and TENORM waste produced during e&p activities.
- Eni Upstream Operating Technical Guideline - Air Quality Monitoring in Upstream Oil&Gas activities (AMTE-TG-006). It provides a guide or the design, installation and management of Air Quality Monitoring Systems.

- Eni Upstream Operating Technical Guideline - Sustainable Water Management for Upstream Sector (AMTE-TG-012). It defines the procedure for proper and sustainable water management, thus resulting in a usable instrument both for design and operational phases. Moreover it is conceived to be a guideline to develop a Water Management Plan.
- eni Minimum HSE Requirements in Geophysical Operations (opi sg hse 002 e&p r01). It defines the minimum HSE requirements to apply in geophysical operations (including land seismic acquisition and processing, gravity and magnetic survey) in order to ensure compliance with the commitments of eni spa Policies as well as the requirements of internationally recognized best practices.
- eni Code of Ethics (Mar 2008): Lays out eni's Code of Ethics for its operations.
- eni Guidelines on the Protection and Promotion of Human Rights (Apr 2007).

Moreover *eni Myanmar* refers to some international policies, principles, and standards for its activities; the main of them are listed below:

- OGP/IPIECA - Ecosystem services guidance, 2011;
- International Union for Conservation of Nature (IUCN) Red List;
- International Finance Corporation (IFC) – Performance Standard 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources, 2012;
- International Finance Corporation (IFC) – Performance Standard 7 Indigenous People, 2012;
- International Finance Corporation (IFC) – Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets, 2007;
- WHO – World Health Organization;
- OGP/IPIECA - A Guide to Health Impact Assessment for oil and gas industry, 2007;
- International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978; Annex I-VI.

3.2 POLICY AND LEGAL FRAMEWORK

3.2.1 International treaties and agreements

Myanmar has ratified various international treaties and agreements which related to environmental issues. Those relevant to the Project are listed in Table 3.1.

Table 3.1 International Treaties and Agreements

Conventions	Year	Ratified/Acceded /Accepted
Environment		
Plant Protection Agreement for the Southeast Asia and Pacific Region, Rome 1956	1959	Ratification
ICAO: ANNEX 16 to the Convention on International Civil Aviation Environmental Protection Vol. I and II, Aircraft Noise and Aircraft Engine Emission		Accession

Conventions	Year	Ratified/Acceded /Accepted
Vienna Convention for the Protection of the Ozone Layer, Vienna 1985	1993	Ratification
Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal 1987	1993	Ratification
London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London 1990	1993	Ratification
United Nations Framework Convention on Climate Change (UNFCCC), New York 1992	1994	Ratification
Convention on Biological Diversity, Rio de Janeiro 1992	1994	Ratification
The Convention Concerning the Protection of the World Cultural and Natural Heritage, Paris 1972	1994	Acceptance
International Tropical Timber Agreement (ITTA), Geneva 1994	1996	Ratification
United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought, Paris 1994	1997	Accession
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington DC 1973; and as amended in Bonn, Germany 1979	1997	Accession
ASEAN Agreement on Conservation of Nature and Nature Resources, Kuala Lumpur, 1985	1997	Signatory
Kyoto Protocol to the Convention on Climate Change, Kyoto 1997	2003	Accession
ASEAN Agreement on Trans-boundary Haze Pollution	2003	Ratification
Stockholm Convention on Persistent Organic Pollutants (POPs), 2001	2004	Accession
Ramsar Convention on Wetlands of International Importance	2005	Accession
Establishment of ASEAN Regional Centre for Biodiversity	2005	Signatory
Declaration on ASEAN Heritage Parks	2003	Signatory
International Treaty on Plant Genetic Resources for Food and Agriculture, 2001	2004	Ratification
Cartagena Protocol on Biosafety, Cartagena, 2000	2001	Signatory
Social, Labour and Health		
Universal Declaration of Human Rights (UNDHR)		Signatory
Convention on the Rights of the Child	1991	Accession
Convention on Elimination of All Forms of Discrimination against Women (CEDAW)	1997	Accession

Conventions	Year	Ratified/Acceded /Accepted
Relevant ILO Conventions in force in Myanmar		
C1 Hours of Work (Industry)	1921	Ratification
C14 Weekly Rest (Industry)	1923	Ratification
C17 Workmen's Compensation (Accidents)	1956	Ratification
C19 Equality of Treatment (Accident Compensation)	1927	Ratification
C26 Minimum Wage Fixing Machinery	1954	Ratification
C29 Forced Labour Convention	1955	Ratification
C42 Workmen's Compensation (Occupational Diseases) Revised 1934	1927	Ratification
C52 Holidays with Pay	1954	Ratification
C87 Freedom of Association and Protection of the Right to Organize	1955	Ratification
C182 - Worst Forms of Child Labour	2013	Ratification

3.2.2 Applicable Myanmar Legislation & Regulation

3.2.2.1 The Constitution

The latest enacted Constitution (May 2008) provides information on governing laws and regulations in Myanmar. The Constitution takes precedence over any other national legislation or international agreements. The general provisions of the Constitution that relate to the project are the requirement for Myanmar citizens to assist in:

- preservation and safeguarding of cultural heritage;
- environmental conservation;
- striving for development of human resources; and
- protection and preservation of public property.

3.2.2.2 National Environment Policy (NEP) (1994)

The National Environment Policy (NEP) was the first principal policy on environmental protection developed by the NCEA and adopted by the Myanmar Government in 1994. The objective of the NEP is stated as:

"… the integration of environmental considerations into the development process to enhance the quality of life of all its citizens. ...It is the responsibility of the State and every citizen to preserve its natural resources in the interests of present and future generations. Environmental protection should always be the primary objective in seeking development."

With a view to implement the NEP, the NCEA formulated Myanmar Agenda 21 in 1997, under the guiding principles established at the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in 1992. Agenda 21 provided the first framework for integrating environmental considerations into national development plans in Myanmar.

3.2.2.3 Myanmar Agenda 21 (1997)

Agenda 21 represented an environmental action plan for Myanmar and was approved in February 1997. It was written with the assistance of the Asia-Pacific Centre for Environmental Law and the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). The document was presented in June 1997 at the United Nations General Assembly Session on Agenda 21. It is divided into 4 Parts and 19 Chapters, and reviewed the current state of Myanmar development and environmental status. Policies to be undertaken in order to improve environmental protection in Myanmar were suggested, including the creation of national framework legislation on the environment to improve coordination and cooperation between ministries on issues related to the environment; and of a legislation requiring an environmental impact assessments to be issued before developments are undertaken.

In 2007, the NCEA developed the National Sustainable Development Strategy (NSDS) for Myanmar.

It incorporated the suggestions of Agenda 21 as well as Myanmar's Millennium Development Goals. The NSDS was approved in 2009 thereby setting the main guiding principles on environmental protection for the country.

3.2.2.4 National Sustainable Development Strategy (NSDS)

The aim of the NSDS is to achieve sustainable development, focusing on natural resource management, economic development, and social development. Government ministries are expected to apply the NSDS principles within their sectorial development through short-term, medium-term and long-term actions.

Although much of the NSDS guidelines are intended for adoption and integration into legislation, some aspects are targeted at developers, such as the 'polluter pays' principle, as well as the need for reducing energy consumption and greenhouse gas emissions from industry. Since the principles set out in the NSDS are beginning to be incorporated in the country's legislative development, for the companies operating within the private sector may have the opportunity of working with Government in bringing their operations in line with the objectives of the NSDS.

3.2.2.5 ESHIA Requirements in Myanmar

Myanmar's regulatory requirements for Environmental & Social impact assessments (EIA/SIA) are detailed in the Environmental Impact Assessment Procedures, 2016. This section highlights the current requirements with respect to EIA/SIAs and IEEs.

3.2.2.6 ESHIA Legislation

The Myanmar Government has installed new laws on ESHIA requirements as follows:

- **The Environmental Conservation Law, 2012**. The legal mechanism for ESHIA has been put in place with the 2012 Environmental Conservation Law. The law was enacted on April 1, 2012, based on a draft written in 1998.

  The following articles are particularly relevant to ESHIA requirements and this project:

  Article 7 of Chapter 4 mentions the need for SIA and EIA for any project operated by the government or organizations or individuals, as follows:

"7. The environment conservation functions and powers of the Ministry are as follows:
…
(m) formulating and executing environmental impact assessment system and social impact assessment system to determine if any project or activity to be undertaken by any Government department, organization or person may have a significant impact on the environment;"

Also in this law, Article 14 and Article 15 are related with waste disposal in accordance with environmental standards:

"14. Any person causing a point source of pollution shall treat, emit, discharge or deposit any pollutants which cause environmental pollution, in accord with stipulated environmental quality standards.

15. The owner or occupant of a point source of pollution which is an activity, material or place shall install or use an on-site facility or controlling equipment in order to monitor, control, manage, reduce or eliminate environmental pollution. If this is not possible, it shall be arranged to dispose the wastes in accord with environmentally sound methods."

Article 19 is related to maintenance of cultural heritage:

"19. The Ministry shall cooperate with the relevant Government departments and Government organizations in the matters of environmental conservation for the long lasting of cultural heritage areas, natural heritage areas, cultural monuments and natural areas stipulated under any existing law."

For violations of bylaws, regulations and directives issued under this law, punishment is not more than one year or fine (unspecified amount), or both, under Article 32.

- **Foreign Investment Law, 2012, and the 2013 Foreign Investment Rules.** Myanmar passed a new Foreign Investment Law on November 2, 2012, which replaced the Myanmar Foreign Investment Law of 1988. The recently enacted rules require EIA/SIA for large projects according to the rules of the Ministry of Environmental Conservation and Forestry.

  Although the law does not specifically define legislation for EIAs, Notification 1/2013 provides a categorization of the business activities in which foreigners will be allowed to engage. Under this, "oil & gas" projects fall under "Category 4: activities allowed only following an Environmental Impact Assessment".

  The upstream oil and gas regulatory body responsible for the administration Oil & Gas exploration and exploitation activities in Myanmar is the Myanmar Oil & Gas Enterprise (MOGE).

- **Environmental Impact Assessment Procedures, 2015.** Environmental Impact Assessment Procedures have been prepared by the MONREC under the Environmental Conservation Law, 2012. It requires that the Project proponent shall include in its evaluation environmental, social and health aspects of the environment, and

shall identify and assess all adverse impacts and risks for environment, social issues and, if relevant, health that potentially could arise from the Project. Therefore this law shall be effectively considered an ESHIA procedure framework.

These rules state that:

"…all Projects and Project expansions undertaken by any ministry, government department, organization, corporation, board, development committee and organization, local government or authority, company, cooperative, institution, enterprise, firm, partnership or individual (and/or all Projects, field sites, factories and businesses including expansions of such Projects, field sites, factories and businesses identified by the Ministry, which may cause impact on environmental quality and are required to obtain Prior Permission in accordance with Section 21 of the Law, and Article 62 of the Rules) having the potential to cause Adverse Impacts, are required to undertake IEE or EIA or to develop an EMP, and to obtain an ECC in accordance with this Procedure."

In Block RSF-5 *eni Myanmar* will acquire 500 km^2 of 3D seismic

3D seismic surveys fall into Category n. 12 "*Onshore Oil and Gas Seismic Surveys*", therefore, according to *Annex 1* (*Categorization of Economic Activities for Assessment Purposes*) of the Environmental Impact Assessment Procedure, all seismic require an IEE, however as per eni standards an ESHIA was prepared which followed the EIA procedure.

As stated in Chapter V of the draft of the Environmental Impact Assessment Procedure, an Environmental Assessment procedure foresees:

- Screening Phase – An initial assessment is made pursuant to this Procedure to determine whether an IEE or an EIA is required to be carried out. The Project Proponent shall submit to the Department for Screening a Project Proposal completed in accordance with Ministry guidelines;
- Scoping Phase – The Scope of the EIA (i.e., the data that need to be collected and analysed to assess the potential Adverse Impacts of a Project) is determined and the Terms of Reference (ToR) for the preparation of the EIA Report is produced. The Project Proponent shall submit to the Ministry the Scoping Report and the ToR;
- EIA Investigation Phase – The Project Proponent carries out environmental and social assessment investigations, including consultations with public at national and local level (project affected people, authorities, civil society, community based organizations, the Ministry, sector ministries, regional government organizations, etc..), and submits to the Ministry the EIA Report. After submission of the EIA Report, the Project Proponent shall disclose the EIA Report to the public;
- EIA Review and approval – EIA Report Review Body is responsible to review and provide comments and recommendations on the submitted EIA Report. Upon completion of the review of the EIA Report, the Ministry shall communicate whether the EIA Report is approved, subject to any conditions as may be

prescribed, or is rejected. In case of approval, an Environmental Compliance Certificate (ECC) is issued. It is noted that the Project Proponent shall commence implementation of the Project strictly in accordance with the conditions attached to the ECC and including the EMP, within such time as may be prescribed by the Ministry, only after the Myanmar Investment Commission or the relevant authority has given approval to a Project for which an ECC has been issued;

- Appeal Process - Any Project Proponent, Person or organization which has submitted an EIA in accordance with this Procedure, or government organization, or other Person or organization potentially affected by any Adverse Impacts of the Project, shall have the right to file an appeal to the Environmental Conservation Committee.

3.3 INSTITUTIONAL FRAMEWORK

The aim of this Chapter is to describe the Administrative and political divisions of Myanmar. Land Tenure and Ownership in the Country is described as well documenting the governing Laws & Regulation.

3.3.1 Political System

The following is a brief summary of Myanmar's current political system and structure (Economist Group, 2014):

The official name of Myanmar is the Republic of the Union of Myanmar. Under its 2008 constitution, Myanmar has a multiparty democratic system.

The Executive

A new executive, headed by a president, was formally installed in March 2011, after the dismantling of the State Peace and Development Council (the military junta that had held power since 1988).

National Legislature

There are two national legislative chambers, the 440-seat Pyithu Hluttaw (People's Assembly, the lower house) and the 224-seat Amyotha Hluttaw (Nationalities Assembly, the upper house). In both assemblies, 25% of seats are reserved for appointees representing the military, while the other members are directly elected.

Head of State

The president is chosen by the Presidential Electoral College, which comprises three committees—one formed of members of the upper house, one made up of members of the lower house and one consisting of military appointees. Thein Sein was chosen as president in February 2011 alongside two vice-presidents, Tin Aung Myint Oo and Sai Mauk Kham. Tin Aung Myint Oo was replaced by Nyan Tan in August 2012. The new President, Mr. Htin Kyaw from the National League for Democracy is currently the head of state and head of government in Myanmar.

National Elections

Elections were held in November 2010 for both houses of parliament. The military-aligned Union Solidarity and Development Party (USDP) won an overwhelming victory in the polls; the main opposition party, the National League for Democracy (NLD), chose not to participate. The NLD won 43 out of 45 seats in by-elections held in April 2012.

General elections were held in Myanmar on 8 November 2015, with the National League for Democracy winning a supermajority of seats in the combined national parliament.

National Government

A cabinet is appointed by the president and is subject to approval by the national legislative bodies.

Main Political Parties

The main political parties within Myanmar consist of USDP, NLD, National Democratic Force, National Unity Party, Shan Nationalities Democratic Party, Rakhine Nationalities Development Party, and other ethnically based parties.

3.3.2 Administrative Divisions

Myanmar is a multi-ethnic country composed of over 130 ethnic groups, and viewing macroscopically, in the central part of the country from north to south along Ayeyarwady River resides the largest group covering 70% of the total population, Bamar, and in mountainous area in east and west reside most of the minorities.

Myanmar has a three levels administrative structure, as described below.

The first level subdivision includes:

- Seven states;
- Seven regions (regions were previously referred to as "divisions", prior to August 2010);
- Five self-administered zones;
- One self-administered division;
- One union territory.

States and regions are divided into districts. Districts consist of townships, which are composed of towns, wards and village-tracts, that are groups of adjacent villages. The administrative structure of the states, regions and self-administering bodies is defined in the Constitution.

Each region and state has a Regional/State Government, consisting of a Chief Minister, Ministers and an Advocate General. Legislative authority resides with the State/Regional "Hluttaw" (a parliament or legislative body), which are made up of elected civilian members and representatives of the military.

The Constitution states that Naypyidaw is a Union Territory under the direct administration of the President. The Naypyidaw Council, led by a Chairperson, carries out general functions on behalf of the President. The Chairpersons of the Naypyidaw Council are appointed by the President, and include civilians and representatives of the military.

Self-Administered Zones and Self-Administered Divisions are administered by a Leading Body, which is headed by a Chairperson, and has executive and legislative powers. The Leading Body consists of elected State/Regional Hlutttaw members and military personnel. Block RSF-5 is located in Magway Region. Magway Region consists of six districts, as shown in the following Table 3.2.

Table 3.2 Districts of Magway Region

District Name	Township Name	Area (km²)	Population	Capital City
Magway	Magway	1769.95	292,344	Magway Town
	Yenangyaung	1027.61	182,979	
	Chauck	1003.03	214,320	
	Taungdwingyi	1973.38	263,549	
	Myothit	1596.37	179,015	
	Natmauk	2314.28	234,471	
Minbu	Minbu	1667.80	169,623	
	Pwintbyu	1205.14	166,531	
	Ngape	1322.78	46,572	
	Salin	2322.74	262,352	
	Sidoktaya	2830.45	43,198	
Pakokku	Pakokku	1317.44	298,676	
	Myaing	2041.57	253,956	
	Pauk	2464.15	174,240	
	Seikphyu	1527.91	104,050	
	Yesagyo	992.96	252,614	
Thayet	Aunglan	2682.70	230,699	
	Kamma	1148.81	71,717	
	Mindon	2558.55	61,299	
	Minhla	2383.18	111,065	
	Sinbaungwe	2061.20	124,771	
	Thayet	1206.11	103,742	
Gangaw	Gangaw	2486.68	131,595	
	Tilin	1335.21	51,079	
	Saw	1784.79	68,949	
Total		**45024.80**	**4,093,406**	

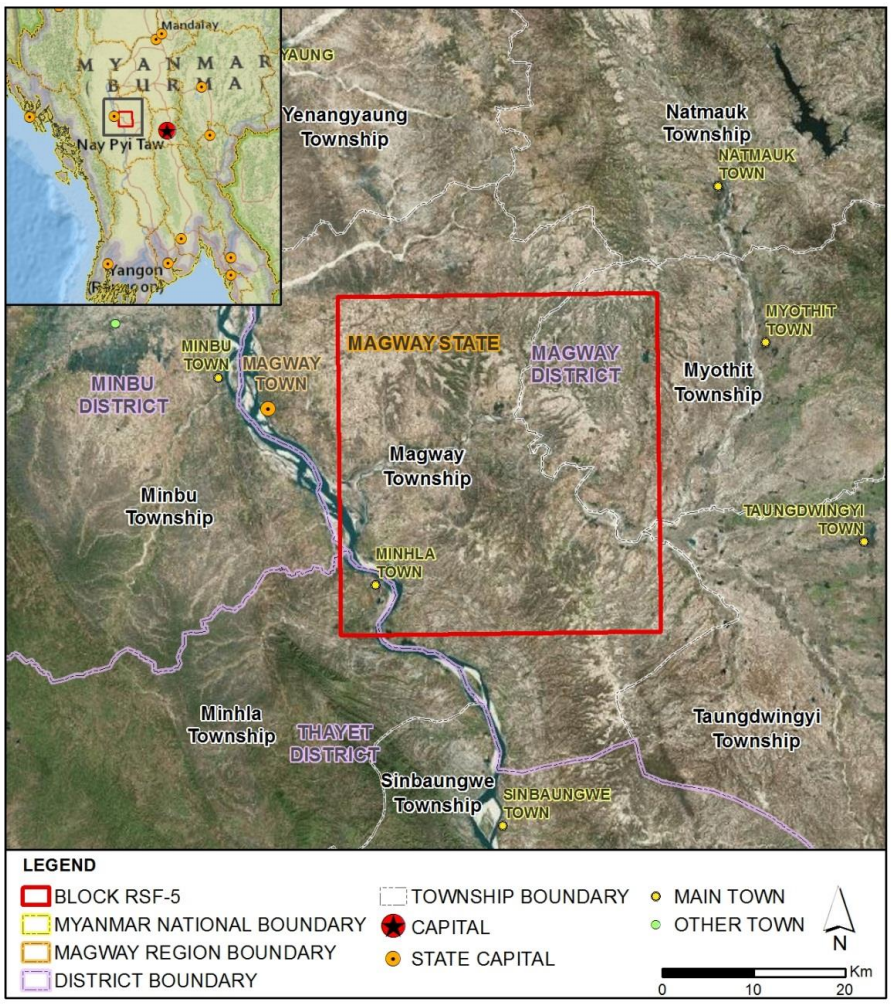
Block RSF-5 contains the following region, districts, and townships (Table 3.3).

Table 3.3 Region, Districts and Townships within Block RSF-5

Region	District	Township
Magway	Magway	Magway
		Myothit
		Taungdwingyi
	Minbu	Minbu
	Thayet	Minhla

Figure 3.1 shows the administrative division of the Magway Region.

Figure 3.1 Administrative Map of Magway Region



Source: eni, 2014

3.3.3 Land ownership

Similar to other former British colonies, the land tenure system in Myanmar recognizes freehold and leasehold title. Such title must be registered to be effective, and is subject to reservation, in favor of the government, of all mines, mineral products, and buried treasures. The government has the right to expropriate land with appropriate consideration. Foreigners, or companies with one or more shares owned by foreigners, are barred from acquiring land (or any interest in land) by way of a transfer, grant, lease or mort-gage, except with government permission.

In September 2011, a Notification was passed that a company operating under the old Foreign Investment Law (FIL) may be granted a "right to use" government-owned land, or private land. The FIL allows the sublease or mortgage of land and buildings under a MIC permit within the term, only with the MIC's approval. Under the FIL, foreign companies may be granted a right to lease or use land for a period of up to 50 years, with two possible renewal terms of 10 years each. The MIC may grant a lease or right to use for a longer period in respect of investment in particularly under-developed regions.

3.4 PROJECT'S ENVIRONMENTAL AND SOCIAL STANDARDS

The necessary Myanmar laws and regulations applicable to the Project and their key requirements are summarized in Table 3.5. A detailed legislative review of all necessary Myanmar National laws that *eni Myanmar* must comply with is included in Annex 9.

The Myanmar Environmental Conservation Law, Environmental Conservation Rules, Environmental Quality (Emission) Standards are the first step to address all the complex environmental and social management issues faced by Myanmar. A number of other laws exists which, either directly or indirectly, relate to environmental and social management, however these laws are general in nature and refer primarily to good practice recommendations.

Regarding air quality and noise, vibration, surface and groundwater quality, waste, brief mentions are included in the Penal Code and Public Health Law. They are mentioned also in the Environmental Conservation Law, Chapter 6, as follows:

"*The Ministry may stipulate the following environmental quality standards*:

a. *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;*
b. *water quality standards for coastal and estuarine areas;*
c. *underground water quality standards;*
d. *atmospheric quality standards;*
e. *noise and vibration standards;*
f. *emissions standards;*
g. *effluent standards;*
h. *solid wastes standards;*
i. *other environmental quality standards"*

For section 14 of Environmental Conservation Law, *eni Myanmar* will not discharge any pollutants which cause environmental pollution in accord with stipulated environmental quality standards under section 14 of Environmental Conservation Law.

The National Environmental Quality (Emission) Standards, released in 2016 by MONREC in exercise of the power conferred by sub-section (b) of section 42 of the 2012 Environmental Conservation Law establish water discharge, air, noise, vibration and odour emission limits for various industries including Oil and Gas.

The Project will comply with the Myanmar Environmental Conservation Law, Environmental Conservation Rules, Environmental Quality (Emission) Standards and all necessary international standards; Table 3.4 reports the IFC General EHS Guidelines for air quality, noise and vibration, waste management and wastewater, that may be relevant for the Project.

eni Myanmar will comply with the following Chapters & Sections of the Protection and Preservation of Ancient Monuments Law (No. 51/2015):

Chapter VI. Informing that an Ancient Monument is found

Section 12. If a person who finds an ancient monument of over one hundred years old and above or under the ground or above or under the water which has no owner or custodian knows or it seems reasonable to assume that the said monument is an ancient monument, he shall promptly inform the relevant Ward or Village-Tract Administrative Office.

Section 13. (a) If the information is received under Section 12, the Ward or Village- Tract Administrator shall keep the said monument as may be necessary and shall forward the information to the relevant Township Administrative Office within 14 days. The Township Administrator shall promptly carry out the necessities and inform the Department within 7 days from the date on which the information is received.

(b) The Department shall inspect whether it is a real ancient monument or not and keep or cause to protect as may be necessary in accord with the stipulations when the information is received under sub-section (a).

Chapter VII. Applying for prior Permission, Scrutiny and Issue

Section 14. Any Department, any organization or any person desirous of any of the followings shall abide by the provisions of other existing laws and apply for the prior permission under this Law to the Department in accord with the stipulations:

(a) repairing and maintaining the whole or a part of an ancient monument without altering its original form or its original workmanship or altering the boundary of its enclosure;

(e) surveying, digging and researching places where an ancient monument is situated;

Section 15. A person aiming at realizing any of the followings within the specified area of an ancient monument shall apply to get prior permission to the Department:

(b) constructing or extending or repairing new buildings including hotels, factories and residential buildings or fencing or extending a fence;

(c) digging to search petroleum, natural gas, gem or mineral, piping petroleum and natural gas, constructing factories, connecting national grid, constructing communication tower, constructing or extending infrastructures such as road, bridge, airfield, irrigation and embankment;

(d) connecting underground electric cable, communication cable and other underground works;

(f) gold sieving, digging, burning bricks, digging well, lake, creek, ditch, gully, pit digging, refilling, levelling, mining, quarry, gravel digging and unearth sand, removing the mounds and hills which can damage the physical feature of the land;

Chapter VIII Prohibitions

Section 19. No one shall carry out any of the following acts within the specified campus of an ancient monument without the written permission of the Department:

(a) destroying or damaging an ancient monument;

(b) carrying out to alter the original form or the original workmanship of an ancient monument;

(c) digging to search for remains;

(d) looting and removing original elements and artefacts from an ancient monument.

Section 20. No one shall carry out any of the following acts which are assumed to cause damage to an ancient monument within the specified area of an ancient monument or of a listed ancient monument without a written prior permission:

(b) using machines which causes vibration within the specified place of an ancient monument and running various types of vehicles;

(c) cultivating, gardening, breeding, fencing by blocking nearby an ancient monument or doing any other act which can affect an ancient monument;

(d) emission of gas such as hot-air balloon which can affect an ancient monument;

(e) landing and taking off and, flying aeroplane and helicopter which can directly or indirectly affect an ancient monument;

(f) discarding chemical substance and rubbish which can affect an ancient monument and the environment.

eni Myanmar will comply with the following Chapters & Sections of the Myanmar Insurance Law (No. 10/1993):

Section 16. An entrepreneur or an organization operating an enterprise which may cause loss to State-owned property or which may cause damage to the life and property of the public or which may cause pollution to the environment shall effect compulsory general liability insurance with Myanmar government.

Section 19. Economic Organizations which have been formed under a permit under the Union of Myanmar Foreign Investment Law shall effect only with the Myanmar Insurance the classes of insurance which the Myanmar Insurance determines from time to time. However from amongst the classes of insurance which the said Economic Organizations are to effect the Ministry of Finance and Revenue may exempt from effecting insurance of any class or more than one class, in the interest of the State.

Myanmar Investment Law, 2016 Provisions to restrict or prohibit investment activities which affect public health, the environment and ecosystems, which produce toxic waste or which engage with toxic chemicals; duties of investors to conduct business in such a way

as to avoid environmental damage, air and water pollution, in accordance with existing laws

Chapter (5) - Resignation, Dismissal from the Commission and Appointment for Vacancy

Section 15. The Government may dismiss a member of the Commission in one of the following events:

(b) Imprisonment by a court due to a criminal offence;

(c) Being declared as insolvent by a court; or

Chapter (12) Rights to Use Land

Section 51. (a) An investor which receives authorization according to this Law has the right to obtain a long-term lease of land in accordance with relevant laws, either from private land-holders or from any government body or government organization in the case of state-owned land. Myanmar citizen investors may invest using land owned by them, in accordance with relevant laws.

(d) The investor shall register the lease agreement at the Registrar Office of Deeds and Assurances in accordance with the Registration Act.

Chapter (16) Responsibilities of Investors

Section 66. The Investor -

(f) shall not make any significant alteration of topography or elevation of the land on which he is entitled to lease or has rights to use, without the approval of the Commission;

(h) shall prepare and keep proper records of books of account and annual financial statement, and necessary financial matters relating to the investments which are performed by permit in accordance with internationally recognized accounting standards; shall also prepare and keep proper records of books of account and annual financial statement, and necessary financial matters relating to the investments which are performed by endorsement in accordance with domestic recognized accounting standards;

(i) shall discontinue the business only after paying compensation to employees in accordance with relevant laws for any breach of employment contracts, closure of investment, sale and transfer of investment, discontinuation of investment, or reduction of workforce;

(j) shall pay wages and salaries in accordance with relevant laws, procedures and directives to employees during the period of closure when the investor temporarily shuts down the business for a concrete reason;

(k) shall pay compensation in accordance with laws to the relevant employee or his/her successor for injury, disability, disease and death due to his/her employment;

(l) shall administer foreign experts, supervisors and their families, who come to Myanmar to work, in such manner so that they will abide by existing laws, orders and directives, and the customs and traditions of Myanmar;

(m) shall respect and comply with existing labor laws;

eni Myanmar will comply with the following Chapters & Sections from the Import and Export Law (2012);

Chapter IV Prohibitions

Section 5. No person shall export or import restricted, prohibited and banned goods.

Section 6. Without obtaining license, no person shall export or import the specified goods which is to obtain permission.

Section 7. A person who obtained any license shall not violate the conditions contained in the license.

eni Myanmar will comply with the following Chapters & Sections of the Highways Law (No. 14/2014).

Chapter (5) Section (8-a,b,c,d), Section (9-a,b,c),

Chapter (6) Section (10-c), Section (11)

Chapter (7) Section (12), Section (13)

Chapter (8) Section (14),(15), Section (16-a,b,c), Section (17-a,b,c,d)

Chapter (9) Section (18), (19), (20), (21), (22)

Chapter (10) Section (23), (24), (25), (26), (27), (28)

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). They are designed to provide relevant industry background and technical information. This information supports actions aimed at avoiding, minimizing, and controlling EHS impacts during the construction, operation, and decommissioning phase of a project or facility.

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 (Environmental Health and Social Guidelines, IFC 2007).

Table 3.4 Applicable IFC EHS Guidelines

Environmental topic	Applicable EHS Guidelines
Air quality	Section 1.1 provides guideline applies for facilities or projects that generate emissions to air at any stage of the project life-cycle. It presents information about common techniques for emissions management. This guideline provides an approach to the management of significant sources of emissions, including specific guidance for assessment and monitoring of impacts. Additional information on approaches to emissions management in projects located in areas of poor air quality, where it may be necessary to establish project-specific emissions standards are included. These Guidelines include the following key recommendations: • facilities and projects should avoid, minimize, and control adverse impacts to human health, safety, and the environment from emissions to air; • impacts should be estimated through qualitative or quantitative assessments by the use of baseline air quality assessments and atmospheric dispersion models to assess potential ground level concentrations; • the dispersion model applied should be internationally recognized, or comparable (examples of acceptable emission estimation and dispersion modelling approaches for point and fugitive sources are reported in these guidelines); • emissions from point sources should be avoided and controlled according to good international industry practice (GIIP) applicable to the relevant industry sector, depending on ambient conditions, through the combined application of process modifications and emissions controls (examples are provided in these guidelines); • a monitoring system should be implemented. For ambient air quality IFC refers to WHO Guidelines (Air Quality Guidelines Global Update, 2005.)
Noise and vibration emissions	Section 1.7 provides standards for daytime and night time noise emissions (for residential and industrial environments, WHO 1999) and recommends that noise prevention and mitigation measures are implemented with regard to predicted noise levels at sensitive receptors. Noise monitoring may be carried out for the purpose of establishing the existing ambient noise levels in the area of the proposed facility or for verifying operational phase noise levels. A key priority should be the implementation of noise control measures at source; the selected methods will depend on the source type and the proximity of sensitive receptors, and can include: equipment selection, acoustic enclosures, vibration isolation, traffic route selection, other.

Environmental topic	Applicable EHS Guidelines
Wastewater and Liquid effluent quality	Section 1.3 provides guidelines applied for projects that have either direct or indirect discharge of process wastewater or wastewater from utility operations. Section 1.3 provides guidelines for treatment approaches of process wastewater and wastewater from utility operations. These Guidelines include the following key recommendations: • points of discharge, rate of discharge, chemical use, dispersion and environmental risk should be considered in a disposal plan; • discharges should be planned away from environmentally sensitive areas, with specific attention to high water tables, vulnerable aquifers, wetlands, and community receptors, including water wells and intakes.
Waste management	Section 1.6 provides guidelines for projects/facilities that generate, store, or handle any quantity of industrial hazardous or not hazardous waste. Section 1.6 provides appropriate guidelines for hazardous waste storage, transport, treatment and disposal, in order to prevent harm to health, safety and environment. These Guidelines include the following key recommendations: • waste management should be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring; • in addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans; • if waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed and all measures should be taken to avoid potential impacts to human health and the environment.

Table 3.5 Environmental and Social Myanmar Applicable Legislation & Regulation

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
Environmental Approval	• The Environmental Conservation Law, 2012 • Environmental Conservation Rules, 2014 • Myanmar Investment Law, 2016 • Myanmar Environmental Impact Assessment Procedures, 2015 • Environmental Quality Standards, 2016	• The Environmental Conservation Law 2012 was enacted in March 2012. Rules to implement the new law have not been announced. MIC Notification 1/2013 requires an environmental impact assessment (EIA) for Oil & Gas projects.	• Ministry of Natural Resources and Environmental Conservation • Ministry of National Planning and Economic Development • Myanmar Investment Commission
Water resources	• The Water Power Act, (No. 11/1927) • Underground Water Act, 1930 • The Conservation of Water Resources and Rivers Law, (No. 8/2006) and The Conservation of Water Resources and Improvement of River Systems Rule (2013);	• The Conservation of Water Resources and Rivers Law (2006) prohibits carrying out any actions with the aim to ruin water resources, including rivers, and causing intentional water wastage, and pollution of water resources.	• Ministry of Agriculture, Livestock and Irrigation • Ministry of Transport
Agriculture and Irrigation	• The Plant Pest Quarantine Law, 1993, and amended in 2011 • The Embankment Act, 1909	• This law would be relevant in case pesticides/fertilizers are planned to be used for vegetation control or rehabilitation purposes.	• Ministry of Agriculture, Livestock and Irrigation
Biodiversity	• The Protection of Wild Life, Wild Plants and Conservation of Natu-	• The Natural Areas Law, 1994, identifies:	• Ministry of Natural Resources and Environmental Conservation

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
	ral Areas Law, 1994 and Rules on Protection of Wildlife and Protected Area Conservation Law (2002) • The Forest Law, 1992	• Categories of 'natural areas' and zoological and botanical gardens, their declaration and uses; • Categories of protected wild animals completely protected, normally protected and seasonally protected.	
Fishery	• The Freshwater Fisheries Law, 1991	• From Chapter 7: 38. No one shall do the following within the boundary of a fishery or fishery creek:— (a) cutting undergrowth or setting on fire habitat of fish; (b) impairing the natural condition of a fishery so as to disrupt the flow of water in the main fishery. 39. No one shall cultivate agricultural crops within the boundary of a fishery creek. 40. No one shall cause harassment of fish and other aquatic organisms or pollution of the water in a freshwater fisheries waters. 41. No one shall alter the quality of water, volume of water or the water -course in a leasable fishery, re-	• Ministry of Livestock, Fisheries and Rural Development

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
		served fishery and creeks contiguous thereto or in water-courses.	
Land Use/Land Plan*	• The Land and Revenue Act (1879); Amended by Law No. 16/2015 • Land Acquisition Act, 1894 • The Farmland Law, 2012, and Farm Land Rules (2012), which repeals the Land Nationalization Act of 1953 • The Vacant, Fallow and Virgin Lands Management Law, 2012	• This law is enforced under the Department of Settlement and Land Records of the Ministry of Agriculture and Irrigation. Requirements for land acquisition can be summarized as follows: 1. A declaration of land acquisition shall be made on Gazette (or made publicly available) and state the district or territorial division where the land is located, the purpose and area of land acquisition, etc.; 2. Issuance of public notice stating government's intentions should be posted at convenient places or near land to be acquisitioned to allow land owners opportunity to claim for compensation; 3. Payment rate of compensation must be calculated and fixed based on type and quantity of crops, in addition to taking into consideration life-long security; 4. Compensations must awarded to rightful owners; 5. Any dispute arising from compensation amount may be re-	• Department of Settlement and Land Records of the Ministry of Agriculture, Live-stock and Irrigation

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
		ferred to the Court. • On expiration of the acquisition term or return of the land to original owner, compensation shall be made for damage to the land and restored.	
Cultural Heritage	• The Protection and Preservation of Cultural Heritage Region law, 1998, and amended in 2009 • ARCHIVE PROPERTIES (AMENDMENT) ACT (1962) • The Protection and Preservation of Ancient Monuments Law, 2015 • The Protection and Preservation of Antique Objects Law, 2015 • The Law Protecting the Rights of National Races (2015)	• Section 2 of the law defines the protected and preserved cultural monuments as follows: ○ Cultural Heritage means ancient monument or ancient site which is required to be protected and preserved by reason of its historical, cultural artistic or anthropological value; ○ Ancient Monument includes the following that existed before 1886 or that have been determined as cultural heritage: architectural structure, shrine, stupa, temple, monastery, palace, residential building and carving, image and painting thereon; natural or man-made cave in which human beings had dwelt; stone inscription and record; road, bridge, sepulchre, sepulchral site and remains of excavated structure; pond, city-wall, wall, gateway, moat,	• The State Peace and Development Council • Ministry of Culture • Department of Achaeology, National Museum & Library

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
		fort and any remains thereof; ○ Ancient Site means place or high ground where a town or settlement of ancient people or ancient monument had existed before 1886 or which is determined as cultural heritage whether it is in the process of excavation or has not yet been excavated.	
Labour	• Factories Act (1951) Amended by law No 12/2016 • The Leave and Holiday Act, 1951 Amended by Law No 30/2014 • The Social Security Law (2012) • The Social Security Rules (2014) • Settlement of Labour Dispute Law (2012) Amended by Law No 40/2014 • Workman's Compensation Act (1923) Amended by Law No 4/2005 • The Minimum Wages Law, No 7/2013 • The Minimum Wages Rules, 2013 as amended 2016	• Myanmar labour law is governed by both old and new laws and regulations, as well as internal policies and practices of the Department of Labour. • Following the enactment of the Social Security Law (2012), Myanmar implemented a Social Security Fund for employees which came into effect on 1 April 2014. Under the law, benefits will be available for sickness, maternity, death, employment injury, invalidity and superannuation.	• Ministry of Industry • Ministry of Labour, Employment and Social Security

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
	• Payment of Wages Law, No 17/2016 • Employment and Skill Development Law No 29/2013 • The Labour Organization Law, 2011 and The Labour Organization Rules, 2012 • Oilfields (Labour and Welfare) Act, 1951 • Law Relating to Overseas Employment, 1999 (being amended) • Employment Restriction Act, 1959		
Oil and Gas activities	• State-Owned Economic Enterprises Law, 1989 • The Private Industrial Enterprise Law, 1990 • The Factories Act, 1951 • The Oilfield (Workers and Welfare) Act, 1951 • The Petroleum Act, 1934 • The Oilfield Act, 1918 • The Oilfield Rules, 1936 • The Petroleum Rules, 1937 • The Essential Supplies and Ser-	• These petroleum laws deal mainly with rights characterized as concessions. Although they are still applicable, in practice, investors generally enter into PSCs, Performance Compensation Contracts (PCCs), IPRs, Improvement of Marginal Recovery Agreements and Reactivation Agreements. The terms and conditions of these contracts govern the process so long as they are not contrary to the laws in force.	• Central Body relating to the Myanmar Special Economic Zone • Ministry of Industry • Ministry of Labour, Employment and Social Security

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
	vices Act, 1947 • The Petroleum Resources (Development Regulation) Act, 1957 • The Law Amending the Petroleum Resources (Development Regulation) Act, 1969 • The Myanmar Petroleum Concession Rules, 1962. • The Explosive Substance Act, 1908 • *Import and Export Law (2012)*		
Transportation	• The Motor Vehicle Law No. 55/15 • The Highways Law (No. 14/2014)	•	•

*) Currently the basic act for physical plans in Myanmar is National Housing Town and Country Development Act legislated in 1951. Provisions of this old act no longer match the situation nowadays that Ministry of Construction, having jurisdiction over this act, proceeds drafting of the replacing act, which is the National Spatial Development Planning Act. The contents of the newly drafted act, as of December 2012, includes: spatial planning policy for three spatial levels (national, regional (region/state) and township), land use regulations, and development permission criteria. It proposes to give roles to districts, which are at the administrative level between region/state and township, of putting township plans together. Ministry of Construction also has a vision of integrating the Spatial Planning system with the system of National Comprehensive Development Plan which Ministry of National Planning and Economic Development establishes.

3.5 HEALTH STANDARDS FOR PROJECTS WITH HEALTH IMPACTS

As part of fulfilling the responsibility to improve and protect health of the citizens the Myanmar government has enacted some health laws. Majority of current health laws are found to be related to the public health law promulgated in 1972. Existing health laws may be categorized as following:

- health laws for promoting or protecting health of the people;
- health laws concerned with standard, quality and safety of care;
- laws relating to social organization.

Main health laws with possible relation with the project are summarized in Table 3.6.

Table 3.6 Myanmar Health Legislation

Reference	Contents
Public Health Law (1972)	It is concerned with protection of people's health by controlling the quality and cleanliness of food, drugs, environmental sanitation, epidemic diseases and regulation of private clinics.
Myanmar Maternal and Child Welfare Association Law (1990) (Amended in 2010)	Describes structure, objectives, membership and formation, duties and powers of Central Council and its Executive Committee.
Nation Drug Law (1992) (Amended in 2014)	Enacted to ensure access by the people safe and efficacious drugs. Describes requirement for licensing in relation to manufacturing, storage, distribution and sale of drugs. It also includes provisions on formation and authorization of Myanmar Food and Drug Board of Authority.
Narcotic Drugs and Psychotropic Substances Law (1993)	Related to control of drug abuse and describes measures to be taken against those breaking the law. Enacted to prevent danger of narcotic and psychotropic substances and to implement the provisions of United Nations Convention Against Illicit Traffic in Narcotic Drugs and Psychotropic Substances. Other objectives are to cooperate with state parties to the United Nations Convention, international and regional organizations in respect to the prevention of the danger of narcotic drugs and psychotropic substances. According to that law Central Committee for Drug Abuse Control (CCADC), Working Committees, Sectors and Regional Committees were formed to carry out the designated tasks in accordance with provisions of the law. The law also describes procedures relating to registration, medication and deregistration of drug users.
Prevention and Control of communicable Diseases Law (1995) (Amended in 2011)	Describes functions and responsibilities of health personnel and citizens in relation to prevention and control of communicable diseases. It also describes measures to be taken in relation to environmental sanitation, reporting and control of outbreaks of epidemics and penalties for those failing to comply. The law also authorizes the Ministry of Health to issue rules and procedures when necessary with approval of the government.

Reference	Contents
The Law Relating to Private Health Care Services (2007)	Enacted to develop private health care services in accordance with the national health policy, to enable private health care services to be carried out systematically as an integrated part in the national health care system, to enable utilizing the resources of private sector in providing health care to the public effectively, to provide choice of health care provider for the public by establishing public health care services and to ensure quality services are provided at fair cost with assurance of responsibility.
The Control of Smoking and Consumption of Tobacco Product Law (2006)	Enacted to inform the public that smoking and consumption of tobacco product can adversely affect health, to make them refrain from the use, to protect the public by creating tobacco smoke free environment, to make the public, including children and youth, lead a healthy life style by preventing them from smoking and consuming tobacco product, to raise the health status of the people through control of smoking and consumption of tobacco product and to implement measures in conformity with the international convention ratified to control smoking and consumption of tobacco product.

Source: Health in Myanmar (2013), Ministry of Health

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4.0 PROJECT DESCRIPTION AND ALTERNATIVES SELECTION

4.1 PROJECT BACKGROUND

On 17th of February 2013 the Republic of the Union of Myanmar announced an invitation to apply for hydrocarbon exploration authorizations and subsequent hydrocarbon exploitation licenses. On 31st July 2014 eni signed in presence of the Country's Energy Ministry the Production Sharing Contract (PSC) for the onshore Block RSF-5. Accordingly eni Myanmar BV has been planning to develop onshore exploration activities within this Block.

The hydrocarbon exploration is the research for hydrocarbon deposits beneath the Earth's surface, such as oil and natural gas. Areas that can possibly contain hydrocarbons are subjected to different surveys to detect features of the sub-surface geology; in particular, through seismic surveys, the substructure profile is designed.

The project, object of the present ESHIA, foresees the acquisition of a 3D seismic survey within the Block, aimed to identify potential opportunities for further hydrocarbon exploration activities. The Block RSF-5 covers an area of 1,292 km^2, but the seismic survey will be executed on a portion of 500 km^2.

4.1.1 Seismic Survey

The 3D seismic surveys represents the first step of the planned exploration activities in the Block RSF-5. Such activity was requested in the invitation to apply for hydrocarbon exploration authorizations and subsequent hydrocarbon exploitation licenses, announced by the Republic of the Union of Myanmar on 17/02/2013 and awarded to eni Myanmar BV.

A separate ESHIA will be conducted for any future activities.

4.2 PROJECT LOCATION

Block RSF-5 is located in Magway Region, about 500 km North of Yangon, and it covers an area of around 1292 km^2 (Figure 4.1).

The full surface co-ordinates for Block RSF 5 are presented below (Table 4.1).

Table 4.1 Coordinates for Block RSF-5

Point	Longitude (E)	Latitude (N)
1	95°00'00"	20°15'00"
2	95°20'00"	20°15'00"
3	95°20'00"	19°55'00"
4	95°00'00"	19°55'00"

Source: Myanmar Ministry of Energy, 2013

4.3 COMPARISON AND SELECTION OF ALTERNATIVES

4.3.1 No Project Alternative

A "No Project" Alternative of development of the exploration Project in Block RSF-5 would mean that no research for hydrocarbon deposits would be performed in this block. This alternative would not contribute to the growth of Myanmar economy and employment. Myanmar is a resource-rich country and the extractive industry of natural gas and petroleum is one of the most productive sectors. Based on 2001 data (2001 est.) the labour force occupied in the industry sector was only 7%, but the Ministry of Labour, Employment and Social Security of Myanmar is currently developing a National Plan on Myanmar Workforce Skill Development with a view to providing skill training for workforce relevant to advanced technology and ensuring job opportunities. In line with the National Plan, Hydrocarbon exploration would provide new job opportunities, the possibility to benefit from the use of hydrocarbon resources within the country and to increase the economy by exporting the extracted resources to foreign countries.

4.3.2 Alternative Project Locations

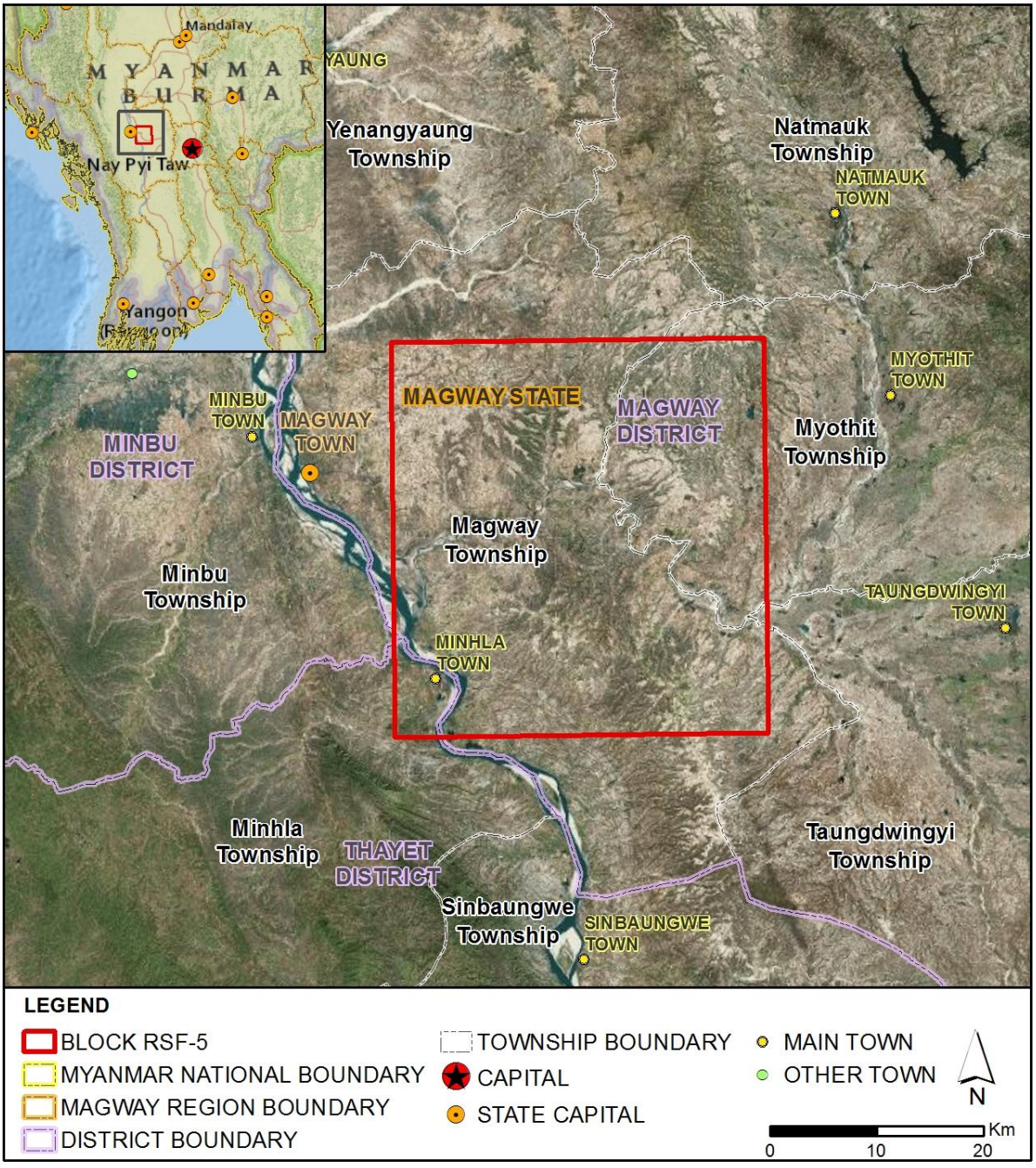
Seismic activities are designed on the basis of the results of the geophysical feasibility study, as their purpose is to give a deeper understanding of the subsurface geological features in all the licence area.

4.4 DESCRIPTION OF THE PROJECT

The seismic survey has been designed based on the results of the geophysical feasibility study performed by eni specialists. The objective of the 3D seismic survey is to give a deep understanding of the subsurface geological features in the RSF-5 block, by obtaining an high quality of imaging features through a better Signal-to-Noise ratio and a good continuity of main targets. The 3D seismic volume will also provide a dense dataset, which should allow attempting a more reliable sedimentogical and structural interpretation.

The detailed location of the seismic survey for the 3D survey is shown in the following paragraphs. The following chapters include the planned design characteristics and the preliminary identification of the potential impacts that such investigation technique could have on the overall Study Area as defined in Figure 4.1.

Figure 4.1 Location of Block RSF-5



Source: eni, 2014

4.4.1.1 Site Preparation activities

Prior to the geophysical equipment arrival on site, the seismic sources and receivers lines will be surveyed. Surveyors will be dropped by vehicles at appropriate accessible points to walk the lines, so that there will be minimum exposure on land by vehicles. Any important sensitivity along the route (e.g. infrastructures, villages, important sites for cultural

heritage, etc.) will be identified and avoided as appropriate. The surveyors will select routes that ensure that lines are as straight as possible within the geophysical parameters defined by *eni Myanmar*. Lateral offsets for both receiver stations and source points, from the theoretical survey lines are not desirable but can, and will be made, when necessary, to avoid especially sensitive or inaccessible locations.

The final locations of the 3D seismic survey have been defined and they are shown in Figure 4.2.

The full surface co-ordinates for survey area are presented below (Table 4.2).

Table 4.2 Survey Area Coordinates for Block RSF-5

Survey Area Coordinates				
	Metric Coordinates		Geographic Coordinates	
	Easting (m)	Northing (m)	Longitude (E)	Latitude (N)
1	712,998.41	2,227,710.85	95° 02′ 15.44″	20° 08′ 05.55″
2	721,001.63	2,205,721.99	95° 06′ 41.37″	19° 56′ 07.45″
3	740,876.20	2,212,955.71	95° 18′ 07.97″	19° 59′ 54.10″
4	732,872.89	2,234,944.56	95° 13′ 42.87″	20° 11′ 52.41″

Source: eni, 2016

Figure 4.2 3D Seismic Lines in Block RSF–5.



Block RSF-5 is characterised by the dominance of agricultural land made of small and medium size crops. The existing road network not always (mainly tracks and dirt roads) gives sufficient access also to small vehicles. A discrete proportion of the Study Area is characterized by the presence of erosional landforms (gullies and rills) and natural vegetation (mainly shrubs, and forest patches along rivers and trenches).

Stated this, access in the 3D seismic survey areas is a key issue that will be carefully planned in advance, by taking into consideration the involved vehicles and instruments. To minimise the potential impacts, existing access routes or possible off-road ways will be identified. All vehicles involved in the survey will use existing tracks wherever possible. Within the Concession Block RSF-5 a dense network of paved and unpaved roads has been identified. The existing network serves the frequent settlements and the agricultural land in the area. Off-road driving and the creation of new, unplanned tracks will be avoided if not strictly necessary.

Roads accessible by vehicles will be used. Accessing trails causing degradation to vegetation or to soil landslide will be avoided. Access routes which are accessible by vehicles, but might cause disturbance to villages, agricultural land, wells etc. will be avoided as much as possible.

Due to the morphology of the study area (most of it dominated by flat plains occupied by agriculture and partially covered by erosional landforms) no major difficulties in routing are expected. A detailed planning of vehicles movement will be performed to consider the frequent presence of rivers and streams and the scarcity of river crossings in the area.

4.4.1.2 Line Clearance

The 3D seismic survey extends for approximately 520 sq. km equal to 130,000 acres. The acquisition layout is represented by a symmetric grid of 450 m by 450 m of receiver and source lines perpendicular each other. This setting implies the line clearance.

Along the receiver lines, a series of geophones (small devices act to detect the seismic energy whose sizes are approximately 3 cm in diameter and 20 cm in length) will be pierced in the ground by hand every four (4) meters and connected by a low voltage electric cable. No intensive site clearance is requested for the receiver lines as no mechanical support is foreseen.

Along the source line, for what concern the part of the seismic survey performed with micro-charges, this technique does not require main site clearance. The source locations will be selected in such a way to minimize the site clearance and anyway, the charge positioning will involve very few square meters of land. A policy of minimal clearance will be implemented by *eni Myanmar* in accordance with *eni* Standards. Controls will be in the form of instructions given to the seismic crew and on-site daily supervision by *eni Myanmar* Superintendent.

The seismic survey will be conducted mainly with the use of vibroseis, so it is likely that, when using this technique, the survey lines will be needing of more vegetation and loose material site clearance because the surface of the source line must be smooth enough to enable the vibroseis to progress unimpeded for seismic acquisition.

Any identified requirement for line clearance using invasive machinery such as bulldozer will need the formal approval of *eni Myanmar* Superintendent before being undertaken.

The Magway Dry Zone Greening Department and the Forest Department listed a series of areas as Natural Conservations sites, without identifying any restrictions to be applied by *eni Myanmar*. Special arrangements have been foreseen anyway by the Company to preserve such areas.

Along the source lines, in order to minimize as much as possible the environmental impact, *eni Myanmar* will instruct his seismic contractor to utilize:

a) Four vibroseis in line with vibropoints every 50 m only when the terrain conditions and distances between trees is sufficient to grant the entrance with vibroseis without support of bulldozer and woodcutting. The use of vibroseis is preferred because during the dry season (the seismic acquisition will last from January to April 2017) and on a natural grass coat, the environmental impact will be negligible and for a short time period.

b) Explosive charges every 50m located at 25m depth, wherever the vegetation density and the terrain morphology do not allow vibroseis accessibility. It this case, portable drilling units (about 2.5 x 2.5m) carried and mounted on site by specialized personnel will be utilized to drill the 6 inches shot holes. All drilling locations will be properly selected, and in case, moved from the theoretical coordinates, in the most suitable place in order to avoid cutting any trees. Moreover, we ensure that no chemical material or additives will be added to the drilling waters. Any material resulting from the drilling will be removed and disposed accordingly with the local legislation, no consequences of the activities will be detectable once the operation will be completed, as the area will be totally restored.

Finally, in the swampy areas, permanently flooded during the year, portable drilling units will be used and the operation will be localized in an area of few square meters and for a short time period.

The use of bulldozer, trucks, crane and other mean of transportation will be limited only to guarantee the safe access to these areas, but never applied within the forest and the plantations. Anytime the *eni Myanmar* Superintendent will be requested to approve these kinds of operations. Any identified requirement for line clearance using invasive machinery such as bulldozer will need the formal approval of *eni Myanmar* management before being undertaken.

- At the end of the seismic survey, in the event of line clearance, restoration activities of the area to the previous condition will be implemented. These activities will include the following geomorphological and vegetational restoration measures: Topsoil, if previously excavated, will be restored in order to enable natural re-vegetation;
- Natural re-vegetation will be promoted or, alternatively, seismic areas will be reseeded with native species if natural re-growth is not sufficient.

4.4.1.3 Seismic Data Acquisition

3D surveys, design and technical specifications are available and reported in the following Paragraphs. As previously described the locations of the 3D seismic survey are detailed in Figure 4.2.

The vibroseis source option will prevail when feasible on the explosive as the survey will be conducted during the dry season, so environmental impact will consist in the soil compacting and only for a short time period.

In the case in which, weather and environmental conditions suggest the use of explosive source, this will be carry by 4x4 vehicles and portable handling system. Quantity (kg) and depth (m) shall be tested before the beginning of the survey: 3 Kg dynamite at 25m depth for single shot can be used as reference, having been applied in the neighbour block in previous seismic acquisitions. The boreholes will be drilled with a medium and small portable power rig (Figure 4.3) to minimize the impact on land cover.

Figure 4.3 Charge placement



Source: eni, 2014

Along the receiver lines, the geophones on a hard surface, each one is usually placed on the ground surface with a heavy body on top, on a soft surface, they are usually buried approximately 15 cm deep.

The signal is recorded by a mobile recording unit (Figure 4.4) which is usually placed approximately 500 m away from the receiving and source lines to avoid any interference.

Figure 4.4 Mobile Recording Unit



Source: eni, 2014

Table 4.3 summarises geophones and source/receiving lines parameters for the 3D survey.

Table 4.3 Technical characteristics of the 3D Seismic Survey.

Source Lines characteristics	
Source Lines per template	45
Source Station Interval (m)	50
Source Line Separation (m)	450
Source Line Orientation (°)	160
Source Station Density (stations/Km^2)	44.56
Total Source Station Number	~21,600

Receivers Lines characteristics	
Receiver Lines per template	10
Receiver Station Interval (m)	50
Receiver Line Separation (m)	450
Receiver Line Orientation (°)	In-line: 70-250 - X-line: 160-340
Receiver Station Density (stations/Km^2)	43.71
Total Receiver Station Number	~23,300
Other Survey Characteristics	
Active channels per template	2520 (252 x 10 lines)
Bin size	In-line = 25m; X-line = 25m
Geophone array	Linear (=> 12 units)
Source type	Dynamite or Vibroseis
Far offset	6275
Migration border	From 2.3 to 3.0 km
Recording length	6s
Nominal fold	70th

Source: eni, 2014

4.4.1.4 Uphole Drilling

In order to calibrate the shallow seismic signal, upholes will be drilled along the survey lines. The location of upholes (at least 20 upholes at min depth of 60 m) will be carefully considered to avoid particularly sensitive areas. To drill an uphole, a truck mounted down-hole drilling rig will be used, supported by a water tanker and recording equipment. Water based bentonite fluids with no additives will be used for the uphole drilling.

These types of muds are widely used and pose no environmental risks, as bentonite is a naturally occurring clay mineral. The upholes will be uncased and on completion of the well, cuttings will be placed back in the hole and the bore plugged with cement.

Potential risk to aquifers is deemed to be low thanks to the design technology to be used. Only in the floodplain areas of the Block RSF-5, the aquifer is expected to be relatively shallow. In advance of the drilling, the potential risk to these aquifers will be carefully assessed.

Drillings will be planned and carried out in a manner to avoid any potential cross-contamination of shallow aquifers which may occur in the area. The final surface expression of the drill site will be levelled with the existing landscape, and the original conditions will be restored as much as possible.

4.4.1.5 Logistics Requirements

Performing a seismic survey requires significant logistics in terms of personnel, equipment, spares and back-up. In order to minimise environmental disturbances earthworks will be limited as much as possible. Trailers, etc. will be levelled by jack rather than with earthworks. Moreover any sensitive area located around the seismic camp site

(e.g. sensitive vegetation, water wells) will be marked with pegs and tape to ensure these remain untouched.

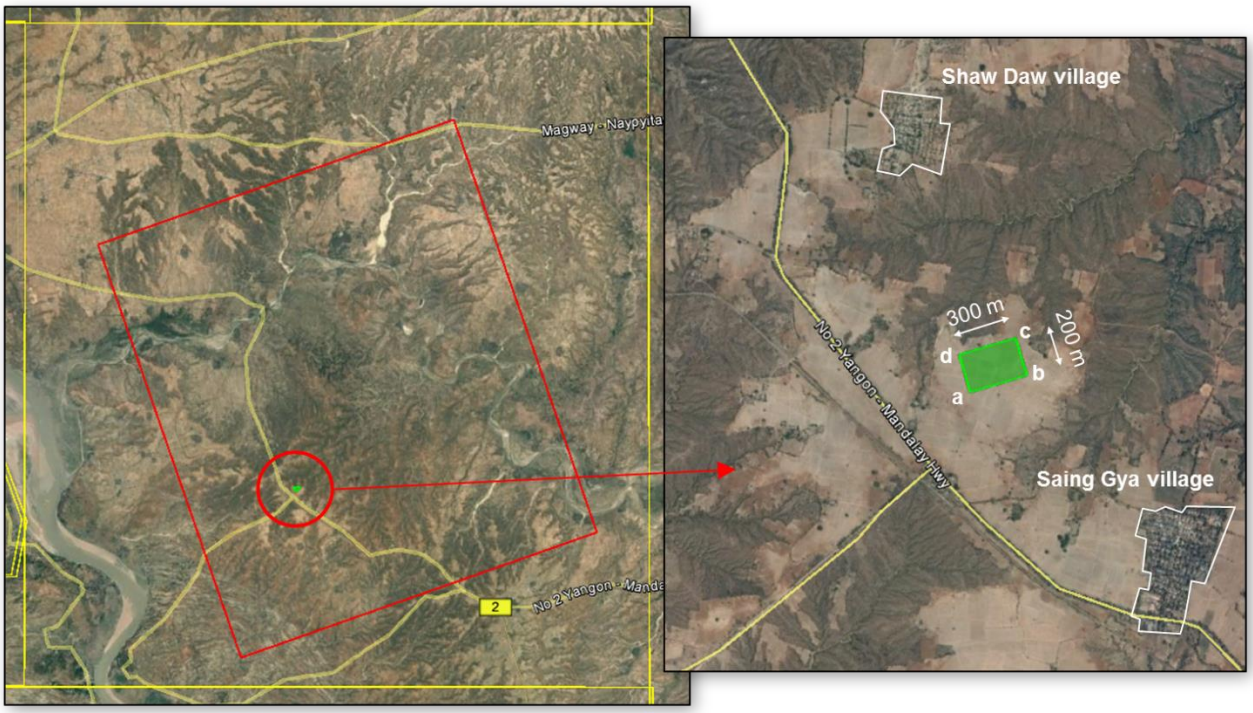
4.4.1.6 Base camps

The location of the camps has been identified within the survey area in an agricultural land, far from forest and villages. Map location of the base camp is reported in Figure 4.5 below.

A standard base camp generally comprises the following facilities:

- kitchen;
- shower/toilet/laundry;
- mess/diner;
- single accommodation for senior staff;
- training room; and
- client office/sleeper.

Figure 4.5 Map location of Base Camp



Source: eni, 2016

Figure 4.6 shows an example of a typical base camp layout.

Figure 4.6 Example of a base camp for seismic survey.



Source: eni, 2014

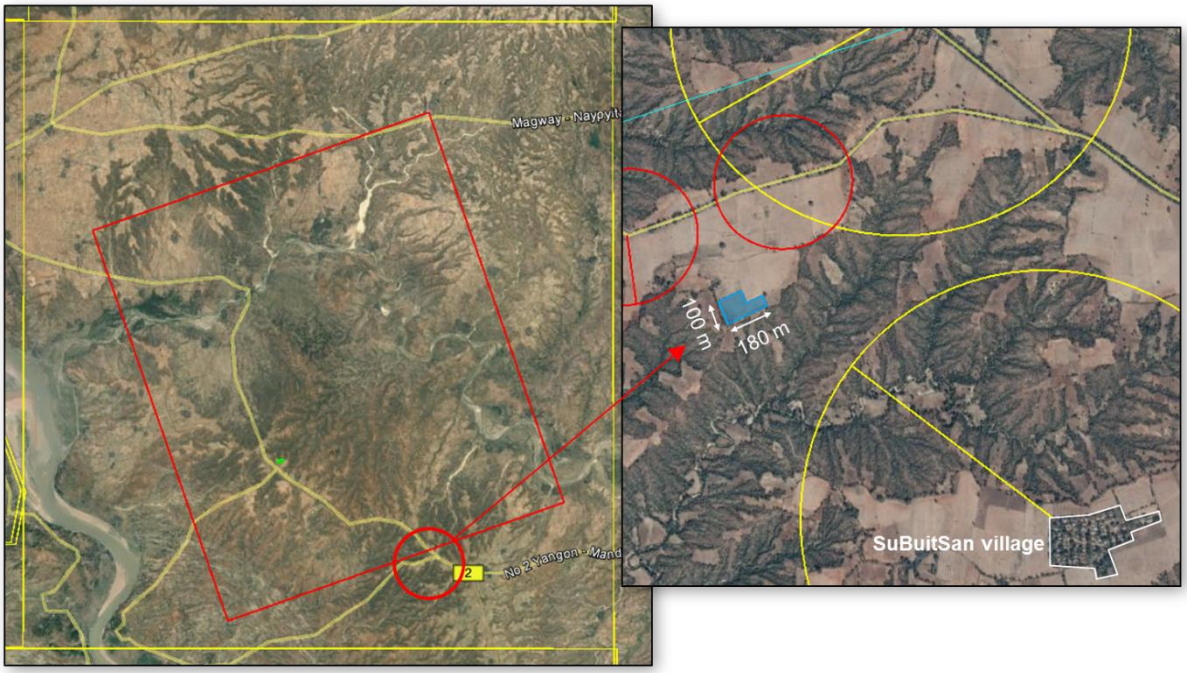
The Main explosive Storage will be located at the nearby Military Compound. while, a temporary explosive storage center will be realized in proximity of the survey area (see example of Explosive storage center at Figure 4.7 and Map location at Figure 4.8). The area will be approved by MOD (Ministry Of Defence). The location of the structure will be defined by the contractor personnel and *eni Myanmar* representatives during the camp preparation. The structure will be fenced and access will be allowed only to authorized and trained personnel. Adequate fire prevention systems will be installed. Protections to prevent damages to the surrounding area in case of unexpected explosions will be placed around the structure and vegetation in the surrounding area will be cleared to prevent accidental fires reaching the explosive.

Figure 4.7 Example of explosive storage in a base camp



Source: eni, 2014

Figure 4.8 Map location of Explosive Storage Center



Source: eni, 2016

The camp will be 'closed', with no trading or hawking allowed (workforce being confined to the camp). Camps will be bound and fenced for security.

eni Myanmar will evaluate the planning of an helicopter landing area in the vicinity of the main base camp to allow medical evacuation of personnel by aircraft if required.

4.4.1.7 Provisions

All provisions will be imported from local commercial centres prior to the confirmation by *eni Myanmar* of the quality of the required goods and transaction sustainability. No purchases will be made from other villages without an assessment of transactions sustainability. Bottled potable water will be used for drinking. Hunting and gathering of local provisions will be strictly forbidden.

The main fuel supplies will be stored at the camp base. Fuel trucks will transfer required fuel to vehicles and equipment in the field. Fuel storage areas will be equipped with tanks fitted with secondary containment protection. The secondary containment will be sufficient to contain 110% of the total volume of stored fuel. Trained personnel will carry out fuel management and facilities for spill prevention. Clean-up activities will be part of the standard working procedures. Typically, these provisions might include drip trays, tip lock hoses and absorbent materials.

If strictly necessary and unavoidable, *eni Myanmar* will drill at least one well for non-potable water in the vicinity of the planned main camp. Consultation with local Authorities and approval will be obtained prior to the drilling of any potable water well. The drilling will follow the same preventive measures (type of muds, etc.) applied to the uphole activities. A close control on water consumption will be followed during the survey to ensure minimisation of water use.

4.4.1.8 Camp Closure

At the end of the seismic activities, the camps will be closed safely and appropriate actions will be taken to clean up and restore the sites to as near as possible to their original condition, promote natural re-vegetation and prevent erosion. Restoration activities will include the following geomorphological and vegetational restoration measures:

- Topsoil, if previously excavated, will be restored in order to enable natural re-vegetation;
- Areas affected by soil compaction will be appropriately ploughed;
- Any interference with normal drainage, including any temporary watercourse crossing, will be removed;
- Natural re-vegetation will be promoted or, alternatively, areas will be reseeded with native species if natural re-growth is not sufficient.

The sites will be landscaped, if appropriate, to blend in with the surrounding areas and any vegetation cut during the site clearance will be placed over the site to reduce erosion.

4.4.2 Use of Resources and Environmental Interferences

4.4.2.1 Land cover

The expected occupied land use for the seismic survey will be related to the temporary occupation of the camp sites, the source locations and the down-hole drilling locations. All the facilities will be placed in bare lands or in arable lands. The locations of the charges will be spread all over the Study Area and they will regard very small portions of land as stated in the previous paragraphs. Local agricultural activities can be temporarily stopped in the neighbourhood of the receiving lines in case big machinery is involved.

4.4.2.2 Materials

Shallow non-invasive earthworks will be performed in the camp sites, and along the survey source lines in case of the use of vibroseis. In the affected areas, original conditions will be restored as much as possible.

Other scientific materials such as cables explosives etc. will be totally recovered.

4.4.2.3 Fuels

Fuels for vehicles and machinery will be provided according to *eni E&P* Standards. Proper management measures will be applied in order to minimise environmental risks.

4.4.2.4 Energy

Generators will be located at the camps sites in order to provide energy to the personnel. The fuel consumption is included in the total amount reported in the Paragraph above.

4.4.2.5 Water Consumption

Bottled drinkable water will be supplied to the camp sites according to eni E&P Standards. Non drinkable water sources will be identified within the Study Area prior to the camp site location by contractor's surveyors.

4.4.2.6 Transportation and Traffic

Transportation of goods and scientific equipment will be as limited as possible. The large part of vehicles movement will be related to the receivers positioning. Existing roads and tracks will be used where possible and no significant impact on the local traffic is foreseen.

4.4.2.7 Air Emissions

Atmospheric emissions during seismic survey will result from diesel fuel exhausted for power generation, and vehicles, etc. The main pollutants of such process will be nitrogen oxides, sulphur dioxide, particle matter, carbon monoxide and volatile organic compounds.

Vehicular traffic on dirty roads will determine dust re-suspension.

4.4.2.8 Noise & Vibration Emission

Noise, light and odours will be generated during the seismic operations. Noise will come from vehicles, accommodation supplies (air conditioning, diesel-generators) and personnel necessary for the operation. Moreover, light during hours of darkness will be present in the seismic camp.

The noise and vibration caused by charges blast will be limited to the surrounding areas of the sources location. The amount of vibration is not expected to be harmful for the surrounding environment, or to cause interference with any receptor in the Study Area, as safe distances will be maintained.

4.4.2.9 Waste Handling and Disposal

Solid Waste

It is estimated that non-hazardous solid waste will be produced monthly. This will include food waste, paper, cardboard, plastic and some scrap metals. All waste generated in the field will be brought back to the seismic camp for further appropriate disposal. Domestic and general waste should be segregated into combustible (paper, food, cardboard, and wood) and the various non-combustible waste streams should be collected using suitability labelled containers to ensure safe collection segregation and handling of all waste streams generated. Closed containers should be provided for potentially wind-blown wastes.

All solid general waste should be sent for recycling or disposal to a licensed facility wherever possible.

Hazardous Waste

Hazardous waste generated may include oils, solvents, used batteries and medical waste.

Hazardous waste will be sent for recycling or disposal at a licensed facility wherever possible. Waste oil, batteries and other hazardous waste will initially be segregated and collected at the main camp.

In case there is no immediate disposal solution for hazardous waste streams, the seismic contractor will ensure appropriate and safe storage while studying appropriate disposal routes. Any new disposal route for the hazardous waste streams will need to be safe.

Waste Management and Minimisation Plan

A Waste Management Plan (WMP) will be produced as part of the Block RSF-5 Environmental Management and Monitoring Plan (EMMP) that *eni Myanmar* will provide on the basis of the sensitivities identified within the ESHIA. Waste management will follow the "5Rs" principle (i.e. reduce, reuse, recycle, recover, residue).

The Contractor will be responsible for waste management during the seismic acquisition programme, and will be required to be in compliance with the local legislation and EMMP. However, *eni Myanmar* will establish an Environmental, Health and Safety Assurance Programme throughout the seismic programme to ensure compliance with company requirements. This will include the following:

- dedicated *eni Myanmar* site representative (to provide assurance of the Contractor's compliance) for the duration of operations (*eni Myanmar* will ensure that a dedicated HSE Representative is located with the survey crew for the first period of operations as a minimum);
- *eni Myanmar* waste management plan;
- regular inspections and audits during operations.

While the focus of waste minimisation is typically on hazardous wastes, non-hazardous wastes will also be minimised at every opportunity. In addition, the conservation of resources (energy, water, gas) and fuel will be addressed. The waste minimisation plan is one part in the overall programme of responsible waste management.

Waste minimisation includes source reduction and control, reuse and recycling. It does not include the treatment or disposal of waste. Waste minimisation focuses on preventing the generation of waste and, where this is not possible, reusing waste. Waste will be reduced at source through management measures such as product substitution (e.g. for toxicity reduction) and product conservation i.e. working efficiently to avoid the generation of waste. Waste will also be controlled through good operating practices i.e. equipment maintenance, spill prevention, routine crew inspections, improved 'housekeeping', and inventory control.

Waste management involves the reuse of waste in place of new products where quality of services and products will not be an issue and also the recycling of waste. Examples of recycling include sending oil for recycling into fuels and sending paper waste to be recycled into other useable products.

Waste Audits

Waste audits will be conducted by *eni Myanmar* as part of the site HSE audit and inspection for the purpose of identification and proper disposal of all waste. The *eni Myanmar* Site HSE Representative will coordinate the audit programme and use it as a tool for training employees in waste minimisation and management techniques.

eni Myanmar will continually strive to minimise the impact of its operations on the environment. An Environmental Management and Monitoring Plan (EMMP) will be developed and appropriate actions taken to prevent environmental pollution, conserve resources and minimise waste. Regulatory compliance, environmental impact reduction and hazard avoidance are planned in order to minimise the risks to personnel and the environment.

4.4.2.10 Wastewater and Sanitary Waste

A septic lined pit will be established for the collection and discharge of both grey and black water at each camp. There will be no segregation of black and grey water.

Septic tanks will be provided with an overflow to a properly designed infiltration field. The infiltration field will be fenced to prevent harm to people or fauna. At the end of operations during closure of the camp the septic tank and its contents in situ will be removed and sent for disposal at a licensed facility wherever possible.

Septic tanks will be located away from areas with a high water table (i.e. floodplain areas) or from water abstraction wells.

4.4.3 Employment and Labour

eni Myanmar will contract a specialist survey company to undertake the work.

In addition to the local content and Contractor staff listed above, *eni Myanmar* will appoint a HSE Supervisor, who will work in the field with the survey contractor during the seismic survey programme.

4.4.4 Overall Duration and Timing

eni will perform the exploration project activities within 10-12 months for the for the 3D seismic survey.

4.4.5 Unplanned Events

4.4.5.1 Fire and Explosion

Explosives will be stored in a segregated and protected structure as previously described. The site will be provided with fire-fighting equipment, and it will be under control of designated specialized personnel. The storage structure will be located at a safety distance from any possible fire source and from any sensitive receptor.

Substances of varying degree of flammability, such as paints, solvents, volatile liquids and similar will be stored in a segregated location, under the direct control of the store keeper, where fire-fighting equipment are available in case of necessity.

Liquid fuels will be stored exclusively within the camp site area in the proximity of the main entrance. Tanks will be surrounded by a containment box or equivalent.

Fire-fighting equipment will be installed in the immediate vicinity of the fuel tanks. Only authorised personnel will operate the fuelling system.

4.4.5.2 Emergency Response

eni Myanmar and the seismic contractor will prepare an Emergency Response Plan to reply to any emergency faced on site timely and adequately.

The emergencies are classified as follows:

1st level

An event that can be dealt with on-site/location personnel, equipment and resources (e.g. Fire Team, First Aid Station).

2nd level

An event which may be dealt with locally but requires involvement of wider Company support and external services/contractor resources.

3rd level

A major event which requires involvement of Eni SpA Upstream and Technical Services emergency organization and other International Resources, either because of unavailability of sufficient Company resources or because the incident has broader implications for the Eni SpA Upstream and Technical Services on matters such as reputation, legal or financial liabilities, license to operate, or in case of multiple injuries, or fatalities.

If in any doubt as to the level of classification it is always prudent to over classify. It is recommended that the classification is updated at periodical intervals.

The several emergency scenarios included in the Emergency Response Plan covers also the environmental accidents like, oil spill, chemicals pollution, fire & explosion, toxic or flammable release, loss of explosive material, etc.

4.4.6 Preliminary Identification of the potential environmental/social/health interferences

The Preliminary Project Interferences Identification Matrix is shown in Table 4.4. The objective of the matrix is to preliminary identify where potential impacts (negative or positive) may occur; blank cells indicate that no potentially relevant interaction between project activities/stressors and receptors exists.

The matrix does not evaluate the impact but aims to aid the reader in understanding, at a preliminary stage, where potential impacts may arise as a result of the interaction between activities (rows) and receptors (columns). For the specific evaluation of impacts, please refer to Chapter 7 of this ESHIA.

A colour code has been used to differentiate the positive impacts from the risks or negative impacts (see Table 4.4).

Table 4.4 Environmental Risk Matrix

		Components													
		Environmental							Social			Cultural	Visual	Health	
		Air	Noise & Vibration	Water	Soil and subsoil	Flora and vegetation	Fauna and Habitats	Biodiversity and ecosystem services	Economy and employment	Infrastructures and public services	Land and Livelihood	Cultural heritage	Landscape	Community Health	
	Seismic Survey – Site Preparation														
	1	Camps site clearance and preparation													
	2	Use of machinery and equipment (portable rigs and earthwork machinery, generators, transportation of personnel and materials)													
	3	Presence of workforce													
	4	Use, storage and management of hazardous raw materials (diesel, explosive, *etc.*)													
	5	Production and management of domestic wastes (black/grey water, paper, *etc.*)													
	Seismic Survey – Line clearance														

Table 4.4 Environmental Risk Matrix

			Components													
			Environmental							Social			Cultural	Visual	Health	
			Air	Noise & Vibration	Water	Soil and subsoil	Flora and vegetation	Fauna and Habitats	Biodiversity and ecosystem services	Economy and employment	Infrastructures and public services	Land and Livelihood	Cultural heritage	Landscape	Community Health	
	7	Lines survey														
	8	Source sites clearance and preparation														
	9	Management of hazardous raw materials (diesel, explosive, *etc.*)														
		Seismic Survey – 3D seismic data acquisition														
	10	Charges blast														
	11	Movement of instruments (receivers) and personnel														
		Seismic Survey – Up-hole drilling														
	12	Site clearance and preparation														

Table 4.4 Environmental Risk Matrix

			Components													
			Environmental							Social			Cultural	Visual	Health	
			Air	Noise & Vibration	Water	Soil and subsoil	Flora and vegetation	Fauna and Habitats	Biodiversity and ecosystem services	Economy and employment	Infrastructures and public services	Land and Livelihood	Cultural heritage	Landscape	Community Health	
	13	Use of machinery and heavy equipment														
	14	Production and management of waste drill cuttings and muds														
		Seismic Survey – Site closure														
	15	Decommissioning, Abandonment and Rehabilitation														
		Seismic Survey – unplanned events														
	16	Fire and Explosions														
		Potential Risk or negative Impact														
		Potential positive impact														

Myanmar
ESHIA STUDY FOR THE EXPLORATION
BLOCK RSF-5

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5.0 DESCRIPTION OF THE SURROUNDING ENVIRONMENT

5.1 SETTING THE STUDY LIMITS

This section reports a description of the Project surrounding environment, based on a review of the available secondary data and on the primary data gathered during the environmental sampling and socio-economic surveys and focus group meeting completed in March, 2016.

5.2 METHODOLOGY AND OBJECTIVES

5.2.1 Scope of the Environmental, Social and Health Baseline

The baseline of the ESHIA is the current, pre-project status and "without project" trend of the physical, biological and human environment. Understanding the baseline is necessary so as to evaluate how significant any project-induced impacts will be. The baseline also provides a means to monitor actual impacts, the effectiveness of mitigation and management measures, and to demonstrate compliance.

The main scope of this section is to give an overview the characteristics of the different environmental, social and health components present in Block RSF-5.

The available data reported in the following Chapters have been provided by literature review; in particular, they refer to the documents listed below.

5.2.1.1 Secondary Data

Environmental baseline

- *AMTE n. 231/2013, Republic of the Union of Myanmar. Environmental and Social Assessment Study – 2013;*
- *Emissions reduction profile Myanmar (UNEP RISØ JUNE 2013, SUPPORTED BY ACP-MEA & UNFCCC);*
- *The 9th Workshop on GHG Inventory in Asia (WGIA 9) – GHG Inventory in Myanmar: INC Report (Prof. Dr. Khin Lay Swe GHG Inventory Team Leader INC Project, Myanmar);*
- http://burmariversnetwork.*org;*
- *Toyo-Thai Corporation Plc. – high Level ESHIA Study for 1280MW USC Coal Fired Power Plant Project in Myanmar – January 2014;*
- http://www.*volcanodiscovery.com/5-1yanm.html;*
- *Myanmar Protected Areas – context, Current Status and Challenges – 2011;*
- *World Health Survey Results – Report of Myanmar, 2013;*
- https://www.*cia.gov/library/publications/the-world-factbook;*
- http://www.*ophi.org.uk;*
- http://globaljusticecenter.*net/index.php/publications/advocacy-resources/103-the-gender-gap-and-women-s-political-power-in-myanmar-burma;*
- http://tbinternet.*ohchr.org/_layouts/TreatyBodyExternal/Treaty.aspx?CountryID=119&Lang=EN;*
- *Land Use and Site Conditions along the proposed Seismic Lines in Block PSG and EP-2 – PTTEP SOUTH ASIA LIMITED, 2012;*
- *Air Quality Monitoring in Urban areas of Myanmar, Ohnmar May Tin Hlaing et al., 2008*
- http://dwms.*fao.org/atlases/5-1yanmar/index_en.htm;*

- *2D Seismic Survey of Onshore Blocks PSC-G & EP-2 – PTTEP South Asia Limited Environmental, Social and Health Impact Assessment, Chapter 3 Environmental Setting;*
- *Environmental Impact Assessment - Myanmar Section of Myanmar –China Gas Pipeline Project, Chapter 7 Environmental Baseline; CNPC and IEM;*
- *Agriculture Sector Review Project –Agricultural Water Resources Study in Myanmar. The Union of Myanmar Ministry of Agriculture and Irrigation by Myanmar Academy of Agriculture, Forestry and Livestock and Fisheries Irrigation Department and Water Resources Utilization Department Yangon, Myanmar, 2003.*

Social baseline

- *Amnesty International. Annual report, 2013;*
- *Asian Development Bank. Asian Development Outlook 2013;*
- *BTI 2012. Myanmar Country Report;*
- *CIA Factbook. Myanmar Country Profile;*
- *CSIS, Center for Strategic and International Studies. The Asian Conventional Military Balance in 2006;*
- *Human Rights & Conflict in Burma, by U.S. Campaign for Burma;*
- *IHS Global Insight report;*
- *Internal Displacement Monitoring Center. Cyclone in Myanmar uproots violence-displaced in Rakhine State yet again, May 2013;*
- *OCHA, 2013. From Reliefweb May 2013;*
- *FAOSTAT Country Profiles;*
- *GJC, Global Justice Center, The Gender Gap and Women's Political Power in Myanmar/Burma, May 2013;*
- *Government of the Republic of the Union of Myanmar, Ministry of Construction, Public Works. Current Situation of Road Networks and Bridges, February 2013;*
- *Harvard Law School, 2009; Ekeh and Smith, 2007;*
- *Human Rights Watch, World Report 2012 Burma;*
- *K. Newland, Refugees, Returnees, and Internally Displaced People in Myanmar, May, 2000;*
- *Internal Displacement Monitoring Center. Country Profile, Myanmar, July 2011;*
- *GSD RC, Vulnerable groups in Burma and access to services, 2011;*
- *Liana Sun Wyler, Burma and Transnational Crime, CRS Report RL34225, Washington, DC: Congressional Research Service, 27 April 2009;*
- *Myanmar: Opportunity for Engagement in Asia;*
- *Ministry of Justice, The Judicial System and Court Proceedings in Myanmar;*
- *Ministry of Labour of Myanmar, Country brief. Unemployment insurance of Myanmar;*
- *Ministry of National Planning and Economic Development, Ministry of Health, UNICEF, Myanmar Multiple Indicator Cluster Survey 2009 - 2010, 2011;*
- *OPHI, Multidimensional Poverty Index 2011: Brief Methodological Note;*
- *PCGN, An introduction to the toponymy of Burma, 2007;*
- *PCGN, The Permanent Committee on Geographical Names, 2007;*
- *UN World Food Program, 2009;*

- *UNDP, United Nations Development Programme, Human Development Report 2013;*
- *UNDP, United Nations Development Programme, Human Development Report 2014;*
- *UNESCO,* http://whc.unesco.org/en/statesparties/MM/;
- *UNHCR Statistical Yearbook 2009, United Nations High Commissioner for Refugees;*
- *United Nations ESCAP (Economic and Social Commission for Asia and the Pacific);*
- *University of Oxford, OPHI Country Briefing 2011, Myanmar;*
- *U.S. Central Intelligence Agency, Ethnolinguistic map of Burma, 1972;*
- *World Health Organization. Country Cooperation Strategy 2014–2018, Myanmar;*
- *World Bank, The Migration and Remittances Factbook 2011;*
- *World Bank, Bringing more electricity for the people of Myanmar, 2013.*

Health baseline

- *Central Statistical Organization (CSO), Ministry of National Planning and Economic Development, 2011; (*) National Mortality Survey, CSO, 1999;*
- *Financial Allocation to Social Budget, Social Protection Conference, [2]5th and [2]6th June 2012, Nay Pyi Taw;*
- *Ministry of Health. Health in Myanmar (2013);*
- *Ministry of Health, Annual Public Health Statistics Report, 2011;*
- *Ministry of Health. Five-year strategic plan for water supply, sanitation and hygiene in Myanmar, 2007-2011;*
- *Ministry of Health, Myanmar Health Statistics, 2010;*
- *Ministry of National Planning and Economic Development, Ministry of Health, UNICEF, Myanmar Multiple Indicator Cluster Survey 2009 - 2010, 2011;*
- *World Health Organization. WHO Country Cooperation Strategy 2008-2011, Myanmar;*

5.2.1.2 Primary Data

International Environmental Management Co. Ltd. (IEM) and local partner Environmental Quality Management (EQM) has completed the onshore environmental baseline sampling program and socio economic surveys and focus group meetings in RSF-5, covering Magway & Myothit Townships, Magway Region Myanmar. Minhla Township was not included during the baseline sampling program since it covers a small portion in the southwest corner of Block RSF-5 and no seismic activities will be completed in this township.

IEM completed the following for Block RSF-5

1. Focus Group meetings and Socio-Economic Surveys in 8 villages
2. Almost 400 household socio economic surveys key informant surveys in the block
3. 14 samples for surface water in the block
4. 26 samples for groundwater in the block
5. 20 samples for soil in the block
6. 10 ambient air measuring stations in the block
7. 10 ambient noise measuring station in the block
8. Archaeological & Cultural survey in 8 villages
9. 150 land use and traditional ecological knowledge surveys

The Block RSF-5 covers an area of 1292 km^2, however the 3D seismic survey will be executed on a portion of 500 km^2. The potentially affected area covers the seismic footprint with a 1km buffer zone. In this area, there are 56 villages consisted of 11,270 households were stakeholder engagement was completed with 8 communities within the potentially affected area.. These villages were selected to give an even distribution throughout the potentially affected area. The following activities were undertaken at each village:

- key Informant Interview with key Township officials and community leaders;
- stakeholders Meeting/Focus Group Discussions with communities, community interest groups and community based organization groups in the communities;
- socio-economic and Opinion Survey of households
- traditional Ecological Knowledge and Biodiversity Surveys

The details and results of the socio-economic surveys are included in the separate *Socio Economic and Attitude Survey Report* included in Annex 4 and the *Key Informant Survey Report* included in Annex 5. The details and results of the key traditional ecological knowledge surveys are included in the *Traditional Ecological Knowledge Survey Report* included in Annex 6. The villages visited are shown in Table 5.1.

Table 5.1 RSF-5 Socio-Economic Sampling Locations

No.	Date	Village	Township
1	11/3/2016	Shar Pin Hla	Magway
2	11/3/2016	Ohndwe	Magway
3	12/3/2016	Shar Saung Kan	Magway
4	12/3/2016	Sai Kya	Magway
5	13/3/2016	Taung Yar Taw	Magway
6	13/3/2016	Myin Saing	Magway
7	14/3/2016	Nwar Hla	Myothit
8	14/3/2016	Wa Gyi Aing	Myothit



Focus Group Meeting



Key Informant Interviews



Conducting Socio-Economic Surveys



Conducting Socio-Economic Surveys

Figure 5.1 Socio-Economic Photographs

5.2.2 General Description of the Study Area

The environmental, social and health conditions prior the execution of the project has been analysed within the whole Block RSF-5, that has been identified as the Study Area of the Project. International Environmental Management Co. Ltd. (IEM) and local partner Environmental Quality Management (EQM) has completed the onshore environmental baseline sampling program and socio economic surveys and focus group meetings in RSF-5, covering Magway & Myothit Townships, Magway Region Myanmar. Minhla Township was not included during the baseline sampling program since it covers a small portion in the southwest corner of Block RSF-5 and no seismic activities will be completed in this township.

In Block RSF-5 *eni Myanmar* will develop a hydrocarbon exploration Project to acquire 500 km^2 of 3D seismic.

The land cover characteristics of an area, namely the physical land type such as forest or open water, are the basis of all the potential interactions between the land and its user, which encompasses the relationship between biophysical features (geology, topography, soil, climate, flora and fauna) and socio-economic issues (land tenure, culture, community organization, income, etc.).

Land cover can be determined by analysing satellite and aerial imagery; by comparing land cover data and maps over a period of time, it is possible to document the trends and changes of the land cover of an area.

Land cover involves the management and modification of natural environment into built environment such as fields, pastures, and settlements. Particularly on social side, land cover takes on an important role in the territorial planning, especially in allocating land function and population distribution.

Based on a satellite images analysis of the whole Block, it was possible to divide the territory in the following land cover areas:

- bare soil;
- vegetation;
- building;
- roads;
- urban area;
- urban vegetation;
- crop lands;
- green land;
- island river;
- river gravel and rock wWhite;
- rivers;
- water bodies.

These land cover areas are described in detail in the Paragraph 5.3.6. The project footprint on these areas will be considered as the basis for the related Impact Assessment in Chapter 6.

5.3 PHYSICAL COMPONENTS

5.3.1 Overview

Block RSF-5 is located in Magway Region, as shown in Figure 5.2. This Region is situated in the rain shadow area of the Yakhaing Yoma and obtains most of its rainfall from the southwest monsoon. The undulating land, composed mainly of sandy loam with low fertility, is subject to severe erosion under rain and strong winds.

Magway Region is made up of Magway, Minbu, Thayet, Pakokku and Gangaw districts, comprising 25 townships and 1,696 ward village-tracts. The capital city is Magway Town (1994 population estimated at 300,000). Other major towns are Pakokku and Minbu.

Magway Region is located in the Central Lowlands, a relatively low-lying terrain drained by the Ayeyarwady River and its major tributaries. Rolling hills, ridges and small mountains are present in some areas. The region is characterized by folded small mountain ranges, a volcanic line and the Sagaing Fault zone, a regionally significant active right lateral strike-slip fault.

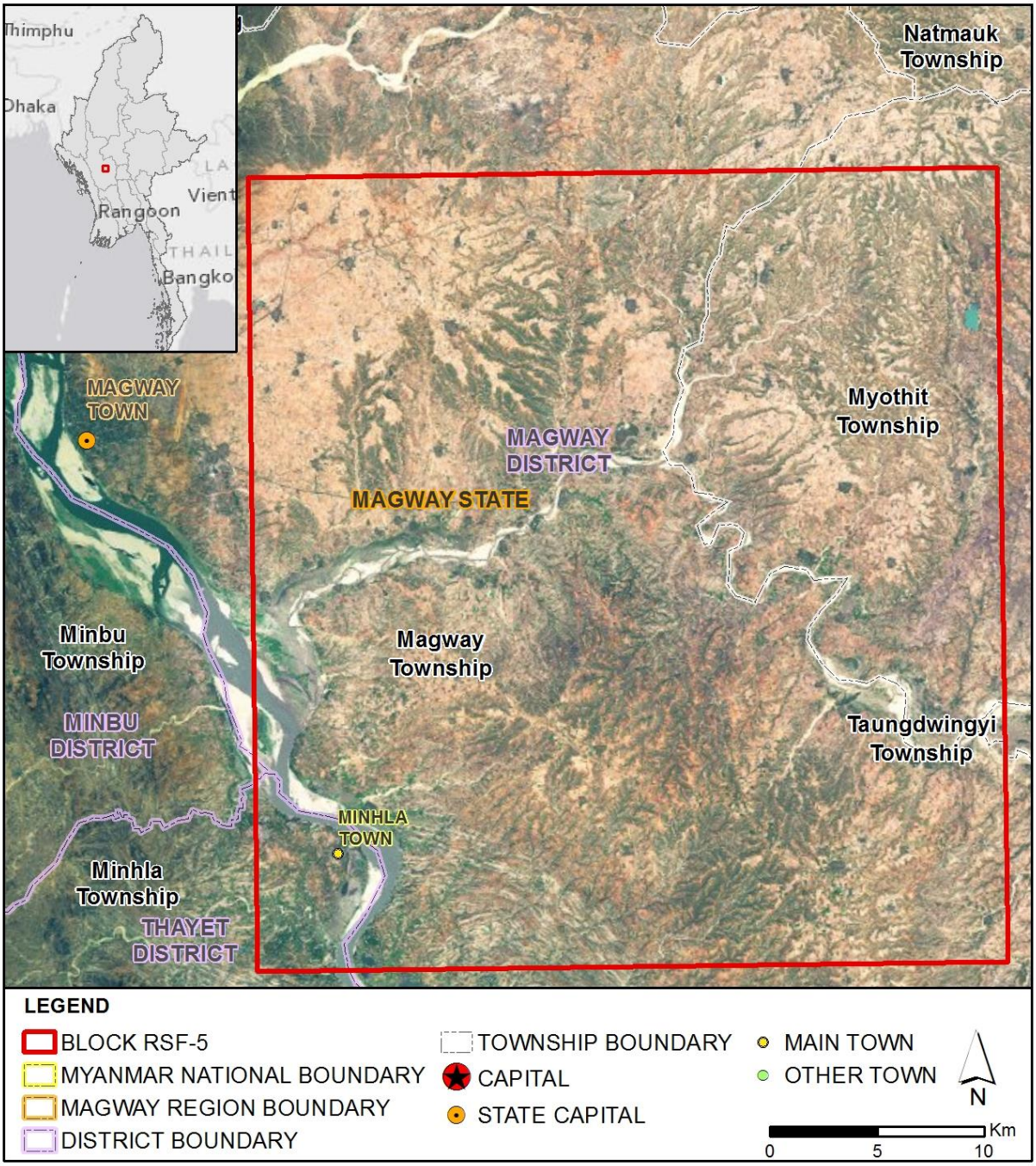
A description of the Study Area is presented in the following chapters:

- atmosphere;
- water;
- soil and subsoil.

5.3.2 Environmental Study Area

Figure 5.2 below presents the Environmental Study Area, that is equivalent to the whole Block RSF-5.

Figure 5.2 Environmental Study Area



Source: eni, 2014

5.3.3 Air

5.3.3.1 Meteorology

The purpose of this paragraph is to describe seasonal and annual distribution of air temperature, relative humidity and rainfall, visibility, wind speed and direction parameters of the Block RSF-5.

The climate of Myanmar is controlled by the great monsoon circulation system of South East Asia and is influenced by topographic peculiarities. The mountain ranges in Myanmar generally run North-South and act as effective climate barriers for the southwest monsoon in the summer and the northeast monsoon in the winter. Therefore, the central part of the Inner Myanmar Tertiary Basin (Central Lowlands) lies in a rain shadow during the summer monsoon (June to September) and receives less than 500 mm of precipitation.

Block RSF-5 is located between the following two climatic zones:

- Tropical savannah climate (around the Dry Zone) with more pronounced dry seasons between the monsoon rains and thus lower precipitation, but similar mean temperatures to those in the tropical monsoon climate;
- Tropical steppe climate (Dry Zone), semi-arid climate with less than 1,250 mm of precipitation per annum and mean annual temperatures in excess of 27° C.

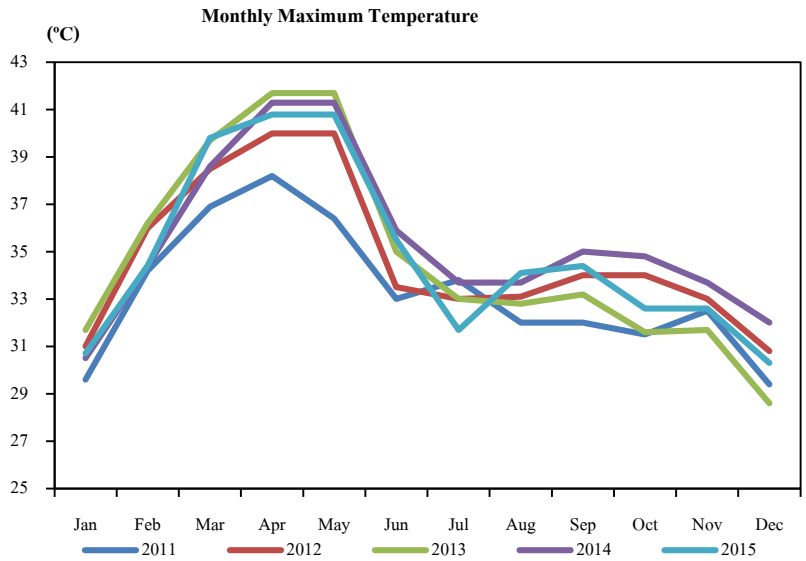
As a country with a monsoon climate, Myanmar has three seasons; namely summer (March to the middle of May), rainy season (middle of May to the end of October) and winter season (November to the end of February). Some researchers divide part of the rainy and winter seasons into two periods: the post-monsoon (October to November) and the cold dry season (December to February).

Data were obtained from the Department of Meteorology and Hydrology for the Magway station which is representative of the Block RSF-5. The available data are monthly mean measurements of 5 years (2011-2015).

Air Temperature

In Block RSF-5 the monthly average maximum temperature ranges between 30.2 and 40.4 as shown in Chart 5.1 and Table 5.2. The highest temperature is measured in April.

Chart 5.1 Average maximum monthly temperatures (2011-2015)



Source: Department of Meteorology and Hydrology, Magway Station, 2016

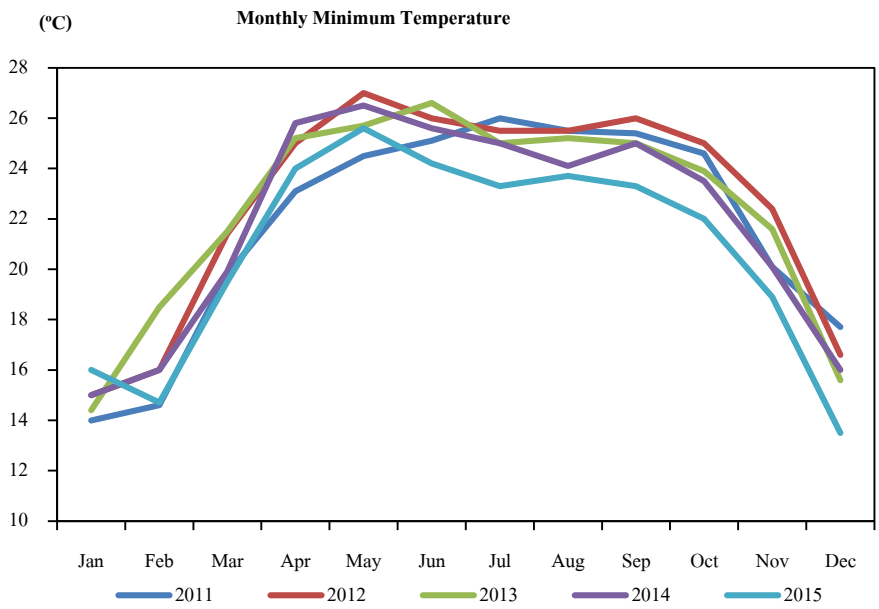
Table 5.2 Average value of monthly maximum temperature for Block RSF-5 (2011-2015)

Month	Max Temperature monthly (°C)
January	30.7
February	35.0
March	38.7
April	40.4
May	40.0
June	34.6
July	33.0
August	33.1
September	33.7
October	32.9
November	32.7
December	30.2

Source: Department of Meteorology and Hydrology, Magway Station, 2016

As shown in Chart 5.2 and Table 5.3, in Block RSF-5 the average value of minimum monthly temperature ranges between 14.9 and 25.9 °C.

Chart 5.2 Average minimum monthly temperatures (2011-2015)



Source: Department of Meteorology and Hydrology, Magway Station, 2016

Table 5.3 Average value of monthly minimum temperature for Block RSF-5 (2011-2015)

Month	Min Temperature monthly (°C)
January	14.9
February	16.0
March	20.4
April	24.6
May	25.9
June	25.5
July	25.0
August	24.8
September	24.9
October	23.8
November	20.6
December	15.9

Source: Department of Meteorology and Hydrology, Magway Station, 2016

Air Humidity

Data of monthly humidity from 2011-2015 at different time scales was averaged to determine the relative humidity within the Block RSF-5 as reported in the following table (Table 5.4).

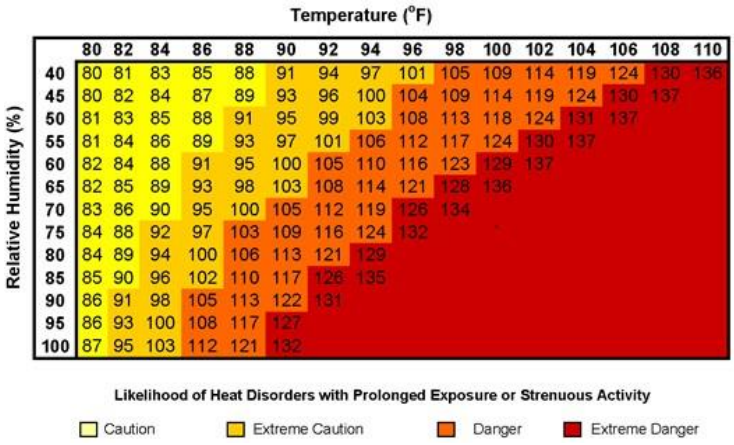
Table 5.4 Average value of monthly maximum humidity for Block RSF-5 (2011-2015)

Month	Max humidity monthly (%)			
Time	**6.30**	**9.30**	**12.30**	**18.30**
January	92	77	57	63
February	88	64	42	49
March	76	51	35	39
April	75	55	40	43
May	82	66	51	60
June	90	79	67	74
July	92	84	73	80
August	93	84	73	80
September	94	82	7	82
October	94	83	70	80
November	92	78	60	77
December	92	79	58	69

Source: Department of Meteorology and Hydrology, Magway Station, 2015

The relative humidity values can be combined with air temperature values to determine the human-perceived equivalent temperature (also called Heat index), according to the following figure (Figure 5.3). For example, when the temperature is 90 °F (32 °C) with high humidity (70%), the heat index can be about 105 °F (41 °C). Potential effects of the heat index are summarized in Table 5.5.

Figure 5.3 Heat index



Source: U.S. National Oceanic and Atmospheric Administration http://www.nws.noaa.gov/os/heat/index.shtml

Table 5.5 Potential effects of the Heat Index

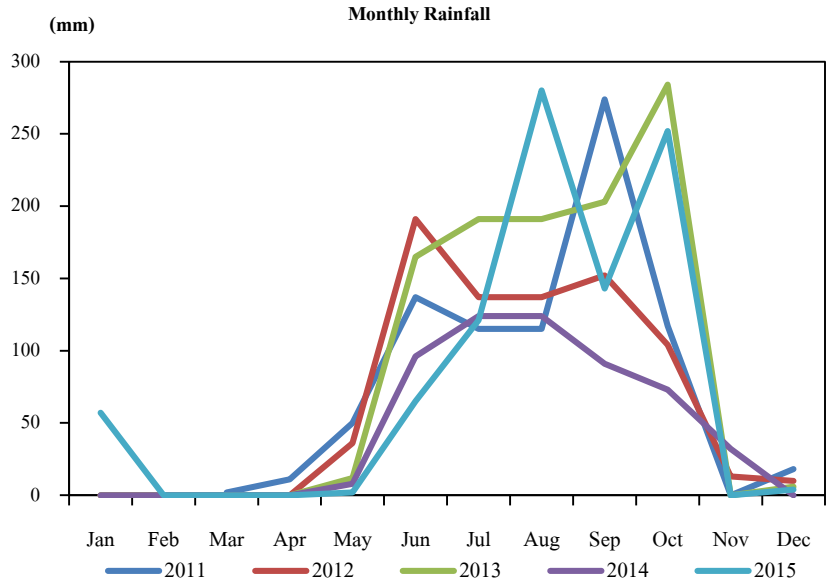
Celsius	***Fahrenheit***	***Notes***
27–32 °C	80–90 °F	Caution — fatigue is possible with prolonged exposure and activity. Continuing activity could result in heat cramps
32–41 °C	90–105 °F	Extreme caution — heat cramps and heat exhaustion are possible. Continuing activity could result in heat stroke
41–54 °C	105–130 °F	Danger — heat cramps and heat exhaustion are likely; heat stroke is probable with continued activity
over 54 °C	over 130 °F	Extreme danger — heat stroke is imminent

As reported in Table 5.5, the highest values of humidity are recorded from June to November that corresponds approximately to the cyclones season. Combining values of Figure 5.3 and Table 5.5, it deduces that during the wet season the heat index is located in the "Extreme Caution" section, it ranges between 95 and 100.

Rainfall

The average of monthly cumulative rainfall for Magway station is shown in Chart 5.3. As shown in Table 5.6, the wettest months are those between June and October.

Chart 5.3 Average monthly cumulative rainfall (2011-2015)



The average value of monthly cumulative rainfall from 2011 to 2015 at the Magway station is reported in Table 5.6.

Table 5.6 Average value of monthly cumulative rainfall for Block RSF-5 (2011-2015)

Month	Monthly cumulative rainfall monthly (mm)
January	12.8
February	0
March	0.4
April	2.2
May	21.6
June	130.8
July	137.6
August	169.4
September	172.6
October	166.0
November	9.0
December	7.6

Source: Department of Meteorology and Hydrology, Magway Station

Visibility

Visibility is defined as the greatest horizontal distance, measured in kilometres, at which selected objects can be seen, identified and/or measured with instrumentation. For meteorological purposes it is necessary that visibility observation provide a measure of the transparency of the atmosphere.

The visibility is low during the rainy season, due to the high percentage of humidity, whereas in the dry season is good, even though it is usual to have foggy sunrise and sunset.

Wind speed and direction

Myanmar has a regular southwest monsoon wind in the rainy season and northeast monsoon wind in the winter or cold-dry season. Mean monthly wind speed at Magway Meteorological Station during January is 1.02 mph and that the wind direction is generally from the east and northeast.

The monthly mean of the wind speed measured at Minbu meteorological station is summarized in Table 5.7.

Table 5.7 Average value of monthly wind speed at Magway meteorological station (2011-2015)

Month	Wind speed monthly (mph)
January	1.02
February	0.93
March	1.50
April	1.42
May	1.64
June	1.67
July	1.37
August	1.11
September	0.88
October	0.98
November	1.16
December	1.13

Source: Department of Meteorology and Hydrology, Magway Station

5.3.4 Air Quality

5.3.4.1 Introduction

Air quality monitoring stations were deployed in RSF-5 from March 11 to March 24, 2016 to collect ambient air monitoring data along with meteorological data on wind speed, wind direction, temperature and relative humidity.

All the data were compared with the applicable national Myanmar standards. If no Myanmar standards were available than international reference standards (IFC, WHO, USEPA, UK, etc.) were used as alternatives.

5.3.4.2 Objective

The objective of the assessment is to reveal the existing baseline air quality status of the proposed project area.

5.3.4.3 Scope of work

The areas falling within the proposed project area have been considered as the baseline study area. The air quality investigations comprise the following components:

- assessment on the existing status of the baseline ambient air status in the vicinity of the proposed area by ambient air quality monitoring.

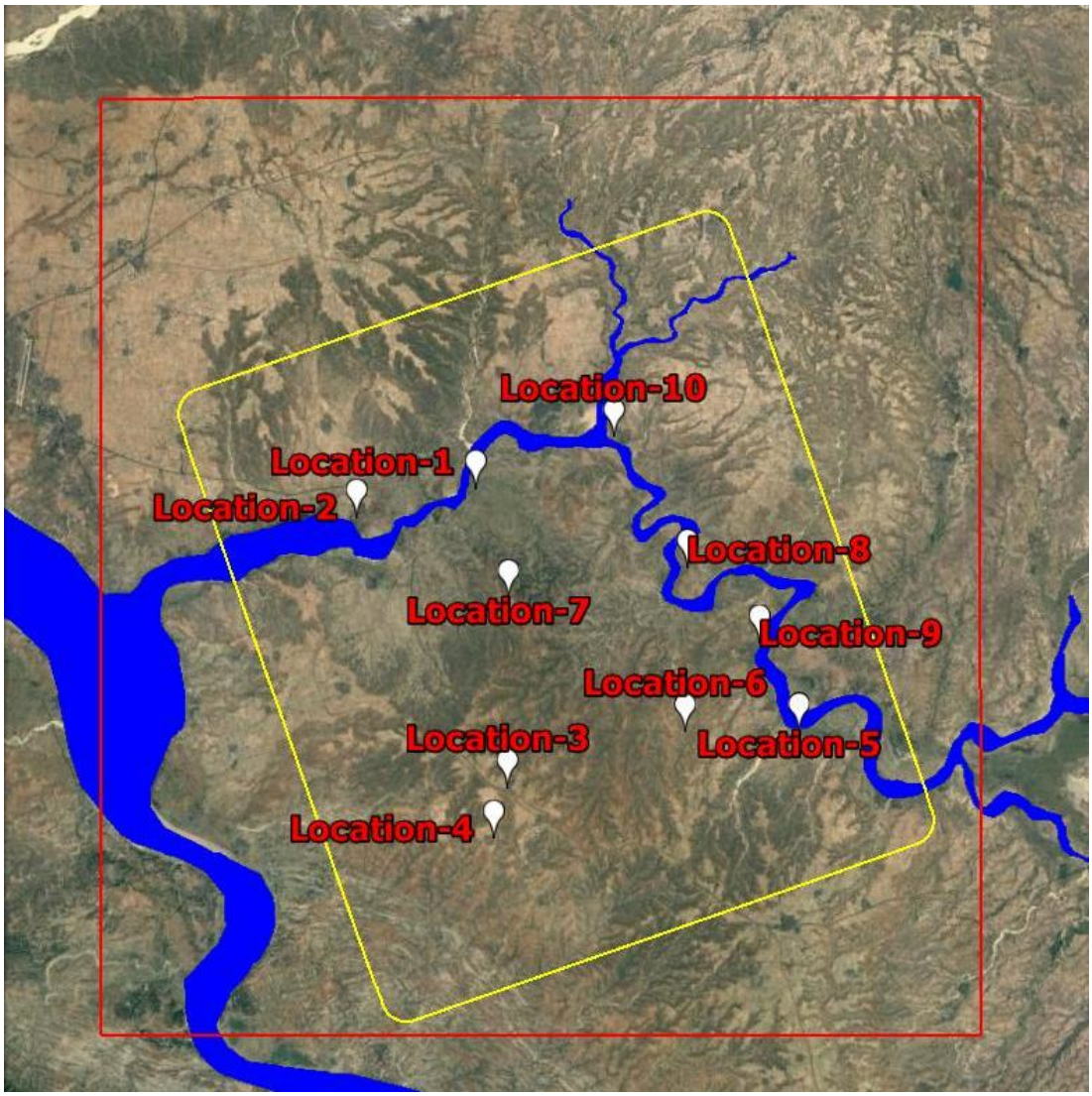
5.3.4.4 Methodology for Study

Locations of air sampling stations is listed in Table 5.8 and shown in Figure 5.4. The air quality sampling methodology used for this project is described in the following subsection.

Table 5.8 Air Sampling Locations for RSF-5 Baseline Survey

Sample	Village	Coordinates		Start Date	End Date
		N	E		
Location-1	Ohndwe	20° 06.740'	095° 08.376'	11.3.2016	12.3.2016
Location-2	Shar Pin Hla	20° 06.121'	095° 05.669'	12.3.2016	13.3.2016
Location-3	Sai Kya	20° 00.366'	095° 09.094'	13.3.2016	14.3.2016
Location-4	Pay Pin San	19° 59.275'	095° 08.785'	15.3.2016	16.3.2016
Location-5	Myin Saing	20° 01.555'	095° 15.715'	16.3.2016	17.3.2016
Location-6	Taung Yar Taw	20° 01.548'	095° 13.130'	17.3.2016	18.3.2016
Location-7	Gal Gyi Kone	20°04'24.17'	95° 09'07.13'	19.3.2016	20.3.2016
Location-8	Ma Nawt Kone	20° 05.050'	095°13.184'	20.3.2016	21.3.2016
Location-9	Lel Yar	20° 03.440'	095° 14.817'	21.3.2016	22.3.2016
Location-10	Nwar Hla	20° 07' 50.07	95° 11' 30. 94'	23.3.2016	24.3.2016

Figure 5.4 Air and Noise Sampling Stations Overview in Block RSF-5



Source: IEM adapted from Google, 2016

Ambient air monitoring instrument

The air monitoring survey will use the HAZ-SCANNER EPAS Wireless Environmental Perimeter Air Monitoring System (EPAS).

(i) Principles

The EPAS, manufactured by EDC/SKC (USA), is a light scattering photometer equipped with a filter sampling system. This dual capability allows for simultaneous real-time and filter measurement. Single-jet impactors are used for particulate size selection and the TSPM, PM10 impactor would be used for this air quality survey.

The highly sensitive EPAS provides real-time determinations and data recordings of airborne particle concentration in $\mu g/m^3$. It provides the minimum, maximum and time-weighted average (TWA) monitoring of gases as well.

This instrument is factory calibrated with the appropriate USEPA certified target gas and correlated with USEPA methods. (Ref: Code of Federal Regulation 40CFR part 53).

The EPAS does not require laboratory analysis to determine concentrations. It operates maximum automation of data collection, uses the optional data logger including Dust Comm Pro Software for PC that provides statistical analysis, graphs, and detailed reports that can be printed for record keeping.

(ii) System Check

Prior to the survey, calibration span and system checks (system flow rate, sensor baseline levels for all parameters, etc.) will be performed on the EPAS to ensure it is operational and ready for monitoring.

The air monitoring instrument will be operated in accordance with the manufacture's guidelines.

5.3.4.5 Ambient Air monitoring

(i) The sensor intakes

The survey would deploy the sensor intakes based on the sitting criteria as specified in the U.S. Code of Federal Regulations (40 CFR 58 Appendix E - Probe Siting Criteria for Ambient Air Quality Monitoring).The survey will comply with the following guidelines as follows:

- particulates and gas sensor intakes will be located between 2-3 meters above the ground level;
- keep unrestricted airflow located away from obstacles so that the distance from the sensor intake is at least twice the height that the obstacle protrudes above the probe;
- keep unrestricted airflow in an arc of at least 270 degrees around the inlet probe, or 180 degrees if the probe is on the side of a building;
- would be clear of optical obstructions, including potential obstructions that may move due to wind, human activity, growth of vegetation, etc;
- spacing from trees (10-20 m);
- spacing from roadways (10-250 m) depending on the traffic;
- observe temporary optical obstructions, such as rain, particles, fog, or snow.

(ii) Location of the monitoring sites

As specific well locations had not been selected by *eni Myanmar*, the monitoring sites were selected based on their being broadly distributed within the seismic area and in proximity to the most sensitive receptors i.e. communities.

Ambient air monitoring sites were selected at the villages within the proposed seismic area. The selected sites were mainly near the schools, monasteries and the paddy fields nearest to the respective villages in order to reveal the background air quality status within the proposed project area and to ensure the sensitive receptors as well.

Being the dry area, air monitoring sites are dusty; however, the selected sites were located away from the dusty roads in order to reduce the local impacts.

(iii) Sampling time and frequency of measurements

The survey will monitor 24hr continuously except battery change after 8hr interval.

(iv) Ambient air parameters to be measured

1) Particulates: TSPM, PM_{10}} USEPA Criteria air pollutants
2) Gases: NO_2, SO_2, CO, VOC, NH_3, CH_4, O_3
3) Meteorology: Temperature, Relative Humidity, Wind Speed, Wind Direction which can have the influence on both local and regional air quality

Particulates (sensor: 90 degree Infra Red Light Scattering)
Calibration: Gravimetric reference NIST Traceable - SAE fine dust- ISO12103-1
Accuracy:± 10% to filter gravimetric SAE fine test dust which falls under the ACGIH/ ISO/CEN criteria.
Detection limit – 1- 20,000ug/m^3

Gases (sensor: electrochemical)
Calibration: ppm equivalent change/year in lab air (24month warranted)
NO_2, Detection limit – (0-5000) ppb
SO_2, Detection limit – (0-5000) ppb
CO, Detection limit – (0-100) ppm

VOC (sensor: photoionisation), Detection limit: – (0-100)ppm
Meteorology (EPAS Meters)
Temperature, Detection limit - (-4° C to 140° F)/ (-20° C - 60° C)
Relative Humidity, Detection limit – 90-100%
Wind Speed (sensor: 3-cup anemometer), Detection limit - (0 – 125 mph)
Wind Direction (sensor: continuous rotation on potentiometric wind direction vane), Detection limit - (5 – 355degrees)

5.3.4.6 Relevant Air Quality Legislation and Guidelines

International Environmental Conventions / Protocols and Agreements signed by Ministry of Environmental Conservation & Forestry

In views of legal policies and framework, the Ministry of Environmental Conservation & Forestry has signed/ratified a number of International Environmental conventions / protocols and agreements relating to air quality as detailed in Table 5.9.

Table 5.9 International Environmental Conventions/Protocols/Agreements Signed/Ratified by Myanmar

International Environmental Conventions/Protocols/Agreement	Date of Signature	Date of Ratification	Date of Member	Cabinet Approval Date
1. United Nations Framework Convention on Climate Change, New York, 1992(UNFCCC)	11-6-1992	25-11-1994 (Ratification)		41/94 9-11-1994
2. Vienna Convention for the Protection of the Ozone Layer, Vienna, 1985		24-11-1993 (Ratification)	22-9-1994	46/93
3. Montreal Protocol on Substances that De-plete the Ozone Layer, Montreal, 1987		24-11-1993 (Ratification)	22-9-1994	46/93
4. London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 1990		24-11-1993 (Ratification)	22-9-1994	46/93
5. 5. ASEAN Agreement on Transboundary Haze Pollution	10-6-2002	13-3-2003 (Ratification)		7/2003 (27-2-2003)

5.3.4.6.1 The Environmental Conservation Law, 2012

The Pyidaungsu Hluttaw Law No. 9/2012 enacts this law. Among them, Chapter I [2 (e), (k)], Chapter VI [10 (d), (f)], Chapter VII [13 (f), 14, 15], Chapter VIII [17 (e)] are concerned with the ambient air pollution, control and management.

In this regard, there is no own air quality standard yet in Myanmar, however, currently, Environmental Conservation Department (ECD), Ministry of Natural Resources and Environmental Conservation (MONREC) has stated that to adopt the WHO air quality guidelines (2005) as National Environmental Air Quality Guideline.

5.3.4.6.2 International Air Quality Guidelines and Standards

Air pollutants can have acute (short-term) and/or chronic (long-term) effects on human health/ecosystems. Therefore, air quality guidelines and thresholds are fundamental to effective air quality management at the proposed project site.

Various international guidelines and standards are combined for the purpose of the general information (Table 5.10). In order to analyze the baseline air quality conditions, WHO air quality guidelines are used in accordance with the ECD guideline.

Table 5.10 International ambient air quality standards/guidelines

Pollutant	Averaging Period	Limit/Guideline Value/ Standards	Relevant Standards/Guidelines
NO_2	1 year	40 µg/m^3	WHO Guideline
		53ppb	NAAQS (USEPA)
		40 µg/m^3	EU (human health)
		30 µg/m^3	EU (vegetation)
	24 hour	150 µg/m^3	World Bank
	1 hour	200 µg/m^3	WHO Guideline
		100 ppb	NAAQS (USEPA)
		200 µg/m^3	EU (human health)
SO_2	1 year	50 µg/m^3	WHO Guideline
		50 µg/m^3	World Bank
		20 µg/m^3	EU (ecosystem)
	24 hours	125 µg/m^3	WHO Guideline
		125 µg/m^3	World Bank
		125 µg/m^3	EU (human health)
	1 hour	75 ppb	NAAQS (USEPA)
		350 µg/m^3	EU (human health)
$PM_{2.5}$	1 year	10 µg/m^3	WHO
		12 µg/m^3	NAAQS (USEPA)
	24 hour	25 µg/m^3	WHO
		35 µg/m^3	NAAQS (USEPA)
PM_{10}	24 hour	150 µg/m^3	NAAQS (USEPA)
		50 µg/m^3	WHO
		50 µg/m^3	EU (human health)
TSPM	24 hour	100 µg/m^3	WHO
CO	8 hour	9 ppm	USEPA (NAAQ)
		10 mg/ m^3	EU (human health)
		10,000 µg/m^3	WHO
	1 hr	35 ppm	USEPA (NAAQ)
		30,000 µg/m^3	WHO
O_3	8 hour	120 µg/m^3	WHO

Table 5.10 International ambient air quality standards/guidelines

Pollutant	Averaging Period	Limit/Guideline Value/ Standards	Relevant Standards/Guidelines
		120 µg/m^3	EU (human health)
		160 µg/m^3	USEPA (NAAQ)
	1 hr	240 µg/m^3	USEPA (NAAQ
Atomic radiation	24hr	25-75 CPM	USEPA

Referring to National Environmental Air Quality Guideline (ECD) mentioning that emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards (i.e. not exceeding 25 percent of the applicable air quality standards, the color codes are categorized in order to reveal the general air quality status of the seismic area.

- Green – meets the standards;
- Yellow (slightly over, <25%);
- Orange (exceeding, >25%).

5.3.4.7 Baseline Ambient Air Quality in RSF-5

Point (1) Ohndwe Village (20° 06.740' N, 095° 08.376' E); RSF 5

Ohndwe village is located in Magway township, Magway division. In terms of gases quality, baseline one hour average concentrations of NO_2 and CO and 8hr average concentration of 8hr at Ohndwe village was found to be lower than the WHO guideline (one hr average) (updated 2005).

The baseline 24hr average SO_2 concentration at Ohndwe village was found to be above the WHO guideline (updated 2005).

VOC, NH_3 and methane were measured to reveal the existing baseline level and as comparison for the post monitoring assessments as well although these levels have not been set for general environment (non-industrial settings).

Background Atomic radiation was monitored as the proactive measure for the hydrocarbon industry like oil and gas exploration. The baseline level met the USEPA standard. It can be due to no specific concerned radiation source like airborne radon and radioactive gas that emanates from the ground around the proposed project area and no measurable increase by man-made radiation.

Regarding particulates, both PM10 levels did not meet WHO guidelines and PM 2.5 was within the range of the guideline. (Table 5.11, Plate 5.1).

The sampling location within Ohndwe Village is shown in Figure 5.5.

Figure 5.5 Air Quality Sampling Location within Ohndwe Village



Table 5.11 Baseline air quality of Ohndwe village

Parameters	Concentration (24hr average) except some Gases (NO2, CO and O3)*	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)
PM10	**119.78**[a](23[b]-1104[c]) µg/m^3	50 µg/m^3
PM 2.5(µg/m^3)	**31**[a](1[b]-2537[c]) µg/m^3	25 µg/m^3
NO_2*	63[a](26[b]-160[c]) ppb/118 µg/m^3 (24 hr) 135ppb/253 µg/m^3 (one hr)	40 µg/m^3 (annual) /200 µg/m^3 (one hour)
SO_2	31[a](1[b]-804[c]) ppb / **81** µg/m^3	20 µg/m^3
CO *	0.37[a](0.001[b]-1.42[c]) ppm/371.23 ppb/424 µg/m^3 (24hr) 923 ppb/1,057 µg/m^3 (one hr)	30,000 µg/m^3 (one hr) 10,000 µg/m^3 (8 hr)
O_3*	0.013[a](0.007[b]-0.024[c]) ppm /13ppb/26 µg/m^3 (24hr) 21 ppb/42 µg/m^3 (8 hr)	100 µg/m^3 (8hr)
VOC	0.47[a](0.001[b]-1.15[c]) ppm	NA
NH_3	0.28[a](0[b]-4.6[c]) ppm	NA
CH_4	8212[a](6022[b]-9614[c]) ppm	NA
Atomic Radiation	16	25-75 CPM(USEPA)
Meteorology		
T (Degree C)		40[a](26[b]-68[c])
RH		32[a](10[b]-54[c])
Wind Speed (kph)		1.58[a](0[b]-15.4[c])
Wind Direction		S
Remark		
There were no special activities around the monitoring site. There was no rain during air monitoring.		

NO2 1 ppb = 1.88 µg/m^3
SO2 1 ppb = 2.62 μg/m3
CO 1 ppb = 1.145 µg/m^3
O3 1 ppb = 2.00 μg/m3
The general equation is: μg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C) where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed. (WHO)
No enforceable standards have been set for VOCs in non-industrial settings.
,[a] Average [b] Min [c]Max



Plate 5.1 Ambient air monitoring station at Ohndwe village

Point (2) Shar Pin Hla Village (20° 06.121'N, 095° 05.669' E); RSF 5

Shar Pin Hla village is located in Magway township, Magway division. In terms of gases quality, baseline one hour average concentrations of NO_2, CO and 8hr average concentration of O_3 at Shar Pin Hla village was found to be lower than the WHO guideline updated 2005).

The baseline 24hr average SO_2 concentration was found to be above the WHO guideline (updated 2005).

VOC, NH_3 and methane were measured to reveal the existing baseline level and methane is monitored as greenhouse gas as well although these levels have not been set for general environment (non-industrial settings).

Background Atomic radiation level met the USEPA standard.

Regarding particulates, both PM10 and PM 2.5 levels did not meet WHO guideline (Table 5.12, Plate 5.2).

The sampling location within Shar Pin Hla Village is shown in Figure 5.6.

Figure 5.6 Air Quality Sampling Location within Shar Pin Hla Village



Table 5.12 Baseline air quality of Shar Pin Hla Village

Parameters	Concentration (24hr average) except some Gases (NO2, CO and O3)*	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)
PM10	**112.78[a]**(38[b]-723[c]) µg/m^3	50 µg/m^3
PM 2.5(µg/m^3)	**72[a]**(1[b]-2924[c]) µg/m^3	25 µg/m^3
NO_2*	62[a](26[b]-160[c]) ppb/117 µg/m^3 (24hr) 147 ppb/276 µg/m^3(one hr)	40 µg/m^3 (annual)*/200 µg/m^3 (one hour) *
SO_2	17[a](1[b]-126[c]) ppb / **45** µg/m^3	20 µg/m^3
CO*	0.33[a](0.001[b]-1.42[c]) ppm/332ppb/380 µg/m^3 (24hr) 962 ppb/ 1,101 µg/m^3(one hr)	30,000 µg/m^3*(one hr) 10,000 µg/m^3*(8 hr)
O_3*	0.013[a](0.007[b]-0.024[c]) ppm/13.48ppb/ 27 µg/m^3 (24hr) 21 ppb/42 µg/m^3 (8hr)	100 µg/m^3*(8hr)
VOC	1.43[a](0.001[b]-2[c]) ppm	NA
NH_3	0.0005[a](0[b]-0.4[c]) ppm	NA
CH_4	8211[a](6022[b]-9614[c]) ppm	NA
Atomic Radiation	17	25-75 CPM(USEPA)
Meteorology		
T (Degree C)		39[a](26[b]-68[c])
RH		34[a](12[b]-54[c])
Wind Speed (kph)		1.4[a](0[b]-10.5[c])
Wind Direction		SSW
Remark		
There were no special activities around the monitoring site. There was no rain during air monitoring.		

NO2 1 ppb = 1.88 µg/m^3
SO2 1 ppb = 2.62 μg/m3
CO 1 ppb = 1.145 µg/m^3
O3 1 ppb = 2.00 μg/m3
The general equation is μg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C) where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed. (WHO)
No enforceable standards have been set for VOCs in non-industrial settings.
,[a] Average [b] Min [c]Max



Plate 5.2: Ambient air monitoring station at Shar Pin Hla village

Point (3) Sai Kya Village (20° 00.366' N, 095° 09.094' E); RSF 5

Sai Kya Village is located in Magway township, Magway division. In terms of gases quality, baseline one hour average concentrations of NO_2, CO and 8hr average concentration of O_3 was found to be lower than the WHO guideline (updated 2005).

The baseline 24hr average SO_2 concentration at Sai Kya village was found to be above the WHO guideline (updated 2005).

VOC, NH_3 and methane were measured to reveal the existing baseline level and methane is monitored as greenhouse gas as well although these levels have not been set for general environment (non-industrial settings).

Background Atomic radiation level met the USEPA standard.

Regarding particulates, both PM10 and PM 2.5 levels did not meet WHO guideline (Table 5.13, Plate 5.3).

The sampling location within Sai Kya Village is shown in Figure 5.7.

Figure 5.7 Air Quality Sampling Location within Sai Kya Village



Table 5.13 Baseline air quality of Sai Kya Village

Parameters	Concentration (24hr average) except some Gases (NO2, CO and O3)*	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)
PM10	**129**[a](27[b]-690[c])µg/m^3	50 µg/m^3
PM 2.5(µg/m^3)	**71**[a](1[b]-2207[c])µg/m^3	25 µg/m^3
NO_2 *	69[a](34[b]-159[c])ppb/130µg/m^3 (24hr) 140 ppb/263 µg/m^3 (one hr)	40 µg/m^3 (annual)*/200 µg/m^3 (one hour) *
SO_2	20[a](1[b]-547[c]) ppb / **53** µg/m^3	20 µg/m^3
CO *	0.38[a](0.001[b]-1.82[c])ppm/384ppb 440 µg/m^3 (24 hr) 738 ppb/845 µg/m^3 (one hr)	30,000 µg/m^3*(one hr) 10,000 µg/m^3*(8 hr)
O_3*	0.014[a](0.009[b]-0.022[c]) ppm/14ppb 28 µg/m^3 (24 hr) 19 ppb/38 µg/m^3 (8 hr)	100 µg/m^3*(8hr)
VOC	1.43[a](0.001[b]-2[c]) ppm	NA
NH_3	0.0005[a](0[b]-0.4[c]) ppm	NA
CH_4	8211[a](6022[b]-9614[c]) ppm	NA
Atomic Radiation	17	25-75 CPM(USEPA)
Meteorology		
T (Degree C)		42[a](30[b]-64[c])
RH		32[a](12[b]-50[c])
Wind Speed (kph)		2.6[a](0[b]-13[c])
Wind Direction		S
Remark		
There were no special activities around the monitoring site. There was no rain during air monitoring.		

NO2 1 ppb = 1.88 µg/m^3
SO2 1 ppb = 2.62 μg/m3
CO 1 ppb = 1.145 µg/m^3
O3 1 ppb = 2.00 μg/m3
The general equation is: μg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C) where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed. (WHO)
No enforceable standards have been set for VOCs in non-industrial settings.
,[a] Average [b] Min [c]Max



Plate 5.3 Ambient air monitoring station at Sai Kya village

Point (4) Pay Pin San Village (19° 59.275'N, 095° 08.785'E); RSF 5

Pay Pin San village is located in Magway township, Magway division. In terms of gases quality, baseline one hour average concentrations of NO_2, CO and 8hr average concentration of O_3 was found to be lower than the WHO guideline updated 2005).

The baseline 24hr average SO_2 concentrations at Pay Pin San village was found to be above the WHO guideline (updated 2005).

VOC, NH_3 and methane were measured to reveal the existing baseline level and methane is monitored as greenhouse gas as well although these levels have not been set for general environment (non-industrial settings).

Regarding particulates, both PM10 and PM 2.5 levels did not meet WHO guideline. (Table 5.14, Plate 5.4).

The sampling location within Pay Pin San Village is shown in Figure 5.8.

Figure 5.8 Air Quality Sampling Location within Pay Pin San Village



Table 5.14 Baseline air quality of Pay Pin San Village

Parameters	Concentration (24hr average) except some Gases (NO2, CO and O3)*	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)
PM10	**125**[a] (37[b]-1935[c])µg/m^3	50 µg/m^3
PM 2.5(µg/m^3)	**45**[a] (1[b]-1400[c])µg/m^3	25 µg/m^3
NO_2 *	70[a](35[b]-171[c]) ppb/132 µg/m^3 (24 hr) 148 ppb/278 µg/m^3(one hr)	40 µg/m^3 (annual)*/200 µg/m^3 (one hour) *
SO_2	7[a](1[b]-85[c]) ppb /18 µg/m^3	20 µg/m^3
CO *	0.3[a](0.001[b]-1.3[c]) ppm/347ppb/397 µg/m^3(24 hr) 520 ppb /595 µg/m^3(one hr)	30,000 µg/m^3*(one hr) 10,000 µg/m^3*(8 hr)
O_3*	0.014[a](0.008[b]-0.025[c]) ppm/14ppb 28 µg/m^3 (24 hr) 21 ppb /42 µg/m^3(8 hr)	100 µg/m^3*(8hr)
VOC	0.001[a](0.001[b]-0.001[c]) ppm	
NH_3	0.42[a](0[b]-3.8[c]) ppm	NA
CH_4	8317[a](6843[b]-9612[c]) ppm	NA

Atomic Radiation	15	25-75 CPM(USEPA)
Meteorology		
T (Degree C)		42[a](26[b]-75[c])
RH		30[a](6[b]-61[c])
Wind Speed (kph)		1.9[a](0[b]-11.2[c])
Wind Direction		S
Remark		
There were no special activities around the monitoring site. There was no rain during air monitoring.		

NO2 1 ppb = 1.88 µg/m^3
SO2 1 ppb = 2.62 μg/m3
CO 1 ppb = 1.145 µg/m^3
O3 1 ppb = 2.00 μg/m3
The general equation is: μg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C) where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed. (WHO)
No enforceable standards have been set for VOCs in non-industrial settings.
[1] Annual mean, [2] 24hr average, NA – not available,[a] Average [b] Min [c]Max



Plate 5.4 Ambient air monitoring station at in Pay Pin San village

Point (5) Myin Saing Village (20° 01.555'N, 095° 15.715' E); RSF 5

Myin Saing village is located in Magway township, Magway division. In terms of gases quality, baseline one hour average concentrations of NO_2, CO and 8hr average concentration of O_3 were found to be lower than the WHO guideline (updated 2005).

The baseline 24hr average SO_2 concentration was found to be above the WHO guideline (updated 2005).

VOC, NH_3 and methane were measured to reveal the existing baseline level and methane is monitored as greenhouse gas as well although these levels have not been set for general environment (non-industrial settings).

Background Atomic radiation level met the USEPA standard.

Regarding particulates, both PM10 and PM2.5 level did not meet WHO guideline -. (Table 5.15, Plate 5.5).

The sampling location within Myin Saing Village is shown in Figure 5.9.

Figure 5.9 Air Quality Sampling Location within Myin Saing Village

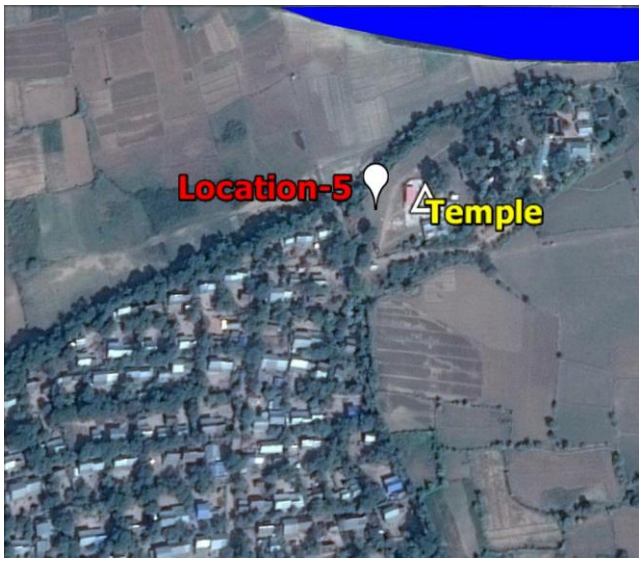


Table 5.15 Baseline air quality of Myin Saing Village

Parameters	Concentration (24hr average) except some gases *	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)
PM10	**105**[a](15[b]-1230[c])µg/m^3	50 µg/m^3
PM 2.5	**28**[a](1[b]-1613[c]) (µg/m^3)	25 µg/m^3
NO_2 *	63[a](36[b]-174[c]) ppb 118 µg/m^3(24 hr) 145 ppb/272 µg/m^3(one hr)	40 µg/m^3 (annual) /200 µg/m^3 (one hour)
SO_2	47[a](1[b]-494[c]) ppb / **123** µg/m^3	20 µg/m^3
CO*	0.3[a](0.001[b]-2.2[c]) ppm/ 307 ppb 352 µg/m^3(24 hr) 1,042 ppb /1,193 µg/m^3(one hr)	30,000 µg/m^3 (one hr) 10,000 µg/m^3 (8 hr)
O_3*	0.013[a](0.006[b]-0.019[c]) ppm/14ppb 28 µg/m^3 (24 hr) 15 ppb /30 µg/m^3(8 hr)	100 µg/m^3 (8hr)
VOC	0.001[a](0.001[b]-0.001[c]) ppm	NA
NH_3	0.6[a](0[b]-10.3[c]) ppm	NA
CH_4	8245[a](6571[b]-9062[c]) ppm	NA
Atomic Radiation	15	25-75 CPM(USEPA)
Meteorology		
T (Degree C)		37[a](28[b]-64[c])
RH		34[a](10[b]-54[c])
Wind speed		2[a](0[b]-13[c])
Wind Direction		S
Remark		
There were no special activities around the monitoring site. There was no rain during air monitoring.		

NO2 1 ppb = 1.88 µg/m^3
SO2 1 ppb = 2.62 μg/m3
CO 1 ppb = 1.145 µg/m^3
O3 1 ppb = 2.00 μg/m3
The general equation is μg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C)where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed. (WHO)
No enforceable standards have been set for VOCs in non-industrial settings.
[1] Annual mean, [2] 24hr average, NA – not available,[a] Average [b] Min [c]Max



Plate 5.5 Ambient air monitoring station at in Myin Saing village

Point (6) Taung Yar Taw Village (20° 01.548'N, 095° 13.130' E); RSF 5

Taung Yar Taw village is located in Magway township, Magway division. In terms of gases quality, baseline one hour average concentrations of NO_2, CO and 8hr average concentration of O_3 were found to be lower than the WHO guideline (updated 2005).

The baseline 24hr average SO_2 concentration was found to be below the WHO guideline (updated 2005).

VOC, NH_3 and methane were measured to reveal the existing baseline level and methane is monitored as greenhouse gas as well although these levels have not been set for general environment (non-industrial settings).

Background Atomic radiation level met the USEPA standard.

Regarding particulates, PM10 level did not meet WHO guideline and PM 2.5 met the guideline. (Table 5.16, Plate 5.6).

The sampling location within Taung Yar Taw Village is shown in Figure 5.10.

Figure 5.10 Air Quality Sampling Location within Taung Yar Taw Village



Table 5.16 Baseline air quality of Taung Yar Taw Village

Parameters	Concentration (24hr average) except some gases *	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)
PM10	**127**[a] ([27][b]-[1020][c]) µg/m^3	50 µg/m^3
PM 2.5(µg/m^3)	13[a](1[b]-611[c]) µg/m^3	25 µg/m^3
NO_2 *	68[a](35[b]-159[c])/128 µg/m^3(24 hr) 141 ppb /265 µg/m^3(one hr)	40 µg/m^3 (annual) /200 µg/m^3 (one hour)
SO_2	5[a](1[b]-117[c]) ppb / 13 µg/m^3	20 µg/m^3
CO*	0.4[a](0.001[b]-1.8[c])ppm/381ppb 436 µg/m^3(24 hr) 736 ppb /843 µg/m^3(one hr)	30,000 µg/m^3 (one hr) 10,000 µg/m^3 (8 hr)
O_3*	0.014[a](0.007[b]-0.022[c]) ppm/15ppb 30 µg/m^3(24 hr) 19 ppb /38 µg/m^3(8 hr)	100 µg/m^3 (8hr)
VOC	0.001[a](0.001[b]-0.001[c]) ppm	NA
NH_3	0.2[a](0[b]-3.1[c]) ppm	NA
CH_4	8255[a](6845[b]-9329[c]) ppm	NA
Atomic Radiation	17	25-75 CPM(USEPA)
Meteorology		
T (Degree C)		40[a](30[b]-63[c])
RH		33[a](12[b]-50[c])
Wind speed		2[a](0[b]-12.4[c])
Wind Direction		S
Remark		
There were no special activities around the monitoring site. There was no rain during air monitoring.		

NO2 1 ppb = 1.88 µg/m^3
SO2 1 ppb = 2.62 µg/m3
CO 1 ppb = 1.145 µg/m^3
O3 1 ppb = 2.00 µg/m3, The general equation is: µg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C)where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed. (WHO)
No enforceable standards have been set for VOCs in non-industrial settings.
NA – not available,[a] Average [b] Min [c]Max



Plate 5.6: Ambient air monitoring station at Taung Yar Taw village

Point (7) Gal Gyi Kone Village (20° 04' 24.17'N, 095° 09' 07. 13'E); RSF 5

Gal Gyi Kone village is located in Magway township, Magway division. In terms of gases quality, baseline one hour average concentrations of NO_2, CO and 8hr average concentration of O_3 were found to be lower than the WHO guideline (updated 2005).

The baseline 24hr average SO_2 concentration was found to be above the WHO guideline.

VOC, NH_3 and methane were measured to reveal the existing baseline level and methane is monitored as greenhouse gas as well although these levels have not been set for general environment (non-industrial settings).

Background Atomic radiation level met the USEPA standard.

Regarding particulates, both PM10 and PM 2.5 levels did not meet WHO guideline. (Table 5.17**,** Plate 5.7).

The sampling location within Gal Gyi Kone Village is shown in Figure 5.11.

Figure 5.11 Air Quality Sampling Location within Gal Gyi Kone Village



Table 5.17 Baseline air quality of Gal Gyi Kone Village

Parameters	Concentration (24hr average) except some gases *	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)
PM10	**98**[a] (23[b]-584[c])µg/m^3	50 µg/m^3
PM 2.5(µg/m^3)	**51**[a] (1[b]-2537[c])µg/m^3	25 µg/m^3
NO_2 *	69[a](32[b]-160[c]) ppb 130 µg/m^3(24 hr) 149 ppb /280 µg/m^3(one hr)	40 µg/m^3 (annual) /200 µg/m^3 (one hour)
SO_2	19[a](1[b]-804[c]) ppb / **50** µg/m^3	20 µg/m^3
CO*	0.4[a](0.001[b]-1.8[c])pm/234 ppb 268 µg/m^3(24 hr) 744 ppb /852 µg/m^3(one hr)	30,000 µg/m^3 (one hr) 10,000 µg/m^3 (8 hr)
O_3*	0.014[a](0.008[b]-0.024[c]) ppm/15ppb 30 µg/m^3(24 hr) 21 ppb /42 µg/m^3(8 hr)	100 µg/m^3 (8hr)
VOC	0.4[a](0.001[b]-1.7[c]) ppm	NA
NH_3	1[a](0[b]-11[c]) ppm	NA
CH_4	8061[a](6022[b]-9614[c]) ppm	NA
Atomic Radiation	17	25-75 CPM(USEPA)

Meteorology	
T (Degree C)	40[a](25[b]-68[c])
RH	33[a](10[b]-52[c])
Wind speed	2[a](0[b]-15.4[c])
Wind Direction	S
Remark	
There were no special activities around the monitoring site. There was no rain during air monitoring.	

NO2 1 ppb = 1.88 µg/m^3
SO2 1 ppb = 2.62 μg/m3
CO 1 ppb = 1.145 µg/m^3
O3 1 ppb = 2.00 μg/m3
The general equation is: μg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C)where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed. (WHO)
No enforceable standards have been set for VOCs in non-industrial settings.
NA – not available,[a] Average [b] Min [c]Max



Plate 5.7: Ambient air monitoring station at Gal Gyi Kone village

Point (8) Ma Nawt Kone Village (20° 05.050'N, 095° 13.184'E); RSF 5

Ma Nawt Kone village is located in Magway township, Magway division. In terms of gases quality, baseline one hour average concentrations of NO_2, CO and 8hr average concentration of O_3 were found to be lower than the WHO guideline (updated 2005).

The baseline 24hr average SO_2 concentration was found to be above the WHO guideline respectively.

VOC, NH_3 and methane were measured to reveal the existing baseline level and methane is monitored as greenhouse gas as well although these levels have not been set for general environment (non-industrial settings).

Background Atomic radiation level met the USEPA standard.

Regarding particulates, both PM10 and PM 2.5 levels did not meet WHO guideline (Table 5.18, Plate 5.8).

The sampling location within Ma Nawt Kone Village is shown in Figure 5.12.

Figure 5.12 Air Quality Sampling Location within Ma Nawt Kone Village

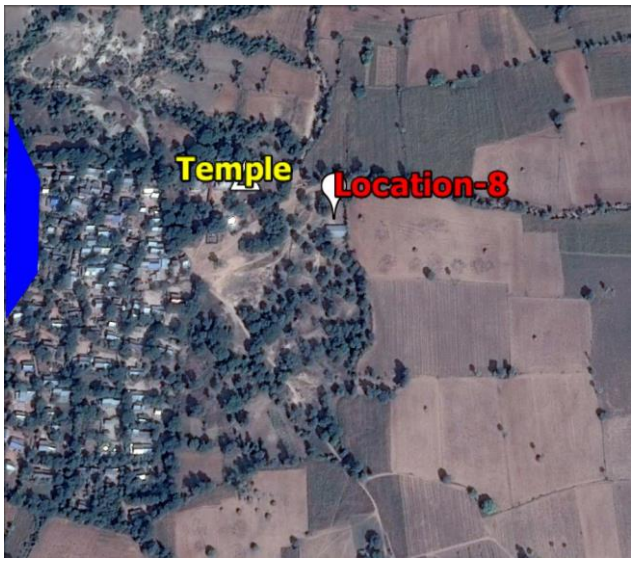


Table 5.18 Baseline air quality of Ma Nawt Kone Village

Parameters	Concentration (24hr average) except some gases *	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)
PM10	**96**[a] (51[b]-584[c])µg/m^3	50 µg/m^3
PM 2.5(µg/m^3)	**49**[a] (1[b]-362[c])µg/m^3	25 µg/m^3
NO_2 *	69[a] (32[b]-160[c]) ppb 130 µg/m^3 (24 hr) 146 ppb /274 µg/m^3 (one hr)	40 µg/m^3 (annual) /200 µg/m^3 (one hour)
SO_2	19[a] (1[b]-804[c]) ppb **/ 50** µg/m^3	20 µg/m^3
CO*	0.2[a] (0.001[b]-0.8[c]) ppm/ 218 ppb 250 µg/m^3(24 hr) 300 ppb /343 µg/m^3(one hr)	30,000 µg/m^3 (one hr) 10,000 µg/m^3 (8 hr)
O_3*	0.015[a] (0.008[b]-0.024[c]) ppm/15 ppb 30 µg/m^3 (24 hr) 21 ppb /42 µg/m^3 (8 hr)	100 µg/m^3 (8hr)
VOC	0.4[a] (0.001[b]-1.7[c]) ppm	NA
NH_3	1[a] (0[b]-11[c]) ppm	NA
CH_4	8,022[a] (6022[b]-9614[c]) ppm	NA
Atomic Radiation	16	25-75 CPM(USEPA)
Meteorology		
T (Degree C)		40[a](25[b]-68[c])
RH		30[a](10[b]-52[c])
Wind direction		SSE
Wind speed		2[a](0[b]-15[c])
Remark		
There were no special activities around the monitoring site. There was no rain during air monitoring.		

NO2 1 ppb = 1.88 µg/m^3
SO2 1 ppb = 2.62 μg/m3
CO 1 ppb = 1.145 µg/m^3
O3 1 ppb = 2.00 μg/m3
The general equation is: μg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C)where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed. (WHO)
No enforceable standards have been set for VOCs in non-industrial settings.
NA – not available,[a] Average [b] Min [c]Max



Plate 5.8 Ambient air monitoring station at Ma Nawt Kone village

Point (9) Lel Yar Village (20° 03.440'N, 095° 14.817' E); RSF 5

Lel Yar village is located in Myo Thit township, Magway division. In terms of gases quality, baseline one hour average concentrations of NO_2, CO and 8hr average concentration of O_3 were found to be lower than the WHO guideline (updated 2005).

The baseline 24hr average SO_2 concentration was found to be above the WHO guideline.

VOC, NH_3 and methane were measured to reveal the existing baseline level and methane is monitored as greenhouse gas as well although these levels have not been set for general environment (non-industrial settings).

Background Atomic radiation level met the USEPA standard.

Regarding particulates, both PM10 and PM 2.5 levels did not meet WHO guideline. (Table 5.19, Plate 5.9).

The sampling location within Lel Yar Village is shown in Figure 5.13.

Figure 5.13 Air Quality Sampling Location within Lel Yar Village



Table 5.19 Baseline air quality of Lel Yar Village

Parameters	Concentration (24hr average) except some gases *	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)
PM10	**207**[a] (31[b]-764[c])µg/m^3	50 µg/m^3
PM 2.5(µg/m^3)	**46**[a] (1[b]-1448[c])µg/m^3	25 µg/m^3
NO_2 *	53[a] (26[b]-115[c]) ppb 100 µg/m^3 (24 hr) 98 ppb /184 µg/m^3 (one hr)	40 µg/m^3 (annual) /200 µg/m^3 (one hour)
SO_2	97[a] (1[b]-1584[c])ppb / **254** µg/m^3	20 µg/m^3
CO*	0.3[a] (0.001[b]-1[c]) ppm/ 389 ppb 445 g/m^3 (24 hr) 920 ppb /1,053 µg/m^3 (one hr)	30,000 µg/m^3 (one hr) 10,000 µg/m^3 (8 hr)
O_3*	0.009[a] (0.006[b]-0.018[c]) ppm/9ppb 18 µg/m^3 (24 hr) 13 ppb /26 µg/m^3 (8 hr)	100 µg/m^3 (8hr)
VOC	1[a] (0.001[b]-2.4[c]) ppm	NA
NH_3	0.2[a] (0[b]-1.5[c]) ppm	NA
CH_4	9115[a] (6015[b]-10710[c]) ppm	NA
Atomic Radiation	31	25-75 CPM(USEPA)
Meteorology		
T (Degree C)		38[a](22[b]-67[c])
RH		42[a](12[b]-68[c])
Wind direction		S
Wind speed		0.005[a](0[b]-4.3[c])
Remark		
There were no special activities around the monitoring site. There was no rain during air monitoring.		

NO2 1 ppb = 1.88 µg/m^3
SO2 1 ppb = 2.62 μg/m3
CO 1 ppb = 1.145 µg/m^3
O3 1 ppb = 2.00 μg/m3
The general equation is: μg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C)where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed. (WHO)
No enforceable standards have been set for VOCs in non-industrial settings.
NA – not available,[a] Average [b] Min [c]Max



Plate 5.9 Ambient air monitoring station at Lel Yar village

Point (10) Nwar Hla Village (20° 07' 50.07' N, 95° 11' 30. 94' E); RSF 5

Nwar Hla village is located in Myo Thit township, Magway division. In terms of gases quality, baseline one hour average concentrations of NO_2, CO and 8hr average concentration of O_3 were found to be lower than the WHO guideline (updated 2005).

The baseline 24hr average SO_2 concentration was found to be above the WHO guideline.

VOC, NH_3 and methane were measured to reveal the existing baseline level and methane is monitored as greenhouse gas as well although these levels have not been set for general environment (non-industrial settings).

Background Atomic radiation level met the USEPA standard.

Regarding particulates, both PM10 level did not meet WHO guideline and PM 2.5 was within the range of the guideline. (Table 5.20, Plate 5.10).

The sampling location within Nwar Hla Village is shown in Figure 5.14.

Figure 5.14 Air Quality Sampling Location within Nwar Hla Village



Table 5.20 Baseline air quality of Nwar Hla Village

Parameters	Concentration (24hr average) except some gases *	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)
PM10	**103**[a] (31[b]-584[c]) µg/m^3	50 µg/m^3
PM 2.5(µg/m^3)	31[a](1[b]-306[c]) µg/m^3	25 µg/m^3
NO_2 *	184[a](184[b]-282[c]) µg/m^3 (one hr)	40 µg/m^3 (annual) /200 µg/m^3 (one hour)
SO_2	19[a](1[b]-804[c]) ppb / **50** µg/m^3(24 hr)	20 µg/m^3
CO*	898[a](742[b]-1053[c]) µg/m^3(one hr)	30,000 µg/m^3 (one hr) 10,000 µg/m^3 (8 hr)
O_3*	34[a](26[b]-42[c])µg/m^3(8 hr)	100 µg/m^3 (8hr)
VOC	0.1[a](0.001[b]-1.1[c]) ppm	NA
NH_3	2[a](0[b]-52[c]) ppm	NA
CH_4	8018[a](750[b]-9338[c]) ppm	NA
Atomic Radiation	15	25-75 CPM(USEPA)
Meteorology		
T (Degree C)		39[a](25[b]-68[c])
RH		30[a](7[b]-50[c])
Wind direction		S

Wind speed	3[a](0[b]-15.4[c])
Remark	
There were no special activities around the monitoring site. There was no rain during air monitoring.	

NO2 1 ppb = 1.88 µg/m^3
SO2 1 ppb = 2.62 µg/m3
CO 1 ppb = 1.145 µg/m^3
O3 1 ppb = 2.00 µg/m3
The general equation is: µg/m3 = (ppb)*(12.187)*(M) / (273.15 + °C)where M is the molecular weight of the gaseous pollutant. An atmospheric pressure of 1 atmosphere is assumed. (WHO)
No enforceable standards have been set for VOCs in non-industrial settings.
NA – not available,[a] Average [b] Min [c]Max



Plate 5.10 Ambient air monitoring station at Nwar Hla village

5.3.4.8 Baseline Gas Quality in RSF 5 Block

Total (8) ambient air monitoring sites and other (2) ambient air monitoring sites are located in the Magwe Township and Myo Thit Township, respectively under Magway Region. These selected sites in each township are being distributed within the seismic area (Block RSF-5) and the distance between each other is approximately 2-5 km.

Based on the findings, in general, 24hr average ambient particulate levels did not meet WHO guidelines for PM2.5 and PM10. The, 24hr average ambient SO_2 concentration level did not meet the WHO guideline. Other gases including NO_2, CO, O_3 and atomic radiation levels met the standards (Table 5.21). The VOC, NH_3, CH_4 gases were monitored to reveal the existing baseline ambient concentration.

Baseline ambient air monitoring of every village located within the seismic area is almost limited to conduct in practice. The existing baseline ambient levels at (10) locations monitored were comparable with each other apart from small-scale variation.

Therefore, the findings were assessed as averaging stations for the whole RSF-5 block based on more or less similar findings over a period of time and the similar in nature of lands use, activities and meteorology.

The Particulate levels (PM2.5 and PM10) were higher than WHO guidelines at all locations except Nwar Hla Village and Taung Yar Taw Village, which only had PM10 values above the guidelines. NO_2, CO, O3 and atomic radiation levels met the standards. Other gases such as VOC, NH3, CH_4 were monitored to reveal the existing baseline ambient concentration. SO_2 levels exceeded guidelines at all locations except (2) stations including Pay Pin San village and Taung Yar Taw under Magway Township. Although the SO_2 levels of above two villages were not above the guideline, these were close to the limit.

Table 5.21 Baseline Gas Quality in the whole Block RSF 5

Substance (24hr average concentration) except NO_2, CO and O3	Block RSF 5	National Environmental Air Quality Guideline (ECD)/WHO Guideline
PM10	**122.3**[a] ± 10.2[b] µg/m^3 116.5[c] (96[d] – 207[e])	50 µg/m^3
PM 2.5	**43.7**[a] ± 5.9[b] µg/m^3 45.5[c] (13[d]- 72[e])	25 µg/m^3
NO_2 *	270 [a] ± 3 [b] 273 [c] (253[d] -280 [e]) µg/m^3 (one hour)	200 µg/m^3 (one hour)
SO_2	25.2[a] ± 8.3[b] 19 [c](5[d]-97[e]) ppb / **50** µg/m^3	20 µg/m^3
CO *	854 [a] ± 99[b] 849 [c] (343[d]-1193[e])(one hour)	30,000 µg/m^3 (one hr)
O_3 **	39.5 [a] ± 1.5 [b] 42[c](30[d]-42[e]) µg/m^3(8 hour)	100 ug/m^3 (8hr)
Atomic radiation	18[a] ± 1.5[b] 17[c] (15[d]-31[e])	25-75 CPM (USEPA)
VOC	0.66[a] ± 0.2[b] 0.44[c] (0.001[d]-1.7[e]) ppm	NA
NH_3	0.6[a] ± 0.2[b] 0.4[c] (0.00007[d]-2[e]) ppm	NA
CH_4	8263.5[a]±100[b] 8211.5[c](8018[d]-9115[e]) ppm	NA

[a] Average[b] SE [c]Median [d]Min [e]MaxAll concentrations are 24 hr average except* one hr average, ** 8hr average

5.3.4.9 Baseline air quality in Magway Township, Magway Division

Table 5.22 Baseline Gas Quality in Magway Township, Magway Region

Substance All concentrations are 24 hr average except NO2*, CO *and O3**	Magway	WHO Guideline
PM10	**128** [a] ±11.9 [b] 123 [c](98[d]-207[e]) µg/m^3	50 µg/m^3
PM2.5	**45** [a] ± 7 [b] 46 [c](13[d]-72[e]) µg/m^3	25 µg/m^3
NO_2 *	65 [a] ±2 [b] 66 [c] (53 [d] – 70[e]) ppb 122 µg/m^3 (24hr) 5.1 µg/m^3 (one hr)	200 µg/m^3 (one hour)
SO_2	26.75 [a] ± 10.43 19(5[b]-97[c]) ppb / **50** µg/m^3	20 µg/m^3
CO*	0.3225 [a] ±0.02 [b] 0.31 [c] (0.2[d]-0.4[e]) ±0.80 ppb 343 µg/m^3 (24hr) 14 µg/m^3 (one hr)	30,000 µg/m^3 (one hr)
O_3**	0.013[a]±0[b] 0.01 [c](0.01[d]-0.014[e]) 13 ppb 26 µg/m^3	100 ug/m^3 (8hr)
Atomic radiation	17.6 [a] ±1.86 [b] 17 [c] (15 [d] -31 [e])	25-75 CPM (USEPA)
VOC	0.76 [a] ±0.2 (0.001[b]-2.6[c]) ppm	NA
NH_3	0.4[a]±0.12[b] 0.24[c](0[d]-11[e]) ppm	NA
CH_4	8324[a]±11 [b] 8228[c] (6022[d]-9614[e]) ppm	NA

[a] Average[b] SE [c]Median [d]Min [e]Max All concentrations are 24 hr average except* one hr average, ** 8hr average

5.3.4.10 Baseline Gas Quality in Myo Thit Township, Magway Region

In Myo Thit Township, 24 hour Baseline levels monitoring of NO_2 and SO_2 were higher than the WHO guideline, but met with NAAQS and World Bank Guideline.

Table 5.23 Baseline Gas Quality in Myo Thit Township

Substance All concentrations are 24 hr average except NO2*, CO *and O3**	Myo Thit Township	WHO Guideline
PM10	**99.5** [a] ± 3.5 [b] 100 [c] (96[d]-103[e]) µg/m^3	50 µg/m^3
PM2.5	**40**[a] ± 9[b] 40[c] (31[d]-49[e]) µg/m^3	25 µg/m^3
NO_2 *	68.5 [a] ± 0.5[b] 69[c](68[d]-69[e]) ppb 129 µg/m^3 5µg/m^3	200 µg/m^3 (one hour)
SO_2	19[a] ± 0[b] ppb / **50** µg/m^3	20 µg/m^3
CO*	0.2 [a] ± 0 [b] ppm	30,000 µg/m^3 (one hr)

	/ 200 µg /m^3 229 µg/m^3 10 µg/m^3 (one hr)	
O_3**	0.015[a]± 0[b] ppm 15ppb 30 µg/m^3	100 ug/m^3(8hr)
Atomic radiation	15.5 [a] ± 0.5 [b] 15.5[c] (15[d]-16[e])	25-75 CPM(USEPA)
VOC	0.25 [a] ± 0.15 [b] 0.25 [c] (0.1 [d] -0.4 [e]) ppm	NA
NH_3	1.5 [a] ± 0.5 [b] 1.5 [b] (1 [d] -2 [e]) ppm	NA
CH_4	8020 [a] ± 2 [b] 8020 [c] (8018 [d] -8022 [e]) ppm	NA

[a] Average [b] SE [c] Median [d] Min [e] Max All concentrations are 24 hr average except* one hr average, ** 8hr

5.3.4.11 Summary of Air Quality Results

In order to determine the existing baseline air quality status within the seismic area (Block RSF-5), the levels of ambient air parameters monitored throughout the survey period were compared with WHO air quality guidelines adopted by Environmental Conservation Department (ECD).

Concerning the findings of average ambient air concentrations within the seismic area, the existing baseline particulates level (PM10 and PM2.5) did not meet the WHO guideline. Being the dry dusty region, fugitive dust emission mainly due to the wind action and local activities including agriculture, open burning, wood stoves are responsible for exceedance of particulate daily levels at rural background area.

Regarding the gases quality, the comparison between one hour average levels of NO_2, CO, 8hr average level of O_3 and WHO guidelines show a good quality as for these indicators.

However, 24 hr average level of SO_2 was higher than the guideline. The increasing SO_2 level throughout the survey area can be due to usage of diesel fuel with high sulphur content in power generators, to the transportation at the villages and biologic decaying of vegetation and animals in the farms as well.

Other gases (CO, NH_3 and CH_4) were monitored and this can be used as the background concentrations in order to have ante operam values to be compared with those emerging in the further monitoring campaign that will be performed. Background ambient atomic radiation level was below the USEPA standard.

In terms of air monitoring station, during the survey period, the ambient air parameters were also being continuously monitored per every single minute (recording counts ranging between 1,380 and 1,440) over the 24 hr monitoring period under the span set up. Thus, these measurements will reveal the actual ambient air concentration in the surrounding environment.

Furthermore, in the nearby of the seismic area similar land as well as general activities and meteorology can be found. For this reason, the baseline ambient air monitoring findings monitored in each location were comparable with each other apart from small scale variation that might be influenced by non homogeneous landscapes.

Thus, the baseline ambient air data gathered at the selected locations throughout the survey period were considered to be representative and typical of other nearby locations.

5.3.4.12 Climate Change

Myanmar ratified United Nation Framework Convention on Climate Change (UNFCCC) on 25 November, 1994 as a non-Annex I Party. Article 12.5 of the UNFCCC requires non-Annex I Parties to make their initial national communications. Thus, Myanmar sought Global Environment Facility (GEF) funding in 2006 to fulfill its commitments and obligations for preparing and reporting its Initial National Communication (INC). The National Commission for Environmental Affairs (NCEA) of Myanmar launched an INC project in 2008 with the financial assistance from GEF/UNEP.

The main sectors that are sources of GHG emissions are reported below:

- Energy sector. The national Green House Gas (GHG) inventory in energy sector covers three major GHGs: carbon dioxide (CO_2), methane (CH_4), Nitrous Oxide (N_2O). The main sources of GHG emissions examined are fossil fuel combustion, traditional biomass combustion, fugitive emissions from coal mining activities and oil and natural gas system. The total GHG emissions fossil fuel combustion in Myanmar for the year 2000 was estimated to be 7,755.11 Gg in which energy industry and transport sectors shared the largest contributions. The per capita CO_2 emission from the energy sector is relatively low because Myanmar relies predominantly on hydroelectric power for industrial, residential and commercial uses.
- Agriculture sector. Prediction of CH_4 and N_2O emissions in agriculture sector during 2000-2030 shows that both GHGs tend to rise until 2030 because of increased agricultural land and more inputs of fertilizers. Among the domesticated livestock, ruminant animals are the major emitters of CH_4 because of their unique digestive system. Methane emissions from the livestock sector from the year 1998 to 2002 increased by 1.25% annually. Because of the increased number of livestock, both CH_4 & N_2O tends to rise until 2030.
- Land Use Change and Forestry sector. Deforestation (that produces approximately 116 million ton of CO_2 per year), due primarily to agriculture, but also logging and fuel wood collection (Emissions reduction profile - Myanmar, drafted by UNEP RISØ, supported by ACP-MEA & UNFCCC, 2013), and forest degradation processes have become the main source of carbon dioxide emissions. Several studies analyzed the possibility of implementing compensation measures: CO_2 removal by land use change and forestry sector (such as natural forests, forest plantations, home garden trees, roadside trees) may compensate the total emissions by different sectors. The Initial National Communication (INC) under the UNFCCC (United Nations Framework Convention on Climate Change) for Myanmar, on behalf of the Ministry of Environmental Conservation and Forestry, calculated that the CO_2 removal in 2000 from the natural forests, forest plantations, home garden trees and roadside trees were 129,839 Gg, 11,750 Gg, 470 Gg and 162 Gg of CO_2 respectively.
- Waste Sector. CH_4 emissions from waste sector have been worked out from two different sources: disposal of solid waste and treatment of domestic and commercial wastewater. Solid waste includes Agricultural waste, Livestock waste, Industrial waste and Domestic waste. For year 2000, urban population is considered as approximately 30% of the total country's population and by expert estimate (*Source: Initial National Communication (INC) under the UNFCCC for Myanmar*), net methane emission from domestic and commercial wastewater is 1.257 Gg. The study in total methane emission from the Waste Sector shows that CH_4 emissions in this sector are increasing due to the increase of total population especially in urban areas.

It is noted that trends for CH_4 and N_2O emissions in agriculture sector clearly highlighted the sharp increase in the short term (2000-2005) as well as in the long term (1990-

2030). Waste sector also caused an increase in CH_4 emissions due to the population growth. Land use change and forestry sector are the major sources of emissions which come from deforestation, shifting cultivation and land clearing. On the other hand, total annual CO_2 removals by natural forests are also declining steadily due to the decrease in the natural forest areas. However, it is estimated that GHG removals in Myanmar will still have outstanding surplus until 2030 (*Source: Initial National Communication (INC) under the UNFCCC for Myanmar*).

5.3.4.13 Noise & Vibration

The purpose of this paragraph is to provide a characterization of the noise background of the Study area and identify the sensitive receptors, mainly inhabited buildings, potentially affected by project activities.

Based on a satellite images analysis (as reported in Paragraph 5.2.2), the Study Area is mainly covered by agricultural, natural and vegetation areas. Thus, it is anticipated that due to the rural nature of the area, the acoustic environment will have low ambient noise levels which will not vary considerably across the Study Area. However, small urban areas may be characterised by higher noise ambient levels due to human activities.

Methodology for Study

Ambient noise monitoring surveys in Block RSF-5 were also undertaken in 10 community locations on March 11 to March 24, 2016. (Table 5.24) These locations were selected near the air quality locations due to their proximity near the schools, monasteries and paddy fields nearest to the respective villages in order to reveal the background noise values within in the villages near sensitive receptors.

The internationally recognised 'A' weighting scale (dBA) was used so that the measured noise corresponded roughly to the overall level of noise that is heard by the average human. 24-hour equivalent noise (LA_{eq}) were taken continuous for 24 hours at each location. The L_{eq} is the preferred method to describe sound levels that varies over time, resulting in a single decibel value which takes into account the total sound energy over the period of time of interest (Acoustic Glossary, 2016). The sound level Baseline noise was measured using a sound level meter model SL-4023SD.

Table 5.24 ◦ Ambient Noise Stations from 10 Rural Communities in Block RSF-5

Village	Coordinates (GCS WGS84)		Station Name	Start	End
	Latitude (N)	Longitude (E)			
Ohndwe	20° 06.740'	095° 08.376'	1	3/11/2016	3/12/2016
Shar Pin Hla	20° 06.121'	095° 05.669'	2	3/12/2016	3/13/2016
Sai Kya	20° 00.366'	095° 09.094'	3	3/13/2016	3/14/2016
Pay Pin San	19° 59.275'	095° 08.785'	4	3/15/2016	3/16/2016
Myin Saing	20° 01.555'	095° 15.715'	5	3/16/2016	3/17/2016
Taung Yar Taw	20° 01.548'	095° 13.130'	6	3/17/2016	3/18/2016
Gal Gyi Kone	20° 04'24.17'	95°09'07. 13'	7	3/19/2016	3/20/2016
Ma Nawt Kone	20° 05.050'	095° 13.184'	8	3/20/2016	3/21/2016
Lel Yar	20° 03.440'	095° 14.817'	9	3/21/2016	3/22/2016
Nwar Hla	20° 07' 50.07	95° 11' 30. 94'	10	3/23/2016	3/24/2016

Results

WHO Community Noise guidelines states that, according to evidences, ISO Standards for occupational noise can be used for environmental and leisure time noise exposures (ISO 1990). This standard indicates that long term exposure to LAeq,24h of up to 70 dBA will not result in hearing impairment. However, mechanical damage to the ear may occur (Hanner & Axelsson 1988) In case of very high instantaneous sound pressure levels. Occupational limits are set at peak sound pressure levels of 140 dBA (EU 1986a).

Ambient noise measurements taken within Block RSF-5 had 24-hour equivalent noise levels ranged from 40.4 dB (A) to 61.5 dB (A). The time base for LAeq for "daytime" and "night-time" is 16 h and 8 h, respectively. The night noise level for Sai Kya, Pay Pin San, Gal Gyi Kone, Ma Nawt Kone were above the WHO standards Leq-Night guidelines for Outside bedrooms resulting in Sleep disturbance with window open (outdoor values). This is most likely the result of motorbike traffic and diesel generator use for electricity. Ambient noise measurement data recorded in each community is summarized below in Table 5.24.

Table 5.25 Results of Average Baseline Ambient Noise from 10 rural communities in Block RSF-5

Station	Community	LA_{eq} (dBA)	LA_{eq}-Day (dBA)	LA_{eq}-Night (dBA)	L_{min} (dBA)	L_{max} (dBA)	L_{90} (dBA)
1	Ohndwe	56.6	44.4	41.7	33.5	65.3	30.3
2	Shar Pin Hla	45.9	40.3	43.2	34.4	56.6	31.0
3	Sai Kya	61.2	48.6	48.8	37.6	72.6	36.8
4	Pay Pin San	57.0	50.8	51.8	42.3	65.4	37.8
5	Myin Saing	40.4	33.7	41.2	28.2	47.5	28.1
6	Taung Yar Taw	55.9	45.2	44.5	33.7	64.7	32.7
7	Gal Gyi Kone	57.6	50.1	53.3	32.9	64.0	33.5
8	Ma Nawt Kone	61.5	49.8	49.7	37.6	72.6	36.9
9	Lel Yar	56.1	47.1	42.9	35.7	65.5	32.2
10	Nwar Hla	55.1	50.9	42.4	36.8	65.4	36.6
International Guidelines		70[1]	55[2]	45[3]	-	140[4]	-

1 ISO 1990 Acoustics–Determination of occupational noise exposure and estimation of noise induced hearing impairment. International Standard ISO 1999, International Organization for Standardization, Geneva, Switzerland.

2 Outdoor living area -Serious annoyance, daytime and evening from WHO, 1999, Guidelines for Community Noise, edited by Birgitta Berglund , Thomas Lindvall, Dietrich H Schwela, World Health Organization, 1999.

3 Outside bedrooms - Sleep disturbance, window open (outdoor values) from WHO, 1999, Guidelines for Community Noise, edited by Birgitta Berglund , Thomas Lindvall, Dietrich H Schwela, World Health Organization, 1999.

4 Hanner P and Axelsson A 1988 Acute acoustic trauma. Scandinavian Audiology 17: 57-63.

5.3.5 Water

The aim of this chapter is to describe the type of freshwater resources, use and availability, water quality and hydrogeology characteristics within Block RSF-5.

5.3.5.1 Water usage & availability

Myanmar comprises a series of river-valleys running from North to South, separated by mountains and hill ranges. The drainage areas or catchment areas (watersheds) of major rivers in Myanmar are shown in Table 5.26.

Table 5.26 Drainage Areas of Myanmar

Drainage Area	%
Ayeyarwady and Chindwinn Rivers and tributaries	55.05
Thanlwin River and tributaries	18.43
Sittaung River and tributaries	5.38
Kaladan and Lemro Rivers and tributaries	3.76
Yangon River and tributaries	2.96
Tanintharyi River and tributaries	2.66
Minor coastal streams	11.76

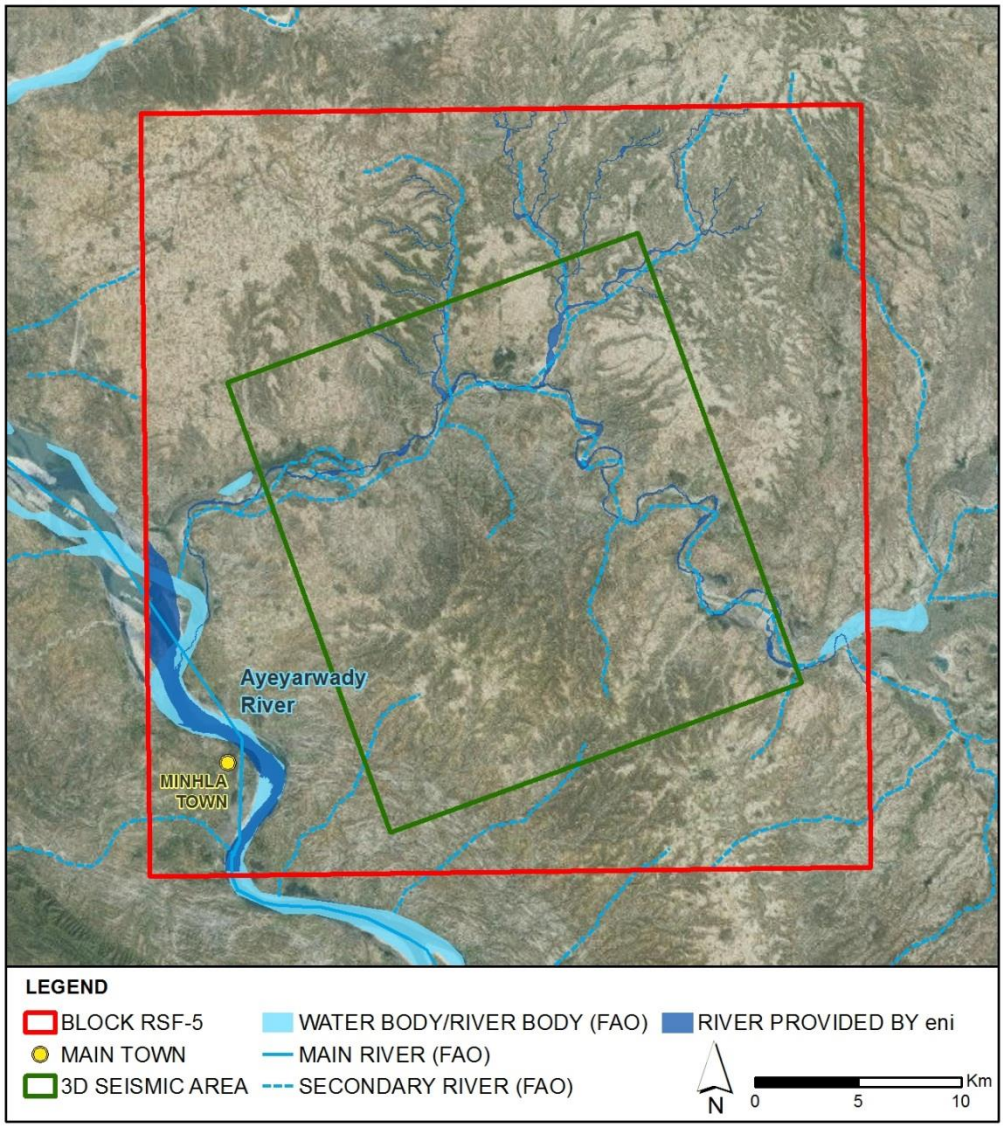
Source: 2D Seismic Survey of Onshore Blocks PSC-G & EP-2 - PTTEP South Asia Limited Environmental, Social and Health Impact Assessment, Chapter 3 Environmental Setting

The water basin characteristics in Myanmar are quite variable depending on the differences in physiographic features. The largest river in Myanmar, Ayeyarwady, crosses the Block RSF-5 in the South East corner. It runs about 2,010 km from its source in the far North to its mouth and is the most significant river system in the Central Lowlands. The orientation of the river system is governed by the general North-South strike of the major geotectonic features.

With a length of about 2,010 km and a catchment area covering 415,700 km^2, the Ayeyarwady is vital in Myanmar. Both its headwater streams, the N' Mai Kha and Mali Kha, rise in the eastern Himalayas. The east (main) tributary, the Nmai Kha, rises in the Langucla Glacier, north of Putao. Both headwater streams join up about 50 km north of Myitkyina. The total average discharge of the Ayeyarwady at Saiktha, before it flows into the delta, is 398,912,000,000 m^3/a (mean value calculated from the discharge measurements made by Gordon 1869-1879, 1885) (Stamp, 1940). The average monthly discharge is about 2,500 m^3/s in February and March to over 30,000 m^3/s in August, near the head of Delta. The total annual load of undissolved material carried by the Ayeyarwady is in the order of 261,000,000 tons. The Ayeyarwady Delta is building up in a seawards direction at a maximum rate of 4.5 km/100 years (Ba Kyi, 1964).

Figure 5.15 shows the river network within the Block RSF-5. The water bodies surface within the Block RSF-5 covers less than 2% of the total area during the dry season; this percentage raise to more than 4% during the wet season.

Figure 5.15 River network Block RSF-5



Source: eni, 2014

Block RSF-5 is subject to flood hazard, especially along the Ayeyarwady river sides. UNEP/GRID- Europe for the Global Assessment Report on Risk Reduction (GAR) estimated the global risk induced by flood hazard and created a flood risk map. Based on this map the flood risk index for Block RSF-5 was designed, identifying 5 classes, from 1 (low) to 5 (extreme), in terms of surface covered by measuring the number of pixel of the map associate to specific flood risk and considering that the pixel dimension is 10 x 10 km) and subsequently in terms of percentage of the overall area of the Block.

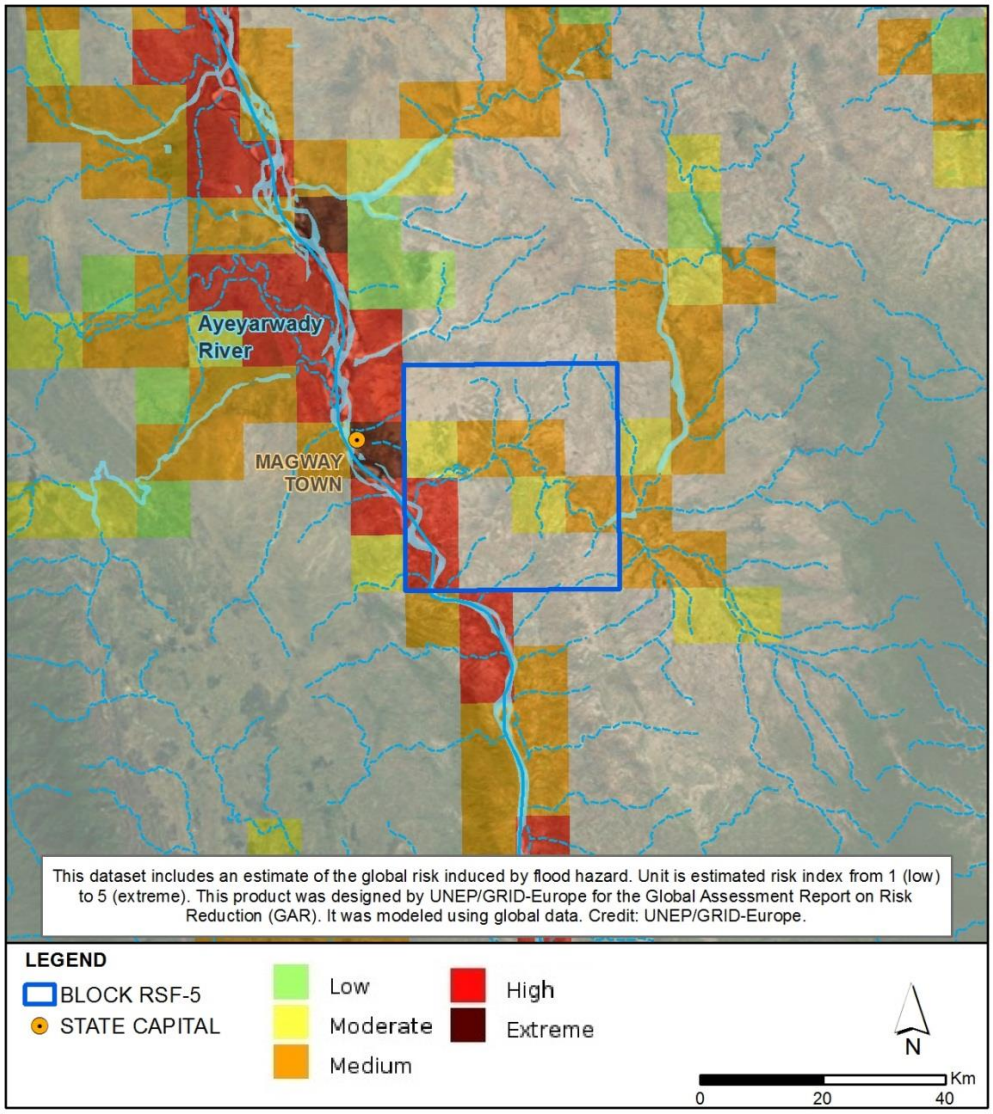
As reported in Table 5.27 and shown in Figure 5.16 along the Ayeyarwady river sides, the flood risk is high. Specific data on flooding seasonality will be collected in a future step of the Project, before the seismic campaign starts.

Table 5.27 Percentage distribution of flood risk index in Block RSF-5

Low	Moderate	Medium	High	Extreme
0.00%	15.50%	23.24%	15.50%	0.00%

Source: AMTE, 2013

Figure 5.16 Flood risk in Block RSF-5



Source: eni, 2014

Freshwater (both surface and ground water) is a precious and essential resource in Myanmar, it is exploited mainly for the following purposes:

- domestic supply;
- irrigation supply.

The Magway region receives water supply from Upper Ayeyarwady and Chindwin watersheds Below a brief description of water usage.

Domestic supply

In Myanmar the estimated water usage for domestic water supply data are received from government departments. For private sector, it is based on data from Ministry of Health. The major source for domestic water supply (especially drinking supply) is groundwater which is about 69% and surface water is only about 31%. Most of the community of the country relies on groundwater source for domestic purpose which is free from bacteria (*Agriculture Sector Review Project -Agricultural Water Resources Study in Myanmar. The Union of Myanmar Ministry of Agriculture and Irrigation by Myanmar Academy of Agriculture, Forestry and Livestock and Fisheries Irrigation Department and Water Resources Utilization Department Yangon, Myanmar, 2003*).

From the 1997-1998 to 2001-2002, the Dry Zone Greening Department had been able to construct 702 ponds, 26 tube wells and 429 check dams to collect rain water; tube wells to tap underground water; and river water pumping stations to pump water from Ayeyarwady river for Sagaing, Magway and Mandalay Divisions. Moreover, a water Quality Monitoring and surveillance program in collaboration with UNICEF was currently concluded; it covered 14 townships in Magway, encompassing the parameters of turbidity, Ec, pH, Fl, Cl, NO_3, Fe, Ca, As, total Coliform and Faecal Coliform. A total of 643 samples in Magway were tested.

Irrigation Water Supply

The Irrigation Department has been implementing the construction of new dams, weirs and flood protection works showing Government's committed priority to agriculture and rural development. Moreover, the storage water of Kyeeohn Kyeewa Dam (located north of Block RSF-5, along the Ayeyarwady River) will contribute to easy availability of drinking water and irrigation water, growing of crops at any seasons, greening environments, protection against flood that occurred in Pakokku Region last year and fire prevention. The hydroelectric power that is generated from the dam can improve the socio-economic status. It was commissioned into service after nine years period. It can benefit 44 village-tracts, 181 villages and 29,992 farmers in Minbu, Pwintbyu and Salin Townships of Magway Region as it can supply water to more than 96,000 acres of farmlands through Mezali diversion dam. It contributes to more growing of summer paddy, monsoon paddy and multiple cropping patterns as well as to the development of the villages.

Water Resources Utilization Department has been implementing pump irrigation water supply program using high discharge capacity pumps since 1995. Table 5.28 presents the tangible achievement of irrigating 50301 acres of croplands from the river pumping stations, recorded by the end of 2001 in Magway region.

Table 5.28 River Pumping Irrigation Projects in Magway region

Electric Pumping		Diesel + Electric Pumping		Diesel Pumping		Total	
Q.ty	Beneficiaries (acres)	Q.ty	Beneficiaries (acres)	Q.ty	Beneficiaries (acres)	Q.ty	Beneficiaries (acres)
15	40286	-	-	31	10015	46	50301

Source: Dry Zone Greening in Central Myanmar, Environmental Management Ministry of Forestry, Myanmar http://www.myanmar-narcotic.net/Ministry/Forest/Environment.html (1999-2012)

Where places where the groundwater potential has existing access for exploitation and worthy for commercial production deep tube wells and irrigation water supply facilities have also been installed. These have benefited 71553 acres of crop lands to date (Table 5.29).

Table 5.29 Groundwater Irrigation Facilities in Magway region

Tube Wells	Cluster Wells	Beneficiaries (Acres)
1289	-	10537

Source: Dry Zone Greening in Central Myanmar, Environmental Management Ministry of Forestry, Myanmar http://www.myanmar-narcotic.net/Ministry/Forest/Environment.html (1999-2012)

5.3.5.2 Surface Water Quality

Methodology for Study

Block RSF-5 surface water quality sampling was conducted in the areas within the proposed seismic area boundary as well as one replicate (Figure 5.17, Table 5.30). Due to the sampling being conducted in the dry season, the landscape surface water was generally restricted to impoundments, seasonal drainage, canals, rivers and stream. In general, either a grab pole or in some cases a bucket was used for collecting water in ponds or flowing water bodies (Direct immersion of meters and dipping sample bottles was used in others. During sample collection, water samples were collected according to the standard procedure and kept in a cooling box with ice.

The Total dissolved solid (TDS), electrical conductivity (EC), Dissolved Oxygen (DO), Temperature and pH value were measured on-site at the sampling stations and again at the laboratory along with numerous other parameters (Table 5.31).

Figure 5.17 Surface Water Sampling Points in RSF-5 Study Area

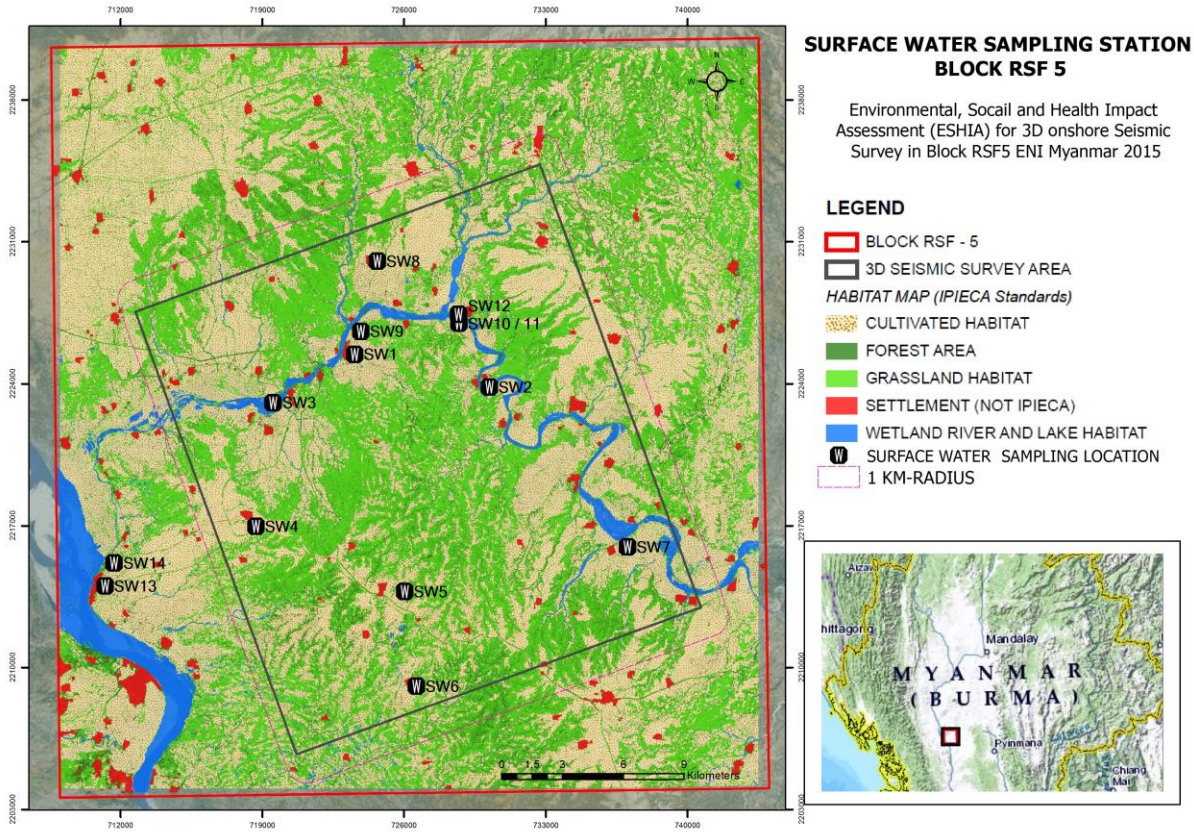


Table 5.30 Surface Water Sampling Locations

ID	Date	Location		Photograph	Note
		North	East		
Surface water					
SW1	11/3/2016	20°06'47.52''	95°08'18.43''		Yin River
SW2	11/3/2016	20°05'52.06''	95°12'06.62''		Yin River
SW3	12/3/2016	20°05'31.62''	95°05'58.92''		Yin River
SW4	12/3/2016	20°02'13.83''	95°05'26.80''		Water Pond
SW5	12/3/2016	20°00'25.92''	95°09'38.03''		Water Pond

ID	Date	Location		Photograph	Note
		North	East		
SW6	12/3/2016	19°57'53.78''	95°09'55.73''		Water Pond
SW7	13/3/2016	20°01'32.65''	95°15'57.65''		Yin River
SW8	14/3/2016	20°09'16.52''	95°08'58.90''		Water Pond
SW9	14/3/2016	20°07'24.28''	95°08'29.19''		Yin River
SW10 / 11	14/3/2016	20°07'35.03''	95°11'15.93''		Yin River

ID	Date	Location		Photograph	Note
		North	East		
SW12	14/3/2016	20°07'49.30''	95°11'15.93''		Chang Ba Stream
SW13	15/3/2016	20°00'40.91''	95°01'09.29''		Ayeyarwaddy River
SW14	15/3/2016	20°01'17.41''	95°01'25.25''		Yin River

Table 5.31 Laboratory Services for Surface Water Samples Collected Provided to Project

Laboratory	Parameters
ALS Hong Kong Laboratory	pH, Temp, Conductivity, Salinity, TDS, TSS, DO, BOD, Total Petroleum Hydrocarbon (TPH including Oil & Grease), Benzene, Toluene, Ethylbenzene, Total Xylenes, Arsenic (As), Barium (Ba), Cadmium (Cd), Copper (Cu), Manganese (Mn), Nickel (Ni), Selenium (Se), Zinc (Zn), Iron (Fe), Total Chromium (Cr), Lead (Pb), Mercury (Hg)

Results

Block RSF-5 lies in Lower Ayeyarwady watershed. The dominant hydrological features in Block RSF-5 are the Ayeyarwady River in the southwest edge of the block and the Yin River which crosses the block and other seasonal / intermittent streams.

There are no standards for surface water quality in Myanmar. In the absence of local standards, surface water quality results were compared against the following international standards (Water Quality Guideline for the Protection of Freshwater Aquatic Life, Canadian Council of Ministers of the Environment).

All parameters were within water quality standards except for pH, TDS and Manganese. pH was above standard for aquatic environments at SW2, SW3,SW4, SW5, SW6, SW9 and SW12. The high pH is due to the sampling being conducted during the dry season. The river, streams and ponds had low water in the locations showing high pH.

Manganese was detected above standard in SW4, SW5 and SW8. There areas were water ponds with slow water volume in highly cultivated areas. Manganese is likely caused by run-off from the agricultural soils in the area. Trace amounts Petroleum hydrocarbons were detected in several of the surface water samples. Petroleum hydrocarbons are most likely caused by human contamination and then concentrated by the low water volumes during the dry season (Table 5.32).

Table 5.32 Summary of Surface Water Quality Results For Block RSF-5 Baseline Survey

Parameter	Unit	Block RSF-5														Standard	
		SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10	SW11	SW12	SW13	SW14	Source	Limits
pH		8.81	9.67	9.53	9.54	9.18	9.60	8.31	8.07	9.06	8.36	-	9.10	7.93	8.45	CA	6.5 to 9.0
Temp	°C	27.4	33.4	26.4	32.4	34.9	30.6	35.1	27.6	28.9	353	-	38.6	27.1	26.8	N/A	-
Conductivity	µS	899	895	909	271	255	219	840	261	893	961	-	784	209	893	CA	1000
Salinity	ppt	430	425	432	128	120	105	398	123	427	461	-	373	101	426	N/A	-
TDS	mg/l	638	631	640	192	180	155	594	185	633	682	-	557	149	636	CA	500*
TSS	mg/l	9	6	8	120	1220	114	87	1410	6	4	<2	42	122	822	N/A	-
DO	mg/l	6.1	6.3	7.1	6.7	10.0	9.4	4.8	2.5	7.6	8.9	-	4.8	6.8	6.5	N/A	
BOD	mg/l	<2	<2	<2	3	56	8	<2	14	<2	<2	<2	<2	<2	<2	N/A	
TPH C6-C9	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	N/A	-
TPH C10-C14	µg/l	<50	<50	<50	<50	251	<50	<50	<50	<50	<50	<50	<50	<50	<50	N/A	-
TPH C15-C28	µg/l	<100	<100	<100	142	1010	269	112	<100	<100	<100	<100	<100	<100	<100	N/A	-
TPH C29-C36	µg/l	<50	<50	<50	64	308	116	57	<50	<50	<50	<50	<50	<50	<50	N/A	-
Benzene	µg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	CA	370
Toluene	µg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	CA	2
Ethylbenzene	µg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	CA	90
Mercury (Hg)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	CA*	3
Arsenic (As)	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	CA	5
Barium (Ba)	µg/l	23	27	22	56	85	15	29	26	24	21	21	21	21	28	N/A	-
Iron (Fe)	µg/l	<50	<50	<50	<50	5640	100	<50	<50	<50	<50	<50	<50	<50	<50	CA	300,000
Cadmium (Cd)	µg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	CA*	5.1
Total Chromium (Cr)	µg/l	3	1	2	1	1	<1	2	<1	2	<1	1	1	<1	2	CA	8.9
Copper (Cu)	µg/l	<1	<1	<1	2	<1	1	2	3	<1	<1	<1	<1	<1	2	CA	700
Lead (Pb)	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	CA	200*
Manganese (Mn)	µg/l	<1	<1	<1	**884**	**2100**	5	1	**252**	<1	<1	1	<1	27	<1	CA	200*
Nickel (Ni)	µg/l	<1	<1	<1	10	10	4	1	15	<1	<1	<1	<1	<1	<1	CA	200*
Selenium (Se)	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	CA*	50
Zinc (Zn)	µg/l	<10	<10	<10	<10	<10	<10	<10	11	<10	<10	<10	<10	<10	<10	CA	30

Remarks: Analytical Methods followed to Standard Methods for the Examination of water and Wastewater, recommended by APHA-AWWA-WEF
CA - Water Quality Guideline for the Protection of Freshwater Aquatic Life, Canadian Council of Ministers of the Environment,
CA* - Water Quality Guideline for the Protection of Agriculture, Canadian Council of Ministers of the Environment

5.3.5.3 Hydrogeology

On the basis of stratigraphy, there are six different types of aquifers in Myanmar, namely Alluvium, Ayeyarwadian, Peguan, Limestone, Igneous (or Volcanic) and Other Minor Aquifers. Quality and quantity of groundwater varies depending on the lithology and depositional environments. Quality and quantity of groundwater varies depending on the lithology and depositional environments.

Block RSF-5 is located in the Ayeyarwady aquifer. Groundwater from Ayeyarwaddy aquifer is generally used for both irrigation and domestic purposes.

The estimated groundwater potential in Myanmar is around 495 km^3, spread across eight principal river basins (Hla Tun Aung, 2005).

The groundwater reserves within Block RSF-5 are included in the Myanmar Central Basin, whose characteristics are summarized below.

A number of potentially good sandstone aquifers, separated by argillaceous aquicludes, exist in the pre- Ayeyarwadian Tertiary sediments. These rocks are exposed along the west side of the Dry Zone (Western Outcrops), so that they form a groundwater recharge area. This zone also receives much precipitation and has considerable surface runoff from the Arakan Yoma. Therefore, good opportunities for groundwater exploration exist in pre- Ayeyarwadian sediments in the Dry Zone west of the Ayeyarwady, particularly where there is only a thin cover of sediments of the Ayeyarwady Group or no cover at all.

In the Dry Zone, the fluviatile sediments of the Ayeyarwady Group attain thickness of more than 2,000 m. The facies changes very rapidly and irregularly in both the lateral and vertical directions from coarse calstic to fine clastic. As a result, the properties of the reservoir rock also vary so that no extensive and continuous aquifers or aquicludes have formed. Consequently, the groundwater regime is not uniform over large areas.

Near-surface groundwater of good quality is encountered locally, but the quantities are small; deeper-lying groundwater in the Ayeyarwady Group is frequently saline. Large quantities of groundwater probably exist in the areas of the groundwater runoff from the Ayeyarwady River and its tributaries, and possibly also in local depressions.

The widespread Pleistocene and Holocene alluvium in the countless former river courses is better source of groundwater than the Ayeyarwady Group. Drilling has revealed that they are frequently more than 80 m thick, consist of clay and more or less argillaceous fine-grained, medium-grained and coarse-grained sands with occasional, gravel beds. Their surface is mostly smooth and flat ("alluvial plains") and almost always covered by fine sandy soil. The pervious clastic sediments predominate; in general, they overlie the less pervious sediments of the Ayeyarwady Group and are partially of entirely surrounded by the latter. This creates a favourable recharge situation: direct infiltration from rainfall (previous soils), groundwater runoff from perennial and seasonal streams, and water inflow from the surrounding less previous sediments of the Ayeyarwady Group.

The south west part of the project Areas is crossed by the Ayeyarwady River.

The United Nations Environment Programme's World Conservation Monitoring Centre lists the Irrawaddy as one of the world's top thirty high priority river basins due to both its support of high biodiversity and high vulnerability to future pressures. The river is home to 79 known fish species and as of 2002 there were four known endemic bird areas in the basin.

The Ayeyarwady River flows from north to south Myanmar. It is the country's largest river and most important commercial waterway. Originating from the confluence of the N'mai and Mali rivers, it flows relatively straight North-South before emptying through the Irrawaddy Delta into the Andaman Sea. Its drainage area of about 255,081 km² covers a large part of Myanmar. As in the past, the river is still as vital today, as a considerable amount of (export) goods and traffic moves by river. Rice is produced in the Irrawaddy Delta, irrigated by water from the river.

5.3.5.4 Groundwater Quality

Methodology for study

Information on local groundwater conditions was collected based on literature review, site-specific sampling tube wells and dug wells at various locations within the Block RSF-5 study area as, well as during interviews with local villagers using groundwater resources.

Groundwater quality sampling was conducted during field surveys at potentially affected community locations within the proposed seismic area. (**Figure 5.18**, **Table 5.33**). The Total dissolved solid (TDS), electrical conductivity (EC) and pH values were measured on-site at the sampling stations and again at the laboratory along with numerous other parameters (**Table 5.34**). During sample collection, groundwater samples were collected according to the standard procedure and kept in a cooling box with ice.

Results of the groundwater quality analysis and the analytical report are summarized in the subsection, which follows.

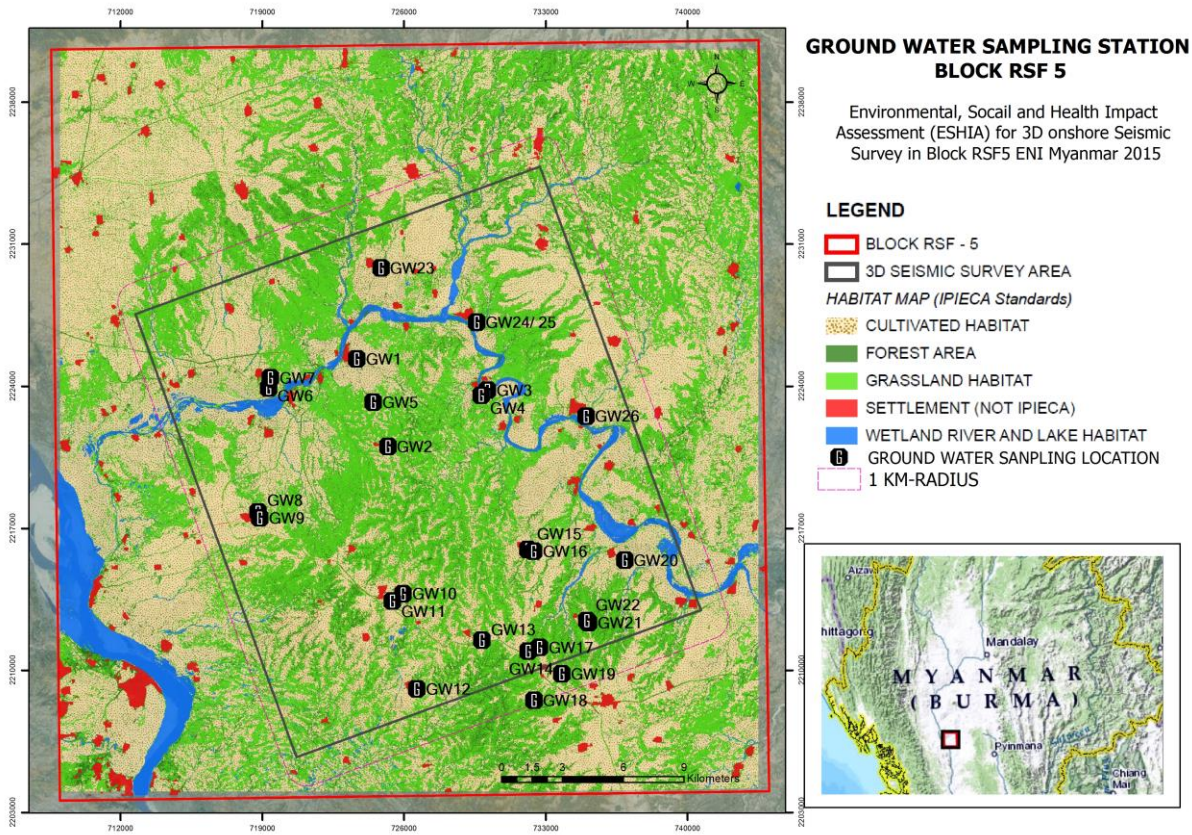


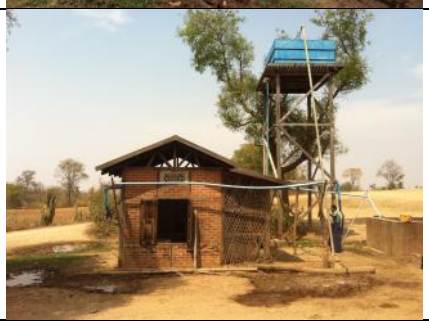
Figure 5.18 Groundwater Sampling Points in Block RSF-5

Table 5.33 Groundwater Sampling Locations

ID	Date	Location		Photograph	Note
		North	East		
Ground Water					
GW1	11/3/2016	20°06'43.99''	95°08'22.00''		Tube Well (220 ft deep with w/l at 25ft)
GW2	11/3/2016	20°04'22.95''	95°09'12.81''		Tube Well (760 ft deep with w/l at 280 ft)
GW3	11/3/2016	20°05'50.94''	95°12'03.35''		Tube Well (45 ft deep with w/l at 18 ft)
GW4	11/3/2016	20°05'42.97''	95°11'52.27''		Dug Well (15 ft with w/l at 6 ft)
GW5	11/3/2016	20°05'34.09''	95°08'48.96''		Tube Well (60 ft deep with w/l at 20 ft)

ID	Date	Location		Photograph	Note
		North	East		
GW6	12/3/2016	20°05'59.14''	95°05'51.36''		Dug Well (15ft deep with w/l at 7 ft)
GW7	12/3/2016	20°06'15.30''	95°05'54.62''		Tube Well (342ft deep with w/l at 183 ft)
GW8	12/3/2016	20°02'40.54''	95°05'30.76''		Dug Well (10ft deep with w/l at 6ft
GW9	12/3/2016	20°02'31.20''	95°05'33.84''		Tube Well (610 ft deep with w/l at 320 ft)
GW10	12/3/2016	20°00'26.62''	95°09'35.63''		Dug Well (8ft deep with w/l at 7.5 ft)

ID	Date	Location		Photograph	Note
		North	East		
GW11	12/3/2016	20°00'15.28''	95°09'17.01''		Tube Well (750 ft deep with w/l at 650 ft)
GW12	12/3/2016	19°57'54.14''	95°09'56.80''		Tube Well (680 ft deep with w/l at 280ft)
GW13	13/3/2016	19°59'10.44''	95°11'48.27''		Tube Well (650 ft deep with w/l at 380ft)
GW14	13/3/2016	19°58'52.04''	95°13'06.50''		Dug Well (10ft deep with w/l at 9.5 ft)
GW15	13/3/2016	20°01'35.05''	95°13'08.25''		Dug Well (18ft deep with w/l at 17.5 ft)

ID	Date	Location		Photograph	Note
		North	East		
GW16	13/3/2016	20°01'31.82''	95°13'18.33''		Tube Well (360 ft deep with w/l at 250 ft)
GW17	13/3/2016	19°58'58.05''	95°13'25.83''		Dug Well (10ft deep with w/l at 9 ft)
GW18	13/3/2016	19°57'33.22''	95°13'15.06''		Dug Well (13ft deep with w/l at 12 ft)
GW19	13/3/2016	19°58'15.18''	95°14'03.20''		Tube Well (500 ft deep with w/l at 400 ft)
GW20	13/3/2016	20°01'15.96''	95°15'52.65''	N/A	Tube Well (70 ft deep with w/l at 20 ft)
GW21	13/3/2016	19°59'36.50''	95°14'49.71''		Dug Well (12ft deep with w/l at 11 ft)

ID	Date	Location		Photograph	Note
		North	East		
GW22	13/3/2016	19°59'39.66''	95°14'46.73''		Tube Well (470 ft deep with w/l at 260 ft)
GW23	14/3/2016	20°09'09.43''	95°09'04.99''		Tube Well (240 ft deep with w/l at 90 ft)
GW24 / 25	14/3/2016	20°07'40.37''	94°11'46.36''		Tube Well (80 ft deep with w/l at 16 ft)
GW26	14/3/2016	20°05'07.46''	94°14'50.02''		Tube Well (150 ft deep with w/l at 65 ft)

Table 5.34 Laboratory Services for Groundwater Sample Analysis Provided to Project

Laboratory	Parameters
ALS Hong Kong Laboratory	pH, Temp, Conductivity, Salinity, TDS, Total Petroleum Hydrocarbon (TPH including Oil & Grease), Benzene, Toulene, Ethylbenzene, Total Xylene, Arsenic (As), Cadmium (Cd), Total Chromium (Cr), Lead (Pb), Nickel (Ni), Mercury (Hg), Selenium (Se), Barium (Ba), Copper (Cu), Zinc (Zn), Iron (Fe), Manganese (Mn)

Results

Groundwater is the principal source of potable domestic water supply in Block RSF-5. Only one groundwater location (GW6) was not used for potable domestic water supply. On the basis of stratigraphy, there are six different types of aquifers in Myanmar, namely Alluvium, Ayeyarwadian, Peguan, Limestone, Igneous (or Volcanic) and Other Minor Aquifers. Block RSF-5 is located in the Ayeyarwady aquifer.

The groundwater depth varied in the project area depending on the aquifers. The groundwater was found in the Block RSF-5 Survey in some areas near the surface from 1.83 m (6 ft) and quite deep in other areas 231.65 m (~760 ft in tube well).

There are no standards for groundwater quality in Myanmar. In the absence of local standards, groundwater quality results were compared against International Water potable water quality standards (National Primary Drinking Water Regulations and National Secondary Drinking Water Regulations, published by the USEPA, May 2009, UK Drinking Water Standards from Water Supply (Water Quality) Regulations 2000, (SI 2000/3184) (as amended) and Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada).

High TDS levels, exceeding the recommended levels for consumption was recorded in the deep tube wells. The high TDS appears to be caused naturally by evaporation, precipitation or rock weathering processes in the aquifers. This would explain why the villagers preferred to consume the groundwater from the shallow wells as all but one (GW6) showed much lower levels of TDS and salinity. Ph was over maximum allowable levels in GW2, GW7, GW10 and GW15. Manganese (Mn) was detected above standards in the GW1, GW3, GW5, GW9, GW13, GW14, GW19, GW20, GW23 and GW24. This correlates with the deeper groundwater aquifers and appears to be caused by natural process. Trace levels of petroleum hydrocarbons below standards were detected in several locations. The cause of the petroleum hydrocarbons is most likely caused by contamination from the well construction, maintenance and use. (Table 5.35)

Table 5.35 Summary of Ground Water Quality Results For RSF-5 Baseline Survey

Parameter	Unit	Block RSF-5													Standards	
		GW1	GW2	GW3	GW4	GW5	GW6*	GW7	GW8	GW9	GW10	GW11	GW12	GW13	Source	Limits
pH	-	8.31	9.80	8.02	8.44	7.92	8.50	8.70	8.28	7.87	8.67	7.86	7.64	7.48	US EPA	6.5-8.5
Temp	°C	30.1	31.2	32.4	28.8	30.0	25.3	29.0	28.4	34.9	25.9	35.2	32.2	33.7	N/A	-
Conductivity	µS	2140	1574	1559	757	869	3820	1088	127.8	1264	170.1	1428	1967	1500	UK	2500 µS
Salinity	ppm	-	777	757	358	414	1940	518	63.8	611	81.7	691	985	731	N/A	-
TDS	ppm	1520	1120	1080	528	617	2700	771	90.5	898	121	1010	1400	1070	US EPA	500
TPH C6-C9	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	CA	1000a
TPH C10-C14	µg/l	<50	79	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50		
TPH C15-C28	µg/l	<100	179	<100	<100	<100	<100	164	146	<100	101	<100	<100	104	CA	1000b
TPH C29-C36	µg/l	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50		
Benzene	µg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	US EPA	5
Toluene	µg/l	13.3	8.4	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	US EPA	1000
Ethylbenzene	µg/l	<2.0	4.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	US EPA	700
Mercury (Hg)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	US EPA	2
Arsenic (As)	µg/l	<10	<10	<10	<10	<10	10	<10	<10	<10	<10	<10	<10	<10	US EPA	10
Barium (Ba)	µg/l	35	2	2	6	31	32	15	<1	8	15	23	22	17	US EPA	2000
Iron (Fe)	µg/l	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	US EPA	300
Cadmium (Cd)	µg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	US EPA	5
Chromium (Cr)	µg/l	1	2	2	2	<1	6	2	6	<1	20	1	4	2	US EPA	100
Copper (Cu)	µg/l	2	<1	1	<1	<1	3	<1	<1	<1	<1	<1	2	<1	US EPA	1300
Lead (Pb)	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	US EPA	15
Manganese (Mn)	µg/l	205	4	104	<1	294	13	41	<1	141	<1	27	27	129	US EPA	50
Nickel (Ni)	µg/l	<1	<1	<1	<1	<1	2	<1	1	<1	2	<1	<1	<1	US EPA	20
Selenium (Se)	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	US EPA	50
Zinc (Zn)	µg/l	27	64	11	<10	47	<10	<10	<10	361	11	57	41	15	US EPA	5000

Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF.

Standard from: USEPA - National Primary Drinking Water Regulations and National Secondary Drinking Water Regulations, published by the USEPA, May 2009.

UK - UK Drinking Water Standards from Water Supply (Water Quality) Regulations 2000, (SI 2000/3184) (as amended).

CA – Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada

Note: [a], [b]: The sum of both fractions must be less than 1000 ug/L

* GW6 was not used for potable use

Table 5.35 Summary of Ground Water Quality Results For RSF-5 Baseline Survey (cont.)

Parameter	Unit	Block RSF-5													Standard	
		GW14	GW15	GW16	GW17	GW18	GW19	GW20	GW21	GW22	GW23	GW24	GW25	GW26	Source	Limits
pH	-	8.44	8.80	7.68	8.95	7.47	7.95	8.05	7.78	7.10	7.36	7.85	-	8.30	US EPA	6.5-8.5
Temp	°C	24.4	25.3	32.8	28.2	26.8	33.6	31.4	26.3	32.5	30.3	31.6	-	31.8	N/A	-
Conductivity	µS	205	277	**2520**	150.5	133.1	1760	1350	114.3	1290	635	1900	-	2250	UK	2500 µS
Salinity	ppt	97.3	130	1260	73.5	65.5	854	654	57.4	622	300	950	-	1120	N/A	-
TDS	ppm	146	194	**1780**	107	94.7	**1240**	**958**	81.6	**912**	450	**1350**	-	**1590**	US EPA	500
TPH C6-C9	µg/l	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	CA	1000[a]
TPH C10-C14	µg/l	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50		
TPH C15-C28	µg/l	203	150	<100	142	<100	<100	<100	120	<100	<100	<100	119	<100	CA	1000[b]
TPH C29-C36	µg/l	59	<50	<50	55	<50	<50	<50	101	<50	<50	54	67	<50		
Benzene	µg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	US EPA	5
Toluene	µg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	US EPA	1000
Ethylbenzene	µg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	US EPA	700
Mercury (Hg)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	US EPA	2
Arsenic (As)	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	US EPA	10
Barium (Ba)	µg/l	4	13	15	4	4	162	28	2	50	5	15	14	3	US EPA	2000
Iron (Fe)	µg/l	90	<50	<50	310	<50	<50	<50	<50	<50	<50	<50	<50	<50	US EPA	300
Cadmium (Cd)	µg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	US EPA	5
Chromium (Cr)	µg/l	2	3	18	<1	17	6	5	18	2	1	4	3	7	US EPA	100
Copper (Cu)	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	US EPA	1300
Lead (Pb)	µg/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	US EPA	15
Manganese (Mn)	µg/l	**122**	<1	7	4	4	**62**	**136**	<1	19	**108**	**170**	<1	<1	US EPA	50
Nickel (Ni)	µg/l	2	<1	<1	2	<1	<1	<1	1	<1	<1	<1	<1	<1	US EPA	20
Selenium (Se)	µg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	US EPA	50
Zinc (Zn)	µg/l	<10	<10	26	<10	<10	61	<10	<10	15	<10	<10	<10	<10	US EPA	5000

Analytical Methods followed to Standard Methods for the Examination of Water and Wastewater, recommended by APHA-AWWA-WEF.

Standard from: USEPA - National Primary Drinking Water Regulations and National Secondary Drinking Water Regulations, published by the USEPA, May 2009.
UK - UK Drinking Water Standards from Water Supply (Water Quality) Regulations 2000, (SI 2000/3184) (as amended).
CA – Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada

Note: [a], [b]: The sum of both fractions must be less than 1000 ug/L

5.3.6 Land cover

The Study Area, as shown in Map 1 in Annex 2, includes mostly agricultural areas (50% of land in the Block RSF-5), bare soils (35% of land) and vegetation areas (8% of land). Urban areas are limited to 2% and water bodies amount to about 4%. This information is derived from the *WorldView-2* (see Table 5.36).

Table 5.36 Land cover Typologies within the Block RSF-5

Land Cover Category	Area (ha)	(%)
Bare soil	44.244	35.12
Vegetation	10.574	8.39
Building	0.003	0.00
Roads	0.202	0.16
Urban Area	1.537	1.22
Urban Vegetation	0.831	0.66
Crop Lands	61.089	48.49
Green Land	2.300	1.83
Island river	0.114	0.09
River Gravel and Rock White	3.122	2.48
Rivers	1.948	1.55
Water bodies	0.0129	0.01
Total	125.980	100

Source: Medium Resolution Multispectral Images

5.3.7 Soil & Subsoil

The aim of this Chapter is to provide an exhaustive characterization of the soil and subsoil status of the Block RSF-5 related to:

- soil quality;
- geological and geomorphological conditions;
- pedological profile;
- seismicity and volcanism risks;
- subsidence risks;
- agriculture.

Most of the information reported in this Chapter are secondary data gathered at national and regional level from literature and previous studies, as listed below:

- *2D Seismic Survey of Onshore Blocks PSC-G & EP-2 - PTTEP South Asia Limited Environmental, Social and Health Impact Assessment*, Chapter 3 Environmental Setting;
- *Environmental Impact Assessment - Myanmar Section of Myanmar –China Gas Pipeline Project*, Chapter 7 Environmental Baseline; CNPC and IEM;

- *Soil types and characteristics of Myanmar* - The Government of The Union of Myanmar Ministry of Agriculture and Irrigation Myanmar Agriculture Service Land Use Division, 2002;
- *Report on Regional Geology of Myanmar*. Department of geological Engineering faculty of Engineering Gadjah Mada University, April 2010.

5.3.7.1 Soil quality

Methodology for Study

Interpretation of distribution of soil types in Block RSF-5 was based on internationally recognized soil maps and a limited field sampling program focusing on primarily agricultural soils within the study area.

Soil samples were collected from drill-holes dug by a hand-auger drill. Soil sampling points are shown in Figure 5.19. The sampling locations in Block RSF-5 are shown in Table 5.37.

Each hand augured hole was dug to approximately 15 cm depth. Samples were packed in double-zipped plastic bags and sent to an accredited laboratory for characterization (Table 5.38). Parameters tested included basic soil chemistry as well as hydrocarbons and metals**.** During sample collection, soil samples were collected according to the standard procedure and kept in a cooling box at -4°C.

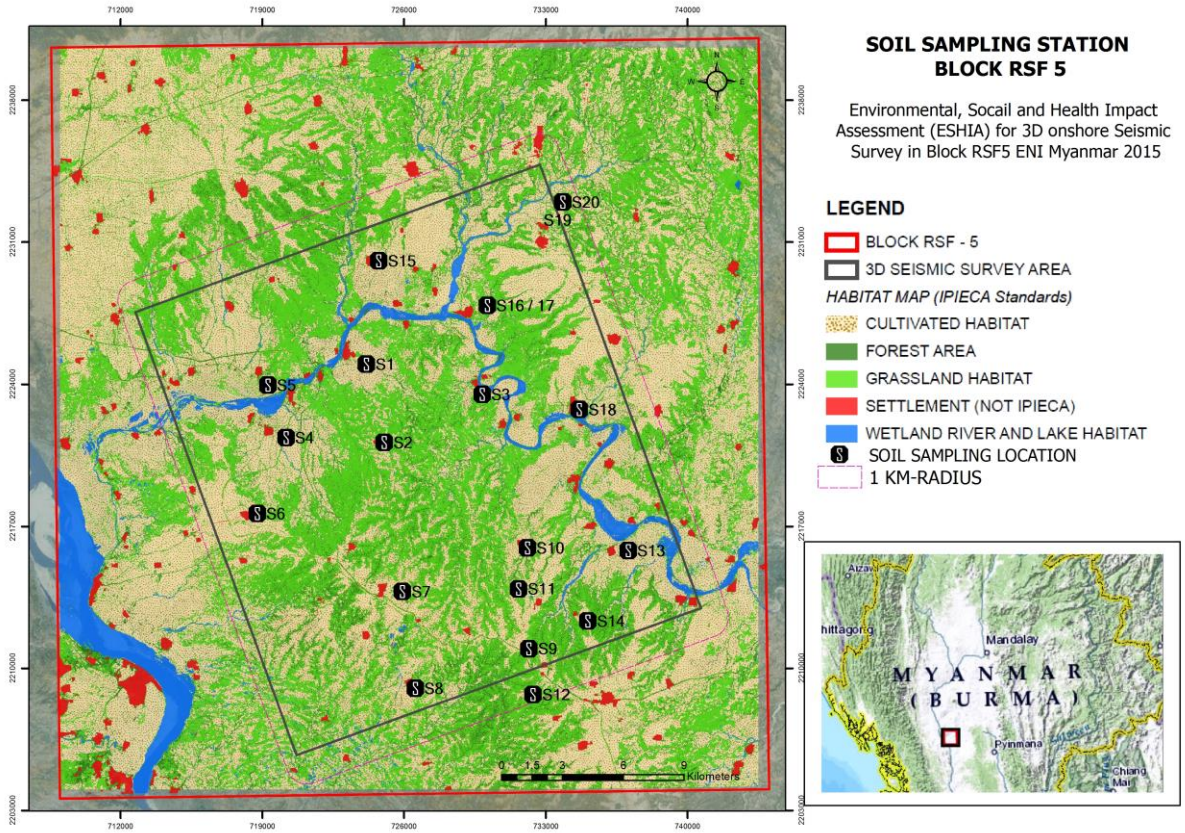


Figure 5.19 Soil Sample Points in Block RSF-5 Study Area

Table 5.37 Soil Sample Locations

ID	Date	Location		Photograph	Note
		North	East		
Soil					
S1	11/3/2016	20°06'32.00''	95°08'38.25''		Ground nut field
S2	11/3/2016	29°04'26.09''	95°09'06.75''		Ground nut field
S3	11/3/2016	20°05'41.31''	95°11'53.96''		Ground nut and sorghum field
S4	11/3/2016	20°04'36.22''	95°06'19.97''		Ground nut and sorghum field

ID	Date	Location		Photograph	Note
		North	East		
S5	12/3/2016	20°06'00.52"	95°05'50.19''		Ground nut and sorghum field
S6	12/3/2016	20°02'34.79"	95°05'29.31''		Ground nut and sorghum field
S7	12/3/2016	20°00'27.09"	95°09'34.36"		Ground nut and sorghum field
S8	12/3/2016	19°57'51.96"	95°09'54.11"		Ground nut field

ID	Date	Location		Photograph	Note
		North	East		
S9	13/3/2016	19°58'52.89"	95°13'07.90"		Ground nut and sesame and sorghum field
S10	13/3/2016	20°01'34.17"	95°13'07.55"		Ground nut and sesame field
S11	13/3/2016	20°00'28.86"	95°12'51.82"		Srub land / Bush
S12	13/3/2016	19°57'39.41"	95°13'13.93"		Ground nut and sesame field

ID	Date	Location		Photograph	Note
		North	East		
S13	13/3/2016	20°01'27.77"	95°15'58.46"		Rice paddy
S14	13/3/2016	19°59'35.71"	95°14'48.57"		Ground nut and sesame field
S15	14/3/2016	20°09'17.46"	95°09'01.43"		Ground nut and sesame field
S16 / 17	14/3/2016	20°08'03.86"	95°12'04.90"		Ground nut and sesame field

ID	Date	Location		Photograph	Note
		North	East		
S18	14/3/2016	20°05'14.85"	95°14'38.86"		Ground nut and sesame field
S19	14/3/2016	20°10'47.52"	95°14'15.26"		Ground nut and sesame field
S20	14/3/2016	20°10'47.66"	95°14'15.26"		Marginal Forest / Srub Land

Table 5.38 Laboratory Services For Soils Analysis Provided to Project

Laboratory	Parameters
ALS Hong Kong Laboratory	pH, ECe, Moisture Content, Soil Texture & Gradation, Total Petroleum Hydrocarbon (TPH including Oil & Grease), Benzene, Toluene, Ethylbenzene, Total Xylenes, Arsenic (As), Barium (Ba), Cadmium (Cd), Copper (Cu), Manganese (Mn), Nickel (Ni), Selenium (Se), Zinc (Zn), Iron (Fe), Chromium (Cr), Lead (Pb), Mercury (Hg)

Results

Soil pH ranged from 5.3 to 9.2 with locations (S1, S2, S5, S11, S12, S13, S19 and S20) outside the standard. All soil samples were free of hydrocarbon contamination. There are no standards for soil quality in Myanmar. In the absence of local standards, soil quality results were compared against the following internationally recognized Canadian environmental quality guidelines (Canadian Council of Ministers of the Environment (2007), Canadian Environmental Quality Guidelines (1999) and Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, 2008).

With the exception of Arsenic (As), Nickel (Ni) and Chromium (Cr) metals data shows that all values are below standards for agricultural purposes. Nickel (Ni) was found above standards for agricultural use at locations S1, S11 and S13. Soil location S13 had Arsenic (As), Nickel (Ni) and Chromium (Cr) metals above standards for agriculture use. This area was a flooded rice paddy and may have become contaminated by the accumulation of heavy metals and metalloids through land application of fertilizers, animal manures, sewage sludge, pesticides, wastewater irrigation, or atmospheric deposition.[1] (Table 5.39)

[1] S. Khan, Q. Cao, Y. M. Zheng, Y. Z. Huang, and Y. G. Zhu, "Health risks of heavy metals in contaminated soils and food crops irrigated with wastewater in Beijing, China," Environmental Pollution, vol. 152, no. 3, pp. 686–692, 2008.

Table 5.39 Summary of Significant Soil Quality Results from Block RSF-5 Field Survey

Parameter	Unit	Block RSF-5										Standard*	
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	Source	Limit
pH	-	**8.7**	**8.9**	7.6	7.4	8.6	6.8	6.5	7.2	6.4	7	CA	6 to 8
ECe	µS/cm	122	114	38	25	120	34	26	25	20	38	CA	2000
Moisture Content	%	5.2	2.2	1	0.7	0.6	0.5	0.3	0.4	2.7	0.5	N/A	-
Soil Texture	-	Sandy SILT/CLAY	Gravelly, very clayey, very silty SAND	Silty, clayey SAND	Clayey,silty SAND	Slightly gravely, clayey, silty SAND	Clayey, silty SAND	Slightly clayey, silty SAND	Silty, clayey SAND,	Silty, clayey SAND	Clayey,silty SAND	N/A	c
% gravel	%	0	7	0	0	4	0	0	0	0	0	N/A	-
% sand	%	48	58	75	86	76	88	89	89	86	88	N/A	-
% silt	%	34	19	12	9	11	7	7	5	6	6	N/A	-
% clay	%	18	16	13	5	9	5	4	6	8	6	N/A	-
Chloride	mg/kg	100	72	106	60	90	65	70	140	154	120	N/A	-
TPH C6-C9	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	CCME	30
TPH C10-C14	mg/kg	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	CCME	150
TPH C15-C28	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	CCME	300
TPH C29-C36	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	CCME	2800
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	CA*	0.24
Toluene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	CA	0.37
Ethylbenzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	CA*	0.28
Iron (Fe)	mg/kg	29000	18500	12700	9790	11900	3970	4760	5430	5340	5430	N/A	-
Mercury (Hg)	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	CA	6.6
Arsenic (As)	mg/kg	5	12	3	3	4	1	1	1	1	<1	CA	12
Barium (Ba)	mg/kg	31	64	36	14	36	15	27	11	22	24	CA	750
Cadmium (Cd)	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	CA	1.4
Chromium (Cr)	mg/kg	62	42	28	19	23	11	9	10	11	12	CA	64
Copper (Cu)	mg/kg	19	7	4	4	5	2	2	2	2	2	CA	63
Lead (Pb)	mg/kg	9	6	4	4	4	2	3	2	3	2	CA	70
Manganese (Mn)	mg/kg	623	561	371	437	535	448	486	211	522	247	N/A	-
Nickel (Ni)	mg/kg	**84**	44	31	26	23	8	12	5	12	11	CA	50
Selenium (Se)	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	CA	1
Zinc (Zn)	mg/kg	55	23	19	18	20	8	8	6	8	9	CA	200

Remarks:
CA -Standard for Coarse Grained Agricultural Soil from Canadian Council of Ministers of the Environment. 2007. Canadian soil quality guidelines for the protection of environmental and human health: 2Summary tables. Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.
CCME -Canadian Council of Ministers of the Environment, CANADA-WIDE STANDARDS for PETROLEUM HYDROCARBONS (PHC) IN SOIL, 2008
CA* - Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada

Table 5.39 Summary of Significant Soil Quality Results from Block RSF-5 Field Survey (Cont.)

Parameter	Unit	Block RSF-5										Standard	
		S11	Source	S13	S14	S15	S16	S17	S18	S19	S20	Source	Limit
pH	-	**8.7**	5.3	**9.2**	7.2	6.4	6	6.2	7.3	5.9	**8.8**	CA	6 to 8
ECe	µS/cm	137	12	572	28	19	17	29	32	11	87	CA	2000
Moisture Content	%	2	4.7	29	1.6	0.5	1.9	0.6	12.7	0.9	2	N/A	-
Soil Texture	-	Gravelly, clayey, very silty SAND	Clayey,silty SAND	Slightly sandy SILT/CLAY	Slightly clayey, silty SAND	Slightly clayey, silty SAND	Silty, clayey SAND	Clayey,silty SAND	Clayey,silty SAND	Slightly gravelly, silty, clayey SAND	Silty, clayey, gravelly SAND	N/A	c
% gravel	%	10	0	0	0	0	0	0	0	2	13	N/A	-
% sand	%	58	88	5	88	91	80	87	86	82	76	N/A	-
% silt	%	19	7	40	8	5	9	8	8	7	5	N/A	-
% clay	%	13	5	55	4	4	11	5	6	9	6	N/A	-
Chloride	-	112	152	479	147	35	153	80	149	106	<10	N/A	-
TPH C6-C9	mg/kg	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	CCME	30
TPH C10-C14	mg/kg	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	CCME	150
TPH C15-C28	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	CCME	300
TPH C29-C36	mg/kg	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	CCME	2800
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	CA*	0.24
Toluene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	CA	0.37
Ethylbenzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	CA*	0.28
Iron (Fe)	mg/kg	21700	4380	39100	4300	3470	3320	3310	3920	6910	13100	N/A	-
Mercury (Hg)	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	CA	6.6
Arsenic (As)	mg/kg	4	1	**19**	2	<1	<1	<1	<1	1	7	CA	12
Barium (Ba)	mg/kg	31	12	59	11	22	11	12	18	18	16	CA	750
Cadmium (Cd)	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	CA	1.4
Chromium (Cr)	mg/kg	47	9	**77**	11	9	22	20	8	17	30	CA	64
Copper (Cu)	mg/kg	12	1	20	2	1	2	2	2	2	4	CA	63
Lead (Pb)	mg/kg	6	3	14	2	2	2	2	3	3	4	CA	70
Manganese (Mn)	mg/kg	456	312	1200	280	487	188	193	319	212	455	N/A	-
Nickel (Ni)	mg/kg	**61**	8	**88**	6	13	4	4	7	13	26	CA	50
Selenium (Se)	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	CA	1
Zinc (Zn)	mg/kg	31	5	62	6	9	5	4	8	9	16	CA	200

Remarks: CA -Standard for Coarse Grained Agricultural Soil from Canadian Council of Ministers of the Environment. 2007. Canadian soil quality guidelines for the protection of environmental and human health: 2Summary tables. Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.
CCME -Canadian Council of Ministers of the Environment, CANADA-WIDE STANDARDS for PETROLEUM HYDROCARBONS (PHC) IN SOIL, 2008
CA* - Ontario Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada

5.3.7.2 Geology & Geomorphology

Geomorphologically, Myanmar can be divided into four regions which are north-south trending linear belts following the major structural trends of respective underlying rock units. These are, namely from west to east: Rakhine Coastal Plain; Western Ranges; Central Lowlands; and Eastern Highlands.

As mentioned above, Block RSF-5 is located in the Central Lowlands, that is a relatively low-lying terrain drained by the Ayewarwady River. It is characterized by a fertile alluvial plain, intermittently cropped out by the mountain range and hills running in North South direction and also enhanced by Mount Popa, a dormant volcano in its central part. A large active fault, the Sagaing Fault (Win Swe, 1981) is passing through the eastern margin of this province.

As shown in Figure 5.20, Block RSF-5 is characterized by the following three geological units:

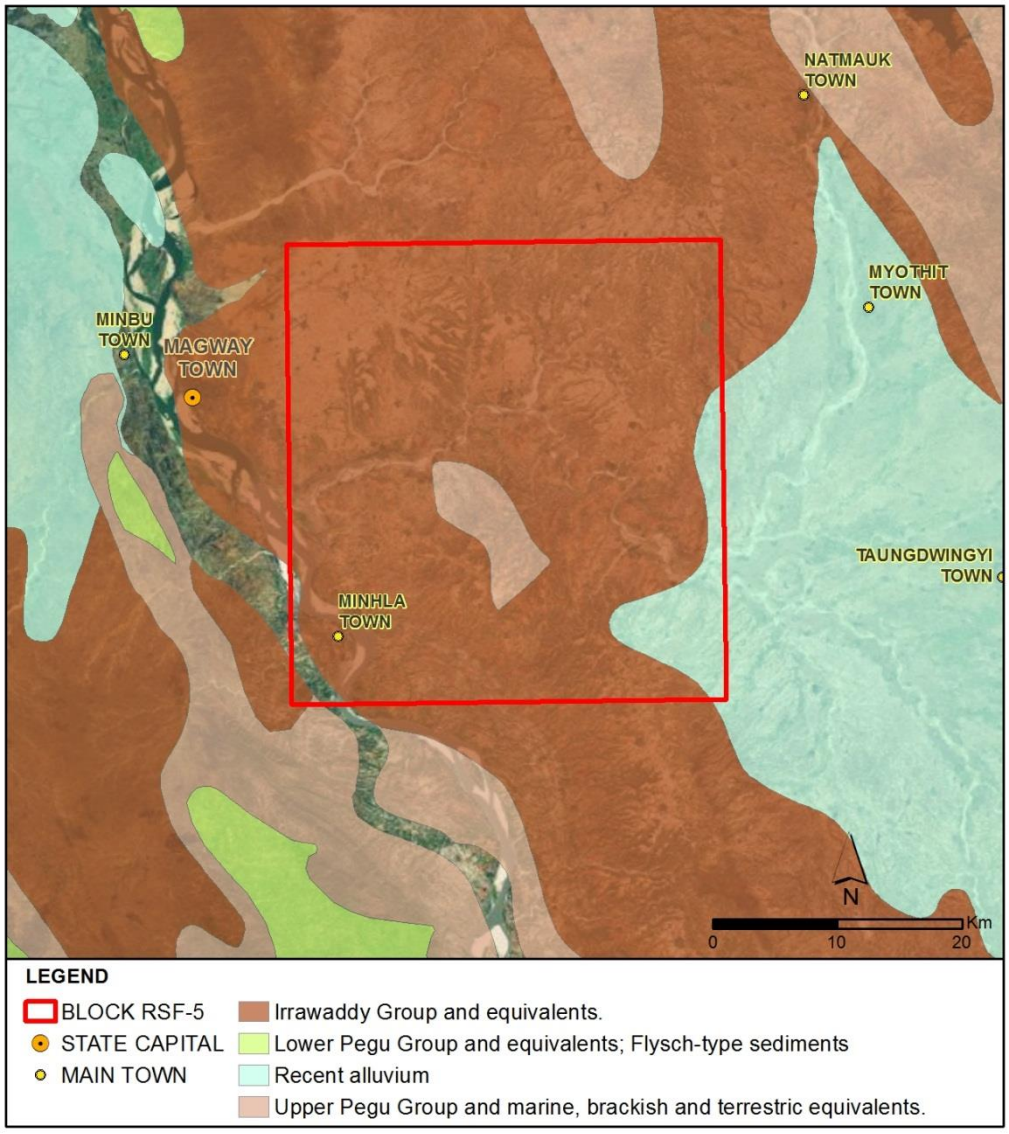
- Irrawaddy Group and equivalents;
- Upper Pegu Group and marine, brackish and terrestric equivalents;
- Recent alluvium.

The Pegu Group and the Irrawaddy Group form a thick sequence of alternating successions of sandstone and shale/mudstone formations. The Pegu Group consists of six alternating sand- and shale/clay-dominated formations and the Irrawaddy Formation covering the rocks of Pegu Group contains essentially thick bedded to massive, loose sandstone and conglomerates with subordinate clayey silt and clays.

Terrace deposits consisting of silty soil and gravel beds commonly occur nearby the banks the Ayeyarwady River.

Recent alluvium unit is characterized by sediments that have deposited side by side since the beginning of Holocene to form the present landscape of Myanmar.

Figure 5.20 Geologic Map of Study Area



Source: eni, 2014

In Magway, because of the sandy topsoil there is also a high level of erosion. The susceptibility of the soil to erosion is compounded by the high level of rainfall occurring over short periods. Wind erosion is a particularly severe problem while sheet and gully erosion are largely confined to wasteland areas. Soil erosion and land degradation are the two components responsible for declining production potential.

At the end of the seismic survey, a site-specific geological and geomorphological characterization of the Study Area will be provided.

Altitude

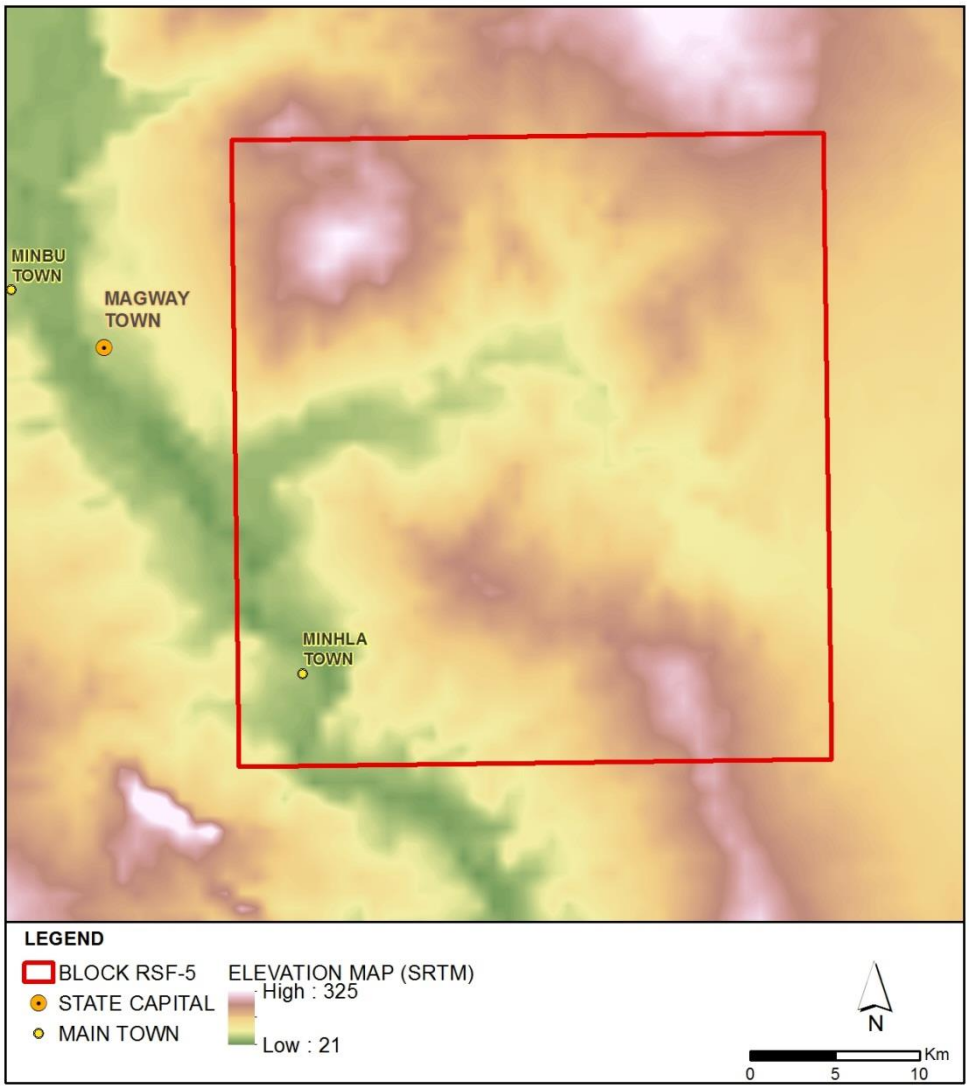
Altitude information in the Study Area was derived by Shuttle Radar Topography Mission (SRTM) elevation data, presented in the Digital agricultural Atlas of the Union of Myanmar.

In compliance with the classification reported in MIMU 2012d (Myanmar Information Management Unit), 5 classes of altitude are identified:

- <250 m s.l.m.;
- 251-500 m s.l.m.;
- 1001-1500 m s.l.m.;
- 501-750 m s.l.m.; and
- 751-1000 m s.l.m.

Therefore, data from Atlas database was elaborated and organized in the 5 classes over identified, leading to define the altitude map in Figure 5.21. The percentage distribution of each class in Block RSF-5 is reported in the Table 5.40.

Figure 5.21 Altitude map of the Block RSF-5



Source: eni, 2014

Table 5.40 Percentage distribution of altitude classes in Block RSF-5

<250 m a.s.l.	*251-500 m a.s.l*	*501-750 m a.s.l.*	*751-1000 m a.s.l*	*1001-1500 m a.s.l*
99.75%	0.25%	0%	0%	0%

As reported in Table 5.40, almost the whole Block RSF-5 is located in an area less high than 250 m a.s.l.

Land Slope

The information of slope in the Study Area was derived by Shuttle Radar Topography Mission (SRTM) elevation data, similarly to altitude. This elevation data was elaborated by ArcGIS Spatial Analyst in manner to calculate the slope data.

Data elaborated by ArcGIS Spatial Analyst from Atlas database was elaborated and organized in 5 classes (Table 5.41*)*, proposed by the Soil Conservation Service.

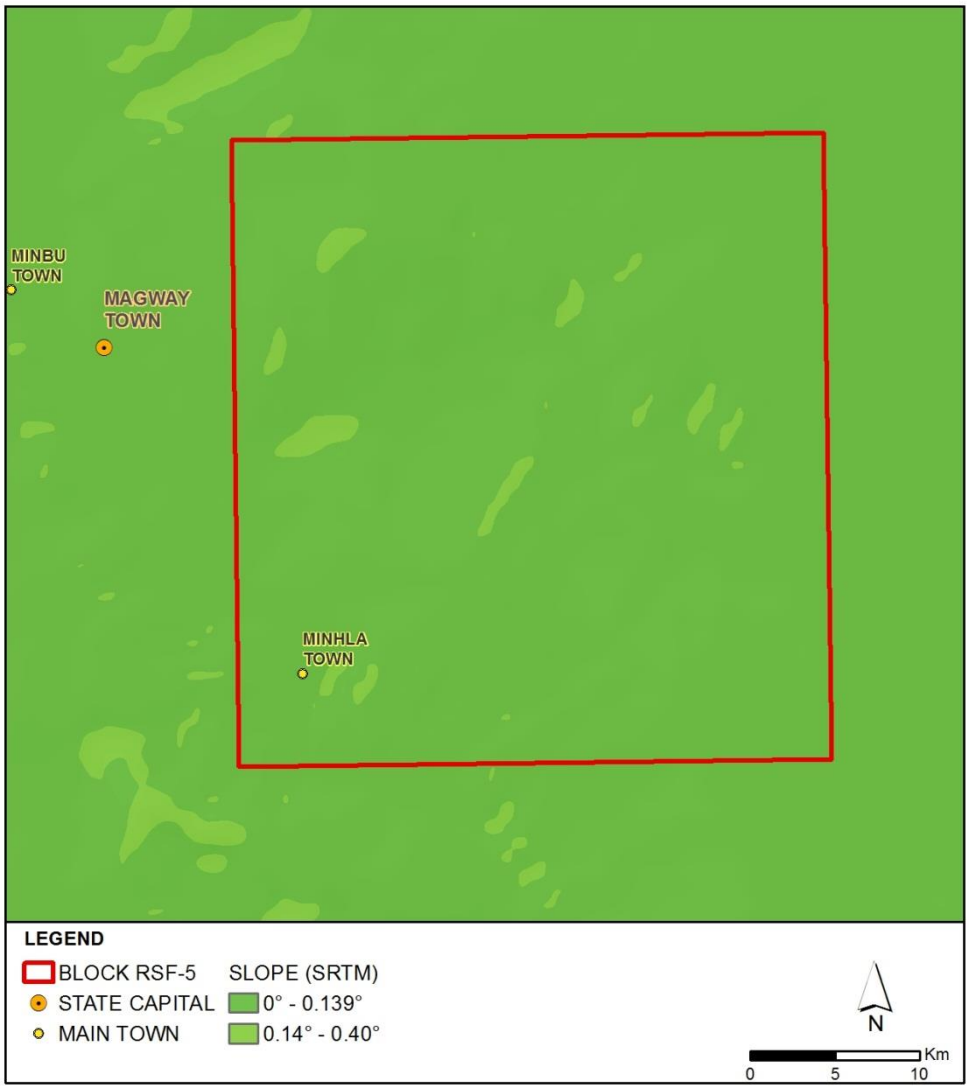
Table 5.41 Classification of degree of slope

Degree of slope %	Degree of slope °	Development Potential
0% to 3%	0° - 1.7°	Generally suitable for all development and uses
3% to 8%	1.7° - 4.8°	Suitable for medium density residential development, agriculture, industrial and institutional uses
8% to 15%	4.8° - 8.5°	Suitable for moderate to low-density residential development, but great care should be exercised in the location of any commercial, industrial or institutional uses
15% to 25%	8.5° - 14°	Only suitable for low-density residential, limited agricultural and recreational uses
Over 25%	> 14°	Only used for open space and certain recreational uses

Source: Soil Surveys of Lehigh Valley PlanningCommission 2008

Data elaborated by ArcGIS Spatial Analyst from Atlas database was elaborated and organized in the 5 classes over identified, leading to the map shown in Figure 5.22.

Figure 5.22 Slope map in the Block RSF-5



Source: eni, 2014

As reported in Figure 5.22, almost the whole Block RSF-5 is located in an area with a slope degree included between 0° and 0.40°.

5.3.7.3 Pedology

The land use division of Myanmar Agricultural Service (2002) takes the responsibility of making soil surveys, soil maps and coordinates the research activities with related agencies for introduction of soil conservation and land improvement practices.

Currently they are not using the FAO soil classification system, but still the Russian model.

The soil classification system was modified in 1970 by Land Use Division and according to the modern classification, there are 24 main soil types being recognized.

The characteristics of these soils are determined upon:

- the physical and mineral composition of the parent material;
- the relief (physical features);
- the climate under which the soil material has been developed;
- the vegetation.

Soil classification has generally been made on the basis of the distribution of the important land resources for agriculture.

Soil characteristics in Block RSF-5 are classified as (Figure 5.23):

- Light Forest Soils (Cinnamon) Nitosol;
- Meadow Soils (Gleysol) and Meadow Alluvial Soil (Gleysol Fluvic);
- Red Brown Savanna Soils (Luvisol) and Dark Compact Soils (Vertisol).

Light Forest Soil (Cinnamon) Nitosol

These soils mostly occur on the very gently sloping alluvial-deluvial under mountainous plains in the Dry zone area. The physical properties of these soils are very favourable and in spite of being sandy they are pervious and not heavy to work. They generally have good fertility which is connected with their position in the under mountainous plains, and there is a permanent supply of nutrients from the surrounding mountains by the surface run-off. These soils are suitable for the cultivation of Yacrops (dry cropping on uplands).

Meadow Soils (Gleysol) and Meadow Alluvial Soil (Gleysol Fluvic)

The meadow soils or paddy soils are widely occurring in the different parts of Myanmar in river plains, delta and low coastal plains and valleys. All types of Meadow Soils have thick solum and are mostly having clayey texture. They are most suitable for paddy cultivation.

The Meadow soils of the Dry zone in the upper Myanmar have the characteristic light colors. There are Meadow soils with neutral reaction, whereas, some have the alkaline reaction. The Meadow Carbonate soils can also be found in that region. Although they are deficient in plant nutrients.

Meadow Alluvial soils (fluvic Gleysols) can be found in the flood plains. They have the texture of silty clay loam and they can be utilized for groundnut, sesame, sunflower, jute, ugarcane and vegetables in addition to rice cultivation. They have the neutral soil reaction and are rich in available plant nutrients. Meadow Gley soils (Gleysol) occurs in the regions of lower depressions where the lands are inundated for more than 6 months in a year. The texture of these soils are clayey to clay and usually having very strong acid reaction, and contain large amount of iron. Moreover, the soils with long periods of moisture content may contain large amount of aluminium and soluble iron, sulphur and manganese by chemical process and can be toxic to plants. The humus content is high and usually deficient in phosphorus and potassium. Rice and jute can be grown on these soils after the floods recede.

Red Brown Savanna Soils (Luvisol)

These soils are mostly found in the undulating relief of the hill slopes and low uplands. The soils are sandy and usually well drained. The soil reaction is about neutral in the top soil and neutral or slightly alkaline in the subsoil (pH ranges from 7.0 to 8.0). The soil contains a

certain amount of lime and is rich in calcium and magnesium. The soils are low in other nutrients except potassium.

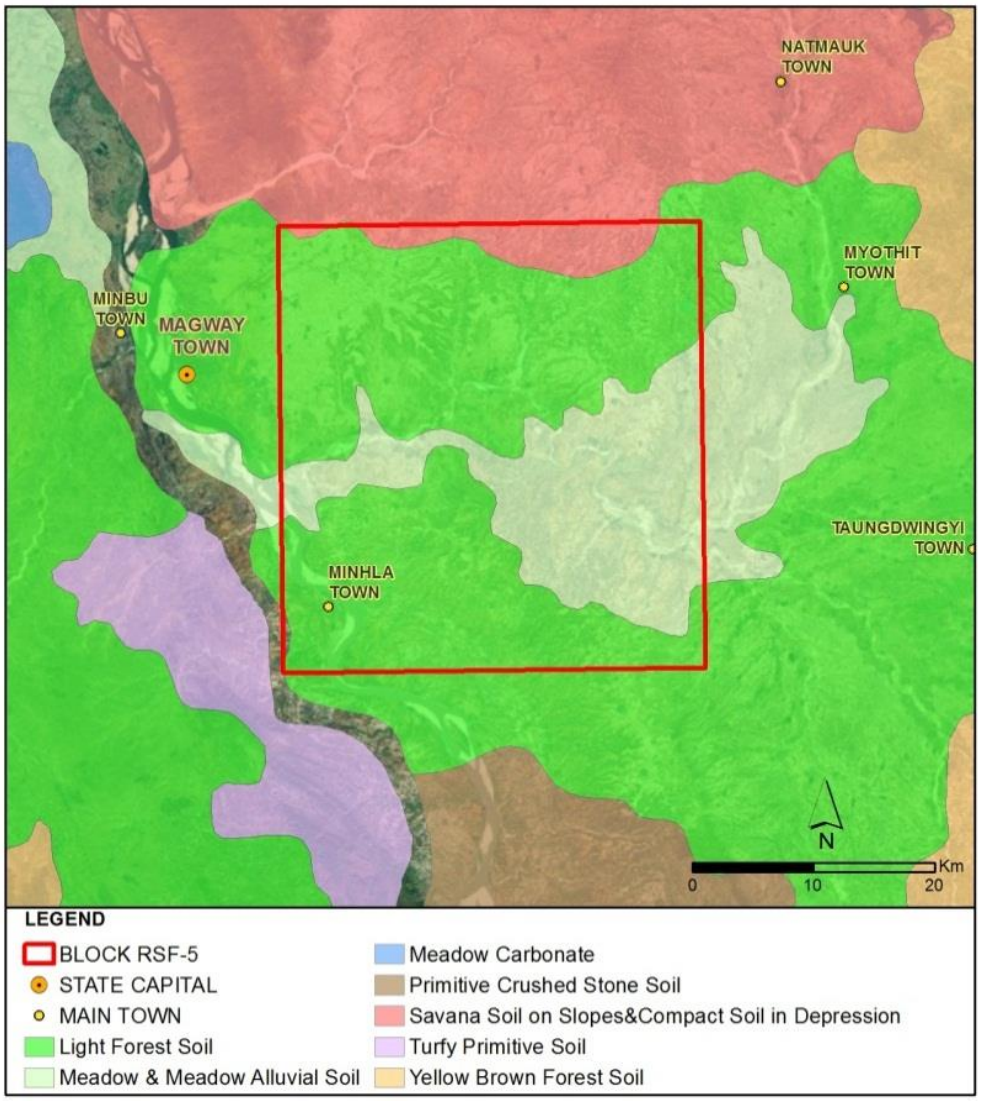
These soils are the most important land resources of the Dry zone area. Most of the areas are ploughed and cultivated. However, large areas have been in great danger of soil degradation at present as a result of strong erosion. Nearly the whole area of these soils has been severely affected by gully, sheet or wind erosion as a result of continuous cropping without soil amelioration for many years. Being the important soils for the variety of cash crops they should be treated with green manure and organic manure together with nitrogen and phosphate fertilizers. Having paid great attention on systematic agricultural practices and soil erosion control measures such as plantation of windbreaks should be carried out on these soils.

Dark Compact Soils (Vertisol)

The Dark Compact soils occur in the Dry zone in the level plains of Sagaing, Mandalay and Magway divisions. They occur on the lowlands near the rivers and broad depression in the areas of Red Brown Savanna Soils. They are very important soils for agriculture in the Dry zone area next to Red Brown Savanna Soils. The soils are deep and mostly composed of clayey materials. Located on the level plains, they are the best soils for irrigated fanning. Due to high content of clay, it is very difficult to work when it is too dry or having excessive moisture.

The humus content of these soils are very low and in the dry state they are deeply cracked, but after rains they turn into mud and very sticky. The infiltration in these soils is also very poor so care should be taken for saline and alkali problems. The soil is alkaline and having pH ranging from 7 to 9 so they are strongly calcareous. With the exception of potassium, they are deficient in nitrogen and phosphorus. The soils contain a considerable amount of calcium and magnesium. The soils can be used for Yacrops in addition to rice under irrigation.

Figure 5.23 Soil Types in Myanmar



Source: eni, 2014

5.3.7.4 Seismicity and Volcanism

Earthquakes

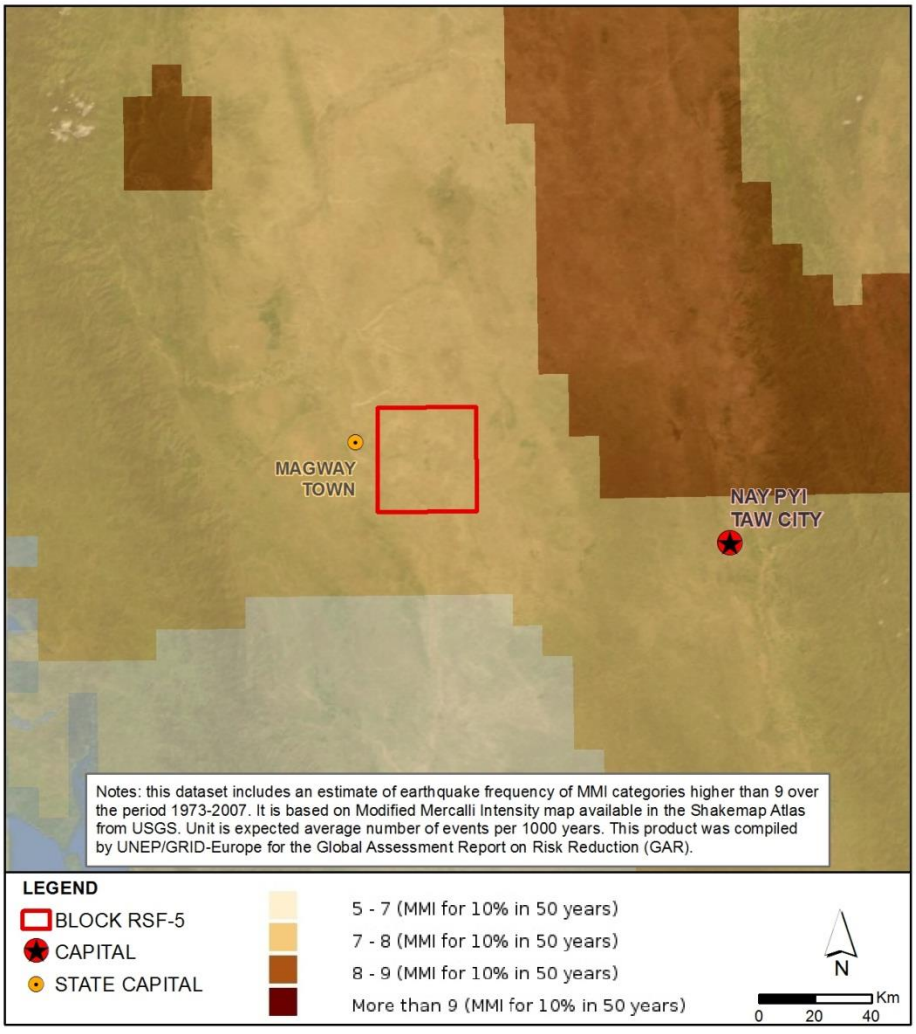
According to Theilen and Pararas-Carayannis (2009): "Myanmar is seismologically unstable and vulnerable to earthquakes due to its proximity to boundaries of major interacting tectonic plates. Specifically, the eastern Himalayan belt marks the collision boundary of the Indian tectonic plate underthrusting the Eurasian plate. The Indo-Burmese Arc extends southward to join the Andaman segment of the great Sunda Arc. Continuous collision and movement of the northward-moving Indian plate, at an average rate of 5.5cm/yr, results in active subduction underneath the smaller Burma plate (part of the Eurasian plate) – the latter moving northward from a spreading center in the Andaman Sea at an average rate of 2.5 – 3.0 cm/yr (Kyaw Kyaw Lin, 2008; Tun, 2008; Pararas-Carayannis, 2007). The movement of the Indian plate

with respect to Eurasia is highly oblique along the margin of the subduction zone. Northward-trending, antithetical right-lateral shear motion occurs along the Great Sumatra fault and extends into the rift system of the Andaman Sea (Asian Disaster Reduction Center, Country Report Myanmar, 2003; Pararas-Carayannis, 2005a and b).

Very large over thrusts along the Western Fold Belt have resulted from past movements along the Sagaing and related faults. Across Myanmar's lowlands, the Sagaing transform fault defines another plate boundary between the Burma and the Southeast Asean tectonic plates. The seismicity of Myanmar's coastal area is relatively low, perhaps because of a fossil plate boundary. However, occasionally, sudden movements along these major active faults have resulted in earthquakes that have affected the region. Historic records show that at least 15 major earthquakes with magnitudes M≥7.0 have occurred in Myanmar in the last hundred years. Destructive earthquakes occurred in 1930 at Bago, in 1970 at Yangon and in 1975 at Pagan."

The distribution of earthquakes intensity in Block RSF-5 is shown in Figure 5.24.

Figure 5.24 Earthquakes intensity in Block RSF-5



As reported in Figure 5.24 Block RSF-5 is completely located in 7-8 MMI (according to MMI Modified Mercalli Intensity) area. A declaration from the Myanmar Engineering Society (MES), Myanmar Earthquake Committee confirms that the Block RSF-5 is not situated in the Sagaing Fault zone resulting in a low seismic risk is included in Annex 11.

Volcanism

Myanmar has a few active volcanoes related to the subduction of the Indo-Pacific under the Eurasian tectonic plate. Below a brief description of them.

Singu Volcano, or better the Singu Plateau (also known as Letha Taung), is a young lava plateau of basaltic-lava in north-central Myanmar, north of the city of Mandalay. Eruptions less than 10,000 years ago produced large lava flows from a series of fissure vents. The flows cover an area of about 62 km^2. Its typical eruption style is effusive and it is currently dormant.

The *Lower Chindwin* volcano is a field of 7 or 8 explosion craters along the lower Chindwin River in central Myanmar. Most cones and lava flows are older than 10,000 years, but a very young-looking basalt flow forms a plateau north of Thayet-Pingan. The volcano belongs to the Myanmar volcanic arc west of the Sagaing-Namyin Fault. The field contains various lava compositions from rhyolitic, dacitic, andesitic to olivine basaltic rocks. Cones and craters include Wazin Taung (366 m), Natyin Taung (237 m), Minma (200 m), Letpadaung Taung (322 m), Okpo Hill (272 m), Ywatha (122 m), lake-filled Taungbyauk crater (198 m), lake-filled Twindaung crater (231 m), lake-filled Songyuang crater. Its typical eruption style is strombolian and it is currently dormant.

Mt. Popa volcano is a large stratovolcano at the northern end of the Pegu Yoma Hills range in central Myanmar. The steep-sided volcano rises 1,150 m from its base of a surrounding lava plateau. It had an eruption in or around 442 BC, which is preserved in local legends. The main edifice of Mt Popa consists of overlapping basaltic and basaltic-andesite lava flows, tephra layers and scoria deposits from strombolian eruptions, which seem to have prevailed during the later stages of its formation. Mount Popa contains a 1.6-km-wide, 850-m-deep horseshoe-shaped caldera that is widely breached to the NW and formed as a result of slope failure. A 3 km^3 debris-avalanche deposit covers an area of 27 km^2 north of the breach. Its typical eruption style is explosive, strombolian and it is currently dormant. No volcano is located within the Block RSF-5.

5.3.7.5 Subsidence

At the end of the seismic survey, local information of the subsidence phenomena in the study area will be provided.

5.3.7.6 Agriculture

The land of Magaway region is totally cultivated, not much natural vegetation is left. The landscape is mostly covered with mosaic croplands/vegetation. The climate is characterized by a tropical savanna, with a tropical very dry forest biozone. The soil in the area is high in nitosols, andosols (nt), soil with deep, clay-enriched lower horizon with shiny ped surfaces. The major crops are sesame and groundnut. Other products are cane, bamboo, charcoal, cutch, teak and hardwoods.

A total of more than 0.36 million acres of land have been put under monsoon paddy and 0.15 million acres of land, under summer paddy.

5.4 BIOLOGICAL COMPONENTS

5.4.1 Overview

This Chapter presents an overview of the environmental biological components in the Study Area, based on a review of the available information, mainly at national and regional levels, below an analysis of the main environmental key topics in the Block is provided.

Information at national level and some data at regional level have been gathered from secondary sources using publicly available information as well as previous studies performed by eni. Block RSF-5 is located in Magway Region, which is presented in the previous paragraph 5.3.1.

Aim of this paragraph is to analyze and describe actual biodiversity value in the Study Area, Ecosystem Services baseline is documented too.

Particularly a discussion on Legally protected and Important Area of Biodiversity is hereby provided, and a detailed discussion about Species & Habitats characterizing Study Area biodiversity is reported. Some similar information have been also provided with a different focus in order to highlight into the document a dedicated section on biodiversity topics.

Myanmar Agenda 21 highlighted that the existing Protected Area System (PAS) was not representative and comprehensive (NCEA 1997). Particularly, there is a considerable conservation gap for marine ecosystems. A broader and more comprehensive gap analysis was recommended to develop a representative and comprehensive PAS (NCEA 1997; Myint Aung 2007).

In the 30-Year Forestry Master Plan, targets were set to have 5% expansion of PAS from 2001-02 to 2005-06 and 10% from 2007-08 to 2016-17 to fulfill the 1995 Forest Policy (MOF 2001). Myanmar is also obliged, as a signatory, to meet the objectives of the Convention of Biological Diversity (CBD) to expand their PAS. The identification of Key Biodiversity Areas (KBA) is considered to be a suitable approach to identify appropriate areas for further study and evaluation for PAS status.

The KBA approach is identified as a tool to address the goal of the Program of Work on Protected Areas in the CBD "to establish and strengthen national and regional systems of protected areas integrated into a global network as a contribution to globally agreed goals" (Langhammer et al. 2007). The KBA approach requires identifying sites of global biodiversity significance in each country to determine which sites are currently not represented in protected area systems, and prioritization of conservation actions among sites.

In addition, this process provides high local ownership and participation because identifying, assessing and prioritizing KBAs is conducted through a multi-stakeholder consultation. Actually in Myanmar a totally of 132 KBA have been identified.

5.4.2 Environmental Study Area

The Environmental Study Area, which is equivalent to the whole Block RSF-5, is presented in Figure 5.1 (section 5.3.2).

5.4.3 Legally protected and Important Areas of Biodiversity

In this paragraph an overview of the protected areas, areas of biodiversity importance, Key Biodiversity Areas at national, provincial and local levels, and sensitive areas is presented. The analysis of biodiversity is focused on the Project Area. Details on protected areas in Myanmar are reported in Annex 1.

5.4.3.1 Myanmar Conservation Corridors

A total of 14 conservation corridors have been identified in Myanmar, organized as follows: 8 terrestrial conservation corridors, 4 river conservation corridors and 2 marine conservation corridors (see Table 1.1 reported in Annex 1).

These areas were selected taking into account: landscape connectivity, maintaining connectivity between two or more KBAs, maintaining evolutionary and ecological processes and safeguarding against the potential impacts of climate change. Of these corridors, only one, the Ayeyawady River Corridor, is partially included in Block RSF-5.

5.4.3.2 Protected Areas at National Level

A total of 43 protected areas have been established in Myanmar, as shown in Table 1.2 in Annex 1. The natural areas for protection are categorized as follows:

- Scientific Nature Reserve;
- National Park;
- Marine National Park;
- Nature Reserve;
- Wildlife Sanctuary;
- Geo-physically Significant Reserve; and
- Other Nature Reserve as determined by the Minister.

The nearest Protected Areas to the Block RSF-5, which are recognized by the national government, are the Shwesettaw Wildlife Santuary and the Wethtikan Bird Sanctuary, respectively about 33 km and more than 50 km from the Block, which are analyzed in detail in Annex 1 (§ 1.5).

5.4.3.3 Protected Areas at Project Level

As reported in the following table, none legally protected areas are present in the Study Area, but:

- there is only a key biodiversity area (the Ayeyarwaddy River Sinbyugyun to Minbu Section) within Block RSF-5;
- the whole Block RSF-5 is included in the Endemic Bird Area of Irrawaddy Plains, which extends in central Myanmar;
- the whole Block RSF-5 is included in the Indo-Burma biodiversity hot spot, as described above.

Table 5.42 Presence of legally protected areas and other areas important for biodiversity conservation in Block RSF-5

Biodiversity Area name	Legally protected	Type of Area	Overlap
Ayeyarwaddy River Sinbyugyun to Minbu Section	No	KBA	Partial
Irrawaddy plains endemic bird area	No	EBA	Partial
Indo-Burma biodiversity hot spot	No	BIOD HS	Partial

Ayeyarwaddy River: Sinbyugyun to Minbu Section

It is a Key Biodiversity Area and is also classified as an Important Bird Area, where two trigger water bird species (Bar-headed Goose *Anser indicus* and Ruddy Shelduck *Tadorna ferruginea*) live during the winter. It is 14,240 ha wide and is located at 30 m a.s.l.. It is characterized by wetlands (inland) habitat. It is not legally protected (*BirdLife International (2014) Important Bird Areas factsheet*).

Irrawady Plains

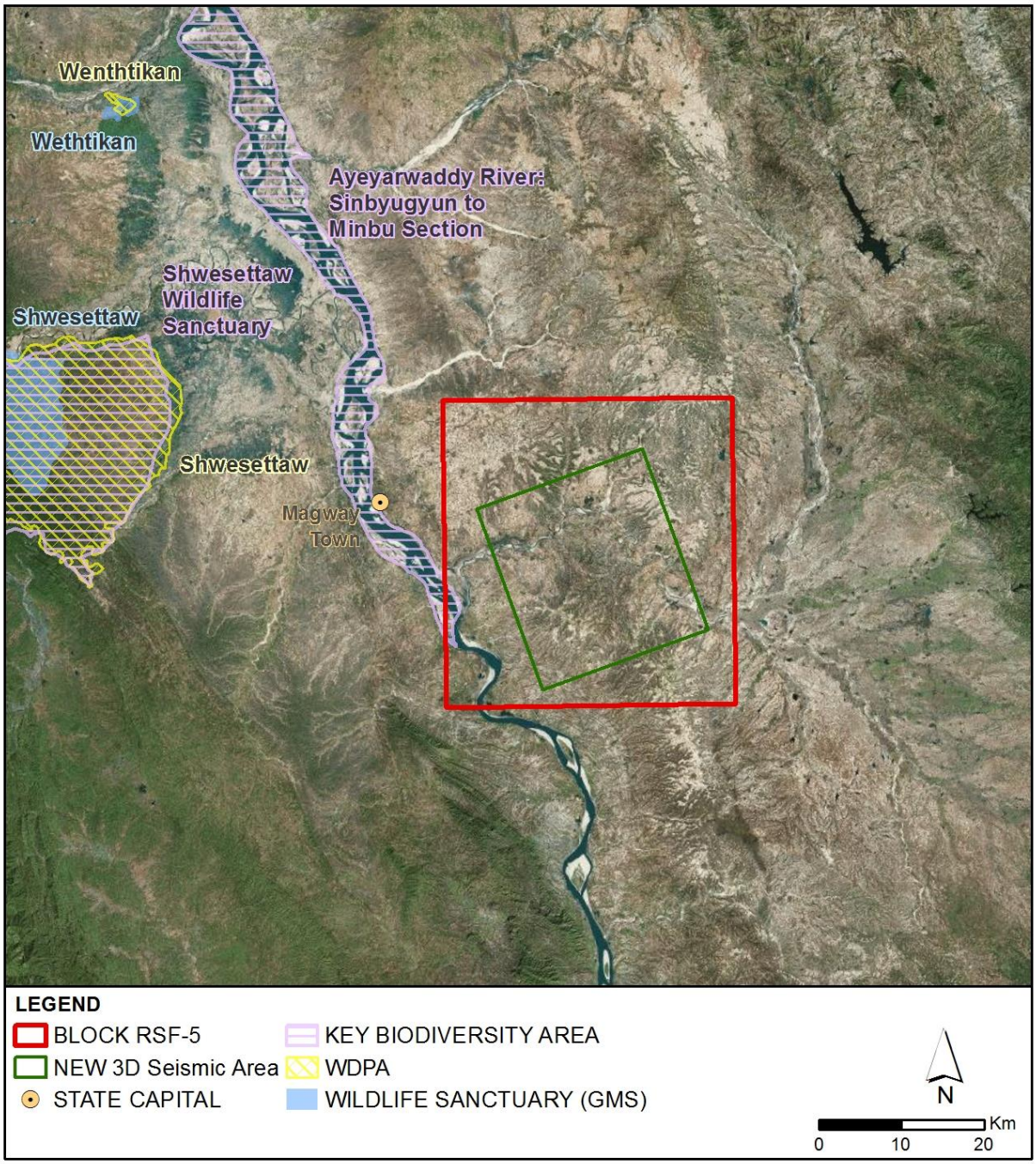
As reported in the BirdLife International (2014) Endemic Bird Area factsheet, the plains of the Irrawaddy river in central Myanmar have a dry and seasonal climate, as it lies in the rain-shadow of mountain ranges which run from north to south through the western part of the country. The natural habitats of this region are known as 'indaing': tropical dry deciduous monsoon forest dominated by species of Dipterocarpus; there is also a small area of tropical thorn forest in the driest central part (*Champion and Seth 1968, Collins et al. 1991*). The restricted-range birds of the EBA are confined to this dry zone, at altitudes below 1,000.

The EBA's two restricted-range bird species are found in dry forest and scrub. *Turdoides gularis* has adapted to man-modified habitats, and is common and widespread within the EBA (*Smythies 1986*). *Crypsirina cucullat*a was also common in the past, but it appears to require more extensive areas of forest or scrub and there had been few records in recent years until it was found in 1995 to be locally common.

The Irrawaddy plains are now almost entirely cleared for agriculture (*Collins et al. 1991*). *Crypsirina cucullata* is classified as threatened because it appeared that it had been seriously affected by this loss of natural habitat, although more recent information suggests that its position is unlikely to be serious.

Figure 5.25 shows the location of the protected areas and the areas important for biodiversity near and within the Block.

Figure 5.25 Protected Areas and areas important for biodiversity conservation near and within the Block RSF-5



Source: eni, 2014

5.4.4 Species

The following table summarizes the globally threatened animals in Myanmar.

Table 5.43 Globally Threatened animals in Myanmar

Taxonomic Group	Global Threat Status			
	Critically Endangered	Endangered	Vulnerable	Total
Mammals	4	9	26	**39**
Birds	5	7	34	**46**
Reptiles	4	10	7	**21**
Invertebrates	0	0	1	**1**
Plants	13	12	13	**38**
Total	**25**	**39**	**80**	**144**

Source: Birdlife International, 2005

5.4.4.1 Fauna

Large Mammals

Among the mammal species found across Myanmar, some species like Tiger *Panthera tigris*, Asian Elephant *Elephas maximus* and Red Panda *Ailurus fulgens* are endangered species. An endemic species of Eld's Deer *Cervus eldi thamin*, Asian Black Bear *Ursus thibetanus*, Takin *Budorcas taxicolor*, Red Goral *Naemorhedus*, Gaur *Bos gaurus*, Clouded Leopard *Neofelis nebulosa*, Asian Golden Cat *Catopuma temminckii*, and Dhole *Cuon alpinus baileyi* are vulnerable species.

The species Sambhur *Cervus unicolor* is a near-threatened species and Eld's deer *Cervus eldi thamin* is endemic to Myanmar.

Birds

Among birds in Myanmar, five species are critically endangered species, seven species are endangered species and 34 species are vulnerable species.

The high mountains in north, central-west and central-east Myanmar have extensive and relatively unspoiled montane forests and alpine habitats, which support threatened species such as *Tragopan blythii, Lophophorus sclateri* and the Myanmar endemic *Sitta victoriae*. There are evergreen and semi-evergreen forests in the lowlands and foothills of Myanmar, and dry dipterocarp forest and arid scrub in the relatively dry and seasonal rain-shadow zone in the centre of the country. The current condition of these forests and their bird communities is not well understood, but some extensive areas remain, which may prove to be the stronghold of several relatively widespread threatened birds, such as *Ardea insignis, Cairina scutulata, Pavo muticus and Columba punicea*. The lowland rainforests in Tanintharyi, southern Myanmar, are part of the Sundaic region. The extensive, relatively intact forests in this region of the country support several threatened species, including *Aceros subruficollis* and the majority of the world population of *Pitta gurneyi*. Despite some losses, the Ayeyarwaddy, Sittaung and Thanlwin (Salween) valleys are still important wetlands areas, together with freshwater lakes (notably Inle and In-

dawgyi lakes) for many water birds, including *Pelecanus philippensis* and *Aythya baeri*, and it is possible that significant breeding populations of threatened species such as *Haliaeetus leucoryphus*, *Grus antigone* and *Rynchops albicollis* could survive in the more remote wetlands. There is even a possibility that *Rhodonessa caryophyllacea* may survive in the remote valleys in the north. Myanmar supports populations of *Gyps bengalensis* and *Gyps tenuirostris*, which are set to become increasingly important because they are presumably not being affected by the factors than those that are causing South Asian vulture populations to crash.

Reptilian and Amphibian Species

There are seven national endemic turtle species, namely, Burmese Frog-faced Softshell Turtle *Chitra vandijki*; Burmese Star Tortoise *Geochelone platynota*; Arakan Forest Turtle *Heosemys depressa*; Burmese Roofed Turtle *Kachuga trivitatta*; Burmese FlapshellTurtle *Lissemys scutata*; Burmese Eyed Turtle *Morenia ocellata*; and Burmese Peacock Softshell *Nilssonia formosa*. These seven species are globally threatened species and endemic to Myanmar.

All recorded amphibian species are not listed under IUCN threatened species. Among the recorded species, *Rana* species are common species distributing in many parts of the project area.

Fishes

The Irrawaddy river is home to a large diversity of animals, including about 43 fish species. The most well-known of these species is the *Irrawaddy Dolphin*. Along the North-South course of the Irrawaddy River, a number of notably different ecoregions can be distinguished.

5.4.4.2 Flora

Tree Species

Among the recorded tree species, Dipterocarp species are recorded to be endangered tree species.

5.4.4.3 Species under protection in the Project Area

Presence of Alien Invasive Species IUCN Red List of Threatened Species the IUCN Red List of Threatened Species is widely recognized as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. Assessed species are classified into the following: Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), and Least Concern (LC). The IUCN Red List data are integrated in IBAT and include all species databases, which are currently made available to organizations, where the spatial distribution (range maps) data are linked with data for the threat status. This included: mammals, amphibians, corals, reptiles, mangroves, seagrasses and birds. Species listed as Critically Endangered, Endangered and Vulnerable are regarded as 'threatened' and therefore subject of conservation attention. Each Block was assessed with respect to the presence of globally threatened species, as shown in the Tables below.

The threatened species have been classified depending on their conservation status, i.e. on their IUCN category. Critically Endangered species are considered at higher threat with respect

to Endangered, which are at higher threat with respect to Vulnerable, as shown in Figure Below.

Figure 5.26 IUCN Red List System Categories

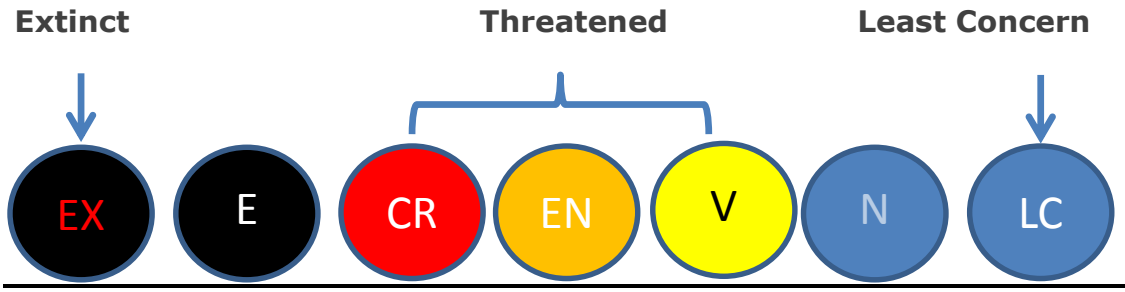


Table 5.44 Presence of Critically Endangered species according to the IUCN Red List of Threatened Species in in the Block RSF-5

Vertebrates / Invertebrates	Class	Genus	Species
V	REPTILIA	*Gavialis*	*gangeticus*
V	AVES	*Aythya*	*baeri*
V	AVES	*Gyps*	*bengalensis*
V	AVES	*Gyps*	*tenuirostris*
V	AVES	*Sarcogyps*	*calvus*
Number of Critically Endangered species in block RSF-5			**5**

Table 5.45 Presence of Endangered species according to the IUCN Red List of Threatened Species in the Block RSF-5

Vertebrates / Invertebrates	Class	Genus	Species
V	MAMMALIA	*Axis*	*porcinus*
V	MAMMALIA	*Cuon*	*alpinus*
V	MAMMALIA	*Rucervus*	*eldii*
V	MAMMALIA	*Trachypithecus*	*phayrei*
V	AVES	*Pavo*	*muticus*
V	AVES	*Sterna*	*acuticauda*
Number of Endangered species in Block RSF-5			**6**

Table 5.46 Presence of Vulnerable species according to the IUCN Red List of Vulnerable Species in the Block RSF-5

Vertebrates / Invertebrates	Class	Genus	Species

Vertebrates / Invertebrates	Class	Genus	Species
V	AVES	*Aquila*	*clanga*
V	AVES	*Emberiza*	*aureola*
V	AVES	*Mulleripicus*	*pulverulentus*
V	MAMMALIA	*Helarctos*	*malayanus*
V	MAMMALIA	*Lutrogale*	*perspicillata*
V	MAMMALIA	*Orcaella*	*brevirostris*
V	MAMMALIA	*Rusa*	*unicolor*
V	MAMMALIA	*Ursus*	*thibetanus*
V	REPTILIA	*Ophiophagus*	*hannah*
Number of Vulnerable species in Block RSF-5			*9*

5.4.5 Project Area Biodiversity

5.4.5.1 Introduction

A biodiversity survey of eni Myanmar's Block RSF-5 petroleum exploration area was completed on August 29-31, 2016. The survey was undertaken as part of the Environmental, Social and Health Impact Assessment (ESHIA) of a proposed 3D seismic program being planned within the 1292 km^2 exploration block located in West Central Myanmar in which 500 km^2 of 3D seismic will be acquired. The full details are included in Annex 8.

The study's overall aim was to identify the important components of biodiversity in the project area and to provide recommendations for practical measures to mitigate the possible impacts related to the seismic operations.

5.4.5.2 Overview of Flora

Formal transect or plot field surveys for flora were not undertaken as part of the biodiversity reconnaissance, however, secondary data was examined in light of habitat conditions present in the Eni Block. The Eni exploration block consists of range of distinct ecotopes or site types with attendant variation in edaphic conditions and associated plant communities. The block is dominated by gently rolling upland areas with extensive cover of sandy soils. Departures from this are found in more gullied ravines with weakly developed badland topography, two larger, poorly drained wetland areas, and along the Yin River where there are more moist conditions, and soils with more silt and organic components. Pockets of poorly drained soils are also present in upland areas.

Native vegetation cover within the Eni exploration block has been subject to a prolonged period of alteration and human activity. Timber harvesting, fuel wood collection, clearing for agriculture and livestock grazing have occurred throughout much of the block. Greatest potential to encounter rare plants is expected in proximity to wetland areas and the riparian margin of the Yin River and possibly in isolated badland and gully areas which are less frequented by livestock and human traffic. Large trees of any species in the area should be treated as "rare" and deserving special conservation.

The forest type within the project area is a dry forest type, dominated by *Acacia catechu* (Shar), *Prosopis spicigera* (Gandaya) and *Acacia lecucophloea* (Htanaung). These tree species are widely distributed within the project area. The few larger trees found in the area include *Bombax insigne* (Di Du) and (*Bombax ceiba* (Let Pan), and wild fig (Ficus sp.). A few dipterocarp species, Shorea obtusa (Thit Yar) and *Shorea siamensis* (In Gyin), are found in plot B3 (public protected forest and reserved forest), however, most of the block is dominated by the Acacia species previously mentioned.

In Myanmar, there are an estimated 50 threatened plant species, of which 18 Critically endangered, 16 Endangered and 16 Vulnerable based on the classification from IUCN Red List[2]. Given the countries extended period of isolation it is also likely that many new species to science are yet to be discovered, particularly in the more remote and restricted entry areas in the northern part of the country. Species of *Dipterocarpaceae* are reported to be the most threatened plant family in Myanmar with 16 Critically endangered species, 7 Endangered species and 2 Vulnerable species out of 19 threatened plant families. The ENI exploration area is outside the primary distribution of Dipterocarp forest.

Of the 18 species of Critically Endangered flora currently identified in Myanmar[3] 3 may have some, albeit lower, potential to find suitable habitat within the block (*Bombax insigne, Dipterocarpus tuberculatus, Hopea sangal*). It was noted that large Bombax sp do occur in the area and are species of concern. Of the 16 flora species currently classed as Endangered, at least 2 (*Shorea roxburghii, Syzygium zeylanicum*,) may have some potential to occur in the area and perhaps, *Vatica cinerea*, a small dipterocarp, which can at times thrive in exposed areas, rocky, dry land as well as in bamboo forests.

Endemic Species

Myanmar is reportedly home to over 1,071 endemic species of flora[4]. It is likely that endemic flora do occur in the project area with higher potential being in wetland complexes as well as in associated with the erosional landforms. During the field reconnaissance the endemic *Tectona hamitonia* was noted. Confirmation of the presence of uncommon local endemics would require intensive, potentially multi-season surveys. In some cases, particularly for herbaceous species, detection may only be practically detected in certain years and under certain conditions.

Iconic Species

The main iconic flora in the exploration block are the more mature *Bombax*, large native *Acacia* and *Ficus,* species (eg. *Ficus religiosa* and *Ficus benghalensis*). Padauk *(Pterocarpus macrocarpus),* the national flower of Myanmar, is not anticipated to occur in this area.

5.4.5.3 Overview of Fauna

The August 29-31, 2016 biodiversity reconnaissance survey and confirmed the presence of 32 species of bird, and 2 species of mammal. Focused community interviews identified potentially a further 15 mammals, 13 birds, 30 species of reptile, 21 species of amphibian, 14 species of invertebrate[5], and 17 species of fish that may be resident or transient in the block. These

[2] https://myanmarbiodiversity.org/2014/plants-conservation-in-myanmar/
[3] https://myanmarbiodiversity.org/2014/plants-conservation-in-myanmar/
[4] http://www.fao.org/docrep/005/AC648E/ac648e08.htm
[5] Residents of Than Bo Kan near B1 noted there were three species of Apis in the area, the domestic bee, and two others (one larger than the other)

include a number of species with special conservation status (Table 5.47). Suitable habitat for a number of these latter species was noted in the area; however, confirmation of the actual occurrence of these species would require extensive, multi-season investigation.

Table 5.47 Number of Species with Special Conservation Status[6] Reported By Local Community as currently Occurring in general vicinity of the Eni Exploration Block

	Mammals	Birds	Reptiles & Amphibians	Insects	Fish[7]
Critically Endangered	1[8]	(1)[9]	0	0	0
Endangered	4	1	1	0	0
Vulnerable	1	0	4	1	(1[10])
Near Threatened	3	2	6	0	(3[11])

Endemic Fauna

The identified endemic fauna in the block comprise 4 bird species: White-throated Babbler (*Turdoides gularis*), Burmese Bushlark (*Mirafra microptera*), Burmese Collared-dove (*Streptopelia xanthocycla*) and Ayeyawady Bulbul (*Pycnonotus blanfordi blanfordi*). Habitat in some areas was also considered to have potential to be supporting Hooded Treepie (*Crypsirina cucullata*) and Jerdon's Minivet (*Pericrocotus albifrons*). Other endemic fauna may be present, however, more intensive potentially multi-season surveys would be required.

Iconic Species

No iconic species of fauna (eg. large carnivores, large herbivores, high profile endangered species) are believed to occur in the project area. Painted stork, (*Mysteria leucocephala*) reported by villagers in Than Bo Kan near the wetland complex is perhaps the largest avian species in the project area.

Alien Invasive Species

During the biodiversity reconnaissance local community representatives were asked whether they had any unusual weed problems and whether they were seeing any new species of plant or animal in their area. Additional information was provided to the community regarding the basis for this concern (e.g. potential for unclean seismic equipment to bring invasive species into the area or spread weeds from field to field). In all cases the community representatives reported they did not have any major weed problems, nor had they noticed any new species in their areas.

[6] Species with special conservation status were considered those receiving special protecton under Myanmar law and or species which are listed as Critically Endangered, Endangered or Vulnerable
[7] At the time of the community survey only local common names could be obtained (Appendix 4)
[8] Pangolin (*Manis* sp.) were reported as common in an area East of the ENI Block.
[9] A species reportedly similar to Baer's Pochard (*Aythya baeri*) was included in the community record, however, project avian specialists suggest that habitat suitability in the project area is low.
[10] If *Cirrihunus* species *is Cirrihunus cirrihunus* (Mrigal Carp or white carp) species is currently listed as **Vulnerable.**
[11] Contingent on actual species. Identification confirmed to Genus only.

Significant invasive plant species previously reported for Myanmar include *Prosopis* spp., *Acacia auriculiformis*, *Ageratum conyzoides*, *Leucaena leucocephala*, *Eucalyptus* spp., *Casurina equisetifolia*, *Chromolaena odorata*, *Hyptis suaveolens*, *Lantana camara*, *Mimosa diplotricha*, *Mikania micrantha*, *Sorghum halepense*, *Paspalum conjugatum*, *Imperata cylindrica*, *Echinochloa crus-galli, Eleusine indica*, *Pennisetum polystachion*[12]. Invertebrate invasives reported in Myanmar include the Giant African Snail *(Achatina fulica)*, Apple snails (*Pomacea canaliculata*), the parasitic bee mite *Varroa jacobsoni* and *African Catfish (Clarias gariepinus),* and the minnow *Cyprinus carpio.* During local community interviews catfish from the genus *Clarias* were reported, however, it as unconfirmed whether it may have included *C. garieninus.*

Previous assessment has noted that in Myanmar Dry Forest areas, *Prosopis juliflora* and *Euphorbia* spp. are widespread, particularly in more open areas.

5.4.6 Ecosystems Services

Ecosystem services are the benefits that people, including businesses, derive from ecosystems. They can be divided for the analysis into four categories: *supporting*, *provisioning*, *regulating* and *cultural services*. Biodiversity is not an ecosystem service itself, but forms the basis of all ecosystem services. Increased levels of biodiversity (i.e. greater variety of ecosystems, species and genes) tend to support a broader range of ecosystem services. Biodiversity also enhances the resilience of ecosystem services. However, the value associated with conservation of biodiversity is commonly covered under cultural service values through recreational use value, and non-use values whereby individuals may be willing to pay to maintain biodiversity whilst having no intention of using it.

It is also important to highlight the linkages between ecosystem services and socio-economic issues. Many provisioning services (e.g. fish, crops, livestock and timber) support local livelihoods. This is particularly important for local populations who may rely on hunting and gathering of wildlife for their survival. Furthermore, regulating services such as flood and storm control, or water flow regulation can be essential for maintaining the health and security of people in the even to extreme weather conditions, e.g. storms or droughts. Finally, cultural services such as recreation, tourism, aesthetic and spiritual values can be extremely important in terms of providing personal satisfaction and livelihoods.

These considerations are particularly important in poor realities like the Area of Influence one, since livelihood of local people is often totally or partially dependent from available natural resources. In this contest, the preservation of biodiversity and ecosystems services assume a fundamental role, not only for the related cultural value, but especially for the support given as a survival mean.

The Ecosystem Services guide and checklist developed by IPIECA help to identify the categories that cover the main oil and gas E&P activities likely to have a dependence or impact on ecosystem services.

Oil and gas *provisioning* service dependencies include use of water, aggregates and timber for consumption by staff, and for the construction and operation of facilities.

Oil and gas *regulating* service dependencies are typically more indirect, and include a range of physical functions provided by vegetation and habitats such as erosion control, water filtration and flood control.

[12] Ministry of Environmental Conservation and Forestry 2011. National Biodiversity Strategy and Action Plan Myanmar 2011. The Republic of the Union Of Myanmar.UNEP, Global Environmental Fund.

Cultural service can be important for remotely operating workforces that can benefit in terms of enjoyment, health and motivation, from activities such as ecotourism and bird watching, and simply from appreciating the surrounding undisturbed landscapes.

In terms of provisioning services, oil and gas impacts include potentially restricting access for gathering wild food; on regulating services include reducing erosion and flood control through loss of vegetation cover. Potential oil and gas impacts on cultural services include disturbance to iconic species, such as whales due to seismic activity. On the other hand, a range of positive provisioning, regulating and cultural services can be gained through oil and gas companies helping to restore and protect habitats from a multitude of threats.

5.4.6.1 IPIECA Habitat

Due to the absence of primary data from field surveys, a preliminary habitat mapping has been produced on the basis of the land cover categories and their correlation with IPIECA's habitat types. At this stage, it is not possible to classify the habitats according to IFC requirements, as the proper detail of information about flora/fauna coverage is missing. A biodiversity field survey will be performed in a future step of the Project in order to collect all the required field data for the implementation of a more detailed and comprehensive habitat mapping.

According to IPIECA methodology for identifying the habitats present in the Area of Influence, the following table has been developed throughout the analysis of currently available data. A map of the identified habitats is reported in Map 3 of Annex 2.

Table 5.48 Habitats present in the Study Area - Correlation of Land Cover Categories and IPIECA's habitat types

Land Cover Category	IPIECA's Habitat Type
Bare soil	Grassland habitat
Vegetation	Forest area
Building	Settlements (*)
Roads	Settlements (*)
Urban Area	Settlements (*)
Urban Vegetation	Settlements (*)
Crop Lands	Cultivated habitat
Green Land	Cultivated habitat
Island river	Wetland, river and lake habitat
River Gravel and Rock White	Wetland, river and lake habitat
Rivers	Wetland, river and lake habitat
Water bodies	Wetland, river and lake habitat

Note: (*) Category not identified by IPIECA

For the identified habitats the associated ecosystems services are briefly outlined.

Grassland habitats

Grassland habitats include prairies, steppes, savannahs and others, are defined as areas where natural grasses are the dominant form of plant life. Provisioning services in grassland areas include plants and wild game for consumption, and forage for livestock grazing. Grassland habitats can offer waste assimilation, carbon sequestration and water regulation services, depending upon the context. Grasslands are important habitats for culturally important bird and grazing species; tropical savannahs in particular are known for supporting iconic species and endangered wildlife. They can also be important destinations for ecotourism.

Forest habitats

Forest habitats are defined as area dominated by trees and woody vegetation. Almost all forests provide abundant provisioning services in the form of timber, wild game, fruits, berries, mushrooms and medicines. Forests can provide regulating services such as: carbon sequestration, climate and nutrient regulation, local temperature, humidity control, etc. Furthermore forest can provide cultural services related to recreational activities, bird and wild watching, spiritual areas.

Cultivated habitats

Cultivated habitats include any area that has been converted to support human agricultural uses. Cultivated lands provide food in the form of grains, fruits and vegetables, plant fibers for clothing and other use, and woody products for a variety of uses. In addition. some kind of agriculture provide local climate and air quality regulation services (most likely from tree species). Agriculture has a cultural services role, as a source of livelihood and independence. Some areas may have served as cultivated land for generations and hence have cultural significance to the communities and individuals who rely upon them.

Wetlands, rivers and lakes

Wetlands encompass a range of habitats such as tidal marshes, mud flats and bogs. They may be seasonal, inland, or coastal and may be tidal or non-tidal. Rivers and streams are bodies of water that flow into lakes or the sea. Lakes are categorized as inland bodies of freshwater. Lakes, rivers and wetlands provide provisioning services in the form of water, food, fuel and materials for construction. They provide protein to many local communities through fish and shellfish as well as plant food. Peat is also harvested from bogs as a source of fuel, and reeds are utilized to make things and build houses. Regulating services in these habitats include groundwater recharge, water storage, flood control and water purification (waste assimilation). Bogs also offer significant carbon sequestration services.

Ecotourism and bird watching are examples of cultural services. These habitats are particularly recognized for their populations of endemic and migratory birds and protected species such as crocodiles, manatees and turtles.

The Ecosystem Services identified in the Area of Influence by Habitat type are presented in Table 5.49.

Table 5.49 Ecosystem Services identified by Habitat Type

Ecosystem Services	Forest areas	Wetland, river and lake habitat	Cultivated habitat	Grassland habitatFlood
Provisioning				
Crops			XX	
Livestock				X
Capture fisheries		XX		
Aquaculture				
Wild foods	XX	X		XX
Timber and other fibers	XX	XX		X
Fibers and resins	XX	XX		X
Animal Skins	XX	X		X
Sand, gravel, etc.	X	XX		X
Ornamental Resources	XX	X		X
Biomass Fuel	X	X		X
Freshwater	XX	XX		X
Genetic Resources	X	XX		X
Biochemical, natural medicine	XX	X		XX
Regulating				
Air quality regulation	XX	X	X	XX
Global climate regulation	XX	XX	X	XX
Regional/local climate regulation	XX	X		XX
Water regulation	XX	XX		XX
Erosion regulation	XX		X	XX
Water purification	XX	XX	X	XX
Waste assimilation	XX	XX	XX	XX
Disease regulation	X	X		X
Soil quality regulation	XX	XX		XX
Pest/invasive species regulation	XX	X		XX
Pollination	XX	XX		XX
Natural Hazard regulation	XX	X		XX
Cultural				
Recreation	X	X		XX
Ethical/non-use values		X	XX	X

Note:
X= Medium/Low importance; XX= High importance

5.5 SOCIAL COMPONENTS

5.5.1 Overview

This Section presents an overview of the socioeconomic conditions in the Social Study Area, based on a review of the available information, mainly at national and regional levels gathered from secondary sources using publicly available information as well as previous studies performed by eni.

Block RSF-5 is located Magway Region, as shown in Figure 5.27. This Region is situated in the rain shadow area of the Yakhaing Yoma and obtains most of its rainfall from the southwest monsoon. The undulating land, composed mainly of sandy loam with low fertility, is subjected to severe erosion under rain and strong winds.

Magway Region is made up of Magway, Minbu, Thayet, Pakokku and Gangaw districts, comprising 25 townships and 1,696 ward village-tracts. The capital city is Magway Town (1994 population estimated at 300,000). Other major towns are Pakokku and Minbu.

Magway Region is located in the Central Lowlands, a relatively low-lying terrain drained by the Ayeyarwady River and its major tributaries. Rolling hills, ridges and small mountains are present in some areas. The region is characterized by folded small mountain ranges, a volcanic line and the Sagaing Fault zone, a regionally significant active right lateral strike-slip fault.

A detailed description of the Social Study Area is presented in the following sections:

- demography and social determinants,
- welfare,
- facilities,
- political and institutional framework,
- transparency and corruption,
- national and local economy,
- gender issues,
- cooperation,
- human rights.

The details and results of the socio-economic surveys are included in the separate *Socio Economic and Attitude Survey Report* included in Annex 4 and the *Key Informant Survey Report* included in Annex 5. The details and results of the key traditional ecological knowledge surveys are included in the *Traditional Ecological Knowledge Survey Report* included in Annex 6.

5.5.2 Social Study Area

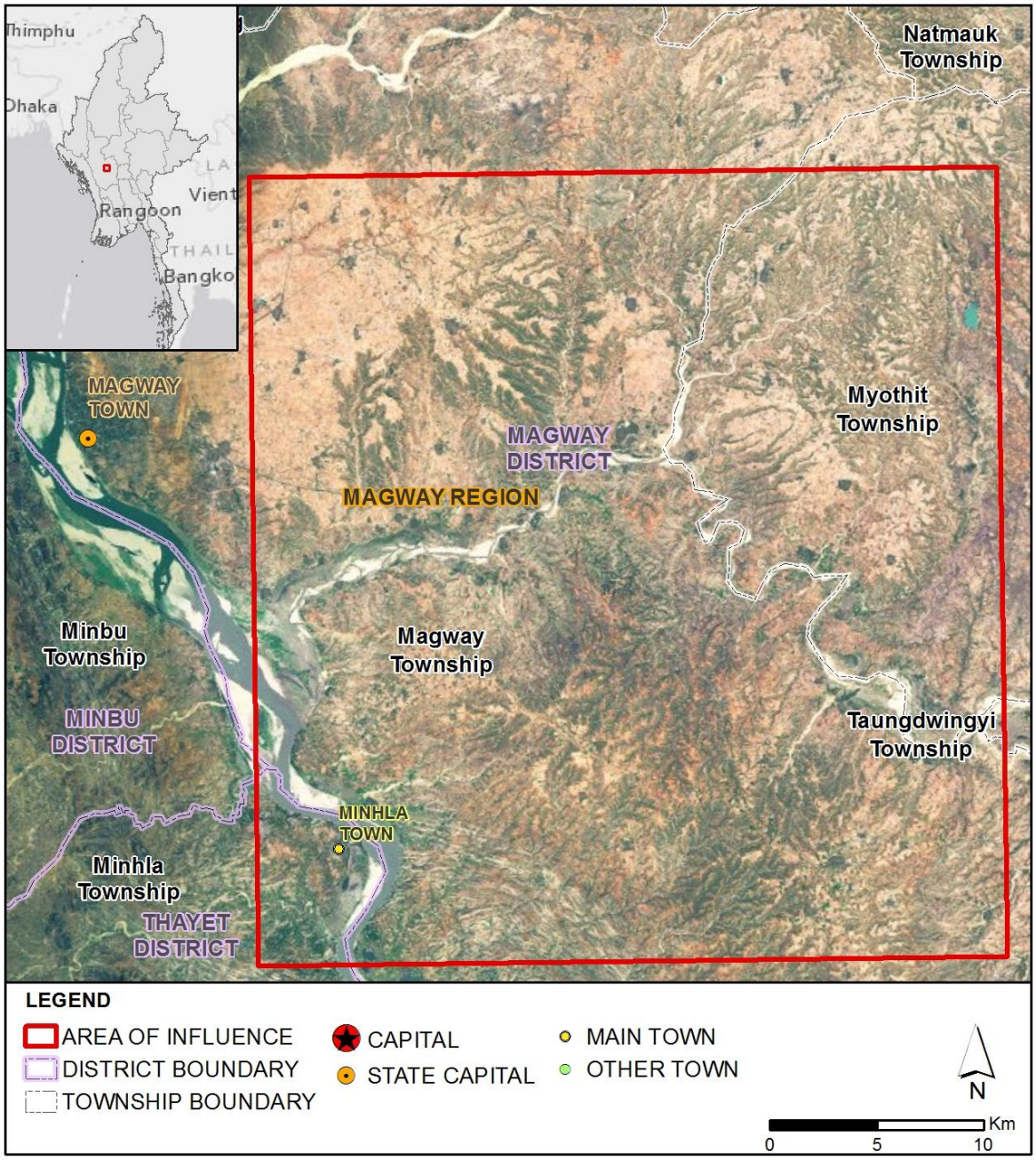
The Study Area for the socioeconomic baseline is equivalent to the whole RSF-5 Block and spans across only 1 region (Magway). It is further split up in 2 districts and 3 townships, as shown in the following Table 5.50.

Table 5.50 Social Study Area for Block RSF-5

Region	District	Township
Magway Region	Magway	Magway
		Myothit
	Thayet	Minhla

Figure 5.27 below presents the Social Study Area, that is equivalent to the whole Block RSF-5.

Figure 5.27 Social Study Area



Source: eni, 2014

Considering a buffer of 1 km around the 3D seismic survey as the area potentially affected by project activities, settlements identified in this buffer are 56. The details and results of the socio-economic surveys are included in the separate *Socio Economic and Attitude Survey Report* included in Annex 4.

5.5.3 Demography and Social Determinants

5.5.3.1 Population, Social Distribution

Estimated Population of Myanmar as of July 2013 was 55,167,330 (*Source: CIA World Factbook, 2013 est.*) with the population growth rate of 1.05%. The Figure 5.29 presents the Myanmar population density map in 2013.

The age structure (*Source: CIA World Factbook, 2013 est*.) is reported in the following Table 5.51.

Table 5.51 Age Structure

Age group	Percentage of population
0-14 years	26.7% (male 7,514,233/female 7,227,893)
15-24 years	18.6% (male 5,183,653/female 5,060,385)
25-54 years	42.8% (male 11,724,297/female 11,879,420)
55-64 years	6.7% (male 1,754,397/female 1,963,051)
65 years and over	5.2% (male 1,244,758/female 1,615,243)

Source: CIA World Factbook, 2013 est.

The female population is slightly bigger than the male population (50.3% vs 49.7%). The following Table 5.52 shows the sex ratio by age.

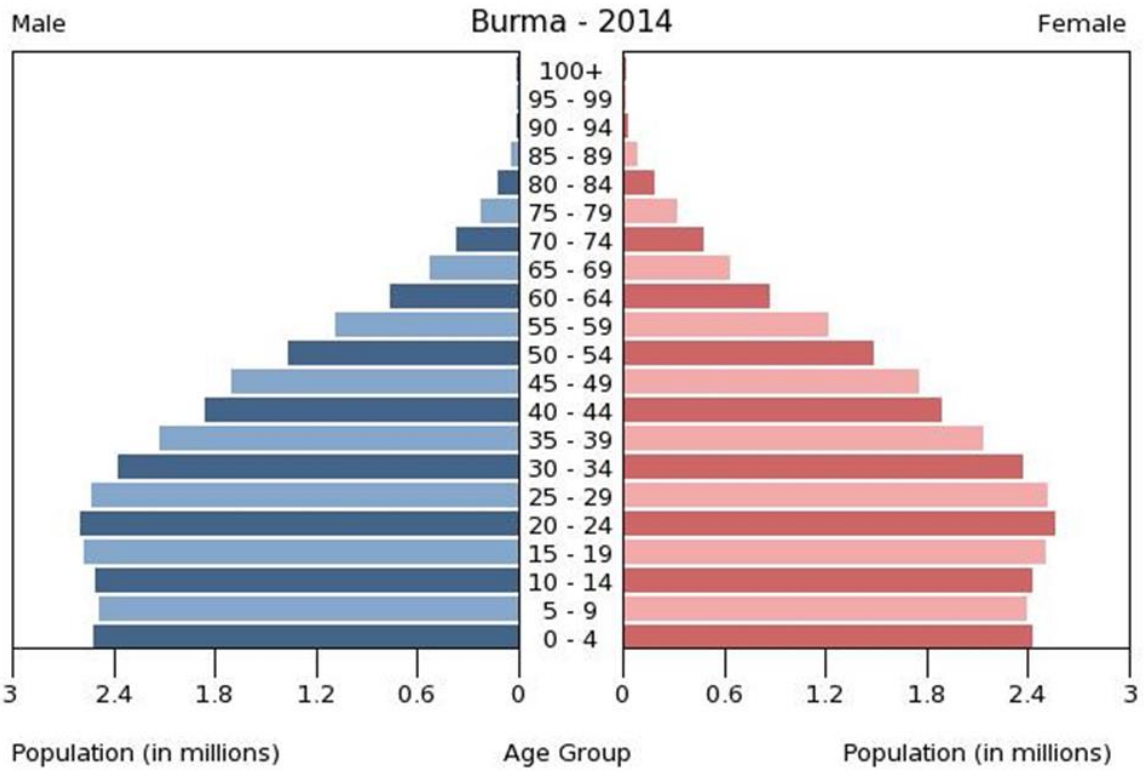
Table 5.52 Sex Ratio by Age

Age group	Male/female ratio
At birth	1.06 male(s)/female
0-14 years	1.04 male(s)/female
15-24 years	1.02 male(s)/female
25-54 years	0.99 male(s)/female
55-64 years	0.9 male(s)/female
65 years and over	0.77 male(s)/female
Total population	0.99 male(s)/female

Source: CIA World Factbook, 2013 est.

At a national level, the largest age group is between 25 and 54 years old for both male and female, followed by 15-24 years old; people over 65 years are only 5.2% of population, as shown in Figure 5.28.

Figure 5.28 Age Distribution by Sex in Myanmar



Source: CIA World Factbook (2013 est.)

The median age of population is, actually, 27.6 years, slightly highest for women (28.2 years) compared to men (27 years).

The main statistics related to population are the reported in the following Table 5.53; they are compared with data of neighbouring countries.

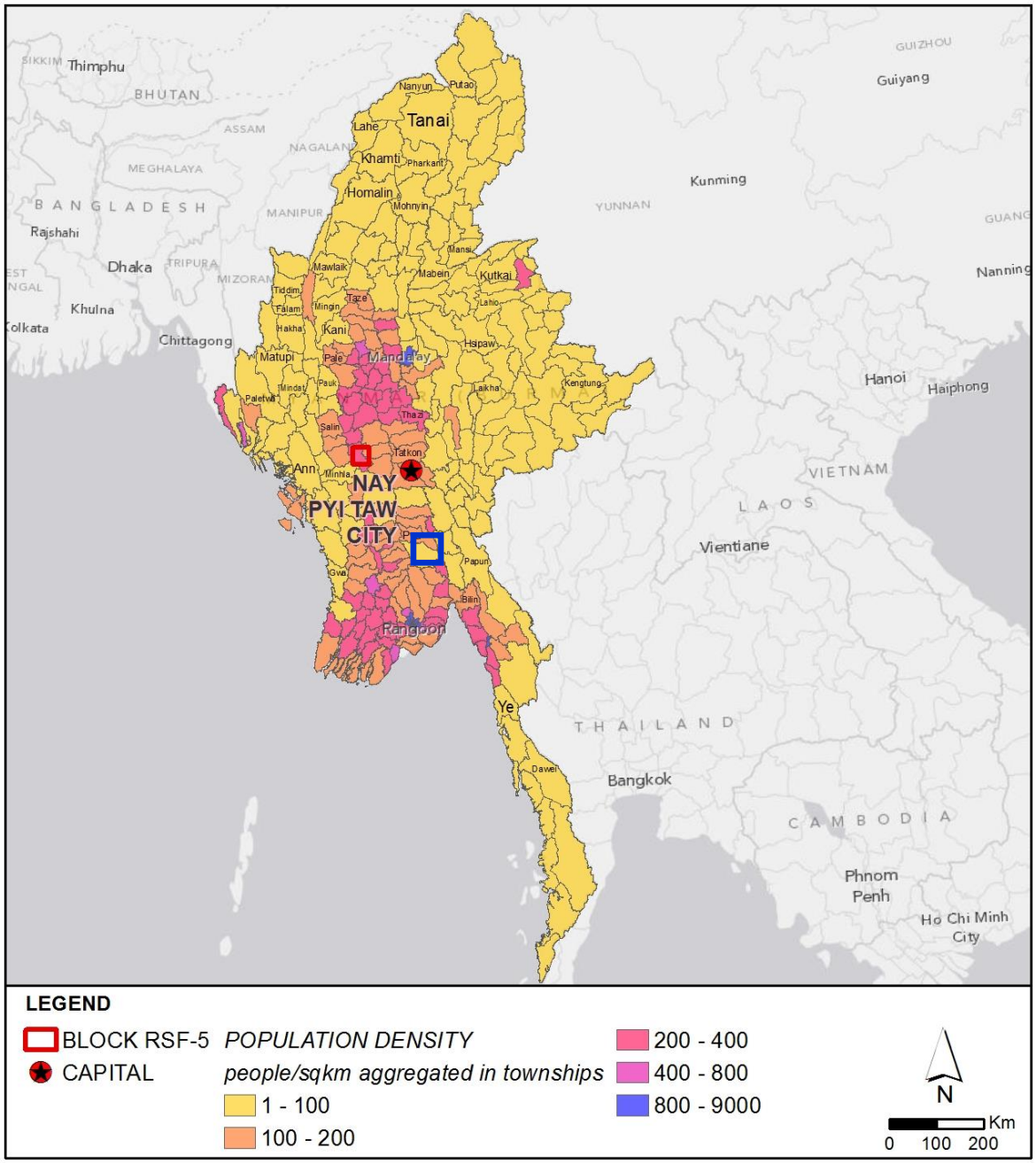
Table 5.53 Population Statistics

Indicator	Thailand	China	Myanmar	India	Laos	Bangladesh
Population growth rate	0.35%	0.44%	**1.05%**	1.25%	1.59%	1.6%
Birth rate (births/1,000 population)	11.26	12.17	**18.89**	19.89	24.76	21.61
Death rate (deaths/1,000 population)	7.72	7.44	**8.05**	7.35	7.74	5.64

Source: CIA World Factbook, 2013 est.

The following Figure 5.29 shows the population density on the national territory (*Source: MIMU, Myanmar Information Management Unit*). The population density of territories included in the Block RSF-5 is, on average, higher than that of other regions.

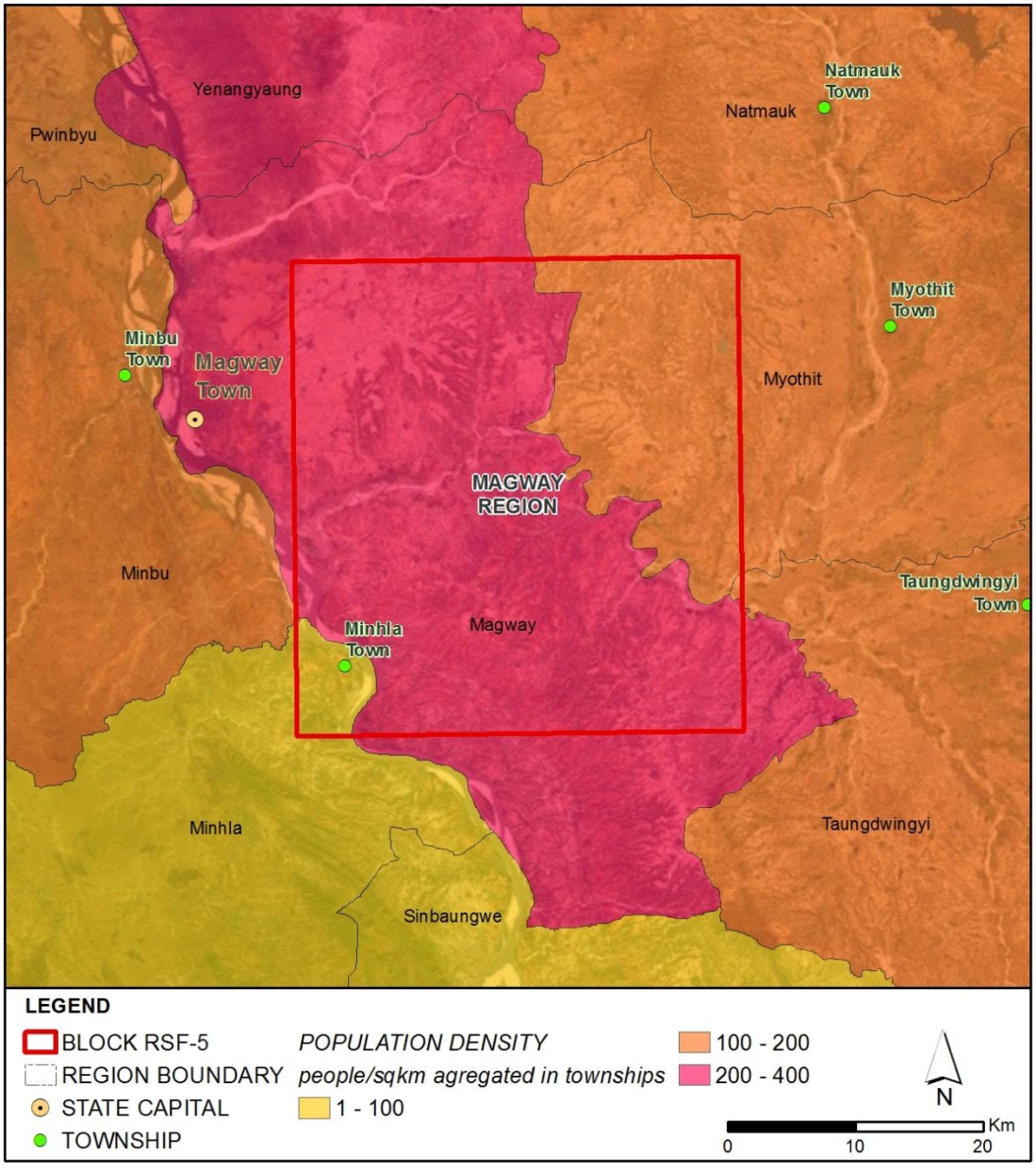
Figure 5.29 Myanmar Population Density Map (2013)



Source: MIMU, Myanmar Information Management Unit, 2014

With reference to the project Block RSF-5, the Figure 5.30 show a detail of the population density map.

Figure 5.30 Population Density Map in the Block RSF-5, 2013



Source: eni, 2014

The population density of the 3 townships involved by the Block RSF-5, represented in the previous Figure 5.30, is summarized in the next Table 5.54.

Table 5.54 Population Density in each Township

Township	Population density
Magway	201.49 people/km^2
Myothit	110.06 people/km^2
Minhla	57.42 people/km^2

Source: eni, 2014

5.5.3.2 Migration Trends

The net migration rate in Myanmar is -0.3 migrants/1,000 population (*Source: CIA World Factbook, 2013 est.*). In the following Table 5.55 main data related to migration are summarized.

Table 5.55 Migration Data in Myanmar, 2010

	Indicator	Value
EMIGRATION	Stock of emigrants	514.2 thousands
	Stock of emigrants as percentage of population	1.0%
	Top destination countries	Thailand, United States, India, Malaysia, Australia, United Kingdom, Japan, Canada, Republic of Korea, Germany
IMMIGRATION	Stock of immigrants	88.7 thousands
	Stock of immigrants as percentage of population	0.2%
	Females as percentage of immigrants	48.7%
	Refugees as percentage of immigrants	0.0%
	Top source countries	China, India, Pakistan, Bangladesh

Source: World Bank, The Migration and Remittances Factbook, 2011

5.5.3.3 Minorities, Indigenous People, Ethnic groups

There are more than 135 different ethnic groups in Myanmar, each with its own history, culture and language. The majority Burman ethnic group makes up about two-thirds of the population, roughly 36 million.

The minority ethnic nationalities, making up the remaining one-third, dominate the highland states around the country's Burman-dominated centre. The seven largest minority nationalities, besides Burman, are Shan, Karen, Arakanese, Mon, Kachin, Chin, and Karenni.

The principle on which the Union was based was one of ethnic balance, whereby the Burmans live in 7 first-order administrative units known as divisions, while each of the other 7 major ethnic groups forms a majority population in its own state. The relationship between the administrative divisions and the principal ethnic groups can be simplified as reported in the following table.

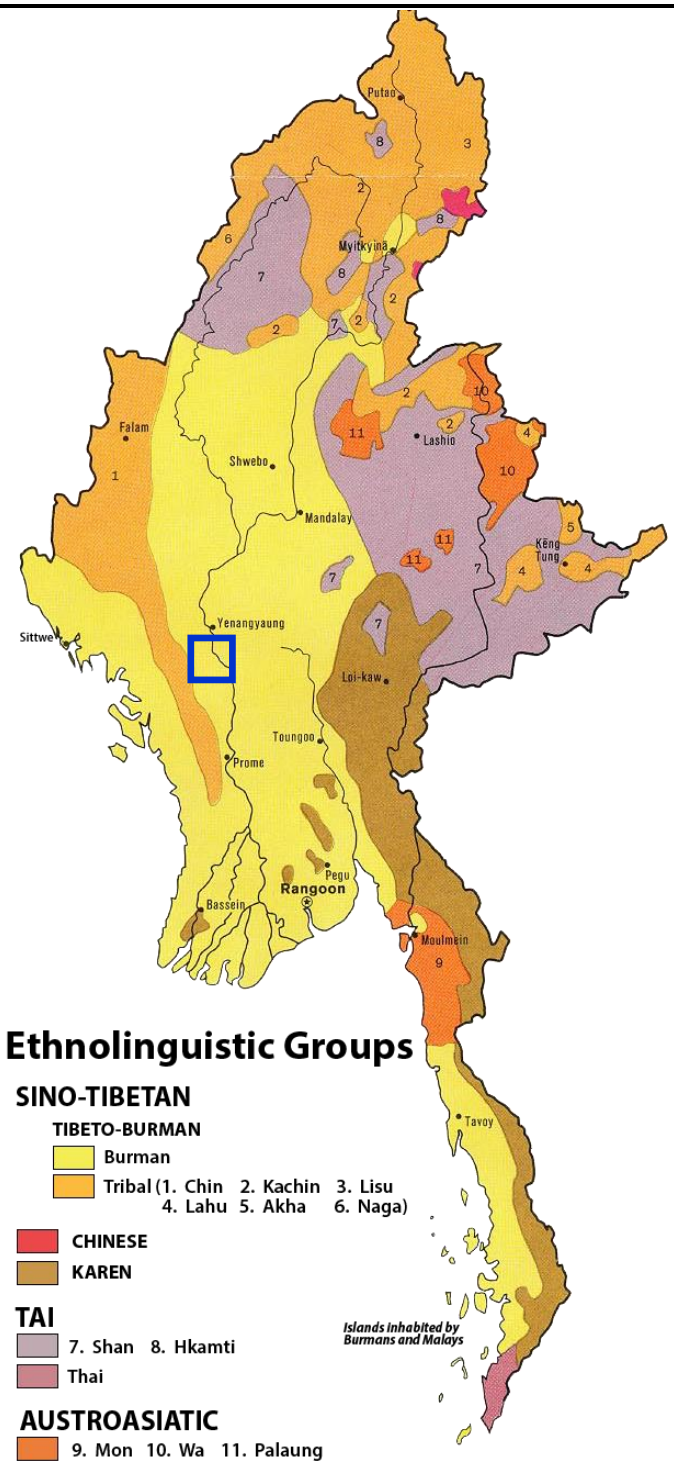
Table 5.56 Main ethnic groups

States/Division		Principal Ethnic Groups
States	Chin	Chin
	Kachin	Kachin
	Kayah	Karenni
	Kayin	mainly Karen; some Burman and Mon
	Mon	Mon and Burman
	Rakhine	Arakanese
	Shan	mainly Shan; some Wa, Karen and Palaung
Divisions	Ayeyarwady	mainly Burman; some Karen
	Bago	mainly Burman; some Karen
	Magway	Burman
	Mandalay	Burman
	Sagaing	mainly Burman; some Naga
	Tanintharyi	Burman, Mon and Karen
	Yangon	mainly Burman; some Karen

Source: pcgn, The Permanent Committee on Geographical Names, 2007

Table 5.35 shows the distribution of major ethno-linguistic groups.

Figure 5.31 Ethnolinguistic Groups (in Blue the Block RSF-5)



Source: U.S. Central Intelligence Agency, Ethnolinguistic map of Burma 1972

5.5.3.4 Criminality

According to a report spread by the Congressional Research Service (*Source: Liana Sun Wyler, Burma and Transnational Crime, CRS Report RL34225, Washington, DC: Congressional Research Service, 27 April 2009*), in Myanmar and across Southeast Asia operate transnational organized crime groups, that traffic drugs, humans, wildlife, gems, timber and other contraband flow.

Myanmar has an official strategy to combat drugs and it is party to all three major United Nations international drug control treaties:

- the 1961 Single Convention on Narcotic Drugs;
- the 1971 Convention on Psychotropic Substances;
- the 1988 Convention against the Illicit Traffic in Narcotic Drugs and Psychotropic Substances.

Also with regard to human trafficking, Myanmar is a party to the United Nations Convention against Transnational Organized Crime and its protocol on migrant smuggling and trafficking in persons, however there are still cases of sex and labour trafficking, as well as military recruitment of children.

5.5.3.5 Urbanization trends

Myanmar is still an agricultural country, with about 70% of the population living in rural areas. The urban population is 32.6% of total population (*Source: CIA World Factbook, 2011 est*.), the annual rate of urbanization is 2.49% (2010-15 est.).

The major urban areas are: Rangoon (capital of Myanmar), with 4.259 million inhabitants, Mandalay, with 1.009 million inhabitants, and Nay Pyi Taw, with 992,000 inhabitants (*Source: CIA World Factbook, 2009 est.*).

5.5.3.6 Religions and Local Beliefs

Myanmar is predominantly a Buddhist country with the Buddhists making up about 80% of the population, following the school of Theravada Buddhism. There are also Christians, Muslims, Animists and other.

An estimate of the religious composition of the country is the following (*Source: CIA, The World Factbook*):

- Buddhist 89%;
- Christian 4% (Baptist 3%, Roman Catholic 1%);
- Muslim 4%;
- Animist 1%;
- other 2%.

5.5.3.7 Languages

The three principal language families present in Burma are as follows:

- Tibeto-Burman (eastern branch): including Burmese, Kachin, Naga & Karen;
- Mon-Khmer: including Mon, Palaung, Wa;
- Thai: including Shan.

The situation is greatly complex, as is suggested by a linguistic survey begun in 1917, which identified 242 languages and dialects (*Source: pcgn, An introduction to the toponymy of Burma, 2007*). About three-quarters of the population of Burma, that is to say some 40 million people, speak one of the Tibeto-Burman languages. These are mostly Burmans who speak Burmese, almost the only language spoken in much of the central plains.

Native Burmans seldom speak any indigenous language other than Burmese, but many educated non-Burmans do speak Burmese as a second language, so Burmese can serve as a medium of communication away from the central plains also. Burmese exists in both a literary/ceremonial and in a colloquial form, the language itself being known as myanma (h)batha in the former but generally as bama (h)batha in the latter.

5.5.4 Welfare

5.5.4.1 Education System and Infrastructures, Access

The educational system of Myanmar is operated by the government's Ministry of Education, the Universities and professional institutes. The education system is based on the United Kingdom's system, due to nearly a century of British presence in Myanmar.

The education system is organized as follows.

- *Primary Education*: Following an optional pre-school period, children enter primary school for 5 compulsory years. To proceed further they must successfully write a comprehensive examination in basic academic subjects.
- *Middle Education*: The first phase of secondary education takes place at middle schools. where students pass through grades 6 to 8 before they write their standard eight examinations.
- *Secondary Education*: High school students entering at grade 9 may choose either an arts or science stream. All study Myanmar, English and mathematics. Arts students also study geography, history and economics, while science students concentrate on chemistry, physics and biology instead. At the end of this period students at government schools may sit for their university entrance examinations. Students who attend international English-language schools or other private schools are not eligible to sit for the matriculation exam, nor are they allowed to enrol in Myanmarese universities. Instead, they typically study overseas, at destinations such as Singapore, Malaysia, Australia, United Kingdom and the United States.
- *Vocational Education*: Vocational training, which is largely in the hands of the private sector has become popular among young people wanting to enter the hospitality, tourism, beauty, fashion, nursing or engineering sectors. It acts as a bridge to better jobs for those with little or no work experience.
- *Tertiary Education*: Myanmar is well endowed with universities where the widest range of courses may be followed.

In Table 5.57, some educational indicators are reported.

Table 5.57 Educational Indicators for Myanmar

Indicator	Value
Adult literacy rate	92.3%
Population with at least secondary education	17.8%
Gross enrolment ratio	Primary: 126% Secondary: 54% Tertiary: 11%
School teachers trained to teach	99.9%
Primary school dropout rate	25.2%

Source: UNDP, Human Development Report 2013

Overall 22.9% of Myanmar children aged 36–59 months are attending early childhood education; this value in Mandalay Region is considerably lower, in the amount of 16.7% (Table 5.58).

At national level there is no difference between boys and girls. Urban–rural differences are, however, visible with 39.1% of children in urban areas attending early childhood education, compared to 15.9% in rural areas. Socioeconomic status is another important factor: as many as 46% of children in the richest households attend early childhood education, while the rate for the poorest is as low as 7.6%.

Table 5.58 Early Childhood Education, Myanmar, 2009-2010

	Percentage of children aged 36-59 months currently attending early childhood education*	Number of children aged 36-59 months	Percentage of children attending first grade who attended pre-school programme in previous year**	Number of children attending first grade
Sex				
Male	22.6	3,093	38.5	654
Female	23.2	2,886	41.1	622
State/Division				
Kachin	34.6	229	86.9	47
Kayah	60.7	53	74.2	15
Kayin	25.1	228	16.4	53
Chin	32.7	107	80.2	21
Mon	13.1	268	16.0	87
Rakhine	5.4	485	(15.9)	38
Shan (North)	22.1	328	71.3	57
Shan (East)	22.4	75	(37.0)	11
Shan (South)	35.0	325	(68.1)	48
Ayeyarwaddy	16.2	467	47.3	85
Bago (East)	19.5	389	28.9	79
Bago (West)	24.7	168	(50.0)	50
Magwe	16.7	444	22.9	120
Mandalay	26.9	656	51.0	204
Sagaing	13.9	547	30.2	183
Tanintharyi	13.7	146	(2.2)	27
Yangon	34.0	1,066	37.8	151
Area				
Urban	39.1	1,802	52.8	373
Rural	15.9	4,178	34.4	904
Age of child				
36-47 months	13.8	3,132	na	na
48-59 months	32.9	2,848	na	na
5 years	na	na	39.8	1,276
Wealth index quintiles				
Poorest	7.6	1,522	34.5	265
Second	16.2	1,223	31.0	276
Middle	19.5	1,054	42.1	274
Fourth	32.3	1,117	41.8	233
Richest	46.0	1,064	51.7	227
Total	22.9	5,980	39.8	1,276

Source: Ministry of National Planning and Economic Development, Ministry of Health, UNICEF, Myanmar Multiple Indicator Cluster Survey 2009 - 2010, 2011

Universal access to basic education and the achievement of primary education by the world's children is one of the most important goals of the Millennium Development Goals (MDG).

Table 5.59 provides the percentage of children of primary school age, which is 5–9 years, attending primary school. In Myanmar, the majority of children of primary school age (90.2%) are attending school; this value is slightly higher for the Magway Region (93.5%). At the national level there is no notable difference between boys and girls. Slightly more children in urban areas (93%) than in rural areas (89.2%) are attending. While only 77.3% of 5-year-olds are attending school, 95% of both 7- and 8-year-olds are in school, indicating that several children begin school late. A total of 94.9% of children from the richest households are in school, compared to 81.4% from the poorest households.

Table 5.59 Primary School Net Attendance Ratio in Myanmar, 2009-2010

	Male		Female		Total	
	Net attendance ratio	Number of children	Net attendance ratio	Number of children	Net attendance ratio*	Number of children
State/Division						
Kachin	94.9	256	96.6	236	95.8	492
Kayah	95.4	60	95.1	59	95.3	119
Kayin	93.0	251	96.0	242	94.5	493
Chin	88.9	109	89.4	124	89.2	233
Mon	93.9	369	93.7	375	93.8	744
Rakhine	78.0	667	73.7	670	75.8	1,337
Shan (North)	75.8	399	80.0	313	77.6	712
Shan (East)	81.4	99	90.1	95	85.6	194
Shan (South)	93.0	349	94.0	325	93.5	674
Ayeyarwaddy	89.8	530	89.9	530	89.8	1,060
Bago (East)	91.2	481	91.0	472	91.1	953
Bago (West)	84.9	280	90.9	239	87.7	519
Magwe	92.1	585	94.8	597	93.5	1,183
Mandalay	91.5	990	92.0	885	91.7	1,875
Sagaing	93.7	735	94.7	746	94.2	1,480
Tanintharyi	97.7	228	98.3	200	98.0	428
Yangon	92.2	909	92.3	960	92.3	1,869
Area						
Urban	93.0	1,921	92.9	1,953	93.0	3,874
Rural	88.6	5,377	89.8	5,114	89.2	10,491
Age**						
5	77.3	1,523	77.3	1,415	77.3	2,938
6	90.3	1,501	92.9	1,440	91.6	2,941
7	94.0	1,414	96.0	1,452	95.0	2,866
8	95.0	1,419	95.2	1,314	95.1	2,733
9	93.1	1,440	91.9	1,446	92.5	2,887
Wealth index quintiles						
Poorest	81.0	1,952	81.8	1,866	81.4	3,818
Second	90.0	1,480	91.1	1,495	90.6	2,976
Middle	93.2	1,421	94.3	1,381	93.7	2,802
Fourth	94.6	1,280	95.3	1,218	94.9	2,499
Richest	94.7	1,164	95.1	1,107	94.9	2,271
Total	89.8	7,298	90.6	7,067	90.2	14,364

Source: Ministry of National Planning and Economic Development, Ministry of Health, UNICEF, Myanmar Multiple Indicator Cluster Survey 2009 - 2010, 2011

The secondary school net attendance ratio in Myanmar is presented in Table 5.60. Only 58.3% (55.8% in Magway region) of the children of secondary school age are attending secondary school. Of the remaining children, some of them are either out of school or attending primary school. The difference in secondary school attendance between urban and rural areas is a lot more pronounced than it is for primary school attendance. While 76% of children in urban areas attend secondary school, the rate in rural areas is 52%.

Secondary school attendance varies according to age. Only half of 10-year-olds are in secondary school, but this increases to 67.4% for 11 and 12-year-olds and decrease to 45.2%for 15-year-olds attend secondary school. Socioeconomic status has a strong impact on attendance in secondary school. Only 28.2% of children from the poorest households are in secondary school, while the figure for children from the richest households is as high as 85.5%.

Table 5.60 Secondary School Net Attendance Ratio in Myanmar, 2009-2010

	Male		Female		Total	
	Net attendance ratio	Number of children	Net attendance ratio	Number of children	Net attendance ratio*	Number of children
State/Division						
Kachin	62.7	247	73.3	237	67.9	484
Kayah	64.5	55	75.1	58	69.9	113
Kayin	56.2	241	62.1	262	59.3	503
Chin	65.6	130	61.7	124	63.7	254
Mon	52.2	411	59.0	378	55.4	789
Rakhine	33.3	625	28.4	607	30.9	1,232
Shan (North)	44.6	325	41.0	387	42.6	712
Shan (East)	42.8	81	54.1	102	49.1	183
Shan (South)	57.8	318	67.1	355	62.7	673
Ayeyarwaddy	53.2	589	56.2	608	54.7	1,197
Bago (East)	60.0	563	58.2	624	59.0	1,186
Bago (West)	55.3	330	54.6	334	54.9	664
Magwe	57.5	691	54.0	698	55.8	1,389
Mandalay	59.5	1,113	59.0	1,040	59.3	2,153
Sagaing	65.7	929	62.1	898	63.9	1,827
Tanintharyi	63.8	244	69.4	273	66.7	517
Yangon	73.9	896	75.5	963	74.7	1,859
Area						
Urban	75.0	2,051	77.0	2,098	76.0	4,149
Rural	51.9	5,735	52.0	5,849	52.0	11,584
Age**						
10	50.0	1,371	50.4	1,353	50.2	2,724
11	66.2	1,310	68.6	1,324	67.4	2,634
12	67.2	1,343	67.7	1,315	67.4	2,658
13	62.4	1,301	63.5	1,430	63.0	2,730
14	56.0	1,231	55.6	1,240	55.8	2,471
15	45.6	1,230	44.9	1,286	45.2	2,516
Wealth index quintiles						
Poorest	29.3	1,796	27.2	1,829	28.2	3,626
Second	51.3	1,640	50.2	1,702	50.7	3,343
Middle	61.2	1,630	65.4	1,601	63.3	3,232
Fourth	73.3	1,506	76.4	1,517	74.9	3,023
Richest	86.4	1,212	84.7	1,297	85.5	2,509
Total	58.0	7,785	58.6	7,947	58.3	15,733

Source: Ministry of National Planning and Economic Development, Ministry of Health, UNICEF, Myanmar Multiple Indicator Cluster Survey 2009 - 2010, 2011

Considering the young female literacy, the percentage of literate young women is presented in Table 5.61. Overall, 87.8% of young Myanmar women (93.3% in Magway Region) are literate. The percentage is higher in urban areas at 94.9% than in rural areas, at 84.9%.

Socioeconomic differences are visible: among young women in the poorest households, 69% are literate, while among the richest the literacy rate is as high as 96.6%.

Table 5.61 Young Female Literacy in Myanmar, 2009-2010

	Percentage literate*
State/Division	
Kachin	96.4
Kayah	90.7
Kayin	86.5
Chin	78.0
Mon	87.8
Rakhine	54.6
Shan (North)	63.6
Shan (East)	65.1
Shan (South)	85.9
Ayeyarwaddy	91.0
Bago (East)	92.0
Bago (West)	94.5
Magwe	93.3
Mandalay	88.4
Sagaing	96.1
Tanintharyi	95.9
Yangon	95.6
Area	
Urban	94.9
Rural	84.9
Age	
15-19	89.6
20-24	86.0
Wealth index quintiles	
Poorest	69.0
Second	86.7
Middle	91.2
Fourth	94.9
Richest	96.6
Total	87.8

Source: Ministry of National Planning and Economic Development, Ministry of Health, UNICEF, Myanmar Multiple Indicator Cluster Survey 2009 - 2010, 2011

Human Development Index (HDI)

Myanmar's HDI value for 2013 was 0.524 (*Source: UNDP, Human Development Report 2014*); this a low human development value and ranks the country at 150 out of 187 countries and territories. Between 1980 and 2013, Myanmar's HDI value increased from 0.328 to 0.524, an increase of 59.6% or an average annual increase of about 1.43%.

The following table shows Myanmar's progress in each of the HDI indicators. Between 1980 and 2013, Myanmar's life expectancy at birth increased by 10.2 years, mean years of schooling increased by 2.3 years and expected years of schooling increased by 2.6 years. Myanmar's GNI per capita increased by about 468.7% between 1980 and 2013.

Table 5.62 Myanmar's HDI Trends

	Life expectancy at birth	Expected years of schooling	Mean years of schooling	GNI per capita (2011 PPP$)	HDI value
1980	55.0	6.0	1.7	0,703	0.328
1985	56.9	6.2	2.2	0,826	0.355
1990	58.7	5.9	2.4	0,679	0.347
1995	60.5	7.1	2.7	0,837	0.385
2000	62.1	7.5	3.0	1,177	0.421
2005	63.5	8.3	3.4	2,084	0.472
2010	64.7	8.6	4.0	3,423	0.514
2011	64.8	8.6	4.0	3,599	0.517
2012	65.0	8.6	4.0	3,793	0.520
2013	65.2	8.6	4.0	3,998	0.524

5.5.4.2 Poverty

The gap between the small number of wealthy people and the poor has been widening. According to the UNDP's 2010 figures, the national poverty rate is 32%, with a significant urban-rural gap and a much higher rate in rural areas (*Source: BTI 2012, Myanmar Country Report*).

Myanmar is still an agricultural country, with about 70% of the population living in rural areas. Many farmers barely survive at very low income levels, and cannot access credit sufficient to significantly increase their agricultural inputs, thus improving their agricultural production. This situation worsened after Cyclone Nargis in 2008, as the storm hit the Irrawaddy Delta, the country's rice bowl. Surviving farmers lost their homes, their capital, their seeds and other agricultural inputs, while many of their fields and water sources were inundated by salty water.

The majority of people in Myanmar spend 70% of their income on food, with little left for health care and education for their children.

Multidimensional Poverty Index (MPI)

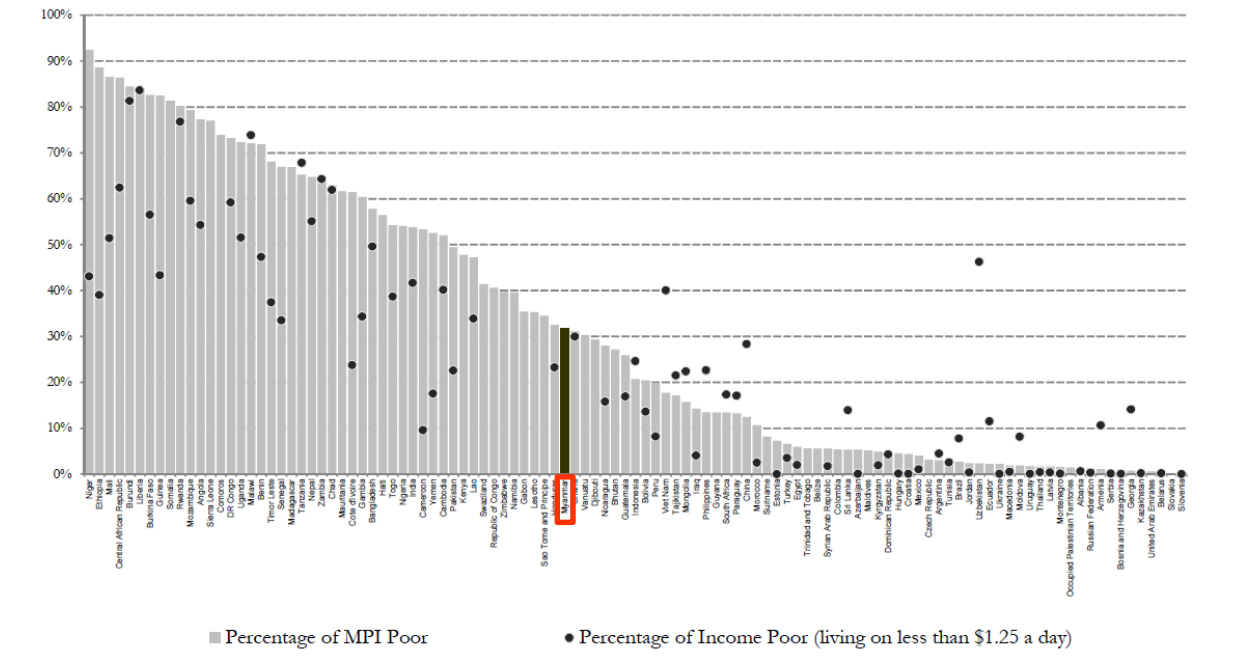
The Multidimensional Poverty Index of Myanmar during the year 2011 was 0.154. This index was developed in 2010 and it replaced the previous Human Poverty Index.

The MPI is an index of acute multidimensional poverty and it uses different factors to determine poverty beyond income-based lists. It shows the number of people who are multidimensionally poor (suffering deprivations in 33.33% of weighted indicators) and the number of deprivations with which poor households typically contend.

The following Figure 5.32 shows the percentage of people who are MPI poor in the 109 developing countries analysed; the column denoting Myanmar is dark, with other countries shown in light grey. The percentage of MPI poor in Myanmar is 31.8% (*Source: University of Oxford, OPHI Country Briefing 2011, Myanmar*). Myanmar position according to MPI is 48th on 109.

The dark dots denote the percentage of people who are income poor according to the $1.25 a day poverty line in each country; dots are only shown where the income data available is within three years of the MPI survey year. There isn't this data for Myanmar.

Figure 5.32 Percentage of MPI Poor



Source: University of Oxford, OPHI Country Briefing 2011, Myanmar

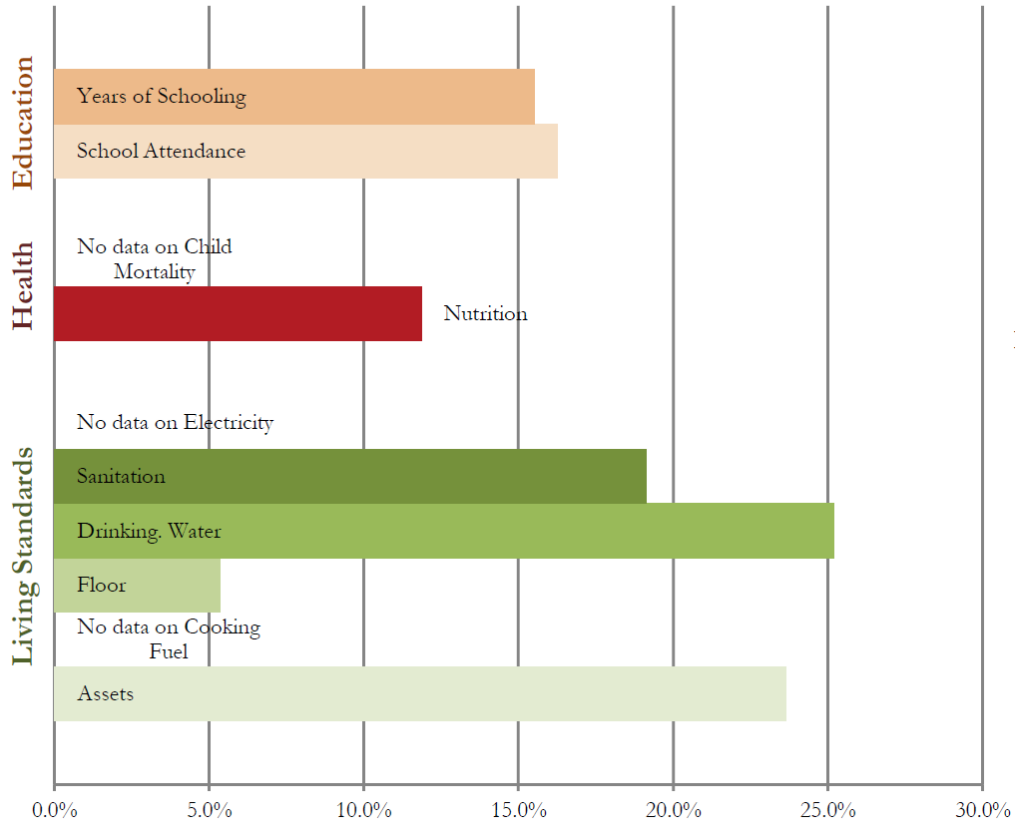
The MPI uses 10 indicators to measure poverty in three dimensions: education, health and living standards. The indicators are (*Source: OPHI, Multidimensional Poverty Index 2011: Brief Methodological Note*):

- *Years of schooling*: deprived if no household member has completed five years of schooling;
- *Child school attendance*: deprived if any school-aged child is not attending school up to class 8;
- *Child mortality*: deprived if any child has died in the family;
- *Nutrition*: deprived if any adult or child for whom there is nutritional information is malnourished;
- *Electricity*: deprived if the household has no electricity;
- *Sanitation*: deprived if the household's sanitation facility is not improved or it is improved but shared with other households;

- *Drinking water*: deprived if the household does not have access to safe drinking water or safe drinking water is more than a 30-minute walk from home roundtrip;
- *Floor*: deprived if the household has a dirt, sand or dung floor;
- *Cooking fuel*: deprived if the household cooks with dung, wood or charcoal;
- *Assets ownership*: deprived if the household does not own more than one radio, TV, telephone, bike, motorbike or refrigerator and does not own a car or truck.

The bar chart in Figure 5.33 reports the proportion of the population that is poor and deprived in each indicator. The most widespread deprivation in Myanmar is in drinking water (about 25% of population), the less common is in floor (about 5% of population).

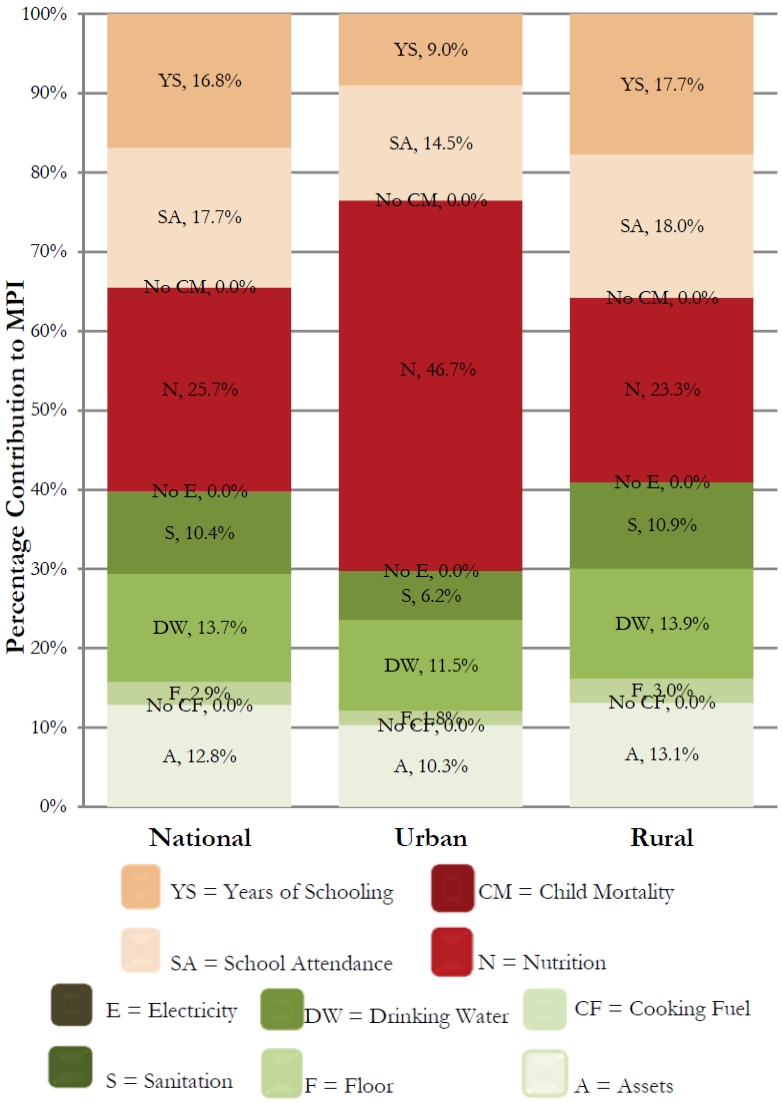
Figure 5.33 Percentage of the Myanmar Population who are MPI Poor and Deprived in each Indicator



Source: University of Oxford, OPHI Country Briefing 2011, Myanmar

Finally, Figure 5.34 shows the decomposition of MPI at the national level, for urban areas and for rural areas. It shows that nutrition is a more widespread issue in urban areas compared to rural areas (46.7% vs. 23.3%), whereas sanitation and years of schooling are more widespread in rural areas compared to urban areas (respectively 10.9% vs. 6.2% and 17.7% vs. 9.0%).

Figure 5.34 Contribution of Indicators to the MPI at the National Level, for Urban Areas and for Rural Areas



Source: University of Oxford, OPHI Country Briefing 2011, Myanmar

5.5.5 Facilities

5.5.5.1 Transportation

The following Table 5.63 presents some statistics related to the national transportation system.

Table 5.63 Statistics related to the National Transportation System

Transportation system	Type	Value
Airports	Total number	64
Airports with paved runways	Total number	36
	Over 3,047 m	12
	2,438 to 3,047 m	11
	1,524 to 2,437 m	12
	Under 914 m	1
Airports with unpaved runways	Total number	28
	Over 3,047 m	1
	1,524 to 2,437 m	4
	914 to 1,523 m	10
	Under 914 m	13
Heliports	Total number	11
Railways	Total length	5,031 km
Roadways	Total length	34,377 km (includes 358 km of expressways) (1)
Waterways	Total length	12,800 km (2)
Ports and terminals	Major seaports	Moulmein, Sittwe
	River ports	Rangoon (Rangoon River)

Note
(1) 2010 est.
(2) 2011 est.

Source: CIA World Factbook, 2013 est.

International airports are located in Yangon and Mandalay. The state-run airline is Myanmar Airways International. Domestic flights run frequent between Yangon and other cities and an international service is active from Yangon to several major Southeast Asian cities. The nearest airport is the Magwe Airport, at less than 10 km from the western boundary of Block RSF-5.

There are also small privately owned airlines that offer domestic and very limited international service.

The first railway line, running from Yangon to Pyay (Prome) and built in 1877, followed the Irrawaddy valley. The line was not extended to Mandalay; instead, after 1886 a new railway from Yangon up the Sittang valley was constructed, meeting the Irrawaddy at Mandalay. From Mandalay it crossed the river and, avoiding the Irrawaddy valley, went up the Mu River valley to connect with the Irrawaddy again at Myitkyina. A short branchline now connects Naba to Katha on the Irrawaddy below Bhamo.

The Yangon-Mandalay-Myitkyina railway is the main artery, and from it there are branchlines connecting the northern and central Shan Plateau with the Irrawaddy. Other branches run from Pyinmana across the Bago Mountains to Kyaukpadaung and from Bago to Mawlamyine to Ye. The Pyay-Yangon railway has a branchline crossing the apex of the delta to Hinthada and Pathein (Bassein). The Block RSF-5 is crossed, from West to East, by the Magway - Taungdwingyi railway.

The road system, until independence, was confined to the Irrawaddy and Sittang valleys, duplicating the railway route. A road goes from Pyay along the Irrawaddy to the oil fields, and many roads extend into the rural areas. These rural roads, however, are often impassable during the wet season. There were originally three international roads in use during World War II:

- the Burma Road from Lashio to Kunming in China;
- the Stilwell, or Ledo, Road between Myitkyina and Ledo in India;
- the road between Kengtung, in the southeastern Shan Plateau, and northern Thailand.

These roads subsequently became neglected but more recently were rebuilt and extended.

The country's major port is Yangon, with up-to-date equipment and facilities. Pathein, Mawlamyine, and Sittwe are also important ports.

5.5.5.2 Water and Sanitation

An overview of the percentage of household members both using improved sources of drinking water and having access to a sanitary means of excreta disposal is presented in Table 5.64. In Myanmar 72.3% of the population both use improved sources of drinking water and have access to a sanitary means of excreta disposal.

This figure is strongly correlated with wealth and area of residence. While 65.2% of the rural population both use improved sources of drinking water and have access to a sanitary means of excreta disposal, this proportion rises to 88.8% in urban areas.

Use of improved sources of drinking water and access to a sanitary means of excreta disposal is lowest in Rakhine (30.1%), whereas the highest coverage is found in Shan (East), with 91%. In Magway Region the coverage of improved sanitation facilities and water sources is 66.5%.

Only 43.1% of the poorest quintile in Myanmar both use an improved source of drinking water and have access to improved sanitation facilities, contrasting with 93.6% of the richest quintile.

Table 5.64 Use of Improved Water Sources and Access to Improved Sanitation in Myanmar, 2009-2010

	Percentage of household population:			
	Using improved sources of drinking water*	Access to sanitary means of excreta disposal**	Using improved sources of drinking water and access to sanitary means of excreta disposal	Number of household members
State/Division				
Kachin	89.3	92.1	83.3	4,034
Kayah	69.6	81.2	59.7	834
Kayin	51.1	73.6	42.1	4,142
Chin	86.5	86.9	79.9	1,696
Mon	86.3	91.2	78.4	6,390
Rakhine	57.7	48.0	30.1	9,303
Shan (North)	81.4	68.3	59.7	5,882
Shan (East)	99.0	92.1	91.0	1,860
Shan (South)	89.0	85.6	78.5	6,215
Ayeyarwaddy	79.4	83.1	66.2	11,306
Bago (East)	83.5	79.8	73.0	9,054
Bago (West)	91.2	88.4	81.3	6,432
Magwe	79.3	84.2	66.5	12,619
Mandalay	81.9	91.1	76.6	20,833
Sagaing	86.6	90.9	80.1	16,346
Tanintharyi	72.7	84.4	63.5	3,706
Yangon	92.5	93.8	88.0	20,618
Area				
Urban	93.2	94.4	88.8	42,339
Rural	77.6	80.4	65.2	98,930
Wealth index quintiles				
Poorest	66.8	59.8	43.1	28,252
Second	79.2	82.6	67.1	28,257
Middle	82.0	88.9	74.4	28,251
Fourth	88.2	93.4	83.2	28,256
Richest	95.0	98.2	93.6	28,252
Total	82.3	84.6	72.3	141,269

Source: Ministry of National Planning and Economic Development, Ministry of Health, UNICEF, Myanmar Multiple Indicator Cluster Survey 2009 - 2010, 2011

A more detailed description of water and sanitation issues is reported in section 5.8.7.

5.5.5.3 Roads

Myanmar has about 148,690 km of road networks (*Source: Current Situation of Road Networks and Bridges, Government of the Republic of the Union of Myanmar, Ministry of Construction, Public Works, 2013*). The length of various categories of road are as under:

- Union Highway, 19,503 km;
- Township network road, 19,580 km;
- Major city road and other roads, 27,507 km;
- Village and boundary area roads, 82,100 km.

The following Table 5.65 reports some data about number of registered vehicles and road length in the last 12 years.

Table 5.65 Statistical Data of Vehicles and Roads Length

Year	Registred vehicles	Road length (km)
2001	445,167	69,732
2002	461,692	73,843
2003	476,350	78,266
2004	960,341	90,713
2005	978,522	92,859
2006	991,566	104,058
2007	1,024,372	111,737
2008	1,997,358	125,355
2009	2,067,839	127,942
2010	2,298,677	130,050
2011	2,331,663	142,395
2012	2,476,672	148,690

Source: Government of the Republic of the Union of Myanmar, Ministry of Construction, Public Works, 2013

Asian Highway Network

Myanmar is crossed by the Asian Highway Network (or the Great Asian Highway), a 141,000km network of roads running across 32 countries. It is being built with an intention to improve transport facilities throughout these nations and provide road links to Europe. It is a part of the Asian Land Transport Infrastructure Development (ALTID) project being supported by United Nations Economic and Social Commission for Asia and the Pacific (ESCAP).

In Myanmar, the Great Asian Highway runs through 3,003 km.

The whole length of the project is divided into various stretches, numbered from AH1 to AH87. Single digit roads are major roads in the network which connect more than one sub-region. The stretches crossing Myanmar are the following:

- the AH1, a 20,557 km highway from Tokyo (Japan) to the Turkey-Bulgaria border. It is the longest among the entire network and passes through Korea, China, south-east Asia, India, Pakistan, Afghanistan and Iran;
- the AH2, a 13,177 km roadway from Denpasar (Indonesia) to Khosravi (Iran). It passes through Indonesia, Singapore, Malaysia, Thailand, Myanmar, India, Bangladesh, Nepal, Pakistan and Iran;
- the AH3, a 7,331 km roadway from Ulan-Ude (Russia) to Tanggu (China) and from Shanghai (China) to Chiang Rai (Thailand) and Kengtung (Myanmar);
- the AH14, a 2,077 km roadway from Hai Phong (Vietnam) to Mandalay (Myanmar).

The following Table 5.66 shows some features of the Asian Highway in Myanmar.

Table 5.66 Status of the Asian Highway in Myanmar

No. Route	Itinerary	Length (km)	Paved (km)		Unpaved (km)
			2 Lanes or more	1 Lane	
AH1	Myawadi – Payagyi (– Yangon) – Meiktila – Mandalay –Tamu	1,650	969	467	214
AH2	Tachilek – Kyaning Tong – Meiktila – Mandalay – Tamu	807	50	541	216
AH3	Mongla – Kyaning Tong	93	-	5	88
AH14	Muse – Lashio – Mandalay	453	453		
Total		3,003	1,472	1,013	518
Percentage		100%	49,0%	33,7%	17,3%

Source: United Nations ESCAP (Economic and Social Commission for Asia and the Pacific)

Figure 5.35 The Asian Highway in Myanmar



AH1 Yangon to Bago



AH1 near Tamu

Source: United Nations ESCAP (Economic and Social Commission for Asia and the Pacific)

Figure 5.36 The Asian Highway Routes in Myanmar (in Blue the Block RSF-5)



Source: United Nations ESCAP (Economic and Social Commission for Asia and the Pacific)

Local Roads

Most of Myanmar's country roads are unpaved, and many become impassable during the monsoon season.

5.5.5.4 Communications

Compared to other member countries of the Association of Southeast Asian Nations (ASEAN), Myanmar has a relatively weak access network. Teledensity, including mobile telephony, is only 1.32 %, the lowest in the ASEAN. The number of Internet users is also negligible. But the demand for telephone services is high and the minutes of use and Average Revenue per User (ARPU) are increasing, which implies that there are network externalities and the return on investments in telephone services will improve in the future.

The number of automated switching systems has been increasing in urban areas, while manual switches continue to be used in rural areas. The transmission systems consist mainly of microwave links and satellite links except in Yangon and the Yangon–Mandalay route where the optical fibre cables are buried. The microwave links consist of analogue and digital links. The current transmission systems are more than enough to meet the country's telecommunications demand. Myanmar's international link is also satisfactory in the sense that the main submarine cable is backed up by a satellite link.

As of February 2007, there were about 91,450 Internet users using dial-up (71.25 % of users), Asymmetric Digital Subscriber Line — ADSL — (12.64 %), broadband wireless (6.73 %), satellite terminal (5.66 %), fibre-optic cable line (2.9 %), X.25 line (0.65 %) and E1 line (0.17 %).

There are 163 public access centres (PACs) in Yangon, 13 PACs in Mandalay, and 43 PACs in regional areas.

The short-term goal of Myanmar's ICT Infrastructure Master Plan was to install 100,000 lines and achieve 3.2 % teledensity by % mobile subscription rate, and install village phones in rural areas. The long-term vision is to achieve 30 % teledensity with each household having access to telephone lines, reach a 25 % mobile subscription rate, and make telephones and the Internet available at a government office in every village by 2025.

5.5.5.5 Electricity

Over 70% of the population has no access to electricity (*Source: World Bank, Bringing more electricity for the people of Myanmar, 2013*), due to the low electrification rates (22% in 2011). Myanmar's electricity policy is focused on exploiting the country's hydropower potential to boost revenue generating electricity exports and to provide base load domestic electricity supplies. Further development of coal and gas-fired capacity is also envisaged to help meet peak power demand and to boost electricity supplies during the dry season.

The electricity production in Myanmar was 5,850,000 MWh in 2009 (*Source: World Bank, 2010*). Additional statistics relating to electricity in Myanmar are shown in the following Table.

Table 5.67 World Bank Electricity Information for Myanmar, 2009

Electricity production (billion kilowatt hours)	Sources of electricity (% of total)						Access to electricity (% of population)
	Coal	Natural gas	Oil	Hydropower	Renewable sources	Nuclear power	
5.9	0%	19.6%	8.9%	71.5%	0%	0%	13.0%

Source: eni, 2009

The main source of electricity comes from hydropower production. In particular Magway Region has 57 conserved dams/lakes, three dams/lakes that are not conserved by Irrigation Department and 1102 small dams/lakes, 30 river water pumping stations.

Water stored in dams or weirs is used also for irrigation of farmland, especially for paddy cultivation.

Myanmar's electricity generation sector remains dominated by the Ministry of Electric Power-1 and the Myanmar Electric Power Enterprise (MEPE), a state owned enterprise established in 1997. The Ministry of Electric Power-1 is responsible for operating and carrying out maintenance work at HPPs and coal-fired power plants, while the MEPE operates and maintains gas-fired power plants. MEPE falls under the Ministry of Electric Power-2.

5.5.5.6 Waste Generation and Management

Traditionally, waste collection and disposal in Myanmar have been the responsibility of local municipal authorities, without any private sector involvement. Except for Yangon (lower Myanmar) and Mandalay (upper Myanmar), where autonomous City Development Committees and their Pollution Control and Cleansing Departments (PCCDs) are tasked with solid waste management within their municipal areas, In other parts of the country Township Development Committees under the Department for Development Affairs (DDA), Ministry of Progress of Border Area Development and National Races and Development Affairs (MPBND), manage municipal waste collection and disposal. This makes DDA responsible for 323 out of the total of 325 townships in Myanmar (National Commission for Environment al Affairs, 2006).

In the Magway Region, 84.2% uses sanitary means of excreta disposal. In terms of improved sanitation facilities, 0.0%, 7.0%, 4.3 %, 71.5%, and 1.3% use flush/pour flush to: piped sewer system, septic tank, Ventilated Improved Pit latrine, pit latrine with slab toilet and composting toilet respectively.

In terms of unimproved sanitation facilities, in Magway Region, 0.0%, 5.7%, 0.0%, 0.0 %, 10.1% and 0.0% use: pour flush to somewhere else, pit latrine without slab/ open pit, bucket, hanging toilet, hanging latrine, other and no facilities respectively (DOH, 2010).

5.5.6 Political and Institutional Framework

5.5.6.1 Administrative System

Myanmar is divided into twenty-one administrative subdivisions, which include:

- 7 States (Chin State, Kachin State, Kayin State, Kayah State, Mon State, Rakhine State and Shan State);
- 7 Regions (Ayeyarwady Region, Bago Region, Magway Region, Mandalay Region, Sagaing Region, Tanintharyi Region, Yangon Region);
- 1 Union Territory (Naypyidaw Union Territory);
- 5 Self-Administered Zones (Danu Self-Administered Zone, Kokang Self-Administered Zone, Naga Self-Administered Zone, Pa-O Self-Administered Zone and Pa Laung Self-Administered Zone);
- 1 Self-Administered Division (Wa Self-Administered Division).

The regions were called divisions prior to August 2010. States and divisions are divided into districts and these districts consist of townships that include towns, wards and village-tracts. Village-tracts are groups of adjacent villages.

Table 5.68 Administrative Division of Myanmar (Division included in the Study Area in Bold Characters)

Name	Area (Km^2)	Population	Capital City	N. of districts
Chin State	36,019	572,900	Hakha	2
Kachin State	89,041	1,403,700	Myitkyina	3
Kayin State	30,383	1,642,000	Hpa-an	3
Kayah State	11,733	261,400	Loikaw	2
Mon State	12,297	2,611,800	Mawlamyine	2

Name	Area (Km²)	Population	Capital City	N. of districts
Rakhine State	36,778	3,176,700	Sittwe	5
Shan State	155,801	5,774,200	Taunggyi	10
Ayeyarwady Region	35,138	7,749,800	Pathein	5
Bago Region	39,404	5,900,800	Bago	4
Magway Region	**44,820**	**5,032,600**	**Magwe**	**5**
Mandalay Region	37,024	7,113,000	Mandalay	7
Sagaing Region	94,625	5,987,400	Sagaing	8
Tanintharyi Region	43,343	1,424,800	Dawei	3
Yangon Region	10,171	6,170,300	Yangon	4
Naypyidaw Union Territory	2,724	925,000	Naypyidaw	-
Danu Self-Administered Zone	n.a.	n.a.	Pindaya	-
Kokang Self-Administered Zone	n.a.	n.a.	Laukkai	-
Naga Self-Administered Zone	n.a.	n.a.	Lahe	-
Pa-O Self-Administered Zone	n.a.	n.a.	Hopong	-
Pa Laung Self-Administered Zone	n.a.	n.a.	Namhsan	-
Wa Self-Administered Division	n.a.	n.a.	Hopang	-
Total	**679,301**	**55,746,400**		

Source: pcgn, The Permanent Committee on Geographical Names, 2007

Myanmar's governing machinery has been characterised for more than half a century by a strong executive and a weak judiciary. This has important contemporary repercussions, but so too does its more recent adherence to the principle of the separation of powers: the notion that good governance is promoted by dividing responsibilities for the enactment, application and adjudication of laws.

Myanmar is a unitary presidential constitutional republic with recent parliamentary government took power in March 2011. The President Thein Sein has been a chief of state and head of the government since 4 February 2011. The president has the exclusive or primary right to nominate all senior Union officials, including members of the Constitutional Tribunal, Supreme Court justices, and the Attorney General.

Executive

The 2008 constitution sets out that the government consists of the president (who heads the government), two vice-presidents, ministers of the union, and the attorney-general of the union. All ministers and deputy ministers not nominated by the commander-in-chief are nominated by the president but require approval from the Pyidaungsu Hluttaw (the Assembly of the Union) which can block the appointment only if the person does not match the basic requirements listed in the constitution. Certain executive functions are also vested in the National Defence and Security Council (NDSC), which is led by the president but has a majority of military appointees. It comprises the two vice-presidents, the speakers of the Pyithu Hluttaw and Amyotha Hluttaw, the commander-in-chief and the deputy commander-in-chief of the

defence services, as well as the ministers for defence, foreign affairs, home affairs, and border affairs.

Legislature

According to the 2008 constitution, legislative power is exercised by the two chambers of the Pyidaungsu Hluttaw: the Amyotha Hluttaw and the Pyithu Hluttaw. The constitution provides for a 25% quota for military representatives. The Pyithu Hluttaw has a total of 440 representatives, and the Amyotha Hluttaw has 224 members. Laws can be drafted and proposed by a list of Union-Level Organisations, which include the Union Government (the Executive Branch), the National Defence and Security Council, the Financial Commis- sion, the Supreme Court, and a few others, all of which are formed by the Executive Branch or Pyihtaungsu Hluttaw. These laws are then voted on in parliament.

Judiciary

The 2008 constitution provides for the establishment of a Supreme Court, with the chief justice appointed by the president. There is also a high court in each of the seven regions and states and district and township courts. To deal with all matters related to military personnel, there is a court martial with no civilian oversight, which ultimately makes the word of the commander-in-chief final and conclusive.

5.5.6.2 Geopolitical Issues Internal and International Conflicts

The country, in the years, has experienced two types of conflict, one between the military regime and the opposition, which has prevailed since 1988 – 1990, and the second between the military government and the country's various ethnic minorities.

Various ethnic groups have waged armed struggle against the government for autonomy in their ethnic areas. Although the government has forged ceasefire agreements with more than a dozen ethnic armies, no significant political concessions were made. Tensions have been growing in the ceasefire areas since 2009, when the military ordered ethnic armies that were party to the ceasefire to be transformed into border guard forces (BGF) under the Myanmar military's control. While some ethnic groups accepted the border guard proposal, the largest groups have so far refused to lay down their weapons (*Source: BTI 2012, Myanmar Country Report*).

However in the recent years, after the election of the Prime Minister Thein Sein as president, the government has initiated a series of political and economic reforms leading to a substantial opening of the long-isolated country. These reforms have included also releasing hundreds of political prisoners, reaching preliminary peace agreements with 10 of the 11 major armed ethnic groups, enacting laws that provide better protections for basic human rights, and gradually reducing restrictions on freedom of the press, association, and civil society.

Economic and Human Loss due to Natural Disaster

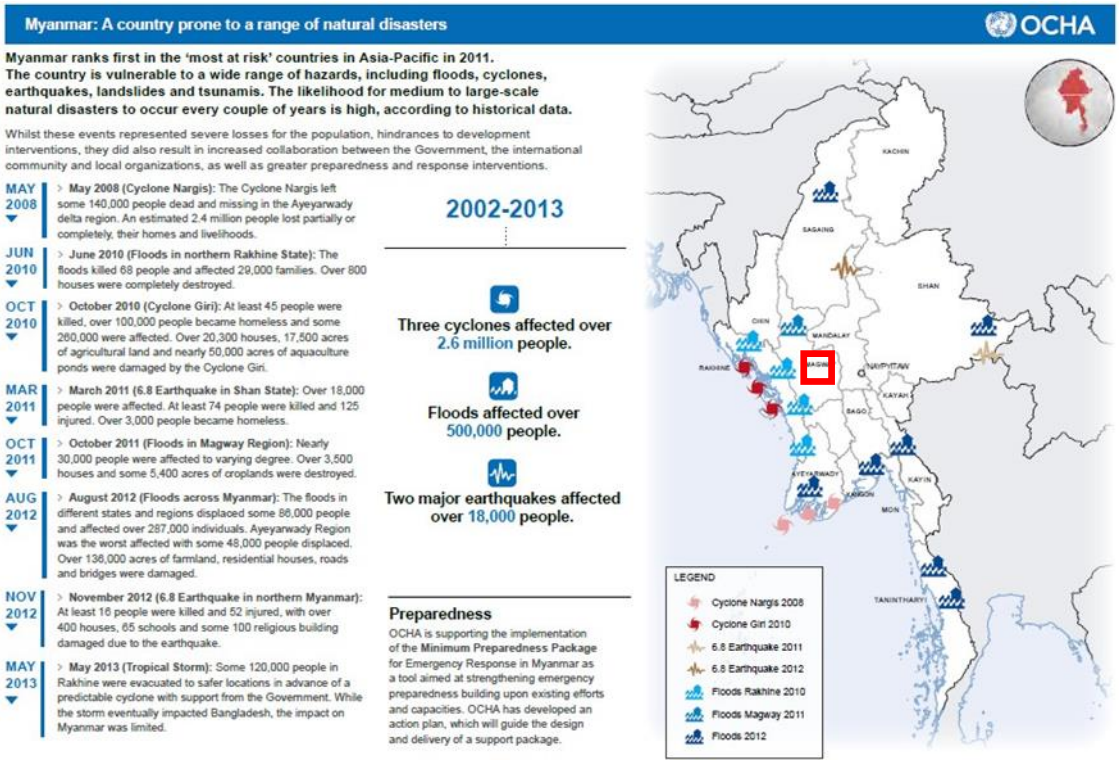
In Myanmar, the population is exposed to a plethora of natural hazards – cyclone, flood, drought, earthquake, tsunami and wild fires. IDMC's report reveals that a round 1.9 million people have been displaced by disasters in the country over the last five years (2008-2012).

Just in 2012, 86,000 were displaced by floods and a further 25,800 by an earthquake disaster in the country. In the south-west, people living in the Ayeyarwady delta face particularly high

disaster risk. Many coastal communities became even more vulnerable following the devastation brought by the Cyclone Nargis disaster in 2008, along with Cyclone Giri that hit Rakhine state in 2010 that combined displaced over 1.6 million and 100,000 people, respectively. (*Source: Internal Displacement Monitoring Center, May 2013*).

Following Figure shows the OCHA snapshot on 2002-2013 natural disaster in the country. Magway region and the area of Block RSF-5 haven't been interested by such natural disasters.

Figure 5.37 OCHA Snapshot on 2002-2013 Natural Disaster in the Country (in Red the Block RSF-5)



Source: OCHA, 2013. From Reliefweb May 2013

5.5.6.3 Military Authorities

The military organization of Myanmar is the Myanmar Armed Forces, officially known as Tatmadaw. The armed forces are administered by the Ministry of Defence and are composed of the following service branches:

- the Myanmar Army, the largest branch of the Armed Forces of Myanmar, which has the primary responsibility of conducting land-based military operations;
- the Myanmar Navy, the naval branch of the armed forces of Myanmar;
- the Myanmar Air Force, the aerial branch of Myanmar's armed forces.

The Myanmar military forces, in 2006, were of around (*Source: csis, Center for Strategic and International Studies, The Asian Conventional Military Balance in 2006*):

- 428,000 soldiers in Myanmar Army;
- 13,000 soldiers in Myanmar Navy;
- 12,000 soldiers in Myanmar Air Force;
- 800 soldiers in Marine.

Auxiliary services include Myanmar Police Force, People Militia Units and Frontier Forces.

Currently, all service personnel are volunteers in theory, although a 2010 law reintroducing conscription has not yet entered into force; it allows, if the President considers it necessary for Myanmar's defence, that the provisions of the law be activated.

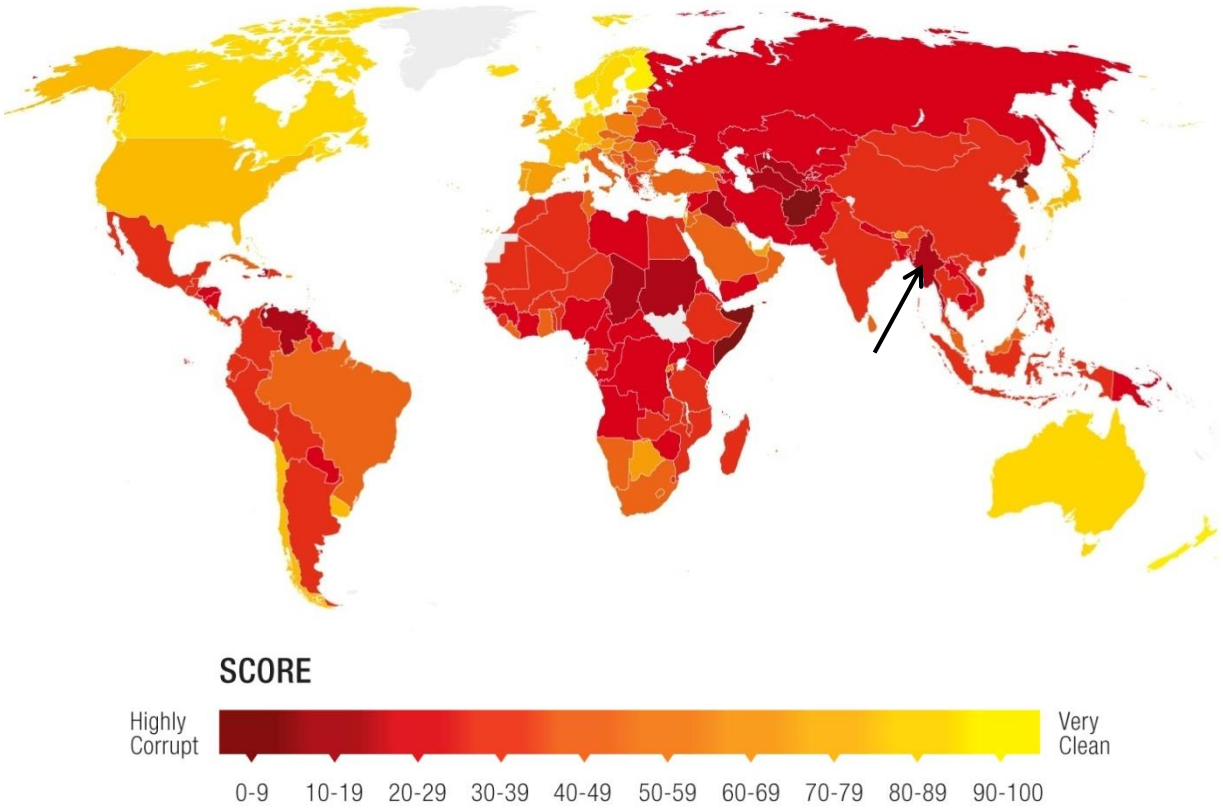
The age for voluntary military service is 18-35 years of age for men and 18-27 years of age for women. Service obligation is 2 years for male (ages 18-45) and female (ages 18-35), whereas professionals (including doctors, engineers, mechanics) serve up to 3 years. Service terms may be stretched to 5 years in an officially declared emergency.

The manpower fit for military service, or the number of people falling in the military age range for a country (defined as being ages 16-49) and who are not otherwise disqualified for health reasons, is 10,451,515 for males and 11,181,537 for females (*Source: CIA, The World Factbook, 2010 est.*).

5.5.7 Transparency and Corruption

In the following Figure, the map of the corruption perception index is reported. Myanmar has a score of Corruption Perception Index of 15, and a rank of 172 on 174 in the world.

Figure 5.38 Corruption Perception Index, 2012



Source: Transparency International, 2012

5.5.8 National and Local Economy

The economy of Myanmar is an emerging economy with an estimated nominal GDP of $59.43 billion; the real growth rate is estimated at 6.8% for the 2013 fiscal year.

Myanmar is primarily an agriculture-based economy; cognizant of the fact that the agricultural sector can contribute to overall economic growth of the country the government has accorded top priority to agricultural development as the base for all round development of the economy as well. However, efforts have been made by the government to develop also the industrial sector and, during the last decade, this sector has seen growth.

The country is endowed with rich natural resources such as timber, tin, antimony, zinc, copper, tungsten, lead, coal, limestone, precious stones, natural gas, hydropower and some petroleum. It is a leading source of jade and gems. Its agricultural products are rice, beans, sesame, groundnuts, sugarcane, hardwood, fish and fish products. The manufacturing industries consist of agricultural processing, knit and woven apparel, wood and wood products, copper, tin, tungsten, iron, construction materials, pharmaceuticals, and fertilizer.

The major agricultural production is rice, which covers about 60% of the country's total cultivated land area. Rice accounts for 97% of total food grain production by weight. In 2011, Myanmar's total milled rice production accounted for 10.26 million tons, an increase from the 1.8% back in 2010 (Calderon, Justin, "Myanmar's economy to quadruple by 2030", May 2013).

The following Table 5.69 reports the main commodities production in Myanmar.

Table 5.69 Myanmar Top Ten commodities Production, 2012

Commodity	Quantity [t]
Rice (paddy)	33,000,000
Sugar cane	10,000,000
Vegetables (fresh)	4,000,000
Beans (dry)	3,900,000
Maize	1,500,000
Fruit (fresh)	1,425,000
Groundnuts (with shell)	1,371,500
Milk (whole fresh cow)	1,300,000
Onions (dry)	1,140,000
Meat indigenous (chicken)	1,079,726

Source: FAOSTAT Country Profiles

5.5.8.1 Economic Performance

Myanmar is a resource-rich country; the most productive sectors will continue to be in extractive industries, especially oil and gas, mining, and timber.

Myanmar's socioeconomic indicators, nevertheless, show that the country remains one of the world's least developed countries. The Fund for Peace estimated in its most recent Failed States Index that only 20 out of 177 nations were more fragile (*Source: FFP, The Fund for Peace).*

According to 2011 statistics, the working age (15-59 years) population of Myanmar is about 37.44 million and the working population is 30.13 million. So, the unemployment rate is 4% (5.2% unemployment rate according to CIA, 2013 estimation).

Information on the labour force is usually obtained from two sources: Labour Force Surveys and Population Censuses. The latest Labour Force Survey was conducted in 1990 by the Department of Labour of Myanmar with the assistance of ILO and UNDP. In this regard, the volume of labour force by sex and the rate of unemployment were projected on the basis of information collected in the 1990 Labour Force Survey (*Source: Ministry of Labour of Myanmar, Country brief. Unemployment insurance of Myanmar*).

Although the total labour force can be estimated, characteristics of labour force such as labour force by education level, employed population by occupation and industry and employment status could not. That's why, it is concluded that the reliability of the above data is rather low. Nowadays, measures are being taken to conduct the population census of Myanmar in 2014 with the assistance of UNFPA and following the population census, the Labour Force Survey would be conducted in 2015-2016 based on the outcomes of the census.

Labour force by occupation was (2001 est.):

- agriculture:70%;
- industry:7%;
- services:23%.

The Ministry of Labour, Employment and Social Security of Myanmar is currently developing a National Plan on Myanmar Workforce Skill Development with a view to providing skill training for workforce relevant to advanced technology and ensuring job opportunities, the Employment and Skill Development Law (Draft) has been finalized and submitted to Hluttaw (Parliament) for the enactment of the legislation (*Source: ILO*).

Growth in Myanmar's gross domestic product (GDP) quickened to an estimated 6.8% in fiscal year 2013, compared with an average of 6% in the previous 2 years. The pickup reflects business optimism buoyed by the government's steps since 2011 to liberalize the economy and prospects for further reform (*Source: Asian Development Bank, Asian Development Outlook 2013*).

Estimated GDP was $59.43 billion (2013 est.), GDP per capita $1,700 (2013 est.), one of the lowest in Southeast Asia, country comparison to the world is 201st of 228 (*Source: CIA, The World Factbook*).

Estimated GDP composition by sector was (2013 est.):

- agriculture: 38%;
- industry: 20.3%;
- services: 41.7% (2013 est.).

Agriculture products include rice, pulses, beans, sesame, groundnuts and sugarcane. Key industries are: agricultural processing, wood and wood products, copper, tin, tungsten and iron, cement and construction materials, pharmaceuticals, fertilizer, oil and natural gas, garments, jade and gems.

The following table shows the main economic performance of Myanmar.

Table 5.70 Economic Performance

Indicator	Value	Year
GDP	$ 59.43 billion	2013 est.
GDP (gross domestic product) - real growth rate	6.8%	2013 est.
	6.4%	2012 est.
	5.9%	2011 est.
GDP (gross domestic product) - per capita	$1,700	2013 est.
	$1,600	2012 est.
	$1,600	2011 est.
Industrial production growth rate	11.4%	2013 est.
Unemployment rate	5.2%	2013 est.
	5.4%	2012 est.
Population below poverty line	25.6%(*)	2010
	32.7%	2007 est.
Exports	$9.043 billion	2013 est.
	$7.82 billion	2012 est.

Indicator	Value	Year
Exports - commodities	natural gas, wood products, pulses, beans, fish, rice, clothing, jade and gems	-
Exports - partners	Thailand 40.7%, India 14.8%, China 14.3%, Japan 7.4%	2012 est.
Imports	$10.11 billion	2013 est.
	$7.998 billion	2012 est.
Imports - commodities	fabric, petroleum products, fertilizer, plastics, machinery, transport equipment; cement, construction materials, crude oil; food products, edible oil	-
Imports - partners	China 36.9%, Thailand 20.2%, Singapore 8.7%, South Korea 8.7%, Japan 8.2%, Malaysia 4.6%	2012 est.

Note:

(*) data from Asian development Bank, FACT SHEET 2013

Source: CIA, The World Factbook

The following table shows how the main economic indicators have changed during the last 5 years.

Table 5.71 Economic Indicators, 2008-2012

Indicator	2008	2009	2010	2011	2012
GDP (gross domestic product) growth (% change per year)	3.6	5.1	5.3	5.5	6.3
CPI (consumer price index) (% change per year)	22.5	2.3	8.2	2.8	3.5
Unemployment rate (%)	4.0	4.0	4.0	4.0	n.a.
Fiscal balance (% of GDP)	-2.5	-5.2	-5.4	-3.9	-5.4
Export growth (% change per year)	12.3	-1.4	25.8	13.3	11.2
Import growth (% change per year)	25.6	1.9	15.8	24.4	22.0
Current account balance (% of GDP)	-3.1	-2.6	-1.2	-2.5	-4.0

Source: ADB. 2013. Asian Development Outlook 2013

5.5.8.2 Natural Resources and Use of Land

The country is endowed with rich natural resources such as timber, tin, antimony, zinc, copper, tungsten, lead, coal, limestone, precious stones, natural gas, hydropower, and some petroleum. It is a leading source of jade and gems. Its agricultural products are rice, beans, sesame, groundnuts, sugarcane, hardwood, fish and fish products.

The Study Area, as shown in Map 1 in Annex 2, includes mostly agricultural areas (50% of land in the Block RSF-5), bare soils (35% of land) and vegetation areas (8% of land). Urban areas

are limited to 2% and water bodies amount to about 4%. This information is derived from the *WorldView-2* and is reported in Table 5.36 (§ 5.3.5).

5.5.9 Gender Issues

5.5.9.1 Role of Women

The status of Myanmar women has always been high and they enjoy equal rights as men.

In Myanmar family, the husband and wife share equal household responsibilities. The husband provides the financial needs and it is the woman who manages the family decision making in providing food, clothing, schooling, etc. The women may go out to work for the social development; they still have the major responsibility to look after the family (*Source: MNCWA, Myanmar National Working Committee for Women's Affairs*).

5.5.9.2 Main Gender Inequality

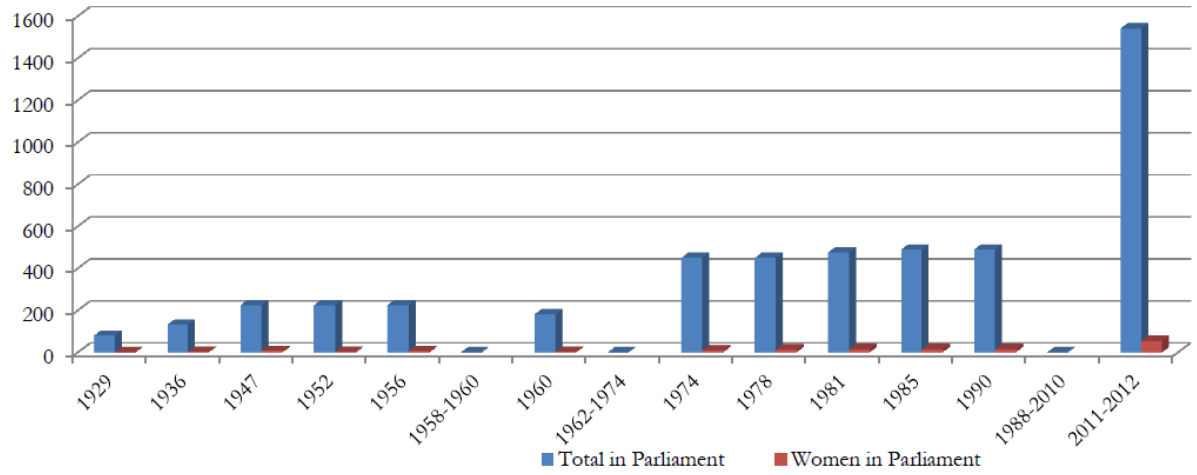
The chapter 8 of Myanmar Constitution states that

- "*Citizens shall enjoy equal rights in the following areas: (a) civil service; (b) occupation; (c) trade; (d) business; (e) technical know-how and profession; (f) exploration of arts, science and technology*" (art. 5).
- "*Women shall be entitled to the same rights and salaries as that received by men in respect of similar work*" (art. 6).
- "*Mothers, children and expectant women shall enjoy rights as prescribed by law*" (art. 7).

Myanmar has also ratified the international convention on elimination of all forms of discrimination against women (CEDAW), even if the 2008 Constitution does not quite conform to it. For example, in assigning duties to civil services personnel the constitution prescribes that there be no discrimination "*based on race, birth, religion, official position, status, culture, sex and wealth*" (art. 4), but it also says that "*nothing shall prevent appointment of men to the positions that are naturally suitable for men only*" (art. 8).

The following Figure 5.39 shows the percentage of women presence in parliament during the Myanmar history. Currently, women hold 25 of 440 (5.7%) seats in the Pyithu Hluttaw (lower house) and 4 of 224 (1.8%) seats in the Amyotha Hluttaw (upper house), which together make up the national Union Parliament. Women hold 29 out of the 498 elected seats (5.8%), which does not include the 166 seats appointed by the military. Including the state and regional parliaments, women hold a total of 54 of 1,541 seats (3.5%).

Figure 5.39 Women's Political Representation in Burma/Myanmar from 1929 (pre-independence) to 2012



Source: GJC, Global Justice Center. The Gender Gap and Women's Political Power in Myanmar

Nowadays, the legal system of Myanmar provides equal rights to women and men in the area of business and commerce. Myanmar is changing to the market economy and as such, not only the government sector, but also the private sectors are playing an important role. As such, more women are entering the private sectors, contributing a significant labour force.

With regard to education, the literacy rate of women is 73%. There is no gender discrimination in the education system. The government is making concerted efforts to promote the education status of women and children especially in the rural and remote border areas. With regard to health, the government places special emphasis on family health, the most basic and integral unit of society. The health coverage is extended to the rural and far-reaching border areas (*Source: MNCWA, Myanmar National Working Committee for Women's Affairs*).

Life expectancy at birth is higher for women (about 5 years):

- female: 68.46 years;
- male: 63.57 years;
- total population: 65.94 years *(Source: CIA, The World Factbook, 2014 est)*.

Indicators reported in the following table shows some gender indicators in Myanmar: Myanmar Gender inequality index (0.437) is on average with world value (0.463), but lower than Arab States (0.555), South Asia (0.568) and Sub-Saharian Africa (0.577).

Female population with at least secondary education is greater than male population, and female labour force participation rate is lower than male one.

Table 5.72 Gender Indicators

Indicator	Value	Year
Gender inequality index:		
- Myanmar	0.437	2012
- South Asia	0.568	
- World	0.463	
Population with at least secondary education (% ages 25 and older):		
- female	18	2006-2010
- male	17.6	
Labour force participation rate (% ages 15 and older):		
- female	75	2011
- male	82.1	
Seats in national parliament (% female)	4.6	2012

Source: United Nations Development Programme (UNDP), Human Development Report 2013

5.5.9.3 Promotion of equal opportunities

The World Bank is committed to working closely with the Government of Myanmar to promote gender equality and women's empowerment (*Source: The World Bank*).

- The Ministry of Social Welfare and Relief and Resettlement is leading reforms to enhance gender equality and empowerment. It is cooperating with other government agencies, civil society, academia, and the international community.
- Myanmar has committed to the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) and the Millennium Development Goals.
- Myanmar's National Strategic Plan for the Advancement of Women covers key areas of the Beijing Platform for Action, which is the United Nations agenda for women's empowerment.
- Myanmar's Education for All National Action Plan ensures that all children have access to basic education of a good quality by 2015.
- Myanmar's National Reproductive Health Strategic Plan of 2009-2013 sets out to achieve the Millennium Development Goal 2015 target of reducing maternal and infant mortality rates.
- Current challenges in Myanmar include high maternal mortality rates and unequal pay for women for similar work with men. With fewer women elected to office, women have a weaker voice and influence than men in politics.
- With increasing development, Myanmar needs to prepare now for new challenges that will have an impact on gender equality: economic integration, domestic and international migration, rapid urbanization, new information and communication technology, and population aging.

5.5.10 Cooperation

5.5.10.1 Regional and National Programmes

The European Commission has proposed the following main sectors for development cooperation with Myanmar for 2014–2020 (*Source: European Commission, Development and Cooperation – Europeaid*):

- rural development;
- education;
- governance;
- support to peace building.

The EU has provided development assistance to Myanmar since 1996, with over € 300 million committed so far. The achievements and results of current EU funded programmes are the followings.

Education

The EU supports an education project (Quality Basic education Programme) to reach disadvantaged children and communities and to contribute to reducing disparity in both access and quality of education. It also focuses on basic education (early childhood education, primary education, non-formal education).

Some of the results so far include:

- Over 600,000 children attending more than 4,000 primary schools in the 25 townships benefited from the Child-Friendly School (CFS) approach;
- Over 900,000 children received essential learning packages to support their schooling;
- 230,000 children under five in disadvantaged and hard to reach areas attended Early Childhood Development (ECD) services;
- 28,500 teachers receiving training in child-centred approaches.

Civil Society

Since 2008 the EU has supported the civil society and other donors in Myanmar through programmes like The Non-State actor programme and Local Authorities (NSA/LA), The Instrument for stability (IfS), The Assistance to Uprooted People Programme (AUP), etc.

Under NSA/LA, funding is provided to various initiatives countrywide and in a broad range of sectors, to enhance the ability of local and community based organisations and local authorities to contribute to poverty alleviation through the delivery of community-based services and small-scale development projects (in health, education, livelihoods, disaster risk reductions, environment), and focusing on marginalised groups.

The AUP programme provides support to internally displaced people (IDP) – especially in ethnic states. About €55 million has been allocated since 2004 to improve livelihoods and living conditions for IDPs, provide a degree of protection from forced repatriation or relocation and from other human rights abuses, and promote reconciliation and conflict resolution through community participation and constructive engagement. More than €26 million of on-going projects are implemented through NGOs.

Unicef, Water, Sanitation, and Hygiene Sector

To date, UNICEF and its water, sanitation, and hygiene sector (WASH) partners focused on distributing basic hygiene items, providing latrines and bathing areas, operating safe solid waste disposal and drainage systems, constructing safe water supplies, and hygiene promotion.

5.5.10.2 International agencies and NGOs

In this section, the major national and regional NGOs involved in social issues are presented. The extended list of NGO's operating in Myanmar can be consulted here:

http://www.aseanpostnargiskm.org/knowledge-base/links/ngos-in-myanmar

http://lrcmyanmar.org/en/ngoprofiles/Local%20NGO

Burma Environmental Working Group (BEWG)

BEWG brings together Burma focused ethnic environmental and social organizations. Member organizations monitor Burma development policy and advocates for alternative development policies meeting their specific traditional and comprehensive understanding of local sustainability. BEWG provides a forum for member organizations to combine the successes, knowledge, expertise and voices of ethnic peoples in pursuit of not just local livelihoods, but sustainable and peaceful national, regional and international development policy. Members collaborate on research, reporting, advocacy campaigns, capacity building initiatives and policy formulation. BEWG also networks with non-member organizations to encourage harmony and diversity in its own activities as well as strengthen democracy and civil society in Burma.

Arakan Oil Watch (AOW)

Is an independent non-governmental organization that aims to protect human rights and the environment from extractive industries in Arakan State and in Myanmar.

AOW educates affected peoples on these issues, develops and promotes oil and gas revenue transparency standards, and conducts international advocacy. AOW is an active core member of the Shwe Gas Movement and a member of South East Asia Oil Watch.

Bridging Rural Integrated Development and Grassroots Empowerment (BRIDGE)

BRIDGE works together with rural communities impacted by political and socio-economic change in Kachin state to strengthen their capacities to manage their own natural resources. BRIDGE supports their community-based development activities and builds collaborations and partnerships that advocate for sustainable development and foster a culture of peace.

Earth Rights International (ERI)

ERI is a group of activists, organizers, and lawyers with expertise in human rights, the environment and corporate and government accountability. Since 1995, ERI has worked in Myanmar to monitor the impacts of the military regime's policies and activities on local populations and ecosystems.

Kachin Development Networking Group (KDNG)

KDNG is a network of civil society groups and development organizations in Kachin State. KDNG's purpose is to effectively work for sustainable development based on indigenous knowledge and culturally appropriate environmental management and conservation methods.

KDNG works to maintain the integrity of land and forest, and empower indigenous people by providing awareness on environment issues, especially relating to human rights, environmental rights and indigenous rights. It achieves these goals through trainings, workshops, research, documentation, and advocacy.

The Karen Environmental and Social Action Network (KESAN)

KESAN was established in 2001 as the first local community-based organization to raise environmental awareness among Karen people. KESAN works to empower and educate communities and local institutions to revitalize existing indigenous knowledge and practices for increased livelihood security in Karen and Kachin States and in areas along the Thai-Burmese border. KESAN strives to build up local capacities in forest and natural resource management, raise public environmental awareness, and support community based development initiatives. In addition to playing a leading role in environmental law and policy formulation, KESAN advocates for environmental policies and development priorities that ensure sustainable ecological, social, cultural, and economic benefits and promote gender equity.

The Lahu National Development Organization (LNDO)

Set up by leading Lahu democracy activists in March 1997 to advocate for the welfare and well-being of the Lahu people, including the promotion of alternatives to destructive development projects and opium cultivation. LNDO seeks to protect the livelihoods and lands of Lahu and Akha peoples and to increase understanding among the local ethnic nationalities about human rights, democracy, federalism, community development, and health issues. LNDO also aims to develop unity and cooperation among the Lahu and other highlanders from Shan State and to provide opportunities for development of civic leadership skills among local groups.

Network for Environmental and Economic Development (NEED)

NEED is a non-profit NGO working to strengthen Burmese civil society so that all the people of Burma may benefit from the practice of indigenous and holistic development strategies, based on economically, environmentally, and socially sustainable ideas. NEED concentrates on the promotion of environmental conservation, sustainable agriculture, and economic development in Burma.

Shan Sapawa Environmental Organization (Sapawa)

Sapawa works along the Thai-Burmese border and inside Burma to promote environ- mental protection and human rights in Shan State, Burma.

The Shwe Gas Movement (SGM)

SGM is a non-governmental organization campaigning against the Shwe Gas Project and China's Trans-Burma Pipelines, for Human Rights, Environment Justice and revenue transparency in oil and gas sector. SGM specializes in fact-finding, training grassroots and community leaders and advocacy campaign. Its members include the All Arakan Students

and Youths' Congress, Arakan Oil Watch and Shwe Gas Movement (India) and dedicated activists in Burma.

Myanmar faces significant humanitarian, development and political challenges. International sanctions intended to punish the country's military junta for human rights violations have constrained levels of foreign aid. Still, many international NGOs (INGOs) implement programs in Myanmar.

5.5.11 Human Rights

5.5.11.1 Relevant International Conventions

The ratification status of International Human Rights Treaties for Myanmar are reported in the following Table (*Source: University of Minnesota, Human Rights Library*).

Table 5.73 Ratification Status of International Human Rights Treaties for Myanmar

International Treaty	Description
Women's Human Rights	• CEDAW - Convention on the Elimination of All Forms of Discrimination against Women; accession date on 22nd July 1997; • United Nations Convention against Transnational Organized Crime, ratification date on 30th 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, accession date on 30th March 2004; • Protocol against the Smuggling of Migrants by Land, Sea and Air, supplementing the United Nations Convention against Transnational Organized Crime, accession date on 30th March 2004.
Slavery and Slavery-Like Practices	• Convention for the Suppression of the Traffic in Persons and of the Exploitation of the Prostitution of Others, signature date on 14th March 1956.
Rights of the Child	• CRC - Convention on the Rights of the Child; ratification date on 15th July 1991; • CRC-OP-SC - Optional Protocol to the Convention on the Rights of the Child on the sale of children child prostitution and child pornography; ratification date 16th January 2012.
Rights of Person with Disabilities	• CRPD - Convention on the Rights of Persons with Disabilities; ratification date on 7th December 2011.
Freedom of Association	• Freedom of Association and Protection of the Right to Organise Convention, ratification date on 4th March 1955.
Employment and Forced Labour	• Convention concerning Forced or Compulsory Labour, ratification date on 4th March 1955.
War Crimes and Crimes Against Humanity, Genocide, and Terrorism	• Convention on the Prevention and Punishment of the Crime of Genocide, signature date on 30th December 1949 and ratification date on 14th March 1956.

International Treaty	Description
Law of Armed Conflict	• Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field, ratification date on 25th Aug 1992; • Geneva Convention for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea, ratification date on 25th Aug 1992; • Geneva Convention relative to the Treatment of Prisoners of War, ratification date on 25th Aug 1992.
Terrorism and Human Rights	• International Convention for the Suppression of Terrorist Bombing, accession date on 12th November 2001; • International Convention for the Suppression of the Financing of Terrorism, signature date on 12th November 2001; • International Convention for the Suppression of Unlawful Seizure of Aircraft, ratification date on 22nd May 1996.
U.N. Activities and Employees	• Convention on the Privileges and Immunities of the United Nations, accession date on 25th January 1955.

5.5.11.2 Human Rights Impact Assessment

5.5.11.2.1 Introduction & Methodology

In 2015, the Danish Institute for Human Rights (DIHR) was invited by Eni Impresso and Eni Myanmar to conduct a scoping for a Human Rights Impact Assessment (HRIA) for the activities of Eni Myanmar. The aim of this exercise was to define the Terms of Reference (ToR) and an Action Plan for the development of a HRIA, together with recommendations for a participatory process. The field visit took place from 7-16 March 2016. The field visit was prepared in collaboration with the Impresso Department of the Eni, Eni Myanmar HSE Manager and IEM. IEM, together with its Myanmar partner EQM, was in charge of organizing the field visit to the eight villages in the RSF-5 Block.

The DIHR team held 18 interviews with individuals or smaller groups in Yangon and Magway (including both ENI staff and externals), as well as 45 focus group interviews with villagers in the RSF-5 Block. Additionally, relevant local and international media sources and reports by authoritative organizations and in-country experts have been consulted as shown in Table 5.74.

DIHR integrated a number of human rights related questions into the household survey questionnaires and questionnaires for key informants in the villages developed by IEM and EQM, in order to obtain more data in addition to the focus group discussions held by the DIHR assessors. During the assessment, the assessment team used various data gathering and interview approaches and techniques, including focus plenary sessions with communities, focus group interviews, children-only and women-only group.

Although interview questionnaires were developed focusing on a wide range of issues, in practice, the interviews held were semi-structured, focusing on the most important human rights issues highlighted through the desktop research and based on input from NGOs the DIHR assessment team met in Yangon and Magway.

Table 5.74 Overview of interviews completed by DIHR

Yangon Interviews – March 7-8 and 16		Magway Interviews	Interviews with villagers in the RSF-5 Block
Internal Interviews Eni Myanmar - Yangon: • Managing Director Eni Myanmar • Procurement manager • HR & General Services managers • Exploration manager • Local Eni Myanmar staff (including drivers) Business partners: • Interview with MPRL, Eni Myanmar's local business partner	NGO Interviews Yangon: • Spectrum • Myanmar Association for Transparency and Accountability • Natural Resource Governance Institute • EarthRights International • Myanmar China Pipeline Watch Committee	NGO/CBO interviews in Magway: • Marie Stopes International • Pact Myanmar Microfinance Fund • Magway EITI Watch • Green Future Network • Red Cross Society • Ayerwaddy West Development Association • Magway Farmers' Union • Magway Youth Association	In total, the DIHR assessment team visited 8 villages in the RSF-5 Block and conducted focus group discussions with: • Groups of men: approximately 55 persons in total • Groups of women: Approximately 45 persons in total • Groups of children: Approximately 50 persons in total Villages visited: • Ohn Twe • Shar Pin Lar • Saik Kya • Shar Sang Kan • Taungyartaw • Myan Sai • Nwar Hla • War Gyi Aing In addition to the focus group discussions, enumerators of IEM, the ESHIA provider, conducted a number of socio-economic surveys and key informant interviews (with the village head, monk, nurse etc.) in each village

5.5.11.2.2 Key Human Right Impacts

The key impacts identified by the field trip and included in a separate DIHR report include:

Social Potential Impacts

- damage to public buildings due to the use of explosive;
- lack of basic knowledge about *eni Myanmar* activities.

Environmental Potential Impacts

- water availability & quality;
- waste management.

Land Management

- potential impact to livehoods due to land use;
- vulnerable group to be reached in the consultation process;
- potential impact due to women lack of voice and representation in decision making on land.

Safety Potential Impact

- due to lack of basic knowledge about *eni Myanmar* activities;

- increase of the truck traffic.

Working conditions

- use of employment agencies with forced labour practices;
- excessive working hours.

5.5.11.2.3 Recommendations

DHIR developed two check lists to manage potential impacts highlighted in the report and suggest concrete actions for mitigation for:

Seismic Activities

Required steps for Eni Myanmar and relevant contractors, to be undertaken before, during and after the seismic activities in:

- managing sub-contractors;
- engaging with communities and other stakeholder;
- engaging on land and crop compensations.

Future ESHIA

List of recommendations for Eni Myanmar to consider when carrying out future ESHIA processes both for:

- the selection of ESHIA providers;
- actual ESHIA process.

DHIR suggested the ESHIA/IEE publication to support transparency, *eni Myanmar* in the process for the disclosure.

5.6 CULTURAL HERITAGE COMPONENTS

The culture of Myanmar has been heavily influenced by Buddhism and the Mon people. Myanmarese culture has also been influenced by its neighbours India, Thailand and China. In more recent times, British colonial rule and westernisation have influenced aspects of Burmese culture, including language and education.

Myanmar has been referred to as the Land of Pagodas as there are a considerable number of Buddhist pagodas. The sites regarded as the most important Buddhist pilgrimage sites are:

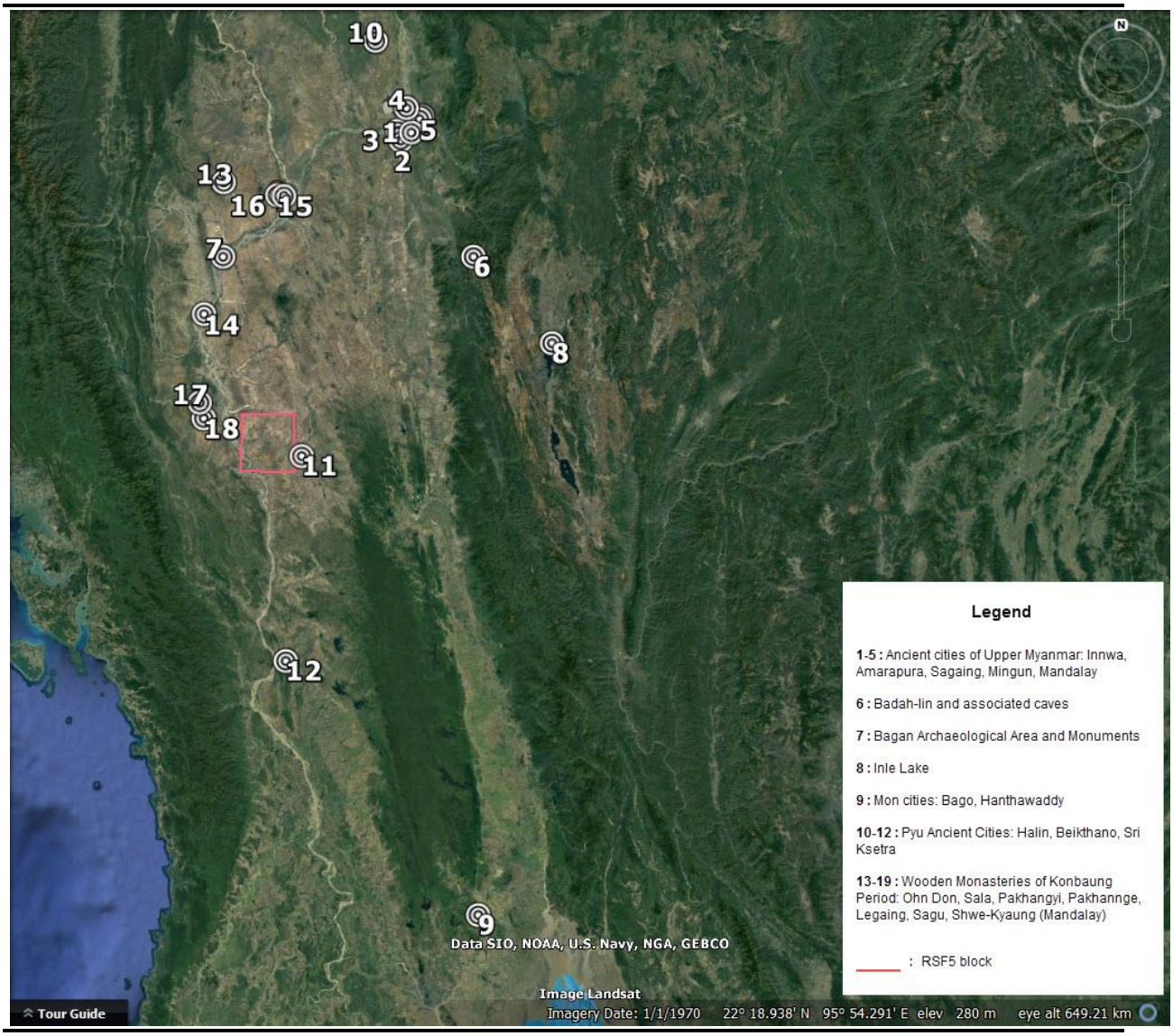
- Mahamuni Buddha in Mandalay;
- Bagan;
- Shwesandaw Pagoda in Pyay;
- Shwedagon Pagoda in Yangon Shwemawdaw Pagoda Kyaiktiyo Pagoda in Mon State.

Myanmar currently only has one site with three locations on the World Heritage List; The Pyu Cities: Beikthano-Myo, Halin, Tharay-Khit-taya (Sri Ksetra) (*Source: UNESCO, 2016*). All other properties are submitted on the Tentative List are as follows:

- *Ancient cities of Upper Myanmar*: Innwa, Amarapura, Sagaing, Mingun, Mandalay (04/10/1996);
- Badah-lin and associated caves (04/10/1996);
- Bagan Archaeological Area and Monuments (04/10/1996);
- Inle Lake (04/10/1996);
- Mon cities: Bago, Hanthawaddy (04/10/1996);
- Myauk-U Archaeological Area and Monuments (04/10/1996);
- *Wooden Monasteries of Konbaung Period*: Ohn Don, Sala, Pakhangyi, Pakhannge, Legaing, Sagu, Shwe-Kyaung (Mandalay) (04/10/1996).

These cultural and archaeological areas are identified in Figure 5.40. Two of these sites are located near the project area. The Beikthano Ancient Pyu City is located 3 km from the boundary of Block RSF-5 and the site nr. 19 (Wooden Monasteries of Sagu) is located in a buffer of 30 km around Block RSF-5. Their area described in the following sections.

Figure 5.40 Location of Site on World Heritage Tentative List



ID	Description
1, from 3 to 6	Ancient cities of Upper Myanmar
2	Badah-lin and associated caves
7	Bagan Archaeological Area and Monuments
8	Inle Lake
9	Mon cities: Bago, Hanthawaddy
10	Myauk-U Archaeological Area and Monuments
From 11 to 13	Pyu Cities: Beikthano-Myo, Halin, Tharay-Khit-taya (Sri Ksetra)
From 14 to 20	**Wooden Monasteries of Konbaung Period**

Source: eni, 2014

Beikthano Ancient Pyu City

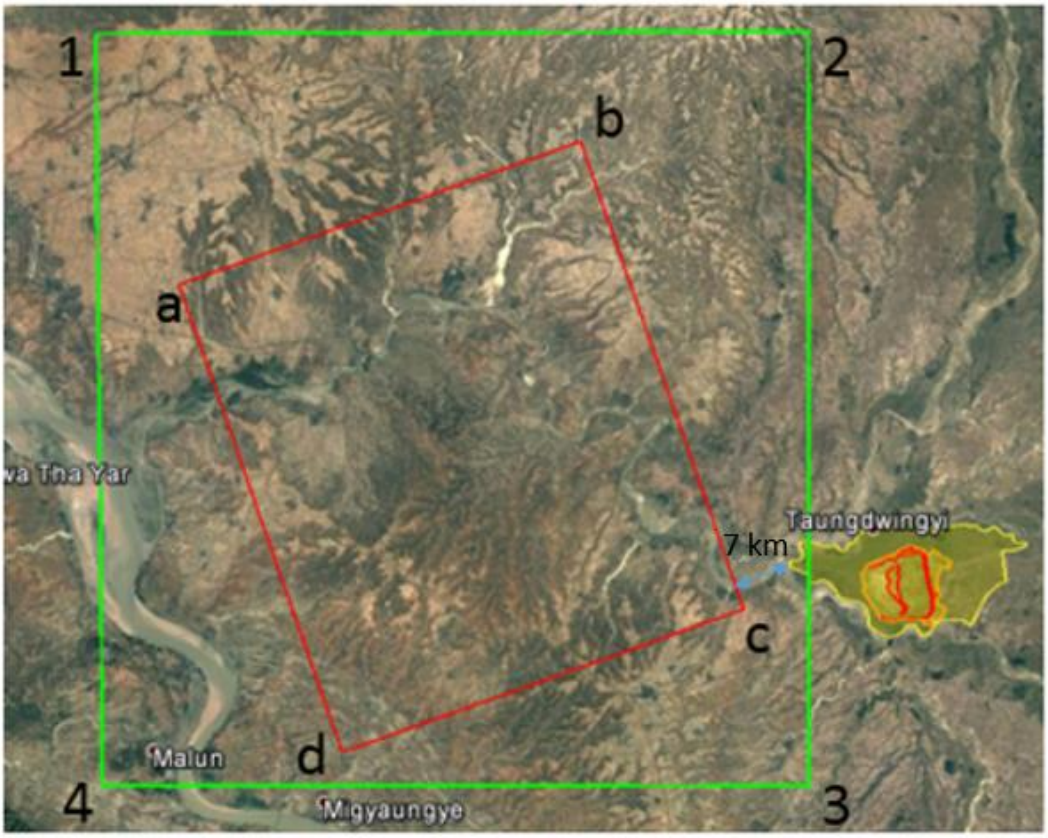
On 22 June 2014, the Pyu Ancient Cities in Myanmar were inscribed to the UNESCO World Heritage List. Covering a combined area of over 5,000 hectares (or 50km^2) in the dry zone, the three Pyu Ancient Cities of Halin, Beikthano, and Sri Ksetra developed and flourished for over 1,000 years between 200 Before Common Era (BCE) and 900 Common Era (CE).

Pyu Ancient Cities includes the ruins of three bricked, walled and moated cities of Halin, Beikthano and Sri Ksetra located in vast irrigated landscapes in the dry zone of the Ayeyarwady (Irrawaddy) River basin.

Formal measures for the legal protection and administrative management of the Pyu Ancient Cities have been institutionalized at central government, regional, district, and township levels. The Department of Archaeology and National Museum of the Ministry of Culture has the primary responsibility for all aspects of protection and management of the three Pyu Ancient Cities.

Beikthano represents one of the most important archaeological site in Myanmar. According to the available UNESCO data and GPS survey data, the Beikthano WHS area is highlighted in red and its protected cultural buffer zone in yellow in the above reported picture (Figure 5.42). Therefore, only a minimal portion of the protected cultural buffer zone is partially in the Block RSF-5 boundaries (0.5 km) and it is located far from the area of operation at least 7 km away. This distance could be considered safe for any monument within the archaeological site, but a dedicated test Peak Particle Velocity (PPV) test will be conducted as per international standards before seismic activities begin in order to demonstrate that there is no risk of impact from seismic operation. The PPV monitoring will also be carried out during the duration of the seismic program. *Eni Myanmar* requested to the World Cultural and Heritage Beikthano to confirm that the seismic operations area is outside the Beikthano WHS area (red area, Figure 5.42) and its protected cultural buffer zone (yellow area, Figure 5.42) as confirmed in Annex 12.

Figure 5.41 Location of Beikthano Ancient Pyu City near the Block RSF-5



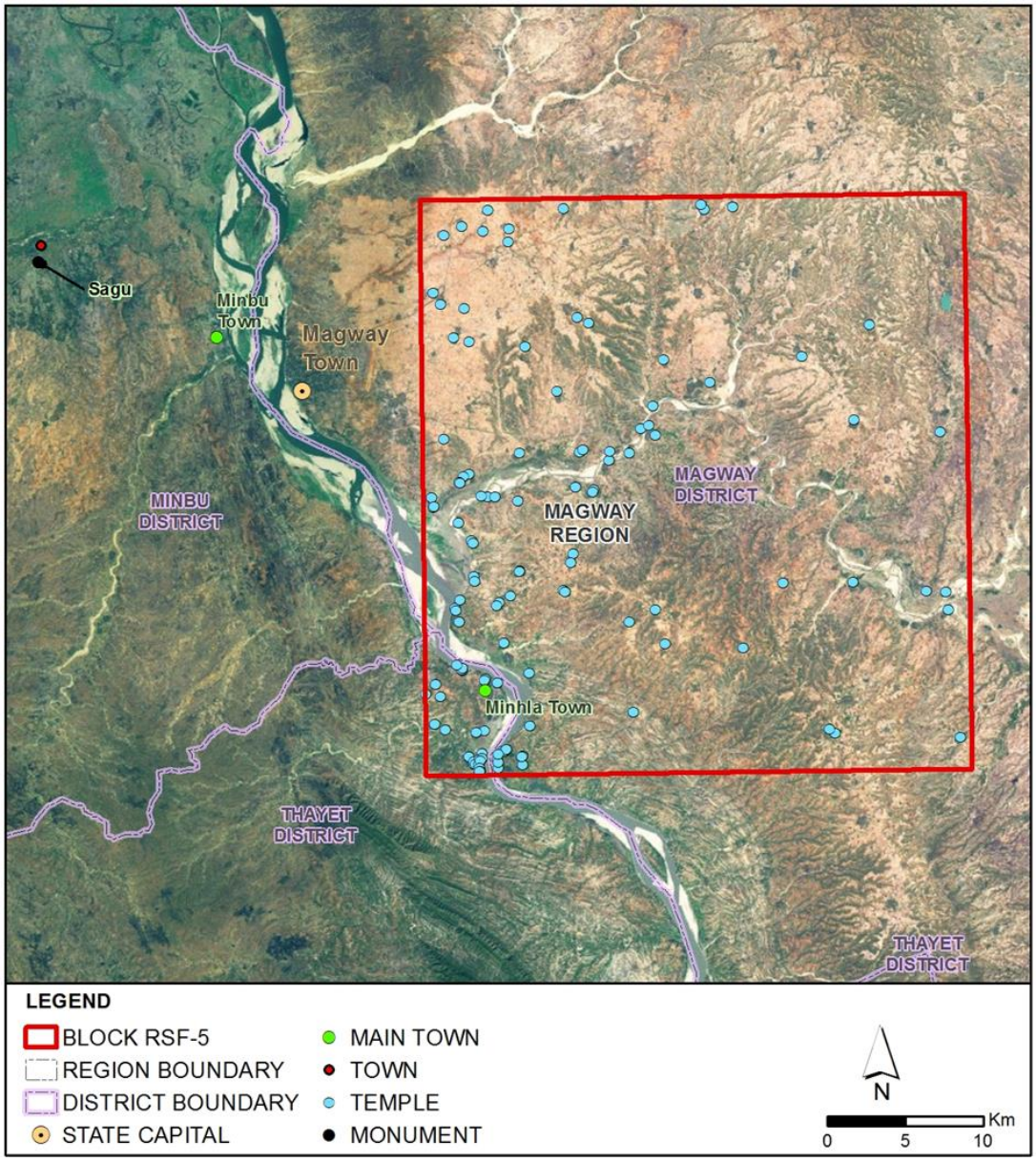
Source: Eni adapted from UNESCO, 2016

Wooden Monasteries of Konbaung Period: Ohn Don, Sala, Pakhangyi, Pakhannge, Legaing, Sagu, Shwe-Kyaung (Mandalay)

Large timber monasteries, mostly built during the 18th and 19th centuries AD, on a similar linear plan. Four main timber structures are usually aligned on a large wooden platform on posts, providing spaces for cult, assemblies and accommodation for the monks: from east to west, the shrine, the prayer hall, the main teaching hall and an ancillary building. Above the shrine, the major landmark is a tall tiered tower (pyathat). Access from three or four sides by brick stairways. The whole monastery is profusely decorated by extensive woodcarving, depicting all aspects of the daily life in Myanmar. several of these monasteries contain rich collections of manuscripts, paintings, sculptures and metalware. Ohn Don, the oldest surviving example built in 1742 AD, is particularly noticeable by its gilded and lacquer inner decoration. The largest of these monasteries, Pakhannge, built in 1856, measures 76 by 45m and is supported by 332 teak columns. The best preserved example with outstanding woodcarving is Sale, which is now used as a museum.

Within the Block RSF-5, instead, there are 96 temples, as shown in the following Figure 5.42. An exact mapping of the location of these temples has been carried out only within the Block RSF-5's boundary.

Figure 5.42 Location of Cultural Heritage Sites and Temples in the Block RSF-5 (blue circles)



Source: eni elaboration

5.7 VISUAL COMPONENTS

The territory of the whole Block RSF-5, on the basis of a satellite images analysis, could be divided in the following main macro-areas, which are described in the following:

- agricultural areas;
- settlements and villages;
- floodplain areas;
- erosional landforms.

Agricultural areas are characterized by continuous agricultural plots with irregulars shape and dimension varying from less than 20.000 m^2 to more than 10 Ha. The crops are served by an intricate track network made of very narrow trails connecting isolated farms (no more than few buildings) and the crop themselves. The area is served by the main natural drainage network, from which, small artificial trenches have been developed in order to serve the agricultural areas. The main features of these areas are summarized in the following table.

Table 5.75 Characteristic of Agricultural Areas in the Block RSF-5

Land cover Features	Agricultural plots with dimension varying from 0.2 ha to 10 ha
Drainage Network	Small artificial channels and trenches connecting crops
Road Network	Intricate network of trails connecting all crops. Roads connecting settlements
Natural Vegetation	Very low presence of natural vegetation; mainly isolated adult trees within fields and small trees lines along road and channels
Accessibility	Very accessible on foot and with small vehicles
Built-up	Sparse houses, farms and barns
Topography	Flat areas, hill tops or valleys

Floodplains areas are dominated, thanks to high water availability, by intensive agriculture (probably two or more harvests a year). Agricultural areas are alternated to vigorous natural vegetation patterns: mainly grassland and small trees forest. The rivers are mainly braided; therefore their beds are characterized by the presence of wide sand dunes and small islands. Where possible they are cultivated. Many wide settlements are located in the floodplains; they are connected with a network of major roads. River crossings, such as bridges, seem to be very scarce; probably due to the nature of the rivers themselves. The main features of these areas are summarized in the following table.

Table 5.76 Characteristic of Floodplains Areas in the Block RSF-5

Land cover Features	Crops with regular shape and varying dimension. Wide settlements located very close to rivers sides. Patches of vigorous natural vegetation.
Drainage Network	Braided rivers and smaller tributaries. Sand dunes, sand islands and
Road Network	Major and minor road network connecting settlements and adjacent agricultural areas. Very few bridges and river crossing locations
Natural Vegetation	Vigorous grassland shrubs and small trees patches.

Accessibility	Accessible on foot and with off-road vehicles.
Built-up	Wide settlements located very close to river sides
Topography	Flat areas

The morphology of the *erosional landforms* area is characterized by wide erosional landforms in hilly areas. Minor order tributaries, small streams and channels continuously create rills and gullies, clearly visible from satellite images. The areas are dominated by presence of shrubs and bush with forest patches located close to minor tributaries and streams. These landforms are alternated to agricultural areas that occupy hills edges or valley bottoms. The river network is a typical natural dendritic drainage system. These zones are not served by a well-developed road network; settlements and sparse houses are rare. The main features of these areas are summarized in the following table.

Table 5.77 Characteristic of Erosional Landforms Areas in the Block RSF-5

Land cover Features	Erosional features: gullies and rills. Baer soil
Drainage Network	Well-developed dendritic drainage system; in some spots it develops to trellis drainage system due to the local geological setting.
Road Network	Few main roads connecting the rare settlements; a system of tracks and dirt roads serving the cultivated patches.
Natural Vegetation	Mostly shrubs and bush. Forest patches develop along channels and streams.
Accessibility	Scarce
Built-up	Few small and isolated settlements and sparse houses.
Topography	Gentle hills and valleys.

5.8 HEALTH COMPONENTS

5.8.1 Overview

This Section presents an overview of the health conditions in the Study Area, based on a review of the available information, information at national level and some data at regional level have been gathered from secondary sources (information obtained from sources such as official data, research reports, historical texts, bibliographic databases, documentation on demographic trends on country and project area), using publicly available information as well as previous studies performed by ENI.

Block RSF-5 is located Magway Region, as shown in Figure 5.43. This Region is situated in the rain shadow area of the Yakhaing Yoma and obtains most of its rainfall from the southwest monsoon. The undulating land, composed mainly of sandy loam with low fertility, is subjected to severe erosion under rain and strong winds.

Magway Region is made up of Magway, Minbu, Thayet, Pakokku and Gangaw districts, comprising 25 townships and 1,696 ward village-tracts. The capital city is Magway Town (1994 population estimated at 300,000). Other major towns are Pakokku and Minbu.

Magway Region is located in the Central Lowlands, a relatively low-lying terrain drained by the Ayeyarwady River and its major tributaries. Rolling hills, ridges and small mountains are present in some areas. The region is characterized by folded small mountain ranges, a volcanic line and the Sagaing Fault zone, a regionally significant active right lateral strike-slip fault.

A detailed description of the study area is presented in the following sections:

- health system development
- health institutional framework
- mortality, morbidity and disability
- national health accounts
- health policy and programs implementation
- target area community ill-health risk factors
- morbidity
- mortality
- health care delivery services
- private/traditional workers/systems
- health organizations.

5.8.2 Study Area

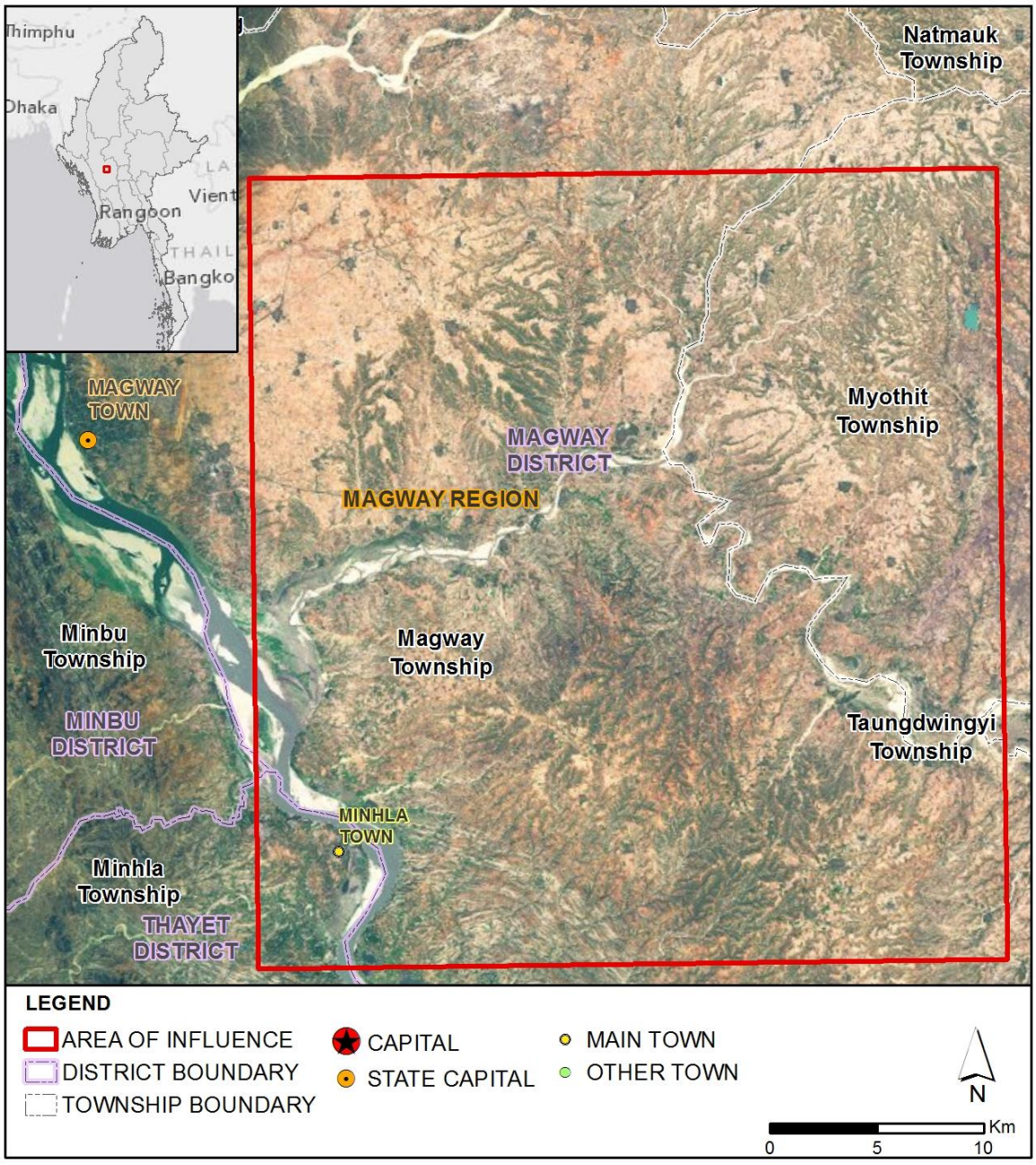
The Study Area for the health baseline spans across only 1 region (Magway). It is further split up in 2 districts and 3 townships, as shown in the following Table 5.78.

Table 5.78 Health Study Area for Block RSF-5

Region	District	Township
Magway Region	Magway	Magway
		Myothit
	Thayet	Minhla

Figure 5.43 below presents the Study Area for the health baseline.

Figure 5.43 Study Area for the Health Baseline



Source:eni, 2014

5.8.3 Health System Development

5.8.3.1 Historical Outlines

Disparities about coverage and utilization of health services in Myanmar are a major concern. Access to health information and health services is very limited for some population groups

particularly vulnerable to health problems. These include people living in rural, remote and border areas, and low-income families in peri-urban areas.

The National Health Committee, chaired by the Secretary of the State Peace and Development Council, is a high-level interministerial and policy-making body for health matters concerning the country. Health committees exist at each administrative level, providing a mechanism for intersectoral collaboration and coordination.

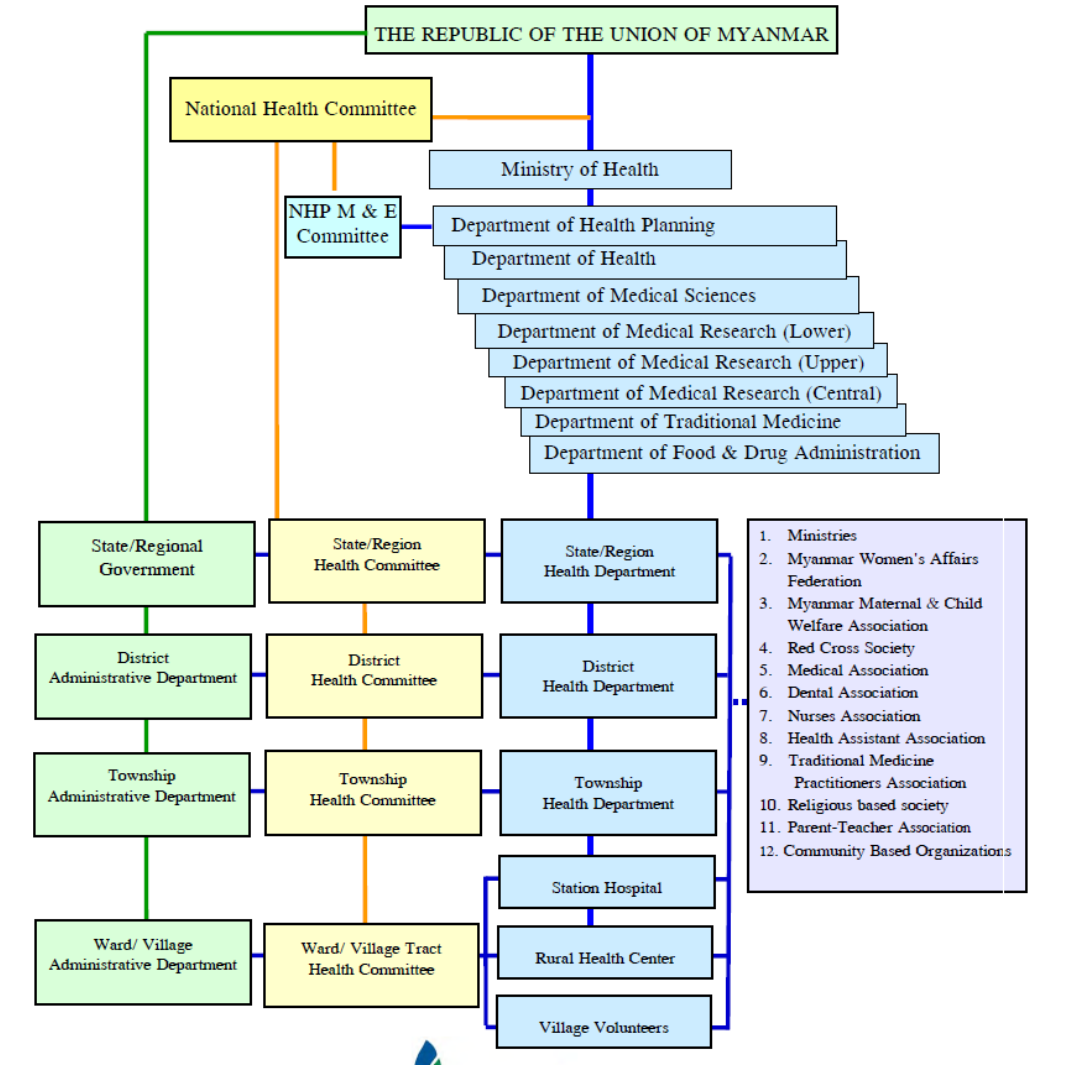
The Ministry of Health has seven departments:

- Department of Health;
- Department of Health Planning;
- Department of Medical Sciences;
- three Departments for Medical Research (for Lower Myanmar, Upper Myanmar and Central Myanmar);
- Department of Traditional Medicine.

The largest of the seven is the Department of Health, which employs 93% of over 58,000 personnel employed by the Ministry of Health, and accounts for approximately 75% of the ministry's expenditure. It is responsible for the preventive, promotive, curative and rehabilitative components of Myanmar's health service, and for supervising the health departments at the state, division and township levels as well as the hospitals and clinics. Some other ministries are also involved with health care, mainly curative in nature, for their employees and families.

The health departments at the state or divisional level are charged with planning, coordinating, supervising and monitoring the health departments at district and township levels. Actual implementation of health services is undertaken by township health departments, each of which serves between 100,000 and 200,000 people on an average and is headed by a Township Medical Officer (TMO).

Figure 5.44 Organization of Health Service Delivery



Source: Health in Myanmar (2013), Ministry of Health

5.8.4 Health Institutional Framework

5.8.4.1 Ministry of Health and other Socially Relevant Line Ministries and Institutions

The Ministry of Health, aiming to the uplifting the health status of the entire nation, is taking the responsibility of providing comprehensive health care services covering activities for promoting health, preventing diseases, providing effective treatment and rehabilitation to raise the health status of the population.

The Department of Health, one of seven departments under the Ministry of Health, plays a major role in providing comprehensive health care throughout the country including remote and hard to reach border areas.

Some ministries are also providing health care for their employees and their families. They include Ministries of Defence, Railways, Mines, Industry, Energy, Home and Transport. Ministry

of Labour has set up three general hospitals, two in Yangon and the other in Mandalay to render services to those entitled under the social security scheme. Ministry of Industry is running a Myanmar Pharmaceutical Factory and producing medicines and therapeutic agents to meet the domestic needs.

5.8.4.2 Formal Medical and Paramedical Training Institutions

Health-related universities in Myanmar include four medical, two dental, two nursing, two for medical technology, two pharmacological and one community health institutions. In addition, there are 46 nursing schools and an Institute of Traditional Medicine. The University of Traditional Medicine was established in 2001. Basic training on traditional medicine has been included in the curriculum for the MBBS courses in universities of medicine.

Students attending in Universities and Training Schools under Department of Medical Science as of February 2013 are as reported in Table 5.79.

Table 5.79 Undergraduate at February 2013 (Universities in Magway Region, included in the Study Area, are in Bold)

No.	University/ Training Schools	Number of Students
1.	University of Medicine(1), Yangon	3,818
2.	University of Medicine, Mandalay	3,276
3.	University of Medicine(2), Yangon	3,376
4.	**University of Medicine, Magway**	**2,371**
5.	University of Dental Medicine, Yangon	958
6.	University of Dental Medicine, Mandalay	796
7.	University of Pharmacy, Yangon	626
8.	University of Pharmacy, Mandalay	353
9.	University of Medical Technology, Yangon	597
10.	University of Medical Technology, Mandalay	417
11.	University of Nursing, Yangon	773
12.	University of Nursing, Mandalay	728
13.	**University of Community Health, Magway**	**659**
14.	Nursing Training Schools	3,833
15.	Midwifery Training Schools	1,988
16.	Lady Health Visitor Training School	104

Source: Health in Myanmar (2013), Ministry of Health

5.8.4.3 Inter-Ministerial Committees, Governmental Intersectorial Coordinating Bodies

The National Health Committee (NHC) was formed on 28 December 1989 as part of the policy reforms. It is a high level inter-ministerial and policy making body concerning health matters. The National Health Committee takes the leadership role and gives guidance in implementing

the health programmes systematically and efficiently. The high level policy making body is instrumental in providing the mechanism for intersectorial collaboration and coordination.

It also provides guidance and direction for all health activities. The NHC is reorganized in April 2011.

In the following Table 5.80 the composition of the National Health Committee is reported.

Table 5.80 Composition of the National Health Committee

Position	Role
1. Union Minister, Ministry of Health	Chairman
2. Union Minister, Ministry of Labour, Employment and Social Security	Vice-Chairman
3. Deputy Minister, Ministry of Home Affairs	Member
4. Deputy Minister, Ministry of Border Affairs	Member
5. Deputy Minister, Ministry of Information	Member
6. Deputy Minister, Ministry of National Planning and Economic Development	Member
7. Deputy Minister, Ministry of Social Welfare, Relief and Resettlement	Member
8. Deputy Minister, Ministry of Labour, Employment and Social Security	Member
9. Deputy Minister, Ministry of Education	Member
10. Deputy Minister, Ministry of Health	Member
11. Deputy Minister, Ministry of Science and Technology	Member
12. Deputy Minister, Ministry of Immigration and Population	Member
13. Deputy Minister, Ministry of Sports	Member
14. Council Member, Nay Pyi Taw Council	Member
15. President, Myanmar Red Cross Society	Member
16. President, Myanmar Maternal and Child Welfare Association	Member
17. Deputy Minister, Ministry of Health	Secretary
18. Director General, Department of Health Planning, Ministry of Health	Joint Secretary

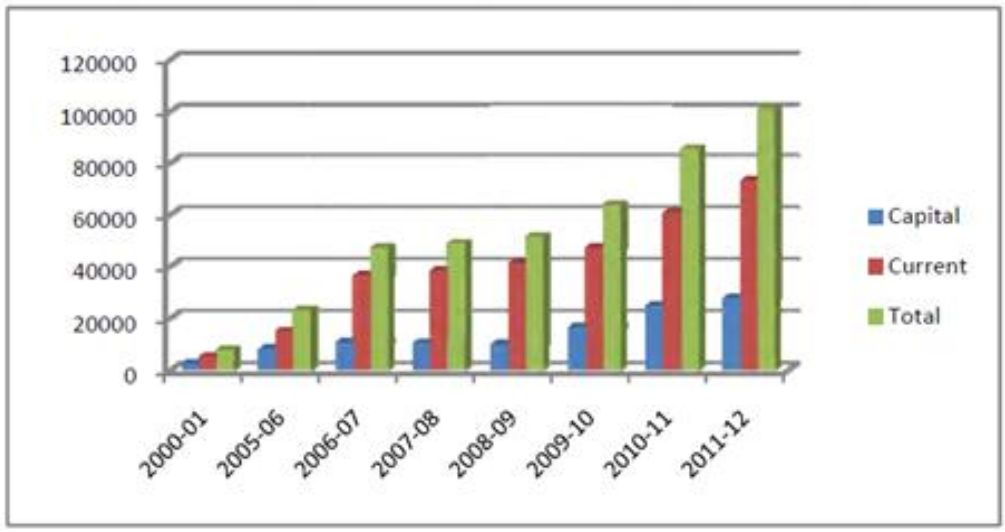
Source: Health in Myanmar (2013), Ministry of Health

5.8.5 National Health Accounts

5.8.5.1 Health Expenditure

The sources of finance for health care services are the government, private households, social security system, community contributions and external aid. Government has increased health spending on both current and capital yearly. Total government health expenditure increased from 7,688 million kyat in 2000-01 to 100,825 million kyat in 2011-12.

Figure 5.45 Government Health Expenditures from 2000-01 to 2011-12 (million kyat)



Source: Health in Myanmar (2013), Ministry of Health

The government share to the health sector as a percentage of general government expenditures for last three financial years were indicated in the following Table 5.81.

Table 5.81 Government Health Expenditures as Percentage of Gross Domestic Product (GDP) and of General Government Expenditures (GGE)

Financial year	Government Health Expenditures as Percentage of GDP	Government Health Expenditures as Percentage of GGE
2010-11	0.20	1.03
2011-12	0.21	1.05
2012-13	0.76	3.14

Source: Financial Allocation to Social Budget, Social Protection Conference, 25th and 26th June 2012, Nay Pyi Taw

Although health services are free, drugs are often not available in adequate quantities in public health institutions. Patients are therefore compelled to purchase them from the market. Private expenditure on health as a percentage of total expenditure on health was 80.6% in 2003 (*Source: Ministry of Health. Five-year strategic plan for water supply, sanitation and hygiene in Myanmar, 2007-2011*). Consequently, households having to make high out-of-pocket payments for the treatment of ailments are faced with an onerous economic burden on account of health care.

5.8.6 Health Policy and Programs Implementation

5.8.6.1 Health Policies, Strategic Planning, Standard and Best Practices Setting, Roles/Responsibilities and Guidance

The National Health Policy was developed with the initiation and guidance of the National Health Committee in 1993. The National Health Policy has placed the "Health for All" goal as a prime objective using Primary Health Care approach. The National Health Policy is designed as follow (Box 5.1).

Box 5.1 National Health Policy

1 To raise the level of health of the country and promote the physical and mental well-being of the people with the objective of achieving "Health for all" goal, using primary health care approach.

2 To follow the guidelines of the population policy formulated in the country.

3 To produce sufficient as well as efficient human resource for health locally in the context of broad frame work of long term health development plan.

4 To strictly abide by the rules and regulations mentioned in the drug laws and by-laws which are promulgated in the country.

5 To augment the role of co-operative, joint ventures, private sectors and non-governmental organizations in delivering of health care in view of the changing economic system.

6 To explore and develop alternative health care financing system.

7 To implement health activities in close collaboration and also in an integrated manner with related ministries.

8 To promulgate new rules and regulations in accord with the prevailing health and health related conditions as and when necessary.

9 To intensify and expand environmental health activities including prevention and control of air and water pollution.

10 To promote national physical fitness through the expansion of sports and physical education activities by encouraging community participation, supporting outstanding athletes and reviving traditional sports.

11 To encourage conduct of medical research activities not only on prevailing health problems but also giving due attention in conducting health system research.

12 To expand the health service activities not only to rural but also to border areas so as to meet the overall health needs of the country.

13 To foresee any emerging health problem that poses a threat to the health and well-being of the people of Myanmar, so that preventive and curative measures can be initiated.

14 To reinforce the service and research activities of indigenous medicine to international level and to involve in community health care activities.

15 To strengthen collaboration with other countries for national health development.

Policy guidelines for health service provision and development have been provided in the Constitution of different administrative period. The following Box 5.2 reports the policy guidelines related to health sector included in the Constitution of the Republic of the Union of Myanmar 2008.

Box 5.2 The Constitution of the Republic of the Union of Myanmar 2008

Article 28

The Union shall:

(a) earnestly strive to improve education and health of the people;

(b) enact the necessary law to enable National people to participate in matters of their education and health;

Article 62

The Union shall:

(a) care for mothers and children, orphans, fallen Defence Services personnel's children, the aged and the disabled;

Article 351

Mothers, children and expectant women shall enjoy equal rights as prescribed by law.

Article 367

Every citizen shall, in accord with the health policy laid down by the Union, have the right to health care.

5.8.6.2 Strategic Health Development Programs at National Level

Several National Health Plans, based on primary health care services, have been systematically developed and implemented in Myanmar. The Ministry of Health had formulated four yearly People's Health Plans from 1978 to 1990, followed by the National Health Plans from 1991-1992 to 2006-2011. These plans have been formulated within the frame work of National Development Plans for the corresponding period.

National Health Plan (2011-12 to 2015-2016)

National Health Plan (2011-2016) is developed within the objective frame of the short term first five year period of the National Comprehensive Development Plan – Health Sector, a 20 year long term visionary plan.

With the ultimate aim of ensuring health and longevity for the citizens the following objectives have been adopted for developing programs for the health sector in ensuing five years covering the fiscal year 2011-2012 to 2015-2016:

- To ensure quality health services are accessible equitably to all citizens;
- To enable the people to be aware and follow behaviours conducive to health;
- To prevent and alleviate public health problems through measures encompassing preparedness and control activities;
- To ensure quality health care for citizens by improving quality of curative services as a priority measure and strengthening measures for disability prevention and rehabilitation;

- To provide valid and complete health information to end users using modern information and communication technologies;
- To plan and train human resources for health as required according to types of health care services, in such a way to ensure balance and harmony between production and utilization
- To intensify measures for development of Traditional Medicine;
- To make quality basic/essential medicines, vaccines and traditional medicine available adequately;
- To take supervisory and control measures to ensure public can consume and use food, water and drink, medicines, cosmetics and household materials safely;
- To promote in balance and harmoniously, basic research, applied research and health policy and health systems research and to ensure utilization as a priority measure;
- To continuously review, assess and provide advice with a view to see existing health laws are practical, to making them relevant to changing situations and to developing new laws as required;
- To promote collaboration with local and international partners including health related organizations and private sector in accordance with policy, law and rules existing in the country for raising the health status of the people.

To achieve these objectives current National Health Plan (2011-2016) is developed around 11 program areas, taken into account prevailing health problems in the country, the need to realize the health related goals articulated in the UN Millennium Declaration, significance of strengthening the health systems and the growing importance of social, economic and environmental determinants of health. For each program area, objective and priority actions to be undertaken have also been identified.

These Program Areas are the following:

1) Controlling Communicable Diseases;
2) Preventing, Controlling and Care of Non-Communicable Diseases and Conditions;
3) Improving Health for Mothers, Neonates, Children, Adolescent and Elderly as a Life Cycle Approach;
4) Improving Hospital Care;
5) Traditional Medicine;
6) Human Resources for Health;
7) Promoting Health Research;
8) Determinants of Health;
9) Nutrition Promotion;
10) Strengthening Health System;
11) Expanding Health Care Coverage in Rural, Peri-Urban and Border Areas.

National Comprehensive Development Plan - Health Sector (2010-11 to 2030-31)

A long-term (30 years) visionary plan, the National Comprehensive Development Plan - Health Sector (2010-2011 to 2030-2031) had been drawn up to meet the future health challenges. It is composed of 9) main areas:

- health policy and law;
- health promotion;
- health service provision;
- development of human resources for health;
- promotion of traditional medicine;
- development of health research;
- role of co-operative, joint ventures, private sectors and NGOs;

- partnership for health system development;
- international collaboration.

The expected benefits for the long-term visionary plan are:

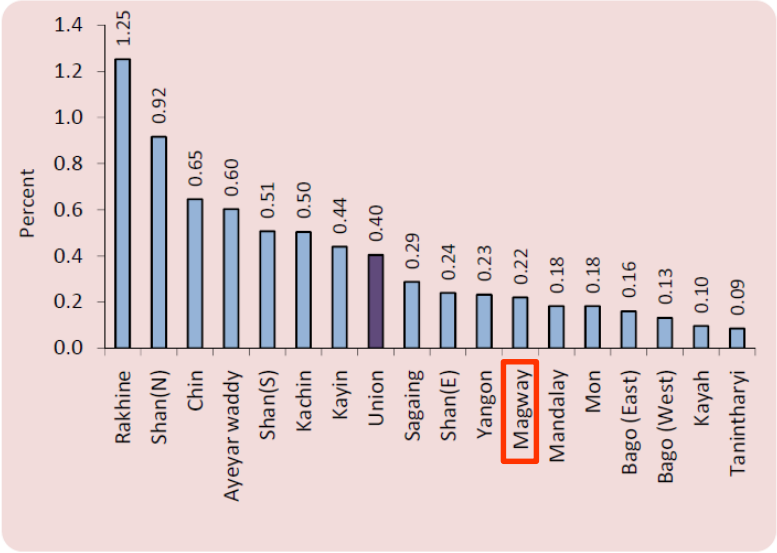
- an increase of Life Expectancy at Birth from existing (2001-02) 64-64 years to 75-80 years;
- a decrease of Infant Mortality Rate/1000 LB from existing 59.7 to 22;
- a decrease of Under five Mortality Rate/1000 LB from existing 77.77 to 29;
- a decrease of Maternal Mortality Ratio/1000 LB from 2.55 to 0.9.

5.8.7 Target Area Community Ill-Health Risk Factors

5.8.7.1 Nutritional Status of the Population

Regarding to the nutritional status of under one and three years old children in the regions and states in 2009, the union level of underweight percent was 3.8% in under one year and 4% in under three years in the nutrition surveillance areas. Rakhine had the highest percentage (7.4%) of underweight children under one year old and Sagaing (7.5%) had those of under three years children. However, the lowest percentage of both (1.2% and 0.9% respectively) was achieved by Kayah State.

Figure 5.46 Severe underweight percent by Regions and States, 2009



Source: Ministry of Health, Annual Public Health Statistics Report, 2011

The severe underweight percent under three years of age was demonstrated in above figure. There were six regions and states above the union level of 0.4% (Magway region value is 0.22%). Among them, Rakhine was the one that recorded more than threefold of the union level (1.25%).

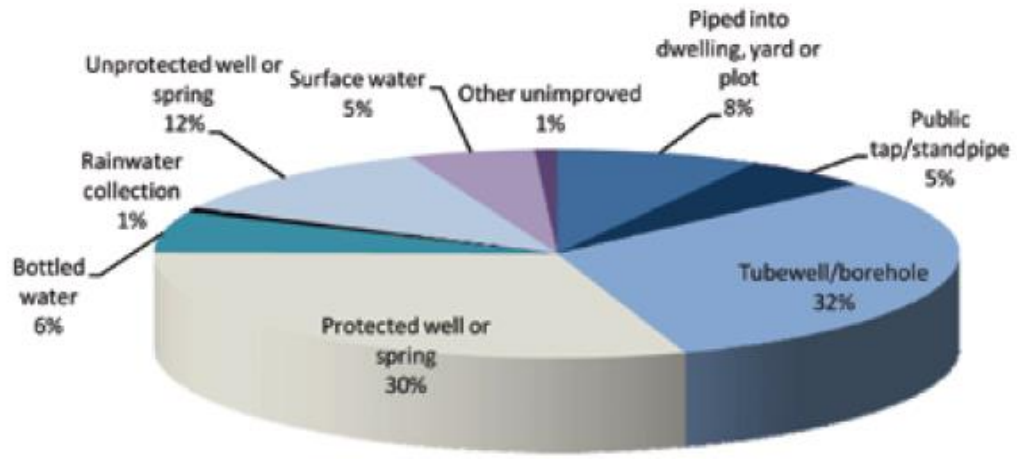
5.8.7.2 Water, Water Sanitation and Treatment and Food Hygiene Issues

Safe drinking water and sanitation are basic necessities for good health. Contaminated drinking water can be a significant carrier of diseases such as trachoma, cholera, typhoid, and schistosomiasis. The most common cause of bacteriological contamination of water is exposure to faecal matter of human origin. Drinking water can also be tainted with chemical, physical and radiological contaminants with harmful effects on human health.

The distribution of the population by source of drinking water is shown in Figure 5.47. The population using improved sources of drinking water are those using any of the following types of supply: piped water (into dwelling, yard or plot), public tap/standpipe, tube well/bore hole, protected well, protected spring, or rainwater collection. Bottled water is considered as an improved water source only if the household uses an improved water source for other purposes, such as hand washing and cooking.

Overall, 82.3% of the population use an improved source of drinking water, 93.2% cent in urban areas and 77.6% in rural areas.

Figure 5.47 Percentage Distribution of Household members by Source of Drinking Water in Myanmar, 2009-2010



Source: Ministry of National Planning and Economic Development, Ministry of Health, UNICEF, Myanmar Multiple Indicator Cluster Survey 2009 - 2010, 2011

The source of drinking water for the population varies across states and divisions (Table 5.82). Only 4.1% of Myanmar household population have water piped into their dwelling (consider that the term 'piped water' may have been interpreted differently, to include not only water piped through the main public pipes, but also self-made structures made of bamboo).

The percentage is as high as 31.3% in Chin State, a location where it is common to use bamboo pipes to bring water from a protected spring into the dwelling (but in this case the water at the point of consumption cannot be defined as safe). In contrast, in several states

and divisions less than 1% has water piped into their dwelling. Magway Region has only a 0.4% of water piped.

The most common sources of drinking water in Myanmar are tube well/bore-hole (31.5%) and protected well (27.2%), but as many as 10.9% use unprotected wells. The use of unprotected well is high in Kayin (43.9%) and Rakhine (37.2%). In Magway Region 7.2% rely on unprotected wells and 10.6% on surface water.

Table 5.82 Use of Improved Water Sources in Myanmar, 2009-2010

	Main source of drinking water																
	Improved sources								Unimproved sources							Total	Improved source of drinking water*
	Piped into dwelling	Piped into yard/ plot	Public tap/ stand-pipe	Tube-well/ bore-hole	Protected well	Protected spring	Rain-water	Bottled water[1]	Unprotected well	Unprotected spring	Tanker truck	Cart with tank/ drum	Surface water	Bottled water[1]	Other		
State/Division																	
Kachin	0.5	3.9	2.0	43.8	35.0	0.2	0.0	3.8	10.2	0.2	0.0	0.0	0.2	0.0	0.1	100.0	89.3
Kayah	10.6	10.6	5.5	1.9	34.7	3.6	0.0	2.7	23.8	2.4	0.0	0.0	4.1	0.2	0.0	100.0	69.6
Kayin	1.1	0.5	0.5	5.8	36.8	3.1	0.0	3.3	43.9	1.7	0.2	1.8	0.8	0.6	0.0	100.0	51.1
Chin	31.3	26.5	21.2	0.0	0.2	7.3	0.0	0.0	0.5	2.5	0.0	0.0	8.8	0.0	1.7	100.0	86.5
Mon	0.9	1.6	1.9	3.8	69.2	1.6	0.4	6.9	11.0	0.0	0.6	0.4	0.9	0.8	0.0	100.0	86.3
Rakhine	1.6	1.4	3.2	11.2	39.9	0.2	0.2	0.0	37.2	2.5	0.0	0.0	2.3	0.1	0.1	100.0	57.7
Shan (North)	2.2	5.9	3.3	10.0	23.2	33.7	0.0	3.0	5.0	5.1	0.1	0.0	8.2	0.1	0.0	100.0	81.4
Shan (East)	7.3	16.0	6.2	18.2	40.7	0.6	0.0	10.1	0.7	0.0	0.2	0.0	0.0	0.1	0.0	100.0	99.0
Shan (South)	3.3	3.0	12.6	6.5	43.3	12.7	6.7	0.9	1.7	1.3	0.3	0.0	7.8	0.0	0.0	100.0	89.0
Ayeyarwaddy	0.8	0.7	11.2	43.5	21.4	0.1	0.6	1.2	8.6	0.1	0.1	2.4	9.3	0.2	0.0	100.0	79.4
Bago (East)	0.6	0.3	2.1	43.8	31.2	1.5	0.6	3.4	15.8	0.4	0.2	0.0	0.0	0.1	0.0	100.0	83.5
Bago (West)	0.7	0.8	0.6	61.4	22.1	1.0	1.7	2.8	4.0	0.0	0.0	0.7	4.0	0.1	0.0	100.0	91.2
Magwe	0.4	2.1	3.3	53.9	18.9	0.6	0.0	0.1	7.2	2.8	0.1	0.0	10.6	0.0	0.0	100.0	79.3
Mandalay	6.5	5.1	4.5	35.6	21.2	1.5	0.8	6.7	7.9	0.5	0.1	0.2	9.3	0.1	0.1	100.0	81.9
Sagaing	0.8	1.7	10.6	38.4	30.5	3.6	0.4	0.7	6.6	0.1	0.0	0.0	6.6	0.1	0.0	100.0	86.6
Tanintharyi	11.1	2.1	0.8	4.3	48.0	0.3	0.0	6.1	20.4	0.2	1.0	4.0	0.0	1.7	0.0	100.0	72.7
Yangon	11.3	10.3	3.5	30.8	10.0	0.0	0.4	26.3	6.4	0.0	0.1	0.5	0.2	0.1	0.1	100.0	92.5
Area																	
Urban	10.4	9.7	4.8	30.2	16.7	0.9	0.6	19.9	3.9	0.1	0.4	0.8	1.0	0.5	0.1	100.0	93.2
Rural	1.5	1.7	5.3	32.0	31.7	4.0	0.7	0.6	13.9	1.3	0.0	0.4	6.8	0.0	0.0	100.0	77.6

Source: Ministry of National Planning and Economic Development, Ministry of Health, UNICEF, Myanmar Multiple Indicator Cluster Survey 2009 - 2010, 2011

Use of in-house water treatment is presented in Table 5.83. Boiling, adding bleach or chlorine, using a water filter, and using solar disinfection were considered as proper treatment of drinking water.

In Myanmar, the most common way of treating water is to strain it through a cloth (76.2%), a practice which will not make water safe to drink. While 33.1% of household population boil their water, only 1.4% use a water filter and 0.6% add bleach or chlorine. As many as 12.2% do not use any water treatment method, and 9.5% let their water stand and settle.

Overall, 34.5% of the household population use an appropriate water treatment method. Out of those using improved water sources, 35.3% treat their water with an appropriate method, and 31% of those with unimproved water sources do so.

The urban population is more likely than the rural population to treat their water with an appropriate method, with 39% and 32.6% respectively. The highest level of household water treatment is found in Kayah (84.3%) and Chin (83.2%), where the preferred method is boiling. The level of appropriate water treatment in Magway is 43.4%.

Table 5.83 Household Water Treatment in Myanmar, 2009-2010

	Water treatment method used in the household							
	None	Boil	Add bleach/ chlorine	Strain through a cloth	Use water filter	Solar dis-infection	Let it stand and settle	Other
State/Division								
Kachin	16.8	41.7	0.9	67.7	7.6	0.4	3.9	0.1
Kayah	6.7	84.2	0.8	49.1	0.0	0.0	1.1	0.2
Kayin	8.2	26.8	0.1	85.5	0.0	0.1	9.7	0.0
Chin	14.1	83.2	0.0	2.9	0.0	0.0	11.2	0.0
Mon	6.7	65.7	0.5	85.8	0.1	0.1	12.4	0.0
Rakhine	19.9	17.9	0.0	76.0	0.4	0.0	1.8	0.0
Shan (North)	35.5	60.0	0.4	11.4	0.1	0.0	0.9	0.3
Shan (East)	20.7	39.1	0.1	59.1	6.4	0.0	0.3	0.0
Shan (South)	11.8	62.5	0.6	61.8	0.1	0.0	0.6	0.1
Ayeyarwaddy	4.1	17.9	0.8	89.4	0.1	0.0	16.6	2.8
Bago (East)	9.9	46.4	0.4	77.7	6.8	1.4	21.1	0.3
Bago (West)	4.5	9.2	0.0	92.3	0.0	0.0	21.4	1.1
Magwe	4.6	43.4	0.2	88.1	0.1	0.1	11.9	1.5
Mandalay	9.4	23.1	0.3	83.3	0.4	0.0	4.2	0.1
Sagaing	8.0	18.1	0.1	84.0	3.5	0.0	1.1	0.1
Tanintharyi	6.9	26.0	0.3	86.7	0.1	0.0	1.1	0.2
Yangon	23.1	33.0	2.4	69.5	0.8	0.5	18.8	2.6
Area								
Urban	18.9	37.6	1.5	69.6	1.2	0.2	8.6	1.1
Rural	9.4	31.2	0.2	79.1	1.5	0.2	9.9	0.8

Source: Ministry of National Planning and Economic Development, Ministry of Health, UNICEF, Myanmar Multiple Indicator Cluster Survey 2009 - 2010, 2011

Inadequate disposal of human excreta and poor personal hygiene is associated with a range of ailments including diarrhoeal diseases and polio. Improved sanitation facilities for excreta disposal include: flush or pour flush to a piped sewer system, septic tank, or latrine; ventilated improved pit latrine, pit latrine with slab, and composting toilet. Information on sanitary facilities is based on the facility household members access in their homes, and does not capture the type of facility used by household members who leave the home during the day for work or school.

Overall, 84.6% of the population of Myanmar live in households with improved sanitation facilities (Table 5.84). The table indicates that access to improved sanitation facilities is strongly correlated with wealth and area of residence. In urban areas 94.4% of the population have access to sanitary means of excreta disposal, compared to 80.4% in rural areas. Only 59.8% of the poorest population have access to improved facilities, compared to 98.2% among

the richest population. 84.2% of the population in Magway region have access to improved sanitation facilities.

In both urban and rural areas, the most common toilet facility is a pit latrine with slab, which is in 53.5% of the urban households and 69.8% of the rural households. In urban areas it is also common to have a toilet flushing to septic tank/pit (32.3%).

Population without access to sanitary facilities are found almost exclusively in rural areas, with 9.7% of the rural population not having access to sanitary facilities. In contrast less than one per cent in urban areas lack sanitary facilities.

Table 5.84 Access to Sanitary Means of Excreta Disposal in Myanmar, 2009-2010

	Type of toilet facility in household												
	Improved sanitation facility					Unimproved sanitation facility						Total	Percentage of population with access to sanitary means of excreta disposal*
	Flush/pour flush to:		Ventilated improved pit latrine	Pit latrine with slab	Composting toilet	Flush/pour flush to somewhere else	Pit latrine without slab/open pit	Bucket	Hanging toilet/hanging latrine	No facilities/bush/field	Others		
	Piped sewer system	Septic tank/pit											
State/Division													
Kachin	0.0	31.6	5.7	53.9	0.9	0.6	6.8	0.0	0.1	0.4	0.0	100.0	92.1
Kayah	0.0	4.8	0.4	74.3	1.7	3.0	15.1	0.0	0.0	0.7	0.0	100.0	81.2
Kayin	0.0	2.2	1.2	69.4	0.7	0.0	18.5	0.0	0.1	7.9	0.0	100.0	73.6
Chin	0.0	0.3	5.6	76.8	4.2	0.4	3.0	0.0	0.3	9.2	0.3	100.0	86.9
Mon	0.0	2.9	12.9	75.0	0.4	1.3	1.9	0.3	1.4	3.9	0.0	100.0	91.2
Rakhine	0.0	1.0	1.6	41.6	3.9	0.4	10.6	0.1	0.2	40.7	0.0	100.0	48.0
Shan (North)	0.0	16.0	3.6	42.8	6.0	0.8	27.3	0.0	0.0	3.1	0.5	100.0	68.3
Shan (East)	0.0	71.0	0.4	20.6	0.1	0.9	4.0	0.0	0.1	2.9	0.0	100.0	92.1
Shan (South)	0.3	11.7	5.0	68.1	0.6	6.7	7.5	0.1	0.0	0.2	0.0	100.0	85.6
Ayeyarwaddy	0.0	3.7	0.9	77.1	1.4	2.1	9.3	0.0	0.8	4.7	0.0	100.0	83.1
Bago (East)	0.2	9.6	0.8	69.3	0.0	0.1	8.4	0.0	0.3	5.6	5.7	100.0	79.8
Bago (West)	0.0	0.6	1.3	85.8	0.8	0.0	9.1	0.0	0.0	2.4	0.1	100.0	88.4
Magwe	0.0	7.0	4.3	71.5	1.3	0.0	5.7	0.0	0.0	10.1	0.0	100.0	84.2
Mandalay	0.0	17.5	8.5	65.0	0.0	0.2	1.5	0.0	0.0	6.9	0.2	100.0	91.1
Sagaing	0.0	2.1	1.5	86.8	0.5	0.4	2.5	0.0	0.0	6.2	0.1	100.0	90.9
Tanintharyi	0.0	20.7	6.4	55.3	1.9	5.1	3.0	0.0	3.9	3.6	0.0	100.0	84.4
Yangon	7.3	38.8	0.9	46.7	0.2	2.0	3.0	0.0	0.5	0.3	0.4	100.0	93.8
Area													
Urban	3.6	32.3	4.8	53.5	0.3	1.6	2.6	0.0	0.4	0.8	0.2	100.0	94.4
Rural	0.0	6.0	3.1	69.8	1.4	0.9	8.0	0.0	0.3	9.7	0.7	100.0	80.4

Source: Ministry of National Planning and Economic Development, Ministry of Health, UNICEF, Myanmar Multiple Indicator Cluster Survey 2009 - 2010, 2011

5.8.8 Morbidity

5.8.8.1 Top Endemic Diseases

In this section, the main endemic diseases are examined, at national and regional level.

Malaria

Malaria is one of the priority diseases in Myanmar. Malaria prevalence is found to be falling from 24.53 per 1,000 populations in 1988 to 9 per 1,000 populations and 10.75 per 1,000 populations in 2007 and 2008 respectively.

Magway Region shows one of the lower incidence rate (defined as the number of new cases per 1,000 population), as shown in Figure 5.48.

Figure 5.48 Malaria Morbidity Rate by State and Division, 2008 (in Red the Block RSF5)



Source: Ministry of Health, Myanmar Health Statistics, 2010

Tuberculosis

Tuberculosis (TB) is also one of the major public health problems in Myanmar. DOTS (Directly Observed Treatment Short Course) strategy was introduced in 1997 and it covered all the townships since November 2003. The National TB Programme (NTP) achieved case detection rate 90%, cure rate 77% (treatment success rate 85%) and has reached the global TB control targets since 2006 and maintained.

Figure 5.49 shows new case detection rate (defined as the percentage of newly notified tuberculosis cases on the total estimated cases) in Myanmar.

Figure 5.49 Tuberculosis Case Detection Rate by State and Division, 2008 (in Red the Block RSF-5)



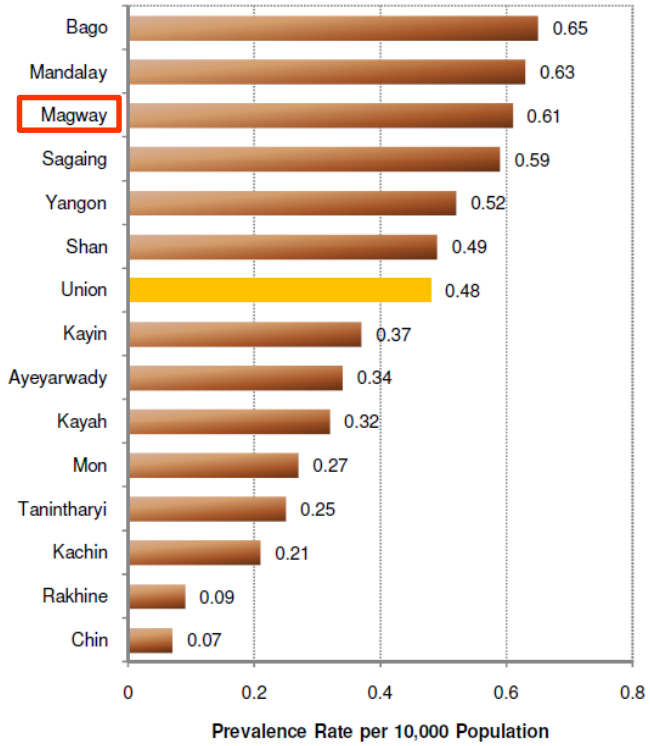
Source: Ministry of Health, Myanmar Health Statistics, 2010

Leprosy

Myanmar has achieved Leprosy Elimination Goal several years back since 2003. The national prevalence rate was 0.48 in 2008 0.47 per 10,000 population in 2009.

Bago Division has reported the highest rate of 0.65 per 10,000 population and followed by Mandalay Division and Magway Division with the prevalence rate of 0.63 and 0.61 per 10,000 population respectively.

Figure 5.50 Prevalence of Leprosy by State and Division, 2008



Source: Ministry of Health, Myanmar Health Statistics, 2010

HIV/AIDS

The results from the Estimation and Projection of HIV/AIDS (2009) revealed that approximately 238,000 adults and children are living with HIV in Myanmar at the end of 2009. An estimated adult HIV prevalence among 15 to 49 years age group is 0.61%. The adult HIV prevalence peaked around 2000-2001 and since then there is a steady decline.

AIDS Case reporting

In 2008, a total of 1,067 AIDS cases, including 39 paediatric AIDS cases, were reported from the hospitals all over the country. Out of them, 32.3% (345/1,067) were females and 67.7% (722/1,067) were males. Based on these reported cases, it has been found that 72.8 % of the cases were attributed to sexual transmission, 3% to injecting drug use, 1.7% to blood transfusion, 2.8% to mother to child transmission and the remaining 19.7% to other causes.

5.8.8.2 Communicable vs non Communicable Diseases

In the following Table 5.85 the main causes of morbidity in Myanmar are reported. Leading causes of morbidity for 2011 are injuries of specified, unspecified and multiple body regions (10.6%), complications of pregnancy and delivery (6.7%), single spontaneous delivery (6.0%), diarrhoea and gastroenteritis of presumed infectious origin (5.4%) and malaria (3.2%).

Table 5.85 Single Leading Causes of Morbidity (2011)

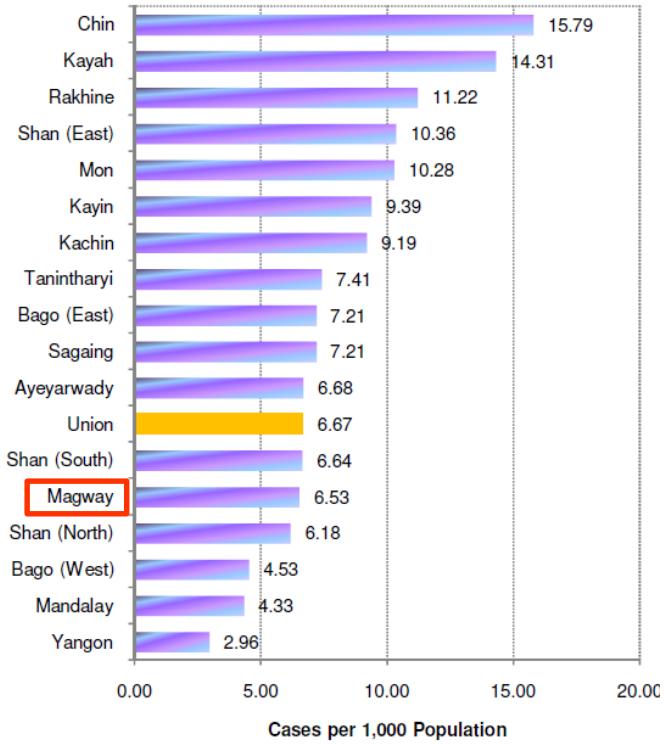
Causes	Percent
1 Other injuries of specified, unspecified and multiple body regions	10.6%
2 Other complications of pregnancy and delivery	6.7%
3 Single spontaneous delivery (*)	6.0%
4 Diarrhoea and gastroenteritis of presumed infectious origin	5.4%
5 Malaria	3.2%
6 Other pregnancies with abortive outcome	2.9%
7 Other viral diseases	2.6%
8 Gastritis and duodenitis	2.1%
9 Cataract and other disorders of lens	2.0%
10 Other acute upper respiratory infections	1.8%
11 Fractures of other limb bones	1.8%
12 Other conditions originating in the perinatal period	1.7%
13 Respiratory tuberculosis	1.6%
14 Toxic effects of substances chiefly nonmedicinal as to source	1.5%
15 Other diseases of liver	0.5%
All other causes	49.6%
Total	100.0%

Source: Health in Myanmar (2013), Ministry of Health

Diarrhoea

In 2008, high diarrhoea morbidity was seen in Chin, Kayah, Rakhine, Shan (East) and Mon States where sanitary latrines coverage was moderate, whereas Mon State. Yangon, Mandalay, Bago (West) and Magway Divisions had low diarrhoea morbidity with high sanitary latrine coverage, as shown in Figure 5.51. Overall, it was found that all states and divisions which had higher sanitary latrines coverage experience low diarrhoea morbidity.

Figure 5.51 Morbidity of Diarrhoea by State and Division, 2008



Source: Ministry of Health, Myanmar Health Statistics, 2010

5.8.9 Mortality

5.8.9.1 Mortality Rates

In Myanmar, the current death rate is 8.01 deaths/1,000 population (*Source: CIA, The World Factbook,* 2014 est.). The maternal mortality rate is 200 deaths/100,000 live births (*Source: CIA, The World Factbook,* 2010); the total infant mortality rate is 44.91 deaths/1,000 live births, 51.35 deaths/1,000 live births for male and 38.07 deaths/1,000 live births for female.

The following Table 5.86 reports data on mortality rate, stratified for area (urban or rural). The outliers in mortality rates in 2008 are due to the passage of cyclone Nargis, on 2nd May 2008.

Table 5.86 Statistics on Mortality Rates

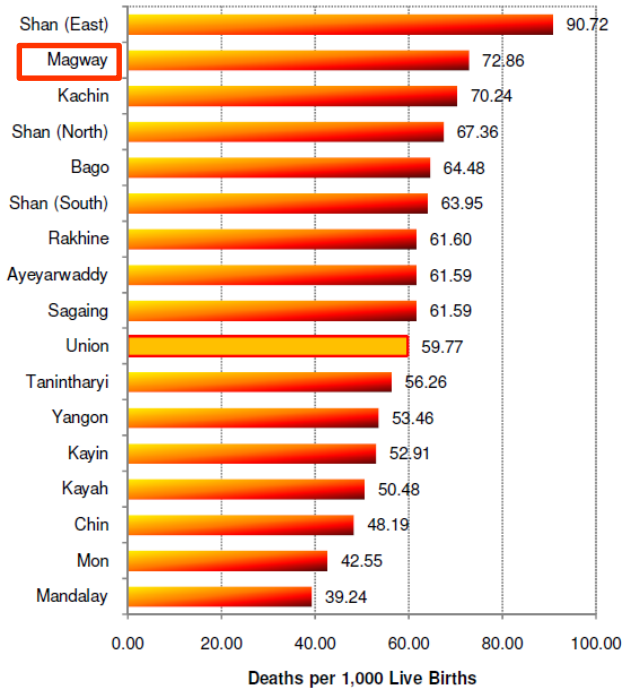
Mortality rates	1988	1999	2005	2006	2007	2008	2009	2010
Crude Death Rate (per 1,000 population):								
- Urban	8.9	6.0	5.5	5.3	5.3	7.6	5.1	5.2
- Rural	9.9	7.8	6.4	6.3	5.9	8.7	5.8	6.1
Infant Mortality Rate (per 1,000 live births):								
- Urban	47.0	55.1(*)	45.1	44.9	43.4	28.2	25.7	25.6

Mortality rates	1988	1999	2005	2006	2007	2008	2009	2010
- Rural	49.8	62.5(*)	47.0	46.9	46.3	30.0	27.8	27.8
U5 Mortality Rate (per 1,000 live births):								
- Union	-	77.77(*)	70.84	66.22	64.25	40.73	36.53	34.91
- Urban	72.9	65.12(*)	70.02	64.15	62.10	39.80	36.15	34.43
- Rural	-	85.16(*)	71.16	67.03	65.02	41.08	36.69	35.11
Maternal Mortality Ratio (per 1,000 live births):								
- Union	-	2.5(*)	1.17	1.16	1.13	1.48	1.41	1.42
- Urban	1.0	1.8(*)	0.96	0.96	0.94	1.23	1.13	1.12
- Rural	1.9	2.8(*)	1.43	1.41	1.36	1.57	1.52	1.54

Source: Central Statistical Organization(CSO), Ministry of National Planning and Economic Development, 2011; (*) National Mortality Survey, CSO, 1999

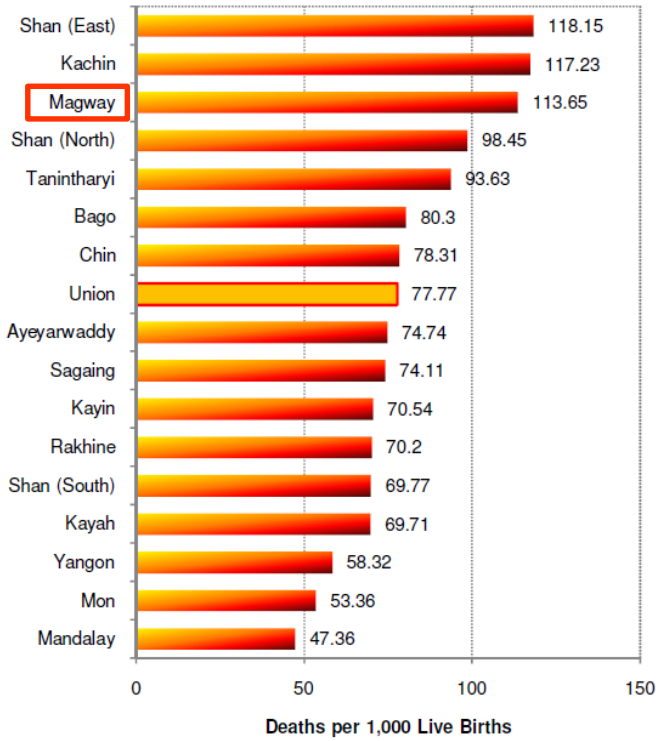
The following Figure 5.52, Figure 5.53 and Figure 5.54 shows mortality rates by State. Magway Region has one of the highest infant mortality rate and under five mortality rate of Myanmar (respectively 72.86 deaths per 1,000 live births and 113.65 deaths per 1,000 live births). The maternal mortality ratio is 2.86 deaths per 1,000 live births.

Figure 5.52 Infant Mortality Rate by State and Division (National Mortality Survey, 1999)



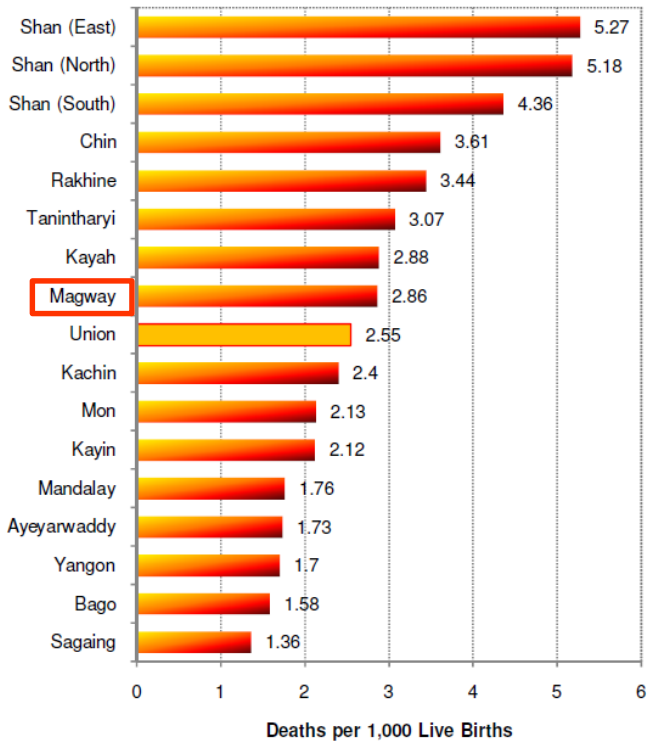
Source: Ministry of Health, Myanmar Health Statistics, 2010

Figure 5.53 Under Five Mortality Rate by State and Division (National Mortality Survey, 1999)



Source: Ministry of Health, Myanmar Health Statistics, 2010

Figure 5.54 Maternal Mortality Ratio by State and Division (National Mortality Survey, 1999)



Source: Ministry of Health, Myanmar Health Statistics, 2010

In the following Table 5.87 the main causes of mortality in Myanmar are reported. Leading causes of mortality for 2011 HIV disease (6.3%), septicaemia (5%), disease of the respiratory system (3.9%) and respiratory tuberculosis (3.9%). Malaria causes 3.1% of deaths.

Table 5.87 Single Leading Causes of Mortality (2011)

Causes	Percent
1 Human immunodeficiency virus [HIV] disease	6.3%
2 Septicaemia	5.0%
3 Other diseases of the respiratory system	3.9%
4 Respiratory tuberculosis	3.9%
5 Other diseases of liver	3.8%
6 Slow fetal growth, fetal malnutrition and disorders related to short gestation and low birth weight	3.7%
7 Stroke, not specified as haemorrhage or infarction	3.6%
8 Heart failure	3.2%
9 Malaria	3.1%

Causes	Percent
10 Other heart diseases	2.3%
11 Pneumonia	1.8%
12 Intracranial haemorrhage	1.6%
13 Renal Failure	0.9%
14 Acute myocardial infarction	0.9%
15 Other viral diseases	0.9%
All other causes	55.1%
Total	100.0%

Source: Health in Myanmar (2013), Ministry of Health

5.8.9.2 Life Expectancy

Life expectancy at birth is the following (*Source: CIA, The World Factbook,* 2014 est):

- total population: 65.94 years;
- male: 63.57 years;
- female: 68.46 years.

The following Table 5.88 reports data on life expectancy, stratified for sex and area (urban or rural).

Table 5.88 Statistics on Life Expectancy

Average Life Expectancy	1988	1999	2005	2006	2007	2008	2009	2010
Urban								
- Male	59.0	61.0	62.5	62.9	64.0	65.1	65.5	65.8
- Female	63.2	65.1	66.6	67.3	69.0	70.5	70.7	70.8
Rural								
- Male	56.2	60.3	62.0	62.5	63.2	63.9	64.1	64.3
- Female	60.4	62.7	64.9	65.4	67.1	67.4	67.5	67.8

Source: Central Statistical Organization(CSO), Ministry of National Planning and Economic Development, 2011

5.8.10 Health Care Delivery Services

5.8.10.1 Health Sector

An estimated 75% of the population of Myanmar does not have quality health care (*Source: World Bank, Power to People: World Bank Group to invest US$2 billion in Myanmar, to support reforms, reduce poverty, increase energy and health access, 2014*).

At the township level, both curative and preventive health services are provided by the township health departments. Township hospital staff take part in curative aspects and training. Township health departments are staffed by *health assistants* of grade 1 and *township health nurses* who take care of the promotive and preventive aspects of the health services. There are also station hospitals situated in strategic areas of the townships and four to five rural health centres including an urban health centre. Rural health centres are staffed by a *health assistant*, a *public health supervisor*, *lady health visitor* and a *midwife*, who are trained mainly in public health and primary health care.

At the level below each rural health centre are, on an average, four to five subrural health centres, each of which are staffed by a *midwife* and a *public health supervisor* of grade 2. Health staff at the community level provide promotive, preventive, curative and rehabilitative services using the primary health care approach.

Each sub-rural health centre provides health-care services to a cluster of five to ten villages in which there are usually *voluntary health workers (auxiliary midwives and community health workers)*, who receive no remuneration. Home births may be attended by auxiliary midwives but they are not authorized to administer injectable medication.

Volunteers and members of local NGOs and faith-based organizations are also active in the field of health. For example, the Myanmar Maternal and Child Welfare Association and Myanmar Red Cross Society have members from many villages. With the support from health committees and local administrative authorities, these members can be mobilized to assist in and promote the delivery of health-care services in the villages they live in.

Traditional medicine also plays an important role in the public health system. The government accords high importance and provides considerable support to traditional medicine. Services and drugs are made available free of charge, although drugs are often not available in adequate quantities in public health institutions.

While private sector health care has expanded rapidly and is estimated to provide 75%-80% of ambulatory care currently, private service providers have had very limited involvement in public health programmes. A number of members of the Myanmar Medical Association from its branches in several cities and towns were provided training recently on issues such as reproductive health and malaria.

5.8.10.2 Data on Human Resources for Health

Although government expenditure on health has increased thirteen-fold between 2000-2001 and 2011-2012, the health sector is highly under-resourced. While health services are free, drugs are often not available in adequate quantities in public health institutions.

As seen in Table 5.89, there were a total of 29,832 practising medical doctors in Myanmar in 2012-2013, of whom 17,032 were engaged in private practice and 12,800 in state service. This represents an increase from figures of 12,268 medical doctors, 7,891 practising privately and 4,377 in state service in 1988-1989.

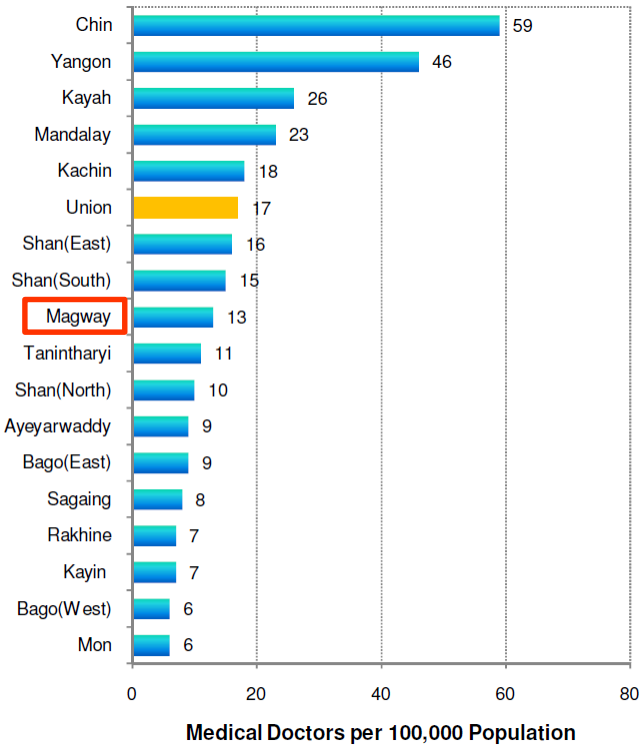
Table 5.89 Health Manpower Development in Myanmar

Health Manpower	1988-89	2008-09	2009-10	2010-11	2011-12	2012-13
Total No. of Doctors	12,268	23,740	24,536	26,435	28,077	29,832
- Public	4,377	9,583	9,728	10,450	11,675	12,800
- Cooperative & Private	7,891	14,157	14,808	15,985	16,402	17,032
Dental Surgeon	857	2,092	2,308	2,562	2,770	3,011
- Public	328	777	703	756	774	802
- Cooperative & Private	529	1,315	1,605	1,806	1,996	2,209
Nurses	8,349	22,885	24,242	25,644	26,928	28,254
Dental Nurses	96	244	262	287	316	344
Health Assistants	1,238	1,822	1,845	1,883	1,893	2,013
Lady Health Visitors	1,557	3,238	3,278	3,344	3,371	3,397
Midwives	8,121	18,543	19,051	19,556	20,044	20,617
Health Supervisor 1	487	529	529	541	612	677
Health Supervisor 2	674	1,484	1,645	2,080	1,718	1,850
Traditional Medicine Practitioners	290	950	890	890	885	875
- Public	2,500	5,397	5,737	5,737	5,867	5,979
- Private						

Source: Health in Myanmar (2013), Ministry of Health

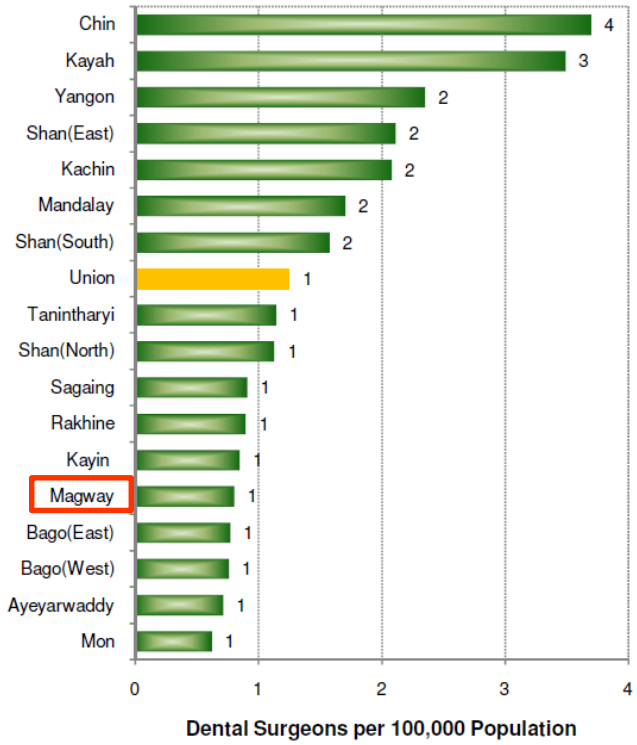
The following Figures shows the distribution of health manpower by State. Magway Region has, compared with the other State, an lower presence of Medical Doctors (13 per 100,000 population), Dental Surgeons (1 per 100,000 population) and Nurses (20 per 100,000 population), whereas the distribution of Midwives is higher than average value of Union (24 per 100,000 rural population).

Figure 5.55 Distribution of Medical Doctors by State and Division, 2009



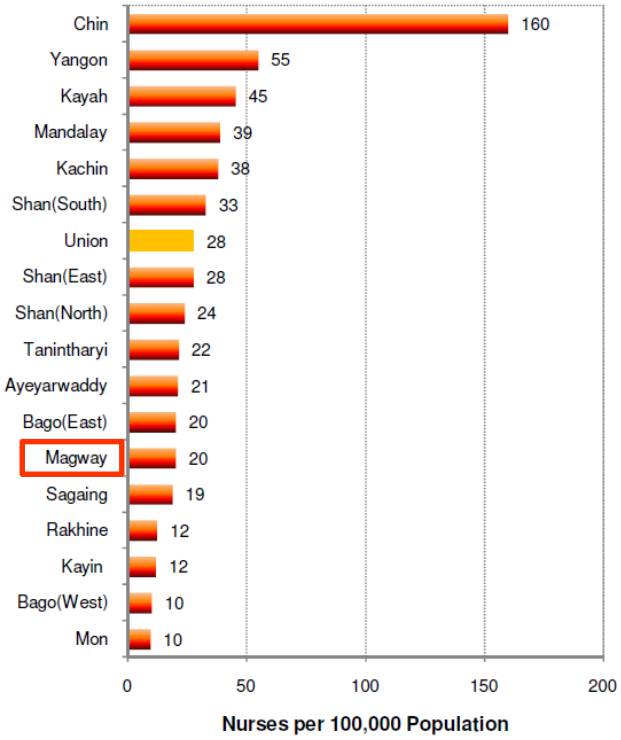
Source: Ministry of Health, Myanmar Health Statistics, 2010

Figure 5.56 Distribution of Dental Surgeons by State and Division, 2009



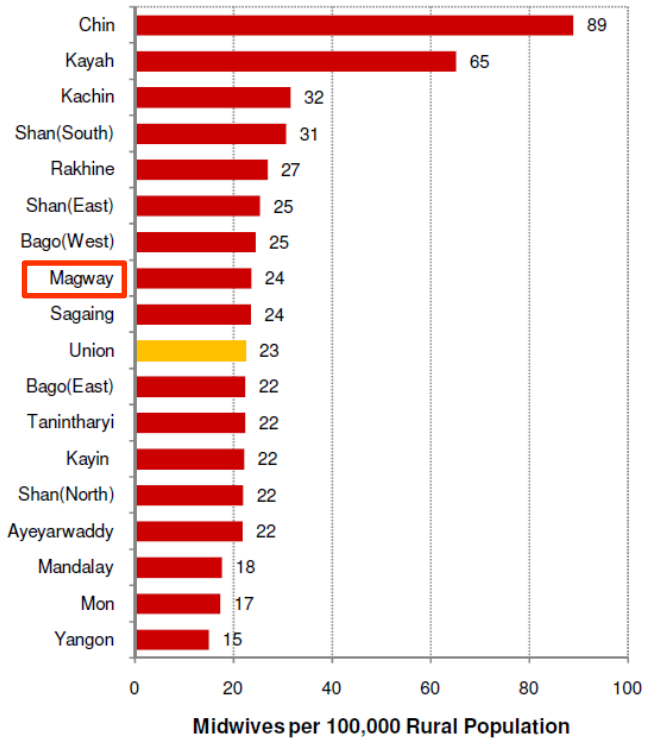
Source: Ministry of Health, Myanmar Health Statistics, 2010

Figure 5.57 Distribution of Nurses by State and Division, 2009



Source: Ministry of Health, Myanmar Health Statistics, 2010

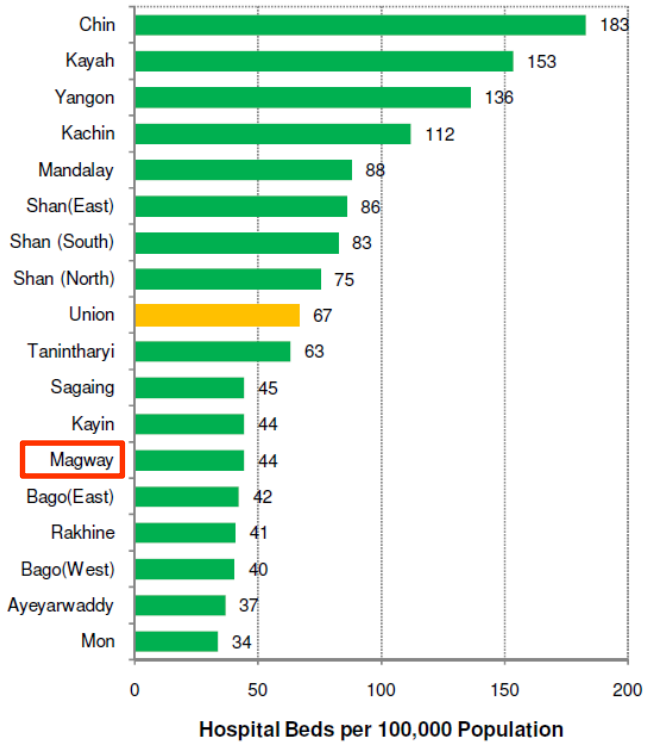
Figure 5.58 Distribution of Midwives by State and Division, 2009



Source: Ministry of Health, Myanmar Health Statistics, 2010

Also referring to the hospital beds, the Magway Region value is one of the lower in Myanmar (44 hospital beds per 100,000 population), as shown in Figure 5.59.

Figure 5.59 Government Hospital Bed Strength by State and Division, 2009



Source: Ministry of Health, Myanmar Health Statistics, 2010

5.8.10.3 Health Financing Outlines

The sources of finance for health care services are the government, private households, social security system, community contributions and external aid. Government has increased health spending on both current and capital yearly.

As reported in section 5.8.5, total government health expenditure increased from 7,688 million kyat in 2000-01 to 100,825 million kyat in 2011-12 (*Source: Health in Myanmar (2013), Ministry of Health*).

The following Table shows the government health expenditures by providers.

Table 5.90 Government Health Expenditures by Providers

Providers (%)	2008-09	2009-10	2010-11	2011-12
Hospitals	70.33%	67.89%	69.39%	69.80%
Ambulatory health care	17.54%	17.01%	14.43%	14.63%
Retail sale and medical goods	3.84%	3.79%	3.45%	3.86%
Provisioning and administration of public health programs	2.00%	2.51%	1.50%	1.65%
General health administration	0.51%	0.50%	2.46%	3.14%

Providers (%)	2008-09	2009-10	2010-11	2011-12
Health related services	1.98%	1.82%	1.81%	2.23%
Rest of the world	3.80%	6.48%	6.96%	4.69%

Source: Health in Myanmar (2013), Ministry of Health

Social security scheme was implemented in accordance with 1954 Social Security Act by the Ministry of Labour. According to the law factories, workshops and enterprises that have over 5 employees whether State owned, private, foreign or joint ventures, must provide the employees with social security coverage. The contribution is tripartite with 2.5% by the employer, 1.5% by the employee of the designated rate, while the government contribution is in the form of capital investment. Insured workers under the scheme are provided free medical treatment, cash benefits and occupational injury benefit. To effectively implement the scheme branch offices, workers' hospitals, dispensaries and mobile medical units have been established nation-wide.

5.8.10.4 Health Infrastructures and Medical Equipment Outlines

In Myanmar, at present, there are:

- 1,010 government hospitals, covering 55,305 hospital beds;
- 87 primary and secondary health centres;
- 348 maternal and child health centres;
- 1,635 rural health centres,;
- 16 traditional medicine hospitals and 237 traditional medicine clinics.

Table 5.91 outlines the national development of health facilities since 1988.

Table 5.91 Development of Health Facilities

Health facilities	1988-89	2008-09	2009-10	2010-11	2011-12	2012-13
Government hospitals	631	846	871	924	987	1,010
Hospital beds	25,309	38,249	39,060	43,789	54,503	55,305
Primary and secondary health centres	64	86	86	86	87	87
Maternal and child health centres	348	348	348	348	348	348
Rural health centres	1,337	1,481	1,504	1,558	1,565	1,635
School health teams	80	80	80	80	80	80
Traditional medicine hospitals	2	14	14	14	14	16
Traditional medicine clinics	89	237	237	237	237	237

Source: Health in Myanmar (2013), Ministry of Health

5.8.10.5 Health Management Information System Structure and Function

In Myanmar, Health Management Information System (HMIS) has been established since 1990 with the aim to provide health information that could be used in monitoring and evaluating programmes and projects included in the national health plans.

It is also designed as a tool for enabling local health managers to assess health situations and identifying health problems in their respective regions to formulate micro-health plans. This system also enables health care providers to monitor and assess their performance for undertaking timely corrective measures.

The Health Management Information System covers the public sector all over the country (i.e. 325 townships of 17 States and Divisions). It is a monthly routine reporting system and includes two major components, namely Hospital Information System and Public Health Information System, which are described in the following:

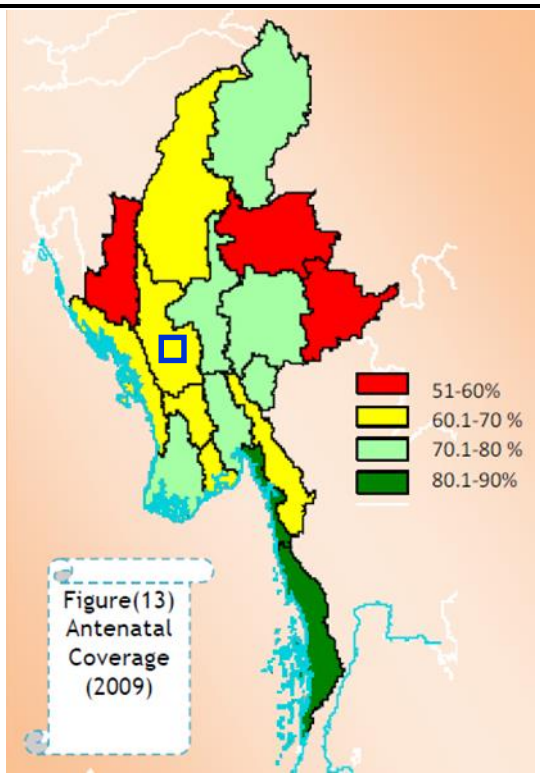
- *Hospital Information System* is a facility based monthly reporting system from all types of hospitals (i.e. Station Hospital, Township Hospitals, State and Divisional Hospitals and Specialist Hospitals). A total of 832 hospitals all over the country send the information as reports and returns to the central level. Department of Health Planning in the Ministry of Health is conscientious for monthly collection of data, data compilation, transmission, coding of diseases, data processing, analysis and reporting. Hospital Statistics are classified into two categories: the first one concerns to hospital administrative statistics of in-patient about utilization of hospital beds and amenities and regularity of services provided; the second one is related to morbidity and mortality outline.
- *Public Health Information System* is intended to provide public health information regarding health services coverage for management of primary health care. It is designed as a system where health care providers themselves are monitoring their health care services providing to the community. Projects integrated in routine public health reporting system are Primary Medical Care and Referral System, Family Health Care, Nutrition, Health Education, EPI, Mental Health, Cardiovascular Diseases Control, Diseases under National Surveillance, Malaria Control, National Tuberculosis Control, AIDS/STD Prevention and Control, Leprosy Control, Prevention and Control of Common Childhood Diseases, Trachoma and Prevention of Blindness, Zoonotic Diseases Control, Environmental Sanitation, School Health, Prevention of Accident and Injury and Vital Statistics.

5.8.10.6 Focus on Mother/Child Health Care at all Levels

Maternal and Child Health including new born care has been regarded as a priority issue in the National Health Plan of Myanmar. Such kind of health services are provided by midwives, auxiliary midwives and Trained Traditional Birth Attendances.

Antenatal care coverage in the regions and states was illustrated in Figure 5.60. The Union level of 2009 was 70.6% which showed that strenuous effort was required to achieve 100% coverage. Antenatal care coverage by State is reported in the following Table 5.92.

Figure 5.60 Antenatal Coverage, 2009 (in Blue the Block RSF-5)

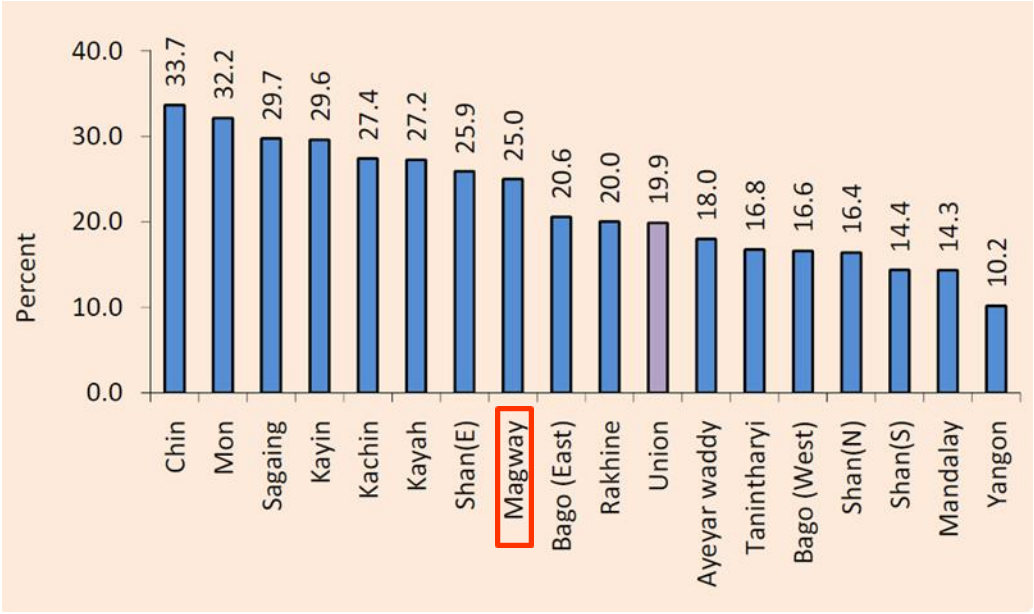


Source: Ministry of Health, Annual Public Health Statistics Report, 2011

Average frequency of AN care was 3.3 times per pregnant mother; and PN care was 6 times in puerperium period.

The following Figure 5.61 represents the clinic attendance rate of children younger than five years, by regions and states, in 2009. Its union level was 19.9% and the coverage ranged from 10.2% in Yangon to 33.7% in Chin. It is observed that the attendance rate in Magway Region is 25%.

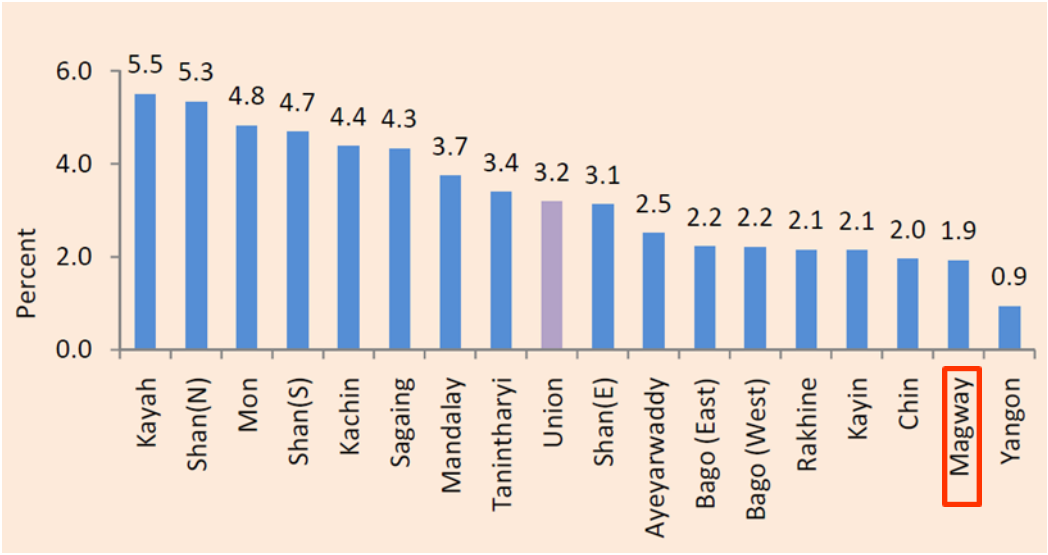
Figure 5.61 Under 5 clinic attendance rate by Regions and States (2009)



Source: Ministry of Health, Annual Public Health Statistics Report, 2011

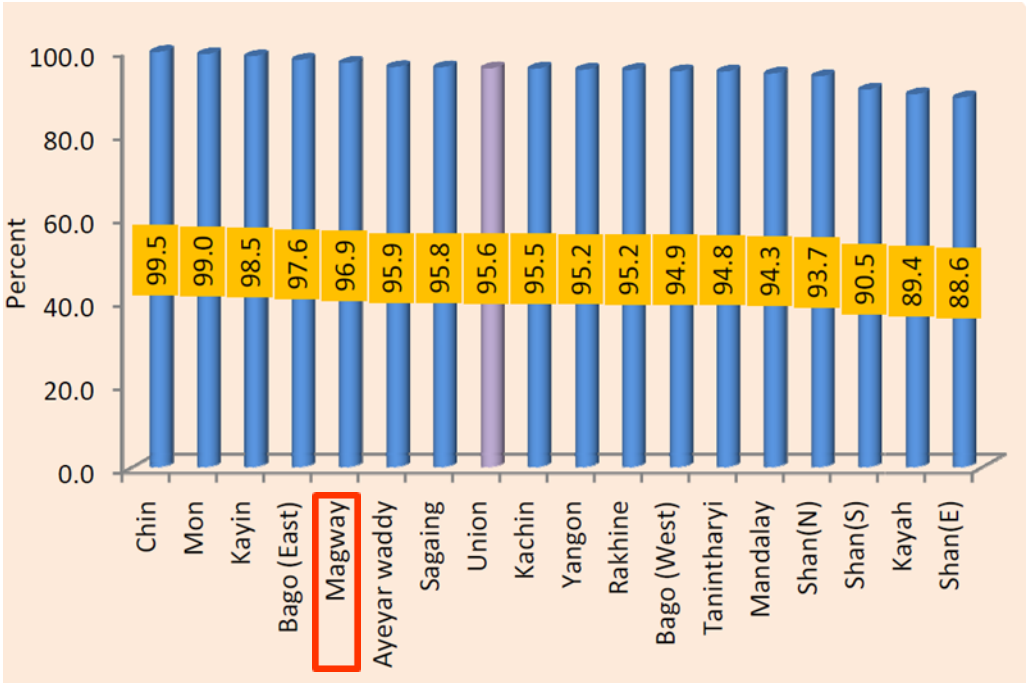
Now-a-days, preventable and curable diseases such as Acute Respiratory Tract Infection (ARI), Diarrhoea and Malaria are still leading causes of under five deaths. The relation of diarrhoea cases and utilization of Oral Rehydration Therapy (ORT) among under five years old children in 2009 was shown in Figure 5.62 and Figure 5.63. Magway region has 1.9% of under five diarrhoea cases with severe dehydration, and the utilization of ORT is 96.9%.

Figure 5.62 Percentage of Under Five Diarrhoea Cases with severe Dehydration Among Total Diarrhoea Cases by Regions and States (2009)



Source: Ministry of Health, Annual Public Health Statistics Report, 2011

Figure 5.63 Percent of Utilization of ORT Among Total Diarrhoea Cases by Regions and States (2009)



Source: Ministry of Health, Annual Public Health Statistics Report, 2011

The following Table 5.92 and Table 5.93 report some indicators relating to maternal and child health activities.

Table 5.92 Indicators for Maternal and Child Health Activities by BHS

Regions and States	AN Care Coverage (%)	Average frequency of AN care	% of deliveries attended by BHS	% of deliveries at RHC delivery room	% of newborn with low birth weight	% of Perinatal mortalities out of total deliveries	Average frequency of PN care
Kachin	79.4	3.3	51.2	1.3	1.3	1.7	5.1
Kayah	76.3	3.7	61.8	1.6	1.2	1.8	4.2
Kayin	68.8	2.9	64.6	7.0	1.1	1.2	4.0
Chin	56.1	3.7	61.2	0.5	0.4	0.8	4.0
Sagaing	68.9	3.9	56.7	2.5	1.1	1.5	6.8
Tanintharyi	87.2	3.0	55.3	2.3	0.7	0.9	6.3
Bago (East)	73.9	3.1	49.7	1.2	1.1	1.6	6.2
Bago (West)	67.2	3.6	68.5	0.3	1.0	1.3	5.8
Magway	**69.6**	**3.9**	**54.4**	**0.5**	**0.8**	**1.1**	**5.7**
Mandalay	73.6	3.4	48.5	2.1	1.0	1.2	6.5
Mon	81.4	3.7	55.7	5.8	2.0	1.7	8.0
Rakhine	66.6	2.9	42.5	0.3	1.5	0.8	4.3
Yangon	65.8	3.3	35.3	2.7	1.2	1.0	8.8
Shan(S)	70.5	3.0	43.5	0.8	1.7	1.4	5.1
Shan(N)	59.6	3.0	49.9	3.8	2.4	1.6	5.1
Shan(E)	53.1	3.4	70.8	5.4	1.1	1.7	4.1
Ayeyarwaddy	72.1	3.1	49.4	1.4	1.5	1.6	5.4
Union	70.6	3.3	50.2	2.0	1.2	1.3	6.0

Note:
BHS = Basic Health Staff
RHC = Rural Health Center
AN = Antenatal
PN = Postnatal

Source: Ministry of Health, Annual Public Health Statistics Report, 2011

Table 5.93 Indicators for Child Health Activities

Regions and States	% of < 5 yr old children who attended clinics	% of <5 yr old children with diarrhoea who suffer severe dehydration	% of < 5 yr old children with diarrhoea who received ORT	% of < 5 yr old children with symptoms for pneumonia	% of < 5 yr old children with severe pneumonia	% of < 5 yr old children referred to higher levels
Kachin	27.4	4.4	95.5	6.6	0.3	0.8
Kayah	27.2	5.5	89.4	6.6	0.6	1.1
Kayin	29.6	2.1	98.5	4.7	0.3	0.6
Chin	33.7	2.0	99.5	9.5	0.4	0.2
Sagaing	29.7	4.3	95.8	7.1	0.4	1.4
Tanintharyi	16.8	3.4	94.8	4.9	0.1	0.8
Bago (East)	20.6	2.2	97.6	3.9	0.1	1.0
Bago (West)	16.6	2.2	94.9	3.1	0.1	1.1
Magway	**25.0**	**1.9**	**96.9**	**7.3**	**0.2**	**1.1**
Mandalay	14.3	3.7	94.3	3.1	0.2	1.8
Mon	32.2	4.8	99.0	3.8	0.2	1.3
Rakhine	20.0	2.1	95.2	5.7	0.2	0.9
Yangon	10.2	0.9	95.2	2.0	0.1	1.1
Shan(S)	14.4	4.7	90.5	3.9	0.2	1.1
Shan(N)	16.4	5.3	93.7	3.6	0.2	1.3
Shan(E)	25.9	3.1	88.6	7.9	0.3	1.4
Ayeyarwaddy	18.0	2.5	95.9	4.4	0.2	1.0
Union	19.9	3.2	95.6	4.6	0.2	1.1

Note:
ORT = Oral Rehydration Therapy

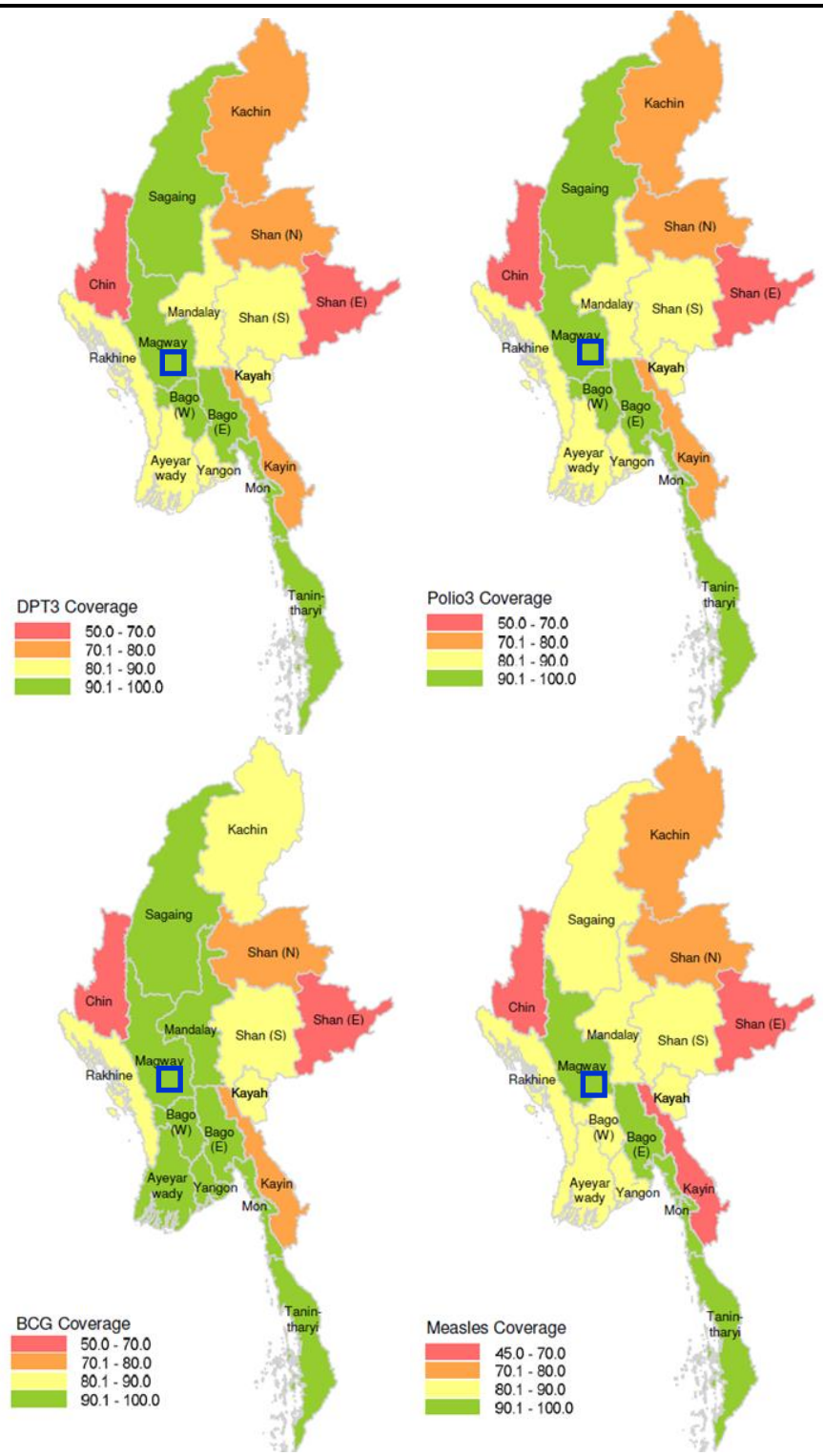
Source: Ministry of Health, Annual Public Health Statistics Report, 2011

Immunization Coverage

BCG coverage is highest among child immunization. On average immunization coverage was BCG 90.3%, Polio 87.4%, DPT3 87.2% and measles 85.5% in 2008. Immunization coverage is lowest in Shan (East) and second lowest in Chin State.

Magway Region has an immunization coverage between 80 and 90% for all vaccines except BCG coverage, which is between 90 and 100%.

Figure 5.64 Immunization Coverage by State and Division, 2008 (in Blue the Block RSF-5)



Source: Ministry of Health, Myanmar Health Statistics, 2010

The tetanus immunization coverage of pregnant mothers for the Union was 84.6% ranging from 44.5% in Shan (East) to 94.1% in Bago (West) in 2008. Out of seventeen states/divisions, ten states/divisions have reported that over 80% of pregnant women had received second dose of tetanus immunization. The coverage of pregnant mothers from three states/divisions receiving tetanus immunization were 70 to 80% and remaining four states/divisions had reported 45 to 70%.

5.8.10.7 Main Vertical Program for Control of Endemic Diseases

Communicable diseases prevention and control is one of the priority tasks of Ministry of Health in achieving its objectives of enabling every citizen to attain full life expectancy and enjoy longevity of life and ensuring that every citizen is free from diseases.

The ultimate aim of the Communicable Disease Control Programme is to minimize prevalence of communicable diseases, mortality and social and economic sufferings consequent to these and to provide rehabilitation.

Plans have been developed systematically for preventing and controlling diseases like malaria, tuberculosis, leprosy, filariasis, dengue haemorrhagic fever, water borne epidemic diseases (diarrhoea, dysentery, viral hepatitis) and other preventable diseases.

AIDS, TB and Malaria primarily affect the working age. These three diseases are considered as a national concern and treated as a priority. The ministry has determined to tackle these diseases with the main objectives of reducing the morbidity and mortality related to them, of being no longer a public health problem.

Other communicable diseases and emerging communicable diseases that have regional importance are also tackled through activities encompassing surveillance and control.

Under the Disease Control Division and with the support of Central Epidemiological Unit, supervision, monitoring and technical support are provided by disease control teams at central level and state/regional levels.

The main national programs developed are the followings:

- *Myanmar Leprosy Control Programme*, launched in 1952. Myanmar has achieved Leprosy Elimination Goal at the end of January 2003; it means that the registered prevalence rate per 10,000 population was less than one and that leprosy was eliminated as a public health problem.
- *Trachoma Control and Prevention of Blindness project*, launched in 1964. At that time trachoma was one of the major cause of blindness in Myanmar. With the concerted effort of the program and support of Government, WHO, UNICEF and INGOs, active trachoma rate was reduced from 43% in1964 to under 1% in 2000.

5.8.11 Private/Traditional Workers/Systems

An important feature of Myanmar health system is the existence of traditional medicine along with allopathic medicine.

Traditional medicine has been in existence since time immemorial and it is well accepted and utilized by the people throughout the history. With encouragement of the State scientific ways of assessing the efficacy of therapeutic agents, nurturing of famous and rare medicinal plants, exploring, sustaining and propagation of treatises and practices can be accomplished.

There are a total of 16 traditional hospitals run by the State in the country. Traditional medical practitioners have been trained at an Institute of Traditional Medicine and with the establishment of a new University of Traditional Medicine conferring a bachelor degree more competent practitioners can now be trained and utilized. As in the allopathic medicine there are quite a number of private traditional practitioners and they are licensed and regulated in accordance with the provisions of related laws.

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6.0 IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES

6.1 IMPACT ASSESSMENT METHODOLOGY

6.1.1 Introduction

The identification and assessment of the Project's environmental and social impacts has been conducted for the planned 3D seismic acquisition as follows:

- overview;
- impact identification and assessment;
- mitigation measures analysis;
- conclusion.

The Impact Assessment has been performed for the following components:

- Environment:
  - air;
  - noise and vibration emission;
  - water;
  - soil & subsoil;
  - flora and vegetation;
  - fauna & habitats
  - biodiversity and ecosystem services;
- social;
- cultural heritage;
- landscape;
- community health.

6.1.2 Impact Assessment Approach and Evaluation

Once identified potential impacts need to be assessed, the significance of each impact (positive or negative) has been assessed through the application of the following criteria, in line with eni Standard requirements (*Environmental, Social and Health Impact Assessment in Exploration - AMTE TG 002 r00*):

- temporal scale of the impact (i.e. temporary, short-term, long-term, permanent);
- spatial scale of the impact (i.e. local, regional, national, international, trans-boundary);
- sensitivity, resilience and/or importance of the receptor/resource that is being impacted;
- number of elements (including individuals, households, enterprises, species and habitats) that could be affected by the impact.

The eni standards requirements define that each criterion should be ranked with scores assigned as defined in the following Table to determine the significance of every single impact (equal to the sum of the scores). According to the impact significance, appropriate control and management measures shall be defined and undertaken (see Table 6.1).

Table 6.1 Ranking and Evaluation Criteria

Ranking	Evaluation Criteria				Significance
	Duration	**Extent**	**Importance / Resilience of Receptor/ Resource**	**No. of elements involved**	
1 – Low	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	Low value/ sensitivity of receptors or resources, able to recover or adapt to the change without interventions	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	*Ranging from 4 to 16*
2 - Medium	Between 1 and 5 years	Regional scale: as determined by country's administrative boundaries	Moderate value/sensitivity of receptors or resources, able to adapt with some difficulty and which may require interventions	Affecting small number of individuals, communities or administrative and/or higher no. of species and habitats	
3 - High	Between 5 and 10 years	National scale: Entire country	High value/ sensitivity of receptors or resources, poorly able to adapt to changes with strong interventions	Affecting great no. of individuals, households and /or medium/large enterprises and/or habitats and ecosystems	
4 - Critical	Over 10 years / Irreversible	International scale: trans-boundary	Extreme value/ sensitivity of receptors or resources, resulting in permanent changes	Affecting huge no. of individuals, households and /or large enterprises and/or habitats structure and ecosystems functions	
Score	*1, 2, 3 or 4*	*1, 2, 3 or 4*	*1, 2, 3 or 4*	*1, 2, 3 or 4*	

Table 6.2 Impact Significance, Control and Management Actions

Ranking	Impact Level		Control and Management Action
4-6	LOW	Actions in the short term	Ensure that policy and control measures are adequate to control the impact
		Actions in the long term	Verify that monitoring and reporting activities are properly established to guarantee the correct application of policy and ensure that control measures remain adequate.
7-9	MEDIUM	Actions in the short term	Check if current policy and control measures are adequate, and revise them accordingly to set appropriate objectives for improvement.
		Actions in the long term	Develop adequate plans and activities for control measures, ensuring that are approved and implemented with timescales set and resources (budget and personnel) allocated.
10-12	HIGH	Actions in the short term	Plans and activities are implemented to mitigate the impact as soon as possible. Interim reduction measures are established.
		Actions in the long term	Long-term plans and activities are developed. Parameters and KPIs are set and properly measured, monitored, reported and verified. Targets are set for improvement and feedback used for corrective actions.
13-16	CRITICAL	Actions in the short term	Immediate emergency measures to reduce the impact. Align the current level of control and implemented measures to best available practices to address the issue. Parameters and KPIs are measured, monitored, reported and verified. Targets are set for improvement and feedback used for continuous improvement.
		Actions in the long term	The Company demonstrates the delivery of continuously improved performance through Research and Development, technology innovation, training of the personnel, strategic partnerships and input and feedback from internal and external stakeholders

The evaluation reported in the following sections is carried out on a case-by-case basis, as the significance of an impact heavily relies on the values of the affected society, the site-specific human and natural environment, the nature of the project and the specific conditions of the Area of Influence. Consequently, the weights specified in the eni Standards are intended to act as guidelines (as defined in eni Standard itself), and can be adjusted in some instances due to the actual possibility of occurrence of the impact.

6.1.3 General Mitigation Measures

The ESHIA process is intended to reduce the negative impacts and enhance the benefits of an intended activity by identifying impacts and benefits and the ways of dealing with them during the planning and design stages of the project. In this assessment the mitigation hierarchy for planned events is as follows:

Table 6.3 Mitigation Hierarchy for Planned Project Activities

Avoid at Source; Reduce at Source
Avoiding or reducing at source is essentially 'designing' the project so that a feature causing an impact is designed out (or altered often called minimisation. Example e.g. re-routing a pipeline, relocating facilities, etc).
Reduction on Site
This involves adding design control system to the basic design to abate the impact - pollution controls fall within this category. Often called "end-of-pipe". (Example wastewater treatment, NOx reduction technology).
Reduce off Site
If an impact cannot be abated on-site then measures can be implemented off-site. (Example soundproof equipment at a nearby residences, visual screening by planting of hedges).
Repair or Remedy
Some impacts involve unavoidable damage to a resource, eg vegetation disturbance. Repair essentially involves restoration and reinstatement type measures.
Compensate in Kind
Where other mitigation approaches are not possible or fully effective, then compensation, in some measure, for loss, damage and general intrusion might be appropriate. (Example in a like-for-like biological offset attaining ecological no net loss).
Net Positive Outcomes
Make a positive contribution to Biodiversity conservation and/or improvement of Ecosystem Services and communities' development.

6.2 ENVIRONMENTAL IMPACT ASSESSMENT

6.2.1 Air Quality and GHG

6.2.1.1 Overview

This section assesses the potential impacts on local air quality over the Project area that may arise as a result of the Project activities. Impacts on local air quality are likely to occur during the seismic survey. The GHG emissions are analysed in a dedicated paragraph.

The Project's contribution to ground level pollutant concentrations might produce changes on air quality. Air pollution may affect atmospheric properties, materials, vegetation, human health, and in general contribute to safety hazards and interfere with the enjoyment of life and property.

The box below shows the key sources of impact, potentially impacted resources and receptors, baseline and Project related influencing factors associated with the Project impacts on local air quality.

Box 6.1 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- *Seismic Survey*: atmospheric emissions during seismic survey will result from diesel fuel exhausted for power generation, and vehicles, etc. The main pollutants of such process will be nitrogen oxides, sulphur dioxide, particle matter, carbon monoxide and volatile organic compounds. Vehicular traffic on dirty roads will determine dust re-suspension.

Potentially Impacted Resources and Receptors

- Climate and air quality.
- Residential population living near the project site, workers and local vegetation.

Project Influencing Factors

- Amount of machinery in use during the surveys, duration of the activities.

The following table presents the key impacts of the project on local air quality during the key project phases.

Table 6.4 Key Impacts –Air Quality

Seismic Survey
• Negligible Impact on local air quality due to the atmospheric emissions produced by vehicles and power generators.

6.2.1.2 Air Quality Sensitivity

In order to be able to evaluate the significance of impact on air quality, it is necessary to describe the baseline condition in terms of presence of pollutants.

The Particulate levels (PM2.5 and PM10) were higher than WHO guidelines at all locations except Nwar Hla Village and Taung Yar Taw Village which only had PM10 values above the guidelines. Being the dry dusty region, fugitive dust emission mainly due to the wind action and local activities including agriculture, open burning, wood stoves are responsible for exceedance of particulate daily levels in the rural area.

Looking at the gases level, 24hr average ambient SO_2 concentration level did not meet the WHO guideline. NO_2, CO, O_3 and atomic radiation levels met the standards. Other gases such as VOC, NH_3, CH_4 were monitored to reveal the existing baseline ambient concentration.

SO_2 levels exceeded guidelines at all locations except (2) stations including Pay Pin San village and Taung Yar Taw under Magway Township. Although the SO_2 levels of above two villages were not above the guideline, these were close to the limit. The increasing SO_2 level throughout the survey area can be due to usage of diesel fuel with high sulphur contents in power generators and transportation at the villages and biology decaying of vegetation and animals occurring in the farms as well.

The sensitivity of the resource has been evaluated for each land cover, as following:

- in areas characterized by presence of *bare soil and vegetation,* the sensitivity has been evaluated as **Low**;
- in *urban areas* and areas characterized by *buildings, roads and urban vegetation*, the sensitivity has been evaluated as **High**;
- in areas characterized by crops lands and green lands, the sensitivity has been evaluated as **Low**.
- in areas characterized by presence of water bodies, island rivers, river gravels and rock white, the sensitivity has been evaluated as **Low**.

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.5 Air Quality Impacts

Source of Potential Impact	Potential Impact
Use of explosive	Dust emission
Use of power generators and vehicle movement.	Atmospheric emissions of pollutants, dust emission

The impact assessment on air quality described in the following sections is based on the analysis of the source of potential impact reported above.

Impacts Identification

Atmospheric emissions during seismic survey will result from diesel fuel exhausted for power generation, and vehicles, etc. The main pollutants of such process will be nitrogen oxides, sulphur dioxide, particle matter, carbon monoxide and volatile organic compounds. Vehicular traffic on dirty roads will determine dust re-suspension.

Dust Dispersion from Vehicles

For this project, dust will be generated from transportation on unpaved roads. Equipment, materials and workers will be transported in light 4-wheel drive and pick-up trucks. Approximately 100 general-use vehicles and trucks will be used for the seismic survey each day plus 4 large vibroseis machines. There are 2 main highways and many laterite/ unpaved roads and dirt tracks that can be used to access the project area. However, suspended dust particles from these roads are relatively large, and thus they are expected to generate little dispersion and settle rapidly to the ground.

It is conceivable that without mitigation measurement, there will be short-term increase in dust near certain roads and along the seismic lines as a result of the project activities. This might lead to slight increases in TSP and PM10 near those roads, especially in the dry season. But those increases would be short-term in duration and no different from any other vehicles currently travelling these roads.

Without mitigation measures, air quality impacts from transportation and vehicle use are thus expected to be local in extent, short-term in duration, reversible and of small magnitude. The project team intends to adopt mitigation measures in order to decrease dust dispersion such as limiting car velocity and sprinkling water on unpaved roads. These mitigation measures will reduce the amount of dust dispersing into the atmosphere.

Dust dispersion from shooting/recording

For this 3D-seismic survey, a combination use of dynamite and vibroseis will be used. For each dynamite shot hole location, the diameter is 3-6 inches (7.62 -15.24 cm) and depth of 10-30 m and the shooting area for each shot hole will be approximately 10 m^2; shooting will be done by a field recorder. This activity may cause dust dispersion around the mouth of the shot holes. It is expected that the contractor will cover 12.5 km/day and space each shooting point about 50 m apart for the dynamite areas. Therefore, shooting will total about 250 points/day in the micro-charge use areas of Block RSF-5. Each hole will be shot until the shooting for each area is completed as planned before moving to the next area.

The amount of dust dispersion from this activity can be estimated from an equation for mine explosion (US EPA, 1985) as shown below.

$$Emission = \frac{961\,A^{0.8}}{D^{1.8} * M^{1.9}}$$

Where:

Emission	=	Amount of dust dispersion with a particle size less than 30 micron (in pound/shooting point; 1 pound = 0.454kg)
A	=	Shooting area (in ft^2; 1 m^2 = 10.764 ft^2)
D	=	Depth of shot hole (in ft; 1 m = 3.281 ft)
M	=	Percentage of soil moisture, with a range of 8-37% (in this case, 9.35% is used)

Table 6.6 gives the estimation of dust dispersion (dust emission) generated from a single hole.

Table 6.6 Dust Emissions Generated from Shot Holes

Type of shot hole	Depth of shot hole (m)	Dust emission (kg/shooting point)	Total dust emission (kg/day)[1] (Calculated from 250 shooting point/day)
Single-hole	10-30	0.11-0.81	30-203

The total amount of dust dispersion generated per day from all shot holes is 30-203 kg/day. Dust dispersion will only occur near the line survey over a short period of time and this dust will quickly settle out near the shot hole. Moreover, community health will not be affected as the survey team will avoid community areas in accordance with the safety distance standards.

Mitigation Measures

Several studies have proved that using effective dust control measures can significantly reduce dust emission and help preserve road surfaces. In particular, according to common best practice, dust control can reduce dust production by 30 % to 80 %. For example only cutting average vehicles speed from 40 mph to 35 mph reduces dust emission by 40 %. *(US*

department of Transportation: Federal Highway Administration, 2010 - Gravel Roads Maintenance and Design Manual (SD LTAP); Wisconsin Transportation Information Center, 1997. Wisconsin Transportation Bulletin No 13). Therefore the implementation of the above mentioned mitigation measures will considerably reduce the expected potential impacts related to dust emissions.

The following mitigation measures will be put in place in order to limit dust emission:

- wet suppression which includes watering, spraying dusty surfaces, in case of need, especially in dry weather at least twice a day (morning and afternoon);
- Post speed limits on project access route and limit vehicle speed to 30 km/h on unsurfaced roads;
- Use vehicles with dust flaps;
- dust control measures such us covering loose materials and sheeting trucks;
- maintenance of the shape of the roads, in order to ensure a proper crown, adequate drainage and a well compacted surface.

The following mitigation measures to manage temporary emissions of exhaust gases will be adopted:

- vehicles and machinery will be turned off when not in use;
- regular maintenance checks will be carried out and records kept on all vehicles and machinery;
- planning of activities to minimise the use of vehicles and machinery: limitation of deliveries to full capacity loads, scheduling and restricting personnel movements to minimise journeys, minimisation of supply distances (if and where possible), and limitation of driving on existing tracks as much as possible.

The following measures are to be considered in the selection of power generators (diesel generators and diesel compressors):

- generators are to be well maintained (including the maintenance inspections recommended by the manufacturer) and with emission levels meeting WHO recommendations;
- generators to be located down-wind and the distances from areas frequented by personnel as well as from air conditioning intakes maximised (wherever possible the minimum recommended distance would be 100 m);
- application of energy efficiency principles to minimise power requirements: improving power management, utilization of less generators optimizing the individual power load, selection of contractors based on the efficiency of the power generation system offered.

Conclusion

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the potential impact significance on air quality associated with the seismic survey are summarized in Table 6.7.

Table 6.7 Ranking of Impacts on Air Quality - Seismic Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Dust emissions	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: low (1) • Water bodies, island rivers, river gravels and rock white : low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation**: low (4)** • Urban areas, buildings, roads and urban vegetation**: low (6)** • Crops lands and green lands: **low (4)** • Water bodies, island rivers, river gravels and rock white : **low (4)**
Score	*1*	*1*		*1*	
Vehicles Exhausts	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: low (1) • Water bodies, island rivers, river gravels and rock white : low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation**: low (4)** • Urban areas, buildings, roads and urban vegetation**: low (6)** • Crops lands and green lands: **low (4)** • Water bodies, island rivers, river gravels and rock white : **low (4)**
Score	*1*	*1*		*1*	

The potential impact on air quality results as **Low** for the whole territory.

6.2.1.3 GHG & Air Pollutant Emissions

Impacts Identification

The overall GHG footprint of the Project is a result of the typology and number of vehicles/equipment in use and the duration of activities:

- during seismic survey, CO2 emissions will be the result of fuel combustion from vehicles used for personnel transport and power generator for energy supply.

The GHG emissions produced by the exhaust systems of road vehicles for personnel transport may be assessed by means of the methodology COPERT IV, developed by the European Environment Agency. COPERT IV, defines emissions factors, in terms of grams of pollutants emitted per kilometre (or per kg of fuel consumed), for individual vehicle types.

GHG emissions from energy use, in the form of diesel generators, drillers, and mobile combustion, are estimated following the Tier 1 approach of IPCC (2006) for stationary combustion and mobile combustion. GHG emissions are estimated using emission factors and global warming potentials for the three main greenhouse gases (CO_2, CH_4 and N_2O).

Energy Use by Generators and Drillers (Stationary Combustion)

During seismic operations, electricity will be supplied from gasoline and/or diesel-fuelled generators. Fuel consumption of the generators is estimated to amount to approximately 2,232 L/day (see Table 6.8), and the flushing drillers are expected to consume about 20 L/day each, with 50 drillers totalling 1,000 L/day.

Table 6.8: Generators to be used for the Project

Generator (Gasoline)	Estimated Full-Load Fuel Consumption (L/unit/hour)	QTY	Fuel Use (L/day)
Yamaha 1KW	1 L/hr[1]	40	960
Yamaha 5KW	3 L/hr[1]	8	576
Honda 20KW	6 L/hr[2,3]	3	432
Honda 30KW	11 L/hr[2,3]	1	264
Total			2,232

Source:
1 - http://powerequipment.honda.com
2 - http://www.dieselserviceandsupply.com
3 - http://www.perfectfuel.ca

Greenhouse gas emissions in terms of CO_2 equivalent are estimated according to the emission factors presented in Table 6.9 (IPCC, 2006), and the following equation:

$$Emissions_{GHG,\ fuel} = Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG,fuel}$$ **Equation 6-1**

where:

$Emissions_{GHG,\ fuel}$ = emissions of a given GHG by type of fuel (kg GHG)

$Fuel\ Consumption_{fuel}$ = amount of fuel combusted (TJ)

Emission Factor$_{GHG,\ fuel}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ)

Using unit conversion factors of 1 kg = 10^{-3} tonne = 10^{-6} Gg, and the IPCC default net calorific value for gas/diesel oil of 43.33 TJ/Gg, fuel consumption (in terms of energy) can be calculated as follows:

Fuel Consumption$_{Diesel}$ =Diesel Use (L/day) x Diesel Density (0.8397 kg/L[1])x 10^{-6} Gg/kg x 43.33 (TJ/Gg)

=3,232 (L/day) x 0.8397 kg/L x 10^{-6} Gg/kg x 43.33 (TJ/Gg)

=0.118 TJ/day

Equation 6-2

Emission Factor$_{CO2,\ Diesel}$ = 74,346.6 kg CO_2 eq/TJ (from Table 6.9)

resulting in:

Emissions$_{CO2,\ Diesel}$ (kg)= 0.118 TJ/day x 74,346.6 kg CO_2 eq/TJ

= 8,743 kg CO_2/day

= 8.74 tonnes CO_2/day

For a total of 180 days of operation, the total emission of greenhouse gases from generators during the seismic operation is therefore estimated to be at a maximum of 1573 tonnes.

Table 6.9 Emission Factor for Fuel Use by Generators (Stationary Combustion)

Types	Unit	CH_4	N_2O	CO_2	Total GHG
Diesel	kg/TJ	3	0.6	74,100	
	kg CO_2 eq*/TJ	69	177.6	74,100	74,346.6

Source: IPCC (2006)

* Global warming potentials (100 year time horizon): CO_2 = 1; CH_4 = 23; N_2O = 296

Energy Use for Vehicle Transportation

General-use vehicles, assuming they are Class 2A (2,722 – 3,856 kg, light duty trucks) will consume an average of 5.95 L/km (U.S. Department of Energy, 2010, http://cta.ornl.gov/data/chapter4.shtml). Assuming an approximate distance travelled of 80 km/day, and 100 vehicles, the general-use vehicles for the project will consume approximately 53,312 L/day.

GHG emissions from general vehicle transportation are estimated following the Tier 1 approach of the IPCC guideline (Equation 6-1) for mobile on road combustion, with an emission factor for mobile road combustion of 74,853 kg CO_2 eq/TJ (from Table 6.10) and fuel consumption of 53,312 L/day (1.94 TJ/day, estimated using Equation 6-2). This results in CO_2 emission of 145.19 tonnes CO_2 eq/day. For a total of 180 days of seismic operations, the maximum total emission of greenhouse gases from general vehicle use is therefore estimated to be 26,134 tonnes.

[1]IEA (2004), Density of Oil Products, Energy Statistics Working Group Meeting

Table 6.10 Emission Factor for Fuel Use by Generators (Mobile Combustion – Road Transportation)

Types	Unit	CH_4	N_2O	CO_2	Total GHG
Diesel	kg/TJ	3.9	3.9	74,100	
	kg CO_2 eq*/TJ	89.7	1,154.4	74,100	75,344.1

Source: IPCC (2006)

* Global warming potentials (100 year time horizon): CO_2 = 1; CH_4 = 23; N_2O = 296

Energy Use for Seismic Vibroseis Trucks

The seismic support trucks consume approximately 95.53 L/hour (at 400 kW power) for each truck, corresponding to a worst case of 4,585 L/day, assuming operation of 4 trucks for 12 hours per day.

GHG emissions from seismic operation are estimated following the Tier 1 approach of the IPCC guideline (Equation 6-1) for mobile off-road combustion, with an emission factor for mobile off-road combustion of 82,661.1 kg CO_2 eq/TJ (from Table 6.11) and fuel consumption of 4,585 L/day (0.167TJ/day, estimated using Equation 6-2). This results in CO_2 emission of 13.79 tonnes CO_2 eq/day. For a total of 180 days of seismic operations, the maximum total emission of greenhouse gases from general vehicle use is therefore estimated to be 2,482 tonnes.

Table 6.11 Emission Factor for Fuel Use by Generators (Mobile Combustion – Off road Transportation, Industry)

Types	Unit	CH_4	N_2O	CO_2	Total GHG
Diesel	kg/TJ	4.15	28.6	74,100	
	kg CO_2 eq*/TJ	95.45	8,465.6	74,100	82,661.1

Source: IPCC (2006)

* Global warming potentials (100 year time horizon): CO_2 = 1; CH_4 = 23; N_2O = 296

Total Combined GHG Emissions

The total release of equivalent CO_2 during the seismic operations is estimated to be 30,189 tonnes of CO_2 eq, as shown in Table 6.12. When compared with available data on Myanmar's national CO_2 equivalent GHG emissions of 184,710,000 tonnes in 2012, including land use change (World Resources Institute, Climate Analysis Indicators Tool (CAIT)), the GHG emissions arising from the proposed activities are insignificant (approximately 0.02%), and therefore will not significantly impact the environment.

Table 6.12 Estimated Total GHG Emissions for Site Preparation Phase

Project Phase	Activity	One Time CO_2 Release (ton CO_2)
Entire Seismic Operation	Generators and drillers (stationary sources)	1,573
	General vehicle transportation	26,134
	Seismic Support trucks	2,482
	Total	**30,189**

Without mitigation measures, air quality impacts from air pollutants generated by the combustion of engines are thus expected to be local in extent, short-term in duration, reversible and of small magnitude.

Air Pollutant Emissions

These come from various sources: fugitives and exhausts, fuel combustion, gas and oil refrigerators and freezers, vaporization, etc.

Potential concerns are:

- personnel safety
- global greenhouse effect
- ozone depletion
- fire hazards

Gaseous emissions may not deteriorate local air quality, but may contribute to the global problems of greenhouse warming and ozone depletion. The primary gaseous emission concerns are hydrocarbons, nitrogen oxides, sulphur oxides and carbon monoxide, and the contribution they will make to onshore levels of those gases or to existing problems, e.g., photochemical smog. Mercury vapour, sulphur dioxide and carbon monoxide in confined space present serious personnel health threats, while combustible gases may constitute fire hazards.

Fuel use for construction activities causes emission of pollutants. Emissions include CO, CO_2, NO_X and SO_2. Potential impacts of these and engine emissions are summarized in **Table 6-13**.

Table 6-13: Potential Impacts of Combustion Emissions

Emission Species	Environmental Impact
CO	Contributes indirectly to climate change by enhancing low-level of ozone formation.
CO_2	A GHG. Contributes to climate change.
NO_X	Contributes to the formation of acidic species that can be deposited by wet and dry processes, impacting aquatic and terrestrial ecosystems.
SO_2	Contributes to the formation of acidic species that can be deposited by wet and dry processes, impacting aquatic and terrestrial ecosystems.
CH_4	A GHG. Contributes to climate change. Reactant of ozone. Impact on respiratory system and circulatory system of living creature
N_2O	A GHG. Contributes to climate change.

Based on compilation of air pollution emission factors established by the U.S. Environmental Protection Agency (EPA), air pollutants generated from diesel oil combustion will consist of carbon monoxide, nitrogen dioxide, sulphur dioxide, and methane. The major contributor of air pollutants will be from fuel consumption.

During seismic operations, the total fuel consumption per day is 61,129 L/Day (generator, drillers, general-use vehicels and seismic support trucks) for a total of 180 days of seismic operations. Based on compilation of air pollution emission factors established by the U.S. Environmental Protection Agency (EPA), air pollutants generated from diesel oil combustion of

will consist of carbon monoxide, nitrogen dioxide, sulphur dioxide, and methane at estimated concentrations shown in **Table 6-14**.

Table 6-14: Air pollution emissions from Seismic

Air Pollutant	Emission Factor (kg/TJ)	Emission of Air Pollutant (tonne/day)	Total Emission (tonnes)
Fuel Consumption – (61,129 /day/well), 180 days			
Nitrogen Oxides (NO_x)	1,896	4.217	**759.06**
Sulphur Oxides (SO_x)	126	0.280	**50.4**
Carbon Monoxide (CO)	410	0.912	**164.16**

Sources: US.EPA, "Compilation of Air Pollution Emission Factors, Volume 1, Stationary Point and Area Sources", Fifth Edition, January 1995; http://www.epa.gov/ttn/chief/ap42/ch03/bgdocs/b03s03.pdf.

Note: Density of diesel oil is 0.8397 kg/L for calculation, IEA (2004), Densities of Oil Product, Energy Statics Working Group Meeting; Net Calorific Values is 43.33 TJ/Gg for calculation, IEA (2009), CO2 Emission From Fuel Combustion, Documentation For Beyond 2020 Files

Without mitigation measures, the impact from air pollutants in the outside & open atmosphere will be local in extent, short-term in duration, reversible and of medium magnitude.

Mitigation Measures

The reduction of the GHG emissions may be achieved through the implementation of best available technologies and processes able to improve the equipment's efficiency.

The following measures are to be considered in the selection of power generators and vehicles:

- the implementation of the best available cost effective technology for energy efficiency, as the use of efficient power generators that produce lower GHG emissions;
- generators and all vehicles are to be well maintained (including the maintenance inspections recommended by the manufacturer) and with emission levels meeting WHO recommendations.

The following mitigation measures to manage temporary emissions of greenhouse gases will be adopted:

- ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer;
- maintain road going vehicles to ensure that fuel use is efficient and emissions are within acceptable limits;
- instruct drivers on the benefits of driving practices that reduce the risk of accidents, fuel consumption and dust generation;
- turn off all vehicles and equipment when not in use as well as prohibit vehicles from idling;
- planning of activities to minimise the use of vehicles and machinery: limitation of deliveries to full capacity loads, scheduling and restricting personnel movements to minimise journeys, minimisation of supply distances (if and where possible).

Conclusions

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the potential impact significance on air quality associated with GHG emissions are summarized in Table 6.15.

Table 6.15 Ranking of Impacts on Air Quality – GHG & Air Pollutant Emissions

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
GHG & Air Pollutant emissions from vehicles in use during seismic surveys	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• All receptors - human and ecosystem (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation**: low (4)** • Urban areas, buildings, roads and urban vegetation**: low (6)** • Crops lands and green lands: **low (4)** • Water bodies, island rivers, river gravels and rock white : **low (4)**
Score	*1*	*1*	*3*	*1*	

Notes:

(1) GHG emissions have an impact on a world scale, thus human receptors and ecosystems have been considered as a unique resource.

The potential impact on air quality from GHG & Air Pollutant emissions results as **Low**.

6.2.2 Noise and Vibration Emission

6.2.2.1 Overview

This section assesses the potential impacts on the acoustic climate of the Project area that may arise as a result of the Project activities. Impacts on local air quality are likely to occur during the planned 3D Seismic Survey.

During the seismic survey, the main potential impacts are related to the noise emissions generated during blasting events and equipment operations for site clearance. Lower noise emissions will come also from employees' accommodation (air conditioning, diesel-generators) and vehicles for personnel's transport. Noise sources will be not continuous and will depend on

the number and types of machinery used for each activity. Considering the nature of these sources, it is expected that the noise emissions will prevalently affect the area adjacent to the seismic camp.

A change in the acoustic environment due to the introduction of additional noise emissions may directly affect:

- human receptors: residential areas and noise sensitive receptors (e.g. hospitals, schools) by interfering with sleep, communication, performance and behaviour and, in more serious circumstances, causing hearing damage;
- fauna: by causing signal masking and avoidance behaviour.

The box below shows the key sources of impact, potentially impacted resources and receptors, baseline and Project related influencing factors associated with the Project impacts on local air quality.

Box 6.2 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- *Seismic Survey:* noise and vibration will be caused by blasting and equipment operations, vehicles for personnel transport, employees' accommodation (air conditioning, diesel-generators).

Potentially Impacted Resources and Receptors

- Residential population living near the surveyed area, workers and fauna.

Project Influencing Factors

- Amount of machinery in use during the surveys, duration of the activities.

The following table presents the key impacts of the project on local air quality during the key project phases.

Table 6.16 Key Impacts – Acoustic Climate

Seismic Survey
• Temporary annoyance at residential buildings near the work sites; • Potential temporary disturbance and/or dis-placement of fauna (e.g. reduction of usable habitat); • Potential temporary disturbance due to vibration emissions in the surrounding environment, or at receptors in the proximity of the Project area.

6.2.2.2 Noise Receptors Sensitivity

Based on a satellite images analysis (as reported in Section 5, Paragraph 5.2), the Study Area is mainly covered by agricultural, natural and vegetation areas. Thus, it is anticipated that due to the rural nature of the area, the acoustic environment will have low ambient noise levels which will not vary considerably across the Study Area. In these areas the presence of human receptors is minor or unlikely and consequently the score of sensitivity is lower.

While in urban areas, the acoustic environment may be characterised by higher noise ambient levels due to human activities but the potential presence of numerous human receptors raises the score of the sensitivity.

The sensitivity of the resource has been evaluated for each land cover, as following:

- in areas characterized by presence of *bare soil and vegetation,* the sensitivity has been evaluated as **Moderate**;in *urban areas* and areas characterized by *buildings, roads and urban vegetation*, the sensitivity has been evaluated as **Critical**;
- in areas characterized by *crops lands and green lands,* the sensitivity has been evaluated as **Moderate**;
- in areas characterized by presence of *water bodies, island rivers, river gravels and rock white*, the sensitivity has been evaluated as **Moderate**.

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.17 Noise Quality Impacts

Source of Potential Impact	Potential Impact
Equipment operations and vehicles movement for site preparation	• Temporary annoyance at residential buildings near the work sites; • Potential temporary disturbance and/or dis-placement of fauna (e.g. reduction of usable habitat).
Use of explosive	• Temporary annoyance at residential buildings closest to work sites; • Potential temporary disturbance and/or dis-placement of fauna (e.g. reduction of usable habitat); • Potential temporary disturbance due to vibration emis-sions in the surrounding environment, or at receptor in the in the proximity of the Project area.

The impact assessment on the acoustic climate described in the following sections is based on the analysis of the source of potential impact reported above.

Impacts Identification

The overall increase in the background noise level during the seismic survey activities will be caused by noise emissions from the equipment involved in the site preparation, including employee transport and from blasting activities. Both activities may produce ground vibrations.

Site Preparation

During site preparation, the main potential impacts on the acoustic environment are related to noise emissions from machinery in use during soil scraping, levelling and earth movements (i.e. excavator, loader, compactor, truck) that will affect noise sensitive receptors in the area adjacent to the camp site/temporary explosive storage center/work sites. The overall noise produced during this phase comes from several types of equipment and from specific activities.

Noise sources will be intermittent and will depend on the number and types of machinery used for each activity; therefore, the noise impact related to this project phase will vary throughout the day and with the different operations.

A typical list of equipment in use during civil works for site preparation are listed in Table 6.18, below. In the table the typical sound power level of the equipment is identified from international standards on noise emissions from equipment (i.e. European Directive 2006/42/CE Machinery Directive) or from noise vendor datasheets.

Table 6.18 Typical Noise Power Level for the Equipment

Phase	Equipment	Number (1)	Typical Sound Power Level [dBA]
Site Preparation (Civil Works)	Excavator	1	105
	Roller compactor	1	99
	Grader/ Loader	1	101
	Dump truck	1	106
	4WD car	1	85

Notes:

(1) Equipment number is based on assumptions on the number of equipment in use simultaneously in the same area

Source: eni, 2014

The noise emission levels generated by the equipment involved in the site preparation can be estimated considering each piece of machinery as a single point source located in the centre of the camp site and temporary explosive storage center. The noise propagation from the source (the piece of equipment) to the receptor can be calculated using standard calculation methods, and the cumulative noise effect of all the equipment working simultaneously in the same area.

The following table present the likely estimated noise impact at fixed distances from the camps ite and temporary explosive storage center.

Table 6.19 Predicted Sound Pressure Levels during Site Preparation

Phase	Total Sound Pressure Level [dB(A)] at (1)					
	100 m	200 m	300 m	500 m	700 m	1000 m
Site Preparation (Civil Works)	62	56	52	48	45	42

Notes:

(1) Noise pressure levels calculated through a semi-spherical omni-directional free field propagation model ($L_P = L_W - 20 \log r - 8$)

Source: eni, 2014

Noise pollution is not currently regulated at national level, hence international guidelines (e.g., IFC) shall be applied to the Project. The noise limits established by the World Bank

Group/International Finance Corporation (IFC) for residential areas are the following [2]:

- **55 dBA during daytime** (daytime hours 07:00 to 22:00).
- **45 dBA during night-time** (night-time hours 22:00 to 07:00).

The activities related to site preparation are planned to be undertaken only during daytime, so the significance criteria used to identify potential noise impacts at sensitive receptors will be 55 dBA. Comparing the project sound pressure levels with the IFC standards for daytime operations, it is observed that at 300 m the project noise contribution is below the noise limit for the day time. Therefore, it is likely that a noise impact due to civil works for site preparation will be limited to receptors located less than 300 m from the camp site and temporary explosive storage center. The noise impact at these locations will, however, be temporary, due to the temporary and transient nature of the different activities and equipment.

Blasting Activities

The seismic acquisition will be carried out using a combination of micro-charges and vibroseis. The charges, placed in an in-line configuration, will be blasted with a remote control.

Micro-charges used for shooting will be small in amount and will be buried at a depth of 10-30 m. Therefore, the generated noise will be brief and at low levels. Moreover, seismic shots will only be conducted during daylight hours. Noise and vibration monitoring has been previously conducted during shot hole tests as part of a similar 3D-seismic survey as shown in Table 6.20 (CGG Veritas, 2008). The noise generated from firing two shot holes were monitored at a distance of 50 m. The measured noise levels were detectable but were only slightly above ambient background; and the maximum noise (L_{max}) measured was 72.4 dB (A). The measured L_{max} values were well below the ambient noise standards (L_{max} not more than 140 dB (A)).

Table 6.20 Noise and Vibration Measurement from Shot Hole Testing at 50 m from shot hole

No. of Shooting	Depth of Shot Hole (m)	Charge Size (Kilograms)	Noise Level (dB(A))		Vibration	
			Background Noise	L_{max}	PPV (mm/s)	Frequency (Hz)
1	9	1.5	64.2	72.4	4.45	14
2	9	1.5	61.5	67.1	4.64	11

Source: CGGVeritas, 2008

Noise generated during the seismic survey is expected to be small, localised and confined to daytime only.

[2] IFC establishes noise limits only for Project operations. Conservatively, considering the duration of the survey activities, these limits have been applied also to this Project phase.

Vibration Emission

Vibration may potentially affect cultural heritage sites and/or other sensitive receptors (i.e. communities, buildings, ecological areas, area of geomorphological importance) in proximity of the work site (camp site, temporary explosive storage center, charge area, access road).

The impacts will be mainly generated by blasting and vibroseis activities and secondary from ground-disturbing activities including levelling, stabilising, compaction and excavation.

Each sensitive receptors within 500 m from project areas (camp site, temporary explosive storage center, line survey, access road); will be monitored to quantify the vibration caused by blasting. Further details are reported in the Environmental Management & Monitoring Plan (Section 8).

This assessment is based on the peak particle velocity from explosion. Peak particle velocity (*V*) is a measure of the maximum rate of displacement of ground particles (with vertical, longitudinal and transverse components) resulting from vibrations produced by blasts. *V* is an industrial standard used to describe the effects of vibration from explosion and can be calculated using the formula (Department of Mineral Fuels, Thailand):

$$v = 600\left(\frac{r}{\sqrt{W}}\right)^{-1.4}$$

Where V = Peak particle velocity (mm/sec)

r = Distance from charge to measured point (m)

W = Weight of explosive (kg) (In this case, 3.0 kg)

600 = Coefficient with a unit of √kg/sec

For this project, safety distances from shot holes to various sensitive areas have been set at a range of 100 to 550 m. At these safety distances, the peak particle velocity is estimated to range from 0.19 to 2.05 mm/sec (Table 6.21).

Table 6.21 Explosion Vibration Level Measurement from Shot Hole to Sensitive Area at a Safety Distance

Safety distance for explosive source (m)	Sensitive area	Peak particle velocity (mm/sec)	Safety standard[1] (mm/sec)	Safety standard[2] (mm/sec)
200	- Dirt roads/tracks	0.78	Less than 50.8	-
200	- Metal and PVC piped water well - Telephone lines - Main roads/highways	0.78		-
150	- Oil or gas well - Wooden house - Brick or concrete house - Cemetery - Concrete bridge - Railway tracks - Water resources	1.16		Less than 10
100	- Pipeline	2.05		-

Safety distance for explosive source (m)	Sensitive area	Peak particle velocity (mm/sec)	Safety standard[1] (mm/sec)	Safety standard[2] (mm/sec)
200	- Concrete ring water well - Dams (earth or concrete) - High voltage power lines (large towers)	0.78		Less than 25
	Monastery/school/medical nursing place/government offices - Canals (concrete)	0.78		Less than 10
550	Ancient monuments /archaeological sites	0.19		Less than 2

Note: (1) Safety standard of vibration of soil layer from explosion, Department of Mineral Resources, 1991
(2) Safety standard of vibration from explosion followed by Australian Standard AS 2187-1983

The predicted peak particle velocities estimated for the project safety distances are all considerably lower than the safety standard values specified by the Department of Mineral Resources and the Australian Standard.

The frequency of vibrations is also important in assessing the effects of explosion on structures and human responses: lower frequencies typically cause higher levels of impacts. The standard of vibrations from mining and quarrying relates peak particle velocity to the vibration frequency and absolute displacement, e.g., the peak particle velocity is not to exceed 4.7 mm/s with 0.75 mm displacement at 1 Hz and the peak particle velocity is not to exceed 50.8 mm/s with 0.20 mm displacement at 40 Hz.

Vibration monitoring data were collected from previous 3D-seismic survey tests (Table 6.21). At a distance of 50 m, all vibration levels were well below the Vibration from Mining and Quarry Standards. The maximum vibration recorded was 4.64 mm/sec at frequency of 11 Hz, much lower than the standard of 27.6 mm/s at frequency of 22 Hz.

Assuming the frequency of vibration generated from shot hole firing of this project is similar to that generated from shot hole firing during the previous project, it can be concluded that vibration generated from shot hole firing of 3D-seismic survey will not exceed the vibration standard and will not affect the structure of buildings.

From the above assessment, shooting of shot holes will not impact building structures or communities provided the safety distances are adhered to. If any damage is caused by the seismic activities to local infrastructure, these will be appropriately compensated and repaired.

Thus, impacts from noise and vibrations created by the seismic survey are expected to be local in extent, short-term in duration, reversible and of small magnitude.

Mitigation Measures

In addition to general mitigation measures, the noise & vibration impacts on receptors during the seismic survey will be specifically reduced using the following measures:

- switch off equipment when not in use;
- limit noisy activities to the least noise-sensitive times of day;
- vehicles and equipment transportation will avoid sensitive environmental areas;

- construction activities and Vehicle/equipment movements will be restricted to daylight hours;
- limit vegetation removal to a minimum;
- schedule operation of noisy construction equipment at different times;
- ensure use of mufflers on diesel/gas driven machinery;
- use low noise equipment;
- ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer;
- use enclosures when possible to contain noise on site;
- conduct PPV testing and follow Shot Hole set back distances;
- project operations in heavily populated areas shall be minimized;
- conducting operations to adjacent survey lines at the same time shall be avoided;
- operation time must be minimized;
- if shot-hole method is applied, charge size and height of the pit must be chosen and the opening of those the drill holes must be sealed. In this way, noise dispersion will be further mitigated.

Conclusion

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the noise impacts on sensitive receptors associated with the seismic survey are summarized in **Table 6.22**.

Table 6.22 Ranking of Noise & Vibration Impacts on Receptors - Seismic Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor /Resource*	*No. of Elements Involved*	*Impact Rank*
Short Term Impact due to noise & vibration emission during the site preparation and line clearance	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: critical (4) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white: moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (5)** • Urban areas, buildings, roads and urban vegetation: **medium (7)** • Crops lands and green lands: **low (5)** • Water bodies, island rivers, river gravels and rock white : **low (5)**
Score	*1*	*1*		*1*	
Short Term Impact due to noise & vibration emission during the blasting activities	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: critical (4) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white: moderate (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (5)** • Urban areas, buildings, roads and urban vegetation: **medium (7)** • Crops lands and green lands**: low (5)** • Water bodies, island rivers, river gravels and rock white : **low (5)**
Score	*1*	*1*		*1*	

The potential impact on noise quality results as **Low** for the whole territory except for the area where are located settlements or villages, where the impacts have been evaluated as **Medium**, considering the limited duration of the activities and the mitigation measure above mentioned.

It has to be highlighted that in Section 8 it is outlined the noise & vibration monitoring plan to be performed during the activities execution, which will evaluate the real noise emissions due to project and the increase above the current background level and evaluate the effectiveness of the mitigation measures.

6.2.3 Water

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the Project on freshwater resources.

Box 6.3 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- *Seismic survey*: preparation of the site, line clearance, construction of roads, consumption of water, movements of vehicle; equipment and personnel, waste management.

Potentially Impacted Resources and Receptors

- Surface Water, Groundwater.
- Flora and Fauna, Habitats.

Baseline Influencing Factors

- The largest river in Myanmar, Ayeyarwady, crosses the Block RSF-5 in the South East corner.
- Block RSF-5 is subject to flood hazard, especially along the Ayeyarwady river sides. In these areas the flood risk is high.

Project Influencing Factors

- Specific techniques used for water management and waste management.
- Project planning, in relation to flooding periods and avoidance of sensitive receptors.

The following table presents the key impacts of the project on the freshwater component during the key project phases.

Table 6.23 Key Impacts –Water Quality

Seismic Survey
• Potential water contamination due to discharge of solid and liquid waste; • Potential contamination from fuels, lubricant oils and chemicals (surface water and groundwater); • Consumption of water and groundwater resources.

The *sensitivity* of the freshwater (surface and groundwater) component is reported in the following Sections.

6.2.3.1 Water Sensitivity

6.2.3.2 Overview

In Myanmar the estimated water usage for domestic water supply data are received from government departments. For private sector, it is based on data from Ministry of Health. The major source for domestic water supply (especially drinking supply) is groundwater which is about 69% and surface water is only about 31%. The baseline socio-economic results indicated that the main sources of drinking water used by the household for the past 12 months comes from tube wells (68%), river / streams (14%), protected dug wells (10%) and piped water (9%). Therefore, the majority of communities relies on groundwater source for domestic purpose which is free from bacteria (*Agriculture Sector Review Project -Agricultural Water Resources Study in Myanmar. The Union of Myanmar Ministry of Agriculture and Irrigation by Myanmar Academy of Agriculture, Forestry and Livestock and Fisheries Irrigation Department and Water Resources Utilization Department Yangon, Myanmar, 2003*).

The sensitivity of the resource has been evaluated for each land cover, as following:

- in areas characterized by presence of *bare soil and vegetation,* the sensitivity has been evaluated as **Moderate**;
- in *urban areas* and areas characterized by *buildings, roads and urban vegetation*, the sensitivity has been evaluated as **High**;
- in areas characterized by *crops lands and green lands,* the sensitivity has been evaluated as **Moderate**;
- in areas characterized by presence of *water bodies, island rivers, river gravels and rock white*, the sensitivity has been evaluated as **Moderate**.

Regarding the Seismic Survey, the following source of impact has been identified.

Table 6.24 Water Quality Impacts

Source of Potential Impact	Potential Impact
Movement of vehicles, equipment and personnel	Temporary effects of sediment plumes on surface water, potential contamination from fuels, lubricant oils and chemicals (surface water and groundwater).
Use of water	Temporary consumption of water resources (surface water and groundwater).
Production and disposal of solid and liquid wastes	Potential temporary contamination of water resources (surface and groundwater) by hazardous and non-hazardous liquid effluents, and contamination of water resources (surface water) by hazardous and non-hazardous wastes.
Storage and handling of fuels and chemicals	Potential temporary contamination of water resources (surface and groundwater)
Preparation of the site (site clearance)	Temporary effects of sediment plumes on surface water, potential effects on hydrological and hydraulic regime.

The impact assessment on water quality resources described in the following sections is based on the analysis of the sources of potential impact reported in Table 6.24.

Impacts Identification

The aim of this Section is to identify the possible impacts on water quality and hydrologic aspects during the Seismic Survey. The potential impacts on freshwater (surface water and groundwater) is likely to be confined to the area and the surrounding of the camp site, temporary explosive storage center and of the line survey.

Key potential impacts on water resources (surface water and groundwater) are the following:

1. potential contamination of water resources with solid and liquid wastes;
2. potential contamination from fuels, lubricant oils and chemicals;
3. potential effects arising from runoff;
4. effects of sediment plumes on surface water;
5. consumption of water resources.

1. Potential Contamination of Water Resources with Solid and Liquid Wastes

Solid and liquid wastes need to be minimized in accordance with local regulations, industry and international best practices, and also in line with eni technical guideline on water management.

The main wastes that will be generated during the site preparation / camp site / temporary explosive storage center construction activities are the followings:

- domestic wastes, such as latex, cardboard, wood, rags, food, etc.; these wastes will be collected and disposed in controlled disposal sites. The waste from the designated waste area will be regularly collected and disposed at an approved disposal site;
- inert construction wastes, such as earth (not including excavated material, which is destined to be backfilled when the area is restored), unused construction material, etc., generated during preparation and restoration of worksites. These wastes pose low risk of pollution and they will be disposed of at a controlled disposal site;
- Special and hazardous wastes, such as the oily waste associated with vehicle and heavy equipment maintenance; unused or waste chemicals, paints and solvents; and, any other waste, sludge or debris that are unsuitable for disposal in village/town type landfills. Such wastes will be segregated for collection and disposal;
- sanitary waste water. This waste water comes from sanitary installations within the construction camp site. The construction camp will install suitable pre-treatment systems, in compliance with any applicable legislation. Biological digesters shall be used for those installations where the average workforce exceeds 10-15 people. In case of minor facilities specific techniques, such as phyto-depuration or sub-irrigation, shall be considered.

The main wastes that will be generated during the seismic survey activities are the followings:

- Non-Hazardous Waste - The 600-person work crew is expected to generate about 0.6 tonnes of general non-hazardous waste/day or 180 tonnes of waste over the 10-month survey (30 working days per month, waste generation is estimated at 1 kg/day/worker). Workers will collect all waste from field work to dispose in the designated waste sites located at the field office, camp site and temporary explosive storage center. The waste from the designated waste area will be regularly collected and disposed at an approved disposal site;
- Shooting / Cutting Wastes - Most of the explosives will be completely burned during shooting; therefore, visible waste generated from shooting will only be a gab wire from the detonator. After shooting, the shooting team will collect gab wires to dispose or to

re-use. Therefore, only a small amount of waste will remain in shot holes. The recovery team will check or collect some residues remaining in the shooting area to ensure that only minimal waste remains in the area. Drilling of the shot holes create cuttings around the mouth of the holes every 50 m. The maximum amount of cuttings from drilling of a single-hole can create approximately 0.137 m^3 of cuttings/hole. The amount of cuttings from a single hole is negligible in relation to the total project area. After drilling, explosives will be loaded into the drilled holes, and the cuttings / mud from the holes will be buried back into the same holes. Therefore, only a small amount of cuttings will be left, which will have minimal effect as no additives will be used during the shot-hole drilling;

- Special and hazardous wastes, such as the oily waste associated with vehicle and heavy equipment maintenance; unused or waste chemicals, paints and solvents, materials containing heavy metals, such as batteries; and, any other waste, sludge or debris that are unsuitable for disposal in village/town type landfills. Such wastes will be segregated for collection and disposal;
- sanitary waste water. This wastewater comes from sanitary installations within the camp site and temporary explosive storage center. The camp site and temporary explosive storage center will install suitable pre-treatment systems, in compliance with any applicable legislation. Biological digesters shall be used for those installations where the average workforce exceeds 10-15 people. In case of minor facilities specific techniques, such as phyto-depuration or sub-irrigation, shall be considered.

All materials brought onto the camp site and temporary explosive storage center will be logged and all sources of potential hazardous waste will be identified by the relevant supplier or contractor.

All wastes will be segregated and separated on-site to facilitate proper disposal. General non-hazardous solid wastes will be segregated at source into recyclable and non-recyclable wastes and stored in marked containers. Recyclable materials will be given to local recycling facilities for a net economic benefit and the remaining materials will disposed at a site approved by the Local Authority. Improper handling and disposal of non-hazardous materials may cause adverse effects by materials spills or (as in the case of domestic wastes) being carried away by wind, vectors, etc. Burning some types of innocuous-looking waste types (especially plastics) may create toxic tar or even extremely toxic dioxin. Depending on their pathway, the end result would be air, soil, groundwater, freshwater life contamination.

General hazardous solid wastes will be segregated at source into recyclable or returnable items (such as used batteries, chemical totes, etc.) and non-recyclable hazardous wastes and stored in properly labelled and covered skips in a secured and fenced off area. The hazardous waste area will be designed to safely contain hazardous wastes with a impervious base to protect from leaching and provided with a safety spare space in case of volatile substances. Hazardous wastes will be handled and stored in accordance with the material safety data sheets (MSDS) and tracked from source to its final destination. The estimated quantity from similar projects is 0.25 tonnes per month of hazardous waste from seismic activities. All hazardous wastes will disposed to approved government sites or at an incinerator. The incinerator will be at a government approved location to ensure the impacts from toxic and other toxic products is properly controlled and reduced.

The appropriate disposal sites will be identified before the beginning of project activities in accordance with the local authorities.

2. Potential Contamination from Fuels, Lubricant Oils and Chemicals

The seismic program will generate a low volume of hazardous waste including lubricating and hydraulic oil, rags and other materials used at the camp site and temporary explosive storage center such as batteries, clinic wastes etc.

Potential contamination of freshwater may arise from the transport, storage and handling of fuels, lubricants and chemicals during site clearance and access roads construction.

3. Potential Effects Arising from Runoff

During site clearance and access roads construction, excavation for topsoil removal in the camp site and temporary explosive storage center can affect the hydrological and hydraulic regime of the area. Especially in areas with high slope rates, the terrain mobilisation can result in landslip phenomena and in a loss of resistance against soil erosion by runoff and runout or other external agents, influencing the drainage network.

The project areas (line survey, camp site and temporary explosive storage center) will be cleared and smoothed using non-invasive techniques, where possible. The surface of the source line must be smooth enough to enable the operators to progress unimpeded for seismic acquisition. However the whole length of the line will not be cleared (only those areas of uneven ground will be smoothed).

Surface runoff from roads, camp site and temporary explosive storage center may result in increased drainage potentially affecting roads and infrastructure. Vegetation removal, camp site, temporary explosive storage center and access road construction can alter surface water hydrology by reducing interception, evaporation/ transpiration and infiltration, which in turn can increases runoff and change local drainage patterns. Heavy rains can intensify changes in surface water hydrology and cause changes in drainage patterns.

Agriculture and water sources around project sites could be affected from water drainage during camp site and temporary explosive storage center construction. However, a civil engineering contractor will be hired to survey the site and upgrade the road. The contracted civil engineer will determine and recommend if culverts or additional ditches are necessary to manage surface water runoff. Local authorities and local land owners will also be consulted to address their requirements for any culverts or ditching to be installed at any point along the road. If culverts are required or requested, the size of culvert to install will depend on the civil engineer's recommendation and/or local authority's recommendation. Generally, culverts in this area are 60 cm in diameter, made of reinforced concrete and purchased prefabricated.

Construction of the access roads, camp site and temporary explosive storage center for this project will result in some vegetation removal. The area of vegetation removal will be small and site preparation will be conducted on flat terrain. In addition, *eni Myanmar* will install culverts under the access roads if required or requested to maintain natural drainage. No changes in surface water hydrology are therefore expected.

All access roads will be 9-m wide. In consultation with adjacent landowners, roads will incorporate culverts to allow the flow of natural surface drainage and prevent any ponding of water around the access road. The required permission will be obtained from all relevant agencies.

Vegetation removal, construction of camp site, temporary explosive storage center and access roads can alter surface water hydrology by reducing interception, evaporation/ transpiration and infiltration, which in turn can increase runoff and change local drainage patterns. Heavy rains can intensify changes in surface water hydrology; these changes are also enhanced on steep slopes.

4. Effects of Sediment Plumes on Water Resources

Site preparation and access road construction may increase suspended sediments in surface runoff, draining into surface water and leading to sediment plumes (i.e. increasing water turbidity). Indeed, temporary exposure of surface materials to rainfall, erosion and scour may deliver coarse and fine sediment via surface runoff to watercourses and water bodies, with related potential changes in the magnitude and timing of natural suspended sediment transport in surface water. This impact may occur in areas where the survey line is located nearby surface waters.

These activities may damage some vegetation covering soil and may also enhance soil erosion from the project area to surface water. However, most of the project area consists of a low slope, this seismic survey will take place during the dry season and the disturbed area for each line or shot hole is small; thus, soil erosion from the project area to surface water will be negligible. For these reasons, the quality of surface water around the project area will not change. If changes occur during the wet season, surface water could increase in turbidity resulting from an increase in suspended solids (SS) and could decrease in dissolved oxygen, which could conceivably lead to impacts on aquatic biota.

These impacts would only affect the project area over a short period of time and vegetation will recover. In addition, the project will take place during the dry season and suitable mitigation measures will be prepared and strictly followed during the seismic survey duration.

Both runoff volume and suspended solids concentrations can increase during and after construction. The typical suspended solids (SS) concentration from different areas is provided in Table 6.25.

Table 6.25 Typical Suspended Solids Concentration in Runoff

Source Area	Suspended Solids Concentration
Landscaped area	500 mg/L
Construction site	10,000 mg/L
Unpaved parking	250 mg/L
Detention pond water	10 mg/L

Source: Pitt and Clark. 2002[3]

Any siltation from surface runoff generated during construction activities is unlikely to travel far. Sustained elevated turbidity levels from runoff can reduce transmission of sunlight, thus limiting photosynthesis. In turn, this can reduce the level of oxygen in the water. Organic matter introduced into a watercourse can lead to further de-oxygenation as the organic matter is decomposed by micro-organisms and result in eutrophication. If oxygen levels fall below the natural DO variability in a system, flora phytoplankton, zooplankton and benthos diversity and abundance could decline.

5. Consumption of Water Resources

The water consumption envisaged during the Seismic Survey is related primarily to the watering of construction sites to reduce dust emissions during earth moving activities, construction activities and for shot-hole drilling.

[3] Pitt, R. and S. Clark. 2002. Emerging stormwater controls for critical areas. Pp. 104-136. In Wet weather flow in the urban watershed. Technology and Management. Field, R. and D. Sullivan. (Eds)

Water for drilling of shot holes will come from nearby natural water sources via pumping system. Using water for the project will not impact natural water sources in the area. If there is no natural water source near the survey site, a water truck will transport water to the site.

During the camp construction phase, water use will consist of water for dust suppression and cleaning and potable water for workers.

Access to and availability of water is an important issue to all communities. Community water wells are a critical piece of local infrastructure, and access to water to support domestic and farming requirement is critical.

Maximum daily water usage is expected to be 60 m^3 per day during drilling when the camp is accommodating a full crew (600 people).

All drinking water will be sourced from local retail suppliers and potable water will be from a deep water well installed on site so that it will not affect water supply for agricultural activities and communities within project area. If tube type wells are not successful or water not suitable, water will be sourced and transported by tanker from nearby reservoirs/rivers. Local authorities will be consulted before water hauling.

6. Potential Contamination of Groundwater Quality & Hydrology

Hydrogeology within the project area varies depending on the characteristics of geology and topography. Groundwater sources can be divided into two types of aquifers: groundwater embedded in unconsolidated aquifers and groundwater embedded in consolidated aquifers. Aquifers in the Central Region vary widely in quantity and quality due to the irregularity in both lateral and vertical directions, and varying lithological and hydrological conditions of Alluvial and Ayeyarwady aquifers.

There are two main activities that can impact the hydrology and quality of groundwater, namely drilling of shot holes and shooting/recording.

The shot holes are to be drilled to a depth of 10-30 m, which is in the range of groundwater level. The groundwater depth varied in the project area depending on the aquifers. The groundwater was found in the Block RSF-5 baseline survey in some areas near the surface from 1.83 m (6 ft) and quite deep in other areas 231.65 m (~760 ft in tube well). There is a potential for drilling to impact groundwater quality by introducing sediment or other contaminants to the groundwater from the surface.

However, the project team has specified a 100 m safety distance from a shot hole to groundwater well. Additionally, if *eni Myanmar* discovers groundwater in the course of seismic operations, they will report to MOGE. In the unlikely case of drilling into a groundwater well that produces water, this hole will be plugged with heavy muds, typical of maintaining pressure when drilling oil or gas wells.

If shooting/recording operates close to a groundwater well (less than safety distance), the structure of the groundwater well could be affected, such as increase clogging of soil pores.

In 1978 several major studies were commissioned in Alberta to determine the effects of seismic shooting on water wells. Twenty areas were selected by The Alberta Research Council, The Alberta Department of Energy and Natural Resources and The University of Alberta. A basic objective was to establish seismic parameters such as charge size and setback distance that would demonstrably change the properties of a domestic water well. A down-the-hole TV camera was used to monitor physical damage in the wells. All projects started with one or two kilograms of explosive at distances of 180 metres or more. This was then intensified by shooting increasingly larger charges closer and closer to wells. All wells were eventually subjected to bombardment which peaked at 22 kilograms only six metres from wells. In one

study, a charge of 15 kilograms was detonated only 3.9 metres from a well. No damage was ever observed, and no permanent changes were observed which would have been noticeable in a domestic well. (Summary Of Previous Studies Of The Effect Of Seismic Shooting On Water Wells In Alberta, I. C. Ross ICI Canada Inc. Calgary March 1995).

The project team has specified a safety distance from shot holes to any groundwater well; therefore, this impact is expected to be minimal.

After shooting/recording, explosives and detonators are almost completely burned. The major residuals will be nitrogen compounds, carbon dioxide, and water. These remains will be collected and disposed. Therefore, shooting/recording will not affect groundwater quality.

Without mitigation measures, impacts on groundwater hydrology and quality from shooting/recording are expected to be local in extent, short-term in duration, reversible and of small magnitude.

Mitigation Measures

The following mitigation measures will be enforced from the management and mitigations measures envisaged in specific Management & Monitoring Plan reported in Section 8.

1. Potential Contamination of Water Resources with Solid and Liquid Waste

No discharge of liquid waste to water resources is envisaged. Waste management will be kept closely in line with the legal framework and best practice principles. A specific Water and Waste Management Plan will be performed (refer to Section 8).

All waste will be collected, stored and transported separately by typology in appropriate and approved bins and containers.

As regards sanitary waste water, where public sewage system does not exist, suitable pre-treatment systems shall be installed, in compliance with any applicable legislation. Biological digesters shall be used for those installations where the average workforce exceeds 10-15 people. In case of minor facilities specific techniques, such as phyto-depuration or sub-irrigation, shall be considered.

- install 1-2 concrete lined septic tanks on each site for holding sewage. Grey water to be discharged to an infiltration field;
- ensure treatment and disposal according to accepted international standard. Wastes shall be accompanied by a waste manifest;
- enforce "Good Housekeeping" practices;
- segregate and store waste in appropriate, secure properly labelled containers;
- dispose of waste in labelled containers for possible recycling;
- no burning of waste on site;
- implement requirements for waste management and related laws;
- store hazardous waste in appropriately designed areas and safe containers that are suitable for transporting/transferring;
- always check and record the type(s) and amount of waste generated;
- provide Waste Manifest System for all waste types;
- compensation in case *eni Myanmar* activities result in damage to agriculture crops;
- pump septic tank fluids to sewage treatment plant on a regular basis to prevent overflow;
- hazardous wastes materials will be handled and stored in accordance with the corresponding MSDS;

- general non-hazardous solid wastes will be managed in accordance with accepted international standards;
- waste reduction at the source will be considered in tenders by supply and construction contractors;
- an eni Myanmar Waste Management Plan for this seismic campaign will be developed;
- waste will be segregated at source into recyclable and non-recyclable wastes, where a net environmental benefit is likely, and stored in clearly marked containers for transport to a recycling contractor wherever practicable, or to a waste disposal site;
- hazardous wastes will be transported for disposal at proper authorized facility;
- MSDS Sheets will be posted in areas where hydrocarbon is stored and with the HSE supervisor;
- use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious floor (e.g. tarpaulin sheet);
- provide drip pans and absorbents to contain any spillage. Absorbents shall be recyclable if possible;
- waste reduction at the source will be considered in tenders by supply and construction contractors;
- non-hazardous wastes will be sent to an approved dump site.

2. Potential Contamination from Fuels, Lubricant Oils and Chemicals

The following management measures will be adopted.

- temporary fuel stored will be correctly bounded;
- procedures for vehicle/equipment refuelling will be implemented to prevent spillage and will prohibit construction vehicles and equipment to be refuelled near water courses. Appropriate spill containment equipment will be available at refuelling sites. All drivers will be trained in emergency spill response procedures;
- the washing of equipment, vehicles or machinery near or within watercourses will be prohibited;
- avoid construction of the access roads, camp site and temporary explosive storage center in areas where this would obstruct water drainage;
- prohibit workers from cleaning machines/equipment in/near a public water source;
- prohibit workers and contractors discharging or discarding project waste, chemicals, oil into public water sources;
- fuel storage tanks to be placed on concrete pad surrounded by bund wall;
- construct drainage system around concrete pad or HDPE liner for fuel storage tanks and generator to divert any spills into sump pit;
- isolate any area(s) that might be contaminated from non-contaminated areas. Provide impervious water drainage system around the contaminated area for collecting water into the sump pit for treatment;
- construct oil traps along perimeter of drainage ditch to prevent any spills from flowing off site;
- store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to their MSDS;
- use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious surfaces (i.e. on tarpaulin sheet);
- provide spill cleanup kits and training for designated rapid response teams to clean up any spills;
- in the event of oil or chemical spill, implement spill response plan;
- hydrocarbons will be securely stored and use, governed by safe operating procedures;

- hydrocarbon spill containment and recovery equipment will be available near hydrocarbon storage;
- procedures for response to hydrocarbon spills will be included in *eni Myanmar's* ERP.

3. Potential Effects Arising from Runoff

The following actions shall be undertaken, where and when appropriate in order to minimize the effects arising from:

- a stormwater management strategy reported in Environmental Management & Monitoring Plan;
- access to the site will be limited to authorized vehicles through controlled access points;
- vegetation clearance will be limited to only areas essential;
- diversion drains will be constructed around the site initially and where necessary to direct runoff from upslope areas around exposed areas;
- sediment collection devices such as check dams and/or silt fences will be installed in drainage lines or around perimeter banks to intercept and retain sediment in runoff;
- trapped sediment will be removed from stormwater drainage system, as required to maintain function;
- geomorphological and vegetational restoration activities will be undertaken after the seismic survey;
- seismic survey will be performed in periods of time when flooding is minimum;
- avoid construction of camp site, temporary explosive storage center and access roads in areas that may cause obstacles to water drainage;
- construct water drainage lines (culverts) to maintain natural drainage. The required permission will be obtained from all relevant agencies;
- Local authority and land owner/user consultation on camp site, temporary explosive storage center and access road construction design;
- follow civil engineer's recommendation on camp site, temporary explosive storage center and access road construction design.

4. Effects of Sediment Plumes on Water Resources

The following management measures will be adopted:

- maximum permitted vehicle speed will be reduced in the proximity of water courses, in order to reduce the amount of dust that potentially could sediment in the water course;
- topsoil will be stored away from watercourses in designated topsoil stockpile areas where it will be covered and protected from potential erosion/flood events due to rainfall runoff;
- a stormwater management strategy will be implemented in the Environmental Management & Monitoring Plan;
- the proposed camp site, temporary explosive storage center and access roads will be selected to minimize areas requiring soil stabilization;
- provide drip pans and absorbents to contain any spillage. Absorbents shall be recyclable if possible;
- provide drainage and sediment traps around project area to reduce suspended particles in runoff from the camp site and temporary explosive storage center to contain minor oil spills;
- avoid construction of the camp site, temporary explosive storage center and/or access road in areas where such construction obstructs water drainage;
- prohibit workers from cleaning machines/equipment in/near a public water source;

- prohibit workers and contractors discharging or discarding project waste, chemicals, oil into public water sources;
- provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).

5. Consumption of Water Resources

The following management measures will be adopted:

- bottled drinkable water will be supplied to the camp site and temporary explosive storage center;
- consult local community leaders before water hauling (if required);
- potable water and industrial water, if taken by tube wells or tanker from nearby reservoirs/rivers, shall not affect the availability of water to locals.

6. Potential Contamination of Groundwater Quality & Hydrology

Impacts to groundwater quality and hydrology can be mitigated through the use of the following measures:

- should water flow from the shot hole, the hold must be plugged with suitable weight muds;
- use suitable charge and shot hole depth for local geology;
- provide drip pans and absorbents to contain any spillage. Absorbents shall be recyclable if possible;
- provide drainage and sediment traps around project area to reduce suspended particles in runoff from the camp site and temporary explosive storage center to contain minor oil spills;
- prohibit workers from cleaning machines/equipment in/near a public water source;
- collect sewage in septic tanks;
- provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).

Conclusion

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the potential impacts on the water quality associated with the seismic survey are summarized in Table 6.26.

Table 6.26 Ranking of Impacts on Water Quality - Seismic Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Potential Contamination of Water Resources with Solid and Liquid Waste	Between 1 and 5 years. The duration will be long. It may require many months, or potentially years, to recover their original condition, even if remediation technologies are applied.	Regional scale: as determined by country's administrative boundaries	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **medium (7)** • Urban areas, buildings, roads and urban vegetation: **medium (8)** • Crops lands and green lands: **medium (7)** • Water bodies, island rivers, river gravels and rock white : **medium (7)**
Score	*2*	*2*		*1*	
Potential Contamination from Fuels, Lubricant Oils and Chemicals	Between 1 and 5 years. The duration will be long. It may require many months, or potentially years, to recover their original condition, even if remediation technologies are applied.	Regional scale: as determined by country's administrative boundaries	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **medium (7)** • Urban areas, buildings, roads and urban vegetation: **medium (8)** • Crops lands and green lands: **medium (7)** • Water bodies, island rivers, river gravels and rock white : **medium (7)**
Score	*2*	*2*		*1*	

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Potential Effects Arising from Runoff	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (5)** • Urban areas, buildings, roads and urban vegetation: **low (6)** • Crops lands and green lands: **low (5)** • Water bodies, island rivers, river gravels and rock white : **low (5)**
Score	*1*	*1*		*1*	
Effects of Sediment Plumes on Water Resources	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (5)** • Urban areas, buildings, roads and urban vegetation: **low (6)** • Crops lands and green lands: **low (5)** • Water bodies, island rivers, river gravels and rock white : **low (5)**
Score	*1*	*1*		*1*	

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Consumption of Water Resources	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (5)** • Urban areas, buildings, roads and urban vegetation: **low (6)** • Crops lands and green lands: **low (5)** • Water bodies, island rivers, river gravels and rock white : **low (5)**
Score	*1*	*1*	•	*1*	
Potential Contamination of Groundwater Quality & Hydrology	Between 1 and 5 years. The duration will be long. It may require many months, or potentially years, to recover their original condition, even if remediation technologies are applied.	Regional scale: as determined by country's administrative boundaries	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **medium (7)** • Urban areas, buildings, roads and urban vegetation: **medium (8)** • Crops lands and green lands: **medium (7)** • Water bodies, island rivers, river gravels and rock white : **medium (7)**
Score	*2*	*2*		*1*	

Considering the potential regional extent and the long duration, the impacts on freshwater due to potential contamination (liquid waste, waste, fuel, oil, etc.) has been evaluated as **medium**. Indeed freshwater pollutants may require many months, or potentially years, to recover their original condition, even if remediation technologies are applied.

The impact on freshwater due to interference on hydrological and hydraulic regime, sediment plumes and water consumption are considered **Low**.

6.2.4 Soil & Subsoil

6.2.4.1 Overview

The following box shows the key sources of impact, potentially impacted resources and receptors, baseline and project influencing factors associated to the impacts of the Project on Soil and Subsoil.

Box 6.4 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- *Seismic survey:* preparation of the site, line clearance, construction of roads, down-hole drilling, movements of vehicle; equipment and personnel, waste management.

Potentially Impacted Resources and Receptors

- Soil.
- Subsoil.

Project Influencing Factors

- A policy of minimal clearance will be implemented by *eni Myanmar* in accordance with eni E&P Standards.

The following table presents the key impacts of the project on the soil component during the key project phases.

Table 6.27 Key Impacts – Soil Quality

Seismic Survey
• Potential soil contamination (potential temporary contamination of soil by hazardous and non-hazardous spill, and contamination of soil by hazardous and non-hazardous waste). • Potential disturbance and degradation (erosion, soil compaction, soil removal modification of morphology). • Landtake.

The *sensitivity* of the soil component is reported in the following Sections.

6.2.4.2 Soil Sensitivity

Soil characteristics in Block RSF-5 are classified as (refer to Section 5).

Light Forest Soils (Cinnamon) Nitosol: these soils mostly occur on the very gently sloping alluvial-deluvial under mountainous plains in the Dry zone area. The physical properties of these soils are very favourable and in spite of being sandy they are pervious and not heavy to work. They generally have good fertility which is connected with their position in the under mountainous plains, and there is a permanent supply of nutrients from the surrounding mountains by the surface run-off. These soils are suitable for the cultivation of Yacrops (dry cropping on uplands)

- Meadow Soils (Gleysol) and Meadow Alluvial Soil (Gleysol Fluvic): the meadow soils or paddy soils are widely occurring in the different parts of Myanmar in river plains, delta and low coastal plains and valleys. All types of Meadow Soils have thick solum and are mostly having clayey texture. They are most suitable for paddy cultivation.The Meadow soils of the Dry zone in the upper Myanmar have the characteristic light colors. There are Meadow soils with neutral reaction, whereas, some have the alkaline reaction. The Meadow Carbonate soils can also be found in that region. Although they are deficient in plant nutrients.Meadow Alluvial soils (fluvic Gleysols) can be found in the flood plains. They have the texture of silty clay loam and they can be utilized for groundnut, sesame, sunflower, jute, ugarcane and vegetables in addition to rice cultivation. They have the neutral soil reaction and are rich in available plant nutrients. Meadow Gley soils (Gleysol) occurs in the regions of lower depressions where the lands are inundated for more than 6 months in a year. The texture of these soils are clayey to clay and usually having very strong acid reaction, and contain large amount of iron. Moreover, the soils with long periods of moisture content may contain large amount of aluminium and soluble iron, sulphur and manganese by chemical process and can be toxic to plants. The humus content is high and usually deficient in phosphorus and potassium. Rice and jute can be grown on these soils after the floods recede.
- Red Brown Savanna Soils (Luvisol): these soils are mostly found in the undulating relief of the hill slopes and low uplands. The soils are sandy and usually well drained. The soil reaction is about neutral in the top soil and neutral or slightly alkaline in the subsoil (pH ranges from 7.0 to 8.0). The soil contains a certain amount of lime and is rich in calcium and magnesium. The soils are low in other nutrients except potassium. These soils are the most important land resources of the Dry zone area. Most of the areas are ploughed and cultivated. However, large areas have been in great danger of soil degradation at present as a result of strong erosion. Nearly the whole area of these soils has been severely affected by gully, sheet or wind erosion as a result of continuous cropping without soil amelioration for many years. Being the important soils for the variety of cash crops they should be treated with green manure and organic manure together with nitrogen and phosphate fertilizers. Having paid great attention on systematic agricultural practices and soil erosion control measures such as plantation of windbreaks should be carried out on these soils.
- Dark Compact Soils (Vertisol). The Dark Compact soils occur in the Dry zone in the level plains of Sagaing, Mandalay and Magway divisions. They occur on the lowlands near the rivers and broad depression in the areas of Red Brown Savanna Soils. They are very important soils for agriculture in the Dry zone area next to Red Brown Savanna Soils. The soils are deep and mostly composed of clayey materials. Located on the level plains, they are the best soils for irrigated fanning. Due to high content of clay, it is very difficult to work when it is too dry or having excessive moisture. The humus content of these soils are very low and in the dry state they are deeply cracked, but after rains they turn into mud and very sticky. The infiltration in these soils is also very poor so care should be taken for saline and alkali problems. The soil is alkaline and having pH ranging from 7 to 9 so they are strongly calcar-

eous. With the exception of potassium, they are deficient in nitrogen and phosphorus. The soils contain a considerable amount of calcium and magnesium. The soils can be used for Yacrops in addition to rice under irrigation.

The sensitivity of the resource has been evaluated for each land cover, as following:

- in areas characterized by presence of *bare soil and vegetation,* the sensitivity has been evaluated as **Moderate**;
- in *urban areas* and areas characterized by *buildings, roads and urban vegetation*, the sensitivity has been evaluated as **Low**;
- in areas characterized by *crops lands and green lands,* the sensitivity has been evaluated as **Moderate**;
- in areas characterized by presence of *water bodies, island rivers, river gravels and rock white*, the sensitivity has been evaluated as **Low**.

Regarding the seismic survey, the following impact sources have been identified. Without mitigation, the sources listed below have the potentiality to cause impacts on soil and landform.

Table 6.28 Soil Impacts

Source of Potential Impact	***Potential Impact***
Movement of vehicles, equipment and personnel	Potential contamination of soil by hazardous and non-hazardous spills, and contamination of soil by hazardous and non-hazardous wastes, compaction of the soil surface and potential degradation.
Preparation of the site (site clearance)	Potential disturbance and erosion (soil exposure), soil compaction.
Production and disposal of solid and liquid wastes	Potential contamination of soil by hazardous and non-hazardous spill, and contamination of soil by hazardous and non-hazardous waste.
Storage and handling of fuels and chemicals	Potential contamination of soil by hazardous and non-hazardous spills, and contamination of soil by hazardous and non-hazardous waste.
Temporary subtraction of natural surface of soil (Landtake)	Potential occupation of soil by cam site with limitation of soil functionalities (habitat, human activities, landscape), soil tamping, increase of waterproof surface (soil loss).

The impact assessment on soil reported in the following sections is based on the analysis of the sources of potential impact reported in Table 6.28.

Impacts Identification and Assessment

The aim of this paragraph is to identify the possible impacts on soil during the seismic survey. The potential impacts on soil are likely to be confined to the area of the line survey and associated access roads and to the camp site and temporary explosive storage center.

The sources of the potential impacts on soil and landform are the following:

- potential contamination of soil;
- potential disturbance and degradation;
- land take.

Potential Contamination of Soil

Soil may potentially be polluted by accidental spills from vehicles, storage tanks and chemical stores and process waste and effluent.

Potential Disturbance and Degradation

Works soil movements will result from the excavation and earthworks related to:

- access road construction;
- camp site preparation;
- temporary explosive storage center;
- line survey preparation (localised flattening of soil);
- shot-hole drilling or vibroseis;
- shooting/recording.

As a consequence, during this phase the potential impacts correlated with physical disturbance and degradation are:

- site clearance (potential removing of top soil – levelling works). However the whole length of the line will not be cleared (only those areas of uneven ground will be smoothed);
- zones of soil damage caused by compaction or erosion by construction vehicles;
- potential creation of soil erosion and non-recoverable soil compaction that leads to soil degradation;
- potential alteration of existing slopes and morphologies.

Soil impact from access to the project area

Vehicles and people treading on agricultural areas to access the seismic lines can compact soils and decrease infiltration of water into subsurface soil. These may lead to water-logging or increase surface run-off and can also cause soil erosion. Moreover, soil compaction can also result in decreased seed germination, root expansion, and growth. The potentially impacted area is the treaded area along seismic lines. Given a treading area of approximately 1 m, the temporary impacted area amounts to an insignificant percentage of the RSF-5 Block area.

Temporary camp site and explosive storage center preparation

The accommodation camp site and temporary explosive storage center will be levelled and elevated by cut and fill methods and compacted using bulldozers, dump trucks, water trucks and graders. The compacted laterite pad will be 200 mm thick. The temporary explosive storage center will occupy an area of 3.87 acres.

The source of impact from the site preparation is caused by soil excavation/filling and construction of access road activity. The project area mainly consists of rice farming, agricultural and forested areas with agriculturally dominated communities and access roads. The agriculture areas are used to grow primarily rice and beans.

The project will cause changes to the topography of the camp site, temporary explosive storage center and nearby surrounding areas. The effect will be limited to the camp site, temporary explosive storage center and access roads.

The abandonment will follow normal industry practices and procedures, conforming to all internal *eni Myanmar* regulations and MOGE requirements.

Soil impact from line site preparation

The majority of the project area consists of a low slope; therefore, excavation or soil filling will not be required. Nevertheless, the survey team needs to cut some grass or clear soil surface of about 10 m^2 per shot hole in order to drill shot holes. Therefore, the temporary impact area considering the total Block area is insignificant.

Soil impact from drilling of shot holes and loading of explosives

The drilling team will drill shot holes that have a diameter of 3 inches (7.62 cm) and a depth of 10-30 m. Drilling of the shot holes create cuttings around the mouth of the holes every 50 m. The maximum amount of cuttings from drilling of a single-hole can create approximately 0.137 m^3 of cuttings/hole. The amount of cuttings from a single hole is negligible in relation to the total project area. After drilling, explosives will be loaded into the drilled holes, and the cuttings from the holes will be buried back into the same holes. Therefore, only a small amount of cuttings will be left, which will have minimal effect.

Soil impact from vibroseis equipment

Seismic support trucks can compact soils and decrease infiltration of water into subsurface soil, which can cause soil erosion. The potentially temporarily impacted area is the treaded area of 1 m wide along the seismic lines. Assuming the seismic support trucks or other support vehicles are used for 50% of the length of the seismic lines, with a 5 m clearance path for trucks, this is equivalent to approximately 0.1 % of the Concession Blocks area, which is insignificant.

Soil impact from shooting/recording

Shooting of shot holes may affect the soil structure at low levels and in limited areas. The main composition of explosives used in this seismic work is ammonium nitrate, which is normally used as fertilizer. There are no documented cases of pollution from its residuals. The components of the detonator include 10% of $Pb(N_3)_2$, and 60% other compounds. The lead from $Pb(N_3)_2$ in one detonator (the weight of detonator is 1 mg) would remain in the soil as estimated at 0.07 mg/kg soil. This estimated value is much lower than the standard of Pb in soil (less than 400 mg/kg soil). Therefore, this residual does not affect the environment. The contractor for seismic survey, will pick up gab wire residues from each shot hole after every explosion and the residues will be re-used or disposed. Therefore, changes to the chemical properties of soil from the shooting/recording would be slight.

Land take

During seismic survey, some portion of land will be used, and consequently cause soil loss, for:

- access roads and site access;
- campsite;
- temporary explosive storage center;
- line survey and upholes.

Once that the activity will be completed the sites will be restored to their original condition.

The project area mainly consists of agricultural and forested areas; other areas include communities, water sources, unoccupied areas, roads, etc. The main project activity that affects land use is site preparation for laying of seismic lines. The project team will assess these impacts and compensate stakeholders with the market price of their agricultural products for any lost crops resulting from the seismic survey. Severe or long-term damage to soils is not anticipated. Moreover, the project team will recover the seismic survey area by filling and leveling the ground to prepare for the following agricultural cycle.

In terms of compensation, if there is any impact on properties or crops of communities, *eni Myanmar* will cooperate with MOGE and Local Authorities to address these impacts on land use and resolve any disputes. *The eni Myanmar* compensation team for seismic will involve a Representative from the Agriculture Department, MOGE, Local District/Township officials and Chief Village and his representatives to determine fair compensation for crops lost due to seismic activities.

Compensation will be managed by the land management plan in accordance with IFC PS. Before the start of the seismic activity a pre survey will be organized to identify the land owner and stipulate an agreement for the operation to be undertaken on his area. When activity on seismic line is complete, i.e. the recording operations have been completed; the compensation team will conduct a post survey to physically check the line and assess the individual landowners' plots for compensation. Once the physical check of the line is complete and the Compensation is agreed. The compensation will be paid during the Payment Ceremony organized by village. *eni Myanmar* is committed to timely compensation and will conduct further engagement sessions with villager representatives, Township officials and MOGE personnel to provide regular briefs on planned activities and other issues of importance.

It is important that all persons present during the compensation assessment process agree on the traverse distances, tariff rates and the payment amounts. This will help to keep the process fair and above board and it is hoped alleviate any disagreements at the Payment Ceremony. No preliminary payments or advances against property compensation payments due to the owner will be paid at this stage of the process. The team shall advise all concerned that *eni myanmar* policy does not permit this and all approved compensation will be paid at the official Payment Ceremony after all recording activities within the boundaries of the village limits have been completed.

The crop compensation price formula to be used in assessing the relevant price will be rationale and fairly applied, and it will be based on the yearly productivity of specific crop, the crop unit price and the area of the selected land. No negotiations, no deviations, no price adjustments will be applied by eni Myanmar and GT to meet the villagers requests, this is in compliance with eni Myanmar sustainability Policies, which are aimed to guarantee a transparent, reliable and rational method of calculation for the crop compensation.

There will be occasions where the landowner refuses to allow the survey team to traverse their property. In cases such as these, the source or shot point may be moved to an adjacent position off the landowners plot. These new locations can be situated only by using the approved offset parameters. This is to be undertaken by the seismic contractor's survey team only. All senior permitting team members must be aware of these procedures so that no incorrect decisions are made on where source points can be moved.

Any employee associated with the permit and land access process, regardless of seniority or position, found to be manipulating, or attempting to influence to their advantage any transactions associated with the permit and land access process will be terminated from their position. In addition, any employee of either the seismic contractor or the Permitting team who

is aware of collusion or manipulation of the permit and land access system by a person or persons and does not report this matter to his superior will also be terminated from the operation forthwith. Eni Myanmar is committed in a timely compensation.

The rental of the land for the camp site and temporary explosive storage center will provide a significant financial benefit to landowners while this land will be temporarily lost from agriculture production. If hydrocarbon resources are not found the land will be given back to the original land owners and restored to its original state. However, the farm workers who do not own land may be displaced and possibly lose employment. The compensation program needs to specifically address this potentially vulnerable group.

The impacts from changes in land use will be local in extent, short term in duration, of major magnitude, reversible and of low to medium importance. The likelihood of land use impacts occurring is very likely. Given the short-term impact of this aspect and its return to its original state, it is determined to be a positive benefit as a result of the financial benefit to land owners.

Mitigation Measures

Potential Contamination of Soil

Waste management will be kept closely in line with the legal framework and best practice principles. All waste will be collected, stored and transported separately in appropriate and approved bins and containers. A specific Waste Management Plan will be performed (refer to Section 8).

Potential Disturbance and Degradation

The following mitigation measure will be undertaken to minimize the soil impact.

- erosional landforms will be avoided or, if this is not possible, minimized in survey planning;
- before starting any work, photographic records will be made of the existing condition of the camp site and temporary explosive storage center. These records will be used as the standards against which the quality of the restoration work will be judged when construction work will be completed;
- except for construction works needed for the opening of new trails and roads, that in any case will be temporary, no machinery will be allowed to leave the working area or access roadways;
- at the end of this phase, a shallow tillage of the soil will be realized through mechanical agitation with the aim of aerating the top layer of soil compacted by machinery;
- restoring pre-existing slopes and the original morphology of the ground, proceeding to the re-activation of ditches and channels, as well as of pre-existing flow lines. This measure will mitigate also the risk of sediment runoff;
- limit soil compaction only to camp site, explosive storage center and access roads;
- exposed site areas shall be kept to a minimum during construction or re-vegetated as soon as possible;
- reduce erosion by preventing/reducing off-site sediment transport through the use of settlement ponds, silt fences and water treatment, and modifying or suspending activities during extreme rainfall and high winds;
- provide effective construction site run-off control and design;
- minimize vehicle traffic along seismic line;
- minimize compaction at shot hole locations.

The foreseen mitigation measures for erosion and sediment control are reported below.

- control of sediment runoff from cleared areas around the water course;
- installation of diversion drains to intercept uncontaminated surface runoff around the camp site and temporary explosive storage center;
- limit construction activities to camp site, explosive storage center and access roads only;
- restore the site to its original condition on site abandonment;
- minimize cutting along seismic lines.

Land take

Impacts on land take can be mitigated through the use of the following measures:

- no machinery will be allowed to leave the access roadways or the working strip;
- transparent and fair compensation to land owners and users;
- consider issue of displaced workers who are not land owners and may lose employment
- ensure all permissions are obtained from land owners and local authorities. Provide summary to MOGE;
- notify surrounding landowners 2 weeks before on location and time of project activities;
- restoration of land to its original state within 6 months of project completion, where applicable.

Conclusions

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the residual impacts on soil component associated with the seismic survey activities are summarized in table below.

Table 6.29 Residual Impacts on Soil - Seismic Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Potential contamination of the Soil	Between 1 and 5 years. The duration will be long, as contaminated soils may require many months, or potentially years, to recover their original condition, even if remediation technologies are applied.	Regional scale: as determined by country's administrative boundaries	• Bare soil and vegetation: moderate(2) • Urban areas, buildings, roads and urban vegetation: low (1) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **medium (7)** • Urban areas, buildings, roads and urban vegetation: **low (6)** • Crops lands and green lands: **medium (7)** • Water bodies, island rivers, river gravels and rock white : **low (6)**
Score	*2*	*2*		*1*	
Potential Disturbance and Degradation	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: low (1) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (5)** • Urban areas, buildings, roads and urban vegetation: **low (4)** • Crops lands and green lands: **low (5)** • Water bodies, island rivers, river gravels and rock white : **low (4)**
Score	*1*	*1*		*1*	

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Land Take	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: low (1) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (5)** • Urban areas, buildings, roads and urban vegetation: **low (4)** • Crops lands and green lands: **low (5)** • Water bodies, island rivers, river gravels and rock white : **low (4)**
Score	*1*	*1*		*1*	

The impact on the soil component due to Project activities is **Low** for the whole territory except the potential contamination of soil in erosion landforms habitat. In this area the impacts has been evaluated as **medium**.

6.2.5 Flora and Vegetation

6.2.5.1 Overview

Potential impacts to flora and vegetation will include various degrees of disturbance as a result of the seismic survey.

The following box shows the key sources of impact, the potentially impacted resources and receptors, the baseline influencing factors and the project influencing factors associated with the impacts of the Project on flora and vegetation.

Box 6.5 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- *Seismic Survey*: site clearance and preparation; use, storage and management of hazardous raw materials; production and management of domestic wastes; presence of workforce; temporary land-take for Project activities.

Potentially Impacted Resources and Receptors

- Native plant species.
- Native plant communities.
- Abiotic factors in ecosystems.

Baseline Influencing Factors

- Presence of species with high conservation value.

Project Influencing Factors

- A policy of minimal clearance will be implemented by *eni Myanmar* in accordance with eni E&P Standards.

The following table presents the key impacts of the project on the flora and vegetation component during the key project phases.

Table 6.30 Key Impacts – Flora and Vegetation

Seismic Survey
• Loss of natural vegetation (and secondary plant species) and deforestation. • Degradation of abiotic components in ecosystems (water, soil and air). • Invasion of alien species. • Due to noise, water, air and light pollution, potential temporary disturbance and/or displacement of flora (e.g. reduction of usable habitat).

The *sensitivity* of the flora and vegetation component is reported in the following Sections.

6.2.5.2 Flora and Vegetation Sensitivity

The sensitivity of the resource has been evaluated for each land cover, as following:

- in areas characterized by presence of *bare soil and vegetation,* the sensitivity has been evaluated as **High**;
- in *urban areas* and areas characterized by *buildings, roads and urban vegetation*, the sensitivity has been evaluated as **Low**;
- in areas characterized by *crops lands and green lands,* the sensitivity has been evaluated as **Low**;
- in areas characterized by presence of *water bodies, island rivers, river gravels and rock white*, the sensitivity has been evaluated as **Moderate**.

The following sources of impact have been identified. Without mitigation, the sources listed below have the potentiality to cause impacts on flora and vegetation.

Table 6.31 Flora and Vegetation Impacts

Source of Potential Impact	Potential Impact
Site Clearance and camp site preparation of temporary facilities (camp site; temporary explosive storage center and access roads)	Habitat fragmentation; introduction of aliens species
Movement of vehicles, equipment and personnel	Deposition of dust and exposure to atmospheric pollutants; Habitat fragmentation.

Source of Potential Impact	Potential Impact
Production and disposal of solid and liquid wastes	Degradation of water quality; Soil degradation.

The impact assessment on flora and vegetation resources described in the following sections is based on the analysis of the sources of potential impact reported in table above.

Impacts Identification and Assessment

The potential impacts will largely be confined to the area of the line survey and associated access roads and to the camp site and temporary explosive storage center.

The Project will potentially impact these two natural components through *loss of habitats* upon which they rely.

Flora and vegetation will be also affected by possible changes (*degradation of abiotic components in ecosystem*) to their environment including:

- degradation of water quality;
- soil degradation;
- deposition of dust and exposure to atmospheric pollutants.

Furthermore the introduction or range expansion of *alien species* may also have wider secondary impact.

Loss of Natural vegetation

Most direct impacts on flora and vegetation are likely to take place during the site clearance due to the temporary occupation of land areas by the line survey, camp site and temporary explosive storage center. A policy of minimal clearance will be implemented by *eni Myanmar* in accordance with *eni Upstream* Standards. Off-road driving and the creation of new, unplanned tracks will be avoided if not strictly necessary.

The project area consists of agricultural (i.e., paddy field and crop) and scrubland & forested (i.e., grass and shrubs, mixed deciduous forest/disturbed deciduous forest, dry evergreen forest/disturbed evergreen forest, disturbed deciduous forest, deciduous dipterocarp forest, and dense deciduous forest).

Land and habitat disturbance could happen as the result of clearance of camp site, temporary explosives storage center and construction of access roads, some physical disturbance along the seismic lines and at shot hole locations.

The camp site will be constructed to house the workers and provide an area for storing equipment during the night. The temporary explosive storage center area will be cleared to construct the structure and vegetation in the surrounding area will be cleared to prevent accidental fires in case of accidental explosion. The temporary explosive storage center will occupy an area of 3.87 acres.

All new access roads will need to be constructed, although these will be minimal. The roads will be constructed with a 6 m wide top and 1.5 m side slope for a total width of 9 m a height of approximately 20 to 30 cm before compaction with granular fill. The construction of the camp site, temporary explosive storage center and access road would affect plants within an area.

There will be minimal disturbance along the seismic lines itself about a meter wide. The actual shot hole locations about every 50 m along the seismic line will occupy a 10 m^2 area in which vegetation will be cut and over impacted. This is a direct and short-term impact.

During the decommissioning phase, the potential for impacts associated with land/habitat disturbance will be of a lesser scale than during the construction phase as the decommissioning strategy is to restore the site to its original condition.

For a 3D-seismic survey, the survey team will use the vibroseis seismic machine on agricultural land on a path with a width of 5 m along the approximately seismic lines to access the shot hole locations. Operation of the vibroseis and the seismic support trucks may lead to soil compaction that might inhibit root penetration and reduce water infiltration. However, the impacts will be localized, short-term, and only slightly alter the original state. Thus, it is unlikely that vegetation growth will be significantly reduced. Only crop species will be impacted but they will be replanted with the next planting cycle. The survey team may need to cut some vegetation for drilling of shot holes that may cause some vegetation loss in that area. The vegetation will be replanted soon after completion of the survey as appropriate. For the scrubland & forested areas the survey team will use the technique which will cause the least disturbance to the natural vegetation, depending on the type of area this may be vibroseis or the use of micro-charges. As standard practice, *eni Myanmar* will ensure that its staff and contractors will not cut trees or forage in the area surrounding the camp site and temporary explosive storage center during the operations.

The vegetation removed is expected to recover naturally when complete. Any potential loss of tree habitat from the camp site, temporary explosive storage center or seismic lines will be compensated.

Degradation of abiotic components in ecosystems

Three abiotic components in ecosystems may potentially affect flora and vegetation:

- degradation of soil;
- alteration of water quality;
- modification of air quality (dust and other atmospheric emissions).

Modification of topsoil characteristics (fertility, texture, etc.), caused by the use of explosives, greatly affects plant growth, especially in natural habitats. However, Project earthworks are limited to the camp site, temporary explosive storage center and small areas along the line survey where natural or semi-natural habitats are very limited in extension. Furthermore, the use of vibroseis will generate minor impacts on topsoil, and consequently on flora and vegetation, compared to explosives.

Sediment plumes from camp site, temporary explosive storage center and access roads due to rainwater runoff may reach the water basin, as well as unintentional discharge of oil and chemicals from machinery. Thus, the water quality of the basin systems may be potentially affected by the Project.

The dust generated from earth movement, excavation, vehicle movement, stockpiles, unpaved surfaces, etc. along the line survey, access roads, camp site and in temporary explosive storage center could be deposited on plants, reducing photosynthetic capacity of leaves. Due to the typical climatic conditions, precipitation is expected to wash dust from leaves, greatly reducing the loss of photosynthetic capacity.

Atmospheric emissions from machinery and vehicles (i.e. generators, excavators, trucks, cars, etc.) will be another source of potential effects on air quality for plants. Limits on the emissions, in particularly on NO_x (the most important gas involved in plant injuries, because SO_2 emission will not occur from the Project) allow an annual average concentration of 100 $\mu g/m^3$.

Alien plants

According to the IUCN (International Union for Conservation of Nature and Natural Resources), invasive alien species are the second worldwide leading cause of decline of biological diversity, after the alteration of natural habitats. Article 8 of the Convention on Biological Diversity advocates the prevention of new introductions and the control or eradication of invasive species already established.

Linear projects, possibly near uncultivated lands, are one of the sources of the spread of alien plants. Road improvements may facilitate the accessibility and subsequent deliberate introduction (i.e. planting alien trees for ornamental or forestry purpose) or accidental spread (e.g. seeds in the soil attached to vehicle tyres) of exotic plants.

At this stage information on the presence of alien species occurring in the area is not available and will be verified in a later stage of the project throughout a field survey.

Mitigation Measures

Loss of Habitat/Habitat Fragmentation

To avoid the loss of vegetation especially for species of priority importance, as endemic species, a monitoring plan shall be performed along the line survey and in correspondence of the camp site and temporary explosive storage center. The floristic surveys shall be planned during the flowering season.

Impacts to natural vegetation & habitat can be mitigated through the use of the following measures.

- high valued habitat to be avoided where practicable in the design process;
- remove vegetation in project areas only (roads, camp site, temporary explosive storage center shot hole site). Avoid cutting Riparian trees;
- mark seismic lines clearly and prohibit vehicles from moving off site onto surrounding land;
- mark trees to be cut prior to constructing camp site/ temporary explosive storage center / seismic lines to prevent the cutting of other trees;
- contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to vegetation;

Degradation of Abiotic Components of Ecosystems

In order to minimise environmental disturbances earthworks will be limited as much as possible. Moreover any sensitive area located around the seismic camp site and temporary explosive storage center (e.g. sensitive vegetation, water well) will be marked with pegs and tape to ensure that these will remain untouched.

These practices appear adequate to minimize soil degradation and therefore plant and vegetation recovery. In addition, revegetation (i.e. the sowing of native herbaceous species on top soils and/or the planting of native shrubs/trees) will be generally more suitable to reduce soil degradation in or close to natural habitats.

To reduce possible impact from modification of water quality, potential preventive/mitigation measures will be properly undertaken as reported in the Section 6.2.3.

Alien Plants

A monitoring plan shall be performed for the most invasive alien species, to record their populations in the study area. The results of the ante and post-operam monitoring will allow to define an eradication plan aimed at removing new populations potentially spreading throughout the Project areas. In addition, prompt re-vegetation (i.e. sowing native herbaceous species and/or planting native shrubs/trees) on bare soil with natural or semi-natural vegetation will reduce the spread of alien species.

Conclusions

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the potential impacts on flora and vegetation component associated with the seismic survey activities are summarized in table below.

Table 6.32 Ranking of Impacts on Flora and Vegetation - Seismic Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Loss of natural vegetation	Between 1 and 5 years. The duration will be long. It may require many months, or potentially years, to recover their original condition, even if remediation technologies are applied.	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: high (3) • Urban areas, buildings, roads and urban vegetation: low (1) • Crops lands and green lands: low(1) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **medium (7)** • Urban areas, buildings, roads and urban vegetation: **low (5)** • Crops lands and green lands: **low (5)** • Water bodies, island rivers, river gravels and rock white : **low (6)**
Score	*2*	*1*		*1*	
Invasive alien plant	Between 1 and 5 years. The duration will be long. It may require many months, or potentially years, to recover their original condition, even if remediation technologies are applied.	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: high (3) • Urban areas, buildings, roads and urban vegetation: low (1) • Crops lands and green lands: low(1) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **medium (7)** • Urban areas, buildings, roads and urban vegetation: **low (5)** • Crops lands and green lands: **low (5)** • Water bodies, island rivers, river gravels and rock white : **low (6)**
Score	*2*	*1*		*1*	

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Degradation of Abiotic Components of Ecosystems	Between 1 and 5 years. The duration will be long. It may require many months, or potentially years, to recover their original condition, even if remediation technologies are applied.	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: high (3) • Urban areas, buildings, roads and urban vegetation: low (1) • Crops lands and green lands: low(1) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **medium (7)** • Urban areas, buildings, roads and urban vegetation: **low (5)** • Crops lands and green lands**: low (5)** • Water bodies, island rivers, river gravels and rock white : **low (6)**
Score	*2*	*1*		*1*	

The impact on flora and vegetation component due to Project activities is **Low** for the whole territory except impacts on flora and vegetation located in erosion landforms. In this area the impacts have been evaluated as **medium**.

6.2.6 Fauna and Habitats

6.2.6.1 Overview

The following box shows the key sources of impact, the potentially impacted resources and receptors, the baseline influencing factors and the project influencing factors associated with the impacts of the seismic survey on fauna and habitats.

Box 6.6 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- *Seismic Survey*: temporary land-take for Project construction (camp site, temporary explosive storage center, access roads, upholes); site clearance and preparation; use of machinery and heavy equipment; use, storage and management of hazardous raw materials; production and management of domestic wastes; presence of workforce..

Potentially Impacted Resources and Receptors

- Wildlife species.
- Wildlife communities.
- Abiotic factors in ecosystems.

Baseline Influencing Factors

- Occurrence of natural vegetation as habitat for several species.
- Presence of species listed in the IUCN Red List of Threatened Species.

Project Influencing Factors

- Biodiversity; water and waste management plan.

The following table presents the key potential impacts of the Project on fauna during the different project phases.

Table 6.33 Key Impacts – Fauna

Seismic Survey
• Habitat reduction, decrease in features of ecological networks, habitat fragmentation, and isolation (camp site, temporary explosive storage center and access road construction), introduction of alien species. • Due to noise, water, air and light pollution, potential temporary disturbance and/or displacement of fauna(e.g. reduction of usable habitat) • Increased mortality of wildlife, caused by accidents (collisions with vehicles)

6.2.6.2 Fauna Sensitivity

Within the Block RSF-5 the following vulnerable species has been identified through the spatial distribution (range maps) data provided by the IUCN Red List of Threatened Species and on the August 29-31, 2016 biodiversity reconnaissance survey confirmed the presence of 32 species of bird, and 2 species of mammal. Focused community interviews identified potentially a further 15 mammals, 13 birds, 30 species of reptile, 21 species of amphibian, 14 species of invertebrate[4], and 17 species of fish that may be resident or transient in the exploration block. These include a number of species with special conservation status (Table 6.34) and Annex 8. Suitable habitat for a number of these latter species was noted in the area; however, confirmation of the actual occurrence of these species would require extensive, multi-season investigation.

Table 6.34 Number of Species with Special Conservation Status[5] Reported By Local Community as currently Occurring in general vicinity of the ENI Exploration Block

	Mammals	Birds	Reptiles & Amphibians	Insects	Fish[6]
Critically	1[7]	(1)[8]	0	0	0

[4] Residents of Than Bo Kan near B1 noted there were three species of Apis in the area, the domestic bee, and two others (one larger than the other)
[5] Species with special conservation status were considered those receiving special protecton under Myanmar law and or species which are listed as Critically Endangered, Endangered or Vulnerable
[6] At the time of the community survey only local common names could be obtained (Appendix 4)
[7] Pangolin (*Manis* sp.) were reported as common in an area East of the ENI Block.

Endangered					
Endangered	4	1	1	0	0
Vulnerable	1	0	4	1	(1[9])
Near Threatened	3	2	6	0	(3[10])

The Government of Myanmar has not designated any portion of Block RSF-5 as a protected area for special management areas for wildlife nor has the area been informally acknowledged by local conservation groups as supporting significant concentrations of any one wildlife species with special conservation status (Critically Endangered, Vulnerable) or for biodiversity overall. This circumstance may or may not reflect the actual occurrence of species on the ground but is suggestive that Critical Habitats of National or International importance may not be present. Based on the field observations, satellite image interpretation, literature and on-line source reviews, and anecdotal accounts obtained to date, it is further believed that no locations within the block would satisfy IFC Criteria for Critical Habitat[11] including any of the four Birdlife International criteria for an International Bird Area[12]. and/or Ramsar Criteria for Identifying Wetlands of International Importance. In such case as exhaustive field surveys were to identify an endemic species whose range was confined to the near proximity of the exploration area then a revised classification could be warranted.

At the same time, however, the present biodiversity survey has obtained information suggesting that some Critically Endangered, Endangered and Endemic species find suitable habitat within the exploration block and satisfy to a certain degree IFC Critical Habitat Criteria "i" and "ii", not withstanding interpretations of "significant importance". Conditions satisfying the remaining three critical Habitat criteria were not observed. Within the context of exploration block locally Critical Habitat is loosely comprised of the remaining areas of native vegetation in the area, and more particularly, the blocks wetland/riparian areas, the remaining large diameter trees, and the more isolated stands of native vegetation (this being largely concentrated within the more incised drainages, gullies and breaks. A number of what are considered Higher Wildlife Value (HWV) sites including the wetland complexes and the entire riparian zone of the Yin River and it's tributaries shall also be considered as likely providing key habitat components for many species of fauna in the area.

The sensitivity of the resource has been evaluated for each land cover, as following:

- in areas characterized by presence of *bare soil and vegetation,* the sensitivity has been evaluated as **Moderate**;
- in *urban areas* and areas characterized by *buildings, roads and urban vegetation*, the sensitivity has been evaluated as **Low**;
- in areas characterized by *crops lands and green lands,* the sensitivity has been evaluated as **Low**;
- in areas characterized by presence of *water bodies, island rivers, river gravels and rock white*, the sensitivity has been evaluated as **Moderate.**

[8] A species reportedly similar to Baer's Pochard (*Aythya baeri*) was included in the community record, however, project avian specialists suggest that habitat suitability in the project area is low.
[9] If *Cirrihunus* species *is Cirrihunus cirrihunus* (Mrigal Carp or white carp) species is currently listed as **Vulnerable.**
[10] Contingent on actual species. Identification confirmed to Genus only.
[11] http://www.ifc.org/wps/wcm/connect/a359a380498007e9a1b7f3336b93d75f/Updated_GN6-2012.pdf?MOD=AJPERES
[12] http://www.birdlife.org/datazone/info/ibacritglob

A summary of the impacts on fauna identified during seismic survey are listed in Table 6.35.

Table 6.35 Fauna Impacts

Source of Potential Impact	Potential Impact
Set-up (including site preparation) of temporary facilities (camp site, temporary explosive storage center, access roads)	Barrier effects: habitat fragmentation. Noise, light and visual impacts
Movement of vehicles, equipment and personnel	Noise, light and visual impacts; Direct incidental loss of wildlife; Deposition of dust and exposure to atmospheric pollutants
Production and disposal of solid and liquid wastes	Degradation of water quality; Soil degradation

Impacts Identification and Assessment

Potential impacts on wildlife species will include various degrees of disturbance as a result of access road construction and sites preparation (camp site, temporary explosive storage center , line survey), including noise, human traffic and the movement of vehicles; fauna may also suffer direct physical injuries.

Wildlife species could also be impacted by loss of small parts of habitat and the introduction of barriers to movement (access road).

Fauna will thus be impacted by changes to their environment as listed below:

- Alteration of abiotic components in ecosystem:
  - air emission;
  - noise;
  - light pollution;
- modification of the ecological network;
- increasing collision rate from traffic.

The significance of these potential impacts will be assessed according to the importance of the habitats involved and the magnitude of the impacts will be predicted on the basis of previous experiences.

It is not foreseen any significant impact on fauna and habitats in case of 3D-seismic survey crossing rivers. In fact, it is planned the location of the geophones on river islands, if any, or the re-location of the seismic survey points along the river banks in order to not interfere with the riverbed.

Alteration of Abiotic Components in Ecosystems

Air emission

The increase in vehicular traffic will cause an increase of dust and gas pollutants. This pollution will be minimized by dust suppression and washing of road surfaces and/or the work areas.

However, transportation of goods and scientific equipment will be as limited as possible. The large part of vehicles movement will be related to the receivers positioning. Existing roads and tracks will be used where possible and no impact on the local traffic is foreseen.

This type of impact will occur mostly at the camp site, temporary explosive storage center as well as along the roads where vehicles pass toward yard areas.

Noise

Noise will come from vehicles, accommodation supplies (air conditioning, diesel-generators) and personnel necessary for the operation.

The noise and vibration caused by charges blast will be limited to the surrounding areas of the sources location. The amount of vibration is not expected to be harmful for the surrounding environment, or to cause interference with any receptor in the study area.

Wildlife responds to noise by altering activity patterns, such as an increase in heart rate and increased production of stress hormones (Algers et al., 1978). In laboratory animals subjected to severe noises, these effects appear at values between 85 and 89 dB. These levels will not be reached during the set-up of the temporary facilities (cap site, access road), even though they may be temporary exceeded by the detonations during the seismic survey.

Studies have been performed to identify the species most strongly affected by noise pollution, as well as critical thresholds of disturbance in relation to specific noise sources. The species characterised by the following characteristics should be considered the most vulnerable to disturbance (Hill et al., 1992): large size, long lifespan, with relatively low reproductive rates; especially specialists to particular habitats, such as exposed (e.g. wetlands) or covered habitats (e.g. forests); rare, with populations concentrated in a few key regions.

In relation to the Project, the main disturbance to wildlife from noise/vibration during seismic survey will fall mainly into the following categories:

- habitat suitability of wildlife will decrease in the work areas and nearby areas, and could also lead to a temporary redefinition of areas used for nesting and/or reproduction by wildlife species;
- wildlife movement may be reduced because of physical barriers, but also to a lesser extent, due to noise and visual impacts.

The Project is expected to potentially affect wildlife species (especially birds and small mammals) that will be displaced from the most affected areas to new home ranges. This may result in an alteration of the wildlife communities, in which opportunistic and ubiquitous species are the less affected.

The seismic survey will be temporary and will be performed only during daytime (so, there is no potential noise impact during the night), while some of the most impacted species perform breeding calls at night (e.g. amphibians, birds) or around dawn (e.g. birds). Therefore, the noise impact will be low. However during the detonation phase, a higher impact may be generated.

Light Pollution

Light pollution is defined as "Any alteration in the amount of natural light present at night and in outdoor environments due to light from anthropic sources". Alteration in day/night equilibrium, caused by direct artificial light could cause substantial harm, especially to animals (i.e. disorientation of nocturnal birds and mammals, death of moths or butterflies caused by the heat produced from the light sources).

Butterflies, and more generally the order Lepidoptera, suffer from disorientation under artificial light conditions. It is well known that moths set their migration route on the moon or very bright stars. Individual light sources or even concentration of artificial lighting, such as in urban areas, may disorient and attract moths. As a consequence, the migration swarm is dispersed, moths may be not able to reach suitable habitats and may be decimated.

Hausmann (1992) conducted research in which he found that the number of moths killed by semi-industrial lamps in areas of southern Italy was considerably high.

Some species of birds using the astronomical orientation in their nocturnal migrations may be affected by the presence of artificial light sources. The effects of light pollution also have an impact on many species of birds (especially forest species) that use morning song to attract specimens of the opposite sex (Kempenaers et al, 2010). In some of these species, the males nearby to the artificial light began to sing well ahead of the normal time, as compared to males located within the forest, away from sources of artificial light.

The Project will not produce significant impacts in terms of light pollution in the area of influence. However, the artificial illumination at the camp site and temporary explosive storage center may produce limited impact on nocturnal fauna.

Modification of the Ecological Network

Landscape fragmentation due to linear survey may promote a process of progressive isolation caused by the lack of ecological permeability to movement and also intra-and interspecific interactions, leading to a high reduction in favourable habitats for many species, particularly in terrestrial vertebrates. However the whole length of the line will not be cleared (only those areas of uneven ground will be smoothed). Considering the policy of minimal clearance will be implemented by eni Myanmar in accordance with eni E&P Standards and that is likely that along the survey lines will be performed small vegetation cutting the fragmentation impact will be not significant.

Furthermore, ecosystem fragmentation occurs not just directly, for example because of buildings, fences or the mere presence of artificial surfaces (pavestone, bare soil, etc.), but also indirectly through noise emissions that could be spread even at a considerable distance from the source. The habitat fragmentation due to noise emission will be minor, because the seismic survey will be very restricted in terms of time. Furthermore the number of detonations and the quantity of blast will be the minimum necessary in order to obtain the required outcome from the survey.

Increasing Collision Rate From Traffic

The "road mortality", i.e. the mortality rates due to collision, is a negative effect of the increased vehicular traffic, which has been greatly increased in the recent decades and is now the top source of wildlife mortality directly caused by humans. The main reasons causing wild animals to cross roads include voluntary crossing, unintentional incursion on the road, feeding on the remains of animals killed by traffic, and seeking micro thermal conditions, nesting sites or shelter.

All wildlife species may be victims of traffic, although reptiles and some mammals are at higher risk than other species. The highest risk situations occur when biological corridors, along which the animals move, cross roads (e.g. roads that interrupt the annual migration of amphibians between feeding, wintering and reproduction areas).

The Project will result in a slightly increase vehicular traffic to and from the base camp. The impact of the slightly increased traffic will be of little consequence on wildlife.

Alien Species

According to the IUCN (International Union for Conservation of Nature and Natural Resources), invasive alien species are the second worldwide leading cause of decline of biological diversity, after the alteration of natural habitats. Article 8 of the Convention on Biological Diversity advocates the prevention of new introductions and the control or eradication of invasive species already established.

Alien species, in particular insects and reptiles, may be directly introduced by vehicles and transport of materials and equipment, both along the seismic line and at the camp. Seismic surveys may also create physical migration pathways.

Mitigation Measures

Before the beginning of the seismic survey, it is important to monitor several wildlife species of conservation interest.

The main actions are the following.

- programs to monitor target wildlife species (i.e. amphibians, reptiles, small mammals and birds). The development of a fauna monitoring campaign is foreseen to provide a record of the variability in species occurrence, abundance and distribution during the project activities in the most sensitive habitats identified within the area of influence of the Project;
- using fences with fine mesh will limit the probability of crossing and access to the camp site and temporary explosive storage center by small vertebrates (e.g. amphibians, reptiles and small carnivores);
- in order to mitigate light pollution on wildlife and to preserve the view of the night sky, artificial lighting (e.g. in the camp site and temporary explosive storage center) will be limited in compliance with best practices. Any lighting required will be a downward directional type in order to minimise light spill to the surrounding area;
- post operam monitoring program will allow to ascertain that populations have not been affected by any potential impact, and to identify eventual compensation actions that might be required;
- a monitoring plan shall be performed for the most invasive alien species, to record their populations in the study area.

In particular, the following mitigation measures will be employed to reduce animal species loss and disturbance and/or displacement of animal species).

- works to be undertaken outside the bird breeding season, and where not possible pre-vegetation clearance surveys to be undertaken;
- waste disposal areas shall be fenced to minimise any interaction with local fauna;
- all personnel to receive appropriate training about the importance of animal conservation and the importance of avoiding disturbance to fauna;
- careful driving will minimise the likelihood of injuring fauna;
- noise sources shall be fitted with mufflers or housing to restrict noise levels;
- all equipment shall be properly maintained to minimise emissions;
- if signs of potential concentrations of wildlife are observed, such as burrow complexes or dense vegetation, these shall be avoided so as not to harm animal populations;
- application of the Waste Management Plan and Emergency Management Plan in case of oil spill scenario;
- mark trees to be cut prior to constructing camp site, temporary explosive storage center access road and seismic lines to prevent the cutting of other trees;

- contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to wildlife;
- hunting and trapping will be specifically prohibited and violations grounds for termination of contract and dismissal;
- remove vegetation at shot hole location areas only;
- minimize the width of corridors;
- do not cut trees of a diameter greater than local regulation permit (in absence of regulation, greater than 20cm); leave in place smaller vegetation, topsoil, root stock, seeds and endangered or protected species used by local communities for commercial or subsistence use;
- mark seismic lines and shot hole sites clearly and prohibit personnel from moving off site onto surrounding land;
- avoid clearing and disturbance in all areas of native vegetation;
- avoid removal of mature tree cover;
- avoid activity in areas of native habitat during peak periods of peak nesting until fledging, for many species this will be between June and September;
- avoid in stream work in Yin river between the beginning of June and end of September (we have a locally reported spawning window June through August);
- conduct a pre-clearing/grading environmental and biodiversity survey of all lines in areas of native vegetation to identify site specific features along individual lines to be avoided and to broaden the local biodiversity data set and ensure there are no "wildlife trees" (trees with large stick nests, cavities, conspicuous signs of wildlife use), dhole dens, concentrations of bank nesting birds. Qualified local field naturalists will record all wildlife observations during these pre-clearing lines surveys;
- where removal of trees with conspicuous stick nests or cavity nests must be undertaken, consider the installation of alternate nest platforms and nest boxes in consultation with qualified professional biologists;
- ensure proper storage and handling of all fuels or other hazardous substance;
- conduct a careful inspection of areas where any riparian work areas to ensure there are no Burmese roofed turtles or their nests in the potentially impacted areas;
- harassment or collection of any wildlife species by seismic crew will not be allowed. Crews will be advised of this as part of their induction. Crews will be encouraged to report any observations of wildlife;
- replanting of high biodiversity value native trees in areas where avoidance of significant individuals is not possible;
- avoid disturbance to any natural or manmade surface water impoundments. Discuss with community the opportunity to enhance water storage of any manmade surface water impoundments to take advantage of the presence of heavy equipment. Care would have to be exercised to ensure this activity did not harm any wildlife resident in the existing water body or productive adjacent habitats.

Conclusions

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the potential impacts on fauna associated with the project are summarized in table below.

Table 6.36 Ranking of Impacts on Fauna - Seismic Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Alteration of abiotic components in ecosystems (air, noise, light pollution)	Between 1 and 5 years . The duration will be long. It may require many months, or potentially years, to recover their original condition, even if remediation technologies are applied.	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: low (1) • Crops lands and green lands: low(1) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (6)** • Urban areas, buildings, roads and urban vegetation: **low (5)** • Crops lands and green lands: **low (5)** • Water bodies, island rivers, river gravels and rock white : **low (6)**
Score	*2*	*1*		*1*	
Modification of the Ecological Network	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: low (1) • Crops lands and green lands: low(1) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (5)** • Urban areas, buildings, roads and urban vegetation: **low (4)** • Crops lands and green lands: **low (4)** • Water bodies, island rivers, river gravels and rock white : **low (5)**
Score	*1*	*1*		*1*	

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Increasing collision rate from traffic	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: low (1) • Crops lands and green lands: low(1) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (5)** • Urban areas, buildings, roads and urban vegetation: **low (4)** • Crops lands and green lands: **low (4)** • Water bodies, island rivers, river gravels and rock white : **low (5)**
Score	*1*	*1*		*1*	

The impact on fauna component due to Project activities is **Low** for the whole territory.

6.2.7 Ecosystem Services

6.2.7.1 Overview

The Ecosystem Services impacts identification has been performed applying the IPIECA Ecosystem Services Guidance (IPIECA, 2011). This guidance approach, it provides a set of checklists to help identify the main habitats involved in the area of influence, ecosystem service dependencies and impacts of oil and gas developments. References to mitigation measures identified in the impact assessment sections are provided in the different matrixes when applicable.

6.2.7.2 Ecosystem Services Sensitivity

According to the baseline data and information analysed and in Section 5 of the ESHIA, the Ecosystem Services are here in after described for each land cover of the Study Area:

- **areas characterized by crops lands and green lands**. Cultivated lands provide food in the form of grains, fruits and vegetables, plant fibers for clothing and other use, and woody products for a variety of uses. In addition some kind of agriculture provide local climate and air quality regulation services (most likely from tree species). Agriculture has a cultural services role, as a source of livelihood and independence. Some areas may have served as cultivated land for generations and hence have cultural significance to the communities and individuals who rely upon them. Project activities can potentially impact the Agricultural area through the loss of temporary livelihood;

- **areas characterized by presence of water bodies, island rivers, river gravels and rock white**. They can provide provisioning services in the form of water, food, fuel and materials for construction. They provide protein to many local communities through fish and shellfish as well as plant plod. Regulating services in these habitat include groundwater recharge, water storage, flood control and water purification (waste assimilation). Ecotourism and bird watching are examples of cultural services. These habitats are particularly recognized for their populations of endemic and migratory birds and protected species. Project activities can potentially impact the River area through the clearance of vegetation, leading to changes in the sensitive balance of water chemistry and downstream water flow and erosion patterns. Introduction of alien-invasive species and fragmentation of habitat can also have implications for native flora and fauna. Disposal of chemicals and wastes in or near the river is usually heavily regulated;

- **areas characterized by presence of bare soil and vegetation**. The areas are dominated by presence of shrubs and bush with forest patches located close to minor tributaries and streams.

6.2.7.3 Seismic Survey

Impacts Identification and Assessment

Table 6.37 Potential Impacts on Ecosystem Services

Sub-activity Issue	Potential Impact	Dependencies on Ecosystem Services			Impacts on Ecosystem Services		
		Provisioning	Regulating	Cultural	Provisioning	Regulating	Cultural
Facility footprint: Construction of Facility (camp site, temporary explosive storage center) and line survey preparation; temporary presence	Modification, fragmentation and loss of habitats and agricultural land. Terrain modification.	Use of local natural materials (e.g. wood) for buildings , etc.	Run-off, erosion and storm controls at site.		Potential reduction of the habitat , in particular -Natural forest: it could reduce the ability to gather wild foods (e.g. fruit, nuts). -Cultivated land: agriculture has a cultural services role, as a source of livelihood and independence. Some areas may have served as cultivated land for generations and hence have cultural significance to the communities and individuals who rely upon them	Loss of carbon sequestration services from clearing vegetation. Reduction in flood and erosion control and water purification by clearing vegetation.	Disturbance (visual, auditory and physical) of wild habitats, iconic species and landscapes
Access: Construction of access roads	Modification, fragmentation and removal of habitats and agricultural land.	Use of local natural materials (e.g. aggregates)	Natural flood and erosion control of surrounding vegetation.		Potential reduction of the habitat , in particular -Natural forest: it could reduce the ability to gather wild foods (e.g.	Loss of carbon sequestration services from clearing trees and vegetation. Reduction in flood and	Disturbance (visual, auditory and physical) of wild habitats, iconic species and

Sub-activity Issue	Potential Impact	Dependencies on Ecosystem Services			Impacts on Ecosystem Services		
		Provisioning	Regulating	Cultural	Provisioning	Regulating	Cultural
	Terrain modification. Noise, dust and vibrations. Visual disturbance.	for roads, etc.			fruit, nuts). -Cultivated land: agriculture has a cultural services role, as a source of livelihood and independence. Some areas may have served as cultivated land for generations and hence have cultural significance to the communities and individuals who rely upon them	erosion control and water purification by clearing vegetation.	landscapes.
Workforce	Disposal and pollution from wastes and wastewater, having visual, physical, biological and chemical impacts. Potential introduction of alien-invasive species.	Use of local natural materials for building camps.	Assimilation service of rivers, soils, etc. disposing of liquid and solid wastes. Water filtration service to provide clean water		Possible pollution of water supply. Potential changes to supply of wild foods through introduction of alien species (typically negative impacts).	Loss of carbon sequestration services from clearing trees and vegetation. Reduction in flood and erosion control and water purification by clearing vegetation.	
Site preparation: Vegetation clearance,	Modification, fragmentation and removal of habitats. Soil				Potential reduction of the habitat , in particular -Natural forest: it could reduce the ability to	Loss of carbon sequestration services from clearing trees and vegetation.	Disturbance (visual, auditory and physical) of wild habitats, iconic

Sub-activity Issue	Potential Impact	Dependencies on Ecosystem Services			Impacts on Ecosystem Services		
		Provisioning	Regulating	Cultural	Provisioning	Regulating	Cultural
excavation, dewatering, trenching	erosion. Water runoff and sedimentation.				gather wild foods (e.g. fruit, nuts). -Cultivated land: agriculture has a cultural services role, as a source of livelihood and independence. Some areas may have served as cultivated land for generations and hence have cultural significance to the communities and individuals who rely upon them	Reduction in flood and erosion control and water purification by clearing vegetation.	species and landscapes
Provisioning workforce: providing food and water, etc.	Depletion of water and local food resources. Reduction in flora and fauna.	Use of local crops, livestock, medicinal plants, water, firewood, etc.			New local market but increased pressure on use of water and wild meat, fruit, nuts, etc. hunted and gathered.	.	Possible reduction in iconic species from increased hunting.
Construction work: Digging, building, etc.	Noise, light, vibrations and dust from construction works affecting flora and fauna. Depletion of natu-	Use of aggregates (sand, gravel, rocks, etc.). Timber from trees. Wa-	Water filtration services to provide clean water.		Disturbance and loss of animals	Interference with natural water supplies downstream (surface and groundwater).	

Sub-activity Issue	Potential Impact	Dependencies on Ecosystem Services			Impacts on Ecosystem Services		
		Provisioning	Regulating	Cultural	Provisioning	Regulating	Cultural
	ral resources for buildings, e.g. cutting forests, excavating sand, etc.	ter, etc.					
Landscape alteration: from presence of the camp site, temporary explosive storage center and construction work	Visual impacts to the local landscape. Import of non-local species.	Visual and aesthetic impact on enjoyment of locals and visitors.					Visual and aesthetic impact on enjoyment of locals and, in case, visitors.
Accidental events: Risk of blow outs, chemical spills, pollution, fires, explosions, etc.	Water, soil and air contamination. Mortality and morbidity to flora and fauna. Noise, fire and smoke.	Use of water to control fires or other natural resources to reduce the impacts. .	Assimilation services (e.g. dilution and microbial action) to help break down and disperse oil and chemicals.		Reduction in provisioning foods and water through contamination by chemicals (actual and perceived).	Reduction of regulating services from loss of habitat extent and quality.	Reduction in local livelihoods, recreation and iconic species through chemical contamination (actual and perceived).

Mitigation Measures

The mitigation measures belong to the Social, Biological or Environmental Impact Assessment Sections, so the relative references have been specified in detail for each impact analysed.

A summary is provided below of the main mitigation measures identified for the components water, soils and subsoils, flora and fauna is reported.

Water:

- no discharge of liquid waste to water resources is envisaged;
- a specific Water and Waste Management Plan will be performed;
- where public sewage system does not exist, suitable pre-treatment systems will be installed, in compliance with any applicable legislation;
- all measures aimed to prevent spillage and runoff will be implemented;
- a stormwater management strategy will be implemented in the Environmental Management & Monitoring Plan.

Soil and Subsoil:

- erosional landforms will be avoided or, if this is no possible, minimized in survey planning;
- no machinery will be allowed to leave the working area or access roadways;
- before starting any work, photographic records will be made of the existing condition of the camp site;
- control of sediment runoff from cleared areas around the watercourse will be implemented;
- minimal cutting of vegetation (including storage center selection and access selection to minimize impacts on areas with relevant vegetation);
- topsoil in stockpiles from topsoil stripping will be vegetated with fast growing seeds to prevent entrainment by wind or rain.

Flora and Vegetation:

- to avoid the loss of vegetation and fauna especially for species of priority importance, as endemic species, a monitoring plan will be performed;
- in order to minimise environmental disturbances earthworks will be limited as much as possible;
- a monitoring plan will be performed for the most invasive alien species, to record their populations in the area;
- ensure all personnel receive appropriate training in the importance of flora and habitats conservation;
- project vehicles and heavy machinery to be restricted to the demarcated corridors;
- conservation of any topsoil and plant debris, to be used during decommissioning activities;
- seeding, hydroseeding and other revegetation techniques will be applied;
- documentation of conditions with photographs and brief report prior to any activity;

- habitat compensation measures to be considered where required;

Fauna:

- using fences with fine mesh will limit the probability of crossing and access to the camp site and temporary explosive storage center by small vertebrates;
- works will be undertaken outside the bird breeding season;
- hunting to be prohibited;
- artificial lighting (e.g. in the camsite and temporary explosive storage center) will be limited in compliance with best practices;
- noise sources shall be fitted with mufflers or housing to restrict noise levels.

Conclusions

The evaluation of the impacts on Ecosystem Services is included in the analysis carried out for the assessment of each component (i.e. social, biological, or environmental) analysed and reported within this Section 6.

6.3 SOCIAL IMPACT ASSESSMENT

6.3.1 Economy and Employment

6.3.1.1 Overview

This section assesses the potential economic and employment impacts associated with the Project. Where significant impacts are foreseen, measures to prevent or mitigate adverse impacts or to enhance positive impacts are included in this report. Based on the assessment of potential impacts, and considering the implementation of the mitigation measures, a summary table of residual impact designations is provided for each area of impact.

Box 6.7 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- *Seismic Survey:* recruitment of workforce; procurement of goods and services; use of local/regional or national waste management companies for management of waste.

Potentially Impacted Resources and Receptors

- Project workers and their households.
- Local, regional and national companies.
- Job seekers.

Project Influencing Factors

- Number of expatriates and locals employed by the Project.
- Wage levels and benefits paid by *eni Myanmar* and contractors.
- Accommodation strategy.
- Duration of employment contracts offered by *eni Myanmar* and contractors.
- Effort demonstrated by the Project to enhance opportunities to the local community.
- Duration of activities.

The following table presents the key impacts of the project on the economy and employment during the key project phases.

Table 6.38 Key Impacts – Economy and Employment

Seismic Survey
• Temporary employment opportunities (positive impact) • Temporary economic impact (positive impact)

The sensitivity of the economy and employment component is reported in the following Sections. The potential impacts relating to each of the project phases (Seismic surveys, and Decommissioning) are described prior to presenting the mitigation measures that will be adopted by the Project.

6.3.1.2 Economy and Employment Sensitivity

Myanmar is primarily an agriculture-based economy; the major agricultural production is rice, which covers about 60% of the country's total cultivated land area. At this stage there isn't detailed information about the economy at level of Study Area, but only at national level.

The sensitivity of the economy into the Block RSF-5 can be evaluated, for each land cover, as following:

- in areas characterized by presence of *bare soil and vegetation,* the sensitivity has been evaluated as **Low**;
- in *urban areas* and areas characterized by *buildings, roads and urban vegetation*, the sensitivity has been evaluated as **High**;
- in areas characterized by *crops lands and green lands,* the sensitivity has been evaluated as **High**;
- in areas characterized by presence of *water bodies, island rivers, river gravels and rock white*, the sensitivity has been evaluated as **High**.

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.39 Economy and Employment Impacts – Seismic Survey

Source of Potential Impact	Potential Impact
Recruitment of local workforce	Temporary employment opportunities (positive impact)
Procurement of local goods and services	Temporary economic impact (positive impact)
Use of local/regional or national waste management companies for management of waste	Temporary employment opportunities (positive impact) Temporary economic impact (positive impact)

The impact assessment on economy and employment described in the following sections is based on the analysis of the source of potential impact reported in the previous Table 6.39.

Impacts Identification

The main project activities and stressors with the potential to impact the regional and local economy during the seismic survey phase are:

- the recruitment of workforce;
- the procurement of goods and services;
- the use of local/regional or national waste management companies for the management of domestic wastes.

These activities involve potential positive impacts on the regional and local economy during the seismic survey phase, related to the creation of employment and economic development and diversification.

Employment Impacts

The direct employment will be at local level and temporary. Workforce will be engaged only for a limited period of few days; as seismic activities will progressively proceed, workers will be replaced with others from nearby settlements.

eni Myanmar will contract a specialist survey company to undertake the work; the survey crew will consist of labourers and drivers, in addition to field technical staff. It is expected that the workforce will consist of a mixture of Burmese sourced from the local area and expatriates employed who will be normally expected to move with them. Unskilled workers are generally sourced from local communities.

During camp construction, 30 – 50 workers will be employed and supplies (such as laterite, selected fill material, fuel, water) and services (accommodation, waste management) will be required. The composition of the crew will depend on actual contracting companies, most of which will be Myanmar subsidiaries of international companies. An onsite camp will be developed for workers.

During seismic operations, maximum of 600 workers will be employed and, consequently, supplies (such as fuel, food and water) and services (accommodation, waste management) will be required.

IEM surveyed approximately 400 households in this region. Results indicated that 16% had an annual income less than 500,000 kyat (~$500 USD); 32% had an annual income of 500,000-1,000,000 kyat (~$500 - $1000 USD); and 22% had an annual income of over 1,000,000 to 2,000,000 kyat (~$1,000 to $2,000).

Of those interviewed 2% indicated that oil and gas drilling will be extremely important to the community; 3% indicated it would be very important; while 42% indicated that oil and gas drilling would be important to their community.

When asked what positive impacts from the project they anticipated increased annual income (42%), increased employment (37%), and improved living conditions (25%).

The creation of indirect employment is expected to be important on a regional and local level. Indirect employment includes people working for enterprises providing goods and services for the project, i.e., suppliers. Efforts shall be made to use local facilities, goods and services such as food and water, laundry services and waste transport.

Induced employment refers to the jobs created through spending in the local economy by both direct and indirect employees. However, local spending by project personnel may be limited during this phase as the majority of workers will be provided with accommodation, food and other services within the camp site.

eni Myanmar has a policy to encourage the hiring of local staff and contractors. Advance meetings with local authorities on approaches to hiring will help eni Myanmar design hiring to maximise the positive effects and limit the loss of labour availability to local businesses at critical times (i.e. harvest).

Economic Impacts

The local economy is likely to benefit from an increase in spending and earning of personnel employed by the Project or of households and individuals owning services and facilities in the area surrounding the Project.

There may also be induced impacts on the economy as a result of the Project. It is likely that additional employment opportunities will result from spending by employees hired by *eni Myanmar* or by contractors during the seismic survey phase. Local and non-local workers are likely to spend part of their income on local accommodation, goods, services and facilities in general, even if they will be located in a work camp. Their integration into

nearby communities could elicit indirect growth and local development of municipalities surrounding the Project Area.

Economic impacts will stem from procurement of goods and services by the Project, induced economic effects of spending by Project employees. The economic impact from purchase of goods and services will primarily accrue at a regional or national level rather than at the local level unless local community procurement is specifically targeted by the Project. The economic impact of spending in the local economy by Project employees is expected to be significant.

The major economic impacts will be registered around local businesses such as food vendor, kiosk/grocery store and rent houses. Workers consumption at local level with therefore represent a multiplier effect of community economic development.

Mitigation Measures

eni Myanmar and its sub-contractors will recruit labour force locally and work with local businesses. The following measures will be implemented to minimise any potential adverse impact on economy and employment and enhance any positive ones.

- capacity Building: work to enhancing the capacities of potential local partners (work-force, contractors and suppliers) to deliver to the highest health, safety, social and environmental standards and thus contribute to the competitiveness of local procurement and opportunities;
- sourcing local goods and services: purchasing of local goods will be optimised as much as possible;
- integrity of recruitment process: equal opportunities and non-discrimination will be guaranteed in the recruiting process. There will be no distinction, exclusion or preference in the recruitment made on the basis of "race, colour, gender, religion, political opinion, marital status, national extraction or social origin, disability, age, sexual orientation, and/or HIV status" Selection criteria will include minimum age (to avoid child labour) and skills requirements. All contractors will be required to implement the hiring guidelines. All job vacancies will be listed clearly with skills and experience required to fill the position, as well as the duration of the employment contract. Clear information on the recruiting process and the selection criteria will be publically available and easy to access to promote transparency of the process;
- managing public expectations: the Project will provide clear information on the number and timescales of employment opportunities, trying to fulfil as much as possible expectations of the community and thus avoid calling effect into the Project area;
- managing influx of non-local job seekers: manage the influx of non-local job seekers to avoid exacerbating urban poverty and plan for provision of social infrastructure;
- meet with local authorities to discuss and design local employment hiring to limit impacts on local businesses and key agricultural seasons;
- employ qualified local workers;
- purchase local supplies and services, whenever possible;
- host a pre-project local community awareness program with communities to facilitate awareness of opportunities and benefits;
- terms of contract for recruitment of manpower in these companies needs to include emphasis on hiring locals, especially for unskilled and semi-skilled workforce;
- restrict workers to within project boundaries and do not allow local interaction within the communities.

Conclusion

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the potential impact significance on economy and employment associated with the seismic survey are summarized in Table 6.40.

Table 6.40 Ranking of Impacts on Economy and Employment – Seismic Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Temporary employment opportunities – regional level (positive)	Less than 1 year / Temporary	Regional scale: as determined by country's administrative boundaries	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: high (3) • Water bodies, island rivers, river gravels and rock white : high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (5)** • Urban areas, buildings, roads and urban vegetation: **medium (7)** • Crops lands and green lands: **medium(7)** • Water bodies, island rivers, river gravels and rock white : **medium(7)**
Score	*1*	*2*		*1*	
Temporary employment opportunities– local level (positive)	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: high (3) • Water bodies, island rivers, river gravels and rock white : high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (4)** • Urban areas, buildings, roads and urban vegetation: **low (6)** • Crops lands and green lands: **low (6)** • Water bodies, island rivers, river gravels and rock white : **low (6)**
Score	*1*	*1*		*1*	

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Temporary economic impact – national level (positive)	Less than 1 year / Temporary	National scale: Entire country	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: high (3) • Water bodies, island rivers, river gravels and rock white : high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (6)** • Urban areas, buildings, roads and urban vegetation: **medium(8)** • Crops lands and green lands: **medium(8)** • Water bodies, island rivers, river gravels and rock white : **medium(8)**
Score	*1*	*3*		*1*	
Temporary economic impact – local level (positive)	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: high (3) • Water bodies, island rivers, river gravels and rock white : high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (4)** • Urban areas, buildings, roads and urban vegetation: **low (6)** • Crops lands and green lands: **low (6)** • Water bodies, island rivers, river gravels and rock white : **low (6)**
Score	*1*	*1*		*1*	

The development of the Project can represent a good opportunity for recruitment since it will give the possibility to persons to get a new job and new skills during the seismic phase. Furthermore, people involved in these activities will probably get a new job easier, thanks to the new capacities developed and the training followed.

In conclusion, the impacts on the economy and employment component, due to Project construction activities, can be considered **Positive**.

6.3.2 Infrastructures and Public Services

6.3.2.1 Overview

This section presents the potential impacts on existing infrastructure and public services as a result of the seismic survey activities.

The box below shows the key sources of impact and the potentially impacted resources and receptors.

Box 6.8 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- *Seismic Survey:* site clearance and preparation activities; work camp location for the drill crew; increased project traffic; production and management of solid and liquid wastes.

Potentially Impacted Resources and Receptors

- Community and worker road users and communities nearby the Project.
- Emergency services and hospitals.
- Local accommodation facilities.
- Utilities such as water, sanitation, electricity.

The following table presents the key impacts of the project on infrastructure and public services during the key project phases.

Table 6.41 Key Impacts – Infrastructures and Public Services

Seismic Survey
• Degradation and temporary disruption of road infrastructures • Increased pressure on public services and utilities and on health care facilities

The sensitivity of the infrastructures and public services component is reported in the following Sections. The potential impacts relating to the project activities are described prior to presenting the mitigation measures that will be adopted by the Project.

6.3.2.2 Infrastructures and Public Services Sensitivity

The sensitivity of the economy into the Block RSF-5 can be evaluated, for each land cover, as following:

- In areas characterized by presence of *bare soil and vegetation,* the sensitivity has been evaluated as **Low**.
- In *urban areas* and areas characterized by *buildings, roads and urban vegetation*, the sensitivity has been evaluated as **Moderate**.

- In areas characterized by *crops lands and green lands,* the sensitivity has been evaluated as **Moderate**.
- In areas characterized by presence of *water bodies, island rivers, river gravels and rock white*, the sensitivity has been evaluated as **Low**.

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.42 Infrastructures and Public Services Impacts – Seismic Survey

Source of Potential Impact	Potential Impact
Work Camp location for the drill crew	Increased pressure on public services and utilities Increased pressure on health care facilities
Movement of vehicles mobilization of equipment, raw materials and personnel	Degradation and temporary disruption of roads

The impact assessment on infrastructures and public services described in the following sections is based on the analysis of the source of potential impact reported in the previous Table 6.42.

Impacts Identification

The main project activities and stressors with the potential to impact negatively on the local infrastructure during the seismic survey phase are:

- work camp location for the crew;
- movement of vehicles mobilization of equipment, raw materials and personnel;
- production and management of solid and liquid wastes.

The following types of potential impacts have been identified:

- degradation and temporary disruption of roads;
- increased pressure on public services and utilities;
- increased pressure on health care facilities.

Degradation and temporary disruption of road infrastructures

Transportation of goods and scientific equipment will be as limited as possible and existing roads and tracks will be used. The large part of vehicles movement will be related to the receivers positioning and equipment mobilization.

Nevertheless, an arise of heavy machinery and truck traffic, equipment and procurement of materials is expected and the existing roads could be deteriorated as a result. The detailed information concerning the involved staff and vehicles will be provided once the contractor will be selected.

Transportation for the seismic survey consists of personnel and equipment transportation. Transportation of personnel and equipment is expected to occur with various size trucks, amounting to approximately 100 trips/day. There are several highways within the project area that will be used for this project. Local roads within districts and villages will also be used during the project period.

Transportation of personnel and equipment is not a constant activity throughout the day. Getting to and from the working area will result in a temporary and local increase in vehicles on the roads. The increase of 100 trips per day will not result in a major increase in traffic. The combination of road surface deterioration and increased traffic volume could potentially cause an increase in road accidents and disturbance to the population (air emissions and noise), having an indirect impact on the health and welfare of the community.

This seismic survey uses explosives as the seismic source. Explosives and detonators will be imported from overseas. After arrival, explosives and detonators will be transported by truck to a temporary storage area. The temporary explosive storage center will be approximately 50-km away from the field office. Without proper mitigation measures, this transport could be highly dangerous.

Explosives, detonators and accessories have been imported into Myanmar. *eni Myanmar* will especially pay serious attention to the security of explosives and detonators to be used in the seismic works. The seismic contractor under the contract with *eni Myanmar*, will take care of the transportation and security through the cooperation with MOGE and any other relevant authorities. eni Myanmar and the Seismic Contractor have to strictly manage the explosive and detonator inventory records; 24 hour security will be kept at the explosive magazine sites.

The project contractor has implemented mitigation measures for dangerous explosives transportation. Explosives transportation to the project site will use registered vehicles that comply with transportation of dangerous materials requirements.

Every day a contractor convoy will bring the explosives from the field storage to the line. The collection of the remaining amount will finish before dark. At the work site, explosives and detonators will be contained in secured day-boxes until used or returned to storage magazines. Explosive and detonator products will be transported separately in fully-enclosed, locked, fire-resistant fixed containers or compartments, separate from the passenger compartment. The use of trailers will not be permitted during explosives transport. Vehicles transporting explosives will operate in a safe manner consistent with prevailing road and weather conditions. In no case a vehicle transporting explosives will be operated at a speed higher than 50 km/h. Vehicles transporting explosives will not be loaded more than the 80% of the manufacturer's rated carrying capacity for the vehicle.

The mitigation measures required by laws and implemented by the contractor will reduce impacts from explosives transportation for the seismic survey to people who live along transportation routes. Should the unlikely event of an accident occur, it is conceivable that traffic could be affected for a short-time.

Increased Pressure on Public Services and Utilities

During the seismic survey, 600 workers will be employed. Most of the workers for non-skilled jobs will be from the communities around the project area. This employment will increase income of the local people and also stimulate local businesses and services. Workers will be employed for 6 months.

Services and utilities (i.e. water supply, wastewater and sanitation services, electricity supply, potable water supply, and solid waste management) will be purchased from local suppliers, where possible.

All waste materials will be collected, stored and transported separately in appropriate and approved bins and containers. Only approved companies will be charged with the transportation, recycling and disposal of waste. This process will be closely aligned with the responsible authorities.

Increased Pressure on Health Care Facilities

Project employees will potentially utilise local health facilities located in nearby villages. Increased pressures on community health infrastructure may occur as a result of the influx of Project workers and activities. This may place a strain on existing public health infrastructure, which is already considered to have limited capacity based on stakeholder indications of limited health staff and hospital beds and corresponding long waiting times at public hospitals. Any impacts from reduced access to health infrastructure will be localised.

Mitigation Measures

As general mitigation measures, methods will be implemented to maintain open, clear and transparent communication with the local communities regarding the use of local infrastructures of the project throughout the different phases. A rapid response grievance mechanism will also be implemented.

The following specific mitigation measures shall be employed during the seismic survey phase to reduce impacts on local infrastructures.

Degradation and temporary disruption of road infrastructures

Impacts from transportation of personnel and equipment can be mitigated through the use of the following measures.

- follow speed limits of 80 km/hour on highways (unless otherwise posted), 60 km/hour on lateritic roads, 20 km/hour in villages or communities, and 80 km/hour on paved roads outside Yangon within the project site and on main roads;
- ensure all vehicles are in good operating condition and comply with project safety standards. Drivers must be healthy, have valid licenses, and by no means allowed to drink alcohol or take forms of medicine or illicit drugs that can affect driving capacities;
- weight of the trucks shall not exceed the limit set by the Myanmar regulations to reduce damage to road surfaces or structures;
- safety equipment and communication equipment must be installed on vehicles such as VHF radio, safety belts and portable fire extinguisher etc. as per company standards;
- maintain and repair all public and private roads that are damaged by project activities;
- all vehicles must be left hand drive;
- post and enforce speed limit (follow traffic law on highway and community area, 30km/hr on unsealed road);
- notify the local authority on the oversized load and put an escort in-front of this convoy with horn and hazard lights;

- restrict/ avoid movement of heavy equipment during rush hours;
- provide traffic signs or flags at junction of access roads and main roads;
- investigate any complaints and handle appropriately. Keep records of complaints and follow-up;
- if the project needs to construct, upgrade or reroute access roads, the Operator must get permission from the appropriate government offices;
- strictly enforce training programs to reduce transport incident cases by its contractors;
- restore any damage to roads as caused by contractor or company;
- purchase or lease land for road access to camp site and temporary explosive storage center;
- restrict local traffic on *eni Myanmar* private access roads;
- cooperate with Military for storage and transport of explosives;

Mitigation Measures for Public Services and Utilities

The project will not use the electrical infrastructure; all power will be generated on site.

The overall objective is to minimise the impacts of waste generated during the construction phase through the following.

- minimise the amount of waste that is generated;
- maximise the amount of waste that is recovered for recycling, including segregation of recyclable wastes at source;
- minimise the amount of waste that is deposited at landfill;
- ensure all wastes are properly contained, labelled and disposed of in accordance with local regulations;
- dispose of waste in accordance with the waste management plan.

Mitigation Measures for Health Care Facilities

The Project will pursue a prevention strategy to reduce the needs for clinic/medic consultations. All workers will receive health and safety trainings to raise their awareness on health and safety risks and correct behaviours. Workers will be provided with primary health care and basic first aid at worksites. *eni Myanmar* will develop Emergency Response Plans (ERPs) taking into account access to health care, major incidences, multiple casualty events and pandemics. These will be developed in consultation with national emergency providers and local health care facilities and will cover all contractors and subcontractors as well as consideration of the local community. The Project will provide health care for any member of the community injured as a result of Project activities.

Conclusion

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the potential impact significance on infrastructures and public services associated with the seismic survey are summarized in Table 6.43.

Table 6.43 Ranking of Impacts on Infrastructures and Public Services– Seismic Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Degradation and temporary disruption of road infrastructures	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: moderate (2) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (4)** • Urban areas, buildings, roads and urban vegetation: **low (5)** • Crops lands and green lands: **low(5)** • Water bodies, island rivers, river gravels and rock white : **low(4)**
Score	*1*	*1*		*1*	
Increased Pressure on Public Services and Utilities	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: moderate (2) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (4)** • Urban areas, buildings, roads and urban vegetation: **low (5)** • Crops lands and green lands: **low(5)** • Water bodies, island rivers, river gravels and rock white : **low(4)**
Score	*1*	*1*		*1*	

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Increased Pressure on Health Care Facilities	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: moderate (2) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (4)** • Urban areas, buildings, roads and urban vegetation: **low (5)** • Crops lands and green lands: **low(5)** • Water bodies, island rivers, river gravels and rock white : **low(4)**
Score	*1*	*1*		*1*	

The potential impact on infrastructures and public services, due to the seismic survey, results as **Low** for the whole territory.

6.3.3 Land and Livelihood

6.3.3.1 Overview

This section presents the potential impacts on land and livelihoods as a result of Project related activities.

The box below shows the key sources of potential impacts and the resources and receptors.

Box 6.9 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- *Seismic Survey:* camp site; temporary explosive storage center, access roads and site access; line survey and upholes.

Potentially Impacted Resources and Receptors

- Households owning or working on land with parcels that cross into Project land areas.
- Business activities in the municipality directly and indirectly affected by the Project

Project influencing factors
- Work sites, laydown areas and other temporary infrastructure.
- Drilling area and work sites during construction.

The following table presents the key impacts of the project on land and livelihood during the project activites.

Table 6.44 Key Impacts – Land and Livelihood

Seismic Survey
• Temporary land take corresponding to the camp site and temporary explosive storage center • Temporary loss of livelihoods and household income • Disturbance to/interruption of crop production

The sensitivity of the land and livelihood component is reported in the following Sections. The potential impacts relating to the main project activities are described prior to presenting the mitigation measures that will be adopted by the Project.

6.3.3.2 Land and Livelihood Sensitivity

The sensitivity of the economy into the Block RSF-5 can be evaluated, for each land cover, as following:

- in areas characterized by presence of *bare soil and vegetation,* the sensitivity has been evaluated as **Low**;
- in *urban areas* and areas characterized by *buildings, roads and urban vegetation*, the sensitivity has been evaluated as **Moderate**;
- in areas characterized by *crops lands and green lands,* the sensitivity has been evaluated as **High**;
- in areas characterized by presence of *water bodies, island rivers, river gravels and rock white*, the sensitivity has been evaluated as **Moderate**.

6.3.3.3 Seismic Survey

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.45 Land and Livelihood Impacts – Seismic Survey

Source of Potential Impact	Potential Impact
Camp site	Temporary land take corresponding to the camp site
Temporary explosive storage center	Temporary land take corresponding to the storage center
Access roads and site access	Temporary loss of livelihoods and household income
Line survey and upholes	Disturbance to/interruption of crop production

The impact assessment on land and livelihood described in the following sections is based on the analysis of the source of potential impact reported in the previous Table 6.45.

Impacts Identification

During seismic survey, some portion of land will be used and consequently cause soil loss, for:

- Camp site;
- Temporary explosive storage center;
- Access roads and site access;
- Line survey and upholes.

In detail, the expected occupied land use for the seismic survey will be related to the temporary occupation of the camp site, the temporary explosive storage center and the source locations and the down-hole drilling locations. All the facilities will be placed in bare lands or in arable lands.

The locations of the charges will be spread all over the Study Area and they will regard very small portions of land as stated in the previous paragraphs. Local agricultural activities can be temporarily stopped in the neighbourhood of the receiving lines in case big machinery is involved.

After the project activities, the sites will be restored to their original condition.

Mitigation Measures

The Project will take into consideration that specific levels of impact among household livelihoods as dependent on the following:

- proportion of productive land temporarily lost per household;
- the household's current level of income;
- level of dependence on the land;
- alternative livelihood options;
- the length of time it takes to restore soil quality post construction.

In all cases the commitment of the Project will be to restore economic livelihoods to pre-Project levels. Moreover all affected households will be compensated for any loss of assets at full replacement cost and assisted to improve or at least restore their livelihoods.

The restoration of livelihoods will be designed to meet the needs of affected stakeholders and established with their involvement.

Conclusion

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the potential impact significance on land and livelihood associated with the seismic survey are summarized in Table 6.46.

Table 6.46 Ranking of Impacts on Land and Livelihood – Seismic Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Temporary land take corresponding to the camp site and temporary explosive storage center	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: moderate (2) • Crops lands and green lands: high (3) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (4)** • Urban areas, buildings, roads and urban vegetation: **low (5)** • Crops lands and green lands: **low(6)** • Water bodies, island rivers, river gravels and rock white : **low(5)**
Score	*1*	*1*		*1*	
Temporary loss of livelihoods and household income.	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: moderate (2) • Crops lands and green lands: high (3) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (4)** • Urban areas, buildings, roads and urban vegetation: **low (5)** • Crops lands and green lands: **low(6)** • Water bodies, island rivers, river gravels and rock white : **low(5)**
Score	*1*	*1*		*1*	

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Disturbance to/interruption of crop production	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: moderate (2) • Crops lands and green lands: high (3) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (4)** • Urban areas, buildings, roads and urban vegetation: **low (5)** • Crops lands and green lands: **low(6)** • Water bodies, island rivers, river gravels and rock white : **low(5)**
Score	*1*	*1*		*1*	

The potential impact on land and livelihood, due to the seismic survey, results as **Low** for the whole territory.

6.4 CULTURAL IMPACT ASSESSMENT

6.4.1 Cultural Heritage

6.4.1.1 Overview

This section identifies and assesses the main potential impacts on cultural component over the Project area that may arise as a result of the Project activities and proposes mitigation and management measures.

The following box shows the key sources of impact and the potentially impacted resources and receptors.

Box 6.10 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- *Seismic Survey*: vibration caused by charges blast; pollution; movement of vehicles, equipment and personnel.

Potentially Impacted Resources and Receptors

- Archaeological sites, monuments, sites with cultural heritage value.

Project Influencing Factors

- Cultural Heritage Management Plan, Chance Finds Protocol.

The following table presents the key impacts of the project on cultural heritage sites during the key project phases.

Table 6.47 Key Impacts –Cultural Heritage

Seismic Survey
• Disturbance due to emission of vibration • Disturbance of topsoil and subsoil and potential destruction of archaeological resources during the line clearance

The sensitivity of the cultural component is reported in the following Sections. The potential impacts relating to the project phases are described prior to presenting the mitigation measures that will be adopted by the Project.

6.4.1.2 Cultural Heritage Sensitivity

A total of 96 temples have been identified through an analysis of currently available data within the Study Area of Block RSF-5. At this stage, it isn't possible to determine if some temples are located along the route of the seismic survey, however every important sites for historical-archaeological and cultural heritage will be identified and avoided as appropriate.

With regard to the chance to find unmapped Cultural heritage sites, the sensitivity of the cultural heritage into the Block RSF-5 has been evaluated for each land cover, as following.

- In areas characterized by presence of *bare soil and vegetation,* the sensitivity has been evaluated as **Moderate**.
- In *urban areas* and areas characterized by *buildings, roads and urban vegetation*, the sensitivity has been evaluated as **Moderate**.
- In areas characterized by *crops lands and green lands,* the sensitivity has been evaluated as **Low**, due to the presence of agricultural plots, which imply a periodic mixing of surface soil, and therefore a less likely of chance finds.
- In areas characterized by presence of *water bodies, island rivers, river gravels and rock white*, the sensitivity has been evaluated as **Low**.

Regarding the seismic survey, the following sources of potential impact have been identified.

Table 6.48 Cultural Heritage Impacts – Seismic Survey

Source of Potential Impact	Potential Impact
Line clearance	Disturbance of topsoil and subsoil and potential destruction of archaeological resources
Use of charges for seismic data acquisition	Degradation or collapse of cultural heritage sites due to vibration
Use of machinery and heavy equipment	Degradation or collapse of cultural heritage sites due to vibration

The impact assessment on cultural heritage described in the following sections is based on the analysis of the source of potential impact reported in the previous Table 6.48.

Impacts Identification

The main project activities and stressors with the potential to impact the archaeology and cultural heritage during the seismic survey phase are:

- line clearance activities;
- use of charges that will be blasted with a remote sensor;
- use of machinery and heavy equipment.

These activities may potentially impact archaeological artefacts located in the proximity of project activities, causing direct physical disturbance or damage to archaeological/cultural heritage sites, and degradation or damage to archaeological/cultural heritage sites, due mainly to vibration.

Direct physical disturbance or damage to cultural heritage sites

Line clearance activities will result in the disturbance of topsoil and subsoil; ground-disturbing activities, indeed, have the potential to damage archaeological resources.

Degradation or damage to cultural heritage sites due to vibration

Cultural heritage sites are subject to impacts from vibration caused by the micro charges blast, but also by operation of machinery and heavy vehicle traffic. Depending on their structural condition, sites with standing or partially standing features may be at risk of degradation or collapse due to vibration.

Ancient remains/archaeological sites can be divided into two classes: ancient remain/archaeological sites with high risk and ancient remain/archaeological sites with low risk or no risk. Township officials identified no archaeological resources during the public consultation. The distinction of high and low risk is based on the distance to the seismic line. A safety distance as determined by international guidelines or a Peak Particle Velocity must be followed to prevent damage to archaeological sites/features, historical sites or cultural resources. Implementation of these safety distances will result in undetectable vibration.

Work in the vicinity of any historical structures will be determined based on following set-back distances that ensures that particle velocity of <2 mm/sec is maintained.

A detailed topographic surveying of the seismic lines will be done prior to shooting. This topographic survey will determine the exact location of the seismic lines and distance to each of the historic and cultural sites. If any sites are within the safety distance, the project team will shift the seismic line or shot hole to an appropriate location to meet the safety distance and to minimize the potential impact from vibration.

If the seismic line cannot be easily relocated to the safety distance and the information is crucial to the integrity of the survey, a vibration test including PPV and Frequency will be conducted to determine the vibration values at various distances within 2,000 m using the same kg. charge. The data will be used to determine a site-specific safety distance for this project to prevent any damage to archaeological sites.

Mitigation Measures

The 3D seismic survey extends for approximately 520 sq. km equal to 130,000 acres. The acquisition layout is represented by a symmetric grid of 450 m by 450 m of receiver and source lines perpendicular each other.

Along the source line, for what concern the part of the seismic survey performed with micro-charges, this technique does not require main site clearance. The source locations will be selected in such a way to minimize the site clearance and anyway, the charge positioning will involve very few square meters of land. A policy of minimal clearance will be implemented by *eni Myanmar* in accordance with *eni* Standards. Controls will be in the form of instructions given to the seismic crew and on-site daily supervision by *eni Myanmar* Superintendent.

The seismic survey will be conducted mainly with the use of vibroseis, so it is likely that, when using this technique, the survey lines will be needing of more vegetation and loose material site clearance because the surface of the source line must be smooth enough to enable the vibroseis to progress unimpeded for seismic acquisition.

Any identified requirement for line clearance using invasive machinery such as bulldozer will need the formal approval of eni Myanmar Superintendent before being undertaken.

The use of bulldozer, trucks, crane and other mean of transportation will be limited only to guarantee the safe access to these areas, but never applied within the forest and the plantations. Anytime the eni Myanmar Superintendent will be requested to approve these kind of operations. Any identified requirement for line clearance using invasive machinery such as bulldozer will need the formal approval of *eni Myanmar* management before being undertaken.

Avoidance is the preferred mitigation measure: the charges shall be blasted at an adequate distance from the known sites: a visual inspection will be conducted along the route and any important sensitivity of high scientific or cultural value will be identified and avoided as appropriate.

If a chance find of high importance will be discovered during seismic activities, the route will be changed and rescue procedures shall be conducted as outlined by international and national standards. Additionally, the following mitigation measures will be implemented:

- comply with established shot hole set back distances;

- watch for artefacts during site construction and inform the Ministry of Culture before commencement of drilling;
- report to the Local Archaeological Department if any archaeological evidence is discovered at the camp and temporary explosive storage center or access roads. The project proponent will cease all activity until the local Archaeological Department verifies and considers the evidence. Through consultation, a plan to proceed will be developed;
- if artefacts are found during the construction phase, *eni Myanmar* will inform the responsible local office within 48 hours;
- consult with local authorities to identify culturally important festivals and plan transportation, construction and drilling activities to avoid impact;
- *eni Myanmar* community liaison officer to monitor possible impact/change on local cultural heritage of any nature;
- review any records for site specific location;
- conduct a visual inspection of the site by qualified personnel (e.g. experienced consultant, government archaeologist etc.);
- monitor earthwork during construction using qualified/trained inspector;
- notify Department of Archaeology, National Museum and Library, Ministry of Culture within 48 hours if significant or suspicious remains / ruins are detected;
- if work is suspended implement approved plan for mitigation (e.g. documentation and salvage, develop immediately adjacent site if feasible etc).

Conclusion

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the potential impact significance on cultural heritage associated with the seismic survey are summarized in Table 6.49.

Table 6.49 Ranking of Impacts on Cultural Heritage – Seismic Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Physical disturbance or damage to cultural heritage sites	Less than 1 year / Temporary *1*	Local scale: the proposed operating site and its immediate environs *1*	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: moderate (2) • Crops lands and green lands: low (1) • Water bodies, island rivers, river gravels and rock white : low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species *1*	• Bare soil and vegetation: **low (5)** • Urban areas, buildings, roads and urban vegetation: **low (5)** • Crops lands and green lands: **low(4)** • Water bodies, island rivers, river gravels and rock white : **low(4)**
Degradation or collapse due to vibration	Less than 1 year / Temporary *1*	Local scale: the proposed operating site and its immediate environs *1*	• Bare soil and vegetation: moderate (2) • Urban areas, buildings, roads and urban vegetation: moderate (2) • Crops lands and green lands: low (1) • Water bodies, island rivers, river gravels and rock white : low (1)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species *1*	• Bare soil and vegetation: **low (5)** • Urban areas, buildings, roads and urban vegetation: **low (5)** • Crops lands and green lands: **low(4)** • Water bodies, island rivers, river gravels and rock white : **low(4)**

The potential impact on landscape, due to the seismic survey, results as **Low** for the whole territory.

6.5 VISUAL IMPACT ASSESSMENT

6.5.1 Landscape

6.5.1.1 Overview

This section identifies and assesses the main potential impacts on visual component over the Project area that may arise as a result of the Project activities and proposes mitigation and management measures.

The following box shows the key sources of impact and the potentially impacted resources and receptors.

Box 6.11 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- *Seismic Survey*: presence of camp site, temporary explosive storage center and equipment, machinery and vehicles.

Potentially Impacted Resources and Receptors

- Panoramic views.
- Landscape elements which have symbolic value for the local community.
- Inhabitants.

Project Influencing Factors

- Volumes and elements position.

The following table presents the key impacts of the project on landscape quality during the key project phases.

Table 6.50 Key Impacts –Landscape

Seismic Survey
• Temporary visual impacts for the presence of camp site, temporary explosive storage center and equipment, machinery and vehicles • Temporary visual impacts along the seismic lines for the presence of machinery and vehicles • Light pollution during the night period due to the presence of the camp site and temporary explosive storage center

The sensitivity of the landscape component is reported in the following Sections. The potential impacts relating to the project phases are described prior to presenting the mitigation measures that will be adopted by the Project.

6.5.1.2 Landscape Sensitivity

The sensitivity of the landscape into the Block RSF-5 can be evaluated, for each land cover, as following:

- in areas characterized by presence of *bare soil and vegetation,* the sensitivity has been evaluated as **High**;
- in *urban areas* and areas characterized by *buildings, roads and urban vegetation*, the sensitivity has been evaluated as **Low**;
- in areas characterized by *crops lands and green lands,* the sensitivity has been evaluated as **Moderate**;
- in areas characterized by presence of *water bodies, island rivers, river gravels and rock white*, the sensitivity has been evaluated as **High**.

6.5.1.3 Seismic Survey

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.51 Landscape Impacts – Seismic Survey

Source of Potential Impact	Potential Impact
Camp site preparation of temporary facilities (camp site; temporary explosive storage center, access roads)	Temporary visual impacts for the presence of camp site and equipment, machinery and vehicles
Line clearance and seismic data acquisition	Physical changes to landscape elements for line clearance along the seismic lines Temporary visual impacts along the seismic lines for the presence of machinery and vehicles
Lighting equipment of the camp site and temporary explosive storage center	Light pollution during the night period due to the presence of the camp site and temporary explosive storage center

The impact assessment on landscape described in the following sections is based on the analysis of the source of potential impact reported in the previous Table 6.51.

Impacts Identification

During the seismic survey, the presence of temporary facilities as the camp site, temporary explosive storage center and the presence of machinery, equipment and vehicles could generate a visual impact; this will be temporary and limited to small areas.

Direct impacts will include the following:

- direct landscape losses or physical changes to landscape elements, including loss of vegetation, arising from line clearance. The source locations will be selected in such a way to minimize any site clearance, in any case the charge positioning will involve very few square meters of land and no invasive line clearance will be performed. The source lines will be cleared and smoothed using non-invasive techniques, where possible, and not the whole length of the line will be cleared but only those areas of uneven ground will be smoothed. Given the topography and surface conditions reported in the environ-

mental baseline, it is anticipated that no bulldozing or invasive line clearance operations are expected so far;
- direct changes to the receiving landscape resulting from the introduction of temporary structures and facilities in correspondence of the camp site and temporary explosive storage center;
- presence of machinery and vehicles associated with the seismic survey activities;
- lighting impact: for safety reasons, the camp site will be illuminated during night time.

Considering that:

- the camp site and temporary explosive storage center facilities will not significantly change landscape features, since their height is relatively small;
- the area will be occupied only temporarily;
- any important sensitivity in the project areas (e.g. infrastructures, areas of significant vegetation cover, sensitive cultivations, important sites for cultural heritage, etc.) will be identified and avoided as appropriate;
- at the end of this phase, camp closure will involve the removal of all vehicles, equipment, infrastructure and fixtures.

It is not foreseen a significant impact on landscape due to the seismic survey.

Mitigation Measures

Particular mitigation measures are not needed during the seismic survey; only the reinstatement of the originally land cover will be carried out along the seismic lines and in correspondence of the camp site and temporary explosive storage center.

Any vegetation cut during the site clearance will be placed over the site to reduce erosion; a photographic record will be made of the final condition of the site following closure and it will be compared to images taken of the location immediately prior to camp construction to verify that the site has been returned to as close as possible to its original state.

Some appropriate mitigation measures will also be put in place in order to reduce the light pollution, as the follow:

- use a lower level of lighting; it will be sufficient to enhance the night time visibility required for safety and security;
- use specifically designed lighting equipment that minimises the upward spread of light near to and above the horizontal.

Conclusion

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the potential impact significance on landscape associated with the seismic survey are summarized in Table 6.52.

Table 6.52 Ranking of Impacts on Landscape – Seismic Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Physical changes to landscape elements (camp site, temporary explosive storage center and seismic lines)	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: high (3) • Urban areas, buildings, roads and urban vegetation: low (1) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (6)** • Urban areas, buildings, roads and urban vegetation: **low (4)** • Crops lands and green lands: **low(5)** • Water bodies, island rivers, river gravels and rock white : **low(6)**
Score	*1*	*1*		*1*	
Visual impacts due to the presence of machinery, vehicles and facilities	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: high (3) • Urban areas, buildings, roads and urban vegetation: low (1) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (6)** • Urban areas, buildings, roads and urban vegetation: **low (4)** • Crops lands and green lands: **low(5)** • Water bodies, island rivers, river gravels and rock white : **low(6)**
Score	*1*	*1*		*1*	

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Light pollution during the night period	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: high (3) • Urban areas, buildings, roads and urban vegetation: low (1) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : high (3)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (6)** • Urban areas, buildings, roads and urban vegetation: **low (4)** • Crops lands and green lands: **low(5)** • Water bodies, island rivers, river gravels and rock white : **low(6)**
Score	*1*	*1*		*1*	

The potential impact on landscape, due to the seismic survey, results as **Low** for the whole territory.

6.6 HEALTH IMPACT ASSESSMENT

6.6.1 Community Health

6.6.1.1 Overview

The presence of the Project could affect the health and safety of the communities along the seismic lines and close to the drilling area as a result of worker-community interactions, the risk of injury associated with construction activities and competition for access to health care resources. Any community concerns or perceptions with regard to reduced health and physical safety by the community also need to be addressed.

The following box shows the key sources of impact and the potentially impacted resources and receptors.

Box 6.12 Key Sources of Impact, Potentially Impacted Resources and Receptors

Sources of Impact

- *Seismic Survey*: presence of national and international workforce, who through interactions with communities may lead to increased disease transmission and community angst. Provision of health care for workforce, who has the potential to affect access to health care for communities (due to competition for resources) with the potential for worsening health outcomes. Changes to the environment due to increased noise and decreased air quality. Increased number of heavy vehicles in the area and traffic might lead to a higher number of road accidents and injuries.

Potentially Impacted Resources and Receptors

- Communities of settlements adjacent to the Project site.
- Health care facilities.
- Land owners and land users of areas adjacent to the Project site.
- Road users.

Project Influencing Factors

- Non-resident workforce management.
- Numbers and movement of Project vehicles.
- Consultation with local communities.

The following table presents the key impacts of the project on human health during the key project phases.

Table 6.53 Key Impacts –Community Health and Safety

Seismic Survey
• Potential increased noise, decreased air quality • Increased transmission of communicable diseases to the local population • Pressure on health care facilities • Road accidents, due to increased project-related traffic

The sensitivity of the community health and safety component is reported in the following Sections. The potential impacts related to the project phases are described prior to presenting the mitigation measures that will be adopted by the Project.

6.6.1.2 Community Health Sensitivity

The sensitivity of the community health into the Block RSF-5 can be evaluated, for each land cover, as following:

- in areas characterized by presence of *bare soil and vegetation,* the sensitivity has been evaluated as **Low**;

- in *urban areas* and areas characterized by *buildings, roads and urban vegetation*, the sensitivity has been evaluated as **High**, because they are the sites where the population live and where the health facilities are located;
- in areas characterized by *crops lands and green lands,* the sensitivity has been evaluated as **Moderate**, because they are the sites where the population work;
- in areas characterized by presence of *water bodies, island rivers, river gravels and rock white*, the sensitivity has been evaluated as **Moderate**.

6.6.1.3 Seismic Survey

Regarding the seismic survey, the following sources of impact have been identified.

Table 6.54 Community Health Impacts – Seismic Survey

Source of Potential Impact	Potential Impact
Blasting of micro charge	Potential increased noise
Presence of the workforce	Increased transmission of communicable diseases to the local population
	Pressure on health care facilities
Use of machinery and heavy equipment	Road accidents, due to increased project-related traffic
	Potential increased noise, decreased air quality
Production and management of domestic wastes	Potential generation/management of wastes

The impact assessment on community health described in the following sections is based on the analysis of the source of potential impact reported in the previous Table 6.54.

Impacts Identification

The main project activities and stressors with the potential to negatively impact health and welfare during the seismic survey are the following:

- use of charges which will be blasted;
- presence of the workforce;
- use of machinery and heavy equipment;
- production and management of waste (black/grey water, paper).

These activities involve potential negative impacts on community health and welfare. Health impacts of the project are those potentially affecting the surrounding cultivated and urbanised areas and individual dwellings (settlements).

The following types of potential impacts on community health and welfare have been identified during the seismic survey phase:

- increased transmission of communicable diseases to the local population through interaction with the workforce (sourced both locally and internationally);

- pressure on health care facilities: the provision of health care to workers (direct, indirect and induced) has the potential to affect access to health care facilities for the communities;
- environmental health: changes to the environment due to increased noise, decreased air quality and generation/management of wastes as a result of the seismic survey activities may affect health and wellbeing;
- impacts on community safety, in particular road accidents, due to increased project-related traffic.

Below is an analysis of the main potential direct negative impacts on health and welfare during the seismic survey is reported.

Increased transmission of communicable diseases

The presence of an external workforce (mainly expatriates) could lead to an increased transmission of communicable diseases within surrounding communities as well as between the workers and working families. These diseases will be influenced by the disease profiles of the local communities and the countries of origin of the workers.

Food safety and malnutrition, safe drinking water, sanitation and poor housing are the main factors contributing to health risks for the population. Communicable diseases of concern are likely to include: malaria, tuberculosis, leprosy, hepatitis, diarrhoeal diseases and acute respiratory infections. Children and the elderly are considered to be the most sensitive receptors as a result of their sanitary behaviour and frailty.

The presence of an external workforce has also the potential to lead to a local increase in sexually transmitted diseases. The prevalence of HIV/AIDS is quite high in Myanmar and therefore the potential for transmission will be influenced by the behaviour of the workforce.

The seismic program will require a maximum of 600 workers. Some of these workers will temporarily move into the area. Experiences from other parts of the world have shown that oil and gas development activities introduced or increased incidence of communicable diseases, such as HIV/AIDS and malaria, in communities where these projects are located. Although the *eni Myanmar* project is not a large-scale development, the influx of outside workers could contribute to proliferation of communicable diseases in local communities.

The structures at the camp site and temporary explosive storage center can conceivably contribute to vector-borne diseases such as malaria, dengue by providing breeding grounds for mosquitoes if they are not properly maintained. These structures include a perimeter drainage trench and an intermediate drainage trench.

Unhygienic practices in the work place may also promote spread of gastrointestinal diseases amongst project employees.

The potential health impacts from an influx of workers could contribute to proliferation of communicable diseases in local communities and the work force.

National estimated statistics on HIV/AIDS are provided in Table 6.55. Detailed information on HIV/AIDS is limited.

Table 6.55 National HIV/AIDS Statistics[13]

Number of people living with HIV	210,000 [190,000 - 230,000]
Adults aged 15 to 49 prevalence rate	0.7% [0.6% - 0.8%]
Adults aged 15 and up living with HIV	200,000 [180,000 - 220,000]
Women aged 15 and up living with HIV	70,000 [59,000 - 72,000]

Dengue fever is a mosquito-borne viral infection In Myanmar dengue fever (DF)/dengue hemorrhagic fever (DHF) is one of the leading causes of of hospitalization and death among children and adults. Myanmar's Ministry of Health reported a total of 13,086 cases in 2014 but 20,255 in 2013.[14]

Malaria is a public health problem in Myanmar, particularly in forested and hilly areas. In the surveyed area, most of respondents claimed to have slept under a mosquito net the previous night. Malaria is a re-emerging public health problem due to climate changes, uncontrolled population migration, ecological changes, existence of multi-drug resistant P. falciparum parasites and appearance of insecticide resistant vector. In 2012, malaria was reported as the Single Leading Cause of Mortality in 2.6% of reported cases (2012).[15]

Finally, the movement of expatriate workers to and from their home countries could provide disease transmission pathways to communities in the Project area.

Impact on community health and wellbeing due to an increase in communicable diseases is considered regional in extent and at medium-term duration, due to serious illness or deaths from an introduced disease or disability.

Pressure on health care

There aren't available information on number of health facilities in the Study Area. A light increased pressure on, and decreased access to, health care facilities could be possible throughout the seismic survey phase due to the workforce and potential changes in the disease profile of the local population. However, a dedicated clinic will be established at the camp to provide emergency treatment as required.

Environmental health

During the seismic survey phase, activities will result in changes to the physical environment, with the potential to affect the health and welfare of communities.

In particular, since the seismic acquisition will be carried out using explosive, it is expected:

- a potential temporary annoyance due to the charges explosion noise at residential buildings closest to work sites;
- a potential temporary disturbance due to the charges explosion vibration for any receptor closest to work sites;
- a potential temporary annoyance due to the dust emission due to the charges explosion.

13 UNAIDS, 2014. Retrieved July 20th from http://www.unaids.org/en/regionscountries/countries/myanmar
14 MOH, 2014. Retreieved July 20th from http://www.moi.gov.mm/moi:eng/?q=news/29/06/2015/id-4205
15 MOH, 2014. Retreieved July 20th from http://www.moh.gov.mm/file/HEALTH%20STATISTICS.pdf

Other sources of noise, dust and exhaust emissions are the vehicles. All these impacts could result in an increase in disturbance and decrease in wellbeing for those people living closest to the work sites.

During the camp site & temporary explosive storage center construction and rehabilitation phase, noise will primarily be generated from project vehicles for transportation of granular fill, workers, construction equipment, and generators.

Construction is expected to result in nuisance noise at some communities but is not expected to exceed the ambient noise standard.

Transport of camp site, temporary explosive storage center and road fill will be on local roads. Heavy trucks are expected to emit noise levels of 88 dB (A) at 50 ft from the source. Houses are located approximately 50 m away from the road. The noise calculated for these houses is approximately 77.7dB (A). The impact however takes place only during the time the truck passes the house. Ambient noise standards do not apply for this type of noise.

Noise levels from construction equipment do not exceed the 90 dB (A) noise standard in the workplace for an 8-hr exposure time. However, a combination of several construction machines could result in a compounded noise level 91 dB (A), exceeding the workplace standard.

The noise levels estimated at communities assumed a worst-case scenario of hemispherical spreading with no attenuation from the surrounding area. However, the presence of trees, vegetation, and the topography will attenuate the noise levels.

During shooting/recording, generated noise and vibration may affect workers. However, the project team has specified a safety distance between shot holes and shooting/recording team of 50 m. Noise measurements at 50 m from shot holes during shooting/recording found the noise level at approximately 65 dB(A). This noise level will not impact the health and safety of workers. In addition, shooting/recording will occur over a short time period (a few minutes) and the project team will provide ear plugs or ear muff to the shooting/recording team as a protective gear.

During the construction of the camp site & temporary explosive storage center, new access roads will be constructed, while some sections of roads will be upgraded. Granular fill transport and construction activities may increase dust concentrations in air.

The potential health effects of dust are closely related to particle size. Particle sizes are normally measured in microns, and the size range of airborne particles is typically from less than 0.1 microns up to about 500 microns, or half a millimetre. Human health effects of airborne dust are mainly associated with particles less than about 10 microns in size (PM10), which are small enough to be inhaled. Nuisance effects can be caused by particles of any size, but are most commonly associated with those larger than 20 microns.

Many forms of dust are considered to be biologically inert, and hence the primary effects on people relate to our sense of aesthetics. When the dust is airborne, here can also be minor health effects, such as eye irritation. Indirect stress-related health effects could also arise, especially if dust problems persist for an unreasonable length of time.

Some nuisance dust may have the potential to cause other types of health effects because of the presence of specific biologically active materials. For instance, some mineral dusts contain quantities of quartz, which can cause the lung disease known as silicosis when persistent at high concentrations. Other dusts may contain significant amounts of toxic metals such as mercury or lead.

There is also the potential for contamination of roof-collected water supplies. Presence of airborne dust for long periods can also affect people's ability to enjoy outdoor activities. For most people, a major effect of a dust nuisance problem is annoyance at the increased requirement for cleaning.

Airborne dust can have effects on visibility, although dust is usually less regionally significant. Visibility effects from dust are usually only a concern in the immediate vicinity of a specific source.

Visibility effects are largely a matter of aesthetics. However, it should also be recognised that visibility is one of the main ways by which people commonly judge air quality. Loss of visibility is also a safety concern under extreme conditions, especially for road traffic.

Dust may result in respiratory irritation of construction workers and worsen asthma of people living nearby the source.

Dust impacts are considered to be localized (i.e. Health impact extends < 100 m radius from the site boundary) and short term (i.e. Health impact expected to last from 0 to 1 year, have a quick reversibility), and magnitude is considered to be medium. As a result of these considerations, the severity is ranked as minor.

A spill would cause contamination of surface and groundwater resources. Consumption of such water may result in bioaccumulation of contaminants and various health impairments. Bathing and washing in it may cause skin irritation. Indirect public health impacts could occur through soil contamination by oils, chemicals and the bioaccumulation of heavy metals impacting crop yields and food quality. Worker health is affected in similar ways. Because workers are closer to and handle hazardous waste, the likelihood of exposure is higher of workers than for the public.

Community safety

During the seismic survey there will be a light increase in traffic movements. This will increase the risk of road traffic accidents which could result in injuries or fatalities to other road users or pedestrians. Children are considered to be at particular risk due to a lack of road traffic safety awareness.

During the seismic survey, maximum 600 workers will be employed. Most of the workers for non-skilled jobs will be from the communities around the project area. This employment will increase the income of the local people and also stimulate local businesses and services. Workers will be employed for 6 months.

In-migration of labour and social interaction may result in conflict between workers from other regions and local communities.

Pre-project awareness programs with migrant workers on local community, social and ethnic group sensitivities will help create increased understanding and, where advisable, limit interactions during camp site and temporary explosive storage center construction.

Mitigation Measures

The following mitigation measures shall be employed during the seismic survey phase to reduce any impacts on community health and welfare.

Mitigation measures for increased transmission of communicable diseases

- implementation of good hygiene practices for the workers (such as hand washing), especially before eating, drinking, smoking and so on. The purpose of this is to prevent ingestion of potentially contaminated material;
- guard against communicable disease introduction by monitoring local health trends in order to be aware of and respond appropriately to any negative health trends that may be linked to the Project and its workers;
- prevention of illness among workers in local communities through health awareness and education initiatives. For example, implementation of educational outreach to increase awareness of major communicable diseases and how to protect against infection;
- ensuring that all workers receive education about transmission routes and the symptoms of the communicable diseases of concern (including STDs);
- limit night movement of workers living in the camp site;
- develop a training and awareness programme for contractors to deliver to their employees to ensure alignment with eni Myanmar corporate requirements for occupational health and safety management including driving and traffic safety;
- implement mitigation measures for non-hazardous, sanitary and hazardous wastes;
- clearing of overgrowth in perimeter;
- keep waste manifest for all waste types.

Mitigation measures for increased Pressure on health care facilities

- ensure sufficient health services are made available by Contractors to meet the day to day needs of Project personnel and families without impacting on access to and overload local health care services for communities;
- establish a requirement as part of the contracting and procurement process for contractors, to ensure they have arrangements established with local health facilities to provide healthcare to their employees;
- establish in-house or outsourced health facilities and emergency medical treatment facilities for workers.

Mitigation measures for environmental change

- implementation of a rapid response grievance mechanism;
- take into account the presence of sensitive receptors (such as communities, or schools) in the design of working construction hours to minimise disruption and sleep disturbance;
- undertake stakeholder engagement prior to the commencement of construction activities to inform communities of the activities proposed, the timing of activities and the duration;
- segregate and store hazardous chemicals and waste in appropriate, labelled and safe containers that are suitable for transporting/transferring. Containers having hazardous

waste must be kept separated from non-hazardous waste in safe areas that are clearly labelled and fenced;

- all hazardous waste will be collected in skips ready for treatment and disposal and sent directly to a proper authorized facility;
- provide Waste Manifest System for transportation of all waste types to treatment area or disposal area;
- always check and record the type(s) and amount of hazardous waste generated;
- provide septic tank for domestic sewage;
- ensure treatment and disposal according to accepted international standard. Keep waste manifest for all waste types;
- enforce "Good Housekeeping" practices;
- segregate non-hazardous and hazardous waste, store each type of waste in closed containers and make sure all containers are clearly labelled;
- dispose of waste in labelled containers for possible recycling;
- prohibit open burning of any waste at project site;
- implement requirements for waste management and related laws;
- store waste in appropriate and safe containers that are suitable for transporting/transferring;
- always check and record the type(s) and amount of waste generated;
- spray water on un-surfaced access roads of project transportation route during dry conditions at least twice a day (morning and afternoon);
- post speed limits on project access route and limit vehicle speed to 30 km/h on un-surfaced roads;
- use vehicles with dust flaps;
- cover loose dry loads;
- vehicles will avoid sensitive environmental areas;
- construction activities and Vehicle movements will be restricted to daylight hours;
- limit vegetation removal to a minimum;
- schedule operation of noisy construction equipment at different times;
- ensure use of mufflers on diesel/gas driven machinery;
- ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer;
- implement transportation plan;
- the camp site must be located a minimum of 500 m from the nearest community;
- select shot hole locations at safe distances from nearest community or sensitive receptor.

Mitigation measures for increased Community safety

- make sure that Company & the Contractor develop agreed routes for transportation for all Project movements (materials, goods and worker movements) to minimise risk of accidents. This shall include a process for the identification of accident hotspots and if required the use of bypasses around these areas;
- health screening of workers before employment;
- on-site health clinic (seismic acquisition) and referral system during all the project operations with external health agencies to ensure timely diagnosis and treatment of workers' illness and injury;
- maximize hiring of qualified local workers to reduce reliance on outside labour and increase local employment;
- do not allow workers to enter communities near the camp site;
- provide awareness to workers on preventive measures for the prevention of communicable and local diseases.

Conclusion

Considering the mitigation measures described in the previous section and the evaluation criteria defined in Section 6.1.2, the potential impact significance on community health associated with the seismic survey are summarized in Table 6.56.

Table 6.56 Ranking of Impacts on Community Health – Seismic Survey

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Increased transmission of communicable diseases	Between 1 and 5 years	Regional scale: as determined by country's administrative boundaries	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (6)** • Urban areas, buildings, roads and urban vegetation: **medium (8)** • Crops lands and green lands: **medium (7)** • Water bodies, island rivers, river gravels and rock white : **medium (7)**
Score	*2*	*2*		*1*	
Pressure on health care	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (4)** • Urban areas, buildings, roads and urban vegetation: **low (6)** • Crops lands and green lands: **low (5)** • Water bodies, island rivers, river gravels and rock white : **low (5)**
Score	*1*	*1*		*1*	

Impacts	*Duration*	*Extent*	*Importance / Resilience of Receptor / Resource*	*No. of Elements Involved*	*Impact Rank*
Environmental health	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (4)** • Urban areas, buildings, roads and urban vegetation: **low (6)** • Crops lands and green lands: **low (5)** • Water bodies, island rivers, river gravels and rock white : **low (5)**
Score	*1*	*1*		*1*	
Community safety	Less than 1 year / Temporary	Local scale: the proposed operating site and its immediate environs	• Bare soil and vegetation: low (1) • Urban areas, buildings, roads and urban vegetation: high (3) • Crops lands and green lands: moderate (2) • Water bodies, island rivers, river gravels and rock white : moderate (2)	Affecting small no. of individuals, households, individual enterprises and/or small no. of species	• Bare soil and vegetation: **low (4)** • Urban areas, buildings, roads and urban vegetation: **low (6)** • Crops lands and green lands: **low (5)** • Water bodies, island rivers, river gravels and rock white : **low (5)**
Score	*1*	*1*		*1*	

The potential impact on landscape, due to the seismic survey, results as **Low** for the whole territory except for an increased risk of transmission of communicable diseases, which results as **Medium**.

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7.0 CUMULATIVE IMPACT ASSESSMENT

eni Myanmar holds the hydrocarbon exploitation licence in the entire Block RSF-5 and no other O&G activity operates in the same Block; furthermore, from an analysis of currently available data of the area, there is no evidence of other industrial activity which may have a potential of cumulative impacts with the project.

The exploration seismic activities are the first step in the O&G development cycle. It is a short term and temporary activity with low risk of cumulative impacts. Cumulative impacts will be investigated in greater detail during the future production phase of the project.

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8.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

8.1 INTRODUCTION

This Environmental Management and Monitoring Plan (EMMP) constitutes a powerful tool in terms of global management of environmental performance by monitoring the effects on those receptors present in the Block. It considers the requirements of the applicable Myanmar legislation and is in line with the key findings that have been reported in the ESHIA. The Chapter sets out *eni Myanmar*'s approach to the management and monitoring of environmental and social issues related to the Project's phases as requested by the Myanmar Environmental Conservation Law.

8.2 SCOPE OF THIS DOCUMENT

The purpose of this EMMP is to define the framework and the required actions for the monitoring of the status and progress of a variety of sensitive receptors present in the study area. It also provides relevant information to evaluate the success of the mitigation measures for the project impacts identified by the ESHIA as well as compliance with applicable environmental standards.

In particular, the EMMP has the following objectives:

- to define the environmental monitoring requirements for the different receptors in accordance with the applicable national legislation.
- To provide tools to monitor compliance with the applicable eni Standards and facilitate any operational changes that may be needed.
- To monitor specific parameters in order to report on selected Key Performance Indicators (KPIs).
- To monitor the results in order to evaluate the success of the implemented mitigation measures in protecting the environment.

As mentioned above, this preliminary EMMP has been outlined considering:

- eni Standards (Environmental, Social and Health Impact Assessment in Exploration – AMTE-TG-002);
- applicable Myanmar legislation;
- International standards, in case of lack of provision in the national legislation.

It is also aligned with the monitoring measures included in the previous sections of the ESHIA.

The following list presents the specific management plans foreseen for the Project, based on the outcomes of the impact assessment and eni's standards.

Table 8.1 Specific Management Plans

Document
Waste Management Plan
Water Management Plan
Air Quality Management and Monitoring Plan
Noise Management and Monitoring Plan
Biodiversity Action Plan
Cultural Heritage Management & Monitoring Plan
Community Relations Plan

8.3 PROJECT DESCRIPTION

Project description is reported in the previous section 4.

8.4 PROJECT'S ENVIRONMENTAL, SOCIAL AND HEALTH POLICIES AND COMMITMENTS, LEGAL REQUIREMENTS AND INSTITUTIONAL ARRANGEMENTS

Environmental, social and health policies and commitments, legal requirements and institutional arrangements applicable to the project are reported in the previous section 3.

8.5 SUMMARY OF IMPACTS AND MITIGATION MEASURES

The summary of Impacts and Mitigation measures are reported in the Tables "Ranking of Impacts" in Section 6.

8.6 DEFINITION OF EMMP PARAMETERS

8.6.1 Environmental Indicators

Environmental Indicators are standardised parameters with low variability in time and space and appropriate tools with which it is possible to verify the scale of the disturbance/contamination and the impact mechanism of a specific environmental component, including reference to legislation limits, thresholds and pre-defined targets. During the monitoring campaigns data on the environmental indicators will be collected in order to provide information for the evaluation of the Key Performance Indicators.

8.6.2 Assessment Endpoints (KPIs)

Assessment endpoints refer to information that a decision or policy maker might wish to know about with respect to the status of the Valued Environmental Components, VEC, for this reason they are often used as Key Performance Indicators (KPI), as they are quantifiable measurements that reflect the critical success factors of an organization. In this section KPIs related to the Project are reported below. These indicators will be used to evaluate the status and progress of the environmental performance during the entire lifecycle

of the Project and will be related to the status of the Valued Environmental Components (VECs). KPIs have been assessed with the aim of providing structured environmental reporting aligned with our understanding/knowledge of the eni environmental reporting system.

Table 8.2 Key Performance Indicators (Assessment Endpoints)

KPIs	Value	Note
Air Quality		
SO_x concentration (µg/m^3) vs legislation/standards/guidelines limits	Air Quality Index IQ_a	$IQa = 1 - \frac{1}{n}\sum_{i=1}^{n}\frac{C_i}{C_{lim_i}}$ n = number of substances used for the index calculation; C_i = concentration of the *i*-parameter [µg/l]; C_{lim_i} = limit concentration of the *i*-parameter [µg/l] based on legislation/standards/guidelines requirements IQa Evaluation scale : • $IQ_a \leq 0.5$ GOOD • $0.5 \leq IQ_a \leq 0.75$ MODERATE • $0.75 \leq IQ_a \leq 0.875$ MEDIUM • $IQ_a \geq 0.875$ CRITICAL
NO_2 concentration (µg/m^3) vs legislation/standards/guidelines limits		
VOC (benzene or other hydrocarbons) concentration (µg/m^3) vs legislation/standards/guidelines limits		
Particle matter (PM_{10}) vs legislation/standards/guidelines limits		
CO concentration (µg/m^3) vs legislation/standards/guidelines limits		
Acoustic & Noise emissions		
Increase in background noise level	dBA	IFC states that the maximum increase in background noise level shall not exceed 3 dBA
Vibration		
Prevent damage to adjacent cultural heritage sites	PPV	*Measure PPV at all* adjacent cultural heritage sites and compare to international standards
Energy savings	kWh	
Flora & Fauna, Habitats and Protected Areas		
Trees over 15+ cm DBH on original alignment which were avoided by reroutes of original alignment	%	Performance target (PT) = 100% avoidance
Trees < 15 cm diameter on original alignment which were avoided by reroutes of original alignment	%	PT = 75% avoidance
Avoidance of Bombax sp., Ficus sp, Dipterocarpus tuberculatus, Hopea sangal of any size:	%	PT = 100% avoidance
Permanent or seasonal wetlands avoided	%	PT = 100% avoidance
Flying Fox Bat roosts avoided	%	PT = 100% avoidance

KPIs	Value	Note
Raptor nest sites avoided	%	PT = 100% avoidance
Dhole den sites or concentrations of small mammal burrow sites avoided	%	PT = 100% avoidance
Any protected bird species nest sites avoided	%	PT = 100% avoidance
Waste		
Monthly non-hazardous waste production	ton	--
Monthly hazardous waste production	ton	--
Percentage of recycled or recovered waste per month	ton	--
Percentage of disposed waste per month (%)	%	--
Monthly non-hazardous waste production	%	--
Water		
Quality status of water effluent	%	*No of complying samples / total of taken samples (x100)*
Quality status of groundwater	%	*No of complying samples/ total of taken samples (x100)*
Soil		
Quality status of surface soil	%	*No of complying samples/ total of taken samples (x100)*
Quantity of impacted surface soils	%	*No of complying samples/ total of taken samples (x100)*

Source: eni, 2014

8.6.3 Valued Environmental Components (VECs)

Valued Environmental Components are fundamental and sensitive elements, susceptible to hazards, which may be affected by the Project. Table 8.3 gives a list of VECs reported for each environmental domain, where applicable, as VECs are generally reserved for the evaluation of biological components that may be affected by changes in the physical environment. Nonetheless proxies may be used for physical elements.

Table 8.3 Valued Environmental Components

DOMAIN	Component	VECs
AIR	Airborne pollutant concentrations	Air quality of environment
NOISE	Noise emissions	Quality of noise environment
	Vibration	
BIODIVERSITY	Terrestrial Flora	Presence of species with high conservation value

DOMAIN	Component	VECs
AIR	Airborne pollutant concentrations	Air quality of environment
	Terrestrial fauna	Occurrence of natural vegetation as habitat for several species Presence of species listed in the IUCN Red List of Threatened Species
	Protected Areas	Habitats that sustain considerable biodiversity or species that are of use to local communities (e.g., fish, mammal, or bird habitats)
	Habitat	
WASTE	Domestic waste	Soil quality of environment Water quality of environment
	Industrial waste	
WATER	Groundwater and Surface water	The largest river in Myanmar, Ayeyarwady, crosses the Block RSF-5 in the South East corner. Block RSF-5 is located in the Ayeyarwady aquifer. Groundwater quality of Ayeyarwady aquifer is potable for both domestic and irrigation water use.
LAND	Soil	Temporary land take in agricultural or forest areas

Source: eni, 2014

8.7 SPECIFIC OBJECTIVES OF THE MONITORING PROGRAMME

The EMMP defines the monitoring requirements for all the environmental components affected by the Project, and provides details for their direct and effective implementation on site during the different developmental phases.

In general, the EMMP aims to:

- estimate the inherent variation within the environment;
- Compare the variation within the environment;
- Make comparisons between different situations (for example, pre-survey and post-survey) and to detect changes;
- Make comparisons against a standard or target level.;
- Evaluate the success of implemented mitigation measures.

General objectives of the monitoring programme are described in Table 8.4. More details are provided in the specific management and monitoring plans reported in the following paragraphs.

Table 8.4 Specific objectives of the monitoring plans

DOMAIN	Component	Specific Objectives
AIR	Airborne pollutants	Monitor the potential nuisance for the receptors located in the proximity of the emission sources and the increase in airborne pollutant concentrations in the environment Monitor compliance with national and international air quality standards
NOISE	Noise emissions	Monitor the potential nuisance for the receptors located in the proximity of the noise emission sources Monitor compliance with national and international noise emission limits
	Vibration	Monitor physical disturbance of or damage to cultural heritage sites or other receptors
BIODIVERSITY	Terrestrial Flora	Monitor plant disturbance at specific flora sites within the Project area of influence Prevent disturbance of flora outside project areas
	Terrestrial fauna	Protect and manage general fauna, especially species with high conservation value Establish trends in species composition Keep a permanent record of animal sightings
	Habitat	Monitor trend changes in the biodiversity values of natural habitats as well as Protected Areas within the project area of influence
WASTE	Domestic waste (hazardous & non-hazardous)	Demonstrate compliance with applicable waste management practices Monitor trends in waste generation by type and final disposal (quantities recycled, re-used, incinerated, landfill)
WATER	Groundwater	Monitor trends in the quality of groundwater in the Block area
CULTURAL	Cultural Heritage site	Monitor the status of the CH sites during the performing of survey

Source: eni, 2014

8.8 SPECIFIC MANAGEMENT AND MONITORING PLANS

8.8.1 Air Quality Management Plan

8.8.1.1 Legal Requirements

The Air Quality Management and Monitoring Plan shall be developed according to a general framework for air quality measurement and assessment available at international levels and eni Air Quality Monitoring Standards. International air quality standards are set by the *IFC Environmental, Health, and Safety Guidelines for Air Emissions and Ambient Air Quality* published on 2007, which refers to the WHO Air Quality Guidelines[1].

Table 8.5 IFC/WHO Air Quality Standards

Parameter	Averaging Time	Concentration (µg/m³)	Notes
Nitrogen dioxides (NO_2)	Annual	40	
	1-hour	200	
Photochemical Oxidants: Ozone (O_3)	8-hour daily maximum	100	
Particulate Matter (PM_{10})	Annual	20	
	24-hours	50	
Particulate Matter ($PM_{2.5}$)	Annual	10	
	24-hours	25	
Sulphur Dioxide (SO_2)	24-hours	20	
	10 minute	500	
Carbon Monoxide (CO)	1-hour	30 (mg/m³)	Carbon monoxide was not included in the WHO Air Quality Guidelines 2005. As a result, the 2000 WHO guidelines per European Air Quality Guideline for CO remain in effect.
	8-hours	10 (mg/m³)	
Benzene	Annual	5	European directive 2008/50/EC

[1] WHO Air Quality Guidelines are available at http://www.who.int/en

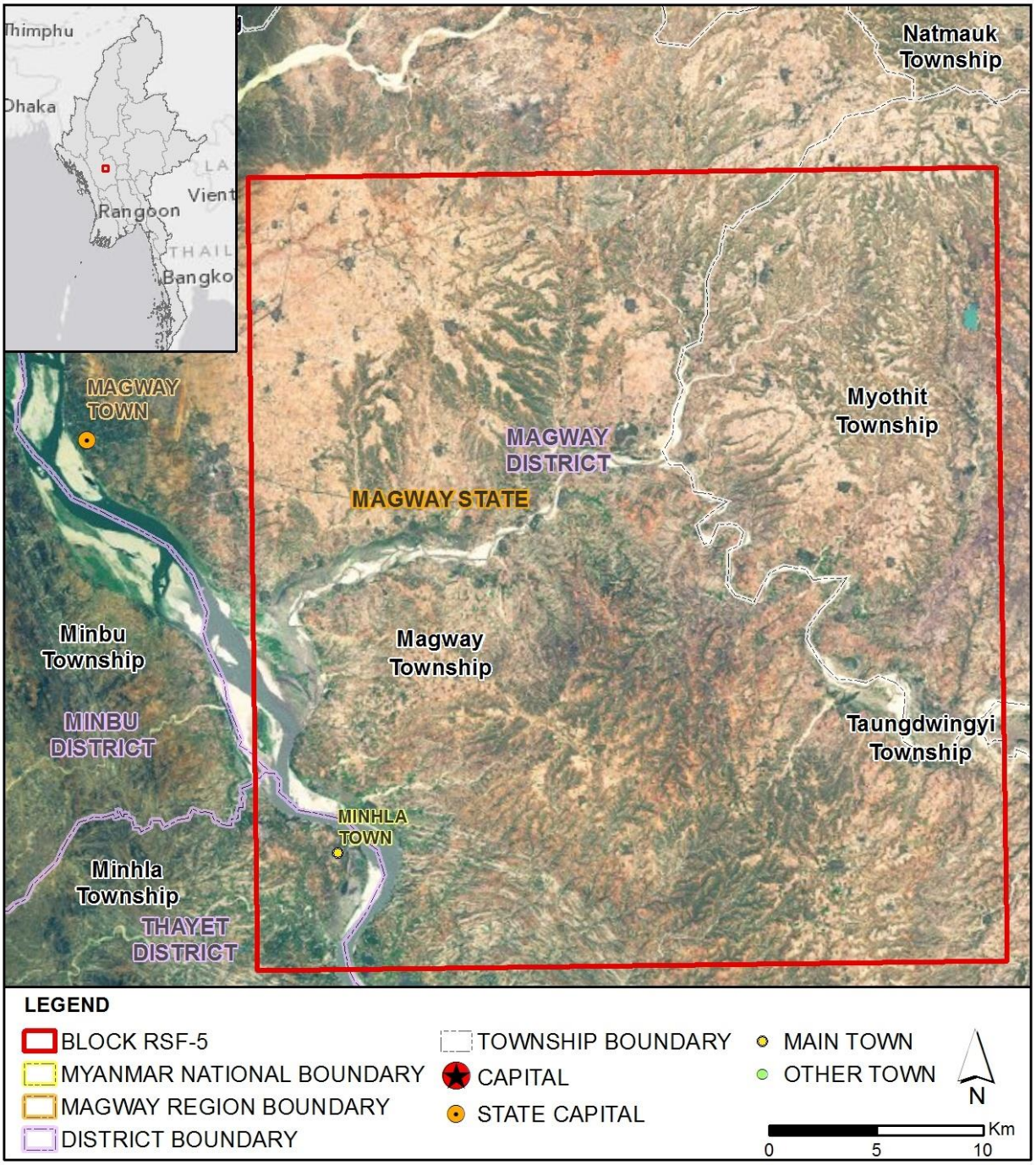
The WHO has established the following air quality criteria to be considered when selecting substances (or pollutant indicators) to be included in an air quality monitoring network:

- The selection of the substances shall be based on the current air pollution issues potentially affecting the area, and on those expected for the future.
- The substances shall be measured fairly extensively, or the extent of monitoring shall be increased due to emerging concerns (for example: PM_{10} and $PM_{2.5}$).
- Only substances for which quality assurance and control procedures exist or are being developed shall be included.

8.8.1.2 Study Area

Figure below presents the Study Area of the Project that is equivalent to the whole Block RSF-5.

Figure 8.1 Environmental Study Area



Source: eni, 2014

8.8.1.3 Management Actions

An important part of the air quality assessment is the quantification and understanding of the current airborne pollutant concentrations in the area surrounding the Project site.

The monitoring campaign will be carried out in order to:

- Monitor the impact on local air quality from the Project during seismic survey.

Representative measurement locations shall be chosen on the outskirts of each sensitive area to characterise the air quality environment when subjected to Project airborne pollutants emissions.

The following management actions will be put in place in order to limit dust emission:

- wet suppression which includes watering, spraying dusty surfaces, in case of need, especially in dry weather at least twice a day (morning and afternoon);
- post speed limits on project access route and limit vehicle speed to 30 km/h on un-surfaced roads;
- use vehicles with dust flaps;
- dust control measures such us covering loose materials and sheeting trucks;
- maintenance of the shape of the roads, in order to ensure a proper crown, adequate drainage and a well compacted surface.

The following management actions will be put in place in order to manage temporary emissions of exhaust gases will be adopted:

- vehicles and machinery will be turned off when not in use;
- regular maintenance checks will be carried out and records kept on all vehicles and machinery;
- planning of activities to minimise the use of vehicles and machinery: limitation of deliveries to full capacity loads, scheduling and restricting personnel movements to minimise journeys, minimisation of supply distances (if and where possible), and limitation of driving on existing tracks as much as possible.

The following management actions will be put in place in the selection of power generators (diesel generators and diesel compressors):

- generators are to be well maintained (including the maintenance inspections recommended by the manufacturer) and with emission levels meeting WHO recommendations;
- generators to be located down-wind and the distances from areas frequented by personnel as well as from air conditioning intakes maximised (wherever possible the minimum recommended distance would be 100 m);
- application of energy efficiency principles to minimise power requirements: improving power management, utilization of less generators optimizing the individual power load, selection of contractors based on the efficiency of the power generation system offered.

The following management actions will be put in place in the selection of power generators and vehicles:

- the implementation of the best available cost effective technology for energy efficiency, as the use of efficient power generators that produce lower GHG emissions;

- generators and all vehicles are to be well maintained (including the maintenance inspections recommended by the manufacturer) and with emission levels meeting WHO recommendations.

The following management actions will be put in place to manage temporary emissions of greenhouse gases:

- ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer;
- maintain road going vehicles to ensure that fuel use is efficient and emissions are within acceptable limits;
- instruct drivers on the benefits of driving practices that reduce the risk of accidents, fuel consumption and dust generation;
- turn off all vehicles and equipment when not in use as well as prohibit vehicles from idling;
- planning of activities to minimise the use of vehicles and machinery: limitation of deliveries to full capacity loads, scheduling and restricting personnel movements to minimise journeys, minimisation of supply distances (if and where possible).

8.8.1.4 Monitoring Plans

The definition of the monitoring plan of airborne pollutants atmospheric concentrations and monitoring locations is based on the following criteria:

- *typical emissions of the project*: the characterisation of the Project relevant emissions allows to identify the specific pollutants emitted, thus to highlight the atmospheric pollutants of interest. For the Project, the pollutants of interest are nitrogen oxides, sulphur dioxide, particle matter, carbon monoxide and volatile organic compounds;
- *wind Regime over the Project Area*: in order to identify the main winds responsible for dispersion/diffusion processes of airborne pollutants over the Project area. Over the Project area the wind direction is generally from the east and northeast;
- *characterization of the Project Area*: identification of sensitive area (e.g. protected areas, natural parks) and or human receptors (e.g. villages); other local sources of pollutants, useful for the monitoring sites selection, will be identified the field surveys, to be performed a later phase of the project.

An understanding of the meteorological conditions over the Project Area is also required to enable a meaningful interpretation of monitored pollutant concentrations, the main parameters to be monitored, at least, are:

- wind speed and direction;
- air temperature;
- relative humidity; and
- precipitation.

The requirements to be considered for the meteorological monitoring stations are detailed by the WMO (World Meteorological Organisation) N° 8 - Guide to Meteorological Instruments and Methods of Observation; the guidelines issued by the American Association of State Climatologists and U.S Environmental Protection Agency should also be considered.

The monitoring programmes proposed for the Project is presented below in Table 8.6.

Table 8.6 Environmental monitoring

Receptor	Monitoring Task	Monitoring locations	Monitoring Parameter	Timing
Sensitive areas (i.e. communities, residential area, ecological areas)	Airborne pollutant concentrations during the seismic survey	At sensitive receptors located downwind the Project sites (e.g. within 20km from emissions sources) and at camp site / temporary explosive storage center	NOx, SO_2, CO, PM, benzene concentrations	Continuous, during activities producing air emissions
	Meteorological conditions	At sensitive receptors located downwind the Project sites (e.g. within 20km from emissions sources) and at camp site / temporary explosive storage center	Wind speed and direction; air temperature; relative humidity; precipitation	Continuous, during activities.

8.8.1.5 Indicators

The environmental indicators are reported in the table below.

Table 8.7 Air Quality indicators

Indicator	UoM	Legislation limit	Applicable legislation/standard
Nitrogen dioxides (NO_2) concentration	µg/m^3	40 (Annual) 200 (1-hour)	IFC/WHO
Ozone (O_3) concentration	µg/m^3	100 (8-hour daily maximum)	IFC/WHO
Particulate Matter (PM_{10}) concentration	µg/m^3	20 (Annual) 50 (1-hour)	IFC/WHO
Particulate Matter ($PM_{2.5}$) concentration	µg/m^3	20 (Annual) 25 (1-hour)	IFC/WHO

Sulphur Dioxide (SO_2) concentration	µg/m^3	20 (24-hours) 500 (10 minute)	IFC/WHO
Carbon Monoxide (CO) concentration	mg/m^3	30 (1 hour) 10 (8 hours)	WHO/EU
Benzene	µg/m^3	5 (Annual)	EU

8.8.1.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

The Plan shall be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.8.1.7 Responsibilities

The table below summarizes the responsibilities of different organizations.

Table 8.8 Air Quality Management Responsibilities

Organization	Responsibilities
eni	Company must guarantee the availability of economic, human and technical resources needed to manage the mitigation and monitoring measure as described in the final EMMP. It is the Company's responsibility to: • ensure that the requirements of the Plan are satisfied; • ensure that the contractors and any sub-contractors engaged are advised of their responsibilities to undertake their activities required by the Plan; • ensure that the monitoring program is implemented properly.
General Contractors	It is the General Contractors' responsibility to: • retain copy of the final EMMP on-site for reference by appropriate personnel; • recommend additions or changes to Plan based on experience gained from implementation of Plan; • verifying specific training/awareness sessions to employees involved in operations that may impact on the air quality environment (e.g., vehicles' use); • ensure that the requirements of the Plan are satisfied; • ensure that the contractors and any sub-contractors engaged are advised of their responsibilities to undertake their activities required by the Plan; • ensure appropriate records are kept and maintained on-site; • recommend additions or changes to Plan based on experience gained from implementation of Plan.

8.8.2 Noise & Vibration Management Plan

8.8.2.1 Legal Requirements

In the absence of relevant national laws, the Project will comply with international standards. The IFC General EHS Guidelines considered relevant to the project are:

- General EHS Guidelines
  - Section 1.7 – Noise and Vibration Emissions

Table 8.9 Applicable IFC EHS Guidelines

Environmental topic	Applicable EHS Guidelines
Noise and vibration emissions	Section 1.7 provides standards for daytime and night time noise emissions (for residential and industrial environments, WHO 1999) and recommends that noise prevention and mitigation measures are implemented with regard to predicted noise levels at sensitive receptors. Noise monitoring may be carried out for the purpose of establishing the existing ambient noise levels in the area of the proposed project or for verifying emission noise levels during project execution. A key priority should be the implementation of noise control measures at source; the selected methods will depend on the source type and the proximity of sensitive receptors, and can include: equipment selection, acoustic enclosures, vibration isolation, traffic route selection, other.

Noise pollution is not currently regulated at national level, hence international guidelines (e.g., IFC) shall be applied to the Project. The noise limits established by the World Bank Group/International Finance Corporation (IFC) for residential areas are the following [2]:

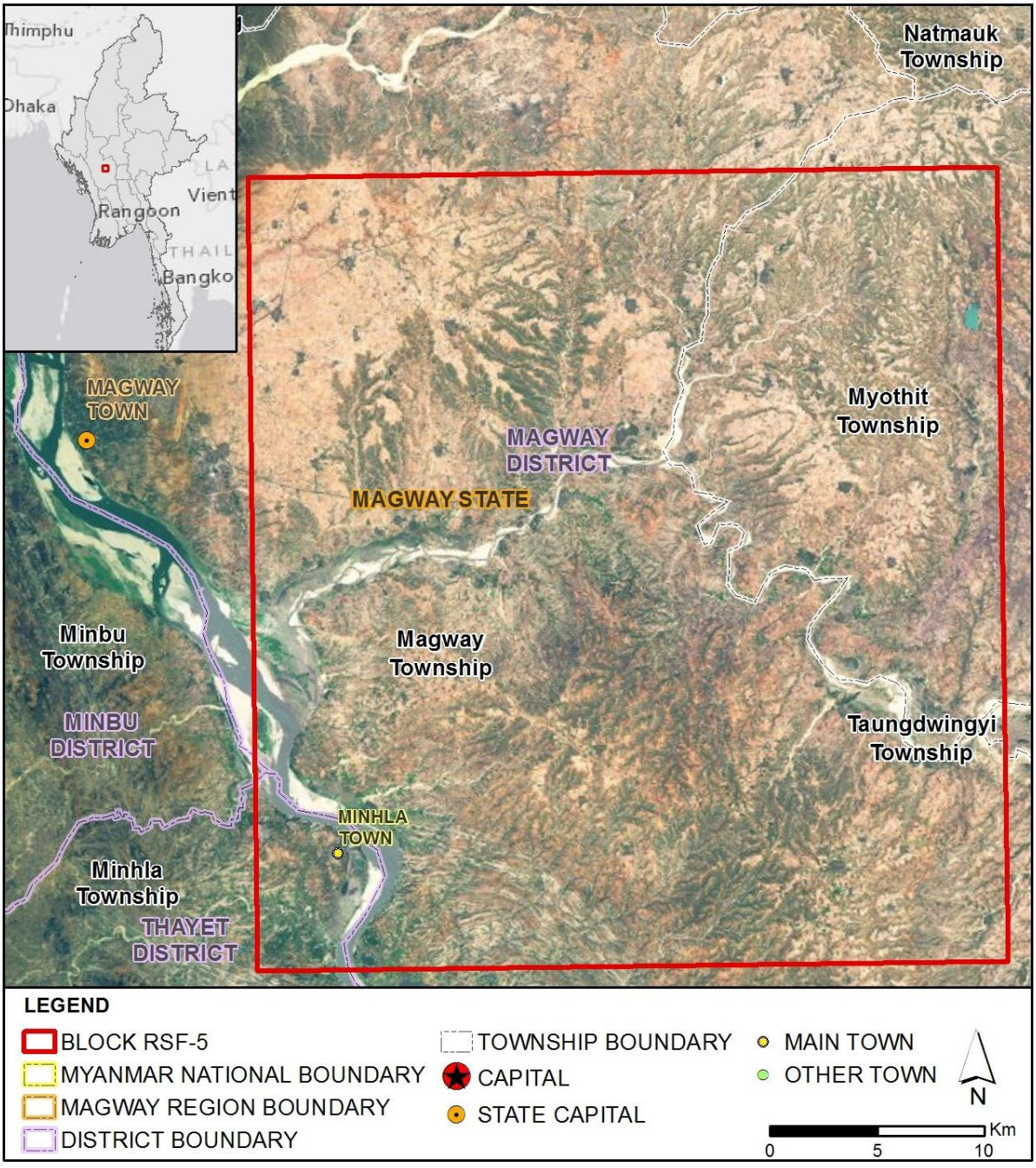
- **55 dBA during daytime** (daytime hours 07:00 to 22:00).
- **45 dBA during night-time** (night-time hours 22:00 to 07:00).

8.8.2.2 Study Area

Figure below presents the Study Area of the Project that is equivalent to the whole Block RSF-5.

[2] IFC doesn't discriminate between temporary and permanent Project operations. Conservatively, in consideration of the survey period and all associated activities, it is considered that the IFC threshold levels for the daytime and for the night time would be appropriate for the entire project phase.

Figure 8.2 Environmental Study Area



Source: eni, 2014

8.8.2.3 Management Actions

An important part of the noise assessment is the quantification and understanding of the current acoustic noise levels at potentially affected sensitive receptors by means of a dedicated noise monitoring survey.

Representative measurement locations shall be chosen on the outskirts of each sensitive area to characterise the acoustic environment when subjected to Project noise emissions.

Vibration

Vibration may potentially affect cultural heritage sites and/or other sensitive receptors (i.e. communities, buildings, ecological areas, area of geomorphological importance) in proximity of the work site (camp site, temporary explosive storage center, charge area, access road).

The impacts will be mainly generated by blasting activities and secondary from ground-disturbing activities including levelling, stabilising, compaction and excavation.

The following management actions will be put in place during the seismic survey:

- switch off equipment when not in use;
- limit noisy activities to the least noise-sensitive times of day;
- vehicles and equipment transportation will avoid sensitive environmental areas;
- construction activities and Vehicle/equipment movements will be restricted to day-light hours;
- limit vegetation removal to a minimum;
- schedule operation of noisy construction equipment at different times;
- ensure use of mufflers on diesel/gas driven machinery;
- use low noise equipment;
- ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer;
- use enclosures when possible to contain noise on site;
- conduct PPV testing and follow Shot Hole set back distances;
- project operations in heavily populated areas shall be minimized;
- conducting operations to adjacent survey lines at the same time shall be avoided;
- operation time must be minimized;
- if shot-hole method is applied, charge size and height of the pit must be chosen and the opening of those the drill holes must be sealed. In this way, noise dispersion will be further mitigated.

8.8.2.4 Monitoring Plans

Vibration

In order to protect buildings and other infrastructure from potential damages *eni Myanmar* seismic contractor will use Peak Particle Velocity meter (PPV) during seismic measurements in order to monitor vibrations level that affect buildings that are in vicinity of seismic source. PPV measurements will be carried out according to local legislations. In case of lack of local norms, PPV procedure will be established based on the safety distance table.

PPV meter is a vibration monitoring system used for measurement of ground vibrations and air shock-waves, which could have a negative influence on people, buildings and other structures as well as installations. The system uses 3-C geophones for direct measurement of particles velocity and a microphone to record air pressure or audible

noise. The geophone is placed by an observer on object that may be potentially damaged by seismic waves. If during seismic measurement PPV meter shows that vibration on concerned object exceeds acceptable level, the measurement is immediately stopped. Then recording system observer decreases energy generated by vibrators up to 50% of nominal one and vibrator point is recorded once again.

Representative measurement locations shall be chosen on the outskirts of each sensitive area to quantify the vibration caused by charges blast. Table 8.10 below provides the locations proposed for the vibration monitoring.

Noise

The monitoring methodology shall be applied in compliance with IFC EHS guidelines, that states the following:

- typical monitoring periods shall be sufficient for statistical analysis and may last 48 hours or hourly, or more frequently, as appropriate;
- noise monitoring shall be carried out using a Type 1 or 2 sound level meter meeting all appropriate IEC standards, and capable of logging data continuously over the monitoring time period;
- monitors shall be located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface (e.g., wall).

The monitoring programmes proposed for the Project is presented below in Table 8.10.

Table 8.10 Environmental monitoring

Receptor	Monitoring Task	Monitoring locations	Monitoring Parameter	Timing
Sensitive areas and receptors (i.e. communities, residential area, scattered settlement, buildings, ecological areas)	Noise level during the blasting activities and from ground-disturbing activities including levelling, stabilising, compaction and excavation	At sensitive receptors within 1km from noise emissions sources (works of site clearance and site preparation, line clearance, access road construction, blasting)	Equivalent Noise Pressure Level LeqA Other parameters (Lmax, Lmin, Percentiles	Long-term measurements (24 hours consecutive) Short-term measurements (15-20 minutes)
Sensitive areas and receptors (i.e. communities, residential area, scattered settlement, buildings, ecological areas, area of geomorphological importance, cultural heritage sites)	Vibration level during the blasting activities and from ground-disturbing activities including levelling, stabilising, compaction and excavation	At sensitive receptors within 500 m from vibration sources (works of site clearance and site preparation, access road construction, blasting)	The sensor measures the effective vibration velocity (rms-root mean square) on a non-rotating machine surface	Continuous, during activities producing potentially significant vibrations

8.8.2.5 Indicators

The environmental indicators are reported in Table 8.11.

Table 8.11 Noise emission and Vibration indicators

	UoM	Legislation limit	Applicable legislation/standard
Noise emissions			
Noise emission level at sensitive receptor (during day time)	dBA	55 dBA[1]	IFC EHS Guidelines for noise
Noise emission level at sensitive receptor (during night time)	dBA	45 dBA[1]	IFC EHS Guidelines for noise
Noise emission level in industrial area (during day time and night time)	dBA	70 dBA[1]	IFC EHS Guidelines for noise
Note *1- LAeq (equivalent sound pressure level A-weighted) for 1 hour, IFC limits relate to the Operation phase.*			
Vibration			
Highest Peak Component Particle Velocity, measured at receptor (particularly during blasting and piling events)	mm/s	**25 mm/s** peak particle velocity (for ground vibrations >35 Hz)	EcoAccess Noise and Vibration from Blasting Guideline (2006) (Environmental Protection Agency of Australian Government)[3]
		10 mm/s peak particle velocity (for ground vibrations <35 Hz)	EcoAccess Noise and Vibration from Blasting Guideline (2006) (Environmental Protection Agency of Australian Government)
		5 mm/s (for 9 out of any 10 consecutive blasts initiated, regardless of the interval between blasts)	EcoAccess Noise and Vibration from Blasting Guideline (2006) (Environmental Protection Agency of Australian Government)
		Less than **2 mm/s** (Ancient monuments /archaeological sites)	Safety standard of vibration from explosion followed by Australian Standard AS 2187-1983

[3] There is no national requirements concerning vibration exposure, thus Australian legislation, has been taken into account as reference for the definition of vibration standards. The Australian Government is considered one of the most reliable authority in terms of blasting regulation.

8.8.2.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

The Plan shall be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.8.2.7 Responsibilities

Table 8.12 below summarizes the responsibilities of different organizations.

Table 8.12 Noise Management Responsibilities

Organization	Responsibilities
eni	Company must guarantee the availability of economic, human and technical resources needed to manage the mitigation and monitoring measure as described in the final EMMP. It is the Company's responsibility to: • Ensure that the requirements of the Plan are satisfied; • Ensure that the contractors and any sub-contractors engaged are advised of their responsibilities to undertake their activities required by the Plan; • Ensure that the monitoring program is implemented properly.
General Contractors	It is the General Contractors' responsibility to: • Retain copy of the final EMMP on-site for reference by appropriate personnel; • Recommend additions or changes to Plan based on experience gained from implementation of Plan; • Verifying specific training/awareness sessions to employees involved in operations that may impact on the noise environment (blasting, site preparation, line clearance); • Ensure that the requirements of the Plan are satisfied; • Ensure that the contractors and any sub-contractors engaged are advised of their responsibilities to undertake their activities required by the Plan; • Ensure appropriate records are kept and maintained on-site; • Recommend additions or changes to Plan based on experience gained from implementation of Plan.

8.8.3 Biodiversity Action Plan

8.8.3.1 Legal Requirements

The Myanmar laws and regulations applicable to the Project and biodiversity are summarized in Table 3.5 of Section 3.

Table 3.4 of Section 3 reports the IFC General EHS Guidelines for air quality, noise and vibration, waste management and wastewater that may be relevant for the Project and for the biodiversity.

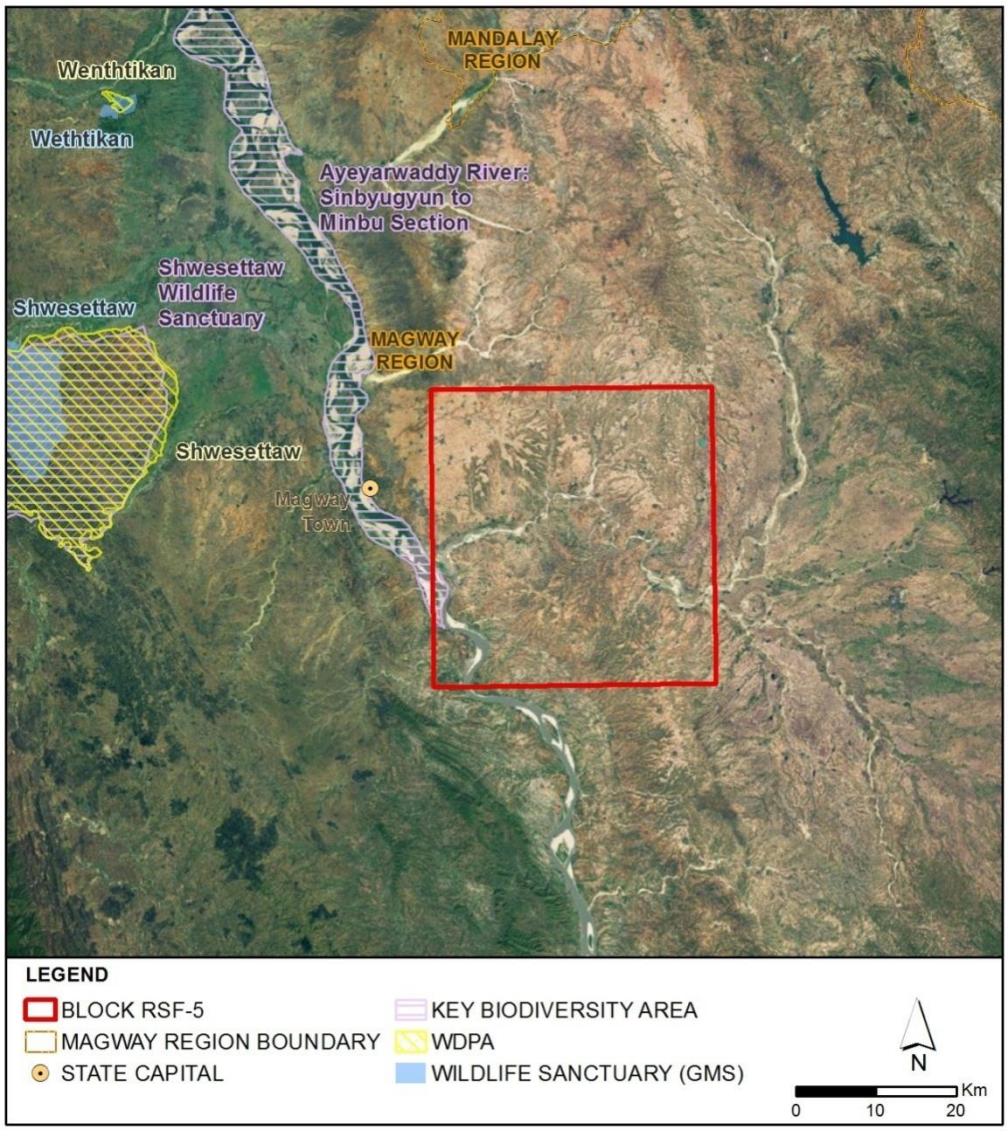
Furthermore, the International Finance Corporation (IFC) has developed a series of Performance Standards that aim at protecting the environment. Performance Standard 6 "recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development". The requirements set out in this Performance Standard have been guided by the Convention on Biological Diversity, which defines biodiversity as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems" (IFC, October 2012).

The guidance notes accompanying Performance Standard 6 indicate that in situations where there is the potential of significant negative impacts to biodiversity the project proponent should develop a Biodiversity Action Plan (BAP), to guide its activities so as to protect the natural environment.

8.8.3.2 Study Area

Following figures shows the location of the protected areas and the areas important for biodiversity near and within the Block.

Figure 8.3 Protected Areas and areas important for biodiversity conservation near and within the Block RSF-5



Source: eni, 2014

Critical Habitat

Under IFC PS 6[4] "Critical habitats" are areas with high biodiversity value, including:

i. Habitat of significant importance to Critically Endangered and/or Endangered species;

ii. Habitat of significant importance to endemic and/or restricted-range species;

[4] IFC 2012. IFC Performance Standards on Environmental and Social Sustainability. International Finance Corporation, World Bank Group. www.ifc.org

iii. Habitat supporting globally significant concentrations of migratory species and/or congregatory species;
iv. Highly threatened and/or unique ecosystems; and/or
v. Areas associated with key evolutionary processes.

The Government of Myanmar has not designated any portion of the *eni Myanmar* Block as a protected area for special management areas for wildlife. However, the biodiversity survey completed on August 29-31, 2016 as detailed in Annex 8, has obtained information suggesting that some Critically Endangered, Endangered and Endemic species find suitable habitat within the *eni Myanmar* exploration block and satisfy to a certain degree IFC Critical Habitat Criteria "i" and "ii", not withstanding interpretations of "significant importance". Conditions satisfying the remaining three critical Habitat criteria were not observed.

Within the context of exploration block locally Critical Habitat is loosely comprised of the remaining areas of native vegetation in the area, and more particularly, the blocks wetland/riparian areas, the remaining large diameter trees, and the more isolated stands of native vegetation (this being largely concentrated within the more incised drainages, gullies and breaks).

8.8.3.3 Management Actions

According to IFC Performance Standard 6, biodiversity conservation actions shall be implemented and applied "to projects located in modified, natural and critical habitats". Thus, before actions are defined, a habitat mapping shall be performed.

eni Myanmar's actions for conservation of biodiversity in the RSF-5 area can be divided into three categories: actions already foreseen in the ESHIA, new conservation-related activities specific to Protected Areas or Natural Forest habitat, and general actions on biodiversity conservation.

Conservation Actions already foreseen in the ESHIA:

- any sensitive area identified (natural or critical habitat) and located around the camp site and temporary explosive storage center (e.g. sensitive vegetation, water wells) will be marked with pegs and tape to ensure that these will remain untouched;
- re-vegetation (i.e. sowing native herbaceous species and/or planting native shrubs/trees) on bare soil with natural or semi-natural vegetation will reduce the spread of alien species;
- to avoid the introduction of alien species, both flora and fauna;
- to avoid hunting and wild resources consumption;
- using fences with fine mesh will limit the probability of crossing and access to the camp site and temporary explosive storage center by small vertebrates (e.g. amphibians, reptiles and small carnivores);
- in order to mitigate light pollution on wildlife and to preserve the view of the night sky, artificial lighting (e.g. in the camp site and temporary explosive storage center) will be limited in compliance with best practices;

- development of measures for control of surface water quality to avoid potential contamination from wastes, fuels, chemicals able to modify the characteristics of the water and influence the water usage by biodiversity;
- design and construction of all facilities outside the flooding hazard zones;
- removal, storage and restoration of disturbed soils;
- planning of project facilities in order to avoid/minimize sensitive areas, to avoid erosion and sediment runoff, to minimize site clearance;
- works to be undertaken outside the bird breeding season, and where not possible pre-vegetation clearance surveys to be undertaken;
- waste disposal areas shall be fenced to minimise any interaction with local fauna;
- all personnel to receive appropriate training about the importance of animal conservation and the importance of avoiding disturbance to fauna;
- careful driving will minimise the likelihood of injuring fauna;
- noise sources shall be fitted with mufflers or housing to restrict noise levels.
- all equipment shall be properly maintained to minimise emissions;
- if signs of potential concentrations of wildlife are observed, such as burrow complexes or dense vegetation, these shall be avoided so as not to harm animal populations;
- application of the Waste Management Plan and Emergency Management Plan in case of oil spill scenario.;
- mark trees to be cut prior to constructing camp site, temporary explosive storage center access road and seismic lines to prevent the cutting of other trees;
- contractors and personnel will not be allowed off site where they could cause unnecessary disturbance to wildlife;
- hunting and trapping will be specifically prohibited and violations grounds for termination of contract and dismissal;
- remove vegetation at shot hole location areas only;
- minimize the width of corridors;
- do not cut trees of a diameter greater than local regulation permit (in absence of regulation, greater than 20cm); leave in place smaller vegetation, topsoil, root stock, seeds and endangered or protected species used by local communities for commercial or subsistence use;
- mark seismic lines and shot hole sites clearly and prohibit personnel from moving off site onto surrounding land;
- avoid clearing and disturbance in all areas of native vegetation;
- avoid removal of mature tree cover;
- avoid activity in areas of native habitat during peak periods of peak nesting until fledging, for many species this will be between June and September;
- avoid in stream work in Yin river between the beginning of June and end of September (we have a locally reported spawning window June through August);
- conduct a pre-clearing/grading environmental and biodiversity survey of all lines in areas of native vegetation to identify site specific features along individual lines to be avoided and to broaden the local biodiversity data set and ensure there are no "wildlife trees" (trees with large stick nests, cavities, conspicuous signs of wildlife use),

dhole dens, concentrations of bank nesting birds. Qualified local field naturalists will record all wildlife observations during these pre-clearing lines surveys;
- where removal of trees with conspicuous stick nests or cavity nests must be undertaken, consider the installation of alternate nest platforms and nest boxes in consultation with qualified professional biologists;
- ensure proper storage and handling of all fuels or other hazardous substance
- conduct a careful inspection of areas where any riparian work areas to ensure there are no Burmese roofed turtles or their nests in the potentially impacted areas;
- harassment or collection of any wildlife species by seismic crew will not be allowed. Crews will be advised of this as part of their induction. Crews will be encouraged to report any observations of wildlife;
- replanting of high biodiversity value native trees in areas where avoidance of significant individuals is not possible;
- avoid disturbance to any natural or manmade surface water impoundments. Discuss with community the opportunity to enhance water storage of any manmade surface water impoundments to take advantage of the presence of heavy equipment. Care would have to be exercised to ensure this activity did not harm any wildlife resident in the existing water body or productive adjacent habitats.

New conservation-related activities specific to Protected Areas or Natural Forest habitat:

- protect the natural areas (protected areas or area of ecological interest) by Company or Contractors' Personnel: all personnel will receive appropriate training about the importance of biodiversity conservation and the importance of respecting and avoiding disturbance to habitats/flora/fauna;
- train Company and Contractor Personnel on the types of sensitive flora and fauna that need to be protected near the areas;
- carry out periodical review of the operations in the sites to review potential negative impacts to biodiversity and implement appropriate corrective actions. Update and enhance BAP as needed based on the mitigation and monitoring program;
- noise and dust control, speed limit and installation of warning signs will promote adaptation of species to disturbance factor of moving traffic;
- Sedimentation ponds fencing in order to avoid potential death of animals (drowning).

New general BAP actions:

- informative meeting for Local Communities on Conservation. *eni Myanmar* will organize this meeting for awareness-raising for local residents on the need for conservation. Handout materials will be made available and other communities close to natural area affected by the project. Age-appropriate materials on conservation will be made available to local schools.

8.8.3.4 Monitoring Plans

The development of flora and fauna monitoring campaign will provide a record of the variability in species occurrence, abundance and distribution throughout the Project activities in the most sensitive habitats identified within the area of influence of the Project.

The monitoring activities will not be conducted over the entire concession, but they will focus on that area evaluated as significant in terms of biodiversity resources.

The campaign will include commonly surveyed taxa that will allow any trends/patterns in regards to their biological parameters to be identified. In case detailed information about flora and fauna species of the Project area are available, the campaign will also focus on the main taxonomic groups identified.

Furthermore, the survey will monitor these biological parameters in the representative habitats within the block, as well as critical habitats (defined as areas with high biodiversity value) located within and close to the perimeter of RSF-5 area. Thus the following biology-related features of the block are to be monitored as part of the Plan:

- flora;
- terrestrial and aquatic fauna (birds, small and large mammals, amphibians, invertebrates and reptiles);
- habitat mapping;
- protected areas.

A monitoring plan shall be performed for the most invasive alien species, to record their populations in the study area.

Table 8.13 Environmental monitoring

Receptor	*Monitoring Task*	*Monitoring locations*	*Monitoring Parameter*	*Timing*
Flora (The main receptors are area of ecological interest)	Avoid the loss of vegetation especially for species of priority importance Ecological supervision Review and audit of mitigation activities to ensure satisfactory implementation of mitigation measures	Areas of ecological interest (e.g. protected areas, natural habitats) in proximity of the camp site, temporary explosive storage center, access road or line survey Area of direct interference (line survey, camp site, temporary explosive storage center, access roads)	Parameters to be monitored are: • Qualitative as well as species presence • Quantitative as well as occurrence, frequency, abundance, percentage cover	Before start of project During the project activities After the project.
Fauna (Birds, large mammals, small mammals, reptiles, amphibians)	Avoid the loss of biodiversity in the areas affected by the project and in the area of influence. Ecological supervision Review and audit of mitigation activities to ensure satisfactory implementation of mitigation measures	Areas of ecological interest in proximity of the camp site, temporary explosive storage center, access road or line survey Area of direct interference (line survey, camp site, temporary explosive storage center, access roads)	Parameters to be monitored are: • Qualitative as well as species presence • Quantitative as well as occurrence, frequency, abundance, percentage cover	Before start of project During the project activities After the project.

8.8.3.5 Indicators

The environmental indicators are reported in Table 8.14.

Table 8.14 Biodiversity indicators

Flora & Fauna, Habitats and Protected Areas			
	UoM	**Performance target (PT)**	**Applicable legislation/standard**
Trees over 15+ cm DBH on original alignment which were avoided by reroutes of original alignment	%	100%	IFC PS6
Trees < 15 cm diameter on original alignment which were avoided by reroutes of original alignment	%	75%	IFC PS6
Avoidance of Bombax sp., Ficus sp, Dipterocarpus tuberculatus, Hopea sangal of any size:	%	100%	IFC PS6
Permanent or seasonal wetlands avoided	%	100%	IFC PS6
Flying Fox Bat roosts avoided	%	100%	IFC PS6
Raptor nest sites avoided	%	100%	IFC PS6
Dhole den sites or concentrations of small mammal burrow sites avoided	%	100%	IFC PS6
Any protected bird species nest sites avoided	%	100%	IFC PS6

8.8.3.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

The Plan shall be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.8.3.7 Responsibilities

Table 8.15 below summarizes the responsibilities of different organizations.

Table 8.15 Management Responsibilities

Organization	**Responsibilities**
eni	Company must guarantee the availability of economic, human and technical resources needed to manage the mitigation and monitoring measure as described in the final EMMP. It is the Company's responsibility to: • ensure that the requirements of the Plan are satisfied; • ensure that the contractors and any sub-contractors engaged are advised of their responsibilities to undertake their activities required by the Plan; • ensure that the monitoring program is implemented properly.

Organization	Responsibilities
General Contractors	It is the General Contractors' responsibility to: • Retain copy of the final EMMP on-site for reference by appropriate personnel; • Recommend additions or changes to Plan based on experience gained from implementation of Plan; • Verifying specific training/awareness sessions to employees involved in operations that may impact on biodiversity; • Ensure that the requirements of the Plan are satisfied; • Ensure that the contractors and any sub-contractors engaged are advised of their responsibilities to undertake their activities required by the Plan; • Ensure appropriate records are kept and maintained on-site; • Recommend additions or changes to Plan based on experience gained from implementation of Plan.

8.8.4 Waste Management Plan

8.8.4.1 Legal Requirements

In this paragraph international Environmental Health and Social Guidelines (IFC 2007) related to the management of the Project's waste are reported in Table 8.16.

Table 8.16 Applicable IFC EHS Guidelines

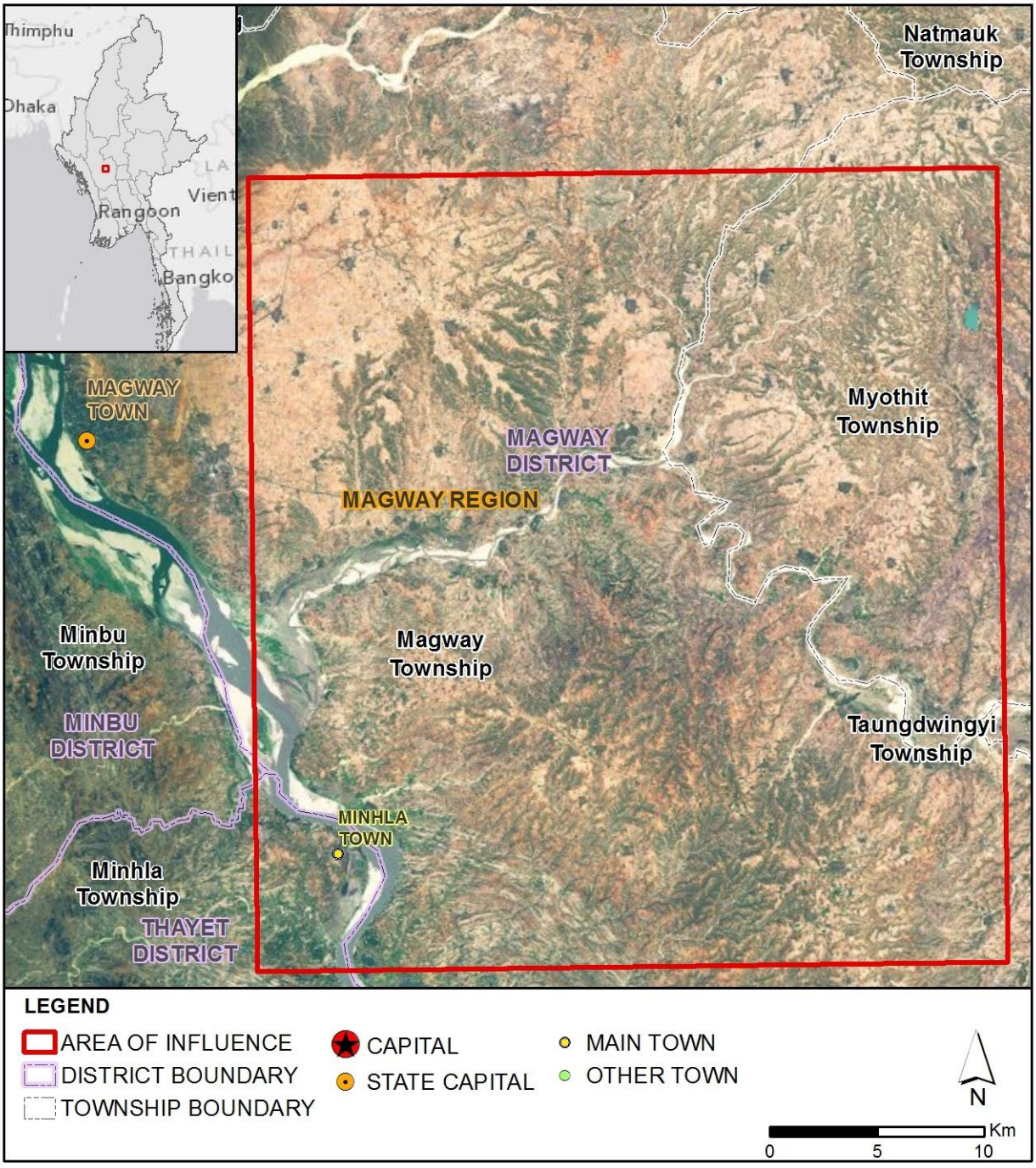
Environmental topic	Applicable EHS Guidelines
Wastewater and Liquid effluent quality	Section 1.3 provides guidelines applied for projects that have either direct or indirect discharge of process wastewater or wastewater from utility operations. Section 1.3 provides guidelines for treatment approaches of process wastewater and wastewater from utility operations. These Guidelines include the following key recommendations: • points of discharge, rate of discharge, chemical use, dispersion and environmental risk should be considered in a disposal plan; • discharges should be planned away from environmentally sensitive areas, with specific attention to high water tables, vulnerable aquifers, wetlands, and community receptors, including water wells and intakes.

Environmental topic	Applicable EHS Guidelines
Waste management	Section 1.6 provides guidelines for projects/facilities that generate, store, or handle any quantity of industrial hazardous or not hazardous waste. Section 1.6 provides appropriate guidelines for hazardous waste storage, transport, treatment and disposal, in order to prevent harm to health, safety and environment. These Guidelines include the following key recommendations: • waste management should be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring; • in addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans; • if waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed and all measures should be taken to avoid potential impacts to human health and the environment.

8.8.4.2 Study Area

Figure below presents the Study Area of the Project that is equivalent to the whole Block RSF-5.

Figure 8.4 Environmental Study Area



Source: eni, 2014

8.8.4.3 Waste Origins/Sources

The Project will have different sources of waste. Below they are analysed based on their origin.

Table 8.17 Wastewater

Waste Source	Generated waste
Camp Site	Sewage
Parking, refuelling and waste storage areas Areas for equipment and vehicles refuelling, maintenance and washing	Used oil, oily waters

The main activities that will generate solid waste are summarized in Table 8.18.

Table 8.18 Solid waste

Waste Source	Generated waste
Camp Site/tank	Sewage sludge
Site clearance wooden pallets from equipment shipments	Soil, Wood or vegetation
Accommodation areas, offices	Food waste; Paper and cardboard; Plastics; Glass; Miscellaneous combustible; Kitchen oil/grease; Hazardous waste (e.g. small batteries, Fluorescent and sodium lamps)
Supply of materials	Plastic and metals containers; Packaging materials
Vehicles, mobile plant	Tyres (used); Lead-acid batteries; Air filters
Storage of oil	Tank bottoms
First aid/medical treatment centers	Medical waste

8.8.4.4 Management Actions

This preliminary plan is developed to avoid solid and liquid waste discharges onto the soil or water. It establishes procedures for waste storage, collection and disposal, including liquid and solid waste and hazardous and non-hazardous waste.

The following items constitute the preliminary Waste Management Plan, based on international best practices in waste management. A detailed project specific Waste Management Plan has been included in Annex 13.

- waste minimization principles: the inventory management systems will be updated to identify the consumption of products, ensuring waste's traceability, and identifying potential wastage and overconsumption. An inventory of all waste generated and disposed of will be retained (type and volume) and *eni Myanmar* will develop goals for reducing the quantities of waste generated, based on periodic review of the inventory.
- separation of solid waste according to established classification: waste generated during Project activities is likely to be classified into four categories for disposal: inert (soil, building rubble, unused construction material, etc.), domestic, oily & hazardous, and liquid. Containers/skips will be associated to waste types (cardboard, plastic, metal scrap, oily, hazardous if any, etc.), in order to permit the separation/segregation. Different types of waste will be separated by camp site and temporary explosive storage center staff, and staff dealing with waste will be trained. Handling of waste on-site and in working sites will be instructed through "procedures." Service companies will go through a qualification process and will be audited during the service period.
- solid waste storage: a daily waste storage area for containers/skips will be located at the camp site and temporary explosive storage center. At the end of the working day, waste in skips will be transported to the camp site / temporary explosive storage center, and stored. Storage will be located in the camp site / temporary explosive storage center, partly roofed. Waste skips for oily waste or other hazardous waste will be waterproof. Procedures for filling fuel tanks of machines and handling of hazardous waste/materials will be established prior to the start of project activities.
- waste reuse/recycle opportunities: different types of waste will be separated according to local regulations and the recycling materials that are dealt with in Myanmar. Recycling materials will be regularly collected to be recycled by certified and authorised local companies.
- waste transfer: waste transfer will be assumed by certified companies; vehicles will be fully equipped, considering the type of waste transported. No exporting of waste is anticipated.

- final disposal of waste: only companies certified and authorised will be used for waste disposal, which identifies that it will be possible to manage and dispose of all the likely operation waste streams at facilities within Myanmar. The inert waste, which poses no risk of pollution, will be disposed of at a controlled disposal site. Domestic waste will be transported to a controlled waste disposal site. Oily and hazardous waste will be disposed by specialist contractors at sites that are equipped and approved for such waste.
- specificities of hazardous waste management: in order to provide protection for the environment and human health, collection, transport and storage of hazardous waste will include action to ensure traceability from production area (mainly on camp site) to final disposal site. The transport of hazardous waste shall only be undertaken in vehicles that are suitably equipped for the type and quantity of hazardous waste to be transported and are of a roadworthy standard.
- waste recording process: all waste will be registered as well as separation/segregation, storage, transfer and reception to the disposal. This inventory will allow traceability to be ensured, particularly for the hazardous waste. Optimization of waste management is a continuous process, and this plan will be periodically reviewed.
- In general solid waste, as for example, all the civil waste (paper, wood, kitchen waste, etc.) produced at camp site and temporary explosive storage center, they will be gathered up in the opposite box and will be transported to a disposal site indicated by the Authorities.

Finally, the plan will include provisions for the training of all workers on how to use the Waste Management Plan, and will include procedures related to communication to stakeholders and community improvement opportunities.

8.8.4.5 Monitoring Plans

A monitoring program for waste management will be implemented to control that all the waste management actions will be conducted in compliance with the Myanmar legislation, the International guidelines and *eni Myanmar*'s standard, and in order to avoid and minimize risk of pollution, due to waste storage, transfer, treatment and final disposal activities.

Three kinds of waste monitoring activities will be conducted, as reported below:

- a measurement of weight/volume of waste, separate by type and final disposal, at source, onsite storage areas, transport vehicles and receptor facilities, using portable or fixed scales. Measurement will be carried out every time the waste is generated, collected and stored to be delivered onsite or to Third Party contractors for subsequent use, treatment or final disposal. These data will be inserted in a waste register.

- all waste storage areas will be inspected regularly (every week) checking their quality status, including good conditions of containers and the proper labelling. A check list will be completed every inspection and for any criticalities that will be found, a corrective action will be planned and implemented, in order to control and minimize any risk of pollution. Furthermore every month a supervisor will check that the waste register will be correctly compiled;

- an environmental monitoring will be performed in order to address all activities that have been identified to have potentially significant impacts on the environment. The production and waste management are most likely to potentially impact soil, water and biological resources. Monitoring activities are briefly summarized in Table 8.19.

In conclusion, an outline of the monitoring programmes proposed for the Project, is presented below in Table 8.19.

Table 8.19 Environmental monitoring

Receptor	*Monitoring Task*	*Monitoring locations*	*Monitoring Parameter*	*Timing*
Soil, freshwater and biological resources	Domestic waste will be weighed/quantified at source using portable/fixed scales All waste storage areas will be inspected regularly checking their quality status, including good conditions of containers and the proper labelling.	Waste may be monitored in all the area: transport vehicle or at receptor facility, final receptor may be intermediate waste storage areas (in case of recycling/reuse of waste)	Direct measurement of weight/volume of waste, separate by Project - Phase - Activity - Type - Final disposal	Sampling should be continuous every time the waste is collected to be delivered to a subcontractor for subsequent use until final disposal.
Soil, freshwater and biological resources	All waste storage areas will be inspected regularly	Waste storage areas	The status of the storage areas, their quality status, including good conditions of containers and the proper labelling	Visual Inspection: every week While every month a supervisor will check that the waste register will be correctly compiled

8.8.4.6 Indicators

The environmental indicators are reported in Table 8.20.

Table 8.20 Waste indicators

Environment Indicators	UoM	Legislation limit	Applicable legislation/standard
Waste			
Volume of waste by type	ton/month	N/A	IFC EHS General Guidelines – Section 1.3 Wastewater and Ambient Water Quality
Final destination of waste (by type)	ton/month	N/A	IFC EHS General Guidelines – Section 1.6 Waste management
Final treatment of waste (by type)	ton/month	N/A	E&P waste management guidelines; OGP reference 2.58/196; September 1993

8.8.4.7 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

The Plan shall be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.8.4.8 Responsibilities

Table 8.21 summarizes the responsibilities of different organizations with respect to the management of waste generated by the Project.

Table 8.21 Waste Management Responsibilities

Organization	Responsibilities

eni	Ensure Project waste is managed in a manner consistent with Myanmar laws and the framework of the final WMP
	• Development and custodianship of this WMP including:
	  ○ collection, compilation and analysis of waste management performance statistics to ensure compliance;
	  ○ driving continual improvements;
	  ○ reporting for documenting the environmental monitoring campaigns;
	  ○ communication of changes in the WMP to Staff, contractors and Myanmar authorities, as required; and
	  ○ communication of waste management procedures to site personnel and contractors including provision of waste awareness training to site staff and contractors.
	• Preparation of contracts that include requirements to manage Project waste in accordance with this WMP;
	• Monitoring waste management performance of Project contractors by undertaking audits
	  ○ Ensure all Project waste management facilities (eni owned or third party owned) are operated in accordance with licenses.

Organization	Responsibilities
General Contractors	Ensure all type of waste are managed in accordance with this WMP and Contract requirements including: • compliance with Myanmar and any other relevant legislative requirements; • development and implementation of Waste Minimization and Management Plan and Reuse and Recycle Plan; • store waste in accordance with this Plan and with mitigation measures reported in the ESHIA (segregation, containers, labelling); • provide assurance to eni that Project waste are being properly managed and disposed through provision of waste generation and waste management data; and • training of staff in Project waste management procedures and requirements of this WMP.
Waste Management Contractors	• Manage waste in accordance with Contract requirements; • Manage all Project waste in accordance with site authorization or license and Myanmar laws; • Complete waste transfer notes and return a copy to eni as evidence of receipt of Project waste; • Provide information and data to eni regarding Project waste managed; • Allow eni access to audit waste management facilities and operations.

The waste management plan will be revised by eni Myanmar following the technical guideline: "Waste Management in Upstream Oil & Gas Activities", AMTE TG 010 r00.

8.8.5 Water Management Plan

The Water Management Plan will have the following objectives:

- monitor water use: the Plan will set procedures for estimating water used by the project, identifying activities that use this resource, and following a reporting procedure for registering volumes of water used;
- minimise water use: the Plan will provide a series of measures to be considered for minimising the use of water;
- log suppliers: the supply, the volume and the type of water provided will be identified and registered in the Plan.

8.8.5.1 Legal Requirements

The Project will comply with the Mynamr Environmental Quality (Emission) Standards and international standards.

The management and mitigation measures of the Plan are aligned with the IFC guidelines detailed here below.

The IFC General EHS Guidelines considered relevant to the project are:

- General EHS Guidelines
  - Section 1.3 – Wastewater and Ambient Water Quality
  - Section 1.6 – Waste Management
- Onshore Oil and Gas Development.

Applicable EHS Guidelines has been summarized in **Table 8.22**.

Table 8.22 Applicable IFC EHS Guidelines

Environmental topic	Applicable EHS Guidelines
Wastewater and Liquid effluent quality	Section 1.3 provides guidelines applied for projects that have either direct or indirect discharge of process wastewater or wastewater from utility operations. Section 1.3 provides guidelines for treatment approaches of process wastewater and wastewater from utility operations. These Guidelines include the following key recommendations: • points of discharge, rate of discharge, chemical use, dispersion and environmental risk should be considered in a disposal plan; • discharges should be planned away from environmentally sensitive areas, with specific attention to high water tables, vulnerable aquifers, wetlands, and community receptors, including water wells and intakes.
Waste management	Section 1.6 provides guidelines for projects/facilities that generate, store, or handle any quantity of industrial hazardous or not hazardous waste. Section 1.6 provides appropriate guidelines for hazardous waste storage, transport, treatment and disposal, in order to prevent harm to health, safety and environment. These Guidelines include the following key recommendations: • waste management should be addressed through a Waste management system that addresses issues linked to waste minimization, generation, transport, disposal, and monitoring; • in addition to the implementation of waste prevention strategies, the total amount of waste may be significantly reduced through the implementation of recycling plans; • if waste materials are still generated after the implementation of feasible waste prevention, reduction, reuse, recovery and recycling measures, waste materials should be treated and disposed and all measures should be taken to avoid potential impacts to human health and the environment

Environmental topic	Applicable EHS Guidelines
Onshore Oil and Gas Development	The EHS Guidelines for Onshore Oil and Gas Development include information relevant to seismic exploration These Guidelines include the following key recommendations regarding wastewater / effluent discharges: • Separate drainage systems for drainage water from process areas that could be contaminated with oil (closed drains) and drainage water from non-process areas (open drains) should be available; • Equipment and vehicle wash waters should be directed to the closed drainage system; • Oily water from drip trays and liquid slugs from process equipment should be routed to the closed drainage system

Table 8.23 reports the Myanmar applicable legislation and regulation regarding the water resources.

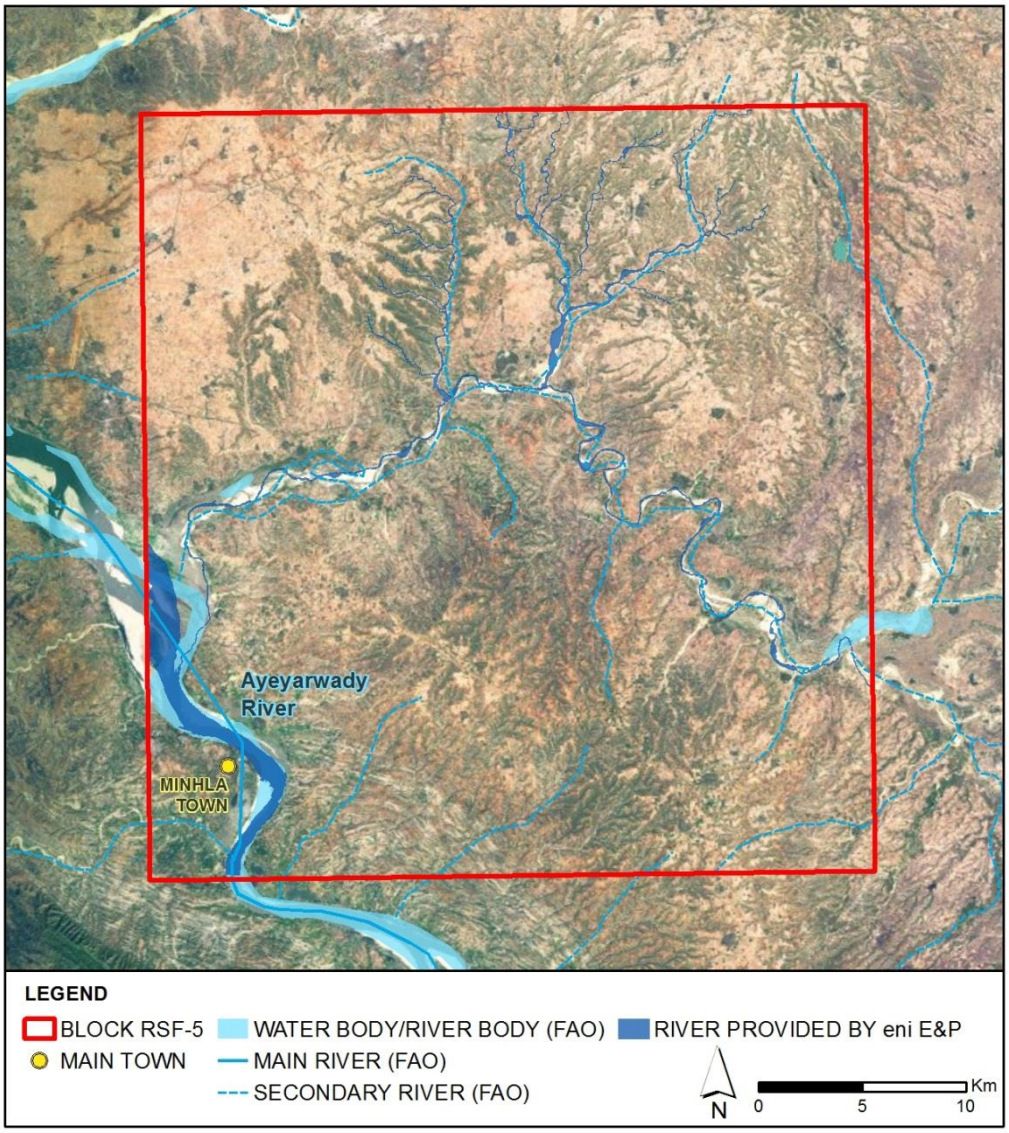
Table 8.23 Myanmar Applicable Legislation & Regulation

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
Water resources	• The Conservation of Water Resources and Rivers Law, 2006 • Underground Water Act, 1930	• The Conservation of Water Resources and Rivers Law (2006) prohibits carrying out any actions with the aim to ruin water resources, including rivers, and causing intentional water wastage, and pollution of water resources.	• Ministry of Agriculture • Ministry of Transport

8.8.5.2 Study Area

Figure 8.5 shows the river network within the Block RSF-5.

Figure 8.5 River network Block RSF-5



Source: eni, 2014

8.8.5.3 Management Actions

The main typology of water used and produced during the Project activities are the following:

- washdown water;
- dust control water;
- sewage/sanitary water;
- stormwater;
- consumption of Water Resources.

The following paragraph analyse the different types of water and their management options.

Washdown water

Washdown water could include hydrocarbons, metals, solid deposited on equipment and chemical additives of washing solutions.

Washdown facilities shall not be established on land subject to seasonal flooding. An adequate separation distance shall be maintained between washdown management facilities and waterways to protect their ecological and social values and prevent water quality degradation. In detail washdown facilities will be not located close to water resources, unless adequate facilities are provided to contain, treat and then dispose of waste residues at an approved location without causing harm to superficial water.

The water required to washdown equipment not contaminated will be supplied by tank, but it may also be used the uncontaminated surface water (stormwater) collected in surface ponds.

Washing activities will take place within demarcated plots connected to a collecting water system. The water collected will be treated in situ and potentially re-used for dust control or irrigation.

Water quality shall be in compliance with the IFC standards for the discharges of liquid effluents to surface water or to land reported in Table 8.24. Otherwise they will be collected in the opposite container and will be transported to a disposal site indicated by the Authorities.

Dust control water

Activities such as the removal of vegetation, site levelling and rehabilitation and the use of existing dirt roads are likely to cause erosion and generate dust, and result in a relatively rapid increase in sediment load in the superficial water if not controlled.

Dust controls reduce the surface and air transport of dust, thereby preventing pollutants from infiltrating into superficial water.

Adequate dust control strategies will be applied to minimize dust deposition and reduce sedimentation in the superficial water, for example periodic spraying of roads or camp site with water.

The water used for this activity will be supplied by tanks in order to decrease the water withdrawals. The water quality shall be in compliance with the IFC standards for the discharges of liquid effluents to surface water or to land.

Table 8.24 Discharge of Liquid Effluents into Natural Environments

Parameters	IFC Indicative Values
pH	6-9
Biochemical Oxygen Demand (BOD)	30 mg/l
Chemical Oxygen Demand COD	125 mg/l
Total Dissolved Solids	-

Parameters	IFC Indicative Values
Total Suspended Solids (TSS)	50 mg/l
Metals	-
Total nitrogen	10 mg/l
Total Kjeldahl nitrogen	-
Ammonia nitrogen	-
Total phosphorous	2 mg/l
Total coliform bacteria	400Most Probable Number/100ml
Oil and grease	10 mg/l

The volume of dust control and irrigation water will be estimated in a more advanced phase of project design.

Sewage/Sanitary Water

Septic tank will be used for disposal of domestic sanitary sewage. The septic tank will be:

- properly designed and installed in accordance with local regulations and guidance to prevent any hazard to public health or contamination of land, surface or groundwater;
- well maintained to allow effective operation;
- installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters.

Septic tank will be removed and sent for disposal at a licensed facility wherever possible (at the end of operations during closure of the camp).

No discharge of liquid waste to water resources is envisaged; all waste will be collected, stored and transported separately by typology in appropriate and approved bins and containers.

Storm Water - Surface water/Runoff

The stormwater management strategy for the Project activities is focused primarily on minimization of sediment loads exported from the site in storm runoff.

During the site preparation, the removal of vegetation and bulk earthworks activities will expose large areas of the site to potential erosion during rainfall periods.

Therefore it is proposed to construct sedimentation ponds and internal swale drains during the initial bulk earthworks activities. All runoff from the site during the Project activities will be directed to the sedimentation ponds via the swale drains in order to minimize the sediment load in run-off discharged from the site. The sedimentation ponds and internal swale drains allow for the removal (via settling out) of any suspended solids allowing the uncontaminated stormwater to be discharged to surface waters located in the block.

If surface ponds are used for surface water storage, the pit shall be constructed outside environmentally sensitive locations.

The following actions shall be undertaken, where and when appropriate in order to minimize the generation and export of pollutants in storm runoff discharged from the site:

- access to the site will be limited to authorized vehicles through controlled access points;
- vegetation clearance will be limited to only areas essential;
- diversion drains will be constructed around the site initially and where necessary to direct runoff from upslope areas around exposed areas and thus minimize volumes of runoff requiring sediment treatment;
- sediment collection devices such as check dams and/or silt fences will be installed in drainage lines or around perimeter banks to intercept and retain sediment in runoff;
- trapped sediment will be removed from stormwater drainage system, as required to maintain function;
- a stormwater management strategy reported in Environmental Management & Monitoring Plan;
- access to the site will be limited to authorized vehicles through controlled access points;
- vegetation clearance will be limited to only areas essential;
- diversion drains will be constructed around the site initially and where necessary to direct runoff from upslope areas around exposed areas;
- sediment collection devices such as check dams and/or silt fences will be installed in drainage lines or around perimeter banks to intercept and retain sediment in runoff;
- trapped sediment will be removed from stormwater drainage system, as required to maintain function;
- geomorphological and vegetational restoration activities will be undertaken after the seismic survey;
- seismic survey will be performed in periods of time when flooding is minimum;
- avoid construction of camp site, temporary explosive storage center and access roads in areas that may cause obstacles to water drainage;
- construct water drainage lines (culverts) to maintain natural drainage. The required permission will be obtained from all relevant agencies;
- Local authority and land owner/user consultation on camp site, temporary explosive storage center and access road construction design;
- follow civil engineer's recommendation oniy, temporary explosive storage center and access road construction design.

Uncontaminated surface water shall be reused in following directions:

- irrigation water for greenery cover areas (not for agricultural use);
- dust control;
- fire water;
- equipment and vehicles washing.

The following control measures will be put in place to prevent the contamination from Fuels, Lubricant Oils and Chemicals:

- temporary fuel stored will be correctly bounded;
- procedures for vehicle/equipment refuelling will be implemented to prevent spillage and will prohibit construction vehicles and equipment to be refuelled near water courses. Appropriate spill containment equipment will be available at refuelling sites. All drivers will be trained in emergency spill response procedures;
- the washing of equipment, vehicles or machinery near or within watercourses will be prohibited;
- avoid construction of the access roads, camp site and temporary explosive storage center in areas where this would obstruct water drainage;
- prohibit workers from cleaning machines/equipment in/near a public water source;
- prohibit workers and contractors discharging or discarding project waste, chemicals, oil into public water sources;
- fuel storage tanks to be placed on concrete pad surrounded by bund wall;
- construct drainage system around concrete pad or HDPE liner for fuel storage tanks and generator to divert any spills into sump pit;
- isolate any area(s) that might be contaminated from non-contaminated areas. Provide impervious water drainage system around the contaminated area for collecting water into the sump pit for treatment;
- construct oil traps along perimeter of drainage ditch to prevent any spills from flowing off site;
- store all chemicals in secured storage area with impervious (cement or plastic sheet) floor and bund wall. Handle all chemicals according to their MSDS;
- use oil catch pans under vehicles when performing maintenance. Conduct maintenance only on impervious surfaces (i.e. on tarpaulin sheet);
- provide spill cleanup kits and training for designated rapid response teams to clean up any spills;
- in the event of oil or chemical spill, implement spill response plan;
- hydrocarbons will be securely stored and use, governed by safe operating procedures;
- hydrocarbon spill containment and recovery equipment will be available near hydrocarbon storage;
- procedures for response to hydrocarbon spills will be included in eni Myanmar's ERP.

The following management measures will be adopted to reduce Effects of Sediment Plumes on Water Resources:

- maximum permitted vehicle speed will be reduced in the proximity of water courses, in order to reduce the amount of dust that potentially could sediment in the water course;
- topsoil will be stored away from watercourses in designated topsoil stockpile areas where it will be covered and protected from potential erosion/flood events due to rainfall runoff;
- a stormwater management strategy will be implemented in the Environmental Management & Monitoring Plan;
- the proposed camp site, temporary explosive storage center and access roads will be selected to minimize areas requiring soil stabilization;
- provide drip pans and absorbents to contain any spillage. Absorbents shall be recyclable if possible;
- provide drainage and sediment traps around project area to reduce suspended particles in runoff from the camp site and temporary explosive storage center to contain minor oil spills;

- avoid construction of the camp site, temporary explosive storage center and/or access road in areas where such construction obstructs water drainage;
- prohibit workers from cleaning machines/equipment in/near a public water source;
- prohibit workers and contractors discharging or discarding project waste, chemicals, oil into public water sources;
- provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).

Consumption of Water Resources

The following management measures will be adopted:

- bottled drinkable water will be supplied to the camp site and temporary explosive storage center;
- consult local community leaders before water hauling (if required);
- potable water and industrial water, if taken by tube wells or tanker from nearby reservoirs/rivers, shall not affect the availability of water to locals.

8.8.5.4 Monitoring Plans

Water quality in the vicinity of the discharge point will be monitored in order to assess ambient water quality characteristics and to monitor the impact.

Surface Water

The monitoring of surface water will consist of specific activities such as visual inspections of surface water bodies where discharge points are located and potential sources of contamination, including the inspection of secondary containments, sump pits, material storage areas to confirm the absence of overflows, leaks and/or spills. All visual observations will be recorded on the field forms and photographs will be taken to support the observations.

The results of the stormwater monitoring will determine the effectiveness of the control measures, and overall stormwater management program.

Evaluation of stormwater will include inspections, visual assessments, and sampling of specified stormwater discharges. Regular stormwater inspections and visual assessments provide qualitative information on whether there are unaddressed potential pollutant sources and whether existing control measures are effective or need to be re-evaluated.

The following monitoring measures will be performed:

- sediment fences will be inspected weekly and following each significant rainfall event to assess the need for repairs or maintenance;
- stormwater will be sampled during the first significant rainfall event each month that results in stormwater being discharged from any of the sedimentation ponds;
- the monitoring and recording of the performance of the drainage control devices, including overtopping, scouring or erosion of drains and sedimentation ponds or other damage sustained by any device, together with details of the rainfall and stormwater discharge will be undertaken following any rainfall event exceeding 25mm in 24 hours;
- stormwater quality will be monitored at the specified discharge points.

Stormwater sampling provides quantitative (i.e., numeric) data to determine pollutant concentrations in runoff and, in turn, the degree to which control measures are effectively minimizing contact between stormwater and pollutant sources.

In detail the monitoring phase will be performed through:

- visual Assessments of Discharges: take a grab sample during a rain event and assess key visual indicators of stormwater pollution – color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other qualitative markers of pollution. The findings of these assessments are used to trigger further facility inspections and corrective actions to modify problems found at the site.

- sampling: Stormwater samples are collected from the site's discharge points for laboratory analysis and the results will be compared with national and international standards.

In conclusion, an outline of the monitoring programmes proposed for the Project, is presented below in Table 8.25.

Table 8.25 Outline of Monitoring Programme

Receptor	*Monitoring Task*	*Monitoring locations*	*Monitoring Parameter*	*Timing*
Surface water	Visual assessments: Inspections of water quality at the sedimentation pounds and at the discharge points	Surface water discharge point Sedimentation's basins (pounds) / lined pit	Color, odor, clarity, floating solids, settled solids, suspended solids, foam, oil sheen, and other qualitative markers of pollution. Monitoring of drainage lines/measures adopted	Daily and after each rainfall event
	Sampling	Surface water discharge point Sedimentation's basins (pounds)	pH Biochemical Oxygen Demand (BOD) Chemical Oxygen Demand COD Total Dissolved Solids Total Suspended Solids (TSS) Metals Total nitrogen Total Kjeldahl nitrogen Ammonia nitrogen Total phosphorous Total coliform bacteria Oil and grease	During the first significant rainfall event each month
	Identification and reporting of erosive events	Camp site / Temporary explosive storage center	Number of erosive events caused by the project Percentage of project related erosive events detected and corrected	Continuous

Groundwater

The key aspect for assessing the potential contamination of the aquifers during the shot hole drilling is:

- should water flow from the shot hole, the hold must be plugged with suitable weight muds;
- use suitable charge and shot hole depth for local geology;
- provide drip pans and absorbents to contain any spillage. Absorbents shall be recyclable if possible;
- provide drainage and sediment traps around project area to reduce suspended particles in runoff from the camp site and temporary explosive storage center to contain minor oil spills;
- prohibit workers from cleaning machines/equipment in/near a public water source;
- collect sewage in septic tanks;

- provide a suitable storage area for construction materials (such as soil, sand, and stone), chemicals (i.e., paint and thinner), and oil (i.e., fuel and lubricating oil).

Groundwater monitoring will consist of periodic sampling so as to evaluate groundwater quality throughout the Project area. Sampling points will be located in correspondence of the sources of discharge above mentioned.

In conclusion, an outline of the monitoring programmes proposed for the Project, is presented below in Table 8.26.

Table 8.26 Outline of Monitoring Programme

Receptor	***Monitoring Task***	***Monitoring locations***	***Monitoring Parameter***	***Timing***
Groundwater	Sampling	Groundwater wells located inside the Block and already sampled for the baseline.	TPH, Metals, BTEX, MTBE	Quarterly and after the closure of the activities

8.8.5.5 Indicators

Dutch and WHO Drinking water standards have been used as environmental indicators for water resources.

The environmental indicators are reported in Table 8.27.

Table 8.27 Water indicators

Water			
TPH	mg/L	600	Dutch Standard Intervention Value
Total Coliforms	CFU/ 100mL	0	WHO Drinking water standards
Antimony	µg/L	20	Dutch Standard Intervention Value
Arsenic	µg/L	60	Dutch Standard Intervention Value
Barium	µg/L	625	Dutch Standard Intervention Value
Beryllium	µg/L	15	Dutch Standard Intervention Value
Cadmium	µg/L	6	Dutch Standard Intervention Value

Chromium	µg/L	30	Dutch Standard Intervention Value
Cobalt	µg/L	100	Dutch Standard Intervention Value
Copper	µg/L	75	Dutch Standard Intervention Value
Mercury	µg/L	0.3	Dutch Standard Intervention Value
Lead	µg/L	75	Dutch Standard Intervention Value
Molybdenum	µg/L	300	Dutch Standard Intervention Value
Nickel	µg/L	75	Dutch Standard Intervention Value
Selenium	µg/L	160	Dutch Standard Intervention Value
Tellurium	µg/L	70	Dutch Standard Intervention Value
Thalium	µg/L	7	Dutch Standard Intervention Value
Tin	µg/L	50	Dutch Standard Intervention Value
Vanadium	µg/L	70	Dutch Standard Intervention Value
Silver	µg/L	40	Dutch Standard Intervention Value
Zinc	µg/L	800	Dutch Standard Intervention Value
Benzene	µg/L	30	Dutch Standard Intervention Value
Toluene	µg/L	1000	Dutch Standard Intervention Value
Ethylbenzene	µg/L	150	Dutch Standard Intervention Value
Xylene (sum)	µg/L	70	Dutch Standard Intervention Value
Methyl-Tert-Butyl Ether (MTBE)	µg/L	9400	Dutch Standard Intervention Value
pH	n/a	6.5-8.5	WHO Drinking water standards
Conductivity	µS/cm	n/a	n/a
Temperature	ºC	n/a	n/a

8.8.5.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the tables above.

The Plan shall be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.8.5.7 Responsibilities

Table 8.28 below summarizes the responsibilities of different organizations.

Table 8.28 Water Management Responsibilities

Organization	Responsibilities
eni	Company must guarantee the availability of economic, human and technical resources needed to manage waters/wastewaters and to guarantee the water quality of the effluents during the Project activities as described in the final EMMP. It is the Company's responsibility to: • Ensure that the requirements of the Plan are satisfied; • Ensure that the contractors and any sub-contractors engaged are advised of their responsibilities to undertake their activities required by the Plan; • Ensure that the monitoring program is implemented properly.
General Contractors	It is the General Contractors' responsibility to: • Retain copy of Plan on-site for reference by appropriate personnel; • Recommend additions or changes to Plan based on experience gained from implementation of Plan; • Verifying specific training/awareness sessions to employees involved in operations that may impact on the water quality (management of wastewater, equipment and vehicle washdown procedure, mitigation and monitoring measures); • Ensure that the requirements of the Plan are satisfied; • Ensure that the contractors and any sub-contractors engaged in the Project activities are advised of their responsibilities to undertake their activities required by the Plan; • Coordinating and verifying implementation of the regular controls of the surface/groundwater and effluents quality; • Ensure appropriate records are kept and maintained on-site; • Recommend additions or changes to Plan based on experience gained from implementation of Plan.

The waste management plan will be revised by eni Myanmar following the technical guideline: "Sustainable Water Management for the Upstream Sector", AMTE TG 012 r00.

8.8.6 Cultural Heritage Management & Monitoring Plan

8.8.6.1 Legal Requirements

The Cultural Heritage Management and Monitoring Plan will have the objective of avoiding potential damage to cultural resources and their associated buffer zones. According to the Operational Guidelines for the Implementation of the World Heritage Convention, section 105 "For the purposes of effective protection of the nominated property, a buffer zone is an area surrounding the nominated property which has complementary legal and/or customary restrictions placed on its use and development to give an added layer of protection to the property. This should include the immediate setting of the nominated property, important views and other areas or attributes that are functionally important as a support to the property and its protection. The area constituting the buffer zone should be determined in each case through appropriate mechanisms. Details on the size, characteristics and authorized uses of a buffer zone, as well as a map indicating the precise boundaries of the property and its buffer zone, should be provided in the nomination."

The Plan has been developed following eni's standards and will consider all the relevant IFC EHS guidelines. Consistent with the convention concerning the Protection of the World Cultural and Natural Heritage, IFC Performance Standard 8: Cultural Heritage aims to ensure that projects protect cultural heritage in the course of their activities, support its preservation and promote the equitable sharing of benefits from the use of cultural heritage. IFC Performance Standard 8 requires that projects:

- protect cultural heritage by ensuring that internationally recognised practices for the protection, field-based study, and documentation of cultural heritage are implemented. Where relevant this includes the retention of a competent professional to assist in the identification and protection of cultural heritage;
- develop provisions for managing chance finds, requiring any chance find to be undisturbed until an assessment by competent professional is complete and management actions are identified;
- consult with affected communities to identify cultural heritage of importance and to incorporate their views into the decision making process. This shall involve national and local regulatory agencies;
- allow continued access to cultural heritage sites by affected communities within living memory for long-standing cultural purposes;
- avoid impacts to or where not feasible minimise (negative impacts) or restore in situ the functionality of replicable cultural heritage;
- do not remove any non-replicable cultural heritage unless the following criteria are met namely, that – there are no technically or financially feasible alternatives; the overall benefit of the project outweigh the anticipated cultural heritage loss from removal; and the removal of cultural heritage is conducted using the best available techniques;
- shall not remove, significantly alter, or damage critical cultural heritage. In exceptional circumstances where impacts are unavoidable, the Project will use a process of Informed Consultation and Participation (ICP);

Table 8.29 reports the Myanmar applicable legislation and regulation regarding the cultural heritage.

Table 8.29 Applicable IFC EHS Guidelines

Aspect/Feature	Laws and Regulations	Key Requirements for the Project	Key Authorities
Cultural Heritage	• The Protection and Preservation of Cultural Heritage Region law, 1998, and amended in 2009 • The Protection and Preservation of Ancient Monuments Law, 2015 • The Protection and Preservation of Antique Objects Law, 2015 • The Law Protecting the Rights of National Races (2015)	• Section 2 of the law defines the protected and preserved cultural monuments as follows: ○ Cultural Heritage means ancient monument or ancient site which is required to be protected and preserved by reason of its historical, cultural artistic or anthropological value; ○ Ancient Monument includes the following that existed before 1886 or that have been determined as cultural heritage: architectural structure, shrine, stupa, temple, monastery, palace, residential building and carving, image and painting thereon; natural or man-made cave in which human beings had dwelt; stone inscription and record; road, bridge, sepulchre, sepulchral site and remains of excavated structure; pond, city-wall, wall, gateway, moat, fort and any remains thereof; ○ Ancient Site means place or high ground where a town or settlement of ancient people or ancient monument had existed before 1886 or which is determined as cultural heritage whether it is in the process of excavation or has not yet been excavated. • According to this law, the Ministry of Culture has the right for acquisition of any land in the country if the area has the above mentioned features.	• The State Peace and Development Council • Ministry of Culture • Department of Archaeology

8.8.6.2 Study Area

The culture of Myanmar has been heavily influenced by Buddhism and the Mon people. Myanmarese culture has also been influenced by its neighbours India, Thailand and China. In more recent times, British colonial rule and westernisation have influenced aspects of Burmese culture, including language and education.

Myanmar has been referred to as the Land of Pagodas as there are a considerable number of Buddhist pagodas. The sites regarded as the most important Buddhist pilgrimage sites are:

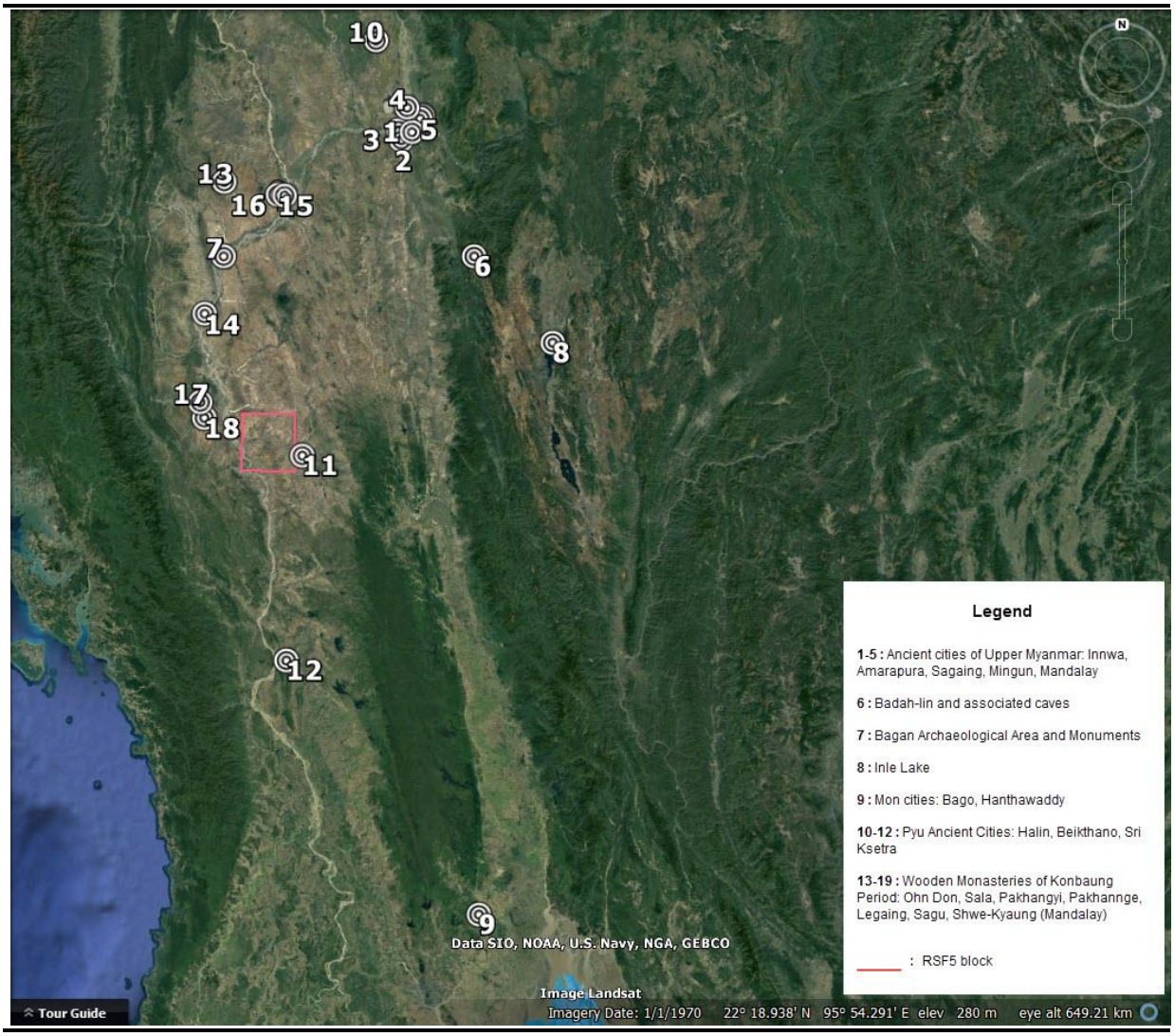
- Mahamuni Buddha in Mandalay;
- Bagan;
- Shwesandaw Pagoda in Pyay;
- Shwedagon Pagoda in Yangon Shwemawdaw Pagoda Kyaiktiyo Pagoda in Mon State.

Myanmar currently only has one site with three locations on the World Heritage List; The Pyu Cities: Beikthano-Myo, Halin, Tharay-Khit-taya (Sri Ksetra) (Source: UNESCO, 2016). All other properties are submitted on the Tentative List are as follows:

- *Ancient cities of Upper Myanmar*: Innwa, Amarapura, Sagaing, Mingun, Mandalay (04/10/1996);
- Badah-lin and associated caves (04/10/1996);
- Bagan Archaeological Area and Monuments (04/10/1996);
- Inle Lake (04/10/1996);
- Mon cities: Bago, Hanthawaddy (04/10/1996);
- Myauk-U Archaeological Area and Monuments (04/10/1996);
- *Wooden Monasteries of Konbaung Period*: Ohn Don, Sala, Pakhangyi, Pakhannge, Le-gaing, Sagu, Shwe-Kyaung (Mandalay) (04/10/1996).

These cultural and archaeological areas are identified in Figure 8.6. Two of these sites are located near the project area. The Beikthano Ancient Pyu City is located 3 km from the boundary of Block RSF-5 and the site nr. 19 (Wooden Monasteries of Sagu) is located in a buffer of 30 km around Block RSF-5. They are described in the following sections.

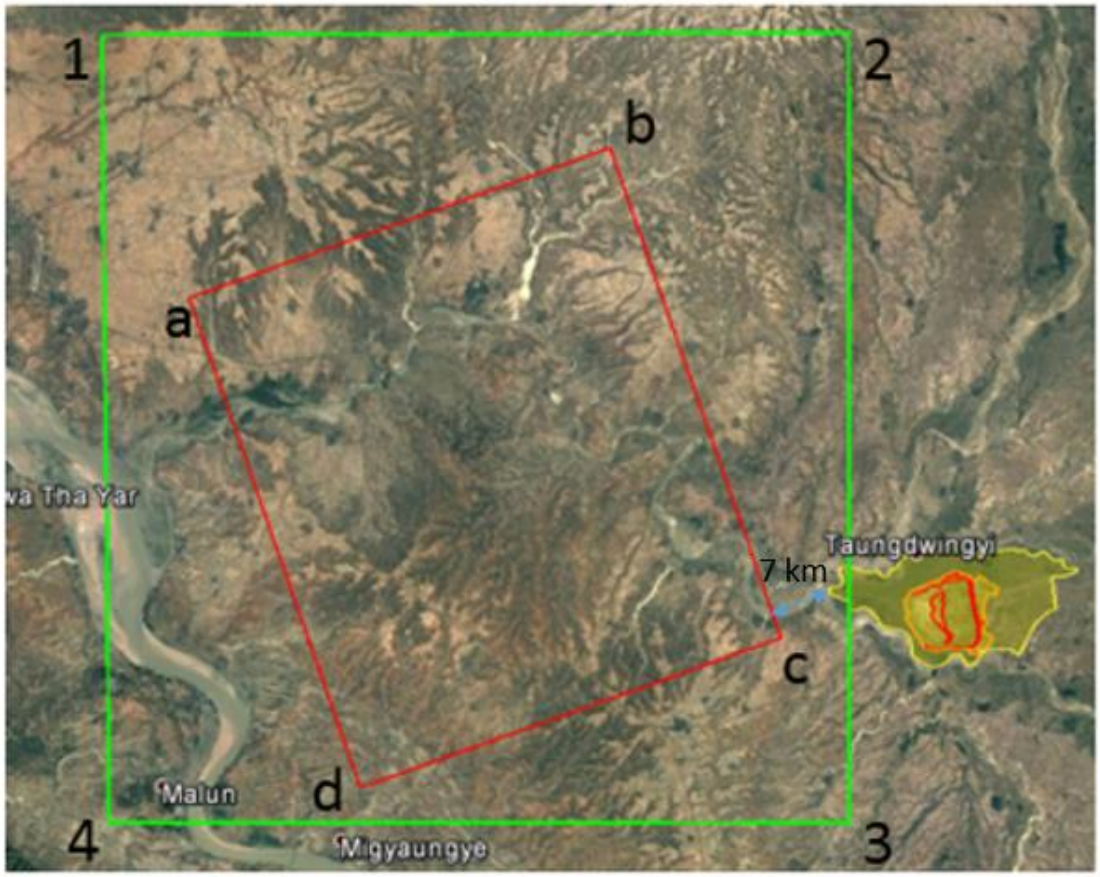
Figure 8.6 Location of Site on World Heritage Tentative List



Beikthano represents one of the most important archaeological sites in Myanmar. According to the available UNESCO data and GPS survey data, the Beikthano WHS area is highlighted in red and its protected cultural buffer zone in yellow in the above reported picture (Figure 8.7). As visible from the picture, only a minimal portion of the protected cultural buffer zone is partially in the Block RSF-5 boundaries (0.5 km) and it is located far from the area of operation at least 7 km.

Eni Myanmar requested to the World Cultural and Heritage Beikthano to confirm that the seismic operations area is outside the Beikthano WHS area (red area, Figure 8.7) and its protected cultural buffer zone (yellow area, Figure 8.7) as confirmed in Annex 12.

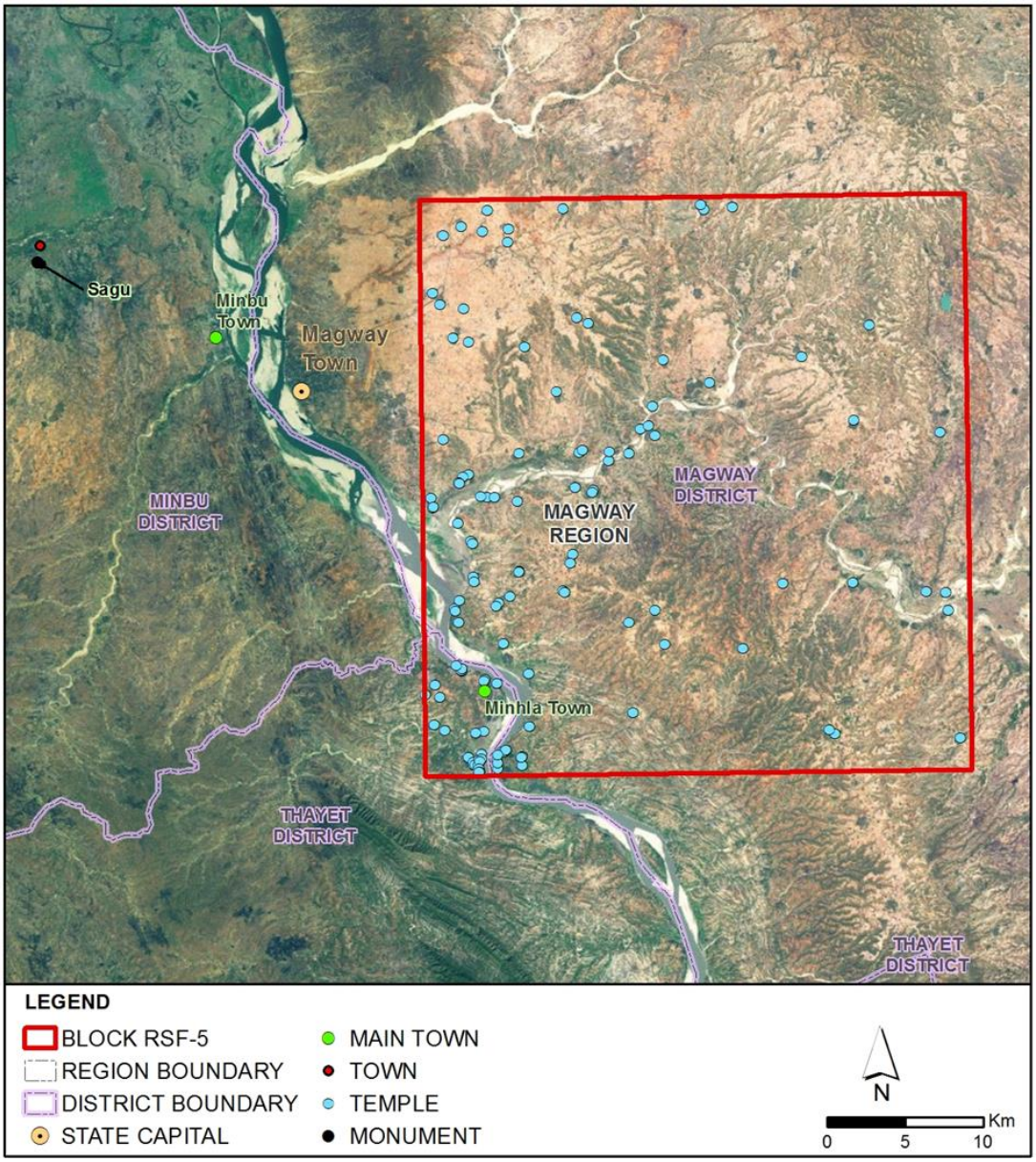
Figure 8.7 Location of Beikthano Ancient Pyu City near the Block RSF-5



Source: Eni adapted from UNESCO

Within the Block RSF-5, instead, there are 96 temples, as shown in Figure 8.8. An exact mapping of the location of these temples has been carried out only within the Block RSF-5's boundary.

Figure 8.8 Location of Cultural Heritage Sites and Temples in the Block RSF-5 (blue circles)



Source: eni, 2014

8.8.6.3 Management Actions

Avoidance of cultural heritage resources is the preferred mitigation method. Marking and protection of cultural heritage sites with temporary barriers such as a bright coloured plastic or mesh wire fence with highly visible flagging or tape is recommended. Marking of areas of high archaeological potential for avoidance in wet conditions is also recommended. More details are reported in Section 6.

Management of cultural heritage resources foresees:

- Myanmar authority engagement strategy to: 1) further evaluation of sites and the use of intrusive and non-intrusive methods, 2) development of a chance finds procedure, 3) developing site-specific mitigation approaches for any archaeological sites found, and 4) archaeological rescue;
- community consultation strategy to: 1) inform local stakeholders of Project activities, 2) understand site boundaries, user access, timing of use, and schedule of special events, 3) consider relocation of unavoidable evidences with cultural heritage value, 4) provide feedback to Project about community concerns, 5) plan alternative access if necessary, and 6) develop site-specific mitigation approaches;
- project activity timing restrictions in the following situations: 1) in very wet conditions over areas of high archaeological potential or near sites sensitive to vibration, 2) following a chance find;
- chance finds procedures to be implemented throughout the Project activities. This includes: 1) arrangement of on-call archaeologists prior to contract to handle an archaeological rescue if required at a chance find, 2) monitoring of Project activities by a professional archaeologist, 3) cessation of work in the vicinity of any new archaeological discovery, and 4) consultation with relevant authorities.

The following controls will be implemented:

- comply with established shot hole set back distances;
- watch for artefacts during site construction and inform the Ministry of Culture before commencement of drilling;
- report to the Local Archaeological Department if any archaeological evidence is discovered at the camp and temporary explosive storage center or access roads. The project proponent will cease all activity until the local Archaeological Department verifies and considers the evidence. Through consultation, a plan to proceed will be developed;
- if artefacts are found during the construction phase, *eni Myanmar* will inform the responsible local office within 48 hours;
- consult with local authorities to identify culturally important festivals and plan transportation, construction and drilling activities to avoid impact;
- *eni Myanmar* community liaison officer to monitor possible impact/change on local cultural heritage of any nature;
- review any records for site-specific location;
- conduct a visual inspection of the site by qualified personnel (e.g. experienced consultant, government archaeologist etc.);
- monitor earthwork during construction using qualified/trained inspector;
- notify Department of Archaeology, National Museum and Library, Ministry of Culture within 48 hours if significant or suspicious remains / ruins are detected;
- if work is suspended implement approved plan for mitigation (e.g. documentation and salvage, develop immediately adjacent site if feasible etc);

8.8.6.4 Set Back Distances

The following set-back distances will be applied to seismic operations (Table 8.30).

Table 8.30 Applicable Seismic Set-Back Distances

	SAFETY DISTANCE IN METERS			
	NON EXPLOSIVE SOURCES		EXPLOSIVE SOURCES	
Structure	Distance (m)	Power Size	Distance (m)	Power Size (kg)
Buildings or structures with a concrete base	100	Any	100	0.25-2.5
			150	2.5-5
			200	≥10
High Pressure Gas Pipeline	100	Any	100	0.25-10
			200	>10
			200	≥10
Low Pressure Gas Pipeline	50	Any	100	Any
Driveway, gateway, survey, monument, buried communications line	5	Any	200	Any
Water well	100	Any	200	Any
Water domestic pipeline (buried)	50	Any	50	Any
Irrigation Canals (width >3m)	50	Any	200	Any
Underground electrical cables	50	Any	100	Any
Underground high voltage cables	100	Any	200	Any
Archeological, ancient and cultural sites, religious sites such as pagodas	TBD by PPV test	Any	550 (TBD by PPV test)	3kg (>3 kg)

8.8.6.5 Monitoring Plans

The cultural Heritage management Plan foresees a structural recording and monitoring program, including:

- pre-survey and recording of the condition and structural integrity of sites with above-ground components that lie within 50 m of the camp site, temporary explosive storage center, access road and line survey;
- follow-up protection or architectural reinforcement at sites found to be at risk from pollution or vibration;
- periodic monitoring of site conditions throughout the life of the Project.

If sites are discovered to be at risk of pollution or vibration, they shall be monitored daily during the blasting activities. Monitoring to include:

- a photographic documentation of each of the cultural resources within each site at risk;
- GPS coordinates for each of the cultural resources built within each site;

- a brief description of any visible changes to the cultural resources in comparison with previous quarterly monitoring reports;
- vibration impact monitoring with the use of Peak Particle Velocity meter (PPV) continuously during seismic measurements in order to monitor vibrations level that may affect cultural sites in vicinity of seismic source. PPV measurements will be carried out according to local legislations. In case of lack of local norms, PPV procedure will be established based on the safety distance table. If during seismic measurement PPV meter shows that vibration on concerned object exceeds acceptable level per international standards, the measurement is immediately stopped. Then recording system observer decreases energy generated by vibrators up to 50% of nominal one and vibrator point is recorded once again.

In conclusion, an outline of the monitoring programmes proposed for the Project, is presented below in **Table 8.30**.

Table 8.31 Environmental monitoring

Receptor	***Monitoring Task***	***Monitoring locations***	***Monitoring Parameter***	***Timing***
CH sites	Monitor appearance of CH resources: survey and recording of the condition and structural integrity of sites with above-ground components.	Area of direct interference (line survey, camp site, temporary explosive storage center, access roads)	Presence of CH resources	Continuous
CH sites	Review and audit of mitigation activities to ensure satisfactory implementation of mitigation measures	Area of direct interference (line survey, camp site, temporary explosive storage center, access roads)	Completion of required reporting, including: • reporting of ground disturbing activities (i.e. location, quantitates, depth…etc.); • Reporting on findings • Completion of induction training • Implementation of all additional measures, such as signage, fencing, structural bracing & conservation • 100% of cultural heritage related grievances and cultural heritage issues raised through community consultation addressed	Weekly

8.8.6.6 Implementation Schedule

The monitoring activities will be performed as mentioned in the table above.

The Plan shall be revised before project activities start, in order to guarantee the compliance with Myanmar laws.

8.8.6.7 Responsibilities

Table 8.32 below summarizes the responsibilities of different organizations.

Table 8.32 Cultural Heritage Management Responsibilities

Organization	Responsibilities
eni	Company must guarantee the availability of economic, human and technical resources needed to manage the cultural heritage procedure and mitigation measures as described in the final EMMP. It is the Company's responsibility to: • Ensure that the requirements of the Plan are satisfied; • Ensure that the contractors and any sub-contractors engaged are advised of their responsibilities to undertake their activities required by the Plan; • Ensure that the monitoring program is implemented properly.
General Contractors	It is the General Contractors' responsibility to: • Retain copy of Plan on-site for reference by appropriate personnel; • Recommend additions or changes to Plan based on experience gained from implementation of Plan; • Verifying specific training/awareness sessions to employees involved in operations that may impact on the cultural heritage sites (site preparation, line clearance); • Ensure that the requirements of the Plan are satisfied; • Ensure that the contractors and any sub-contractors engaged in the Project activities are advised of their responsibilities to undertake their activities required by the Plan; • Alert the Company in case of potential CH evidences found during the works; • Ensure appropriate records are kept and maintained on-site; • Recommend additions or changes to Plan based on experience gained from implementation of Plan.

8.8.7 Community Relations Plan

Prior to both the initiation of seismic activities, as a part of the on going stakeholder consultation and engagement plan, and in response to suggestions received at the stakeholder meetings, *eni Myanmar* Seismic Contractor will undertake the following activities prior to and during the proposed operations:

- appoint a community liaison officer;
- dissemination of Information; and
- feedback and Community Attitudes.

8.8.7.1 Engagement with Communities

Engagement with local communities that may be impacted by *eni Myanmar* business activities shall be conducted to create awareness on Company's operations, including the associated HSE controls and recovery measures. Where there are legislative requirements to conduct such engagements, these requirements shall be fully complied with. To facilitate information exchange, a community liaison officer will be appointed. The local village leader could possibly fulfil this role. Villages nearby the project activities must be advised 2 weeks in advance of project initiation.

8.8.7.2 Dissemination of Information

The objective of these activities is to distribute information to affected stakeholders and communities within the project area. A combination of communication methods will be used to ensure the target groups within the project area are reminded and aware of the proposed plans. eni Myanmar will periodically inform the local authorities about the project plans throughout all phases of the project. *eni Myanmar* has posted the RSF-5 ESHIA on the Company website. An electronic version will also be provided to ECD should they wish to post on the ECD website. A copy of the EIA will be provided to the Magway District Governors Office.

Before project commencement, the Local Authority will be formally notified of the upcoming project. A meeting with the village leaders will be conducted at least 2 weeks before project launch. This meeting will be used to inform the community leaders of transportation routes, drilling operations and potential disturbances from these activities. The meeting will also introduce key staff members and ensure contact details are exchanged. The community leaders will be asked to transfer the information to their communities.

8.8.7.3 Feedback and Community Attitudes

eni Myanmar understands the importance of listening to stakeholder concerns and addressing any valid issues to maintain good relations and demonstrate respect for the neighbouring communities in which it operates.

The following techniques and mechanisms will be utilized to ensure effective feedback:

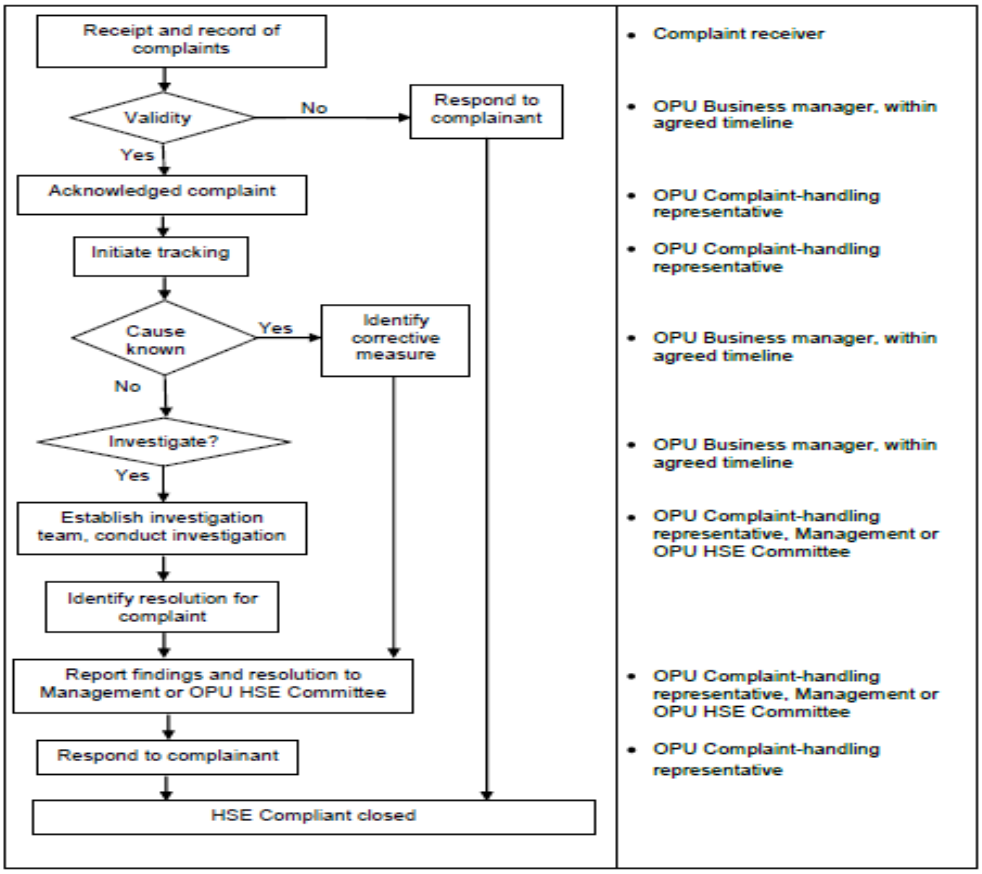
<u>Handling a Stakeholder Complaint</u>

All HSE Complaints must be processed immediately and according to Stakeholder Complaint Procedure. Access to complaint-handling process shall be free-of-charge to the complainant. All Complainants shall be treated courteously and be kept informed of the

progress of their complaint, being addressed in an equitable, objective and unbiased manner throughout the complaint-handling process.

The flow of activities in HSE Complaint process is shown in Figure 8.9 below.

Figure 8.9: HSE Complaint Process Flow



8.8.7.4 Management Actions

eni Myanmar and its sub-contractors will recruit labour force locally and work with local businesses. The following control measures will be implemented to minimise any potential adverse impact on economy and employment and enhance any positive ones.

- capacity Building: work to enhancing the capacities of potential local partners (work-force, contractors and suppliers) to deliver to the highest health, safety, social and environmental standards and thus contribute to the competitiveness of local procurement and opportunities;
- sourcing local goods and services: purchasing of local goods will be optimised as much as possible;
- integrity of recruitment process: equal opportunities and non-discrimination will be guaranteed in the recruiting process. There will be no distinction, exclusion or preference in the recruitment made on the basis of "race, colour, gender, religion, political opinion, marital status, national extraction or social origin, disability, age, sexual orientation, and/or HIV status" Selection criteria will include minimum age (to avoid child labour) and skills requirements. All contractors will be required to implement the hiring

guidelines. All job vacancies will be listed clearly with skills and experience required to fill the position, as well as the duration of the employment contract. Clear information on the recruiting process and the selection criteria will be publically available and easy to access to promote transparency of the process;
- managing public expectations: the Project will provide clear information on the number and timescales of employment opportunities, trying to fulfil as much as possible expectations of the community and thus avoid calling effect into the Project area;
- managing influx of non-local job seekers: manage the influx of non-local job seekers to avoid exacerbating urban poverty and plan for provision of social infrastructure;
- meet with local authorities to discuss and design local employment hiring to limit impacts on local businesses and key agricultural seasons;
- employ qualified local workers;
- purchase local supplies and services, whenever possible;
- host a pre-project local community awareness program with communities to facilitate awareness of opportunities and benefits;
- terms of contract for recruitment of manpower in these companies needs to include emphasis on hiring locals, especially for unskilled and semi-skilled workforce;
- restrict workers to within project boundaries and do not allow local interaction within the communities.

The following specific mitigation measures shall be employed during the seismic survey phase to reduce impacts on local infrastructures.

Degradation and temporary disruption of road infrastructures

Impacts from transportation of personnel and equipment can be mitigated through the use of the following measures:

- follow speed limits of 80 km/hour on highways (unless otherwise posted), 60 km/hour on lateritic roads, 20 km/hour in villages or communities, and 80 km/hour on paved roads outside Yangon within the project site and on main roads;
- ensure all vehicles are in good operating condition and comply with project safety standards. Drivers must be healthy, have valid licenses, and by no means allowed to drink alcohol or take forms of medicine or illicit drugs that can affect driving capacities;
- weight of the trucks shall not exceed the limit set by the Myanmar regulations to reduce damage to road surfaces or structures;
- safety equipment and communication equipment must be installed on vehicles such as VHF radio, safety belts and portable fire extinguisher etc. as per company standards;
- maintain and repair all public and private roads that are damaged by project activities;
- all vehicles must be left hand drive;
- post and enforce speed limit (follow traffic law on highway and community area, 30km/hr on unsealed road);
- notify the local authority on the oversized load and put an escort in-front of this convoy with horn and hazard lights;
- restrict/ avoid movement of heavy equipment during rush hours;
- provide traffic signs or flags at junction of access roads and main roads;

- investigate any complaints and handle appropriately. Keep records of complaints and follow-up;
- if the project needs to construct, upgrade or reroute access roads, the Operator must get permission from the appropriate government offices;
- strictly enforce training programs to reduce transport incident cases by its contractors;
- restore any damage to roads as caused by contractor or company;
- purchase or lease land for road access to camp site and temporary explosive storage center;
- restrict local traffic on *eni Myanmar* private access roads;
- cooperate with Military for storage and transport of explosives.

The project will not use the electrical infrastructure; all power will be generated on site.

The overall objective is to minimise the impacts of waste generated during the construction phase through the following:

- minimise the amount of waste that is generated;
- maximise the amount of waste that is recovered for recycling, including segregation of recyclable wastes at source;
- minimise the amount of waste that is deposited at landfill;
- ensure all wastes are properly contained, labelled and disposed of in accordance with local regulations;
- dispose of waste in accordance with the waste management plan.

The following mitigation measures shall be employed during the seismic survey phase to reduce any impacts on community health and welfare.

- implementation of good hygiene practices for the workers (such as hand washing), especially before eating, drinking, smoking and so on. The purpose of this is to prevent ingestion of potentially contaminated material;
- guard against communicable disease introduction by monitoring local health trends in order to be aware of and respond appropriately to any negative health trends that may be linked to the Project and its workers;
- prevention of illness among workers in local communities through health awareness and education initiatives. For example, implementation of educational outreach to increase awareness of major communicable diseases and how to protect against infection;
- ensuring that all workers receive education about transmission routes and the symptoms of the communicable diseases of concern (including STDs);
- limit night movement of workers living in the camp site;
- develop a training and awareness programme for contractors to deliver to their employees to ensure alignment with eni Myanmar corporate requirements for occupational health and safety management including driving and traffic safety;
- implement mitigation measures for non-hazardous, sanitary and hazardous wastes;
- clearing of overgrowth in perimeter;
- keep waste manifest for all waste types;

<u>Mitigation measures for increased Pressure on health care facilities</u>

- ensure sufficient health services are made available by Contractors to meet the day to day needs of Project personnel and families without impacting on access to and over-load local health care services for communities;
- establish a requirement as part of the contracting and procurement process for contractors, to ensure they have arrangements established with local health facilities to provide healthcare to their employees;
- establish in-house or outsourced health facilities and emergency medical treatment facilities for workers.

Mitigation measures for environmental change

- implementation of a rapid response grievance mechanism;
- take into account the presence of sensitive receptors (such as communities, or schools) in the design of working construction hours to minimise disruption and sleep disturbance;
- undertake stakeholder engagement prior to the commencement of construction activities to inform communities of the activities proposed, the timing of activities and the duration;
- segregate and store hazardous chemicals and waste in appropriate, labelled and safe containers that are suitable for transporting/transferring. Containers having hazardous waste must be kept separated from non-hazardous waste in safe areas that are clearly labelled and fenced;
- all hazardous waste will be collected in skips ready for treatment and disposal and sent directly to a proper authorized facility;
- provide Waste Manifest System for transportation of all waste types to treatment area or disposal area;
- always check and record the type(s) and amount of hazardous waste generated.
- provide septic tank for domestic sewage;
- ensure treatment and disposal according to accepted international standard. Keep waste manifest for all waste types;
- enforce "Good Housekeeping" practices;
- segregate non-hazardous and hazardous waste, store each type of waste in closed containers and make sure all containers are clearly labelled;
- dispose of waste in labelled containers for possible recycling;
- prohibit open burning of any waste at project site;
- implement requirements for waste management and related laws;
- store waste in appropriate and safe containers that are suitable for transporting/transferring;
- always check and record the type(s) and amount of waste generated;
- spray water on un-surfaced access roads of project transportation route during dry conditions at least twice a day (morning and afternoon);
- post speed limits on project access route and limit vehicle speed to 30 km/h on un-surfaced roads;
- use vehicles with dust flaps;
- cover loose dry loads;
- vehicles will avoid sensitive environmental areas;
- construction activities and Vehicle movements will be restricted to daylight hours;
- limit vegetation removal to a minimum;
- schedule operation of noisy construction equipment at different times;
- ensure use of mufflers on diesel/gas driven machinery;

- ensure all machinery and vehicles are properly maintained and serviced as per maintenance schedule recommended by manufacturer;
- implement transportation plan;
- the camp site must be located a minimum of 500 m from the nearest community;
- select shot hole locations at safe distances from nearest community or sensitive receptor.

Mitigation measures for increased Community safety

- make sure that Company & the Contractor develop agreed routes for transportation for all Project movements (materials, goods and worker movements) to minimise risk of accidents. This shall include a process for the identification of accident hotspots and if required the use of bypasses around these areas;
- health screening of workers before employment;
- on-site health clinic (seismic acquisition) and referral system during all the project operations with external health agencies to ensure timely diagnosis and treatment of workers' illness and injury;
- maximize hiring of qualified local workers to reduce reliance on outside labour and increase local employment;
- do not allow workers to enter communities near the camp site;
- provide awareness to workers on preventive measures for the prevention of communicable and local diseases.

8.9 COST OF IMPLEMENTATION

The EMMP implementation is integral part of the *eni Myanmar* seismic contractor commitments and the relevant cost are integrated in the overall budget addressed for the seismic campaign.

The seismic campaign overall cost is $10,000,000 USD. The total cost to implement the EMMP cost is 55% of total investment as follows:

- Seismic Layout Adaptation & Use of Explosives: $3,500,000 USD
- Waste Management Plan: $400,000 USD
- Water Management Plan: $100,000 USD
- Land Compensation: $1,500,000 USD

The 1.5 million USD is the estimated cost for compensation that will go directly to affected areas and villages. This is based on the following: [(4 m width * total length of the source lines) + (1.5 m width * total length of the receiver lines)] * average crop price.

8.10 LAND COMPENSATION

The eni Myanmar compensation team for seismic will involve a Representative from the Agriculture Department, MOGE, Local District/Township officials and Chief Village and his representatives to determine fair compensation for crops lost due to seismic activities.

Compensation will be managed by the land management plan in accordance with IFC PS. Before the start of the seismic activity a pre survey will be organized to identify the land owner and stipulate an agreement for the operation to be undertaken on his area. When activity on seismic line is complete, i.e. the recording operations have been completed;

the compensation team will conduct a post survey to physically check the line and assess the individual landowners' plots for compensation. Once the physical check of the line is complete and the Compensation is agreed. The compensation will be paid during the Payment Ceremony organized by village. *eni Myanmar* is committed to timely compensation and will conduct further engagement sessions with villager representatives, Township officials and MOGE personnel to provide regular briefs on planned activities and other issues of importance.

It is important that all persons present during the compensation assessment process agree on the traverse distances, tariff rates and the payment amounts. This will help to keep the process fair and above board and it is hoped alleviate any disagreements at the Payment Ceremony. No preliminary payments or advances against property compensation payments due to the owner will be paid at this stage of the process. The team shall advise all concerned that *eni myanmar* policy does not permit this and all approved compensation will be paid at the official Payment Ceremony after all recording activities within the boundaries of the village limits have been completed.

The crop compensation price formula to be used in assessing the relevant price will be rationale and fairly applied, and it will be based on the yearly productivity of specific crop, the crop unit price and the area of the selected land. No negotiations, no deviations, no price adjustments will be applied by eni Myanmar and GT to meet the villagers requests, this is in compliance with eni Myanmar sustainability Policies, which are aimed to guarantee a transparent, reliable and rational method of calculation for the crop compensation.

There will be occasions where the landowner refuses to allow the survey team to traverse their property. In cases such as these, the source or shot point may be moved to an adjacent position off the landowners plot. These new locations can be situated only by using the approved offset parameters. This is to be undertaken by the seismic contractor's survey team only. All senior permitting team members must be aware of these procedures so that no incorrect decisions are made on where source points can be moved.

Any employee associated with the permit and land access process, regardless of seniority or position, found to be manipulating, or attempting to influence to their advantage any transactions associated with the permit and land access process will be terminated from their position. In addition, any employee of either the seismic contractor or the Permitting team who is aware of collusion or manipulation of the permit and land access system by a person or persons and does not report this matter to his superior will also be terminated from the operation forthwith. Eni Myanmar is committed in a timely compensation.

The rental of the land for the camp site and temporary explosive storage center will provide a significant financial benefit to landowners while this land will be temporarily lost from agriculture production. If hydrocarbon resources are not found the land will be given back to the original land owners and restored to its original state. However, the farm workers who do not own land may be displaced and possibly lose employment. The compensation program needs to specifically address this potentially vulnerable group.

8.11 EMERGENCY PLAN

The objective of the Emergency Plan is to make sure personnel are prepared and equipment is ready to respond to any process upset, accident, or emergency situation in a manner appropriate to the risks. This will prevent the potential negative consequences, as well as identifying potential incidents and limiting their consequences for humans and the environment, with a view to providing high levels of protection in a consistent and effective manner.

Specific objectives of the ERP are to ensure that the Emergency Response Team are prepared for emergencies by providing/ensuring the following:

- training for the Emergency Response Team members;
- the establishment of emergency procedures and provision of copies as needed (copies to be held by each member of the team);
- ensuring the ERP is available to all employees and site personnel;
- a description/location to be provided of the emergency procedures, emergency evacuation muster points, fire fighting and first aid equipment;
- minimising, as far as is reasonably practicable, the risk to human life, the environment, assets and business, in the event of an incident or emergency situation, by ensuring effective and efficient intervention;
- ensuring the availability of adequate information on the emergency situations through a good communication system;
- ensuring efficient management of the emergency through the effective and efficient response of all dedicated resources;
- identification of the governmental authorities, media and other relevant stakeholders to be notified and production of a description of the procedures for communicating with them.

When required, contractors shall bridge its ERP to *eni Myanmar*'s Emergency and Medical Response Plan.

8.12 HEALTH MANAGEMENT SYSTEM



The Eni Myanmar Health management system is based on Deming cycle and includes the following phases:

1. Definition of the Health Management Plan: definition of specific programmes and targets in line with the risk assessment and in compliance with legislative requirements, specifically the subsidiary health function:
    - carries out a country analysis with the aim of identifying those health risks for employees that are found in the living and working environment;
    - identifies the specific health risks and, for each risk identified, explains the assessment criteria used;
    - prepares a draft health management plan that identifies the intervention and training measures, over a period of several years based

- submission to the MD for approval.

2. Implementation of the Health Management Plan (four year plan and operative annual plan), with strong support from MD with allocation of resources, which shall include at least the following contents:
   - occupational health;
   - industrial hygiene;
   - medical support;
   - medical emergency response;
   - global health (community health and health promotion);
   - travel medicine;
   - staff training;
   - OHSAS 18001 certification.

3. Monitoring: periodic control of guide indicators and areas of analysis and intervention in order to identify corrective actions including:
   - periodical monitoring and reporting to MD and business area health function of performance indicators and other information (according eni health standard and specific request of business area health function) necessary for reporting on the progress of the activities carried out.
   - annual inspections (clinical activities, catering activities, residential or personal use, catering and water) and audits (Technical Audit and Verification of Regulations).

4. Reporting on the progress in the activities and results of the initiatives during the annual Management Review, specifically the review:
   - analyses and evaluates the monitoring results against the defined objectives
   - verifies the level of progress made in implementing any preventive corrective actions identified and those defined in the previous review
   - identifies the improvement targets for the subsequent period
   - records any changes to the internal/external context that have an effect on the health activities.

8.12.1 OCCUPATIONAL HEALTH

Occupational health is the maintenance and promotion of the highest degree of physical, mental and social well-being of workers in all occupations. Occupational health is concerned with the Protection and Promotion of the health of persons at work associated with chemical, physical, biological, ergonomic and psychosocial health hazards and hazards associated with life – style and the living environment. A detailed project specific Safety Management Plans is included in Annex 10.

Occupational Health is a multidisciplinary affair and team exercise, always under responsibility of Managing Director and Line Management, having as key players company Managers and Supervisors. Requires a close interaction between a huge variety of professional, including but not limited to Occupational Health staff (doctors, nurses), Industrial Hygienists, Safety Engineers and when required also input from other specialists as Ergonomics, Toxicology, Epidemiology and Psychology professionals, with a clear requirement of verify the Legal Compliance in all environments where Eni operates.

Several activities are performed at any eni Myanmar, including as a minimum:

Fitness to Work & Health Surveillance: eni Myanmar B.V. has the responsibility to protect the health of employees and others associated to their activities. This is achieved by a medical fitness to work assessment, done by a physician experienced in Occupational Health. It enables the assessing physician to establish whether an employee's medical condition is likely to affect own fitness to work under certain conditions.

This is achieved by an initial pre-employment or fitness for work assessment and then periodic health surveillance checks appropriate to the exposures to hazards that may be associated with the specific work environment for the duration of employment.

The tests and frequency of the fitness for work assessment is based on the health risks associated with the job, living environment and risk factors in the population and individuals.

The key principles for assessing fitness to work are:

- the primary purpose of the medical assessment of fitness to work is to ensure that the employee is fit to perform the tasks required effectively and without risk to the subject's or others' health and safety;
- to collect baseline health data;
- the employee's fitness shall be interpreted in functional terms and in the context of the job requirements;
- employers have a duty to ensure, as far as it is reasonably practicable, the health, safety, and welfare of all their employees;
- legal duties of reasonable adjustment and non-discrimination in employment are imposed by relevant applicable legislation.

The eni Myanmar B.V. fitness to work programme is based on sound ethical and technical practice, such that:

- the employee's privacy and confidentiality of individual health information is maintained;
- written protocols are available;
- there are documented medical standards for all safety sensitive positions.

The program covers the requirement for:

- medical assessment prior to employment in the company,
- jobs where a risk assessment has identified that ill-health, fatigue or other causes of impaired fitness for work could produce potentials for serious injury or death to the individual, other workers or the community, damage to assets, or significant environmental impact;
- continuing health surveillance of workers in jobs where the HRA process has identified exposure risks to hazards that may lead to the development of acute illness on the short term or occupational illness on the long term.

It includes guidelines for programme design, medical examinations, alcohol and substance abuse policies and company assistance.

The Fitness to Work Program requires that:

- specific country requirements are determined for health surveillance and specific medical surveillance and are complied with;
- minimum fitness for duty standards are established and applied for specific work and working conditions where there are critical occupational health risks or safety requirements;
- workplace health risk assessments and exposure limits to identified hazards are measured, monitored and applied according to accepted reference standards;
- appropriate processes are in place to recognize, investigate and report the occurrence of any health related incident, accident or occupational illness;
- appropriate health-related policies are in place, including an alcohol and substance abuse policy.

Any job where the impairment of function, due to illness, fatigue, alcohol, drugs or similar, could impact on the safety and well being of either the employees, other workers or the community, cause significant equipment/plant damage, or significant environmental impact, shall be identified and an assessment of the risks from these conditions is made.

Occupational Disease Management: Prevention, treatment and rehabilitation of Occupational Diseases.

General absence registration shall take place at departmental. The Occupational Health Physician may be requested to assist in analysing absence indicators, such as total sickness absence, average duration and sickness frequency, and compare these parameters for the various departments and work locations. Analysis may reveal problem areas that can be influenced by corrective action.

The Occupational Health Physician may be involved in the management of general sickness absence by monitoring the course and treatment of disease, by liaising with the employee's general practitioner and specialists, and by facilitating rehabilitation. In remote areas, the company physician may be fully responsible for treatment and absence management. Prevention of occupational illness is one of the main objectives of the OHMSP; likewise the prevention of industrial incidents and accidents is the main objective of a safety management programme. The number of occupational diseases can be used as a key OH performance indicator
Work related medical conditions (no lost time; the employee may be temporarily reallocated to other work) and disease (lost time) must be diagnosed, treated, registered, reported and analyzed with the objective to prevent re-occurrence.

For the analysis and follow-up of occupational diseases the same procedures apply as are being used for safety incidents and accidents. Reporting occupational diseases is a legislative requirement in most countries.

Occupational diseases are non-conformances with the HSE policy and its health objectives.

Whereas registration of general sickness absence is a departmental or HR responsibility, the registration of occupational sickness absence is the responsibility of the OH Department.

For consistency in reporting, it is important to define what occupational diseases are and in what they are different from safety accidents. The OSHA definition applies.

'An occupational illness is any work related abnormal condition or disorder, other than resulting from a work injury, caused by or mainly caused by exposures to environmental factors associated with employment'

An occupational injury is the result of an instantaneous event.

For example, noise induced hearing loss (NIHL), due to noise exposure in the workplace, is an occupational disease. Occupational hearing loss due to an explosion is an industrial accident.

For recording, ICD 10 code (WHO - International Code of Disease) can be used or occupational diseases may be grouped in categories for reporting purposes. Reference is made to OGP report 6.78/290, 1999 'Health Performance Indicators' and Annex D-2.1, 2.2 and 2.3.

Guidance can also be found in OSHA Regulations & Compliance, Part 1904, 'Recording and Reporting Occupational Injuries and Illness'.

Noise induced hearing loss (NIHL), silicosis and occupational asthma appears among the top 10 occupational diseases worldwide. It is important to adopt criteria for occupational hearing and respiratory disorders; the latter is particularly important for the mining industry. NIHL is probably the most debilitating occupational disease in industry.

Record keeping and Data analysis

Industry standards require that individual medical and OH records, including information on risk based examinations, be retained for 30 years as occupational conditions may emerge later on in time. This is a legal requirement in most western countries.

Medical records shall reflect adequate medical information on the patient, be legible and kept in a secure and confidential place. Security levels for access must be developed and strictly observed; this equally applies to computerized medical records or a medical data bank.

A computer-based collection health surveillance data and individual characteristics related to life style and environmental issues enables the OH Physician to keep track of the employee's medical and work history, to advise management on the effectiveness of risk controls, to report on trends, to analyse morbidity and lifestyle issues of the workforce, to identify areas which are suitable for intervention, to identify issues for further study and/or health promotion. Such databanks are commercially available.

Catering and water: To ensure that the quality of food & Water is maintained and that the risk of contamination with hazardous substances is minimized, a system of analysis, control and monitoring is implemented at all points of the food production chain.

- Where catering facilities are utilized or food is provided by or on behalf of the Eni Myanmar, the facilities and food will conform to the highest applicable standards with regard to international hygiene regulations and guidelines.
- All prospective food handlers will undergo medical assessment.
- All food handlers will have training appropriate to their level of responsibility.

- Food will be palatable, nutritious and provided in adequate quantity to maintain health.
- Specific dietary needs as dictated by religion, culture, personal belief or medical requirement will be addressed wherever possible.
- Adequate supplies of safe, wholesome drinking water will be available in sufficient quantities to maintain health.
- There will be a traceable record of quality monitoring for both food and water provision.

The Hazard Analysis and Critical Control Point (HACCP) system is an internationally recognized process by which specific hazards and associated control measures can be identified to ensure the safety of food. It has seven basic principles

- Conduct a hazard analysis
- Determine the Critical Control Points (CCP)
- Establish Critical Limits
- Monitor control of the CCP
- Determine corrective actions if CCPs are not met
- Verify that the HACCP system is working effectively
- Documentation of process and record keeping

It is essential that food handlers are assessed for their fitness to occupy the role. This must take place prior to commencing employment and annually thereafter. In addition food handlers shall have their fitness for work re-assessed after sickness absence. In general there is no clinical requirement for routine periodic stool cultures of food handlers.

In addition all food handlers must receive training commensurate with their job role and seniority. All food handlers must receive training in basic food hygiene before commencing work with food. Local legislation may stipulate what level of training is required. Training shall, however, achieve the following:

Basic Food Handlers

Knowledge and understanding of the importance of food hygiene, associated food hazards, good hygiene practice and controls based upon an awareness of food safety management systems.

Supervisors

Knowledge and understanding of the importance of producing safe food through the identification of food safety hazards, control and monitoring procedures and appropriate corrective actions, thus contributing to and encouraging improvements in food safety practice.

Managers

Advanced knowledge and understanding of how to manage food safety within a food business, how to control hazards and the legal responsibilities of food businesses. A pre-emptive HACCP approach to food safety management and meeting legal obligations.

Training courses must be approved by a recognised authority on food safety.

It is recommended that the local medical advisors are trained in food hygiene to supervisor level as a minimum.

8.12.1.1 FOOD QUALITY

It is important that food is provided in such a way that people want to consume it.

- Food must contain appropriate nutrition to sustain the individual.
- Wherever possible food will be prepared daily from fresh ingredients.
- Foodstuffs and ingredients will be stored in an approved method at the correct temperature, and free from contamination.
- Menus and food choices must have sufficient variety that an individual can find something acceptable to eat.
- While it is recognised that everyone must have a choice in what they wish to eat, healthy food choices must be provided at each meal. These shall be indicated on the menu.
- Menus shall be written in both English and the local language(s).

8.12.1.2 SPECIAL DIETARY REQUIREMENTS

Where there are specific dietary needs for religious reasons these will be met. If food has been prepared according to specific religious codes (e.g. Halal, Kosher) this will be indicated on the menu.

8.12.1.3 WATER QUALITY AND HYGIENE

Potable water sources will be required in all business areas. It is estimated that 7.5 litres of potable water per person per day is required purely for drinking and cooking. Additional water will be required for washing laundry etc.

- Potable water must be available in all workplaces.
- Potable water must meet minimum standards of purity.
- Potable water shall be kept below 20°C.
- Where the local piped supply does not meet minimum standards water must be purified before consumption.
- Where it is not possible to provide pure, piped potable water, either for logistical or economic reasons, bottled water must be obtained from a commercial source. Commercial suppliers must be able to demonstrate minimum standards of water quality

Minimum Water Purity Standard.

Local legislation may determine minimum requirements. It is however recommended that drinking water in all cases meets the World Health Organisation (WHO) guidelines for drinking water quality. These standards are regularly updated and are available on the WHO website (http://www.who.int/water_sanitation_health/dwq/guidelines/en/). A more concise set of standards is available at Annex E of this publication

8.12.1.4 INSPECTION AND MONITORING

It is important that regular monitoring of hygiene standards is carried out to ensure food and water quality.

Food Hygiene Monitoring

Regular inspections of catering and food provision facilities must be carried out.

Weekly Inspections - These shall involve the food production supervisor and the local medical advisor. They shall cover general hygiene of the food preparation and storage areas and food handlers, temperature records, cleaning schedules, food stock and rotation.

Yearly Inspection - This shall ideally be carried out by the food production manager (who must have an advanced food hygiene qualification) and a senior medical advisor. Ideally these individuals shall be from a different unit or base to the one being tested. The Inspection shall cover hygiene of the food preparation and storage areas in depth and involve scrutiny of HACCP procedures, records and food handler certification.

If there have been concerns regarding catering arrangements or facilities then more frequent or higher level inspections may be required. Unannounced inspections can also be useful.

Catering inspections can be usefully combined with accommodation hygiene inspections. A sample checklist is included at Annex F and sample of an audit report in the Annex G.

Records of inspections must be kept along with records of any remedial actions recommended as a result of the inspection.

8.12.1.5 Water Quality Monitoring

All potable water systems shall be analysed for Chemical and Mineral Composition and Bacteria, and the presence of contaminants before commissioning and after any work which requires breaking containment of the water system. Specific monitoring may be required for Legionella if the potable water system is also used for showers etc.

Piped potable water shall be analysed for chemical and mineral consistency every 6 months, and for bacteria every 3 months.

Commercial water suppliers shall be asked to submit evidence of suitable water quality and composition during contract negotiations and at yearly intervals thereafter.

Legionella sampling shall take place annually.

More frequent sampling may be required if values are marginal or out-with permissible levels, or to confirm resolution of quality and hygiene issues.

If no specific requirement for sampling is provided by local legislation then the ISO 5667 series shall be followed

Records of testing shall be kept for 5 years. Results shall be compared with previous analyses to examine any trend change. Values out-with acceptable parameters must be investigated. Medical advice regarding the continued suitability of potable water during the investigation shall be sought.

8.12.2 MEDICAL SUPPORT

8.12.2.1 Medical Assistance

The Eni Myanmar health function, using the medical officer and with strong support from Management level, identifies the most appropriate methods for providing access to health care services (e.g. accreditation of health facilities, definition of health services, provision

of insurance, etc.) and the related coverage area (e.g. employees' family members), for each context, with the aim of identifying ways of providing:

- First level service, namely those activities and services related to diagnosis and basic care, health education and individual preventive medicine aimed at appropriately classifying the health need and offering an initial response to this type of need.
- Second level service, namely those activities and services related to diagnosis and treatment of a particular pathology, which require specialist knowledge and/or admission to specialized facilities.
- Third level service, namely those inpatient services, which require specialist knowledge, instrumentation and equipment tailored to the patient's specific needs and over 24 hours of monitoring.

Is also fundamental to define, implement and monitor a Quality Program, which enables the Company to permanently verify the services provided by third party medical contractors, including a strong alignment and compliance with Procurement procedures and standards

8.12.2.2 Medical Emergency

Emergency care is any situation in which a severe and sudden impairment of a person's health requires rapid and effective treatment, and failure to implement such treatment promptly and correctly could cause serious consequences. The main objective of emergency management is to take prompt action to provide a medical response to a situation in which the employee's life is at risk

A standard procedure (Medical Emergency Response Plan – MERP) must be implemented and tailored to the context by the subsidiary health functions within a specific local response plan for health emergencies. This is validated by the area health functions and then approved for implementation by the company's MD.

The purpose of the plan is to establish primary action and responsibility in the event of a medical emergency and the medical evacuation procedure to follow in the event of injury or serious illness at any site of a subsidiary. Based on the worker's medical needs and the resources available on site, there are three levels of medical emergency.

First level
An emergency that can be managed locally with on site staff and equipment is a first level emergency. Medically speaking, this is an injury or illness that can be treated using the first aid available on site.

Second level
A second level emergency is one that can be managed with the assistance of health functions via providers coordinated by the MD of the company and/or the local and peripheral state authorities (e.g. fire brigade, health facilities, etc.) Medically speaking, this includes incidents where an injured or sick eni person requires treatment that is not available on the site where the event occurred, but which is available in a local medical facility. The area health functions and the central health function must be informed of the incident.

Third level
A third level emergency can be managed with either internal or external resources made available by the areas or by central government authorities. Medically, this is an injury or

illness where the patient requires international transportation for medical care that is appropriate for the seriousness of the case. In this circumstance, the patient's care is managed by a medical team in real time (within the central health function) which, based on the specific treatment and healthcare need, decides, in consultation with the doctor in charge of the patient, on medical evacuation or repatriation.

Health crisis management
eni considers a health crisis any event whose resolution can be prolonged over time and that has the potential to cause severe repercussions for the health of its employees and the integrity of the company, both nationally and internationally, as well as compromising the image and reputation of eni on international markets.
Crisis is declared, with the contribution of the eni health functions, also in line with eni regulations on crisis management.

Management of epidemics and pandemics
In order to protect workers against the threat of epidemics and pandemics, minimize their negative impact and safeguard Eni's essential operating activities the subsidiary health function must define, based on the criteria set by the central health function, a procedure for managing this type of emergency.
The document validation and approval cycle follows the same flow as for the local response plan for medical emergencies

8.12.3 INDUSTRIAL HYGIENE

Purpose of the Industrial Hygiene activities is to verify, through samplings and monitoring campaign, possible occupational exposure to Chemical, Physical or Biological agents related to the activities performed and verify comfort and healthy conditions of workplaces, offices and living quarters. In addition, to verify and guarantee compliance with Legislative framework in the country / region where eni operates

The first step of the process is the execution of a Health Risk Assessment (HRA) for the identification of the health risks; HRA will permit the identification and the needs to perform an appropriate Industrial Hygiene monitoring plan.

An Industrial Hygiene monitoring plan shall be used to evaluate potential exposures and to develop controls that will protect the health of all workers.

An efficient monitoring plan shall be repeated periodically in compliance with the existing legislative references

Benefits from an appropriate and well managed Industrial Hygiene monitoring plan are the following:

- can help to guarantee the respect of all the requirements about health for all eni employees, and to avoid possible legal and medical impacts.
- possibility to constantly check the workplace conditions;
- check the efficiency of the improvement action plan carried out.
- minimize the possibility of presentation of chronic work-related pathologies (professional disease)
- ensure an appropriate and efficient Health surveillance and review

8.12.4 GLOBAL HEALTH

8.12.4.1 Community Health

Community health initiatives

Community health initiatives respond to the health needs of the beneficiary populations, identified as a priority by the studies carried out in conjunction with local health authorities.

Eni Myanmar can support the activities through:

- Carry out studies and provide support sign up agreement for the purposes of identifying and defining operating strategies to cope up with Public Health needs of a given population, through:
  - Pre-feasibility study: the preliminary process to identify and assess the community health needs in the previously established area
  - Memorandum of Understanding (MoU) to commit the parties to a more in-depth joint analysis of the previously identified strategy
  - Feasibility study: analysing and validating the previously identified strategy and preparation of the relevant General Plan of Action
  - Partnership agreement: based on the previously signed MoU and the results of the feasibility study

- Coordinate project implementation phase with the main participants at the company level (HR, HSE, Finance, Procurement, Legal, etc.) for project periodical documents (semi-annual operating plan/reporting) and other governance activities (Technical and Steering Committees)

- Develop of a local technical/financial periodic planning, monitoring and reporting process

HIA/ESHIA

HIA is a structured planning and decision-making process for analyzing the potential positive and negative impacts of project activity on public health, and consequently define mitigation/enhancement measures to reduce the negative impacts and enhance those positive.

The company eni (division / business unit / line employer) shall support the activities through actively involving in preliminary evaluation (screening), early define of the impacts (scoping), baseline data collection, impact assessment, draw up the mitigation plan and further set up monitoring plan

8.12.4.2 Health Promotion

Health promotion activities aimed at eni employees and their dependents, seek to generate a culture of health, both in and outside of the workplace.

Health promotion activities are divided into:

- Primary prevention aimed at promoting a healthy lifestyle
- Secondary prevention by defining activities that enable the early detection of some illnesses and

- Tertiary prevention activities directed at those who have already undergone medical treatment for a given pathology and which helps to prevent any relapse and/or recurring health problems as well as facilitate their return to work.

The company eni (division / business unit / line employer) shall support the activities through:

- plan and define the health promotional programmes, to be implemented based on the annual theme and on the existing risks to health in the place in question
- develop of a local periodic planning, monitoring and reporting process.

8.12.5 TRAVEL MEDICINE

Travel medicine deals with the prevention and management of health problems of international travelers during business trips (mission, short and long-term assignments) abroad.

For the purposes of proper implementation of Travel Medicine, it is necessary for every company eni (division / business unit / line employer) to provide initiatives both before departure and upon arrival of the worker at the destination, which can vary depending on the specific context of the country the worker travels, by developing:

- Document risk assessment that takes into account the evaluation of the health risk of the country destination (country guides);
- Surveillance protocol for the employee exposed to risks associated to traveling (fitness to work for mission/contract abroad)
- Support international mobility through the model of training / information on the risks travel related (travel medicine meeting, e-learning course, authorization system);
- A vaccination protocol for the country (vaccination booklet)
- Information related to the medical assistance abroad based on the destination country (eni medical facilities, health care providers, international private insurance)

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9.0 PUBLIC CONSULTATION AND DISCLOSURE

9.1 INTRODUCTION

Stakeholder engagement is a key element of the ESHIA process. The purpose of stakeholder engagement is to allow stakeholders to interact with the decision-making process, express their views and influence mitigation and technical solutions to concerns voiced during the process. Stakeholders include affected communities, enterprises and individuals, community organizations, local authorities, non-governmental organizations (NGOs), media, national and regional governments and general public.

Stakeholder engagement is a process, which involves the two-way sharing of information and knowledge, seeking to understand the concerns of others and building relationships based on collaboration. It allows stakeholders to understand the potential risks, impacts and opportunities of the project in order to achieve positive outcomes.

The main objectives of stakeholder engagement are:

- to ensure that adequate information is provided to those affected by a project;
- to provide these groups with sufficient opportunity to voice their opinions and concerns;
- to ensure that comments are received in a timely manner so that they can be taken into account in project decisions.

The main steps in a successful stakeholder engagement are the following:

- stakeholder identification and analysis, which consists of identification of the various individuals or groups who (i) are affected or likely to be affected (directly or indirectly) by the project, or (ii) may have an interest in the project;
- stakeholder engagement plan, which defines how communication with the identified stakeholders will be handled throughout project preparation and implementation, including the type of grievance procedure envisaged;
- information disclosure, which helps stakeholders understand the planned project and possible risks, impacts and opportunities of the project.

9.2 APPROACH

This section describes the approach adopted for each of the above-mentioned steps.

Stakeholder Identification and Analysis

Stakeholder is 'any individual or group who may be directly or indirectly affected by the Project, as well as those who may have an interest in or influence over the project'. The objective of stakeholder identification is therefore to establish which organisations and individuals may be directly or indirectly affected (positively and negatively) by the Project ("affected parties") and those that may have an interest in the project ("other interested parties").

When identified, stakeholders will be classified according to their importance to the success of the Project and their influence or potential impact over its implementation and outcome. Different issues are likely to concern different stakeholders, therefore stakeholders will be grouped based on their connections to the project; having an understanding of the connections of a stakeholder group to the project helps identify the

key objectives of engagement. The process of stakeholder mapping also aims to identify which stakeholder may have a positive or negative impact or influence on the project.

Box 9.1 Stakeholder Mapping: Definition

Stakeholder Mapping is a process and tool used in Stakeholder Analysis to clarify and categorize the various stakeholders by drawing further pictures of what the stakeholder groups are, which interests they represent to the project, the amount of influence they have, whether they represent inhibiting or supporting factors for the Project and determine the best approach to deal with them.

To aid the stakeholder identification process, a series of questions can be considered, as presented in the following Box 9.2.

Box 9.2 Stakeholder Identification – Questions to Consider

1. What type of stakeholder engagement is mandated by law or other requirements? (E.g. MOGE is involved in the EIA process, as per Law)

2. Which area are the Public authorities and Public administrations directly and indirectly involved in the Project? And, which are the local representative of these Public authorities and administrations?

3. Which stakeholders can best assist in providing relevant baseline data collection? (E.g. Who can provide local information on agricultural activity? Who can best advise on approach to be undertaken with local communities? Who best can help to understand communities' ethnic diversity?).

4. Which stakeholders can best assist with the early scoping of issues and impacts? (Who can best assist to understand the potential interaction of O&G activities on the Territory?).

5. Who will be adversely affected by potential environmental and social impacts in the project's area of influence? (E.g. Who is using the Land? Who is depending on the water resources nearby the Study Area?)

6. Who are the most vulnerable among the potentially impacted stakeholders, and are special engagement efforts necessary? (E.g. Women and young, traditional land farming, etc.)

7. At which stage of project development will stakeholders be most affected (e.g. procurement, construction, operations, decommissioning)?

8. Who strongly supports or opposes the changes that the project will bring and why? (Who has main interest or is potentially most affected by the Project activities? Who will potentially support the Project and Who will potentially inhibit the Project?)

9. Are the Project operations carried out in a region inhabited by indigenous peoples? What indigenous peoples are present and who is their best representative?

Stakeholder Engagement Plan

A Stakeholder Engagement Plan defines how communication with the identified stakeholders will be handled throughout project preparation and implementation, including the type of grievance procedure envisaged. Different levels of engagement and consultation might be appropriate for affected parties and other interested parties.

Various types of engagement will be conducted to ensure that information regarding the Project will be disseminated to all stakeholders. These will be as follows:

- **focus groups discussions** to gain information from specific groups, including vulnerable groups, otherwise difficult to access and to have targeted discussions on issues of concern with regards to the project (i.e. income, land dependency, gender inequalities, livelihood strategies, health, education, etc.). Assumed that a maximum of 8-10 focus groups will be organised with the participation of community members in 'target areas'.
- **key informant interviews** with selected local authorities, community representatives and community based organisations that can provide information on population, land use, economy, health, education and livelihoods and infrastructures that is otherwise difficult to obtain.

The proposed methodology and approach for focus groups and key informant interviews are explained in detail in the following.

Focus Groups

A series of focus group meetings targeting specific audiences in each of the 'target areas'. Box 9.3 describes the definition and purpose of a focus group in this context.

Box 9.3 Focus Groups: Definition

A focus group is a form of group interview in which: there are several participants (including the facilitator); there is an emphasis in the questioning on a particular defined topic; and the accent is upon interaction within the group and the joint construction of meaning. The interaction within groups is an area of interest and is more focused than a group interview.

Source: Bryman. A. (2008) Social Research Methods (3rd Edition). Oxford University Press

Focus groups were arranged with specific population groups that are considered particularly vulnerable or that will be more greatly impacted by Project activities. Vulnerable groups are individuals or communities who are particularly susceptible to marginalisation for reasons of sex, age, gender, race, religion, disability, livelihood or location. Focus groups provide a forum for vulnerable members of society to be heard and allow open discussion of project impacts. In other cases, they allow for discussion with groups that may be disproportionately impacted (positively or negatively) by the Project – e.g. farmers, small industry or land owners – with a focus on learning more about their current situation as well as potential impacts and mitigation.

Table 9.1 presents a list of focus groups considered in each target area. The list is based on standard issues and vulnerable groups identified by *eni Myanmar*. The activities will allow a fine tuning of the list and identifying additional groups that might be relevant to the assessment and therefore may be subject to change. Focus groups were held with settlement representative within each target area identified within Block RSF-5.

Table 9.1 List of Focus Groups

Focus Group	Purpose
Agricultural Associations and farmers	• Discuss impacts from temporary land use change (permanent crops and annual) • Discuss water supply issues and potential project related impacts • Identify current methods of water use and extraction • Discuss impacts to livestock where appropriate
Women	• Discuss how the project may impact women and children • Discuss health and education issues • Discuss any other issues
Small Industry and business owners	• Discuss temporary or permanent loss of land during construction and /operation • Discuss water use systems and issues • Discuss any project related impacts to local businesses • Discuss employment and economic growth in the area
Cultural/Ethnic Groups	• Discuss issues facing the population in the project area • Discuss health and education issues • Discuss discrimination or social isolation issues • Discuss any project related impacts • Discuss potential mitigation measures
Elderly	• Discuss issues facing elderly population in the project area • Discuss any project related impacts • Discuss potential mitigation measures

All focus group meetings are opened by informing the group about the Project and purpose of the ESHIA study. Participants are then asked a series of questions on topics specifically related to the group of individuals. All information is recorded in note form then written up into focus group records. Participants were provided with a Project leaflet and contact information should they require any additional information or need to contact Client at a later date.

Key Informant Interviews

The purpose of key informant interviews is to gather qualitative information from an individual who has in-depth knowledge of a specific subject or topic area (Box 9.4).

Box 9.4 Key Informants: Definition

Key informants are select individuals who have knowledge of a specific subject or are informed members of the community. They include government representatives, lawyers, local leaders, religious leaders, school teachers, healthcare professionals, NGOs etc. The purpose of these interviews is to obtain qualitative data and / or quantitative data that is otherwise difficult to obtain.

Key informant interviews were conducted in every target area and in Magway capital city where the regional and main township administration is located.

Table 9.2 below presents a list of key informants and the reason they have been selected. The list covers potential key informants for all major areas of interest at regional and Key Target area. The list may contract or expand as more information on the existence and availability of key informants is obtained through conversations with the authorities.

Table 9.2 List of Key Informants

Key Informant	Purpose
Agriculture	• Understand function and representation of the association (users as well as owners) • Discuss farming practices in the area • Discuss land use and compensation issues • Discuss water use, sources, and issues relating to water in the area
Local Forestry Authority	• Identify different forest use, • Discuss forest ownership, management and access • Discuss potential project impacts facing forest users; • Discuss appropriate mitigation measures
Health Care workers or authorities	• Discuss the main health care issues facing the local community; • Discuss health care provision; • Discuss potential project impacts relating to health.
Skills, Labour and employment	• Discuss current skill types and levels in surrounding communities; • Discuss economic immigrants; • Discuss access to training opportunities; • Discuss relevant employment standards; • Discuss future labour and employment projects.
Hunting/fishing/recreation associations (if these exist)	• Discuss recreational use of forested areas and rivers in the project area • Discuss potential impacts and mitigation measures
Others	• Ad hoc meetings with key informants depending on issues that arise whilst in the field

Where appropriate, key informant interviews were conducted 'in the field', that will involve driving around the local area and asking the key informant questions related to defined discussion topics or issue areas related to the project. Information collected during interviews was recorded into interview forms.

Information Disclosure

Disclosure of relevant project information helps stakeholders understand the risks, impacts and opportunities of the project. If communities will be affected by potential adverse environmental or social impacts from the project, *eni Myanmar* will disclose to them the following information:

- the purpose nature and scale of the project;
- the duration of proposed project activities;
- any risks to and potential impacts with regard to environment, worker health and safety, public health and safety and other social impacts on communities, and proposed mitigation plans;
- the envisaged consultation process and opportunities and ways in which the public can participate;
- time/venue of any envisaged public meetings, and the process by which meetings are notified, summarised and reported.

The information note above was disclosed in the local language and in a manner that is accessible and culturally appropriate, taking into account any vulnerable people (for example ethnic groups or displaced persons).

Additional information may need to be disclosed on an on-going basis, as the project progresses, in case of any material changes in the nature of the project or its impacts, or if material new risks and impacts arise.

9.3 SUMMARY OF UNDERTAKEN ACTIVITIES

The stakeholder involvement for this ESHIA has consisted of five parts: Stakeholder mapping, focus group meetings, key informant interviews, and attitude consultations.

The comments and concerns of the stakeholders consulted during this ESHIA have been considered and incorporated into the project design and mitigation measures.

This chapter presents the key findings from public consultation and disclosure. It also provides recommendations for future consultation to be implemented throughout the execution of the project.

The block area is a remote area with villages sparsely located throughout the area as shown in village location map for Block RSF-5.

Table 9.3 presents the stakeholder categories who have been identified as relevant for the main ESHIA phase of this project.

Table 9.3 Stakeholder Categories

Stakeholder category	
Affected Parties	
• Community representatives • Community based organisation • Individual Farmer • Land owner • Farmer's Association • Farmer Federation • Traditional Farmers (floating agriculture) • Agricultural Companies/Cooperative • Fisherman Association	• Ecotourism Association (Community-based tourism) • Cultural Association • Religious Groups • Monasteries Community • Water Users • Internally displaced persons/Refugees • Vulnerable Groups Representative (women and girls, new asylum-seekers)
Authorities and Administration	
• Oil and Gas Authorities/Administration • National Level Authorities/Administration (Ministry, Committee, Council, etc.) • Regional Level Authorities/Administration (States and Regions)	• Provincial Level Authorities/Administration (Districts) • Local Level Authorities/Administration (Townships, Towns, Wards, Villages, Settle-ments) • Military Authorities
Other Interested Parties	
• Business Association • Forums and working groups • International organization/Agencies • ONG • Other Non-State Actors • Opinion leaders • Political Groups and local/national repre-sentatives	• Public Foundation • Health and Sanitary • Research and Observation Centres • Public Education • Trade Union • Energy Sector • Private Sector
Media	
• National Press Authority • Media Agency • Newspaper	• Radio • Television

Source: eni, 2014

9.3.1 Stakeholder Engagement Methodology

In March 2016, IEM conducted focus group meetings with approximately 400 villagers in 8 villages in the Magway and Myothit townships of Magway District in RSF-5.

Blocks RSF-5 covers an area of 1.292 sq. km in the prolific Salin Basin, located about 500 km north of Yangon. It covers the Magway, Myothit and Min Hla townships of Magway District. Block RSF-5 is characterised by the dominance of agricultural land made of small to medium size crops. The well-developed road network (mainly tracks and dirt roads) gives sufficient access to small vehicles. A discrete proportion of the Study Area is characterized by the presence of erosional landforms (gullies and rills) and natural vegetation (mainly shrubs, and forest patches along rivers and trenches.

Attitude consultations were completed with approximately 50 interviews in each of the 8 villages within the Magway District. These were done to determine the level of understanding and support for the project. As part of the public involvement process, Key Informant Interviews were also conducted with village leaders and health providers.

The sample approach was based on sampling those villages in the area of *eni Myanmar*'s most likely seismic exploration program.

At the focus group meetings, interviewees were informed that *eni Myanmar* will conduct seismic surveys to identify potential hydrocarbon reservoirs, using explosives, vibroseis, or a combination of both.

Villagers were informed that *eni Myanmar*, following its participation in the competitive International Bid Round launched by the Republic of the Union of Myanmar, on 31 July 2014 signed a Production Sharing Contract (PSC) for RSF-5 onshore block in the Magway Region. The Joint Venture is between *eni Myanmar*, the Operator with a 90% participating interest through eni Myanmar B.V, and the Myanmar Production and Exploration Company Ltd (10%).

As part of the planning and preparation process for the exploration seismic activities, *eni Myanmar* is conducting a series of environmental and social studies. IEM has been contracted by *eni Myanmar* to provide specialist support in the development of these studies and is contacting potentially interested stakeholders in the process.

The public involvement program focused on gaining Key Informant information and attitudes on the prospective impacts of the project before, during and after construction.

The purpose of the exploration seismic program is to determine if any possibility of oil or gas exploitation is present. The villagers were informed that the focus group meetings and interviews were being conducted as part of an environmental, social and health impact assessment that is required to obtain approval for the project and to help guide *eni Myanmar* to reduce any potential negative impacts and to enhance potential positive benefits.

9.3.2 Sample Size

The attitude consultation is conducted to evaluate the attitudes of the potentially affected stakeholders. The potentially affected population was determining from the households living in the proposed 3D seismic area in Block RSF-5 as shown in Figure 9.1.

1) Determining the sample sizes

The sample size was collected as follows:

(1) major area – Inside the 3D-seismic area was determined according to Yamane (1973) with the confidence level at 95% as following formula;

$$n = \frac{N}{\left(1 + Ne^2\right)}$$

where
n = Sample size
N= Number of population – households in this study
e = Level of precision at 0.05 in this study

Equation 9-1

The 3D seismic area covered 56 villages consisted of 11,270 households (HH). Using **Equation 9-1** the minimum sample size in area is:

$$n = \frac{11{,}270}{1 + 11{,}270\ (0.05)^2} \quad = \quad 386 \text{ samples}$$

The total required sample to obtain a confidence level of the data at 95% was 386 samples. These samples were evenly distributed through 8 villages within the proposed 3D seismic area.

Figure 9.1: Potentially Affected Villages in 3D Seismic Area

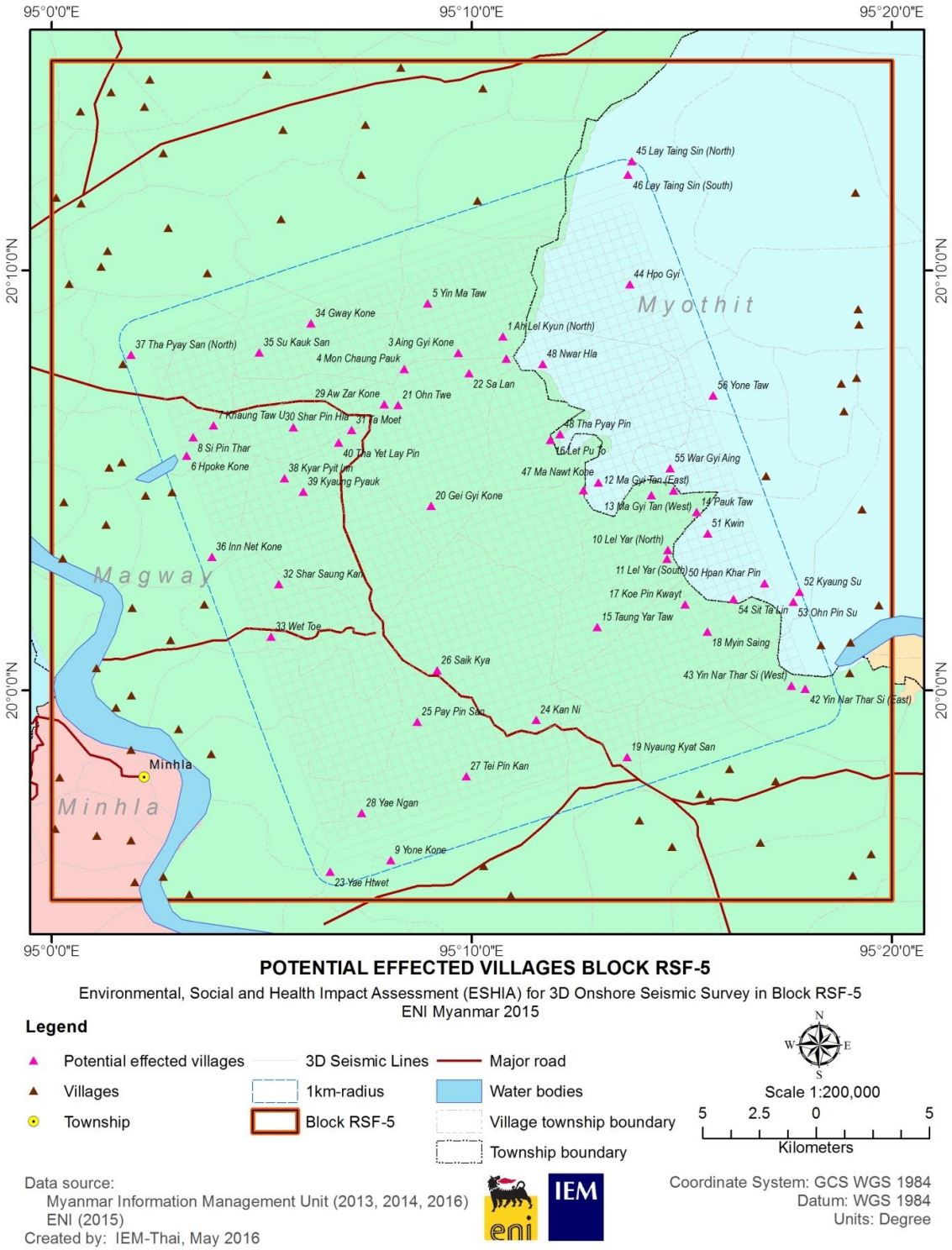


Table 9.4: Household and Populations for Potentially Affected Villages

Sr.	Name of the village	No. of Population	No. of Household	Longitude			Latitude		
1	Ah Lel Kyun (North)	411	107	95°	10'	44.364"	20°	8'	25.656"
2	Ah Lel Kyun (South)	248	50	95°	10'	49.44"	20°	7'	54.048"
3	Aing Gyi Kone	784	152	95°	9'	40.896"	20°	8'	2.364"
4	Mon Chaung Pauk	419	73	95°	8'	23.712"	20°	7'	39.396"
5	Yin Ma Taw	1110	187	95°	8'	57.228"	20°	9'	12.78"
6	Hpoke Kone	1122	271	95°	3'	12.888"	20°	5'	35.196"
7	Khaung Taw U	1220	153	95°	3'	51.336"	20°	6'	18.864"
8	Si Pin Thar	858	175	95°	3'	22.248"	20°	6'	1.656"
9	Yone Kone	916	154	95°	8'	4.236"	19°	55'	2.532"
10	Lel Yar (North)	1425	300	95°	14'	40.236"	20°	3'	20.376"
11	Lel Yar (South)	603	126	95°	14'	39.192"	20°	3'	7.956"
12	Ma Gyi Tan (East)	231	41	95°	14'	48.084"	20°	4'	45.768"
13	Ma Gyi Tan (West)	251	49	95°	14'	16.404"	20°	4'	38.964"
14	Pauk Taw	329	70	95°	15'	21.276"	20°	4'	14.772"
15	Taung Yar Taw	625	78	95°	12'	59.22"	20°	1'	30.648"
16	Let Pu To	1056	200	95°	11'	52.476"	20°	5'	58.02"
17	Koe Pin Kwayt	939	189	95°	15'	4.824"	20°	2'	3.012"
18	Myin Saing	1180	148	95°	15'	36.792"	20°	1'	23.916"
19	Nyaung Kyat San	688	160	95°	13'	41.844"	19°	58'	35.544"
20	Gei Gyi Kone	143	18	95°	9'	2.16"	20°	4'	23.376"
21	Ohn Twe	3000	375	95°	8'	14.676"	20°	6'	47.952"
22	Sa Lan	728	187	95°	9'	55.98"	20°	7'	33.024"
23	Yae Htwet	345	61	95°	6'	37.944"	19°	55'	19.2"
24	Kan Ni	827	103	95°	11'	31.848"	19°	59'	42.012"
25	Pay Pin San	898	112	95°	8'	42.468"	19°	59'	44.748"
26	Saik Kya	1326	166	95°	9'	10.512"	20°	0'	28.728"
27	Tei Pin Kan	1220	153	95°	9'	52.308"	19°	57'	2.652"
28	Yae Ngan	525	113	95°	7'	22.98"	19°	57'	55.14"
29	Aw Zar Kone	303	63	95°	7'	54.948"	20°	6'	48.996"
30	Shar Pin Hla	1401	175	95°	5'	45.204"	20°	6'	16.092"
31	Ta Moet	555	63	95°	7'	8.724"	20°	6'	12.168"
32	Shar Saung Kan	4000	500	95°	5'	24.216"	20°	2'	31.668"
33	Wet Toe	553	141	95°	5'	13.49	20	1'	16.5"
34	Gway Kone	702	178	95°	6'	10.584"	20°	8'	44.808"
35	Su Kauk San	1304	355	95°	4'	56.64"	20°	8'	2.976"
36	Inn Net Kone	957	226	95°	3'	48.96"	20°	3'	10.62"
37	Tha Pyay San (North)*	360	45	95°	1'	53.112"	20°	7'	59.628"
38	Kyar Pyit Inn	759	204	95°	5'	32.496"	20°	5'	3.048"
39	Kyaung Pyauk	1064	284	95°	5'	59.352"	20°	4'	43.788"
40	Tha Yet Lay Pin*	3280	410	95°	6'	50.076"	20°	5'	53.88"
41	Yin Nar Gway Chaung	1054	207	95°	12'	39.564"	20°	4'	46.272"
42	Yin Nar Thar Si (East)	976	222	95°	17'	56.58"	20°	0'	
43	Yin Nar Thar Si (West)	1440	305	95°	17'	36.384"	20°	0'	
44	Hpo Gyi	2202	510	95°	13'	45.66"	20°	9'	40.536"
45	Lay Taing Sin (North)	1118	230	95°	13'	48.576"	20°	12'	36.18"
46	Lay Taing Sin (South)	2858	608	95°	13'	43.248"	20°	12'	17.244"
47	Ma Nawt Kone	1239	255	95°	13'	1.02"	20°	4'	57"
48	Tha Pyay Pin	130	21	95°	12'	5.94"	20°	6'	6.12"
49	Nwar Hla	4716	590	95°	11'	41.172"	20°	7'	46.488"
50	Hpan Khar Pin	407	104	95°	16'	58.22	20°	2	32.712"
51	Kwin	1467	338	95°	15'	36.936"	20°	3'	44.028"
52	Kyaung Su	149	36	95°	17'	48.19	20°	2'	21.12"
53	Ohn Pin Su	661	137	95°	17'	39.19	20°	2'	6.468"
54	Sit Ta Lin	908	223	95°	16'	14.088"	20°	2'	10.212"
55	War Gyi Aing	4000	500	95°	14'	43.584"	20°	5'	17.196"
56	Yone Taw	2822	370	95°	15'	45"	20°	7'	1.272"
	Total Population	64,812	11,270						

Note: * The number of households was determined based on the population using an assumed value of 8 pax per household.

9.3.3 Consultation Locations

Within Block RSF-5, 8 villages were identified for participation in the consultation. The project area within Block RSF-5 is located in Magway and Myothit Township, Magway District.

Table 9.5: Summary of RSF-5 Village and Sample Locations

No.	Date	Village	Township
1	11/3/2016	Shar Pin Hla	Magway
2	11/3/2016	Ohn Twe	Magway
3	12/3/2016	Shar Saung Kan	Magway
4	12/3/2016	Saik Kya	Magway
5	13/3/2016	Taung Yar Taw	Magway
6	13/3/2016	Myin Saing	Magway
7	14/3/2016	Nwar Hla	Myothit
8	14/3/2016	Wa Gyi Aing	Myothit

9.3.4 Focus Groups

At the focus group meetings prior to conducting the opinion questionnaires, the villagers were informed that *eni Myanmar* was planning to conduct a seismic program in Block RSF-5. The project schedule will last up to 12 months for the seismic program.

The purpose of the seismic and exploration drilling program is to determine if any oil or gas is present. If oil and gas is found, then the oil and gas will be produced for sale.

The villagers were informed that the focus group meetings and opinion interviews were being conducted as part of an environmental, social and health impact assessment that is required to obtain approval for the project to proceed and to help guide *eni Myanmar* to reduce any potential impacts.

The presentation/discussion topics for public involvement and disclosure included, but not limited to:

- Objective of Public Consultation
- Overview of project description/information
- Methodology of seismic activities
- Sensitive existing environmental conditions.
- Key impact aspects
- Proposed project mitigation measures and monitoring program
- Compensation

MOGE assisted IEM/*eni Myanmar* by contacting local officials in each Township and village and made arrangements for the team to meet with them. MOGE too, participated in each focus group meeting and addressed those questions appropriate for the government to answer.

Prior to initiating community meetings, a presentation was provided to the Key Township Officials and Administrator to obtain understanding of the project, ESHIA objectives and support and approval for village meetings. A short discussion followed that in general focused on how compensation for land use would be addressed.

eni Myanmar noted that compensation team for seismic will involve a Representative from the Agriculture Department, MOGE, Local District/Township officials and Chief

Village and his representatives to determine fair compensation for crops lost due to seismic activities. Compensation will be managed by the land management plan in accordance with IFC PS. Before the start of the seismic activity a pre survey will be organized to identify the landowner and stipulate an agreement for the operation to be undertaken on their area. When activity on seismic line is complete, i.e. the recording operations have been completed; the compensation team will conduct a post survey to physically check the line and assess the individual landowners' plots for compensation. Once the physical check of the line is complete and the compensation is agreed. The compensation will be paid during the Payment Ceremony organized by village. *eni Myanmar* is committed to timely compensation and will conduct further engagement sessions with villager representatives, Township officials and MOGE personnel to provide regular briefs on planned activities and other issues of importance.



Focus Group Meeting



Key Informant Interviews

Figure 9.2: Focus Group Meeting Photographs

The following Salient Points were discussed during the meetings in each village:

No	Date	Village	Questions	Answers
1	Day 1 (11.03.2016) Morning Sections	Ohn Twe	Q-1 Whether *eni Myanmar* is doing seismic or drilling in the cultivation farm area, how will *eni Myanmar* arrange for compensation for the local farmer?	A-1 *eni Myanmar* is working with government authority as a partner. It was answered that if their land is cultivated, then *eni Myanmar* will pay compensation. *eni Myanmar* will follow all the rules and regulations that have been set by the national and local administration authority. Before *eni Myanmar* starts any project activities, *eni Myanmar* will come with the authority and discuss with the villager and village head any potential impacts. *eni Myanmar* will provide compensation for any damage and any loss from the villagers. The compensation process, was discussed by MOGE step by step.
			Suggestion -1	The villagers would like to suggest that if possible, the exploration period should start after cultivation.
2	Day (1) (11.03.2016) Afternoon Sections	Shar Pin Hla	Suggestion -1	The villagers would like to suggest that if possible, the exploration period should start after cultivation.
3	Day (2) (12.03.2016) Morning Sections	Saik Kya	Q-1. What qualifications do the workers require for the job opportunities available,	A-1 *eni Myanmar* replied that, in this situation, *eni Myanmar* would like to focus on the Seismic program. The seismic activities in each area will last only a few weeks. *eni Myanmar*, requires un-skilled workers and causal workers from the village to support the seismic program. If the oil and gas is ultimately found, *eni Myanmar* will require long-term jobs, which will provide further opportunities for the local people.
			Q-2 One of the villager asked if *eni Myanmar* will solve the issue of the land compensation.	A-2 MOGE explained that the compensation process will be implemented step by step. First, compensation will be discussed with the landowner, head of village and Village land management committee. Then, it will be sent to the Township land Management Committee and to the District Land Management Committee and Regional Land Management Committee. The Regional Land Management Committee will check if the land is really owned by the villager or not. The head of the village and village land management committee will set the amount of compensation. If all the members agree on the amount of compensation, then *eni Myanmar* will give all the amount of compensation to the landowner.
			Suggestion (1)	One of the villagers suggested that the seismic program can be conducted at the end of December, after harvesting sesame.
			Comment Negative Impact in the past based on Previous Experiences	In the past, the SMART company did the same seismic project near the **Saik Kya** Village. Because of that process, there was negative impact to the communities. in particular, the public tube well was damaged by the seismic exploration activities. Therefore, they want *eni Myanmar* to avoid the cultivation activities for their land.

No	Date	Village	Questions	Answers
4	Day (2) (12.03.2016) Afternoon Sections	Shar Zaung Kan Village	Q-1 As Myanmar GDP is based on Agriculture land, we are worried about the exploration process. If the Seismic project is successful, how will agriculture land recover? Besides, what about job opportunities for marginalized people?	*eni Myanmar* replied that we understand the GDP issue in Myanmar. *eni Myanmar* will manage all issues that have been raised. *eni Myanmar* explained the exploration activities, and said that the exploration process will have very minimal impact. For any damage to agriculture land, *eni Myanmar* will provide compensation to the landowner. Besides, *eni Myanmar* will also consider suggestions as to where and when the seismic program will be conducted in order to minimize possible impact to cultivated areas. With respect to possible job opportunities, the seismic process is only short term and requires geologists, engineers and some support workers. Thus, *eni Myanmar*, will need only causal workers for land preparation, who can be hired in the local community.
			Suggestion (1)	One of the household leaders said that the livelihood from this village is based on agriculture and cultivation. Thus, if possible, they would like to request that *eni Myanmar* conduct exploration on the pasture and fellow land.
5	Day (3) (13.03.2016) Morning Section	Taung Yar Taw Village	Q-1 A Committee Member from the Village said that there was some seismic exploration in the past. Because of that issue there were lots of negative impact in their community. In particular, the community tube well had been damaged and the local community face water problem until now. Apart from that there is no compensation provided. As a result, all of the villagers are afraid of seismic exploration. Therefore, the village headman requested more information about the compensation issue.	Ans:1 *eni Myanmar* replied that we are very interested to discuss this issue with the villager. Hopefully, as *eni Myanmar*, they are trying to avoid the land that has been cultivated and they will also try to avoid the housing areas from the village. If there are some impacts negatively, to the community, *eni Myanmar* will provide compensation. If *eni Myanmar* damage something from the villager, *eni Myanmar* will pay compensation. *eni Myanmar* will work to ensure that any impact is minimized.
6	Day (3) (13.03.2016) Afternoon Sections	Myin Saing Village	Q-1 If you find oil and gas on a person's farm, then how does *eni Myanmar* deal with the farmer? What kind of benefits will *eni Myanmar* provide for the landowner?	Ans-1 As part of the compensation process, there are three main considerations, such as seismic time, drilling time and operation time. Based on the process, the compensation is different. Compensation is based on the type of crop cultivation such as paddy, sesame, and groundnuts. The compensation process is explained in detail above.
			Q-2 If oil and gas is produced for 10 or 20 years, how will *eni Myanmar* arrange for compensation and	Ans-2 In the oil and gas process, there are three main parts such as seismic, drilling and oil and gas production. The compensation for seismic is based on the time for conducting seismic; it is only a few weeks. But for drilling, it may take two or three

No	Date	Village	Questions	Answers
			what is the payment to the landowner.	years. After drilling if *eni Myanmar* does not find oil and gas, they will return the drilled land to the landowner and also give the compensation based on the amount of time that the land was occupied. For the third case in which *eni Myanmar* finds oil and gas, then development is a longer-term scenario and the amount of compensation is also higher. In this case *eni Myanmar* may buy or lease the land from the landowner.
7	Day (4) (14.03.2016) Morning Section	Nwar Hla Village	Q-1 The villager only focused on the land compensation issue.	Ans-1 It has been answered by MOGE as above.
8	Day (4) (14.03.2016) Afternoon Sections	War Gyi Aing Village	Q-1 The road for the village can carry 13 tons only. If the truck for the seismic is too heavy, it cannot run on their road. Therefore, if the road is damaged by those trucks, how will *eni Myanmar* address this issue.	Ans-1 As *eni Myanmar*, will cover all the damage to the community. *eni Myanmar* will avoid the housing, religious building and cultural heritage areas. If eni damages the road during the seismic program, compensation will be provided. For all Villages, *eni Myanmar* will come again and discuss with villagers before they implement the seismic program and discuss with the land owner, villagers and head of the village. If all members agree, they will continue to conduct the seismic activities.

9.3.5 Key Informant Interviews

In March 2016, as part of the public involvement process, Key Informant Interviews were conducted with village leaders in 8 villages.

The Key Informant consultation was designed to focus on gaining attitudes toward the planned seismic program. Key informant interviews were conducted with Village Leaders; Village Medical Officer and Village Education Officer in 8 villages within RSF-5.

To ensure the ability to correlate data, a targeted subset of the attitude consultation was used as a basis for Key Informant Interviews. Some key results include the following:

9.3.5.1 Project Awareness

Of the villagers interviewed, 90% had some knowledge about the project.

The majority of villagers had learned of the project from the interviewers (87%).

9.3.5.2 Importance of Oil and Gas to the Community

Of those interviewed, 80% rate the importance of oil and gas drilling to the community as important, and 7% said very important.

9.3.5.3 Project Expectations

Villagers anticipate positive impacts from the project to include: increased employment (67%), as improved road transport (52%), improved living conditions (43%) and increased annual income (38%).

9.3.5.4 Support for the project

Of those interviewed, 79% agree with the proposed project development. Therefore, the majority of the key informant opinion agrees with the eni project.

9.3.5.5 Project Concerns

Villagers interviewed were concerned about possible negative impacts of the project including: 55% are concerned about access to water, 52% are concerned about loss of land, and 48% concerned about possible social effects.

9.3.5.6 Priority Development initiatives for the community

Villagers priority development initiatives for the community include: electricity (39%), health (32%), and education 29%.

9.3.6 Purpose of Opinion Consultation

Within Block RSF-5, 8 villages were identified for participation in the opinion consultations.

The opinion consultations collected information in this area on the opinions and understanding of *eni Myanmar*'s planned seismic and drilling program.

The opinion consultation was designed to focus on gaining information on the opinions of the prospective impacts of project during and after construction.

Of the responses 61% were Male, and 39% were female. The results of the consultations have been analyzed and the following summary is provided below.

9.3.7 Location

The consultation was conducted in 8 villages in Magway (78%) and Myothit (22%) Township within RSF-5. Villages included Shar Pin Hla, Ohn Twe, Shar Saung Kan, Saik Kya, Taung ar Taw, Myin Saing, and Nwar Hla.

9.3.7.1 Knowledge about the Project

Of the villagers interviewed 57% had no previous knowledge of the project, while 43% had some knowledge of the project.

Villagers had learned of the project from community leaders (45%) and interviewers (27%).

9.3.7.2 Importance of the Project to the Villagers.

Of those interviewed, 48% considered oil and gas drilling to be important to the community.

The majority (72%) of villagers indicated that they had no experience in project development before, while 18% had experience with the oil and gas or pipeline projects.

Villagers indicated that project development had a positive effect (52%).

9.3.7.3 Opinions of Possible Project Benefits

Most of the villagers (32%) were unaware, while 19% are concerned about negative social issues, and 17% are concerned with loss of land, while 13% were concerned about increased costs.

9.3.7.4 Household Support for Project

Of those interviewed, 72% agree with the proposed project development. Therefore, the majority of the public opinion agrees with the eni project.

9.3.8 Community Priorities

Villagers (57%) consider electricity as a priority development initiative, while health 34% and education (30%) are second and third priorities.

9.3.9 Issues to Discuss with Community Stakeholders

To allow subjective data to be quantified, the stakeholders' perceptions about the project and its impacts are quantified using a ranking system. The interviewees are asked to score their perceptions as to whether they felt that the proposed activities would have a positive or negative impact on 29 issues.

The answer ranks attitude in 7 levels from extremely negative to extremely positive (of scale -3 to +3). Minus scales imply negative attitude, while plus scales indicate the opposite. Zero indicates a neutral perception regarding impacts from the project. The ranking system is outlined in Table 9.6.

Table 9.6: Ranking System

Negative Attitude	Neutral Attitude	Positive Attitude
-1 Slightly Negative	0 No Effect	+1 Slightly Positive
-2 Negative	-	+2 Positive
-3 Very Negative	-	+3 Very Positive

Attitude responses, both positive and negative, were deemed significant based on the criteria outlined in Table 9.7.

Table 9.7: Significant Criteria

Significant scores are highlighted in red in Table 1 if response greater than:	
Criteria	Response (%)
-3, +3	5%
-2, +2	10%
-1, +1	15%
0	20%

The attitude consultation results identify the perceptions of the level of impact potentially caused by the planned development activities. This assists the company to understand how the stakeholders view the project. If responses to certain issues are determined to be significant, then they should be further addressed to ensure that the public have factual information about the project and clearly understand the likely effect of the project.

Those perceptions determined to be significant are highlighted in Table 9.8.

When read a statement describing the planned project, the interviewees were asked their perceptions about the positive and negative impacts of the project. Those significant issues perceived to be negatively and positive impacts are highlighted in red in the Table 9.8 below.

Table 9.8: Perceptions of Potential Impacts of the Project in Block RSF-5

Those highlighted in red are considered significant values.

Answer Options	Very negative	Negative	Slightly negative	No effect	Slightly positive	Positive	Very positive
Soil quality	27	67	108	97	19	0	0
Surface water quality	25	29	107	136	21	0	0
Ground water quality	26	38	80	129	42	0	0
Air quality	25	12	50	192	37	1	0
Noise	20	19	49	172	58	0	0
Forestry and conservation areas	4	30	93	163	27	0	0
Agriculture / Farming areas	14	15	95	158	34	1	0
Local animals	9	34	56	174	42	2	0
Pasture	10	15	42	191	58	1	0
Aquatic animals	7	16	51	176	66	1	0
Local Fisheries	3	11	66	196	40	1	0
Local Livestock	2	13	58	150	88	7	0
Local Vegetation	2	32	63	155	60	6	0
Local Industry	2	4	35	180	85	10	0
Local Transportation	1	7	35	96	128	51	0
Local Price	3	0	42	119	121	33	0
Recreation	1	7	41	137	107	22	2
Local Economy	2	2	51	75	129	57	2
Housing	2	3	47	149	97	20	0
Health	0	8	32	136	104	38	0
Education	0	5	29	111	132	40	0
Spiritual	0	5	28	159	113	11	0
Safety	1	10	40	133	117	14	0
Crime	1	4	37	132	128	13	0
Family Structure	0	3	37	98	151	29	0
Job opportunities	1	1	33	68	145	66	3
Income	1	3	25	86	135	65	3
Scenery	1	2	25	161	93	33	1
Access to land	1	5	36	149	108	17	0
Corruption	0	3	45	179	74	11	0
Local Culture	0	2	33	174	94	12	0
Religious Building	0	1	31	224	60	2	0
Cemetery	0	3	26	220	64	5	0
Historic buildings / sites	0	2	35	195	78	8	0

The villagers perceive that the project will have a very negative impact on soil quality, surface water quality, ground water quality, air quality and noise. Other significant issues that were perceived as receiving a negative impact are soil, groundwater, local animals and vegetation. Significant issues that were perceived as receiving a positive impact from the project are local transportation, local price, local economy, health, education, job opportunities, income and scenery.

The company should address these issues and provide accurate information to the public prior to project initiation. If stakeholders understand the likely effects and have realistic expectations, it will reduce the risk of negative perceptions, and/or high expectations from project benefits and therefore increase project manageability.

9.4 FUTURE CONSULTATION AND DISCLOSURE PLAN

Additional public consultations and disclosure prior to project implementation is required. Once the project is initiated and throughout project execution a communication process and schedule must be defined. Consultations conducted early on prior to project commencement will assist to ensure that the concerns of the stakeholders are considered, and that mitigation measures are developed to address them.

Similarly, ongoing stakeholder consultations throughout project execution are essential in order to identify and address new impacts, as well as assess the effectiveness of mitigation measures through stakeholder comments and complaints. Overall, stakeholder consultations promote increased understanding between the project owner and affected communities, resulting in stakeholder acceptance of the project.

A Grievance Mechanism has been established in the form of HSE Complaint Process Flow that is provided in the Environmental Management & Monitoring Plan (EMMP). A Stakeholder Engagement Log will be kept to document engagement carried out throughout the entire life cycle of the project. A Community Liaison Officers (CLO) will be appointed to facilitate the grievance process and also to provide information/clarification to the local community.

Stakeholder consultations throughout project implementation (construction, operation, and decommissioning) will be handled through the Stakeholder Involvement Program as provided in *Section 8: Environmental Management & Monitoring Plan*.

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References

References

Acoustic Glossary, 2016. Access from http://www.acoustic-glossary.co.uk/leq.htm on August 9, 2016.

ADB. 2013. Asian Development Bank Outlook, FACT SHEET 2013.

AI, 2013. Amnesty International. Annual report, 2013.

Alberta Research Council, 1995. The Alberta Department of Energy and Natural Resources and The University of Alberta. Summary Of Previous Studies Of The Effect Of Seismic Shooting On Water Wells In Alberta, I. C. Ross ICI Canada Inc. Calgary March 1995.

Algers B. – Ekesbo, I. – Stromberg, S. 1978. The impact of continuous noise on animal health. Acta Veterinaria Scandinavica, Suppl. 67, 1978, p. 1-26.

AMTE n. 231/2013, Republic of the Union of Myanmar. Environmental and Social Assessment Study – 2013.

AUS, 1993. Safety standard of vibration from explosion followed by Australian Standard AS 2187-1983 AS2187.2 – 1993 Explosives – Storage, transport and use. Part 2: Use of explosives.

Ba Kyi, 1964. Union of Burma, 1964 (CC) 306, 308.

BLI ,2005. Birdlife International , Myanmar Investment Opportunities in Biodiversity Conservation. Yangon: Birdlife International.

BLI, 2014. BirdLife International, Important Bird Areas factsheet.

Bryman .A, 2008 Social Research Methods (3rd Edition). Oxford University Press.

BTI 2012. Myanmar Country Report.

NRN, 2014. Burma Rivers Network. Accessed from http://burmariversnetwork.org.

CCME, 2007. Canadian Council of Ministers of the Environment. 2007. Canadian soil quality guidelines for the protection of environmental and human health: Summary tables. Updated September, 2007. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

CCME, 2008 -Canadian Council of Ministers of the Environment, CANADA-WIDE STANDARDS for PETROLEUM HYDROCARBONS (PHC) IN SOIL, 2008.

Champion, H. G. and Seth, S. K. (1968). A Revised Survey of Forest Types of India, Govt. of India Press, New Delhi, p. 404.

CIA, 1972. U.S. Central Intelligence Agency, Ethnolinguistic map of Burma, 1972.

CIA Factbook, 2013. Myanmar Country Profile Accessed from https://www.cia.gov/library/publications/the-world-factbook.

CNPC, 2009. Environmental Impact Assessment - Myanmar Section of Myanmar –China Gas Pipeline Project, Chapter 7 Environmental Baseline; CNPC and IEM.

Collins, N.M., J.A. Sayer and T.C. Whitmore, 1991. The Conservation Atlas of Tropical Forests: Asia and the Pacific. IUCN, Gland and Cambridge Press, London, UK., ISBN-10: 0-333-53992-3, pp: 300.

CSIS, 2006. Center for Strategic and International Studies. The Asian Conventional Military Balance in 2006.

CSO, 1999. Central Statistical Organization (CSO), Ministry of National Planning and Economic Development, 2011; (*) National Mortality Survey, CSO, 1999.

DMF, 1991. Safety standard of vibration of soil layer from explosion, Department of Mineral Resources, Thailand. 1991.

DMH, 2016. Meterological Data obtained from the Department of Meteorology and Hydrology, Magway Station, 2016.

Diesel Fuel Polishing Services, Systems, Treatments. (n.d.). Retrieved June 24, 2015, from http://www.perfectfuel.ca.

EU 1986a Council Directive on the protection of workers from the risks related to exposure of noise at work. Directive 86/188/EEC of 12.5.1986. Official Journal L 137 (24.5.1986), p. 28, Brussels, Belgium.

FAO, n.d. STATE OF FORESTS AND FOREST GENETIC RESOURCES IN MYANMA by Mu Mu Aung, Forest Research Institute, Yangon, Myanmar. Accessed from http://www.fao.org/docrep/005/AC648E/ac648e08.htm.

FAOSTAT Country Profiles.

Financial Allocation to Social Budget, Social Protection Conference, 25th and 26th June 2012, Nay Pyi Taw.

GJC, 2013. Global Justice Center. The Gender Gap and Women's Political Power in Myanmar, May 2013. Accessed from http://globaljusticecenter.net/index.php/publications/advocacy-resources/103-the-gender-gap-and-women-s-political-power-in-myanmar-burma.

Gordon , 1885. Historical data for the Ayeyarwady at Seiktha. The Gordon survey of 1869-1879.

GSD RC, Vulnerable groups in Burma and access to services, 2011.

Hanner P and Axelsson A 1988 Acute acoustic trauma. Scandinavian Audiology 17: 57-63.

Harvard Law School, 2009; Ekeh and Smith, 2007.

Hla Tun Aung. 2005. Myanmar: The Study of Processes and Patterns, Universities Press, Yangon, Myanmar.

Honda Power Equipment. (n.d.). Retrieved June 24, 2015, from http://powerequipment.honda.com.

Human Rights & Conflict in Burma, by U.S. Campaign for Burma.

Human Rights Watch, World Report 2012 Burma.

IEA, 2004. Density of Oil Products, Energy Statistics Working Group Meeting.

IFC, 2012. International Finance Corporation (IFC) – Performance Standard 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources, 2012.

IFC, 2012. International Finance Corporation (IFC) – Performance Standard 7 Indigenous People, 2012.

IFC, 2007. International Finance Corporation (IFC) – Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets, 2007.

IFC, 2007. International Finance Corporation (IFC)- Environmental Health and Social Guidelines, IFC 2007.

IHS Global Insight report.

INC, n.d. The 9th Workshop on GHG Inventory in Asia (WGIA 9) – GHG Inventory in Myanmar: INC Report (Prof. Dr. Khin Lay Swe GHG Inventory Team Leader INC Project, Myanmar).

Industrial Diesel Generators. (n.d.). Retrieved June 24, 2015, from http://www.dieselserviceandsupply.com.

Internal Displacement Monitoring Center. Country Profile, Myanmar, July 2011.

Internal Displacement Monitoring Center. Cyclone in Myanmar uproots violence-displaced in Rakhine State yet again, May 2013.

IPCC,2006. Inter governmental Panel on Climate Change. 2006. Guidelines for National Greenhouse Gas Inventories [Online]. http://www.ipcc.ch, Accessed in June 2015.

IUCN, 2016. International Union for Conservation of Nature (IUCN) Red List.

ISO 1990 Acoustics–Determination of occupational noise exposure and estimation of noise induced hearing impairment. International Standard ISO 1999, International Organization for Standardization, Geneva, Switzerland.

Kempenaers B, Borgström P, Loës P, Schlicht E, Valcu M. 2010. Artificial night lighting affects dawn song, extra-pair siring success, and lay date in songbirds. Curr Biol. 20:1735–1739.

Langhammer, P. F., Bakarr, M. I., Bennun, L. A., Brooks, T. M., Clay, R. P., Darwall, W., De Silva, N., Edgar, G. J., Eken, G., Fishpool, L. D. C., da Fonseca, G. A. B., Foster, M. N., Knox, D. H., Matiku, P., Radford, E. A., Rodrigues, A. S. L., Salaman, P., Sechrest, W. and Tordoff, A. W. (2007) Identification and gap analysis of key biodiversity areas: targets for comprehensive

protected area systems. Gland, Switzerland: IUCN (Best Practice Protected Area Guidelines Series 15).

Liana Sun Wyler, 2009. Burma and Transnational Crime, CRS Report RL34225, Washington, DC: Congressional Research Service, 27 April 2009.

MIMU, 2014. Myanmar Population Data. Myanmar Information Management Unit, 2014.

MNCWA, n.d. Myanmar National Working Committee for Women's Affairs. Accessed from http://mncwa.tripod.com.

MOA, 2003. Agriculture Sector Review Project –Agricultural Water Resources Study in Myanmar. The Union of Myanmar Ministry of Agriculture and Irrigation by Myanmar Academy of Agriculture, Forestry and Livestock and Fisheries Irrigation Department and Water Resources Utilization Department Yangon, Myanmar, 2003.

MOC, 2013. Current Situation of Road Networks and Bridges, Government of the Republic of the Union of Myanmar, Ministry of Construction, Public Works, February 2013.

MOECAF, 2011 Ministry of Environmental Conservation and Forestry 2011. National Biodiversity Strategy and Action Plan Myanmar 2011. The Republic of the Union Of Myanmar. UNEP, Global Environmental Fund.

MOF, 2012. Dry Zone Greening in Central Myanmar, Environmental Management Ministry of Forestry, Myanmar http://www.myanmar-narcotic.net/Ministry/Forest/Environment.html (1999-2012).

MOH, 2010. Myanmar Ministry of Health, Myanmar Health Statistics, 2010.

MOH, 2011. Myanmay Ministry of Health, Annual Public Health Statistics Report, 2011.

MOH, 2011. Myanmar Ministry of Health. Five-year strategic plan for water supply, sanitation and hygiene in Myanmar, 2007-2011.

MOH, 2013. Ministry of Health. Health in Myanmar (2013).

MOH, 2014. Myanmar Health Statistics Accessed July 20th from http://www.moi.gov.mm/moi:eng/?q=news/29/06/2015/id-4205.

MOH, 2014. Myanmar Health Statistics Accessed July 20th from http://www.moh.gov.mm/file/HEALTH%20STATISTICS.pdf.

MONPED, 2011. Ministry of National Planning and Economic Development, Ministry of Health, UNICEF, Myanmar Multiple Indicator Cluster Survey 2009 - 2010, 2011.

Ministry of Justice, The Judicial System and Court Proceedings in Myanmar.

Ministry of Labour of Myanmar, Country brief. Unemployment insurance of Myanmar.

Myanmar Biodiversity, 2014. Accessed September 5th from https://myanmarbiodiversity.org/2014/plants-conservation-in-myanmar/.

Myanmar: Opportunity for Engagement in Asia.

Myanmar Protected Areas – context, Current Status and Challenges – 2011.

Newland, K. 2000. Refugees, Returnees, and Internally Displaced People in Myanmar, May, 2000.

NOAA, 2013. U.S. National Oceanic and Atmospheric Administration. Heat Safety. Accessed from http://www.nws.noaa.gov/os/heat/index.shtml.

OCHA, 2013. From Reliefweb May 2013.

Ohnmar May Tin Hlaing et al. 2008. Air Quality Monitoring in Urban areas of Myanmar, Ohnmar May Tin Hlaing et al., 2008.

OGP/IPIECA, 2007. A Guide to Health Impact Assessment for oil and gas industry, 2007.

OGP/IPIECA, 2011. Ecosystem services guidance, 2011.

Ontario, 2004 Soil, Ground Water and Sediment Standards for Ontario, Use Under Part XV.1 of the Environmental Protection Act, 9-Mar-04, Canada.

OPHI, 2011. Oxford Poverty & Human Development Initiative Multidimensional Poverty Index 2011: Brief Methodological Note. Accessed from http://www.ophi.org.uk/.

Parenzan, P. & Hausmann, A. (1992): Interesting new finds of Geometridae (Lepidoptera) in southern Italy. - Entomofauna 13 (8), 157-172.

PCGN, 2007. The Permanent Committee on Geographical Names, 2007.

PCGN, 2007. An introduction to the toponymy of Burma, 2007.

Pitt, R. and S. Clark. 2002. Emerging stormwater controls for critical areas. Pp. 104-136. In Wet weather flow in the urban watershed. Technology and Management. Field, R. and D. Sullivan. (Eds).

PTTEP, 2012. Land Use and Site Conditions along the proposed Seismic Lines in Block PSG and EP-2 – PTTEP SOUTH ASIA LIMITED, 2012.

PTTEP, 2013. 2D Seismic Survey of Onshore Blocks PSC-G & EP-2 - PTTEP South Asia Limited Environmental, Social and Health Impact Assessment, Chapter 3 Environmental Setting.

S. Khan, Q. Cao, Y. M. Zheng, Y. Z. Huang, and Y. G. Zhu, "Health risks of heavy metals in contaminated soils and food crops irrigated with wastewater in Beijing, China," Environmental Pollution, vol. 152, no. 3, pp. 686–692, 2008.

Smythies Bertram E., 1986. THE BIRDS OF BURMA, (Bertram Evelyn)/ Hughes A.M. Published by Nimrod Press/ Silvio Mattacchione., England/ Canada. 1986.

Than Tin Aung, K. Satake, Y. Okamura, M. Shishikura, Win Swe, Hla Saw, Tint Lwin Swe, Soe Thura Tun and Thura Aung, 2008. Geologic evidence for three great earthquakes in the past 3400 years of Myanmar. Journal of Earthquake and Tsunami 2, 4, 259–265.

Theilen-Willige, B. & Pararas-Carayannis, G. (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. The International Journal of The Tsunami Society, Vol. 28, No. 2, Published Electronically 2009, http://tsunamisociety.org/282ThielenGPCa.pdf.

Toyo-Thai Corporation Plc. – high Level ESHIA Study for 1280MW USC Coal Fired Power Plant Project in Myanmar – January 2014.

UNHCR Statistical Yearbook 2009, United Nations High Commissioner for Refugees.

United Nations ESCAP (Economic and Social Commission for Asia and the Pacific).

UNEP/GRID-, 2013. Europe for the Global Assessment Report on Risk Reduction. United Nations Environment Programme– Global Resource Information.

Database (UNEP-GRID), 2013.

UNEP, 2013. Emissions reduction profile Myanmar (UNEP RISØ JUNE 2013, SUPPORTED BY ACP-MEA & UNFCCC).

UNEP, 2013. Myanmar National Treaties Accessed from http://tbinternet.ohchr.org/_layouts/TreatyBodyExternal/Treaty.aspx?CountryID=119&Lang=EN.

UNESCO, 2016. World Heritage List; The Pyu Cities: Beikthano-Myo, Halin, Tharay-Khittaya. Accesed on September 5th from from http://whc.unesco.org/en/statesparties/MM/

University of Oxford, OPHI Country Briefing 2011, Myanmar.

University of Minnesota, n.d. Human Rights Library. Ratification status of International Human Rights Treaties for Myanmar.

USDOT, 2010. US department of Transportation: Federal Highway Administration, 2010 - Gravel Roads Maintenance and Design Manual (SD LTAP).

U.S. Department of Energy, 2010, Accessed from http://cta.ornl.gov/data/chapter4.shtml.

USEPA, 2009, National Primary Drinking Water Regulations and National Secondary Drinking Water Regulations, published by the USEPA, May 2009.

UK, 2000, Drinking Water Standards from Water Supply (Water Quality) Regulations 2000, (SI 2000/3184) (as amended).

UNAIDS, 2014. Retrieved July 20th from http://www.unaids.org/en/regionscountries/countries/myanmar.

UNDP, 2013. United Nations Development Programme, Human Development Report 2013.

UNDP, 2014. United Nations Development Programme, Human Development Report 2014.

Volcano Discovery. 2013. Volcanoes in Myanmar. Accessed from http://www.volcanodiscovery.com/searchresults.html?cx=partner-pub-3740653521982427%3A9wc33x-8e80&cof=FORID%3A10&ie=UTF-8&q=,20yanm.

WB, 2011. World Bank, The Migration and Remittances Factbook, 2011.

WB, 2013. World Bank, Bringing more electricity for the people of Myanmar, 2013).

United Nations ESCAP (Economic and Social Commission for Asia and the Pacific).

Government of the Republic of the Union of Myanmar, Ministry of Construction, Public Works, 2013.

WB, 2014. Power to People: World Bank Group to invest US$2 billion in Myanmar, to support reforms, reduce poverty, increase energy and health access, 2014.

WFP, 2009. UN World Food Program, 2009.

WHO, 1999, Guidelines for Community Noise, edited by Birgitta Berglund , Thomas Lindvall, Dietrich H Schwela, World Health Organization, 1999.

WHO, 2008. World Health Organization. WHO Country Cooperation Strategy 2008-2011, Myanmar.

WHO, 2014. World Health Organization. WHO Country Cooperation Strategy 2014–2018, Myanmar.

WHO, 2013. World Health Survey Results – Report of Myanmar, 2013.

WTIC, 1997. Wisconsin Transportation Information Center, 1997. Wisconsin Transportation Bulletin No 13).

Yamane, T. 1973. Statistic: An Introductory Analysis. 3 rd ed. New York: Harper and Row.

MOAI, 2002. Soil types and characteristics of Myanmar - The Government of The Union of Myanmar Ministry of Agriculture and Irrigation Myanmar Agriculture Service Land Use Division, 2002.

DGE, 2010. Report on Regional Geology of Myanmar. Department of geological Engineering faculty of Engineering Gadjah Mada University, April 2010.